TECHNICAL SUPPORT FOR
ROCKY MOUNTAIN ARSENAL

Record of Decision for the On-Post Operable Unit

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Sections 1–11

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U.S. Army Program Manager's Office for the
Rocky Mountain Arsenal

This document is intended to comply with the National Environmental Policy Act of 1969.

The information and conclusions presented in this report represent the official position of the Department of the Army unless expressly modified by a subsequent document. This report constitutes the relevant portion of the administrative record for this CERCLA operable unit.

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List of Acronyms and Abbreviations

°F	Degrees Fahrenheit
µg	Microgram
95% LCL	95 Percent Lower Confidence Limit
95% UCL	95 Percent Upper Confidence Limit
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos-Containing Material
AOC	Area of Contamination
APEN	Air Pollution Emission Notice
ARAR	Applicable or Relevant and Appropriate Requirements
Army	U.S. Army
ATM	Atmospheres
ATSDR	U.S. Agency for Toxic Substances and Disease Registry
BAF	Bioaccumulation Factor
BAS	Biological Advisory Subcommittee
BCHPD	Bicycloheptadiene
BCRL	Below Certified Reporting Limits
BCY	Bank Cubic Yards
BDAT	Best Demonstrated Available Technology
BMF	Biomagnification Factor
BNA	Bureau of National Affairs
bw	Body Weight
CAC	Citizens Against Contamination
CAMU	Corrective Action Management Unit
CBSG	Colorado Basic Standards for Groundwater
CBSM	Colorado Basic Standards and Methodologies for Surface Water
CCR	Code of Colorado Regulations
CDD	CAMU Designation Document
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CF&I	Colorado Fuel and Iron
CFR	Code of Federal Regulations
CFS	Confined Flow System
CHWMA	Colorado Hazardous Waste Management Act
cm	Centimeter
cm^2	Centimeter Squared
cm^3	Centimeter Cubed
C_{max}	Maximum Contaminant Concentration
COC	Contaminant of Concern
Conceptual Remedy	Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal
CPMS	Chlorophenylmethylsulfide
$CPMSO_2$	Chlorophenylmethylsulfone
$C_{rep,mean}$	Arithmetic Mean of Contaminant Concentration
$C_{rep,upper}$	Arithmetic Mean of Contaminant Concentration, 95% Upper Confidence Limit
CSRG	Containment System Remediation Goal
CWA	Clean Water Act
DBCP	Dibromochloropropane
DCPD	Dicyclopentadiene
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
DIMP	Diisopropylmethyl Phosphonate

D_T	Critical Toxicity Value
DW	Exposure Frequency
EPA	U.S. Environmental Protection Agency
ERC	Ecological Risk Characterization
ESC	Exposure Soil Concentration
FFA	Federal Facility Agreement
FS	Feasibility Study
FR	Dietary Fraction
ft	Foot/Feet
g/mole	Gram Per Mole
GAC	Granular Activated Carbon
GB	Sarin
GC/MS	Gas Chromatography/Mass Spectrometry
GIS	Geographic Information System
gpm	Gallons Per Minute
HCCPD	Hexachlorocyclopentadiene
HCL	Hydrogen Chloride
HD	Distilled Mustard
HE	High Explosive
HHEA	Human Health Endangerment Assessment
HHRC	Human Health Risk Characterization
HI	Hazard Index
HQ	Hazard Quotient
Hyman	Julius Hyman and Company
ICS	Irondale Containment System
IEA/RC	Integrated Endangerment Assessment/Risk Characterization
IMPA	Isopropylmethyl Phosphonate
IRA	Interim Response Action
JARDF	Joint Administrative Record Document Facility
kg	Kilogram
l	Liter
LANL	Light Nonaqueous Phase Liquid
lb	Pound
LDR	Land Disposal Restriction
LNAPL	Light Nonaqueous Phase Liquid
LOAEL	Lowest Observed Adverse Effect Level
LOEL	Lowest Observed Effect Level
m	Meter
m^3	Cubic Meter
MATC	Maximum Allowable Tissue Concentration
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg	Milligram
MMAG	Medical Monitoring Advisory Group
mph	Miles Per Hour
MSEC	Mountain State Employer's Council, Inc.
NBCS	North Boundary Containment System
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDMA	N-Nitrosodimethylamine
NEPA	National Environmental Policy Act
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NOAEL	No Observed Adverse Effect Level

NPL	National Priorities List
NRD	Natural Resource Damage
NWBCS	Northwest Boundary Containment System
O&M	Operations and Maintenance
OCP	Organochlorine Pesticide
OPHBG	Organophosphorus Compounds, Agent Related
OPHP	Organophosphorus Compounds, Pesticide Related
Organizations	U.S. Army, Shell Oil Company, U.S. Environmental Protection Agency, U.S. Fish and Wildlife, U.S. Agency for Toxic Substances and Disease Registry, and U.S. Department of Justice
OSCH	Organosulfur Compounds, Herbicide Related
OSCM	Organosulfur Compounds, Mustard Related
OSHA	Occupational Safety and Health Act
Parties	U.S. Army, Shell Oil Company, U.S. Environmental Protection Agency, U.S. Fish and Wildlife, and State of Colorado
PCB	Polychlorinated Biphenyl
PAO	Public Affairs Office
PMRMA	Program Manager for Rocky Mountain Arsenal
ppb	Part Per Billion
PPLV	Preliminary Pollutant Limit Value
ppm	Part Per Million
ppt	Part Per Trillion
PSCo	Public Service Company of Colorado
PVC	Polyvinyl Chloride
RAB	Restoration Advisory Board
RAF	Relative Absorption Factor
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
RfC	Reference Concentration
RfD	Reference Dose
RI	Remedial Investigation
RMA	Rocky Mountain Arsenal
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SACWSD	South Adams County Water and Sanitation District
SD	Standard Deviation
SDWA	Safe Drinking Water Act
sec	Second
SEC	Site Evaluation Criteria
SF	Square Feet
SFS	Supplemental Field Study
Shell	Shell Oil Company
SHO	Semivolatile Halogenated Organic
SHPO	Colorado State Historical Preservation Office
SPPLV	Single-Pathway Preliminary Pollutant Limit Value
SQI	Submerged Quench Incinerator
SSAB	Site-Specific Advisory Board
SVE	Soil Vapor Extraction
SY	Square Yards
TAG	Technical Assistance Grant
TBC	To-Be-Considered Criteria
TCE	Trichloroethylene

TCLP	Toxicity Characteristic Leaching Procedure
TE	Exposure Duration
TEGD	Technical Enforcement Guidance Document
TM	Exposure Time
TMV	Toxicity, Mobility, or Volume
TRC	Technical Review Committee
TRV	Toxicity-Reference Value
TSCA	Toxic Substances Control Act
TSGM	Two-Step Geometric Mean
TX	Crop Agent for "Wheat Rust"
UF	Uncertainty Factor
UFS	Unconfined Flow System
ug	Microgram
USATHAMA	U.S. Army for Toxic and Hazardous Materials Agency
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
UTS	Universal Treatment Standard
UXO	Unexploded Ordnance
VAO	Volatile Aromatic Organics
VHC	Volatile Hydrocarbon Compound
VHO	Volatile Halogenated Organics
VOC	Volatile Organic Compound
VX	Nerve Agent
WP	White Phosporus
yr	Year

Declaration

Declaration

Site Name and Location

Rocky Mountain Arsenal
On-Post Operable Unit
Commerce City, Adams County, Colorado

Statement of Basis and Purpose

This Record of Decision (ROD) presents the selected remedial action for the Rocky Mountain Arsenal (RMA) On-Post Operable Unit in southern Adams County (east of Commerce City) Colorado. This remedy was selected based on the administrative record for the On-Post Operable Unit and chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

U.S. Army (Army) regulations allow for the integration of the requirements of both the National Environmental Policy Act (NEPA) and CERCLA into one document. This ROD is intended to comply with NEPA, except as related to the acquisition of permanent replacement water supplies, and as related to connecting residences in the Henderson, Colorado area to an existing domestic water system.

In accordance with federal law, the federal funding of the Army for implementation of the ROD is subject to appropriations from Congress and other requirements of the Anti-Deficiency Act, 30 USC 1341, et seq. The Army shall request, through the normal Army and U.S. Department of Defense budgetary processes, all funds and authorizations necessary to meet the conditions of, and to implement, the final remedy.

The U.S. Environmental Protection Agency (EPA) and the state of Colorado concur on the selected remedy.

Assessment of the Site

RMA was established in 1942 by the Army to manufacture chemical warfare agents and incendiary munitions for use in World War II. Following the war and through the early 1980s, the facilities continued to be used by the Army. Beginning in 1946, some facilities were leased to private companies to manufacture industrial and agricultural chemicals. Shell Oil Company (Shell), the principal lessee, primarily manufactured pesticides from 1952 to 1982. Common industrial and waste disposal practices used during these years resulted in contamination of structures, soil, surface water, sediment, and groundwater.

One hundred eighty-one sites with varying degrees of contamination, ranging from areas of several hundred acres with multiple contaminant detections at concentrations up to a few parts per hundred to isolated detections of single analytes at a few parts per billion, were delineated during the Remedial Investigation (RI) Program at RMA. Contamination was detected in soil, ditches, stream and lakebed sediments, sewers, groundwater, surface water, biota, structures, and, to a much lesser extent, air. Less extensive or less concentrated sources occur only sporadically within the relatively uncontaminated buffer zone along the boundaries of the site. The most highly contaminated sites (those showing the highest concentrations and/or the greatest variety of contaminants) are concentrated in the central manufacturing, transport, and waste disposal areas. The highest contaminant concentrations tend to occur in soil within 5 ft of the ground surface, although exceptions are noted, particularly at sites where burial trenches, disposal basins, or manufacturing complexes are located. In general, contaminant distribution is significantly influenced by the physical and chemical properties of the contaminants, the environmental media through which they are transported, and the characteristics of the sources, i.e., former manufacturing and disposal practices.

Groundwater contaminant plumes predominantly consist of organic compounds and arsenic, fluoride, and chloride. The organic compounds consist primarily of benzene, dibromochloropropane (DBCP), diisopropylmethyl phosphonate (DIMP), n-nitrosodimethylamine (NDMA), organochlorine pesticides (OCPs), and chlorinated solvents. In addition, elevated concentrations of sulfate are present at RMA's north boundary, chiefly due to natural sources. The unconfined flow system is the principal migration route for groundwater contaminants. The overall concentrations and configurations of the plumes suggest that the greatest contaminant releases to the unconfined flow system have occurred from Basin A and the Lime Settling Basins, the South Plants chemical sewer, South Plants tank farm and production area, the Army and Shell trenches in Section 36, and the Former Basin F. Plumes emanating from the Motor Pool/Rail Yard and North Plants areas are other sources of contaminant releases to the unconfined flow system.

Contaminant sources and pathways were identified to allow a quantitative assessment of the potential for exposure to human and ecological receptors. Twenty-seven contaminants of concern (COCs) were identified for evaluation in the human health risk characterization and 14 COCs were identified for the ecological risk characterization. Most of the potential carcinogenic health risks for human receptors are caused by four chemicals: aldrin, dieldrin, DBCP, and arsenic. Potential excess cancer risks for these chemicals exceed 1 in 10,000 (1×10^{-4}) at some sites. Three chemicals, DBCP, aldrin, and arsenic, account for the majority of noncarcinogenic human health risks (hazard indices exceeding 1.0). The highest estimated risks occur in the central portions of RMA, coinciding with the former location of chemical processing and disposal areas (e.g., the South Plants manufacturing area, the disposal trenches and basins). The primary routes for exposure are consumption, dermal contact, and inhalation. Land-use restrictions and health and safety requirements for site workers and visitors, however, have minimized the potential for human exposure to contaminants on post.

Although it is believed that these COCs are inclusive of the contaminants representing the greatest potential for risk, there are other contaminants that exist that may in the future become a concern (e.g., dioxin). In such an instance, an evaluation of the contaminant with respect to the remedy selected, designed, or implemented will be performed to ensure that the remedy remains protective of human health and the environment.

Under current conditions, biota are the primary receptors of RMA contamination in surficial soil, lakebed sediments, and surface water. Potential risk varies depending on the biomagnification factor (the ratio between the concentration of a chemical in biota tissue to that in soil) used to calculate risk, the chemical or chemical group being considered, and the receptor (trophic box) being considered. Differences among receptors for a given chemical are partly due to differences in the toxicity threshold values that were used to calculate risk, and especially due to differences in the exposure range size. Terrestrial areas where all trophic boxes are expected to be at potential risk (based on cumulative risk from all of the biota COCs combined) are most of the central sections of RMA, even though the specific receptors evidencing risk in one area may be different from those evidencing risk elsewhere. Pesticides (especially aldrin and dieldrin) and metals (especially mercury, which had been conservatively assumed to be present in its most toxic organic form, methyl mercury, but which was later determined to be present primarily as inorganic mercury) are the primary biota COCs. The primary route for biota exposure is ingestion. Consumption of contaminated prey is a concern at higher trophic levels due to contaminants such as OCPs, which are known to bioaccumulate and biomagnify in the food chain.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Scope and Role of the On-Post Operable Unit

The On-Post Operable Unit is one of two operable units at RMA (Figure D-1). The On-Post Operable Unit addresses contamination within the fenced 27 square miles of RMA proper. The Off-Post Operable Unit addresses contamination north and northwest of RMA.

The contaminated areas within the On-Post Operable Unit include approximately 3,000 acres of soil, 15 groundwater plumes, and 798 remaining structures. The most highly contaminated sites are located at South Plants (i.e., Central Processing Area, Hex Pit, Buried M-1 Pits, Chemical Sewers), Basins A and F, Lime Basins, and the Army and Shell trenches. The primary contaminants found in soil and/or groundwater at these sites are pesticides, solvents, heavy metals, and agent byproducts.

The purpose of the on-post remedial action is to implement remedies that eliminate, reduce, or control current or future exposure to contaminated soil or structures; to reduce contaminant migration into the groundwater;

and to prevent contaminated groundwater from migrating off post. In addition, it addresses the arrangement for provision of potable water to community residents through the South Adams County Water and Sanitation District (SACWSD). The selected remedy described in this ROD will permanently address the threats to human health and the environment using a combination of containment (as a principal element) and treatment technologies to reduce the toxicity, mobility, or volume of contaminants in groundwater, structures, or soil; comply with applicable or relevant and appropriate requirements (ARARs); and be cost effective.

Since 1975, the Army and Shell have undertaken 14 Interim Response Actions (IRAs) at RMA. Of these, eight IRAs will be continued through incorporation with the selected on-post remedy. Continuing IRAs include groundwater intercept and treatment north of RMA, groundwater intercept and treatment north of Basin F, groundwater intercept and treatment in the Basin A Neck area, boundary systems operation, remediation of other contamination sources (Motor Pool and Rail Yard groundwater treatment), asbestos removal, CERCLA hazardous wastes, and chemical process-related activities. The IRAs were implemented in accordance with Section XXII of the Federal Facility Agreement (FFA) to expedite the mitigation of contamination prior to the selection of final remedial action. The FFA, which formalizes the framework for remediating RMA, was signed by the Army, Shell, EPA, U.S. Fish and Wildlife Service (USFWS), U.S. Department of the Interior, U.S. Department of Justice, and the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) on February 17, 1989. Actions requiring removal of material have been carried out in accordance with CERCLA and its regulations and have been consistent with and contribute to the efficient performance of the final response action for the On-Post and Off-Post Operable Units. Examples of early remedial actions include the following:

- Constructing (from 1978 to 1984) and operating three boundary groundwater containment systems and six other systems that currently treat more than 1 billion gallons of groundwater per year (more than 10 billion gallons to date)
- Excavating and storing in an engineered wastepile approximately 600,000 cubic yards of Basin F soil and sludge, covering the remaining area of Basin F, and completing the on-site treatment of more than 11 million gallons of Basin F liquids in a specially designed incinerator
- Dismantling the hydrazine blending and storage facility and removing the debris to an off-post hazardous waste landfill
- Installing a soil cover and slurry wall to reduce movement of contaminants from the Shell Trenches in Section 36

More detailed information on the individual IRAs can be found in Section 2 of this ROD and in IRA-related documentation at the Joint Administrative Record Document Facility.

The selected remedy for the On-Post Operable Unit, integrated with the IRAs and the selected remedy for the Off-Post Operable Unit, will comprehensively address all contamination at RMA. If an IRA will not fully address the threat posed by a release and further response is required, the Army will ensure the IRA will either

be incorporated as part of the final response action or end to avoid duplication between the IRA and final response action. The ROD for the On-Post Operable Unit will be the final response action at RMA.

Description of the Remedy

The selected remedy for the On-Post Operable Unit was developed based on the contaminated media present at the site. The major components of the selected remedy for contaminated water, structures, and soil are described below.

Water

The selected water alternative includes the following elements:

- Continued operation of the three RMA boundary groundwater containment and treatment systems, the North Boundary Containment System (NBCS), the Northwest Boundary Containment System (NWBCS), and Irondale Containment System (ICS), which treat groundwater to attain ARARs and health-based remediation goals. These systems and the on-post groundwater IRA systems (Basin A Neck, North of Basin F, Motor Pool, and Rail Yard) will continue to operate until shut-off criteria specified in Section 9.1 of this ROD are met. ARARs for chloride and sulfate at the NBCS will be achieved through natural attenuation as described in "Development of Chloride and Sulfate Remediation Goals for the North Boundary Containment System at the Rocky Mountain Arsenal" (MK 1996). Assessment of the chloride and sulfate concentrations will occur during the 5-year site reviews.
- Installation of a new extraction system to intercept and contain a contaminated groundwater plume in the northeast corner of Section 36 that will be treated at the Basin A Neck IRA system.
- Water levels in Lake Ladora, Lake Mary, and Lower Derby Lake will be maintained to support aquatic ecosystems. The biological health of the ecosystems will continue to be monitored.

  Lake-level maintenance or other means of hydraulic containment or plume control will be used to prevent South Plants plumes from migrating into the lakes at concentrations exceeding Colorado Basic Standards for Groundwater (CBSGs) in groundwater at the point of discharge. Groundwater monitoring will be used to demonstrate compliance.
- Monitoring and assessment of NDMA contamination in support of potential design refinement/design characterization to achieve remediation goals specified for boundary groundwater treatment systems.

Structures

The selected structures alternative includes the following elements:

- Demolition of structures with no planned future use in accordance with a refuge wildlife management plan and salvage of metals where appropriate.
- Disposal of demolition debris from structures with significant contamination in the new on-post hazardous waste landfill.
- Monitoring of all debris from structures associated with Army chemical agent manufacture and treatment by caustic washing for all debris testing positive for the presence of agent followed by disposal in the new on-post hazardous waste landfill.
- Disposal of debris from other structures under the Basin A cover.
- Disposal of process equipment structural debris contaminated with asbestos or polychlorinated biphenyls (PCBs) in the new on-post TSCA-compliant (Toxic Substances Control Act) hazardous waste landfill.

Soil

The selected soil alternative primarily contains soil with principal threat (1×10^{-3} excess cancer risk or hazard index exceeding 1,000) and human health exceedances (1×10^{-4} or hazard index exceeding 1.0) and treats the remaining principal threat soil. The selected soil alternative includes the following elements:

- Treatment of approximately 180,000 bank cubic yards (BCY) of soil at the Former Basin F site by in situ solidification/stabilization.
- Treatment of approximately 1,000 BCY of materials from the Hex Pit by an innovative thermal technology. Disposal of the remaining 2,300 BCY of soil in the on-post hazardous waste landfill. Solidification/stabilization will become the selected remedy if all evaluation criteria for the innovative thermal technology are not met.
- Excavation, solidification/stabilization, and disposal in the on-post hazardous waste landfill of approximately 26,000 BCY of material from the Buried M-1 Pits.
- Monitoring of excavated soil associated with Army chemical agent manufacture and treatment by caustic washing for all excavated soil testing positive for the presence of agent followed by disposal in the on-post hazardous waste landfill.
- Excavation, drying if necessary, and disposal of approximately 600,000 BCY of material from the Basin F Wastepile in dedicated triple-lined cells in the on-post hazardous waste landfill.
- Excavation and disposal of approximately 54,000 BCY of material from the Section 36 Lime Basins in a dedicated triple-lined cell in the on-post hazardous waste landfill.
- Off-post destruction (or on-post detonation if unstable) of any identified unexploded ordnance (UXO) and excavation and disposal of UXO debris and associated soil in the on-post hazardous waste landfill.
- Containment using a soil cover or excavation and disposal of PCB-contaminated soil in the on-post TSCA-compliant hazardous waste landfill
- Excavation and disposal of approximately 1.03 million BCY of contaminated soil exceeding the human health site evaluation criteria (1×10^{-4} excess cancer risk or hazard index exceeding 1.0) and surface soil debris from remaining soil sites in the on-post hazardous waste landfill. These remaining soil sites include the following: North Plants, Toxic Storage Yards, Lake Sediments, Surficial Soil, Secondary Basins, Chemical Sewers, Sanitary Landfills, South Plants Central Processing Area, South Plants Ditches, South Plants Balance of Areas, Buried Sediments, Sand Creek Lateral, Section 36 Balance of Areas, and Burial Trenches.
- Installation of slurry walls and RCRA-equivalent (Resource Conservation and Recovery Act) caps with biota-intrusion barriers for the Army Complex Trenches and Shell Trenches, where contamination will be left in place.
- Construction of a RCRA-equivalent cap over the Former Basin F site and soil covers with biota-intrusion barriers over Basin A and the South Plants Central Processing Area.
- Excavation of 1.5 million BCY of soil posing a potential risk to biota and use as fill under the Basin A and South Plants covers and Basin F cap.
- Construction of variable-thickness soil covers over the Secondary Basins, North Plants, South Plants Balance of Areas, and Section 36 Balance of Areas.

Other

Additional components of the on-post remedy that contribute to protection of human health and the environment are the following:

- Provision of $48.8 million held in trust to provide for the acquisition and delivery of 4,000 acre-feet of potable water to SACWSD and the extension of water-distribution lines from an appropriate municipal water supply distribution system to all existing well owners within the DIMP plume footprint north of RMA as defined by the detection limit for DIMP of 0.392 parts per billion (ppb). In the future, owners of any additional domestic wells, new or existing, found to have DIMP concentrations of 8 ppb (or other relevant CBSG at the time) or greater will be connected to a water-distribution system or provided a deep well or other permanent solution. The Army and Shell have reached an Agreement in Principle with SACWSD, enclosed as Appendix B of this ROD, regarding this matter.

- National Environmental Policy Act – The Program Manager for Rocky Mountain Arsenal will separately evaluate the potential impacts to the environment of both the acquisition of a replacement water supply for SACWSD and for the extension of water-distribution lines.

- The Army and Shell will fund ATSDR to conduct an RMA Medical Monitoring Program in coordination with the Colorado Department of Public Health and Environment. The primary goals of the Medical Monitoring Program are to monitor any off-post impact on human health due to the remediation and provide mechanisms for evaluation of human health on an individual and community basis until such time as the soil remedy is completed. Elements of the program could include medical monitoring, environmental monitoring, health/community education, or other tools. The program design will be determined through an analysis of community needs, feasibility, and effectiveness.

- Trust Fund – During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund to help ensure the long-term operation and maintenance of the remedy once the remedial structures and systems have been installed. In response to this interest, the Parties (i.e., the Army, Shell, EPA, USFWS, and the state of Colorado) have committed to good-faith best efforts to establish a Trust Fund for the operation and maintenance of the remedy, including habitat and surficial soil. Such operation and maintenance activities will include those related to the new hazardous waste landfill; the slurry walls, caps, and soil and concrete covers; all existing groundwater pump-and-treat systems; the groundwater pump-and-treat system to intercept the Section 36 Bedrock Ridge Plume; the maintenance of lake levels or other means of hydraulic containment; all monitoring activities required for the remedy; design refinement for areas that may pose a potential risk to biota as described in Section 9.4; and any revegetation and habitat restoration required as a result of remediation.

  These activities are estimated to cost approximately $5 million per year (in 1995 dollars). The principal and interest from the Trust Fund would be used to cover these costs throughout the lifetime of the remedial program.

  The Parties recognize that establishment of such a Trust Fund may require special legislation and that there are restrictions on the actions federal agencies can take with respect to proposing legislation and supporting proposed legislation. In addition to the legislative approach, the Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remediation sites. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

  A trust fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders, and will be convened within 90 days of the signing of the ROD.

  Notwithstanding these uncertainties, it is the intent of the Parties that if the Trust Fund is created it will include the following:

  - A clear statement that will contain the reasons for the creation of the Trust Fund and the purposes to be served by it.

  - A definite time for establishing and funding the Trust Fund, which the Parties believe could occur as early as 2008, when the remedial structures and systems may have been installed.

An appropriate means for competent and reliable management of the Trust Fund, including appropriate criteria for disbursements from the Trust Fund to ensure that the money will be properly used for the required purposes.

- Restrictions on land use or access are incorporated as part of this ROD. The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 and the FFA restrict future land use and prohibit certain activities such as agriculture, use of on-post groundwater as a drinking source, and consumption of fish and game taken at RMA. Continued restrictions on land use or access are included as an integral component of all on-post alternatives. Long-term management includes access restrictions to capped and covered areas to ensure integrity of the containment systems.
- Continued operation of the existing CERCLA Wastewater Treatment Plant to support the remediation activities.
- Stored, drummed waste identified in the waste-management element of the CERCLA Hazardous Wastes IRA may be disposed in the on-post hazardous waste landfill in accordance with the Corrective Action Management Unit Designation Document.
- Continued monitoring as part of design refinement for the remediation of surficial soil and lake sediments that may pose a potential risk to wildlife (see Section 6.2.4.3).

Summary of the Off-Post Remedy

The Off-Post Operable Unit addresses groundwater contamination north and northwest of RMA. A ROD for this operable unit was issued on December 19, 1995. The selected remedies for both of the operable units, integrated with the IRAs, will comprehensively address all contamination at RMA. The components of the selected remedy for the Off-Post Operable Unit, presented below for informational purposes, are as follows:

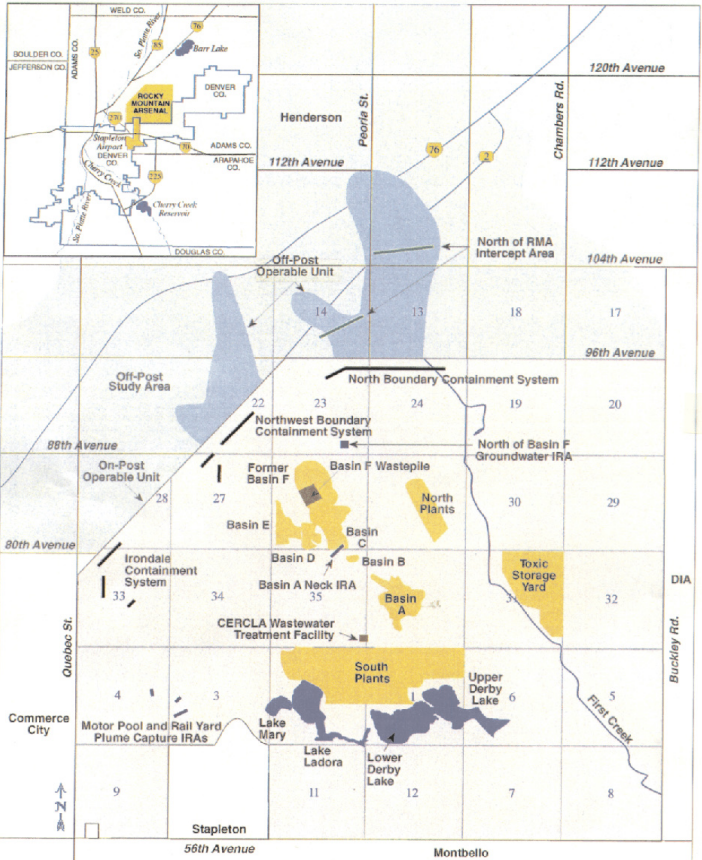
- Continued operation of the Off-Post Groundwater Intercept and Treatment System.
- Natural attenuation of inorganic chloride and sulfate concentrations to meet remediation goals for groundwater in a manner consistent with the on-post remedial action.
- Continued operation of the NWBCS, NBCS, and ICS as specified in Section 7.2 of the ROD for the On-Post Operable Unit.
- Improvements to the NBCS, ICS, NWBCS, and the Off-Post Groundwater Intercept and Treatment System as necessary.
- Long-term groundwater monitoring (including monitoring after groundwater treatment has ceased) to ensure continued compliance with the Containment System Remediation Goals (CSRGs).
- Five-year site reviews.
- Exposure control/provision of alternate water as detailed in the ROD for the Off-Post Operable Unit.
- Institutional controls, including deed restrictions on Shell-owned property, to prevent the use of groundwater exceeding remediation goals.
- Closure of poorly constructed wells within the Off-Post Study Area (see Figure D-1) that could be acting as migration pathways for contaminants found in the Arapahoe aquifer.
- Continuation of monitoring and completion of an assessment by the Army and Shell of the NDMA plume by June 13, 1996 using a 20 parts per trillion (ppt) method detection limit.
- Preparation of a study that supports design refinement for achieving NDMA remediation goals at the RMA boundary. The study will use a 7.0 ppt preliminary remediation goal or a certified analytical detection level readily available at a certified commercial laboratory (currently 33 ppt).

- Tilling and revegetation of approximately 160 acres in the southeast portion of Section 14 and the southwest portion of Section 13 by the Army and Shell.
- Treatment of any contaminated extracted groundwater prior to discharge or reinjection so that it meets CSRGs that meet or exceed the water quality standards established in the CBSGs and the Colorado Basic Standards and Methodologies for Surface Water.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. The remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable. Components of the selected remedy satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. The large volume of contaminated soil present on the site precludes a remedy in which all contaminants could be excavated and cost effectively treated.

Because this remedy will result in hazardous substances remaining at RMA above health-based levels, a review will be conducted no less than every 5 years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment and complies with applicable regulations.



Legend

20 Section (1 section = 640 acres or 1 square mile)

Not to scale

Figure 1.0-1
RMA Site Map

Rocky Mountain Arsenal
Prepared by Foster Wheeler Environmental Corporation

RMA_ROD 3.26.99.jp

Signature Page

For U.S. Environmental Protection Agency

Fred Hansen

Deputy Administrator

Jack W. McGraw

Acting Regional Administrator, Region VIII

For U.S. Army

Robert M. Walker

Assistant Secretary of the Army
(Installations, Logistics and Environment)

For State of Colorado

Roy R. Romer

Governor

Gail Schoettler

Lieutenant Governor

Shell Oil Company

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Suite 4100
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June 11, 1996

Environmental Protection Agency
Region VIII
One Denver Place, 999 18th Street
Denver, Colorado 80202-2413

CERCLA Litigation Unit
Office of the Attorney General
1525 Sherman Street, 5th Floor
Denver, Colorado 80203

Re: Rocky Mountain Arsenal--On-Post ROD

Ladies and Gentlemen:

Shell Oil Company ("Shell") did not invoke dispute resolution on the draft final record of decision for the On-Post Operable Unit of Rocky Mountain Arsenal (the "ROD") under the Federal Facility Agreement dated effective February 17, 1989 (the "FFA"), among the United States Department of the Army, United States Environmental Protection Agency, United States Department of the Interior, Agency for Toxic Substances and Disease Registry, United States Department of Justice, and Shell. Pursuant to paragraph 25.7 of the FFA, Shell is therefore deemed to have concurred in the draft final ROD.

Shell also does not object to the minor changes that have been made since the draft final ROD was issued.

The final ROD is to be signed today. Shell confirms it will not challenge the final ROD under paragraph 25.13 of the FFA.

This letter affirms Shell Oil Company's long standing commitment to a protective and cost-effective remedy for Rocky Mountain Arsenal.

Very truly yours,

SHELL OIL COMPANY

By _____
Rand N. Shulman
Authorized Signatory

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

IN REPLY REFER TO:
FWS/R6/RMA
Mail Stop 61170

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

JUN 11 1996

Raymond J. Fatz, Acting Deputy
Assistant Secretary of the Army
(Environment, Safety and Occupational Health)
OASA (I, L & E)
110 Army Pentagon
Washington, D.C. 20310-0110

Dear Mr. Fatz:

On behalf of the Fish and Wildlife Service I am pleased to endorse and support the signing of this On Post Record of Decision for the remediation of the Rocky Mountain Arsenal. This ROD represents the culmination of years of effort and resolves many years of negotiations between the involved parties. It also represents a major milestone in transitioning the Arsenal to the Refuge as envisioned by Congress in the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992.

There are issues yet to be resolved. The Service remains concerned that the Trust Fund becomes a reality, and it is essential that sufficient water is obtained for maintaining the lakes and revegetating the disturbed areas. It is my hope that the implementation of the ROD results in an expedient and effective remedy to enable the Rocky Mountain Arsenal to become one of the Nation's finest urban national wildlife refuges.

Sincerely,

Terry Terrell

Regional Director

Decision Summary

1.0 Site Name, Location, and Description

The Rocky Mountain Arsenal (RMA) National Priorities List (NPL) site is comprised of two **operable units**,[1] On Post and Off Post. The On-Post Operable Unit is encompassed by the boundaries of RMA; it occupies 27 square miles in southern Adams County, approximately 8 miles northeast of Denver (Figure 1.0-1). Areas bordering RMA exhibit varied land use. To the north and east the land is primarily agricultural, except for Denver International Airport, around which a great deal of business and residential activity is ongoing or scheduled. The southern boundary is adjacent to the Denver residential, commercial, and industrial community of Montbello and to the former Stapleton International Airport, and the western boundary is adjacent to Commerce City, where land use is residential, commercial, and industrial.

Future land use for the On-Post Operable Unit is addressed in the **Federal Facility Agreement (FFA)**, which was signed by the U.S. Army (Army), U.S. Environmental Protection Agency (EPA), U.S. Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Fish and Wildlife Service (USFWS), U.S. Department of Justice, and Shell Oil Company (Shell) in 1989 (these entities are collectively referred to as the Organizations) pursuant to Section 120 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Among other provisions, the FFA states that it is a goal of the signatories to make significant portions of the site available for beneficial public use and requires the preservation of habitat to the extent required by the Endangered Species Act, Migratory Bird Treaty Act, and Bald Eagle Protection Act. In October 1992, in conjunction with the future goal of beneficial public use and in recognition of the unique urban wildlife resources provided by RMA, President George Bush signed the Rocky Mountain Arsenal National Wildlife Refuge Act, making RMA a national wildlife refuge following EPA certification that required response actions have been appropriately completed. Once the EPA Administrator declares the site protective, ownership of the site will be transferred to USFWS.

Restrictions on land use at RMA or access to RMA are agreed to by the Army, EPA, USFWS, Shell, and state of Colorado (Parties) and are included as part of this **Record of Decision (ROD)**. The Rocky Mountain Arsenal National Wildlife Refuge Act and the FFA restrict future land use, specify that the U.S. government shall retain ownership of RMA, and prohibit certain activities such as agriculture, use of on-post groundwater as a drinking source, and consumption of fish and game taken at RMA.

1.1 Environmental Setting

1.1.1 Physiography

RMA is located at the western edge of the Colorado Plains, near the foothills of the Rocky Mountains. It occupies an area of rolling terrain characterized by grasslands, shrublands, wetlands, aquatic habitats, and extensive weedy areas, and it supports a variety of plant and wildlife species. The elevation above mean sea level ranges from 5,330 ft at the southeastern boundary to 5,130 ft at the northwestern boundary.

[1] Items printed in bold face are included in the glossary.

Regional surface drainage is toward the northwest into the South Platte River, which flows parallel to the northwest boundary of RMA and eventually joins the North Platte River in Nebraska. The land surface of RMA has largely been shaped by fluvial processes associated with the South Platte River and its tributaries. Wind-borne deposits cover the alluvial land surface in many areas, particularly in the southern and western portions of RMA.

1.1.2 Climate

According to the National Climatic Data Center records for Denver, the mean maximum temperatures range from 43°F in January to 88°F in July; mean minimum temperatures range from 16°F in January to 59°F in July.

Annual precipitation averages approximately 15 inches (water equivalent). Average monthly precipitation is highest in May and lowest from December through February. The maximum precipitation events are heavy localized thunderstorms that occur during late spring and summer. Tornadoes and severe hailstorms may occur in association with intense thunderstorm activity. Snowfall normally occurs from September through May. The average annual snowfall is 58 inches. Average monthly snowfall is highest in March, when snow also tends to have the highest moisture content. Snow generally melts or sublimates rapidly at RMA and normally does not cover the ground for extended periods.

The prevailing wind is from the south. In summer, the strongest winds are associated with thunderstorms. In other seasons, the strongest winds are generally from the northwest quadrant and are downslope "chinook" winds. The annual mean wind speed at RMA is approximately 9 mph, and the maximum hourly wind speed ranges from approximately 33 mph to 38 mph. A maximum wind gust of approximately 70 mph has been recorded at RMA.

1.1.3 Existing Cultural Features

Most military and industrial activities at RMA occurred in three areas: North Plants, South Plants, and the Rail Yard. Cultural features are generally associated with these areas. The primary roads at RMA form a grid that runs along the township section lines.

Structures at RMA include buildings, foundations, basements, tanks and tank farms, process and nonprocess equipment, pipelines, sewers, and other manmade items such as electrical substations. Most of these structures (53 percent) are located in the South Plants area. Two smaller groupings of structures occur in North Plants (12 percent) and in the Rail Yard (8 percent), and the rest (27 percent) occur as individual or small clusters throughout the site.

There are six former disposal basins at RMA. Basin A was originally developed as an unlined evaporative basin for disposal of aqueous waste from the production of mustard and lewisite. Basin B was used as a holding pond for overflow from Basin A. Basins C, D, and E were created from natural depressions to hold overflow aqueous wastes

from preexisting basins. Basin F, partially remediated under the Basin F Interim Response Action (IRA), was an asphalt-lined evaporation basin. Other disposal sites include the Army and Shell Trenches and sanitary landfills.

Three boundary groundwater containment systems, the North, Northwest, and Irondale systems (NBCS, NWBCS, and ICS, respectively), are present at RMA. These systems are designed to treat and to prevent the migration of groundwater contamination to off-post areas. Each system consists of an array of extraction wells, water treatment facilities, an array of injection wells, and, at the NBCS, recharge trenches.

There are also four internal groundwater treatment systems, the Motor Pool, Rail Yard, Basin F, and Basin A Neck IRA systems. Extraction wells in the Motor Pool and Rail Yard IRA systems pump water to the ICS for treatment prior to reinjection at the ICS. At the North of Basin F IRA, water is extracted and piped to the Basin A Neck IRA system for treatment. The Basin A Neck IRA is a pump-and-treat system that intercepts and treats contamination in groundwater as it moves northwest from Basin A. Water is reinjected at the Basin A Neck reinjection trenches.

1.1.4 Cultural Resources

Previous to Army operations at RMA, a patchwork of small irrigated farms occupied the southeastern and north-central portions of the site and larger dryland farms and ranches occupied the northeastern portion. Lakes in the southern portion are remnants of this agricultural past. Prior to 1850, the site was used by Native American tribes indigenous to the area, such as the Cheyenne and Arapaho.

The Army is in the process of completing cultural resource surveys that will identify structures or sites that may be protected under the National Historic Preservation Act (36 CFR 800) or the Archeological Resources Protection Act (16 USC Section 469 a-l). To determine the extent of historical and prehistorical resources existing on the current RMA site, several areas were investigated by different archeological teams. To bring all these studies together, as well as to close any information gaps, a complete RMA-wide surface sweep was conducted. A final report summarizing the results of this survey will be completed in summer 1996 prior to initiating on-post remedial actions. Native American sites and farmsteads at RMA were investigated.

No National Historic Register nominations have been made as a result of these activities, but two potentially eligible National Historic Districts were determined to exist, the North Plants manufacturing area and the South Plants manufacturing area. Due to their significant contribution in the Cold War, particularly the North Plants area, consultations were entered into with the Colorado State Historical Preservation Office (SHPO). Because contamination and Chemical Weapons Convention issues require the destruction of these potentially eligible districts, a Historic American Engineering Record of the districts is being prepared in advance of demolition, as is a video history of former residents and workers at RMA. Current projects in South and North Plants are carried out under an Interim Memorandum of Agreement between the Army, SHPO, and USFWS.

1.2 Geology

RMA is located within the Denver Basin, an asymmetrical depression approximately 300 miles long and 200 miles wide. The sedimentary rocks in the Denver Basin are more than 10,000 ft thick. Only the surficial soil, unconsolidated alluvium, and Denver Formation units are of interest for remedial actions at RMA.

Virtually all of RMA is covered with unconsolidated alluvial and windblown sediments that may locally reach thicknesses of 130 ft. Due to the nature of the alluvial deposition and erosion and the irregular bedrock surface on which the alluvium lies, there is little lateral continuity in the alluvial units, and the spatial relationships between them are complex. The thickest deposits of these alluvial sediments occur in paleochannels eroded into the underlying Denver Formation, which consists of sandstones, siltstones, and claystones. The paleochannels, which were incised in the bedrock surface and subsequently filled with alluvial deposits, influence regional groundwater flow and the direction and rate of movement of groundwater plumes at RMA. The major paleochannels on post, the First Creek and Irondale channels, direct regional groundwater flow to the north and north-northwest, respectively.

At RMA, the Denver Formation is exposed in only a few isolated outcrops. The unit ranges from approximately 200 to 500 ft in thickness, and is separated from the underlying Arapahoe Formation by a relatively impermeable claystone interval 30 to 50 ft thick. The Arapahoe Formation consists of 400 to 700 ft of interbedded conglomerate, sandstone, siltstone, and shale. The upper portion of the Arapahoe Formation consists predominately of 200 to 300 ft of blue to gray shale with some conglomerate and sandstone beds. The lower portion of the formation consists primarily of sand, gravel, and conglomerate and is a source zone for many water-supply wells in the area.

1.3 Hydrology

Flow of surface water at RMA occurs through a network of streams, lakes, and canals. Four principal drainage basins and three smaller subcatchments are recognized within RMA and include the First Creek, Irondale Gulch, Sand Creek, and Second Creek drainage basins and the Basins A and F and Sand Creek Lateral subcatchments.

Streamflow at RMA is highly variable. Seasonal variations in stream discharge are generally greater than average year-to-year variations and are strongly affected by the amount of urban runoff, released or diverted flow, and direct precipitation. Streams at RMA are generally intermittent, and highest flows tend to occur during spring runoff and during major storms. Water levels in the lakes are less variable than stream discharge and are regulated. Peak storage volumes usually occur in spring or early summer.

Groundwater flow occurring within the alluvium and the uppermost weathered portion of the Denver Formation has been designated as the unconfined flow system (UFS). Deeper water-bearing units within the Denver Formation, which are designated as the confined flow system (CFS), are separated from the UFS by low-permeability confining units. Depending on site-specific hydrological characteristics, varying degrees of hydraulic interchange are possible

between surface water and groundwater and between the UFS and CFS. In general, analytical and hydraulic data indicate little hydraulic interchange between the UFS and CFS.

The UFS includes saturated portions of the unconsolidated materials overlying the Denver Formation, the weathered upper portion of the Denver Formation, and, where the Denver Formation is missing near the South Platte River, the weathered upper portion of the Arapahoe Formation. The CFS includes the deeper portions of the Denver Formation and the underlying Arapahoe Formation. Water enters the UFS as infiltration of precipitation; seepage from lakes, reservoirs, streams, canals, and buried pipelines; flow from upgradient regional flow; and flow from the underlying CFS. Water is discharged from the UFS as seepage to lakes and streams, underflow to off-post areas north and west of RMA, and downward flow into the CFS. The UFS may gain or lose water at various locations and at different times of the year.

The CFS consists of strata within the Denver Formation collectively referred to as the Denver aquifer, where water residing in permeable sandstone or fractured lignite is confined above and below by relatively impermeable shale or claystone. Water enters the CFS primarily through regional updip flow and vertical flow from the overlying UFS. Water is discharged from the CFS by lateral flow into the UFS (where the strata are transmissive) or by leakage to the Arapahoe aquifer. The UFS is the principal migration route for groundwater contaminants at RMA. Some low-level contamination is present in isolated portions of the CFS, but the spread of contamination has been minimal due to the limited permeability and discontinuous nature of the water-bearing zones in the CFS. No contaminant migration pathway has been identified for the CFS and no production wells at RMA currently obtain water from the CFS.

1.4 Biological Habitat

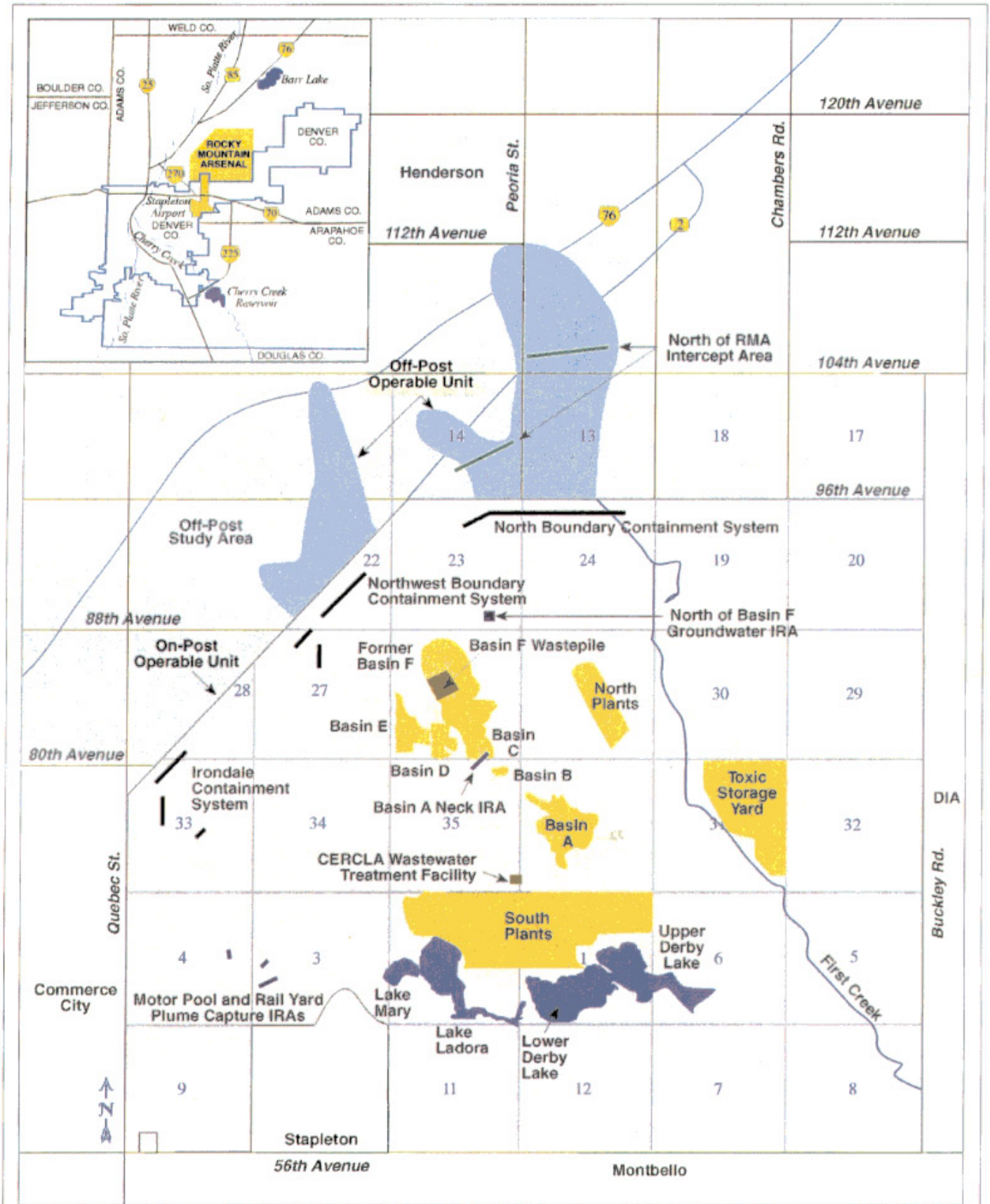
RMA is situated within a temperate grassland region and is part of a broad transition zone between mountain and plains habitats. Tall-grass species are common in moist areas and short-grass species prevail in dry areas. On-post human activity has resulted in vegetation dominated by weedy species and early successional colonists typical for the region. Currently, 88 percent of the RMA land surface is vegetated. Of this total, 41 percent supports early successional plant communities and 19 percent supports crested wheatgrass, which was used in the 1930s and 1940s to stabilize land susceptible to erosion. The remaining 28 percent supports shrubland, patches of yucca, riparian woodlands, cattail marshes and other wetland types, locust and wild plum thickets, upland groves of deciduous trees, and ornamental plantings. Each of these varied plant groups provides potential wildlife habitat.

Regionally dominated by species of prairie, steppe, and savanna communities. The wildlife species inhabiting RMA are those found in similar habitats off post. RMA supports populations of deer, hawks, and eagles, as well as numerous other mammals, birds, and other animals. In contrast to surrounding urban areas where these species are hunted or are sensitive to human presence, RMA provides a relatively less disturbed habitat that is

attractive to wildlife. Its large acreage of diverse open habitats interspersed with lakes, small wooded areas, and a mixture of native grasses and tall weedy forbs, along with a lack of hunting pressure and disturbance, have contributed to an abundance of many wildlife species. The abundance and availability of prey species attracts avian and mammalian predators.

Twenty-six species of mammals have been observed at RMA, a number that includes all of the common mammals that inhabit the prairie grasslands of the Colorado Front Range. One hundred seventy-six species of birds have been observed at RMA, which is approximately 40 percent of all bird species recorded in the state of Colorado. The species richness of RMA birds is high relative to that of the region. At least two regionally rare or declining species (Cassin's sparrow and Brewer's sparrow) are relatively common breeding birds at RMA. Raptor population density and species diversity are comparable with those at other sites in the region. Winter raptor populations, particularly that of the bald eagle, are a primary attraction for the 20,000 to 30,000 visitors that come to RMA during this season.

Several species of reptiles and amphibians may be encountered in nearly every habitat type at RMA. Incidental observation has recorded 61 percent (or 17) of the 28 species of reptiles and amphibians that could potentially occur at RMA. The four lakes in the South Lakes area support aquatic communities, although aquatic insects appear to be largely absent.



Legend

20	Section (1 section = 640 acres or 1 square mile)

Not to scale

Figure D-1
RMA Operable Units

Rocky Mountain Arsenal
Prepared by Foster Wheeler Environmental Corporation

RMA ROD 3.26.96 jb

2.0 Site History and Enforcement Activities

2.1 Production and Operational History

RMA was established by an act of Congress in 1942 to manufacture chemical warfare agents and agent-filled munitions and to produce incendiary munitions for use in World War II. Initial facility building activities included construction of the South Plants manufacturing complex, extension of railway systems onto RMA, construction of a railway classification yard and service and maintenance facilities in Sections 3 and 4, modifications to preexisting irrigation reservoirs (Lake Ladora, Lower Derby Lake) and construction of a new reservoir (Upper Derby Lake) to supply the South Plants complex with process cooling water, and construction of three seepage ponds in a large earthen depression in Section 36. Prior to 1942, the area was largely undeveloped ranchland and farmland.

The first major products produced at RMA were mustard gas, lewisite, and chlorine gas. From 1942 to 1943, the Army manufactured Levinstein mustard in the South Plants. Lewisite was manufactured between April and November 1943. Mustard and lewisite-filled munitions, as well as bulk product in 55-gallon drums, were stored in "toxic storage yards" in Section 5, 6, and 31.

Incendiary munitions were produced at RMA during and after World War II. They included 100-lb M-47 bombs filled with napalm gel and 10-lb M-74 bomblets filled with an incendiary mixture composed of magnesium dust, sodium nitrate, and gasoline. These bomblets were assembled into 500-lb cluster bombs. Once filled, incendiary and cluster bombs were stored in open storage areas and bunkers in Sections 5, 6, 7, and 8. Stockpiles of 10-lb, 6-lb, and 4-lb bomblets were tested in a munitions facility in Section 36. During the Korean War conflict munitions filled with white phosphorus, artillery shells filled with distilled mustard, and incendiary cluster bombs were manufactured, and during the Vietnam conflict approximately 1.3 million white phosphorus grenades, 7.8 million button bombs, 12.2 million microgravel units, and 7 million experimental sandwich button bombs were manufactured at RMA.

During the 1950s and into the 1960s, obsolete and deteriorating World War II ordnance were demilitarized at RMA by either draining and neutralizing the contents and burning the remains or by controlled detonation or open burning. From 1957 to 1959, four areas in Sections 19, 20, 29, and 30 were used for surface detonation and burning of more than twenty-two thousand 500-lb incendiary bombs. Between 1971 and 1973, 3,071 tons of obsolete mustard agent were destroyed.

From 1950 to 1952, the Army designed and constructed the North Plants complex in Section 25 to manufacture the nerve agent GB, also called Sarin. GB was manufactured in the North Plants from 1953 to 1957, the major site for the free world's production of GB during this period. GB munitions were demilitarized in the early 1970s. One-ton containers of bulk GB, bulk VX nerve agent, GB-filled bomb clusters, and GB-filled Weteye bombs were stored in

toxic storage yards in Sections 5, 6, and 31. Diisopropylmethyl phosphonate (DIMP) is a byproduct of GB manufacture.

Between 1962 and 1968, wheat was cultivated on nearly 600 acres in portions of Sections 23, 24, 25, and 26 for the purpose of producing TX, a crop agent. TX is a plant pathogen commonly known as "wheat rust" that does not affect animals or humans. In 1972, stockpiled TX was incinerated and the ash disposed in Section 19.

The Hydrazine Blending and Storage Facility, located just east of the South Plants in Section 1, was owned by the U.S. Air Force and operated by the Army between 1961 and 1982. It was used to produce Aerozine 50, a rocket fuel primarily used in the Titan and Delta missile operations.

Portions of the South Plants manufacturing complex were leased to private industry following World War II, primarily for the production of pesticides. Nine companies conducted manufacturing or processing operations in South Plants between 1946 and 1982, when all Army manufacturing and processing operations in South Plants ceased. The two major lessees of facilities in South Plants were Julius Hyman and Company (Hyman) (1947–52) and Shell Chemical Company (1952–82). Colorado Fuel and Iron (CF&I) also manufactured chlorinated benzenes, chlorine, naphthalene, caustic, and dichlorodiphenyltrichloroethane (DDT) at South Plants between 1946 and 1948.

Hyman manufactured chlorinated pesticides including aldrin, dieldrin, and chlordane. The company also manufactured or brought to RMA feedstock chemicals used in manufacturing its commercial products. These included hexachlorocyclopentadiene (HCCPD), bicycloheptadiene (BCHPD), dicyclopentadiene (DCPD), cyclopentadiene, hydrogen peroxide, acetylene, and chlorine.

In 1942, the South Tank Farm was constructed in the northwest quarter of Section 1 in an area in the southern part of South Plants as part of the initial construction at RMA. The South Tank Farm included 11 storage tank locations that were used for storage of DCPD, crude BCHPD bottoms, isopropyl alcohol, sulfuric acid, D-D fumigant, and dibromochloropropane (DBCP) by Hyman and Shell. In 1948, during the period when CF&I was leasing facilities at South Plants, 100,000 gallons of benzene were spilled in an undisclosed location. In 1979, Shell detected benzene in soil samples collected in the South Tank Farm area. Subsequent sampling under the **Remedial Investigation (RI)** Program (see Section 2.3) revealed the presence of benzene, toluene, xylene, DCPD, and BCHPD in groundwater in the area.

In 1952, Shell acquired the stock of Hyman, which continued as a lessor until 1954 when it was merged into Shell Chemical Company. Following the merger, Shell leased and constructed additional facilities in South Plants. From 1952 to 1982, Shell produced chlorinated hydrocarbon insecticides, organophosphate insecticides, carbamate

insecticides, herbicides, and soil fumigants. These products include Akton, aldrin, Azodrin, Bidrin, Bladex, Ciodrin, Dibrom, dieldrin, endrin, ethyl parathion, Gardona, Landrin, methyl parathion, Nemagon (DBCP), Nudrin, Phosdrin, Planavin, Pydrin, ravap, and Supona.

The process water system installed by the Army in 1942 circulated cooling waters from the South Lakes area of South Plants through South Plants and back to the lakes. In May 1951, an accidental discharge of caustic soda into the process water system at RMA occurred, resulting in a massive fish kill in Lake Ladora. Subsequently, samples of surface water, surface foam, green algae, and sediment from Lake Ladora and Lake Mary were found to contain concentrations of aldrin, dieldrin, Gardona, Bidrin, and heavy metals.

2.2 Waste Disposal Operations

Throughout the 1940s, 1950s, and 1960s solid wastes generated at RMA were disposed in Section 36, east of Basin A. The Army's operations at RMA generated miscellaneous solid chemical wastes as well as potentially contaminated tools, equipment, unwanted containers, rejected incendiaries, and empty munitions casings. These materials were decontaminated with caustic or other appropriate decontaminants and the residue hauled to burning pits for incineration.

The burn pits or trenches were normally 8 to 10 ft deep and 100 to 200 ft long, and were usually dug with earth-moving equipment and draglines. Four to five tons of lumber were placed in the bottom of the pit and the potentially contaminated materials were placed on top of the lumber. When the pit was full, additional wood was placed on top of the materials, 300 to 500 gallons of fuel oil poured onto the heap, and the contents burned. Rejected lots of napalm or M-47 incendiary bombs were sometimes used as fuel for the fire. After burning, the metal was tested to determine whether it was free of contamination. If testing revealed the presence of contamination, the metal was burned again. In 1957, several hundred tons of scrap metal were recovered from the burn pits and sold. In addition, 16 mustard-contaminated forklifts were retrieved and salvaged. After use, burn pits were backfilled with excavated soil. In 1969, the Army halted decontamination of contaminated materials by open pit burning; contaminated material was subsequently stored in contaminated equipment dumps, which began to increase substantially in size. Open pit burning continued only for the purpose of destroying explosives, burster charges, rocket propellant, and rocket motors.

In addition to the solid waste burn pits, the Army operated a number of sanitary landfills in Section 36 (north of South Plants), in Section 4 (west of South Plants), and in Section 30 (northeast of North Plants). Although sanitary landfills were generally used for disposal of uncontaminated wastes, contaminated wastes may have been occasionally disposed at these sites.

Beginning in 1942, most aqueous wastes from South Plants operations were treated with sodium hydroxide and were discharged through the chemical sewer into the Basin A area. Aqueous waste from the chlorine plant at the west end of South Plants was initially discharged into the Sand Creek Lateral, where it ultimately discharged into First Creek in Section 25. However, the resulting dissolved solids levels in First Creek were considered too high, so this waste stream was subsequently diverted into unimproved Basins D and E in Section 26. In 1946, overflow from Basin A was channeled into Basin B and subsequently into Basins D and E. The locations of these source areas are shown on Figure 1.0-1.

In 1953, the unlined basin network was upgraded to facilitate handling of all liquid wastes from both North Plants and South Plants. Basin C was constructed to handle all liquid wastes from South Plants as well as overflow from Basin A. Overflows from Basin C were in turn channeled into Basins D and E.

In a subsequent effort to consolidate aqueous wastes, and in response to complaints by nearby residents about contaminated groundwater, the Army constructed Basin F in late 1956. Basin F was the only disposal basin at RMA equipped with a catalytically blown asphalt liner to protect the substrate from infiltration by contaminated material.

In 1951, Shell disposed of approximately 1,000 cubic yards of materials resulting from the production of HCCPD. This tarry, chlorinated material was buried in thin-gauge caustic barrels and in bulk in an unlined pit in the South Plants Central Processing Area. Although potential migration pathways exist, groundwater data indicate that these wastes are immobile.

In 1961, the Army commenced what was hoped to be the final solution to RMA's chemical waste disposal problem. An injection well was drilled 12,045 ft deep into Precambrian rocks beneath Basin F. Between March 8, 1962, and September 30, 1963, approximately 104 million gallons of treated effluent waste from Basin F were injected into the deep disposal well at rates of 100 to 300 gallons per minute (gpm). A total of 165 million gallons of waste were disposed using this method. Operations were suspended on February 20, 1966, due to growing suspicion that the injection operations had caused an unusual series of earthquakes centered in the RMA area. The well was properly plugged and abandoned on October 22, 1985.

2.3 Previous Investigations

Since the early 1950s potential contamination of the flora and fauna at RMA and various aspects of the ecology of these organisms have been studied. Initial studies were conducted in response to reports of wildlife mortality and agricultural damage. By the late 1950s, complaints of groundwater pollution north of RMA began to surface. In 1974, the Colorado Department of Health (now the Colorado Department of Public Health and Environment, or CDPHE) detected DIMP in a groundwater well north of RMA. Ecological investigations of broader scope were conducted in support of on-post contamination assessments and restoration planning programs that began in the

1970s, and it was during the mid-1970s that the first ecological surveys were conducted. Some of these studies had an RMA toxicological or ecological emphasis, while others were conducted at RMA in support of the proposed Stapleton International Airport expansion onto RMA property and county-wide wildlife habitat planning. More recent studies, initiated in the early 1980s, were performed in compliance with CERCLA and in support of active litigation involving the United States, the state of Colorado, and Shell.

In 1974, the Army established a Contamination Control Program at RMA designed to ensure compliance with federal environmental laws. Under the Contamination Control Program, a number of investigations were conducted by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) during the 1970s and early 1980s. The results of these investigations indicated that the contamination at RMA was concentrated mainly in the alluvial sediments and alluvial groundwater, with minor amounts of contamination in the Denver Formation. Based on this information and personal interviews, a contamination control strategy was developed for RMA that was designed to be consistent with pertinent state and federal statutes. In 1984, USATHAMA, under a separate division created specifically to deal with the contamination at RMA, i.e., Program Manager for Rocky Mountain Arsenal (PMRMA), initiated a series of investigations required under CERCLA, the RI/Feasibility Study (FS) and the Endangerment Assessment. A flow diagram of activities that have been and are currently being conducted under these programs is presented in Figure 2.3-1.

Six of the more recently conducted studies have direct relevance to the selection of the preferred remedial alternatives. These include the following:

- Human Health Exposure Assessment for Rocky Mountain Arsenal (Ebasco 1990)
- Remedial Investigation Summary Report (Ebasco 1992a)
- Development and Screening of Alternatives Report (Ebasco 1992b)
- Human Health Exposure Assessment Addendum for Rocky Mountain Arsenal (Ebasco 1992c)
- Integrated Endangerment Assessment/Risk Characterization Report (Ebasco 1994)
- Detailed Analysis of Alternatives Report (Foster Wheeler Environmental 1995a)

The general time frame under which major RMA documents were completed is presented in Table 2.3-1. These and other comprehensive documents regarding the remediation of RMA have been made available for public review at the Joint Administrative Record Document Facility (JARDF), which is located at the west entrance to RMA at 72nd Avenue and Quebec Street, and at eight area libraries (see Section 3).

2.4 Past and Ongoing Response Actions

Since 1975, the Army and Shell have undertaken numerous efforts to protect on- and off-post human health and the environment by implementing early remedial actions and IRAs to begin the remedial actions at the most highly contaminated sites. IRAs were undertaken at RMA in advance of the ROD to stop the spread of or eliminate

contamination and to begin the actual remediation. A site investigation and alternative assessment was performed for each IRA. All IRAs that require the removal of material are carried out in accordance with applicable laws and regulations and are consistent with and contribute to the efficient performance of the preferred alternatives for the On-Post and Off-Post Operable Units.

Fourteen IRAs have been completed by the Army and Shell or will be incorporated into the final remedy as follows:

- Groundwater Intercept and Treatment North of RMA – This IRA was undertaken to address groundwater contamination that had migrated off post prior to installation of the boundary extraction and treatment systems on post. A groundwater extraction and treatment system is now in place north of RMA for treatment of DIMP, solvents, and pesticides. The IRA includes one extraction and reinjection system located along Highway 2 between 96th Avenue and 104th Avenue and another near 108th Avenue and Peoria. The extracted water is treated by **granular activated carbon (GAC)** to Containment System Remediation Goals (CSRGs) for **organics** at a treatment plant located on Peoria and reinjected into the aquifer. Construction of this IRA was completed in 1993; treatment of groundwater at the north boundary is ongoing.

- Improvement of North Boundary Containment and Treatment System and Evaluation of Existing Boundary Systems – The NBCS was originally designed to remove and treat contaminated water reaching the north boundary. Groundwater is extracted, treated by GAC, and reinjected into the ground. The primary contaminants at this location are chloroform, dieldrin, DIMP, DCPD, and organosulfur compounds. The original system consisted of extraction wells, a 6,740-ft slurry wall, a recharge sump, filters to remove particles from water, three large (20,000 lb) carbon adsorbers to treat organic contaminants to CSRGs from groundwater, and reinjection wells. Groundwater is treated at a rate of 220 to 300 gpm. Operational improvements were implemented as part of the IRA and the reinjection system for treated water was improved by addition of recharge trenches along the entire portion of the extraction well system and the slurry wall. Construction of the improvements to the NBCS was completed in 1993; treatment of groundwater is ongoing.

  The NWBCS was designed to remove and treat contaminated groundwater migrating toward the northwest boundary. The original system included an extraction system, GAC treatment, and a reinjection system as well as a slurry wall to control contaminant migration. The system has been improved under two different IRAs, the Short-Term Improvements and the Long-Term Improvements IRAs. The slurry wall, which originally measured 1,425 ft, was extended by 665 ft under the Short-Term Improvements IRA. Five extraction wells were added to the original 15 extraction wells, and the number of reinjection wells was increased from 21 to 25. The IRA modifications increased the amount of water treated in the NWBCS from approximately 900,000 to 1.4 million gallons per day. The Long-Term Improvements IRA involved the addition of seven monitoring wells, one extraction well, and an expansion of the monitoring program for the system. Groundwater is treated to CSRGs for organic contaminants. Construction of the improvements to the NWBCS was completed in 1993.

  The ICS was designed to remove and treat contaminated groundwater migrating toward the western boundary. The original system included two parallel rows of extraction wells, one row of reinjection (recharge) wells, and GAC treatment. This system was designed to treat a DBCP plume migrating from the Rail Yard. The system was improved during the IRA by installing four extraction wells approximately 2,000 ft upstream from the original system, adding nine new recharge wells adjacent to the original system, and converting three of the original extraction wells to recharge wells. Groundwater is treated to CSRGs for organic contaminants. Construction of the improvements was completed in 1991.

- Groundwater Intercept and Treatment North of Basin F – The purpose of the Basin F Groundwater IRA was to intercept and remove contaminated groundwater migrating from the Basin F area toward the northern boundary. The IRA involves extraction, treatment to CSRGs, and reinjection of groundwater. Water is extracted from a well north of Basin F at a rate of 1 to 4 gpm (approximately 1 million gallons per

year). The extracted water is piped to a treatment system located at Basin A Neck for removal of volatile contaminants (solvents) by air stripping, and the remaining contaminants, such as pesticides, by GAC. Treated water is reinjected in recharge trenches at the Basin A Neck area. Construction of this IRA was completed in 1990; treatment of groundwater is ongoing.

- Closure of Abandoned Wells – At numerous locations throughout RMA, old or deteriorating farm wells and unused on-post wells have been located and cemented closed. This IRA was completed in 1990.
- Groundwater Intercept and Treatment System in the Basin A Neck Area – The Basin A Neck IRA was designed to capture and contain contaminated groundwater migrating from the Basin A area. The IRA consists of extraction wells for removal of groundwater from the aquifer, a slurry wall to minimize migration of contaminated groundwater, a treatment system, and a reinjection system consisting of several recharge trenches. Approximately 12 to 20 gpm (5 to 10 million gallons per year) of groundwater are extracted and treated to CSRGs by GAC at the Basin A Neck IRA treatment system. The contaminants removed from water include solvents and pesticides. Construction of the Basin A Neck system was completed in 1990; treatment of groundwater is ongoing.
- Basin F Liquids, Sludges, and Soil Remediation – This IRA has included transfer of the basin liquids and decontamination water into temporary storage tanks and a lined, covered surface impoundment (Pond A); construction of a 16-acre lined waste storage pile with a leachate collection system; excavation of 600,000 cubic yards of Basin F soil and placement into the wastepile; and incineration of the stored liquids by Submerged Quench Incineration (SQI). This IRA was completed in two phases. The first phase, which involved the containment of the sludges/soil, was completed in 1989. The SQI system, which became operational in May 1993, was shut down in July 1995 following the completion of the treatment of approximately 11 million gallons of waste liquids. The SQI, storage tanks, and pond were closed in accordance with a CDPHE closure plan. The tank farm and pond areas were clean closed to specific closure performance standards for contaminants in the Basin F liquid. The SQI was demolished, and some of the process equipment was salvaged. All field and administrative closure activities were completed by May 30, 1996.
- Building 1727 Sump Liquid – Liquid in the Building 1727 sump was treated by activated alumina and GAC to remove contaminants that included arsenic and DIMP. This IRA eliminated any remaining threat of liquid release from the sump; it was completed in 1989.
- Closure of the Hydrazine Facility – This facility was used as a depot to receive, blend, store, and distribute hydrazine fuels. Wastewater stored at the facility was treated on post at the SQI facility, the structures demolished, and the debris removed. Uncontaminated materials at the site were salvaged for recycling and reuse, and contaminated materials were disposed at an off-post permitted **hazardous waste landfill**. The area encompassing the former facility was regraded and revegetated following demolition and debris removal. This IRA was completed in 1992.
- Fugitive Dust Control – In 1991, the Army completed the reapplication of a dust suppressant (Dusdown 70) in Basin A as part of this IRA. Hydro-seeder trucks were used to spray a nontoxic, water-based dust suppressant.
- Sewer Remediation – As part of this IRA, sanitary sewer manholes were plugged to eliminate the transport of contaminated groundwater that may have entered the sewer system via cracks or loose connections. This IRA was completed in 1992.
- Asbestos Removal – This IRA is part of the Army's ongoing survey of asbestos on post, including removal and disposal activities. The survey and removal of friable asbestos from occupied buildings were completed in December 1989. The Asbestos IRA activities continue as part of the final structures remediation.
- Remediation of Other Contamination Sources – Under this IRA, the following contamination sources have or are being minimized or eliminated:

  – Motor Pool – A groundwater extraction system was constructed to remove trichloroethylene (TCE) in groundwater in the Motor Pool area. Because the low levels of TCE present in this water can be

effectively treated by GAC, the water is piped to the ICS for treatment. The amount of water extracted from the Motor Pool area is approximately 100 gpm. A **soil vapor extraction (SVE)** system was also constructed to draw vapors containing **volatile** contaminants from the soil. Extracted vapors are sent first to a separation tank to remove the water vapor and then to a treatment system where the volatile contaminants are treated. Soil vapor extraction was conducted at the Motor Pool area between July and December 1991 to remediate TCE-contaminated soil. Two vapor extraction wells as well as four clusters of soil gas monitoring wells were installed. The Motor Pool groundwater extraction system is currently operational.

- Rail Yard – This IRA was conducted to assess a potential DBCP problem in this area and introduce cleanup measures if necessary. It was decided that groundwater removal would be necessary, but that adequate treatment could be provided at the ICS at the western boundary of RMA. The Rail Yard IRA extraction system consists of a row of five wells that extract approximately 230 gpm of groundwater containing low levels of DBCP. The water is piped to the ICS where DBCP is removed by GAC. Two additional wells further downgradient act as a backup system. Treatment is currently ongoing.
- Lime Settling Basins – Workers constructed a soil **cover** over the Lime Settling Basins area to isolate the basins from the ground surface and minimize the amount of rainwater seeping into the basins. The construction of the cover was completed in 1993.
- South Tank Farm **Plume** – The South Tank Farm consists of 11 tanks used for storage of alcohol, BCHPD bottoms, DCPD, D-D soil fumigant, and sulfuric acid. Records indicate benzene was also used or stored in this area. The South Tank Farm Plume, located between South Plants and the South Lakes area, consists of two separate groundwater plumes extending toward the lakes, one of which consists of light nonaqueous phase liquids (LNAPLs). The IRA alternative consisted of continued groundwater monitoring to verify that no additional action was necessary due to the natural degradation of the contaminants. Alternative assessment activities were completed in 1994.

  In 1991, an SVE field demonstration, which included collection and analysis of soil, LNAPL, SVE offgas, and soil gas samples, was designed for specific application to the South Tank Farm Plume. The resulting data were used to evaluate the performance, effectiveness, and operating parameters for an SVE system in the area of the plume. Based on the results of the demonstration, it would take more than 10 years for the SVE process to remove the majority of the mass of contaminants that would remain after LNAPL recovery was no longer feasible.
- Army Trenches – Soil samples collected from representative trenches showed elevated concentrations of **ICP metals** and relatively low concentrations of arsenic, mercury, and many organic contaminants, including members of all the analyte groups except pesticide-related organophosphorous compounds and organonitrogen compounds. A large variety of tentatively identified compounds were also detected in the trench soil. High concentrations of some organic contaminants exist in groundwater in portions of this area. The IRA alternative consisted of continued groundwater monitoring in this area. Alternative assessment activities were completed in 1994.
- Shell Trenches – Under this IRA, the trenches were covered with a soil cover and revegetated. A slurry wall that surrounds the trench area was constructed to reduce the lateral movement of contaminants away from the trenches. Construction of this IRA was completed in 1991.

• CERCLA Hazardous Wastes – The initial action was pretreatment of CERCLA liquid wastes. This IRA was later expanded to include identification, storage, and disposal of a variety of CERCLA wastes. The initial action and expanded elements are as follows:

- Wastewater Treatment Plant – A wastewater treatment plant was constructed by 1992 under the first phase of the CERCLA Liquid Waste IRA. This facility is currently used to treat wastewater generated from laboratory operations, field sampling, decontamination, and other sources such as equipment washing. Several treatment technologies are used at the CERCLA Wastewater Treatment Plant including activated GAC, advanced oxidation using ultraviolet light, **air stripping**, chemical

precipitation, and activated alumina adsorption. It is expected that this facility will be used to treat similar wastewater streams during remediation.

- Waste Management – This element identified both off- and on-post landfilling as options to dispose hazardous waste that has been or will be placed in storage areas at RMA and that has not been addressed in another IRA. Waste streams currently being managed include RI/FS wastes; IRA wastes; miscellaneous wastes from vehicles, grounds, and building maintenance; and items found on post.
- Polychlorinated Biphenyls (PCBs) – The purpose of this element was to inventory and sample PCB-contaminated equipment followed by remediation off post. This IRA included characterization of spill sites (i.e., soil and structures) associated with PCB contamination and is ongoing. PCB contamination not addressed in this IRA will be addressed as part of the final remedy.
- Waste Storage – This element included analysis of an on-post facility for temporary management of solids that are bulk hazardous wastes. These wastes primarily consist of contaminated soil and building debris. Analysis resulted in the decision to dispose wastes in the on-post hazardous waste landfill when it becomes available.

- Chemical Process-Related Activities – Agent-related and nonagent-related process equipment and piping located in North Plants and South Plants is being sampled, decontaminated, and dismantled under this IRA. Although much of the equipment in these areas has already been removed and recycled, process-related equipment not remediated as part of this IRA will be disposed in the new on-post hazardous waste landfill. Asbestos-removal activities as required for equipment removal will continue as part of the final response action at RMA.

A summary of the actions undertaken in each IRA, including the status of the IRA, is presented in Table 2.4-1, and the locations at which the actions were taken are presented in Figure 2.4-1. The procedure for IRA implementation is set forth in Section XXII of the FFA. The typical IRA process that applies to most RMA IRAs is outlined in Figure 2.4-2. For a variety of technical reasons, a slightly different process was used for the following IRAs: Improvements of the North Boundary Containment System and Evaluation of all Existing Boundary Containment Systems; Closure of Abandoned Wells; Basin F Liquids, Sludges, and Soil Remediation; and Fugitive Dust Control (PMRMA 1988). The environmental media potentially affected by the implementation of the various IRAs are listed in Table 2.4-2. Reports generated for these IRAs (Technical Plans, Alternatives Assessment Reports, Decision Documents, Implementation Documents, and Operational Reports) can be accessed through the JARDF.

In addition, two other response actions were undertaken at RMA: waste disposal operations at the deep injection well and the construction of the Klein treatment plant. The deep injection well was drilled 12,045 ft deep into Precambrian rocks beneath Basin F as a solution to RMA's chemical waste disposal problem. As described in Section 2.2, 165 million gallons of waste were disposed in this well, but operations were suspended and the well plugged when it was suspected that the injection of the wastes was causing an unusual series of earthquakes. The Klein treatment plant (located in Section 33) was constructed in the mid-1980s to treat off-post groundwater to the west of RMA that was primarily contaminated by chlorinated solvents. (It was subsequently determined that this contamination originated primarily from non-RMA sources.)

2.5 History of Enforcement Activities

2.5.1 CERCLA Enforcement Activities

On December 6, 1982, the EPA, Army, Shell, and Colorado Department of Health (now CDPHE) entered into a Memorandum of Agreement outlining joint participation in the Army's study of decontamination at RMA. Although the Parties followed the process outlined in the Memorandum of Agreement until 1986, they also pursued litigation with respect to issues relating to legal authority over RMA remediation efforts, payment of natural resource damages (NRDs), and reimbursement of costs expended for cleanup activities (response costs).

United States v. Shell Oil Company, Civil Action No. 83-C-2379

On December 9, 1983, the United States filed this action in federal court to recover NRDs caused by the release of Shell's contaminants at RMA and to recover from Shell a portion of the costs expended by the United States for RMA cleanup efforts.

This case was consolidated with the state's case against the United States and Shell (discussed below) by the Court on March 26, 1985. On November 15, 1985, the Court ruled that the United States and Shell were liable parties at RMA, subject to certain defenses. The Parties filed a joint stipulation setting forth the factual bases for the United States' and Shell's liability on November 18, 1985.

On February 1, 1988, the United States and Shell lodged a proposed consent decree with the Court to resolve the litigation between those two parties. The proposed consent decree set forth the process to be utilized to select and implement cleanup decisions for RMA, subject to public comments. The United States and Shell moved for entry of a modified consent decree on June 7, 1988, following the receipt of public comments. This version of the modified consent decree was never entered by the Court.

In February 1989, the Army and Shell, along with EPA, USFWS, ATSDR, and U.S. Department of Justice, executed the FFA, an interagency agreement and administrative order on consent that embodied the terms of the modified consent decree. The state did not agree with parts of the FFA and did not become a signatory. The state has remained actively involved in RMA remediation efforts and participated in informal dispute under the FFA. The United States and Shell also executed a Settlement Agreement that set out a process to deal with financial issues between them, such as the allocation and payment of response costs or NRDs.

Under the Settlement Agreement, the United States and Shell share "allocable costs" relating to RMA remediation to different degrees based on the cumulative total of those costs. Allocable costs are defined in the Settlement Agreement. For the first $500 million of allocable costs, the United States and Shell are equally responsible. For the next $200 million, the United States is responsible for 65 percent of allocable costs and Shell is responsible for 35 percent of those costs. For allocable costs over $700 million, the United States is responsible for 80 percent of

allocable costs and Shell is responsible for 20 percent of those costs. The United States and Shell are also separately responsible for all costs with respect to Army-only or Shell-only response actions, respectively, which are described in exhibits to the Settlement Agreement. This case was resolved by entry of a modified proposed consent decree on February 12, 1993.

EPA, Army, Department of Interior, and Shell have established a process for resolving disputes that arise at RMA concerning CERCLA cleanup actions. This dispute resolution process is set forth in the FFA (EPA et al. 1989). The state of Colorado became a party to the FFA dispute resolution process on June 13, 1995, when it signed, along with the above entities, the Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal (Conceptual Remedy). The only provisions of the FFA that shall be binding upon the state are those relating to dispute resolution.

The state declares its intention to utilize the FFA dispute-resolution process in a good-faith effort to resolve all issues informally. For any issues not subject to dispute resolution under the FFA, and for those issues over which the state has independent authority pursuant to United States v. State of Colorado and the Colorado Department of Health, Civil Action No. 89-C-1646, 990 F. 2d 1565 (10th Cir. 1993), cert. denied 114 S. Ct. 922 (1994), the state reserves any rights and authorities it may have.

State of Colorado v. United States and Shell Oil Company, Civil Action No. 83-C-2386

On December 9, 1983, the state of Colorado filed an action in federal court seeking NRDs from the Army and Shell under CERCLA for injury to the state's natural resources. On November 25, 1985, the state added a claim against the Army and Shell for response costs the state had expended at RMA pursuant to CERCLA.

On March 14, 1989, pursuant to a partial settlement of the state's response cost claim, the Army and Shell each agreed to pay the state $1 million to cover state costs at RMA through December 31, 1988.

The state then requested reimbursement for costs it had incurred from January 1, 1989 to June 30, 1992. The Court ruled on several legal issues relating to these response costs on November 17, 1994. (State of Colorado v. United States and Shell Oil Company, 867 F. Supp. 948 [D. Colo. 1994].) The Court found that the state's costs expended to enforce its hazardous waste laws could be reimbursed to the state under CERCLA if the cost met the CERCLA definition of response costs. The Court also held that the Army and Shell were responsible for interest from the date response costs were incurred because the state had previously demanded payment. The Court also held that the Army and Shell were responsible for interest on response costs incurred after February 7, 1989, the date that the state made a specific dollar amount demand for response costs, at the time these costs were incurred. Interest for response costs incurred before February 7, 1989 was held to begin to accrue on February 7, 1989.

On January 31, 1995, the Parties entered into a partial settlement under which the Army and Shell paid the state $4.8 million for response costs from January 1, 1989 through June 30, 1992.

On February 9, 1995, the Court placed the NRD portion of the state's case against the United States and Shell on administrative closure pending remedial selection. However, the portion of this litigation with respect to subsequent response costs remains open. In September 1995, the state made a demand for payment of response costs to the Army and Shell for the period of July 1, 1992 to June 30, 1994.

2.5.2 State Enforcement Activities

State of Colorado v. Department of the Army, Civil Action No. 86-C-2524

In 1974, the Colorado Department of Health (now CDPHE) detected DIMP and DCPD in the groundwater aquifer north of RMA. On April 7, 1975, CDPHE issued three administrative orders to the Army and/or Shell with respect to this contamination. These orders cited violations of the Colorado Water Quality Control Act and directed Shell and/or the Army to immediately stop the off-post discharge of DIMP and DCPD in surface and subsurface water.

On October 1, 1986, CDPHE issued a final modified closure plan for Basin F pursuant to the Colorado Hazardous Waste Management Act (CHWMA) and its implementing regulations. CHWMA is the state-delegated RCRA program. The closure plan became effective on October 2, 1986. On November 14, 1986, the state filed an action against the Army in state court. On December 15, 1986, the case was removed to the U. S. District Court for Colorado. The state's original complaint alleged violations of the CHWMA groundwater monitoring regulations.

On October 14, 1987, the Army notified CDPHE, based on EPA' s listing of RMA (excluding Basin F) and the proposed listing of Basin F on the NPL on July 22, 1987, Basin F and the RMA were no longer subject to CHWMA jurisdiction. The Army stated its intent to implement a cleanup for Basin F pursuant to its authority under CERCLA.

On December 4, 1987, the state was granted leave to amend its complaint to add claims alleging a failure to close Basin F in accordance with the closure plan issued under CHWMA and alleging the Army's failure to pay fees due under CHWMA.

On February 24, 1989, the Court, in a memorandum opinion denying the United States' motion to dismiss the state's complaint, stated that CERCLA was intended to operate independently of and in addition to RCRA and held that CHWMA enforcement was not precluded by CERCLA in the circumstances then presented (State of Colorado v. Department of the Army, 707 F. Supp. 1562, 1569-70 [D. Colo. 1989]). The Court further ruled that the state's CHWMA regulations pertaining to groundwater monitoring and closure of hazardous waste units were within the waiver of federal sovereign immunity in Resource Conservation and Recovery Act (RCRA). Based, in part, on

EPA's subsequent listing of Basin F on the NPL, the United States filed a motion for reconsideration of the Court's February 24th order on March 6, 1989. The Court did not rule on this motion. The remaining aspects of the case were dismissed without prejudice on September 4, 1991 as a result of subsequent developments in other RMA cases.

United States v. State of Colorado and the Colorado Department of Health, Civil Action No. 89-C-1646

Following inspections of the Basin F site in May and June of 1989, CDPHE issued a compliance order against the Army, citing 42 violations of CHWMA and its implementing regulations regarding hazardous waste management. The compliance order was amended twice. A final amended compliance order was issued on September 1, 1989, with a stated effective date of September 22, 1989.

On September 22, 1989, the United States filed suit in federal court, United States v. State of Colorado and the Colorado Department of Health, Civil Action No. 89-C-1646, seeking a judgment that CDPHE had no authority to enforce the final amended compliance order and that the United States was not liable for civil penalties under RCRA or CHWMA.

On August 14, 1991, the Court ruled in the United States' favor and enjoined the state from taking any action to enforce the final amended compliance order or to impose civil penalties against the United States. The state appealed this ruling in regards to its enforcement authority to the Tenth Circuit Court of Appeals on October 11, 1991.

On April 6, 1993, the Tenth Circuit ruled that RMA is a facility subject to interim status requirements pursuant to CHWMA and its implementing regulations and that the state has the authority to enforce its federally-delegated hazardous waste program at RMA.

On June 30, 1993, the Tenth Circuit issued an amended opinion and denied the United States' petition for rehearing. (United States v. State of Colorado and the Colorado Department of Health, 990 F. 2d 1565 [10th Cir. 1993].) The amended opinion acknowledges that "final disposition of the solids remaining under the Basin F cap and in the wastepile will be determined as part of the remedial action for which a final record of decision will be issued." The opinion also reiterates that the state has authority to enforce CHWMA at RMA by holding that "the Army is obligated to comply with RCRA/CHWMA regulations applicable to interim status facilities pending closure of Basin F pursuant to an approved closure plan" (Id. at 1512 n. 11, 1582 n. 22). On July 8, 1993, the mandate was issued for the Tenth Circuit decision and the case was remanded to the District court.

On November 17, 1993, the United States petitioned the Supreme Court of the United States to review the decision of the Tenth Circuit. The Supreme Court denied the United States' petition on January 24, 1994 (114 S. Ct. 922 [1994]).

On June 30, 1994, the United States and the state of Colorado entered into a consent decree resolving remaining litigation issues. The consent decree required the Army to submit closure plans for Basin F and the Basin F Wastepile for CDPHE approval.

United States v. Colorado Water Quality Control Commission, Civil Action No. 94-C-491

On December 27, 1993, the Colorado Water Quality Control Commission, after a public hearing, issued a Notice of Final Adoption, setting a groundwater standard for DIMP at 8 parts per billion (ppb). The United States filed a lawsuit in federal court on March 2, 1994 challenging the state's DIMP standard. On May 5, 1995, the Court granted the state's motion to dismiss the complaint. The Court relied on the abstention doctrine, under which federal courts decline to review matters concerning state agency action where such review would interfere with state programs pertaining to matters of local concern. On May 18, 1995, the United States filed a motion for amendment and reconsideration of the May 5th decision. The Court has not ruled on this motion.

2.5.3 Conceptual Remedy

As required by CERCLA, and in accordance with the FFA, the Army's selection of a preferred alternative was based on the RI, the Exposure Assessment and Integrated Endangerment Assessment/Risk Characterization, FS, and other scientific and technical information. As part of the remedial process, the Parties engaged in an extensive series of meetings over a 6-month period regarding the remediation of RMA. Interested citizens and representatives of city and county agencies, collectively called the Stakeholders, also participated in discussions about potential remedial approaches. These stakeholder meetings, along with information obtained in the previously described process, provided the basis for negotiations among the Parties that culminated in the Conceptual Remedy, which was signed by the Parties on June 13, 1995. The Detailed Analysis of Alternatives report incorporates the elements of the Conceptual Remedy and became the basis for the Proposed Plan for the Rocky Mountain Arsenal On-Post Operable Unit (Foster Wheeler Environmental 1995b). The Proposed Plan was submitted for public comment on October 16, 1995, and was the subject of a public meeting on November 18, 1995.

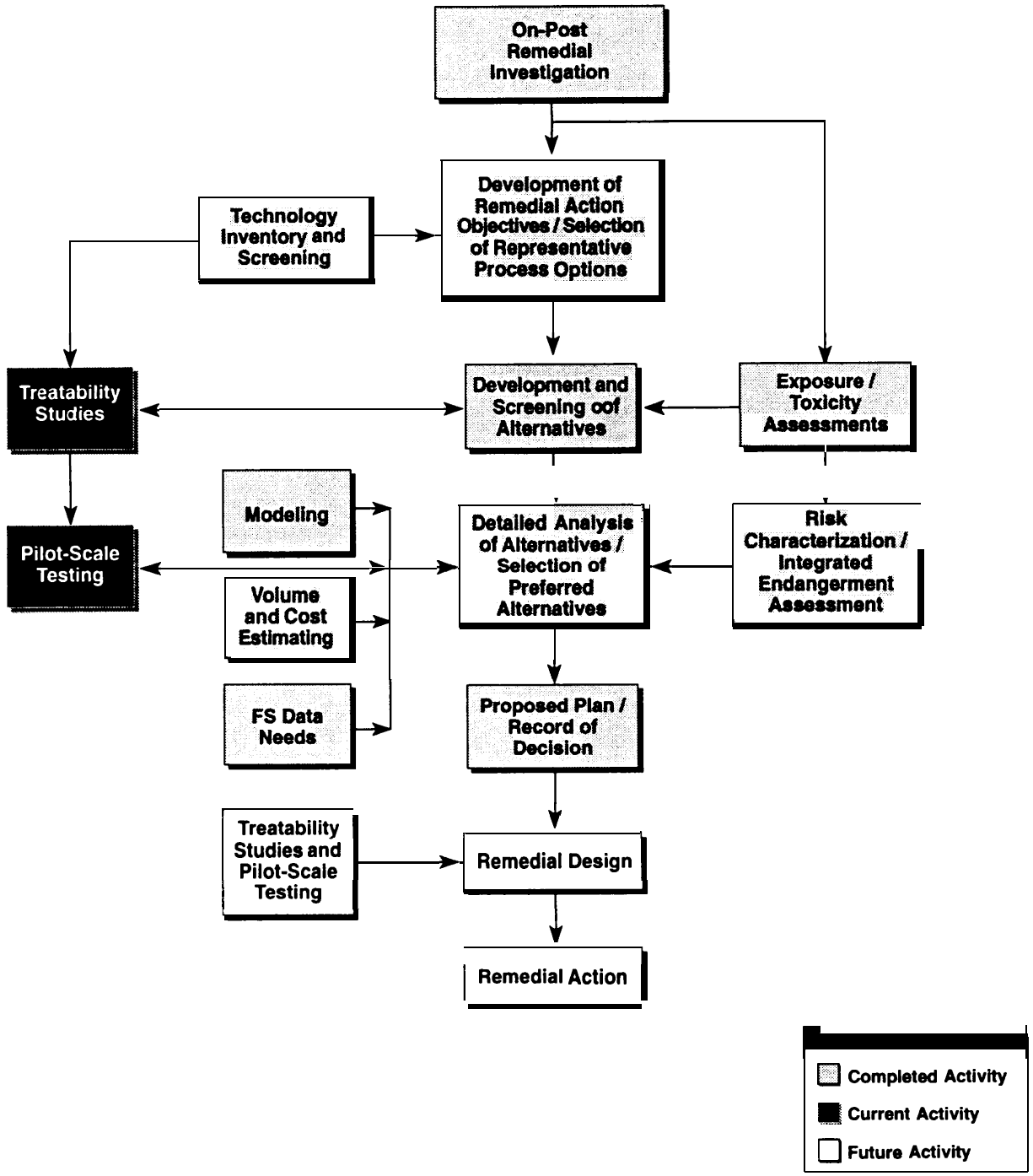
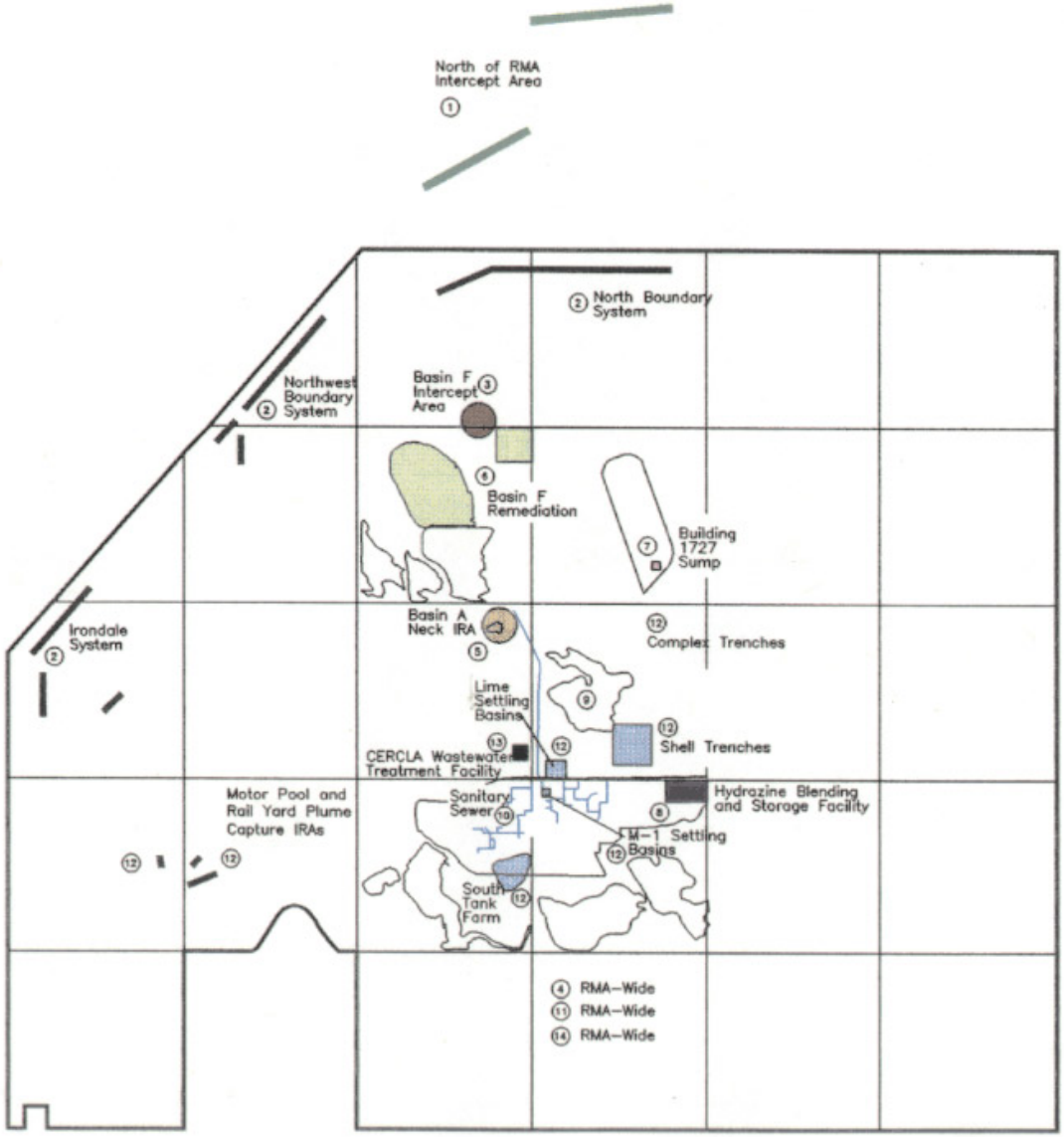


Figure 2.3-1

Remedial Investigation / Endangerment Assessment / Feasibility Study Flow Diagram

Rocky Mountain Arsenal
Prepared by Foster Wheeler Environmental Corporation

RMAROD6.96 jb



Legend

1. Off-Post Groundwater Intercept and Treatment System North of RMA
2. Improvement of North Boundary System and Evaluation of Existing Boundary Systems
3. Groundwater Intercept and Treatment System North of Basin F
4. Closure of Abandoned Wells
5. Groundwater Intercept and Treatment System in the Basin A Neck Area
6. Basin F Liquids, Sludges, and Soil Remediation
7. Building 1727 Sump Liquid
8. Closure of the Hydrazine Facility
9. Fugitive Dust Control
10. Sewer Remediation
11. Asbestos Removal
12. Remediation of Other Contamination Sources
13. CERCLA Hazardous Wastes
14. Chemical Process-Related Activities

-N-

0 2500
Scale in Feet

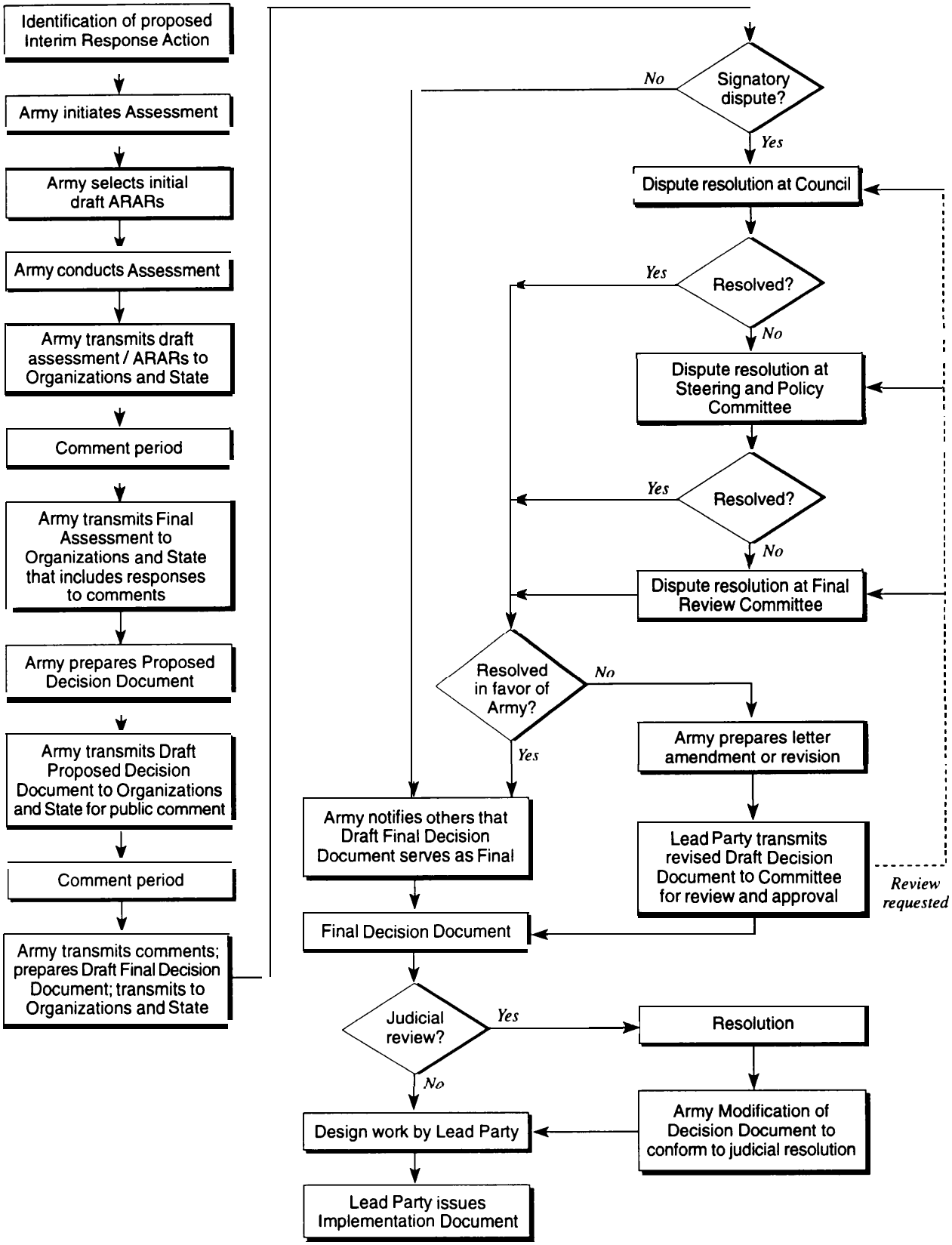
Prepared for:
Office of the Program Manager
for Rocky Mountain Arsenal
June 1996

FIGURE 2.4-1

RMA Interim Response Action Locations

Prepared by:
Foster Wheeler Environmental Corporation

File Name: F:\PROJECTS\RMA\F2_4-1.DWG
Date 6/06/98
Drawn by TH/JLS
Checked by SA



Source: PMRMA (1988)

Figure 2.4-2

Typical RMA Interim Response Action Process

Rocky Mountain Arsenal
Prepared by Foster Wheeler Environmental Corporation

Table 2.3-1 Inception and Completion Dates for Major RMA Documents

Document	Start Date	Finish Date[1]
Remedial Investigation	October 1984	January 1992
Human Health Exposure Assessment	October 1986	September 1990
Human Health Exposure Assessment Addendum	August 1990	December 1992
Integrated Endangerment Assessment/Risk Characterization		
Human Health Risk Characterization	May 1990	September 1992
Ecological Risk Characterization	October 1987	July 1994
Development and Screening of Alternatives	February 1989	December 1992
Detailed Analysis of Alternatives	January 1993	October 1995
Proposed Plan	July 1995	October 1995

[1] Finish date indicates the date the final version of the document was submitted to the administrative record for public review.

Table 2.4-1 Summary of Past and Ongoing Response Actions

Response Action	Objective	Status/Completion[1]
Interim Response Actions		
1. Groundwater Intercept and Treatment System North of RMA	Capture and treat contaminated groundwater plumes north of RMA.	Construction completed 1993; treatment is ongoing.
2. Improvement of the North Boundary Containment and Treatment System and Evaluation of Existing Boundary Systems	Evaluate and improve, as necessary, the operation of the boundary containment and treatment systems.	Construction completed 1993; treatment is ongoing.
3. Groundwater Intercept and Treatment System North of Basin F	Capture and treat contaminated groundwater north of the Basin F area closer to its source.	Construction completed 1990; treatment is ongoing.
4. Closure of Abandoned Wells	Identify, locate, examine, and properly close old or unused wells at RMA to prevent vertical migration of contamination between aquifers.	Completed 1990.
5. Groundwater Intercept and Treatment System in the Basin A Neck Area	Capture and treat shallow contaminated groundwater from Basin A closer to the source area.	Construction completed 1990; treatment is ongoing.
6. Basin F Liquids, Sludges, and Soil Remediation	Construct wastepile and cap that minimize the potential for infiltration of contaminants to groundwater and the potential for volatile emissions; reduce the potential impact of Basin F on wildlife; and incinerate Basin F liquids.	Containment of sludges/soil completed in 1989; incineration of liquids completed 1995.
7. Building 1727 Sump Liquid	Treat contaminated liquid in the sump.	Completed 1989.
8. Closure of the Hydrazine Facility	Treat the wastewater stored at this facility and demolish the aboveground structures.	Completed 1992.
9. Fugitive Dust Control	Minimize the amount of windblown contaminated dust.	Application completed 1991; reapplication as required by final response action.
10. Sewer Remediation	Plug the RMA sanitary sewers so that they cannot transport contaminated groundwater.	Completed 1992.
11. Asbestos Removal	Remove and dispose of friable asbestos in RMA structures where any potential for human exposure exists.	Action is ongoing as part of ROD implementation.
12. Remediation of Other Contamination Sources • Motor Pool • Rail Yard • Lime Settling Basins • South Tank Farm Plume • Army Trenches • Shell Trenches	Minimize or eliminate releases from selected contamination sources.	Action is ongoing as part of ROD implementation.

Response Action	Objective	Status/Completion [1]
13. CERCLA Hazardous Wastes • Wastewater Treatment Facility • Waste Management • Polychlorinated Biphenyls • Waste Storage	Construct and operate a facility to treat wastewater resulting from response actions; identify disposal options for hazardous wastes; inventory, sample, and remediate PCB-contaminated structures and soil; analyze temporary management of bulk hazardous wastes.	Construction of treatment plant completed 1992; liquid treatment and waste management is ongoing; PCB remediation is ongoing as part of ROD implementation; waste storage analysis completed.
14. Chemical Process-Related Activities • Agent Equipment and Tanks • Nonagent Equipment and Tanks • Underground Storage Tanks	Remove and dispose of contaminated process-related equipment from manufacturing areas.	Action is ongoing as part of ROD implementation.
Other Response Actions		
1. Klein Treatment Plant	Construct and operate a facility to treat chlorinated-solvent contaminated groundwater extracted by SACWSD wells west of RMA.	Construction of treatment plant completed 1989; water treatment is ongoing.
2. Deep Injection Well Closure	Properly seal and abandon deep injection well adjacent to Basin F.	Completed in 1985.

[1] All ongoing actions are incorporated as part of the final response action.

Table 2.4-2 Media Potentially Impacted by Past and Ongoing Response Actions

Response Action	Soil	Water	Structures	Air	Biota
Interim Response Actions					
Groundwater Intercept and Treatment System North of RMA		X			
Improvement of the North Boundary System and Evaluation of all Existing Boundary Systems		X			
Groundwater Intercept and Treatment System North of Basin F		X		X	
Closure of Abandoned Wells at RMA		X			
Groundwater Intercept and Treatment System in the Basin A Neck Area		X		X	
Basin F Liquids, Sludges, and Soil Remediation	X	X	X	X	X
Building 1727 Sump Liquid	X	X	X		
Closure of the Hydrazine Facility			X	X	
Fugitive Dust Control	X	X	X	X	X
Sewer Remediation	X	X		X	
Asbestos Removal			X	X	
Remediation of Other Contamination Sources					
• Motor Pool	X	X			
• Rail Yard	X	X			
• Lime Settling Basins	X	X			X
• South Tank Farm Plume	X	X			X
• Army Trenches	X	X			X
• Shell Trenches	X	X			X
CERCLA Hazardous Wastes					
• Wastewater Treatment Facility		X			
• Waste Management		X			
• Polychlorinated Biphenyls	X		X		
• Waste Storage	X		X		X
Chemical Process-Related Activities					
• Agent Equipment and Tanks			X	X	X
• Nonagent Equipment and Tanks			X	X	X
• Underground Storage Tanks			X	X	X
Other Response Actions					
Klein Treatment Plant		X			
Deep Injection Well Closure		X			

3.0 Highlights of Community Participation

The Department of Defense has long recognized that successful environmental restoration projects require the input of interested community residents. To that end, the Army began developing its Community Involvement Program in 1984 as the first environmental investigations were initiated. The Community Involvement Program has one primary objective: inform and involve the public with regard to site studies, proposed technologies, and ongoing remediation projects. A comprehensive Community Relations Plan was first developed in May 1990 to provide a road map for public involvement, which was further revised in May 1995. The Army has accomplished the public involvement objectives by conducting one-on-one sessions and informal group meetings, soliciting input using surveys and questionnaires, and pursuing phone contacts to identify interested citizens and organizations, assess public perceptions of the issues, and determine appropriate mechanisms for engaging in two-way communication. In addition, the Army has made available to the public the comprehensive documentation generated during the remediation process at the JARDF and eight area libraries (Table 3.0-1).

Educational outreach efforts included developing several publications that describe current investigations and available remedial technologies, making literature regarding the on-post remediation available to the public, and conducting more than 20 open houses and public meetings. In 1990, a joint Public Affairs Office (PAO) Subcommittee of the RMA Committee was formed to pool the skills and resources of public information specialists from all the Parties. The majority of fact sheets and training materials were developed by this subcommittee.

An example of a current publication is "Update," which has been distributed to approximately 125,000 households within a 10-mile radius of the installation on a quarterly basis since 1990. The focus of Update is to highlight a single, significant issue of the remediation during the preceding quarter. Past Update topics have included the various technologies considered to manage the Basin F liquid, the building of the SQI, the test-burn results of the SQI, and the release of the Proposed Plan for the On-Post Operable Unit. Along with lead stories on similar topics, the publication has also described opportunities for public involvement, including the schedules for public meetings, workshops, and tours. The Army has also published a tri-fold brochure, called "RMA Public Outreach," focusing on public outreach programs since 1994. Various topics discussed in this quarterly pamphlet include RMA technical information and history, wildlife viewing tour schedules, educational programs, and recycling programs.

Since 1988 all the Parties have made extensive efforts to ensure that the public is kept informed on all aspects of the cleanup program. More than 100 fact sheets about topics ranging from historical information to site remediation have been developed and made available to the public. All educational materials were developed and coordinated with all the Parties. In addition, ATSDR has provided public health information and support, including health consultation related to the Basin F IRA, a Public Health Assessment of RMA, and other health-related studies.

The Army held one of its largest public open houses in January 1994, following the release and distribution of the draft Detailed Analysis of Alternatives report for the On-Post Operable Unit. The purpose of the event was to provide the public one-on-one experience with federal, state, and local professionals who could explain in simple terms the views of their organizations regarding the various aspects of the remediation. It was vital to the success of the open house that the organizations, although not in total agreement with the technologies being proposed for the final remedy, were available to present their respective opinions.

Regulatory agencies represented at the event were EPA, CDPHE, and Tri-County Health Department. The two responsible parties, the Army and Shell, were also present. Members of USFWS were also available to express their opinions on the various proposed remedies from the standpoint of habitat preservation. Each organization created displays that described the organization's position and staffed these displays to answer questions from the public. The displays shown that detailed, in easy-to-understand terms, the various technologies outlined in the draft Detailed Analysis of Alternatives report.

As part of the open house, the Army offered site tours of RMA to the 1,000 citizens who attended. The tours, which were accompanied by technical experts who explained the ongoing remedial operations, provided visitors with a better understanding of the size of the installation and the degree of contamination at various locations as well as its potential as a national wildlife refuge. The Army and USFWS cooperate in implementing and supporting community involvement activities regarding wildlife/habitat during remediation. Remediation activities will take into account RMA's end use as a national wildlife refuge, which fulfills the provision of the FFA that states it is a goal of the Organizations to make significant portions of the site available for beneficial public use. In October 1992, in conjunction with the future goal of beneficial public use and in recognition of the unique urban wildlife resources provided by RMA, President George Bush signed the Rocky Mountain Arsenal National Wildlife Refuge Act, making RMA a national wildlife refuge following EPA certification that required response actions have been appropriately completed.

Prior to April 1994, various public meetings and workshops were coordinated with interested citizens through a Technical Review Committee (TRC), which was established under FFA and CERCLA guidelines. The committee, established at RMA in 1989, was comprised of representatives from local health and regulatory agencies, community residents, and the local government. In November 1993, the TRC opened its meetings to the public.

In April 1994, the Department of Defense directed military installations involved in environmental remediation to transition the TRCs into Restoration Advisory Boards (RABs). The RAB at RMA serves as a forum to exchange information and establish open dialog among the communities, regulatory agencies, the Army, and Shell. In less than 1 year, the RAB modified how public input was obtained and incorporated into the CERCLA process for

selecting a remedy for RMA. For example, one of the primary changes included making the JARDF more user-friendly. Millions of pages of documents relating to RMA history, mission, remediation, and wildlife were made available to the public via a computerized optical disk system. Citizens may access volumes of research material on literally any subject relating to RMA simply by keying in a word or series of words. The system then allows users to select a specific document or page of a document for further review. The JARDF allows users to photocopy up to 100 pages of RMA-related material at no charge.

The Site-Specific Advisory Board (SSAB) of RMA was formed with the assistance of EPA and CDPHE in 1994. Although the RAB is the officially recognized citizen advisory board for RMA, the SSAB serves as another forum for community concerns. Many of the members serving on the SSAB also serve on the RAB. More information on the SSAB can be obtained from CDPHE at (303) 692-3327.

A Technical Assistance Grant (TAG) was awarded to Citizens Against Contamination (CAC) by EPA in 1990. CAC was formed in 1985 and has been monitoring all aspects of the remediation at RMA and has provided a crucial role for public participation in the decision-making process. The TAG has provided funds to CAC so that an outside consultant could be hired to assist with the interpretation of technical information. In 1995, an additional $50,000 grant was awarded to CAC for continued technical assistance.

Members of the public and local authorities participated in an extensive series of meetings during 1994–95 regarding the remediation of RMA. These meetings provided the basis for negotiations among the Parties that led to the Conceptual Remedy in June 1995 and the Detailed Analysis of Alternatives report and Proposed Plan in October 1995.

The Proposed Plan was released for public review on October 16, 1995. On November 18, 1995 the Parties held a public meeting, attended by approximately 50 members of the public, to obtain public comment on the Proposed Plan. As a result of requests at this meeting, the period for submitting written comments on the plan was extended 1 month, concluding on January 19, 1996.

The Army also regularly issues press releases and provides access to hotlines that relate up-to-date information about remedial operations, and publishes brochures on selected topics, environment/wildlife tours, and school programs. Army representatives and public outreach specialists from EPA, USFWS, Shell, and CDPHE also visit area libraries, schools, and grocery stores and distribute flyers and brochures regarding the public meetings, the remediation process, and recreational activities available at RMA. The PAO Subcommittee has also established an active speaker's bureau program that serves as a focal point to communicate with civic organizations. RMA has also established an Internet World Wide Web home page (http://www.pmrma-www.army.mil).

Table 3.0-1 Area Libraries Holding RMA Documentation

Library	Address	Telephone Number
RMA Joint Administrative Record Document Facility[1]	Building 135, Room 16 72nd Avenue and Quebec Street Commerce City, CO 80022	(303) 289-0362
Adams County Library Brighton Branch	575 S. Eighth Avenue Brighton, CO 80601	(303) 659-2572
Aurora Public Library	14949 East Alameda Drive Aurora, CO 80012	(303) 340-2290
Commerce City Public Library	7185 Monaco Street Commerce City, CO 80022	(303) 287-0063
Denver Public Library	10 West 14th Avenue Parkway Denver, CO 80204	(303) 640-6200
EPA Library	999 18th Street, Suite 500 Denver, CO 80202	(303) 312-6937
Lakewood Public Library	10200 West 20th Avenue Lakewood, CO 80215	(303) 232-9507
Montbello Public Library	12955 Albrook Drive Denver, CO 80239	(303) 373-0767
Park Hill Library[2]	4705 Montview Denver, CO 80207	(303) 331-4063

1 The entire administrative record is accessible through the JARDF.
2 Only the Proposed Plan, Detailed Analysis of Alternatives report, and ROD can be found at Park Hill Library.

4.0 Scope and Role of the On-Post Operable Unit

The On-Post Operable Unit is one of two operable units at RMA (Figure 1.0-1). The On-Post Operable Unit addresses contamination within the fenced 27 square miles of RMA proper. The contaminated areas include approximately 3,000 acres of soil, 15 groundwater plumes, and 798 remaining structures. The most highly contaminated sites are located at South Plants (Central Processing Area, Hex Pit, Buried M-1 Pits, Chemical Sewers), Basins A and F, Lime Basins, and the Army and Shell disposal trenches. The primary contaminants at these sites are pesticides, solvents, heavy metals, and agent byproducts, which are found in soil and/or groundwater. The soil in these areas poses a principal threat to human and ecological **receptors**. The potential **exposure pathways** through which a threat would be posed to humans are identified in Section 6.1 and for wildlife in Section 6.2.

At RMA, groundwater contamination is moving principally to the north and northwest, but it is intercepted before it flows off post by the boundary groundwater treatment systems west, northwest, and north of the major source areas. At these systems, the groundwater is treated to established CSRGs (see Section 9). Ongoing monitoring of n-nitrosodimethylamine (NDMA) will be used in support of design refinement for the groundwater treatment systems. Possible ingestion or dermal contact with the groundwater is not a threat to human health on post because the use of groundwater for domestic purposes is restricted by the FFA. Nonpotable uses of on-post groundwater were not anticipated and risk was therefore not considered in the human health risk characterization portion of the Integrated Endangerment Assessment/Risk Characterization for such uses. A risk evaluation would be performed prior to any future nonpotable use to ensure that such use would be protective of human health and the environment.

The purpose of the on-post remedial action is to prevent current or future excessive exposure to contaminated soil or structures, to reduce contaminant migration into the groundwater, and to treat contaminated groundwater at the boundary to meet remediation goals. Remedial measures for on-post groundwater will augment the soil remedy and facilitate long-term remediation of groundwater. In addition, it addresses the arrangement for provision of potable water to the South Adams County Water and Sanitation District (SACWSD). The selected remedy described in this ROD will permanently address the threats to human health and the environment by using a combination of containment (as a principal element) and treatment technologies to reduce the toxicity, mobility, or volume of contaminants in groundwater, structures, or soil; comply with applicable or relevant and appropriate requirements (ARARs); and be cost effective.

The Off-Post Operable Unit addresses contamination in the groundwater north and northwest of RMA. The area impacted by this contamination is referred to as the Off-Post Study Area (see Figure 1.0-1). The final ROD for the Off-Post Operable Unit was issued in December 1995, the major components of which are summarized in Table 4.0-1.

The selected remedy for the On-Post Operable Unit, integrated with the IRAs and the selected remedy for the Off-Post Operable Unit, will comprehensively address all contamination at RMA. The ROD for the On-Post Operable Unit will be the final response action at RMA.

Table 4.0-1 Description of the Remedy for the Off-Post Operable Unit

Component	Description
1	Continued operation of the Off-Post Groundwater Intercept and Treatment System.
2	Natural attenuation of inorganic chloride and sulfate concentrations to meet remediation goals for groundwater in a manner consistent with the on-post remedial action.
3	Continued operation of the NWBCS, NBCS, and ICS as specified in Section 7.2 of the ROD for the On-Post Operable Unit.
4	Improvements to the NBCS, ICS, NWBCS, and the Off-Post Groundwater Intercept and Treatment System as necessary.
5	Long-term groundwater monitoring (including monitoring after groundwater treatment has ceased) to ensure continued compliance with the CSRGs.
6	Five-year site reviews.
7	Exposure control/provision of alternate water as detailed in the ROD for the Off-Post Operable Unit.
8	Institutional controls, including deed restrictions on Shell-owned property, to prevent the use of groundwater exceeding remediation goals.
9	Closure of poorly constructed wells within the Off-Post Study Area that could be acting as migration pathways for contaminants found in the Arapahoe aquifer.
10	Continuation of monitoring and completion of an assessment by the Army and Shell of the NDMA plume by June 13, 1996 using a 20 ppt method detection limit.
11	Preparation of a study that supports design refinement for achieving NDMA remediation goals at the RMA boundary. The study will use a 7.0 ppt preliminary remediation goal or a certified analytical detection level readily available at a certified commercial laboratory (currently 33 ppt).
12	Tilling and revegetation of approximately 160 acres in the southeast portion of Section 14 and the southwest portion of Section 13 by the Army and Shell.
13	Treatment of any contaminated extracted groundwater prior to discharge or reinjection so that it meets the CSRGs that meet or exceed the water quality standards established in the CBSGs and CBSMs.

5.0 Summary of Site Characteristics

This section provides a general overview of site characteristics at RMA. More detailed information regarding the environmental setting, nature and extent of the contamination, contaminant fate and transport, and other special investigations associated with the RI Program can be found in the Remedial Investigation Summary Report and references therein.

The Army initiated the RI Program in 1984 to define the nature and extent of contamination in soil, water, structures, air, and biota at RMA to a degree sufficient to permit an assessment of contaminant migration and exposure to human and ecological receptors and selection of viable remediation options for RMA.

5.1 Sources of Contamination

Contaminants were introduced into the RMA environment beginning in the early 1940s by disposal of liquid waste in open basins, solid waste burial in trenches, accidental spills of feedstock and product chemicals, leakage from sewer and process water systems, emissions from air stacks, and use of commercial chemical products during normal facility operation. The most highly contaminated sites are located at South Plants, Basins A and F, and the Army and Shell disposal trenches in Section 36. Other contaminated sites include storage areas, maintenance areas, and sewer lines. Over time contaminants have migrated from the soil and sediments to groundwater at RMA.

5.2 Nature of Contamination

More than 600 chemicals have been associated with activities at RMA since it was first established. However, on the basis of risk and frequency of use, the RI focused on about 70 chemicals. Of these, the principal contaminants are organochlorine pesticides (OCPs), metals (including arsenic and mercury), agent-degradation products and manufacturing byproducts (e.g., DIMP), DBCP, and chlorinated and aromatic solvents. Contamination in soil, sediment, and groundwater includes relatively mobile and soluble compounds (e.g., solvents) and less soluble contaminants, principally OCPs and arsenic. This range of contaminants exhibits a great variability in environmental mobility and persistence. OCPs are less mobile than the other contaminants present and are more persistent, tending to associate with soil and sediment and to **biomagnify** in the food chain. Conversely, a solvent or DIMP migrates more readily into the groundwater and can spread more rapidly in groundwater plumes. However, the relative contributions of various sources to groundwater plumes are often difficult to ascertain as contaminants within a groundwater plume can rarely be unequivocally associated with a specific source.

5.3 Contaminant Migration Pathways

Chemicals have historically migrated from source areas through the unsaturated zone, unconfined and confined flow systems, surface water, and wind-borne pathways. These pathways are briefly described as follows:

- **Unsaturated Zone** – This is the usual pathway by which contaminants enter the aquifer. Contaminants migrate through the unsaturated zone to the aquifer most readily when it is thin and/or highly permeable.

The unsaturated zone is relatively thin beneath Basin A, the Lime Settling Basins, the Section 36 disposal trenches, and the north-central portion of South Plants.

- Unconfined Flow System – This is a major groundwater **migration pathway** that has transported contamination in shallow groundwater to the north and west from source areas.
- Confined Flow System – This pathway generally consists of fine-grained discontinuous, permeable sand lenses and lignites, separated by low-permeability siltstones and claystones, of the Denver Formation. Detections of contaminants in this pathway generally correspond with contaminant plumes in the overlying UFS, but the contamination is much less widespread and at much lower concentrations. In many cases, detections are suspected to be related to faulty well installation rather than actual migration into this zone. Transport of contaminants along this pathway is much slower than in the UFS.
- Surface Water – Historically, this was a major contaminant transport pathway, contributing to the spread of contaminants in basins, ditches, lakes, ponds, and land at RMA. Use of the disposal ditches has been discontinued. Runoff from major storm events or snow melt is expected to transport low concentrations of contaminants present in surficial soil, although the efficiency of this mechanism is limited for most areas.
- Windblown – Windblown transport of residual contamination from various sources is responsible for broad areas of low-level surficial soil contamination within RMA boundaries adjacent to the major source areas.

In the past, human and ecological receptors have potentially been exposed to contaminants via these pathways. The surface water pathway has been greatly reduced by discontinuing use of the liquid waste disposal and process water networks. IRAs have been designed to reduce and control the threats to off-post receptors, and land-use restrictions have minimized risks to humans on post. IRAs have also been designed to isolate ecological receptors from the most toxic sources. However, some of the major sources continue to pose a risk to ecological receptors and to humans (although access restrictions and health and safety practices prevent site workers and visitors from coming into contact with these sources).

5.4 Extent of Contamination

One hundred eighty-one sites with varying degrees of contamination, ranging from areas of several hundred acres with multiple contaminant detections at concentrations up to a few parts per hundred to isolated detections of single analytes at a few parts per billion, were delineated during the RI and subsequent studies. During the FS, these sites were combined into groups of sites containing similar contaminant types and distributions, as shown in Figure 5.4-1. In addition, areas of RMA potentially containing Army chemical agent or **unexploded ordnance (UXO)** were delineated, as shown in Figure 5.4-2. Summary discussions of the contaminant concentrations and distributions, along with analytical results in tabular format, can be found in the Remedial Investigation Summary Report and subsequent studies referenced in the Detailed Analysis of Alternatives report.

Contamination was detected in soil, ditches, stream and lakebed sediments, sewers, groundwater, surface water, biota, structures, and, to a much lesser extent, air. Less extensive and less concentrated contamination occurs only sporadically within the relatively uncontaminated buffer zone along the boundaries. The most highly contaminated sites (those showing the highest concentrations and/or the greatest variety of contaminants) are concentrated in the

central six sections (square miles) of RMA (Sections 1, 2, 25, 26, 35, and 36) within which the manufacturing and waste disposal areas are located.

A number of sites at RMA that posed a potential risk to human health and the environment have been initially addressed by the implementation of IRAs. Additional actions at these sites and the other contaminated sites that remain will be undertaken as specified in this ROD, thereby reducing the risks to human health and the environment. Current conditions for air, wildlife, water, structures, and soil are described below.

Air

The Army is currently monitoring the ambient air at strategic locations at RMA. No [illegible] air [illegible] to RMA has been consistently detected, and air quality at RMA is generally better than that of the surrounding Denver metropolitan area.

Wildlife

Elevated contaminant concentrations have been detected in some wildlife at RMA. Adverse impacts, including death, have been identified for individuals of species feeding or residing in certain highly contaminated areas at RMA. USFWS, through the ongoing biomonitoring program, is studying the wildlife populations at RMA for health effects by analyzing tissue samples, conducting bioassays, and recording animal observations such as reproduction, survival, and mortality. The Parties, represented by the Biological Assessment Subcommittee (BAS), are working together with USFWS to ensure that the study of potential effects is designed to consider actual exposures for the individuals sampled. The potential for additional unacceptable levels of exposure to biota on RMA is being evaluated for support of design refinement by Phase I of the **Supplemental Field Study (SFS)** (see Section 6.2.4.3).

Groundwater

The regional

Because RMA is located in a semiarid environment, the amount of annual groundwater recharge from precipitation is low (precipitation is approximately 15 inches per year). Sources of manmade recharge have historically contributed to the groundwater mound in South Plants. These manmade sources include leaking potable and process water systems (used for fire protection), sanitary and storm sewer systems, infiltration of steam plant cooling water discharged to ditches, and infiltration of precipitation that ponds in depressions and ditches adjacent to buildings and roadways. The amount of recharge from these manmade sources is decreasing and eventually will be eliminated when remediation activities are completed. The sanitary and chemical sewers systems were closed in 1992 and the steam plant in South Plants is no longer in operation. Since that time, measurements indicate that groundwater elevations in South Plants have decreased several feet. It is currently believed that the decrease in water levels is the result, in part, of the reduction in manmade recharge; however, some of the decreases in water levels may be due to drought. In the long term, water levels in the mound area are expected to decrease as a result of eliminating manmade recharge.

To develop and evaluate remedial alternatives, the 15 groundwater contaminant plumes identified at RMA were grouped into 5 plume groups, primarily based on location (Figure 5.4-3). The five plume groups are as follows:

- North Boundary Plume Group
- Northwest Boundary Plume Group
- Western Plume Group
- Basin A Plume Group
- South Plants Plume Group

The North Boundary Plume Group includes the Basins C and F Plume and the North Plants Plume (Figure 5.4-3). The NBCS extracts and treats these plumes as they approach the northern boundary of RMA. The Basins C and F Plume flows primarily within alluvial-filled paleochannels and to a lesser extent through weathered bedrock. The North Plants Plume flows primarily within sandy alluvial material. The primary contaminants in the Basins C and F Plume are chloroform, benzene, atrazine, dieldrin, DIMP, TCE, DBCP, and DDT. The plume also has high levels of inorganics such as fluoride, chloride, and sulfate. The primary contaminant in the North Plants Plume is DIMP. Sulfate is present at high concentrations (chiefly due to natural sources) in the First Creek aquifer. Concentration ranges for these primary contaminants are presented in Table 5.4-1.

The Northwest Boundary Plume Group includes the Basin A Neck Plume and the Sand Creek Lateral Plumes. The existing NWBCS (Figure 5.4-3) was installed to intercept and treat these plumes at the RMA boundary. The Basin A Neck Plume extends from Basin A in Section 36 to the northwest boundary of RMA. The Sand Creek Lateral Plumes appear to originate in the vicinity of the Sand Creek Lateral in the western portion of Section 35 and merge with the Basin A Neck Plume. The primary organic contaminants in these plumes are dieldrin, chloroform, and DIMP. The Basin A Neck Plume also has high levels of chloride, fluoride, and sulfate. However, dieldrin is the only compound

that is present at levels requiring treatment at the boundary. Contaminant concentration ranges for the primary contaminants in this plume group are presented in Table 5.4-2.

The Western, Motor Pool, and Rail Yard Plumes are collectively defined as the Western Plume Group. The Motor Pool and Rail Yard Plumes are treated by the ICS and those portions of the Western Plume that extend off post (downgradient) are extracted by the SACWSD water supply wells and treated at the Klein treatment plant. The plumes occur primarily within thick alluvial-terrace deposits. The primary contaminants in these plumes are TCE in the Motor Pool Plume; 1,1-dichloroethylene, 1,1 ,1-trichloroethane, and TCE in the Western Plume; and DBCP in the Rail Yard Plume. The concentrations of these primary contaminants are shown in Table 5.4-3.

The Basin A Plume Group includes the Basin A Plume, the South Plants North Plume, and the Section 36 Bedrock Ridge Plumes. Contaminated groundwater flow in the South Plants North and Basin A Plumes occurs principally within saturated alluvium, with lesser flow through the underlying weathered bedrock. However, in the Section 36 Bedrock Ridge area, the water table generally lies below the alluvium and groundwater flows predominantly within weathered bedrock. The major contaminants detected in all the Basin A Plume Group are chloroform, methylene chloride, DIMP, TCE, DBCP, and benzene. Additionally, aldrin, dieldrin, and chlordane are also major contaminants in the South Plants North and Basin A Plumes. The concentrations of these contaminants are presented in Table 5.4-4.

The South Plants Plume Group includes the South Plants Southeast, Southwest, North Source, and the South Tank Farm Plumes. Groundwater in these plumes flows principally within the weathered, upper portion of the Denver Formation. Small portions of the South Plants North Source and South Plants Southeast Plumes also flow within areas of thin, saturated alluvium. Continued monitoring of groundwater adjacent to Lake Ladora and Lower Derby Lake will make it possible to assess migration of contaminants toward the lakes. The primary contaminant in the South Tank Farm Plume is benzene. The major contaminants in the other plumes in the South Plants Plume Group include chloroform, carbon tetrachloride, TCE, tetrachloroethylene, benzene, aldrin, dieldrin, and DBCP. Contaminant concentrations for these contaminants are presented in Table 5.4-5.

Structures

The structures medium encompasses a wide variety of structural types and materials including all aboveground structures, buildings, foundations, basements, tanks (including underground storage tanks), process and nonprocess equipment (including bone yards), aboveground chemical and nonchemical pipelines, asbestos-containing material (ACM), equipment and materials contaminated with PCBs, and other miscellaneous manmade objects placed at RMA since it was acquired by the Army in May 1942. The structures medium also includes a few houses and barns constructed before 1942 that still exist at RMA.

During the FS, the use history information was used to categorize structures in terms of their potential for contamination. Detailed use histories of structures at RMA were gathered based on plant operational records, official Army and Shell histories, and depositions from operational personnel. The histories of each structure were summarized in the Task 24 Structures Survey Report (Ebasco 1988). For example, the history of a structure involved with chemical production would include the chemicals produced, the years of operation, and any spills, exposures, or accidents that occurred there. Similarly, the history of a structure used for nonproduction activities would include the type of use, such as staff housing or administration, and any chemical spills or accidents that may have occurred there.

There are 798 structures currently standing at RMA. In order to efficiently evaluate cleanup alternatives, structures with similar use histories and potential for contamination were placed in one of four groups. One of the four groups is identified as "Future Use," meaning that the use history indicates the structures are uncontaminated, and they have some usefulness at the conclusion of remedial activities. The other three groups are identified as "No Future Use," meaning that they are not needed following remediation and that their use history indicates the structures may be contaminated. Many of these structures must be removed to access the underlying contaminated soil. These three groups are further distinguished by the relative severity of the potential contamination associated with their use histories. The four structures medium groups, and the number of structures included in the groups, are as follows:

- Future Use, No Potential Exposure (Future Use Group) – 48 structures
- No Future Use, Significant Contamination History (Significant Contamination History Group) – 49 structures
- No Future Use, Other Contamination History (Other Contamination History Group) – 631 structures
- No Future Use, Agent History (Agent History Group) – 70 structures

Tables 5.4-6 through 5.4-9 present an inventory of the structures included in each medium group. Refinement of the Future Use structures inventory will be completed during remedial design.

Soil

The soil medium consists of unsaturated soil, bedrock, fill material, process water lines, chemical and sanitary sewer lines, lake sediments, and soil/waste/debris mixtures. The term "soil," used for convenience in this document, refers to any of these materials. A total of 178 potentially contaminated soil sites were investigated during the RI, and three sites were added during the FS as a result of additional IRA and RI investigative efforts. Of the 181 sites investigated, 114 were determined to require further evaluation in the FS based on the site evaluation criteria (SEC) as described in Section 7.1.3, on potential agent or UXO presence, or on the potential risk to biota as described in Section 6.2. These 114 sites are organized into four exceedance categories as follows:

- Potential UXO Presence – Potential presence of UXO identified as the only risk
- Potential Agent Presence – Potential presence of Army chemical agent identified as the only risk

- Biota Risk – Potential risk only to biota based on the evaluations presented in the Integrated Endangerment Assessment/Risk Characterization report
- Human Health Exceedance – Exceedance of human health SEC, although portions of these sites may also potentially contain UXO, potentially contain agent, and/or pose potential risks to biota

The sites were further organized into 15 medium groups, which are groups of sites within each exceedance category that are similar in site type and contamination patterns (e.g., sanitary landfills with metallic debris and rubbish). Eight of these medium groups were divided into subgroups based on chemical or physical variation between the sites within a group.

The site characterisics that were used to develop medium groups and subgroups fall into nine general criteria, which are described as follows:

- Depth of Contaminated Soil – This criterion is evaluated because the depth of contamination may limit the suitability of particular remedial technologies. For example, technologies such as **surface heating** are effective only for volatile contaminants at shallow depths.
- Driver Contaminants – The types of contaminants that comprise the exceedance volumes influence the evaluation of alternatives. One treatment technology may provide effective remediation for all contaminants detected at the site. In some cases, however, a primary remedial technology is developed for the most prevalent contaminant(s) and a secondary treatment system or systems are used for the remainder of the contamination.
- Depth to Groundwater – Thickness of the unsaturated zone varies across RMA, and treatment technologies may require a minimum thickness for installation and function of the system. For example, **in situ vitrification** and **RF heating** require a minimum unsaturated soil thickness to operate.
- Major Soil Type – The total of 10 soil units that have been identified at RMA were divided into four soil types based on texture, clay content, and soil permeability for the purpose of evaluating subgroups. Soil types may increase or reduce treatment effectiveness. For example, **soil venting** is more effective on a sandy loam than on a clay loam due to the increased porosity and permeability of a sandy unit.
- Soil/Groundwater Interactions – Soil/groundwater interactions are evaluated at each site to assess the potential impacts of soil alternatives on groundwater alternatives.
- IRAs – Sites at which IRAs have been or are being performed (see Section 2.4) may not need further remediation if the IRA is determined to provide long-term protection of human health and the environment.
- Site Configuration – Site shapes vary and are categorized as either square to oblate or extremely narrow. The shape of a site can affect the selection of an alternative. For example, extremely narrow sites, such as ditches, are not favorable locations for access controls like **habitat modifications**.
- Agent/UXO Presence – Agent and/or UXO along with human health **contaminants of concern (COCs)** or contaminants that pose potential risk to biota may be present at some of the sites. Sites are identified that potentially contain agent and/or UXO based on historical usage of the site as presented in the Remedial Investigation Summary Report. Additional FS data-collection programs have been performed to further define the extent of agent contamination.
- Site Type/Usage – Each site was evaluated for site type or usage and eight categories were developed in the Remedial Investigation Summary Report. The site type/usage categories include surface soil/windblown; ordnance testing and disposal; spills/isolated; lake sediments, ditches, and ponds; basins or lagoons; buildings, equipment, and storage; sewer systems; and buried waste.

The exceedance categories, medium groups, and subgroups that were developed based on these criteria are listed in Table 5.4-10; the medium group and subgroup characteristics are described in Table 5.4-11. The contaminant concentrations (range and average) detected for each medium group and subgroup within the soil exceedance volumes defined by the SEC are listed in Table 5.4-12. The exceedance volumes represent only those parts of a site that exceed the SEC; therefore, the listed ranges and average concentrations are higher than the data for each site as a whole (see Section 6).

5.5 Potential Human and Environmental Exposure

Contaminant sources and pathways are identified to allow an assessment, described in Section 6, of the potential for exposure and risk to human health or the environment. In summary, most of the potential human health risks are caused by four chemicals, aldrin, dieldrin, DBCP, and arsenic. The highest estimated risks are limited to the central portions of RMA, coinciding with the former location of chemical processing and disposal areas (e.g., South Plants, the disposal trenches and basins). The primary routes for potential exposure are consumption, dermal contact, and inhalation. Some of the sites pose a risk to wildlife and could pose a risk to site workers and visitors. However, in these heavily contaminated areas, public access is carefully restricted and workers follow prudent health and safety procedures. IRAs have reduced some of the potential risks associated with these sites; however, risks still remain and the reduction of those risks to acceptable levels (see Section 6) is addressed by this ROD.

Under current conditions, biota are the primary receptors of RMA contamination in surficial soil, lakebed sediments, and surface water. Because of this, significant wildlife management practices have been implemented to attract wildlife to uncontaminated areas of RMA and also to eliminate wildlife from contaminated areas. Most of the potential biota risks are caused by pesticides and metals. The primary route for biota exposure is ingestion. Consumption of contaminated prey is a concern at higher trophic levels due to contaminants such as OCPs, which are known to **bioaccumulate** and biomagnify in the food chain.

Legend

- RMA Boundary
- SAR Site Boundary[1]
- Munitions Testing
- Agent Storage { North Plants / Toxic Storage Yards
- Lake Sediments
- Surficial Soil
- Ditches/Drainage Areas
- Basin A
- Basin F { Former Basin F / Basin F Wastepile
- Secondary Basins
- Sewer Systems
- Disposal Trenches { Complex Trenches / Shell Trenches / Hex Pit
- Sanitary Landfills
- Lime Basins { Section 36 Lime Basins / M-1 Pits
- South Plants (Central Proc., Ditches, Balance)
- Buried Sediments/Sand Creek Lateral
- Undifferentiated { Section 36 Balance of Areas / Burial Trenches
- 5 Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

-N-

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 5.4-1

RMA Soil Medium Groups

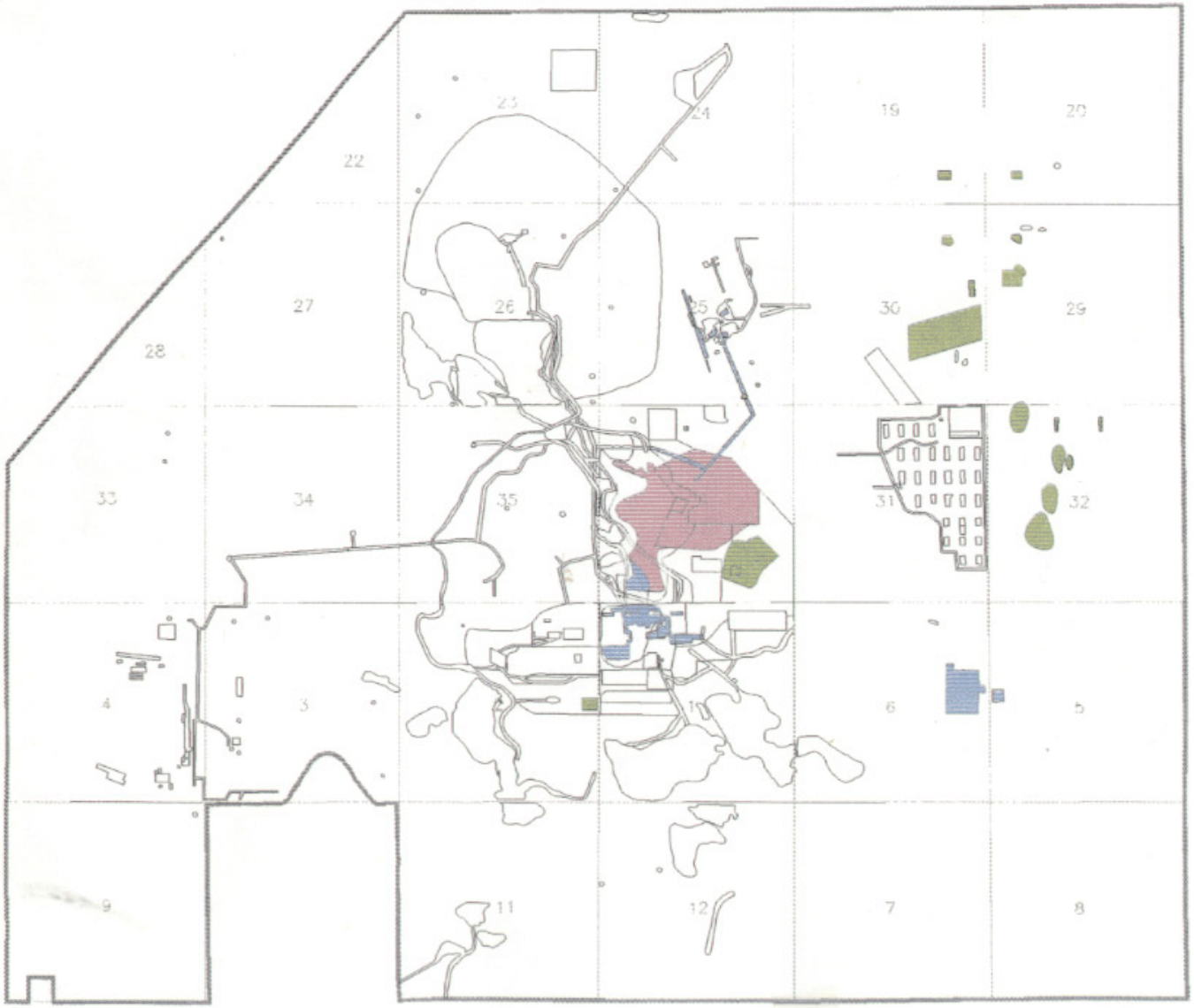
Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\MEDGRP

Date 6/06/96

Drawn by XG

Checked by SA



Legend

- RMA Boundary
- SAR Site Boundary[1]
- Potential Agent and UXO Area
- Potential UXO Area
- Potential Agent Area
- Section Number

[1] Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

-N-

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 5.4-2

Potential Agent/UXO Presence Areas

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\AGT-UXO

Date 6/06/96

Drawn by XG

Checked by SA

LEGEND

North Boundary Plume Group
- (1) Basins C and F Plume
- (2) North Plants Plume

Northwest Boundary Plume Group (Outlined in blue: ———)
- (3) Basin A Neck Plume
- (4) & (5) Sand Creek Lateral Plumes

Western Plume Group
- (6) Western Plume (Outlined in yellow: ———)
- (7) Motor Pool Plume
- (8) Rail Yard Plume

Basin A Plume Group
- (9) South Plants North Plume
- (10) Basin A Plume
- (11) Section 36 Bedrock Ridge Plume

South Plants Plume Group
- (12) South Plants North Source Plume
- (13) South Plants Southeast Plume
- (14) South Plants Southwest Plume
- (15) South Tank Farm Plume

Groundwater Control System

[1] Colored portions of plumes indicate summed total organic concentrations above 100 ug/l.

Scale in Feet

Prepared for:
U.S. Army Program Manager for Rocky Mountain Arsenal
Prepared June 1996

Figure 5.4-3
Generalized Contaminant Plume Locations[1]

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corporation

File Name: F:\PROJECTS\RMA\FS_4-3.DWG
Date 6/06/96
Drawn by TH/JLS
Checked by SA

Table 5.4-1 Primary Contaminant Concentrations in the North Boundary Plume Group[1,2]

Analyte	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	TSGM[3] (µg/l)
North Plants Plume			
DIMP	<0.39	3,900	44
Sulfate	8,600	1,800,000	600,000
Basins C and F Plume			
Chloroform	<0.5	85,000	8.5
Trichlorethylene	<0.5	790	1.6
Benzene	<0.5	460	1.8
Dieldrin	<0.05	440	0.46
DIMP	<0.2	64,000	210
DDT	<0.049	27	0.11
Atrazine	<0.51	1,800	5.4
DBCP	<0.06	71	0.21
Chloride	7,200	32,000,0000	1,000,000
Fluoride	180	500,000	4,100
Sulfate	<180	10,000,000	660,000

1 The reported concentrations are based on data from first quarter 1989 through second quarter 1994.
2 Concentrations are reported with two significant figures.
3 The two-step geometric mean (TSGM) was used to calculate plume concentration averages. In the first step, the geometric mean of all samples for each individual well was calculated, and in the second step, the geometric mean for all wells within the identified plume was calculated.

Table 5.4-2 Primary Contaminant Concentrations in the Northwest Boundary Plume Group[1,2]

Analyte	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	TSGM[3] (µg/l)
Basin A Neck Plume			
Chloroform	<0.5	30	3.4
Dieldrin	<0.05	3.5	0.14
DIMP	<0.39	5,900	66
Chloride	30,000	1,900,000	670,000
Fluoride	1,100	6,200	2,600
Sulfate	190,000	2,400,000	630,000
Sand Creek Lateral Section 35 Plume			
Chloroform	<0.5	4.5	0.96
Dieldrin	<0.05	0.10	0.032
Sand Creek Lateral Section 27 Plume			
Chloroform	18	22	20
Dieldrin	0.50	2.6	1.1
DIMP	0.81	3.2	1.8

1 The reported concentrations are based on data from first quarter 1989 through second quarter 1994.
2 Concentrations are reported with two significant figures.
3 The two-step geometric mean (TSGM) was used to calculate plume concentration averages. In the first step, the geometric mean of all samples for each individual well was calculated, and in the second step, the geometric mean for all wells within the identified plume was calculated.

Table 5.4-3 Primary Contaminant Concentrations in the Western Plume Group[1,2] Page 1 of 1

Analyte	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	TSGM[3] (µg/l)	TSGM[3,4]
Western Plume				
1,1,1-Trichloroethane	<0.76	100	4.0	4.3
1,1-Dichloroethylene	<1.7	48	3.6	3.7
TCE	<0.56	55	5.8	4.0
Motor Pool Plume				
TCE	<0.49	180	3.0	1.1
Rail Yard Plume				
DBCP	1.1	29	13	1.0

1 The reported concentrations are based on data from first quarter 1989 through second quarter 1994.
2 Concentrations are reported with two significant figures.
3 The two-step geometric mean (TSGM) was used to calculate plume concentration averages. In the first step, the geometric mean of all samples for each individual well was calculated, and in the second step, the geometric mean for all wells within the identified plume was calculated.
4 These data were estimated using third quarter 1994 through fourth quarter 1995 data.

Table 5.4-4 Primary Contaminant Concentrations in the Basin A Plume Group[1, 2] Page 1 of 1

Analyte	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	TSGM[3] (µg/l)
Basin A Plume			
Chloroform	<0.5	100,000	180
TCE	<0.56	8,200	26
Methylene chloride	<2.5	910,000	50
Benzene	<1.1	39,000	52
DIMP	<0.2	29,000	60
Aldrin	<0.05	9.5	0.080
Dieldrin	<0.05	19	0.17
Chlordane	<0.095	120	0.11
DBCP	<0.13	10,000	9.7
Section 36 Bedrock Ridge Plume			
Chloroform	<0.5	23,000	56
TCE	2.2	3,000	98
Tetrachloroethylene	1.1	14,000	370
Methylene chloride	<1.0	910,000	50
Benzene	<1.0	890	5.8
DBCP	<0.13	120	0.24
South Plants North Plume			
Chloroform	<0.5	2,900,000	180
TCE	<0.56	6,200	6.2
Methylene chloride	<2.5	34,000	39
Benzene	<1.1	100,000	24
Aldrin	<0.05	300	0.21
Dieldrin	<0.046	65	0.20
Chlordane	<0.095	460	0.56
DBCP	<0.13	480	0.90

1 The reported concentrations are based on data from first quarter 1989 through second quarter 1994.
2 Concentrations are reported with two significant figures.
3 The two-step geometric mean (TSGM) was used to calculate plume concentration averages. In the first step, the geometric mean of all samples for each individual well was calculated, and in the second step, the geometric mean for all wells within the identified plume was calculated.

Table 5.4-5 Primary Contaminant Concentrations in the South Plants Plume Group[1,2]

Analyte	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	TSGM[3] (µg/l)
South Tank Farm Plume			
Benzene	<1.0	1,500,000	1,200
South Plants Southwest Plume			
Chloroform	14	420	71
Carbon Tetrachloride	<0.99	200	9.0
TCE	<0.56	8.6	2.1
Tetrachloroethylene	<0.75	23.7	4.6
Benzene	<1.1	220	1.6
Dieldrin	0.092	15	0.27
DBCP	<0.13	0.93	0.11
South Plants Southeast Plume			
Chloroform	400	45,000	2,500
Carbon Tetrachloride	30	1,500	140
TCE	2.5	710	22
Tetrachloroethyene	<0.75	440	17
Benzene	9.9	8,100	230
Aldrin	<0.05	310	0.17
Dieldrin	<0.05	32	0.23
DBCP	<0.195	1,900	22
South Plants North Source			
Chloroform	1.6	500,000	1,400
TCE	<1.31	1,500	18
Tetrachloroethylene	<0.75	950	60
Methylene chloride	<2.5	3,800	14
Benzene	2.2	82,000	390
Aldrin	<0.083	71	0.44
Dieldrin	<0.05	110	0.35
Chlordane	<0.095	29	0.21
DBCP	<0.13	3,200	4.7

1 The reported concentrations are based on data from first quarter 1989 through second quarter 1994.

2 Concentrations are reported with two significant figures.

3 The two-step geometric mean (TSGM) was used to calculate plume concentration averages. In the first step, the geometric mean of all samples for each individual well was calculated, and in the second step, the geometric mean for all wells within the identified plume was calculated.

Table 5.4-6 Inventory of Future Use, No Potential Exposure Medium Group

Place #	Structure Number	Description of Structure	Bank Volume (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
1	0105	Bus Shelter			33		Short-Term			Not in T-24	
2	0111	RMA Administration, Hqs, Offices	770	39,000	35						
3	0112	Communication Headquarters	290	2,300	35				Cleanup		
4	0120	Facilities Maintenance Headquarters		15,380	35		Long-Term			Not in T-24	
5	0121	Change House		5,000	35		Long-Term			Not in T-24	
6	0124	Maintenance Garage		6,900	35		Long-Term			Not in T-24	
7	0128	Mission Support Contractor		13,200	35		Long-Term			Not in T-24	
8	0129	Administrative Record Facility		38,400	35				Cleanup	Not in T-24	
9	0130	Chemistry Laboratory		17,500	35		Long-Term		Cleanup	Not in T-24	
10	0133	Sewage Lift Station			35		Long-Term			Not in T-24	
11	0135	Guardhouse			04					Not in T-24	
12	0143	West Gate Guardhouse	23	180	04						
13	0145	South Gate Guardhouse	46	170	11						
14	0211	Gas Meter House	21	240	02		Long-Term		Cleanup		
15	0312	Fire Station Headquarters	860	12,000	36		Long-Term				
16	0361	Primary Electrical Substation	54	380	02				Cleanup and Beyond		
17	0369	Lower Derby Valve Gate	20	49	01		Long-Term		Cleanup		
18	0370	Restroom			02		Long-Term			Not in T-24	
19	0371	Water Pumping Station	820	1,800	02		Long-Term		Cleanup		
20	0372	Million Gallon Reservoir (Potable)	530	21,000	02						
21	0383	Community Club	340	6,100	02		Short-Term				
22	0385	Water Pump Station	14	140	04		Long-Term		Cleanup		
23	0386	Water Pump Station	14	140	04		Long-Term		Cleanup		
24	0387	Water Pump Station	14	140	04		Long-Term		Cleanup		
25	0551	Elevated Storage Tank, South Plants	620		01				Cleanup		Tanks/Pipes
26	0552	Valve Pit	55	310	01				Cleanup		
27	0618	Warehouse	5,300	110,000	03		Short-Term		Cleanup		
28	0619	Warehouse	5,200	110,000	03		Long-Term		Cleanup		
29	0702	Bald Eagle Observation Structure			05		Long-Term			Not in T-24	
30	NN0501	Abandoned School-fdn & wall	45	1,300	05		Long-Term				
31	NN0903	VORTAC Station	110	1,000	09						
32	SS 0370	Substation-1T-150'W of C			03		Long-Term				

Table 5.4-6 Inventory of Future Use, No Potential Exposure Medium Group

Place #	Structure Number	Description of Structure	Bank Volume (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
33	SS 0371	Substation-10T-N of 371			02		Long-Term				
34	SS 0385	Substation-3 T-N of 385			04		Long-Term				
35	SS 0386	Substation-3 T-N of 386			04		Long-Term				
36	SS 0387	Substation-3 T-W of 387			04		Long-Term				
37	SS 0619	Substation-4T-N of 619			03		Short-Term				
38	Z-28	Trailer			23				Cleanup	Not in T-24	
39	Z-3	Trailer			35				Cleanup	Not in T-24	
40	Z-38	Trailer			04				Cleanup	Not in T-24	
41	Z-39	Trailer			04				Cleanup	Not in T-24	
42	Z-40	Trailer			25				Cleanup	Not in T-24	
43	Z-41	Trailer			25				Cleanup	Not in T-24	
44	Z-42	Trailer			25				Cleanup	Not in T-24	
45	Z-58	Trailer			35				Cleanup	Not in T-24	
46	Z-68	Trailer			35				Cleanup	Not in T-24	
47	Z-69	Trailer			35				Cleanup	Not in T-24	
48	Z-70	Trailer			04				Cleanup	Not in T-24	

[1] These buildings may be reevaluated for potential historic preservation or future use. The Rocky Mountain Arsenal National Wildlife Refuge Act states that "transfer shall be made without cost to the Secretary of the Interior and shall include such improvements on property as the Secretary of the Interior may request in writing for refuge management purposes."

Table 5.4-7 Inventory of No Future Use, Significant Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Volume (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
1	0242	Chlorine Production/US Mint Storage	3,100	42,000	02						
2	0243	Chlorine Production Compressor Bldg	1,000	9,200	02						
3	0247	Salt Storage Building & foundation	1,100	58,000	02						
4	0251	Chlorine Evaporator/Storage	1,100	23,000	02						
5	0342	Warehouse/M74 I. B. Storage	1,000	13,000	02						
6	0411	SM & SD Manufacturing/Storage	1,500	16,000	01						
7	0411A	Steam Meter House	6	72	01						
8	0424A	Mustard Scrubber-foundation	10	720	01						
9	0424C	Aldrin Filter Building-foundation	16	750	01						
10	0451	Warehouse/Production Filling	900	11,000	01	Leased					
11	0471	TC Reactor/Pesticide Production	580	5,100	01	Leased					
12	0473	TC Drum Loading/Pesticide Packaging	86	1,900	01	Leased					
13	0475	Railroad Car Warmer Shed	180	980	01	Leased					
14	0502	West Chemical Metering Pump	41	700	01	Owned					
15	0503	East Chemical Metering Pump	37	290	01	Owned					
16	0505	DET Pretreatment Feed Pump House	30	510	01	Owned					
17	0507	DET Separator Pumphouse	41	520	01	Owned					
18	0515	CP/DDT/Pesticide Production	1,600	15,000	01	Leased					
19	0515A	Nudrin/Endrin Storage	202	1,900	01	Owned					
20	0521	Acetylene Compressor/Pesticide Mfg.	220	1,100	01	Leased					
21	0521A	Refrigeration/DCPD Cracking	36	320	01	Owned					
22	0523	AT Mfg. Bldg./Igniter Tube Filling	300	4,000	01						
23	0523C	Arsenic Trioxide Dry Storage Silo	71	210	01	Leased					
24	0523D	Arsenic Trioxide Dry Storage Silo	96	360	01	Leased					
25	0523E	Arsenic Trioxide Dry Storage Silo	96	360	01	Leased					
26	0523F	Arsenic Trioxide Dry Storage Silo	96	360	01	Leased					
27	0523G	Arsenic Trioxide Dry Storage Silo	96	360	01	Leased					
28	0525	Product Development Lab/Nudrin Mfg.	380	8,100	01	Leased					
29	0526	Pesticide Filter-foundation	26	900	01						
30	0532	Pesticide Storage/Warehouse	1,100	12,000	01	Leased					
31	0533	Flammable Materials Storehouse	19	130	01	Leased					
32	0534	Pumphouse/Storage	330	930	01	Leased					

Table 5.4-7 Inventory of No Future Use, Significant Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Volume (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
33	0534A	Drum Storage/Field Shop/Office	250	2,700	01	Owned					
34	0534B	Planavin Manufacture	470	13,000	01	Owned					
35	0542	Drummed Product Storage/Gen.Storage	1,000	11,000	01						
36	0544	Heavy Equipment Maintenance Shop	180	3,300	01						
37	0561	BCH Unit Control House	170	1,600	01	Owned					
38	0571	Vent Gas Burner	140	520	01	Owned					
39	0571B	Tank Room/HCCPD Drum Storage	130	2,600	01	Owned					
40	0616	Warehouse	910	11,000	03		Short-Term				
41	0624	Repair/Salvage/Surplus Facility	850	24,000	04				Cleanup		
42	0627	Vehicle Maintenance Shop	620	16,000	04		Short-Term		Cleanup		
43	0631	Railcar Maintenance/Roundhouse	350	4,500	04				Cleanup		
44	0643	Flammable Materials Storehouse	55	400	03						
45	0646	Rodent Control Building-foundation	5	840	04						
46	0724	Incinerator/Electostatic Preciptator	460	2,600	01	Owned					
47	0741	Refrigeration Building	880	6,300	01						
48	0834	Incinerator	120	3,800	36						
49	0884	Igloo Storage	210	1,600	06						

[1] These buildings may be reevaluated for potential historic preservation or future use. The Rocky Mountain Arsenal National Wildlife Refuge Act states that "transfer shall be made without cost to the Secretary of the Interior and shall include such improvements on property as the Secretary of the Interior may request in writing for refuge management purposes."

Table 5.4-8 Inventory of No Future Use, Other Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
1	0112A	Emergency Generator Plant	35	240	35				Cleanup		
2	0112B	BBQ-N of 112	2	16	35						
3	0114	Security Incinerator	8	34	35						
4	0116	Bus Stop Shelter	4	140	01						
5	0132	Shell/MKE Field Headquarters			35				Cleanup	Not in T-24	
6	0136	Garage-to 134-foundation	3	130	35						
7	0137	Garage-to 131-foundation	3	130	35						
8	0148	Storage/Pass Office-NW of 166	1	410	34						
9	0169B	Gas Station House-fdn-S of 150	4	100	34						
10	0176	5-Unit Garage & Unused Apt-foundation	24	1,500	03						
11	0213	Calibration Facility/X Ray Lab	680	4,600	02						
12	0241	Administration/Lab/Change House	290	3,000	02						
13	0244	3 Liquid Chlorine Tank Saddles	30	200	02						
14	0245	Substation Building	23	210	02						
15	0246	HCl Production Facility	56	1,600	02						
16	0248	Brine Treatment Plant-foundation	180	4,200	02						
17	0249	Brine Storage & Pump House-foundation	260	9,300	02						
18	0252	Cell Liquor Storage-foundation	29	2,900	02						
19	0253	50% NaOH Storage-foundation	36	4,500	02						
20	0254	Caustic Fusion Plant/Drum Storage	1,200	16,000	02	Leased					
21	0255	Fuel Oil Pump Station & 2 tank pads	23	300	02	Leased					
22	0256	Fuel Oil Tank-SE corner of 254	6	65	02						
23	0282	Guard Station-foundation-NW of NN0102	7	64	01						
24	0286	Guard Station-SE of 557-foundation	6	64	01						
25	0287	Guard Tower-foundation	6	64	01						
26	0291	Guard Station-foundatn-735'W of 362	6	64	02						
27	0295	Guard Tower-SE of 112-foundation	6	64	02						
28	0296	Guard Tower-foundation	6	64	02						
29	0307	Potable Water Valve & Meter Pit	11	130	36				Cleanup and Beyond		
30	0309	Maintainence/Storage-S of 545	10	420	01						
31	0311	Sterns-Rogers Office/Sample Storage	350	4,400	02				Cleanup		
32	0313A	Sewage Pump Station	3	38	01						

Table 5.4-8 Inventory of No Future Use, Other Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
33	0314	Fixed Laundry Service Building	770	8,600	01						
34	0315A	Steam Meter Pit-W of 315	7	100	01				Cleanup		
35	0316	Plants Dispensary/Clinic	240	3,200	01	Leased					
36	0316	Wood Shed-W of 727	2	100	01	Leased					
37	0316A	Morrison-Knudsen/Change House	340	5,100	01	Owned					
38	0317A	Pipe Shop/Grease Pit	48	2,600	01						
39	0318				35				Cleanup	Not in T-24	
40	0321	Boiler Plant-Central Gas Heat Plant	6,000	56,000	02				Cleanup		
41	0321C	Pumphouse	37	580	02				Cleanup		
42	0321D	Fuel Oil Pumphouse	38	480	02				Cleanup		
43	0322	Coal Sampling Building	30	340	02						
44	0322A	Tractor Storage Shed	34	410	02						
45	0323	Ash (Coal) Storage Silo-Hopper	350	500	02						
46	0324	Coal Hopper Structure	6	160	02						
47	0325	Electrical Power Plant	3,100	12,000	02						
48	0326	Power Plant Pumphouse & Spray Pond	720	15,000	02						
49	0327	Cafeteria-foundation	29	1,600	02						
50	0328	Goop Mixing and Filling Building	2,300	16,000	02						
51	0328A	Toilet House	15	130	02						
52	0329	Gasoline Pump Building	46	400	02						
53	0331	Phosgene Filling Warehouse	1,000	12,000	02				Cleanup		
54	0332	Warehouse	1,000	12,000	02				Cleanup		
55	0333	Warehouse	980	11,000	02				Cleanup		
56	0334	Warehouse	980	11,000	02				Cleanup		
57	0335	Warehouse	990	11,000	02				Cleanup		
58	0336	General Purpose Warehouse	990	11,000	02				Cleanup		
59	0337	Locker Room/Change House	57	590	02						
60	0338	Storage Magazine	12	54	02						
61	0339	Storage Magazine	14	54	02						
62	0340	Magazine	14	54	02						
63	0341	Change House	1,000	12,000	02						
64	0341A	Condensate Pump House	15	160	02				Cleanup		

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
65	0341B	Sewage Lift Station-covered pit	8	71	02						
66	0343	Manuf. Bldg. -PreClustering Warehous	1,000	11,000	02						
67	0343A	Flammable Materials Storehouse	29	240	02						
68	0344	Mfg Assembly/Warehouse	1,200	11,000	02						
69	0345	Mfg Assembly/Storage/Warehouse	1,000	11,000	02						
70	0346	Warehouse	920	11,000	02				Cleanup		
71	0347	Warehouse/Chemical Storage	1,900	27,000	02	Leased			Cleanup		
72	0351	Change House	920	9,000	02						
73	0352	Open Storage-foundation	250	12,000	02						
74	0352A	Quonset Storage	19	970	02						
75	0353	Open Storage-foundation	760	13,000	02						
76	0354	Warehouse	1,000	12,000	02						
77	0355	Warehouse	1,000	13,000	02						
78	0356	Warehouse	1,000	13,000	02						
79	0362	Warehouse	4,000	59,000	02				Cleanup		
80	0364	Sewage Lift Station-SE of 354	21	85	02						
81	0365	Explosive Blending Building	490	3,200	02						
82	0368	Swimming Pool & Filter House	640	1,900	02						
83	0372A	Chlorinator Station	56	380	02		Long-Term		Cleanup		
84	0373	Officer's Quarters	130	1,100	02		Long-Term				
85	0373B	Garage-to 373	42	720	02						
86	0374	Water Treatment Plant-W o'Lr Derby-fdn	110	890	02						
87	0378	Chlorinating Station (on airport)	16	150	10				Cleanup		
88	0379	Chlorinating Station	20	210	03				Cleanup		
89	0381				02				Cleanup	Not in T-24	
90	0382	Chlorinating Station	7	56	03						
91	0383A	Officer's Club Storage	16	82	02						
92	0391	Sewage Disposal & Treatment Plant	88	1,100	24						
93	0392	Sewage Lift Station	46	260	34				Cleanup		
94	0393	Sewage Lift Station	46	260	34				Cleanup		
95	0394	West Gate Sewage Treatment Plant	3	140	33						
96	0395	Toxic Yard Sewage Plant-NW of 867B	7	88	06						

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
97	0409	Condensate Pump House	4	130	01						
98	0413	WP Storage/SM Storage	670	5,500	01						
99	0413A	Phossy Water Tank-W of 413	120		01						Tanks/Pipes
100	0415	Caustic Makeup Tank-foundation	79	290	01						
101	0432	Sand Blasting Pad/Change House-fdn	180	9,200	01	Leased					
102	0434	West Gas Holder	730		01	Leased					Tanks/Pipes
103	0435	East Gas Holder	720		01	Leased					
104	0459	Acetylene Generator Building	229	3,200	01	Owned					
105	0459A	Lime Slurry Pumphouse	24	81	01	Owned					
106	0459B	Lime Slurry Pumphouse	36	170	01	Owned					
107	0459C	Small Building-N of 459	6	140	01						
108	0461	Tank Farm Pumphouse	51	430	01	Leased					
109	0464	Sample Building	2	55	01						
110	0471B	Electrical Vault	9	160	01	Owned					
111	0471C	TC Refrigeration	66	730	01	Owned					
112	0472	TC Refrigeration	110	1,200	01	Leased					
113	0472A	Lunchroom/Maintainence Equipmt Stor	24	320	01	Owned					
114	0474	Electrical Control House	16	80	01	Leased					
115	0504	DET Emergency Diesel Generator	31	330	01	Owned					
116	0506	DET Control House	68	830	01	Owned					
117	0508	DET Copper Sulfate Treatment	160	4,700	01	Owned					
118	0509	DET Methyl Cl Compressor/Liquifier	69	430	01	Owned					
119	0510	Methyl Isocyanate Refrigeration	28	300	01	Owned					
120	0511	Chlorinated Paraffin Mfg./Storage	2,500	23,000	01	Leased					
121	0511A	Chlorinated Paraffin/Change House	160	1,700	01	Leased					
122	0512A	Flammable Solvent Storage Shed	7	250	01	Owned					
123	0514C	Pump House	1	96	01	Owned					
124	0514D	Refrigeration Compressor	13	200	01	Owned					
125	0514E	Monomethylamine Dilution Control	4	92	01	Owned					
126	0516B	Misc Electrical Equipment Storage	34	210	01	Owned					
127	0518A	Emergency Fire Protection Generator	22	290	01	Owned			Cleanup		
128	0519	Hydrogen Peroxide Storage	82	290	01	Owned					

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
129	0519A	Hydrogen Peroxide Pumphouse	4	160	01	Owned					
130	0520	Sample Pump/pH Probes Storehouse	1	36	01	Owned					
131	0521B	Compressor House/Maintainence	93	670	01	Owned					
132	0521C	Lunchroom/Field Foreman Office	41	640	01	Owned					
133	0522	WP Cup Filling/Acetylene Mfg	890	9,400	01						
134	0522A	Phossy Water Tank	17	112	01						Tanks/Pipes
135	0522B	Change House/Administration Bldg	420	5,100	01						
136	0523A	WP Storage Tank House	140	1,500	01						
137	0524	WP Filling Building-fndatn	27	1,400	01						
138	0525A	Refrig Compressor/Electrical Vault	31	440	01	Owned					
139	0527	Change House/Quonset Hut	16	1,000	01						
140	0529	NaOH Make Up/Azodrin Support Struct	87	750	01	Leased					
141	0531	Warehouse	970	11,000	01	Leased					
142	0534C	Emergency Generator/Electric Vault	27	210	01	Owned					
143	0534D	Emergency Generator	46	440	01	Owned					
144	0538A	Compressor Building	67	690	01						
145	0539	Electrical Substation Builiding	17	430	01						
146	0541A	Magazine	9	88	01						
147	0543	Maintainence Shops/Instrument Lab	2,000	25,000	01				Cleanup		
148	0543A	Steam Meter Pit	12	93	01				Cleanup		
149	0543B	Facilities Engineers	590	8,700	01				Cleanup		
150	0545	Paint Shop	22	800	01						
151	0546	Sewage Lift Station	12	72	01						
152	0548	Water Pumping Station	370	2,300	01						
153	0549	Reservoir and Cooling Tower	630	4,500	01						
154	0550	Lift Station	6	280	01						
155	0553	Vault	8	64	01						
156	0555	Guardhouse/Gas Mask Training(TW-14)	5	210	01						
157	0557	Salvage Yard Storage/Maintenance	51	1,000	01	Owned					
158	0561A	Acetylene Compressor-foundation	400	5,000	01						
159	0571A	Electrical Vault	21	85	01	Owned					
60	0605	Flammable Materials Storehouse	2	170	03						

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
161	0606	Flammable Materials Storehouse-fdn	1	170	03						
162	0607	Flammable Materials Storehouse	2	210	03						
163	0608	Flammable Materials Storehouse	2	210	03						
164	0611	Data Processing Building	440	4,600	04		Short-Term				
165	0612	Courier Building	240	5,100	04		Short-Term				
166	0613	Management Information Systems	480	6,500	04		Short-Term				
167	0614	Warehouse	920	11,000	03						
168	0615	Warehouse	920	11,000	03						
169	0617	Warehouse	920	11,000	03						
170	0621	Property Disposal/Salvage Ofice	890	19,000	04				Cleanup		
171	0621A	Truck Scale Platform	56	740	04				Cleanup		
172	0622	Paint Shop/General Storage	160	1,700	04						
173	0623	Carpenter Shop/Hobby Shop/Auto Shop	230	4,200	04						
174	0625	Warehouse	870	11,000	04				Cleanup		
175	0626	Machine and Welding Shop-foundation	100	6,000	04						
176	0626C	Heavy Equipment Shop-foundation	10	580	04						
177	0627B	Flammable Materials Storehouse	5	240	04						
178	0629	Service Station	44	290	04						
179	0629E	Service Station Shelter	35	25	04						
180	0630	Gas Meter House	37	240	03				Cleanup		
181	0631A	Flammable Materials Storehouse	5	240	04						
182	0632	Gas-Fired Heating Plant	420	1,400	04		Short-Term		Cleanup		
183	0633	Cafeteria/Bug Lab/Movie Theatre	130	2,500	04						
184	0633A	Laboratory/Storehouse	56	680	04						
185	0633B	Hazardous Materials Storage	140	640	04				Cleanup		
186	0634	Flammable Materials Storehouse	58	400	04				Cleanup		
187	0635	Admin Offices-Rocky Mtn Railcar	48	590	03						
188	0639	Lumber Storage	94	4,500	04						
189	0641	Warehouse-foundation	95	900	03						
190	0644	NCO Quarters-foundation	17	1,400	03						
191	0644A	Garage/Storage-foundation	1	40	03						
192	0647A	Motor Pool Dispatch Office	35	1,000	04						

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
193	0647B	Motor Pool Vehicle Storage	100	9,600	04		Short-Term				
194	0647C	Motor Pool Vehicle Storage	29	3,000	04		Short-Term				
195	0647D	Motor Pool Vehicle Storage	29	3,000	04		Short-Term				
196	0648	Road Oil Pump and Boiler House	56	350	04						
197	0670				03				Cleanup	Not in T-24	
198	0673	Railcar Scale House	2	88	03				Cleanup		
199	0679	Warehouse/Can Scouring-foundation	62	780	10						
200	0680	Radio Range B-foundation	2	49	09						
201	0684	Guard Tower-E of 644, N of 675-fndn	6	64	03						
202	0685	Guard Tower-SE of 673-foundation	6	64	03						
203	0688	Guard Tower-E of 615-foundation	6	64	03						
204	0727	Facilities Maintenance	98	3,600	01	Owned			Cleanup		•
205	0729	General Purpose Warehouse	1,600	23,000	01	Leased			Cleanup		
206	0731	Reserve Center/Office/Change House	770	12,000	01						
207	0732	Army Reserve Warehouse/M19 Bomb Rew	3,900	47,000	01						
208	0733A	Magazine	34	400	01						
209	0733B	Magazine	34	400	01						
210	0733C	Magazine	34	400	01						
211	0733D	Magazine	58	400	01						
212	0733E	General Purpose Magazine	65	400	01						
213	0733F	General Purpose Magazine	69	400	01						
214	0735	Foamite/Oil Product Storage	37	440	01						
215	0743	RMA Laboratory/Change House/Office	360	5,400	01						
216	0743A	Chemical Sewer Lift Station	4	36	01						
217	0744	Gasoline/Benzol Pumphouse	78	760	01						
218	0745	Fire Fighting Manifolds for 745ABC	21	24	01						
219	0746	Gasoline Unloading Rack	2	1	01	Leased					
220	0748	Flammable Materials Storehouse	49	400	01						
221	0751	Paint and Process Shop	640	5,500	01						
222	0752	Carpenter Shop/Storage	610	4,900	01						
223	0752A	Lumber Storage	110	1,000	0 1						
224	0753	Steam Fitter Maintenance/Storage	52	000	0						

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
225	0754	Lumber Storage	49	840	01						
226	0765	Potable Water Purificaton			01				Cleanup	Not in T-24	
227	0784	Guard Station-SE of 742-foundation	6	64	01						
228	0787	Warehouse	480	9,600	06		Long-Term		Cleanup Use		
229	0801	Radio Relay Station-N of 1726	12	180	25				Cleanup		
230	0808	No Bdry Groundwater Treatment Plant	650	3,900	23				Cleanup Use		
231	0809	Irondale Groundwater Treatment Sys.	320	3,000	33				Cleanup		
232	0810	NW Bndry Groundwater Treatment Bldg	490	3,100	27				Cleanup		
233	0825	Basin A Neck Treatment Bldg.			35				Cleanup	Not in T-24	
234	0831	Technical Escort/Officer's Quarters	120	1,100	35				Cleanup		
235	0831A	Garage/Storage Shed	27	360	35				Cleanup		
236	0833	Lumber Storage Shed	82	580	35						
237	0836	Air Force Seismic Monitoring	590	7,100	24						
238	0840	Air Monitoring Station			25				Cleanup	Not in T-24	
239	0841	CO Public Service Co Meter House	82	200	12				Cleanup and Beyond		
240	0851	Pistol Range House	6	250	19						
241	0853	Observation Pit/Mortar Range	94	2,000	30		Long-Term				
242	0854	Concrete Wall	12	200	26						
243	0863	Target Range House	5	260	12						
244	0864	General Storehouse	10	400	06						
245	0865	Warehouse	41	1,000	06						
246	0866	Toxic Yard Office & Change House	140	2,400	06				Cleanup		
247	0867A	Toxic Yard Metal and Wood Shop	67	1,600	06						
248	0867B	Flammable Materials Storehouse	13	190	06						
249	0871A	Magazine	66	600	06		Long-Term				
250	0871B	Magazine	66	600	06		Long-Term				
251	0871C	Magazine	66	600	06						
252	0871D	Magazine	86	800	06						
253	0872A	Magazine	86	800	06						
254	0872B	Magazine	86	800	06						
255	0872C	Magazine	86	800	06						
256	0872D	Magazine	86	800	06						

Table 5.4-8 Inventory of No Future Use, Other Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
257	0873A	Magazine	86	800	06						
258	0873B	Magazine	86	800	06						
259	0873C	Magazine	86	800	06						
260	0874A	Magazine	86	800	06						
261	0874B	Magazine	86	800	06						
262	0874C	Magazine	86	800	06						
263	0874D	Magazine	86	800	06						
264	1403	2-HF Storage Tanks & Unloading Dock	83		25						Tanks/Pipes
265	1404	Carbon Tetrachloride Storage Tank	83		25						Tanks/Pipes
266	1405	Hydrochloride Acid Storage Tanks	83		25						Tanks/Pipes
267	1502	Unloading Dock-Isopropanol Storage	83		25						Tanks/Pipes
268	1504A	Monitoring Shed	7	220	25						
269	1505A	Sentry Station	2	85	25						
270	1507	Methanol Storage Tank	83		25						Tanks/Pipes
271	1508	TBA Storage Tank	84		25						Tanks/Pipes
272	1509	Isopropanol Dehydration Unit	76	400	25			Treaty			
273	1510	Fuel Oil Tank	1,200		25						Tanks/Pipes
274	1510A	Fire Apparatus Buildng/Foam Storage	16	130	25						
275	1512	Sentry Station/Gate House	18	130	25			Treaty			
276	1611A	Sentry Station	4	84	25						
277	1618	General Storehouse-N of North Plant	36	1,000	25						
278	1619	Administration Building-N o'N Plant	8	320	25						
279	1622	General Storehouse-N of North Plant	34	970	25						
280	1701	Warehouse	2,300	26,000	25			Treaty	Cleanup		
281	1704	Compressed Air Plant	1,400	9,100	25			Treaty			
282	1705	Instruction Building/Cafeteria	250	4,000	25			Treaty			
283	1706	Sentry Station/Gatehouse	44	360	25		Long-Term	Treaty			
284	1707	Cooling Tower	560	2,800	25			Treaty			
285	1710	Clinic and Administration Building	920	15,000	25				Cleanup		
286	1711	Gas Meter House	6	170	25				Cleanup		
287	1712	Gas Heating Plant	320	2,300	25						
288	1713	Standby Generator Plant	100	2,500	25			Treaty	Cleanup		

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
289	1715				25				Cleanup	Not in T-24	
290	1717	Chlorinating Station	11	120	25				Cleanup		
291	1718	Valve Pit & Chlorinating Station	24	260	25				Cleanup		
292	1719	Electrical Distribution System	13	130	25				Cleanup		
293	1726	Elevated Process Water Tank, North Plants	270		25		Short-Term		Cleanup		Tanks/Pipes
294	1728	Potable Water Tank	69		25						Tanks/Pipes
295	1730	Guardhouse	13	110	31						
296	1734	Change House	48	470	31		Long-Term				
297	NN0101	Valve Gate-W side of Upper Derby	20	49	01		Long-Term				
298	NN0102	Foundation-N of 534B	19	750	01						
299	NN0103	Bathroom-N of 533	3	120	01						
300	NN0104	Flare Tower-N of 571B. NW of 571	17	660	01	Owned					
301	NN0105	Gas Meter House-SW of 508	5	200	01						
302	NN0106	Fertil & Waste Loadng Fac-N of 728	78	99	01						
303	NN0107	Metal Shed-W of 733B	1	310	01						
304	NN0108	Metal Shed-W of 733C	1	310	01						
305	NN0109	Guard Station-NE of 732	1	64	01						
306	NN0110	Metal Shed-S of 521B	3	80	01						
307	NN0111	Three Metal Incinerator-NW of 541	150	440	01	Owned					
308	NN0112	Stack Observation Station-E of 527	12	280	01						
309	NN0113	2 Metal Sheds-S of 474 SS	27	250	01						
310	NN0114	Wooden Hut-SW of 461	2	22	01						
311	NN0115	Flare Tower-N of Lime Pond	17	660	01	Owned					
312	NN0116	Long Metal Shed-S of 544	47	6,000	01						
313	NN0117	2 Sheds-SW of 557	4	130	01						
314	NN0201	Concrete Silo-NW of 254	350	1,300	02						
315	NN0202	Brick Structure-E of SS 361	15	140	02						
316	NN0204	Coal Hopper foundation-N of 334	38	1,100	02						
317	NN0205	Brick Valve House-S of 321B	27	150	02						
318	NN0300				03				Cleanup	Not in T-24	
319	NN0301	Metal Shed-N of 618	1	410	03						
320	NN0302	Metal Shed-N of 618	1	410	03						

Table 5.4-8 Inventory of No Future Use, Other Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
321	NN0303	Metal Shed-N of 619	1	2,400	03						
322	NN0304	Metal Shed-N of 619	1	1,900	03						
323	NN0601	Loading Dock-W of 866	150	11,000	06						
324	NN0602	Long Metal Shed-W of 865	1	3,500	06						
325	NN0603	Metal Shed-E of 867A	1	510	06						
326	NN0902	Survey Tower-N of Post Office	1	140	09				Cleanup		
327	NN1208	Brick Structure-900'SW of 846	9	81	12						
328	NN1209	Concrete Bunker-1100'S of 846	14	68	12						
329	NN1210	Concrete Bunker-1250'S of 846	10	56	12						
330	NN1211	Concrete Bunker-1300'S of 846	14	68	12						
331	NN1212	Concrete Bunker-1350'S of 846	6	64	12						
332	NN1213	AMSA/OMS Maintenance Shop-N of 841	780	10,000	12						
333	NN2001	Antenna Installation-1/2 mi N o'9th	17	44	20						
334	NN2002	Tank Pad-N of 9th, 2/3 mi E of F St	14	380	20				Cleanup		
335	NN22	36 GW Wells-NW Boundary Treatment			22						
336	NN23	36 GW Wells-N Boundary Treatment			23						
337	NN2301	Abandoned Water Purification Plant	60	1,600	23						
338	NN24	56 GW Wells-N Boundary Treatment			24						
339	NN2401	Concrete Structure-E of Bog	3	25	24						
340	NN2402	Wooden Shed-N of Trickling Filters	7	170	24						
341	NN2403	2 Trickling Filters-S of 391	1,800	17,000	24						
342	NN2404	Imhoff Tank-S of 391	410	2,800	24						
343	NN2405	Antenna Installation-N of 836	12	44	24						
344	NN2501	Shed-NW of 1618	8	300	25						
345	NN2502	Gas Pump & Pad-NE of 1618	32	950	25						
346	NN2503	Pumping Station-S of 1510	4	72	25						
347	NN2601	Decon Pad/Tank-NE of Basin F	58	2,300	26						
348	NN2602	Valve gate-N end of Reservoir C	19	56	26						
349	NN28	2 GW Wells-Irondale Treatment			28						
350	NN3001	Metal Shed-E of 853	1	580	30						
351	NN3002	Metal Shed-E of 853	1	580	30						
352	NN3101	Metal Shed-N of 1734	1	80	31						

Table 5.4-8 Inventory of No Future Use, Other Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
353	NN3102	3 Sets Shed Siding-1100'SE of 1735	2,400	59,000	3 1						
354	NN3103	Storage Bldg-Toxic Storage Yard	1	1,500	31						
355	NN3104	Shack-W of Berms-Toxic Storage Yard	1	70	31						
356	NN3105	Shed-NW End of Berms-Toxic Storg Yd	1	110	31						
357	NN3106	Shed-NE End Berms-Toxic Storage Yd	2	4,000	31						
358	NN3107	Antenna Station-Toxic Storage Yard	4	32	31						
359	NN3108	Shed-SW End of 1st Berm-Toxic Yard	1	110	31						
360	NN3109	Shed-SE End of 1st Berm-Toxic Yard	2	4,000	31						
361	NN33	45 GW Wells-Irondale Treatment			33						
362	NN3501	3 Communications Antenna Pits	6	48	35						
363	NN3601	Incinerator-500'NE of 834	30	350	36						
364	NN3602	Incinerator-1000'SE of 834	6	100	36						
365	NN3603	Metal Shed-NW of 725	4	140	36						
366	NN3604	Metal Shed-SW of 725	6	200	36						
367	NN3605	Metal Shed-SE of 725	2	200	36						
368	NNT0101	Vertical Tank-TF0101	21		01						Tanks/Pipes
369	NNT0103	Vertical Tank-TF0106	1		01						Tanks/Pipes
370	NNT0105	Horizontal Tank-TF0108	1		01						Tanks/Pipes
371	NNT0106	Vertical Tank-TF0109	2		01						Tanks/Pipes
372	NNT0107	Horizontal Tank-E of 471C	1		01						Tanks/Pipes
373	NNT0110	Horizontal Tank-E of 536	1		01						Tanks/Pipes
374	NNT0111	Vertical Tank-TF0105	5		01						Tanks/Pipes
375	NNT0201	Undrground Oil Tank w/DCPD-W of 321	1		02						Tanks/Pipes
376	PR01	Pipe Runs in Section 1	2,000		01						Tanks/Pipes
377	PR02	Pipe Runs in Section 2	520		02						Tanks/Pipes
378	PR04	Pipe Runs in Section 4	100		04						Tanks/Pipes
379	PR25	Pipe Runs in Section 25	820		25						Tanks/Pipes
380	PR36	Pipe Runs in Section 36	470		36						Tanks/Pipes
381	SS 0100	Substation-1T-30'N of 866			06						
382	SS 0101	Substation-2T-200'NE of 866			06						
383	SS 0102	Substation-1T-500'W of 867A			06						
384	SS 0103	Substation-1T-700'W of 865			06						

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
385	SS 0104	Substation- 1T-400'N of 872A			06						
386	SS 0105	Substation-1T-NE of 867A			06						
387	SS 0111	Substation-2T-N side 111			35						
388	SS 0112	Substation-1T-150'S of 112			02		Short-Term				
389	SS 0121	Substation-1T-NW corner of section			03						
390	SS 0141	Substation-3T-E of 141			04						
391	SS 0176	Substation-1T-W of Staff Quarters			03						
392	SS 0213	Substation-3T-SE of 213			02		Short-Term				
393	SS 0232	Substation-3T-SW of 254			02						
394	SS 0243	Substation-1T-W of 243			02						
395	SS 0245	Substation-3T-S of 245			02						
396	SS 0311	Substation-1T-S of 311			02						
397	SS 0312	Substation-1T-S of 312			01						
398	SS 0312A	Substation-1T-NE of 312			36						
399	SS 0313	Substation-3T-W of 313			01						
400	SS 0313-2	Substation-3T-W of 313			01						
401	SS 0314	Substation-3T-NW of 314			01						
402	SS 0315	Substation-3T-SW of 315			01						
403	SS 0316	Substation-1T-S of 316			01						
404	SS 0316A	Substation-3T-S of 316A			01						
405	SS 0317	Substation-1T-NW of 433			01						
406	SS 0321	Substation-6T-S of 321			02						
407	SS 0321A	Substation-3T-SW of 242			02						
408	SS 0321B	Substation-1T-SE of 242			02						
409	SS 0325	Substation- 14T-between 325 & 311			02						
410	SS 0327	Substation-3 T-W of 332			02						
411	SS 0328	Substation-3T-N of 328			02						
412	SS 0330	Substation-1T-SW of 337			02						
413	SS 0335	Substation-3 T-S of 336			02						
414	SS 0342	Substation-3T-ENE of 342			02						
415	SS 0344	Substation-5T-E of 344			02						
416	SS 0355	Substation-3T-E of 356			02						

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
449	SS 0529	Substation-3 T-S of 540			01						
450	SS 0531	Substation-1T-W of 531			01						
451	SS 0534	Substation-3 T-200'N of 534A			01						
452	SS 0539	Substation-2T-SE of 537			01						
453	SS 0541	Substation-3T-W of 541			01						
454	SS 0543	Substation-5T-W of 543			01						
455	SS 0548	Substation-1T-N of 548			01						
456	SS 0548A	Substation-1T-101'W of 548			01						
457	SS 0556	Substation-1T-N of 541			01						
458	SS 0571	Substation-3 T-75'W of 504A			01						
459	SS 0575	Substation-1T-N of 504			01						
460	SS 0575A	Substation-1T-N of 505			01						
461	SS 0611	Substation-3T-S of 611			04		Short-Term				
462	SS 0612	Substation-1T-E of 612			04		Short-Term				
463	SS 0613	Substation-3T-NW of 613			04		Short-Term				
464	SS 0614	Substation-1T-W of 614			03						
465	SS 0616	Substation-3T-N of 614			03						
466	SS 0618	Substation-3T-N of 618			03						
467	SS 0618-2	Substation-1T-W of 618			03						
468	SS 0622	Substation-1T-NE of 621			04						
469	SS 0624	Substation-3T-E of 624			04						
470	SS 0625	Substation-1T-E of 624			04						
471	SS 0627	Substation-3T-E of 627			04		Short-Term				
472	SS 0627A	Substation-1T-E of SS 627			04		Short-Term				
473	SS 0629	Substation-3T-NE of 629			04						
474	SS 0631	Substation-3 T-N of 631			04						
475	SS 0632	Substation-1T-NE of 632			04		Short-Term				
476	SS 0633	Substation-3 T-S of 633			04						
477	SS 0634	Substation-3T-SE of 634			04						
478	SS 0635	Substation-1T-W of 635			03						
479	SS 0647	Substation-1T-E of 647A			03						
480	SS 0673	Substation-1T-1200'NNE of 619			03		Short-Term				

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
481	SS 0725	Substation-3 T-S of SS 726			36						
482	SS 0726	Substation-3 T-200'S of 725			36						
483	SS 0727	Substation-1T-W side of 727			01						
484	SS 0728	Substation-3 T-E of 728			01						
485	SS 0729	Substation-6T-E of 729			01						
486	SS 0732	Substation-6T-S of 732			01						
487	SS 0742	Substation-6T-N of 742			01						
488	SS 0747	Substation-1T-75'S of 729			01						
489	SS 0755	Substation-3 T-S of 868C			01						
490	SS 0756	Substation-1T-W of 868C			01						
491	SS 0757	Substation-1T-S of 463D			01						
492	SS 0780	Substation-1T-N of T1505			01						
493	SS 0781	Substation-1T-NE of T1507			01						
494	SS 0782	Substation-1T-N of 732			01						
495	SS 0791-2	Substation-1T-E of 145			11						
496	SS 0806D	Substation-1T-SE of 806			26						
497	SS 0806G	Substation-1T-0.25 mi SW of 9 & D			26						
498	SS 0808ABC	Substation-3T-NE of 808			23						
499	SS 0808D	Substation-1T-0.3 mi SW of 808			23						
500	SS 0808E	Substation-1T-0.2 mi SW of 808			23						
501	SS 0808F	Substation-1T-427'SSE of 808			24						
502	SS 0808G	Substation-1T-800'SE of 808			24						
503	SS 0808H	Substation-1T-0.36 mi ESE of 808			24						
504	SS 0808I	Substation-1T-0.49 mi ESE of 808			24						
505	SS 0808K	Substation-1T-0.68 mi ESE of 808			24						
506	SS 0808L	Substation-1T-0.65 mi E of 808			24						
507	SS 0809	Substation-3 T-S of 809			33						
508	SS 0809A	Substation-3 T-300'SW of 809			33						
509	SS 0809B	Substation-3 T-200'W of 809			33						
510	SS 0809C	Substation-3 T-400'N of 809			33						
511	SS 0809D	Substation-3 T-700'NE of 809			33						
512	SS 0809E	Substation-3 T-500'E of 809			33						

Table 5.4-8 Inventory of No Future Use, Other Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
513	SS 0809F	Substation-3 T-0.2 mi S of 809			33						
514	SS 0831	Substation-3 T-200'S of 8th & D St			35						
515	SS 0831E	Substation-1T-538'SSE of 8th & D St			36						
516	SS 0832	Substation-1T-300'E of 159			34						
517	SS 0836	Substation-3 T-S of 836			24						
518	SS 1402	Substation-3 T-150'W of 1601/1701			25						
519	SS 1403	Substation-3 T-S of 1701			25						
520	SS 1404	Substation-3 T-130'S of 1501			25						
521	SS 1501	Substation-7T-SE of 1501			25						
522	SS 1505	Substation-3 T-E of 1505			25						
523	SS 1506	Substation-2T-NW corner of 1506			25						
524	SS 1510	Substation-2T-150'W of 1601			25						
525	SS 1601-1	Substation-1T-E of 1601			25						
526	SS 1601-2	Substation-1T-E of 1601			25						
527	SS 1602	Substation-2T-100'SE of 1606			25						
528	SS 1603	Substation-3 T-100'NE of 1602			25						
529	SS 1605	Substation-1T-between 1605 & 1608			25						
530	SS 1606-1	Substation-3 T-100'E of 1606			25						
531	SS 1606-2	Substation-1T-100'NE of 1606			25						
532	SS 1607	Substation-3 T-100'E of 1607			25						
533	SS 1609	Substation-1T-150'NE of 1609			25						
534	SS 1611	Substation-1T-E of 1611			25						
535	SS 1611AB	Substation-2T-S of 1611			25						
536	SS 1614	Substation-2T-NE o'1615			25						
537	SS 1616	Substation-2T-NE of 1616			25						
538	SS 1701	Substation-3 T-100'E of 1701			25						
539	SS 1702	Substation-2T-W of 1702			25						
540	SS 1703	Substation-1T-S of 1703			25						
541	SS 1704-1	Substation-3 T-E of 1704			25						
542	SS 1704-2	Substation-2T-E of 1704			25						
543	SS 1704-3	Substation-3 T-E of 1704			25		Long-Term				
544	SS 1706	Substation-1T-N of 1706			25						

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
545	SS 1707	Substation-1T-S of 1704			25						
546	SS 1710	Substation-3T-100'E of 1710			25						
547	SS 1711	Substation-3T-100'E of 1706			25						
548	SS 1724	Substation-3T-200'N of 1706			25						
549	SS 1730	Substation-2T-NW of 1730			31						
550	SS 1731	Substation-1T-200'NW of 1730			31						
551	SS 1732	Substation-1T-NW corner of section			31						
552	SS 1735	Substation-3T-E of 1736			31						
553	SS 1736	Substation-2T-200'S of 1736			31						
554	SS 6C	Substation-1T-SW corner of section			02						
555	SS 7215	Substation-1T-fenced railcar area			36						
556	SS 7C	Substation-1T-112'ESE 7th & C			02						
557	SS AL338	Substation-1T-SE corner of section			31						
558	SS AWL021	Substation-1T-S of pool rd			02						
559	SS CPR 1	Rectifier-1R-130'SSE of 254			02						
560	SS CPR 10	Rectifier-1R-S of 742A			01						
561	SS CPR 2	Rectifier-1R-W of 313			01						
562	SS CPR 3	Rectifier-1R-146'W of 326			02						
563	SS CPR 4	Rectifier-1R-E of 352A			02						
564	SS CPR 5	Rectifier-1R-with SS 514			01						
565	SS CPR 6	Rectifier-1R-with SS 515			01						
566	SS CPR 7	Rectifier-1R-NE of SS 411			01						
567	SS CPR 8	Rectifier-1R-W of 433			01						
568	SS CPR 9	Rectifier-1R-W of 542			01						
569	SS F182	Substation-1T-500'W of T1512			36						
570	SS FL842	Substation-1T-N of 1618			25						
571	SS GA	Substation-1T-0.1mi N of 732			36						
572	SS H-1	Substation-2T-SE of 319			01						
573	SS LDLA	Substation-1T-W of Lower Derby			01						
574	SS NN2201	Substation-1T-640'NNW of 810			22						
575	SS NN2202	Substation-1T-960'NNW of 810			22						
576	SS NN2203	Substation-1T-1260'NW of 810			22						

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
577	SS NN2204	Substation-1T-1600'NW of 810			22						
578	SS NN2205	Substation-1T-2050'NW of 810			22						
579	SS NN2206	Substation-1T-2500'NW of 810			22						
580	SS NN2207	Substation-1T-800'WNW of 810			22						
581	SS NN2208	Substation-1T-1100'WNW of 810			22						
582	SS NN2209	Substation-1T-1350'WNW of 810			22						
583	SS NN2210	Substation-1T-1670'WNW of 810			22						
584	SS NN2211	Substation-1T-2370'WNW of 810			22						
585	SS NN2301	Substation-3T-200'N of 808			23						
586	SS NN2501	Substation-1T-SE corner of 1602			25						
587	SS NN2601	Substation-1T-S of 806			26						
588	SS NN2701	Substation-3T-W of 810			27						
589	SS PSCOST	Substation-1T-1/8 mi S of 7th on C			02						
590	SS PT56/57	Substation-2T-NE of 510			01						
591	SS SBA	Substation-3T-SE side of 834			36						
592	SS SWIM	Substation-1T-W of pool/on C			02						
593	SS WR	Substation-1T-600'NE of 732			36						
594	T 0026	Horizontal Tank-TF0107	1		01	Owned					Tanks/Pipes
595	T 0064	Horizontal Tank-TF0107	1		01	Owned					Tanks/Pipes
596	T 0065	Vertical Tank-TF0103	31		01						Tanks/Pipes
597	T 0075	Vertical Tank-TF0103	1		01						Tanks/Pipes
598	T 0076	Vertical Tank-TF0103	1		01						Tanks/Pipes
599	T 0078	Vertical Tank-TF0103	1		01						Tanks/Pipes
600	T 0139	Horizontal Tank-TF0107	1		01						Tanks/Pipes
601	T 0190	Horizontal Tank-TF0107	3		01						Tanks/Pipes
602	T 0289	Air Receiver/Surge Tank-NE of 516	1		01						Tanks/Pipes
603	T 1040	Vertical Tank-TF0107	1		01	Owned					Tanks/Pipes
604	T 1128	Methanol Tank-TF0104	1		01						Tanks/Pipes
605	T 1129	MMAA Tank-TF0104	1		01						Tanks/Pipes
606	T 1132	Trimethylphosphite(TMP) Tank-TF0103	1		01						Tanks/Pipes
607	T 1133	MMA Tank-TF0104	1		01						Tanks/Pipes
608	T 1140	Chloroform Tank-TF0104	1		01						Tanks/Pipes

Table 5.4-8 Inventory of No Future Use, Other Contamination History Medium Group

Place #	Structure Number	Description of Structure	Bank Vol (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
609	T 1146	Dicetene Tank-TF0110	2		01						Tanks/Pipes
610	T 1147	Dicetene Tank-TF0110	2		01						Tanks/Pipes
611	T 1168	Brine Storage Tank-SE corner 528	5		01						Tanks/Pipes
612	T 1178	Acetone Storage Tank-TF0103	1		01						Tanks/Pipes
613	T 1216	Mother Liquor/Dinitro Tank-TF0102	6		01						Tanks/Pipes
614	T 1324	Brine Storage Tank-TF0103	1		01						Tanks/Pipes
615	T 1327	Vertical Tank-TF0103	17		01						Tanks/Pipes
616	T 1340	Crystal, Acetone Tank-TF0102	16		01						Tanks/Pipes
617	T 1392	Vertical Tank-E of 512	5		01						Tanks/Pipes
618	T 1463	Vertical Tank-TF0104	2		01						Tanks/Pipes
619	T 1570	Vertical Tank-TF0105	5		01	Owned					Tanks/Pipes
620	T 1606	Horizontal Tank-TF0109	5		01						Tanks/Pipes
621	T 1973	Vertical Tank-TF0103	2		01						Tanks/Pipes
622	TF0107	Tank Farm-W & S of 514A	110		01						Tanks/Pipes
623	TF2501	Tank Farm-W of 1704	25		25						Tanks/Pipes
624	TW-13	Open Storage-foundation-N of 1611	120	5,800	25						
625	V 1064	Vertical Tank-TF0109	1		01						Tanks/Pipes
626	V 1214	Vertical Tank-TF0106	2		01						Tanks/Pipes
627	V 1220	Vertical Tank-TF0106	6		01						Tanks/Pipes
628	V 1250	Horizontal Tank-TF0104	1		01						Tanks/Pipes
629	V 1253	Horizontal Tank-TF0104	1		01						Tanks/Pipes
630	V 1267	Surge Vessel-TF0105	2		01						Tanks/Pipes
631	V 1270	Horizontal Tank-TF0105	1		01						Tanks/Pipes

[1] These buildings may be reevaluated for potential historic preservation or future use. The Rocky Mountain Arsenal National Wildlife Refuge Act states that "transfer shall be made without cost to the Secretary of the Interior and shall include such improvements on property as the Secretary of the Interior may request in writing for refuge management purposes."

Table 5.4-9 Inventory of No Future Use, Agent History Medium Group

Place #	Structure Number	Description of Structure	Bank Volume (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
1	0313	Laboratory	1,000	10,000	01						
2	0315	Warehouse-Laundry	1,000	10,000	01						
3	0319	Magazine/Flammable Material Storage	52	400	01						
4	0414	Mustard Scrubber Unit-foundation	79	310	01						
5	0416	H/Dichlor Disposal Reactor-foundatn	79	300	01						
6	0417	H/Dichlor Decon Pit-foundation	79	280	01						
7	0422	H Manufacture/Aldrin Production	2,100	23,000	01	Leased					
8	0426	Mustard Disposal Reactor-foundation	59	1,600	01	Leased					
9	0427	Decontamination Pit-fdn	4	80	01	Leased					
10	0428	Incinerator	6	56	01						
11	0429	H Brine Mixing/Pesticide Mfg.	15	560	01						
12	0512	Filling/Pesticide Production	610	3,800	01	Leased		Treaty			
13	0514	Lewisite/HD/Pesticide Production	3,200	27,000	01	Leased		Treaty			
14	0514A	L/M- 1 Storage/Dowtherm Boiler	110	1,700	01	Leased		Treaty			
15	0516	Lewisite Distillation/Pest. Prod.	1,400	13,000	01	Leased					
16	0517	Offices/Change House/Laboratory	1,300	18,000	01	Leased					
17	0528	HD Burning/Pesticide Manufacture	380	2,200	01	Leased					
18	0536	Ammo.Dem.Facility/Crude Mustard Sto.	990	4,100	01						
19	0537	Thaw House	2,300	16,000	01			Treaty			
20	0538	Ton Container Reconditioning Plant	1,200	15,000	01			Treaty			
21	0540	Ton Container Renovation Plant	330	4,900	01						
22	0541	Warehouse/WP Filling	770	11,000	01						
23	0725	Bomb Testing Station	99	460	36						
24	0726	Bomb Test Building	40	430	36						
25	0728	HD Filling/Pesticide Storage/Wareh.	1,400	21,000	01				Cleanup		
26	0742	Warehouse	4,800	49,000	01			Treaty	Cleanup		
27	0742A	Tank House	330	1,300	01			Treaty			
28	0785	Warehouse	1,400	29,000	06		Long-Term				
29	0786	Warehouse	480	9,600	06		Long-Term		Cleanup		
30	0788	Warehouse	480	9,600	06		Long-Term		Cleanup		
31	0791	Warehouse	480	9,600	31				Cleanup		
32	0792	Drum Storage Warehouse	440	9,600	31				Cleanup		

Table 5.4-9 Inventory of No Future Use, Agent History Medium Group

Place #	Structure Number	Description of Structure	Bank Volume (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
33	0793	Drum Storage Warehouse	470	9,600	31				Cleanup		
34	0794	Drum Storage Warehouse	520	9,600	31				Cleanup		
35	0795	Drum Storage Warehouse	480	9,600	31				Cleanup		
36	0796	Warehouse	480	9,600	31				Cleanup		
37	0797	Drum Storage Warehouse	480	9,600	31				Cleanup		
38	0798	Drum Storage Warehouse	480	9,600	31				Cleanup		
39	0881	Igloo Storage	210	1,600	06		Long-Term		Cleanup		
40	0882	Igloo Storage	210	1,600	06				Cleanup		
41	0883	Igloo Storage	210	1,600	06						
42	0885	Igloo Storage	210	1,600	06		Long-Term		Cleanup		
43	0886	Igloo Storage	210	1,600	06				Cleanup		
44	1501	GB Manufacturing/Demil. Building	9,000	81,000	25			Treaty			
45	1503A	Scrubber Facility-1503 A/B/C=1503	440	580	25			Treaty			
46	1503B	Scrubber Facility-1503=1503A/B/C	88	580	25			Treaty			
47	1503C	Scrubber Facility-1503=1503A/B/C	79	580	25			Treaty			
48	1504	200-ft Steel Stack	630	710	25			Treaty			
49	1506	GB Storage	1,900	9,000	25			Treaty			
50	1601	GB Filling	7,700	69,000	25			Treaty			
51	1601A	Ammunitions Demilitarization Facility	670	2,800	25			Treaty			
52	1602	Paint Storage	620	2,200	25			Treaty			
53	1603A	Scrubber Facility	89	580	25						
54	1603B	Scrubber System-1603=1603A/B	89	580	25						
55	1605	Munitions Storage Igloo	150	1,000	25						
56	1606	Cluster Assembly Buildinge	14,000	60,000	25			Treaty			
57	1607	Warehouse	1,700	26,000	25			Treaty	Cleanup		
58	1608	Munitions Storage Igloo	150	1,000	25						
59	1609	Munitions Storage Igloo	150	1,000	25						
60	1610	Munitions Storage Igloo	150	1,000	25						
61	1611	Demilitarization Facility	3,100	32,000	25						
62	1613	Explosive Unpacking Building	77	750	25			Treaty			
63	1614	Warehouse	260	7,800	25						
64	1615	Warehouse	170	4,000	25			Treaty			

Table 5.4-9 Inventory of No Future Use, Agent History Medium Group

Place #	Structure Number	Description of Structure	Bank Volume (BCY)	Size (SF)	Section	Shell Use	USFWS Use[1]	Treaty	Cleanup Use	Added After Task 24	Pipe Runs & Tanks
65	1616	Warehouse	85	4,000	25			Treaty			
66	1702	Weld Shop	49	2,400	25						
67	1703	Spray Dryer Facility	2,700	28,000	25			Treaty			
68	1727	Industrial Waste Sewer	36	700	25			Treaty			
69	1735	Loading Dock	670	11,000	31						
70	T 0027	Vertical Tank-TF0107	1		01						Tanks/Pipes

[1] These buildings may be reevaluated for potential historic preservation or future use. The Rocky Mountain Arsenal National Wildlife Refuge Act states that "transfer shall be made without cost to the Secretary of the Interior and shall include such improvements on property as the Secretary of the Interior may request in writing for refuge management purposes."

Table 5.4-10 Soil Exceedance Categories, Medium Groups, and Subgroups

Human Health Exceedance Category

- Basin A Medium Group
- Basin F Medium Group
  - Basin F Wastepile Subgroup
  - Former Basin F Subgroup
- Secondary Basins Medium Group
- Sewer Systems Medium Group
  - Chemical Sewers Subgroup
  - Sanitary/Process Water Sewers Subgroup
- Disposal Trenches Medium Group
  - Complex Trenches Subgroup
  - Shell Trenches Subgroup
  - Hex Pit Subgroup
- Sanitary Landfills Medium Group
- Lime Basins Medium Group
  - Section 36 Lime Basins Subgroup
  - Buried M-1 Pits Subgroup
- South Plants Medium Group
  - South Plants Central Processing Area Subgroup
  - South Plants Ditches Subgroup
  - South Plants Balance of Areas Subgroup
- Buried Sediments/Ditches Medium Group
  - Buried Sediments Subgroup
  - Sand Creek Lateral Subgroup
- Undifferentiated Medium Group
  - Section 36 Balance of Areas Subgroup
  - Burial Trenches Subgroup

Biota Exceedance Category

- Surficial Soil Medium Group
- Lake Sediments Medium Group
- Ditches/Drainage Areas Medium Group

Potential Agent Presence Category

- Agent Storage Medium Group
  - North Plants Subgroup
  - Toxic Storage Yards Subgroup

Potential UXO Presence Category

- Munitions Testing Medium Group

Table 5.4-11 Summary of Soil Medium Groups and Subgroups

Medium Groups	Subgroup	Description
Munitions Testing	—	This group is comprised of sites having similar histories and uses. The sites, considered potential HE-filled UXO presence areas and predominantly located in the eastern portions of RMA, were used for testing or destruction of nonchemical munitions. These sites typically contain slag, debris, and potential UXO in the uppermost 1 ft of soil and therefore present physical hazards. The mortar impact area in Section 30 may contain UXO at depths as deep as 6 ft. COC concentrations were not detected above human health SEC at any of the sites.
Agent Storage	North Plants	Sites in this subgroup have potential agent presence but do not contain human health exceedances except as isolated detections. They are located in the North Plants GB manufacturing area. These sites are presumed to contain agent based on use histories and detections of agent breakdown products. Isolated detections of arsenic exceed the human health SEC. Portions of the sites in this subgroup potentially pose risks to biota.
	Toxic Storage Yards	Sites in this subgroup (including the New and Old Toxic Storage Yards) are located in the storage areas in the eastern portion of RMA and are considered to potentially contain agent based on use histories and detections of agent breakdown products. However, sampling has not indicated the presence of agent at these sites. The Old Toxic Storage Yards were retained as sites presumed to contain agent. Isolated detections of chloroacetic acid and arsenic exceed the human health SEC.
Lake Sediments	—	Sites within this medium group include sediments from lakes located in the southern portion of RMA and sediments from the North Bog. They were grouped together based on the potential risk they present to ecological receptors. Contamination has resulted from the influx of suspended solid- or dissolved-phase contaminants transported to the lakes by surface water or groundwater. Isolated exceedances of human health SEC include chlordane and chromium and acute exceedances of aldrin and dieldrin. Water is not currently allowed to pond in Upper Derby Lake, and portions of Upper Derby Lake contain soil that poses a potential risk to biota.
Surficial Soil	—	This medium group consists of areas of shallow soil contamination (including Basin F Exterior) posing risk to biota that are not included as sites in other medium groups/subgroups. Portions of this group contain OCPs above human health SEC. This group also contains the pistol and rifle ranges.
Ditches/Drainage Areas	—	Exceedance sites within this medium group have various disposal and release histories and contain low levels of contaminants, primarily OCPs, that pose risks to biota.

Medium Groups	Subgroup	Description
Basin A	—	This medium group is comprised of two sites within the Basin A high-water line. Basin A contains soil and sediment that were contaminated by organic and inorganic chemicals from manufacturing wastewater discharged to the basin. The medium group is also characterized by the potential presence of agent and agent-filled UXO. Agent was detected in the southern portion of Basin A. COCs detected above the human health SEC include primarily OCPs; soil near the center of the basin exceeds the principal threat criteria.
Basin F	Basin F Wastepile	This subgroup consists of the Basin F Wastepile that was formed as a result of the Basin F IRA. The IRA has included incineration of Basin F liquids in the SQI, excavation of Basin F soil from below the original asphalt liner and the final grading, capping, and revegetation of the excavated area. The Basin F Wastepile consists of excavated sediment and soil that are contaminated with organic compounds, arsenic, and metals at concentrations exceeding human health SEC and principal threat criteria. The total concentrations of organics are inferred to be on the order of 1,000 to 10,000 ppm. This material also contains elevated levels of salts due to the high chloride content in the wastewater stored in the former Basin F.
	Former Basin F	The former Basin F site consists of the former basin area, including the area beneath the Basin F Wastepile. Basin F received wastewaters through the chemical sewer system, and the site is expected to contain somewhat elevated levels of salts due to the high chloride content in the wastewater. COCs remaining in the soil exceeding human health SEC include OCPs and chloroacetic acid; large portions of the former basin exceed principal threat criteria. The Basin F IRA included the installation of a soil cover.
Secondary Basins	—	Sites within this subgroup consist of four liquid disposal basins (Basins B, C, D, and E) that collected overflow water from Basin A and the former deep disposal well. These sites are expected to contain somewhat elevated levels of salts that are a result of the storage of wastewater with high chloride content. COCs detected in the soil above human health SEC include OCPs, although the majority of contamination potentially poses risks to biota only.
Sewer Systems	Sanitary/ Process Sewers	Sites within this subgroup consist of sanitary and process water sewers. Soil around these sewer lines does not exceed human health SEC and does not pose risks to biota based on the depth of the sewer lines; however, these sewer lines potentially serve as conduits for the migration of groundwater contamination.
	Chemical Sewers	Sites within this subgroup consist of chemical sewers. COCs in the soil exceeding human health SEC and principal threat criteria in portions of South Plants include OCPs, volatile organics, and chloroacetic acid. These sewers are further characterized by the potential presence of agent.

Table 5.4-11 Summary of Soil Medium Groups and Subgroups

Medium Groups	Subgroup	Description
Disposal Trenches	Complex Trenches	This subgroup is characterized by trenches or pits that were filled with trash and manufacturing/military wastes. Wastes are suspected to consist of drums of solid and liquid material, wood, glass, metal, laboratory and manufacturing equipment, and miscellaneous material. This subgroup is further characterized by the potential presence of agent and agent-filled UXO.
	Shell Trenches	This subgroup is characterized by trenches or pits that were filled with trash and manufacturing/military wastes in the area of the Shell Trenches. Wastes are suspected to consist of drums of solid and liquid material. IRA activities at this site have consisted of the placement of a soil cap across the entire site and a vertical barrier surrounding the site.
	Hex Pit	This site was historically used for disposal of hex bottoms, a tarry, chlorinated wastestream resulting from the production of HCCPD. The soil at this site is contaminated with these resinous materials. This material was buried in thin-gauge caustic barrels and in bulk.
Sanitary Landfills	—	This medium group consists of sanitary landfills and inferred trenches that are predominantly located in the eastern and western portion of RMA. These sites contain trash and rubbish, but are not anticipated to contain drums of hazardous material, agent, or UXO.
Lime Basins	Section 36 Lime Basins	The Section 36 Lime Basins, used for the neutralization of process wastes related to agent production, are characterized by soil/sludge mixtures with high pH levels and the potential presence of agent. COCs in the soil/sludge exceeding human health SEC include primarily OCPs; low-level inorganic contamination is also present. IRA activities at this site involved placing a soil cover across the entire site.
	M-1 Pits	The Buried M-1 Pits, used for the neutralization of process wastes related to agent production, are characterized by soil/sludge mixtures with high pH levels and the potential presence of agent. COCs in the soil/sludge exceeding human health SEC and principal threat criteria primarily consist of arsenic and mercury. This subgroup is distinguished by percentage levels of arsenic and mercury.

Medium Groups	Subgroup	Description
South Plants	South Plants Central Processing Area	This subgroup consists of the main processing area within the South Plants. Contamination has resulted from manufacture, storage, and disposal of chemicals and from the demilitarization of agent-filled ordnance. A wide range of COCs in the soil exceeding human health SEC and principal threat criteria include volatiles, OCPs, and arsenic. The soil in this area potentially contains agent.
	South Plants Ditches	This subgroup consists of the drainage ditches within South Plants. Contamination has resulted from manufacture, storage, and disposal of chemicals and from the demilitarization of agent-filled ordnance. COCs in the soil exceeding human health SEC and principal threat criteria include primarily OCPs. Also, contaminated soil in these ditches potentially poses risk to biota.
	South Plants Balance of Areas	The remainder of the sites within South Plants were placed in this subgroup. Contamination at these sites has resulted from manufacture, storage, and disposal of chemicals and from the demilitarization of agent-filled ordnance, and from windblown dispersion of contaminants from the Central Processing Area. COCs in the soil exceeding the human health SEC and principal threat criteria primarily consist of OCPs and ICP metals. Most of the contaminated soil in the balance of South Plants potentially poses risks to biota. This subgroup is also characterized by the potential presence of high explosives-filled UXO and agent.
Buried Sediments/ Ditches	Buried Sediments	This subgroup consists of two sites that contain contaminated sediments that were dredged from the adjacent lakes (Lake Ladora and Derby lakes), deposited in unlined ditches at their current locations, and covered with clean soil. COCs exceeding human health SEC include OCPs.
	Sand Creek Lateral	This subgroup consists of the northern and southern segments of the Sand Creek Lateral that transported runoff from the South Plants Central Processing Area during storm events and snowmelt, and of the drainage ditches used to transport water to and from the Secondary Basins and to drain the South Plants and North Plants process areas. COCs in the soil exceeding Human Health SEC primarily consist of OCPs.
Undifferentiated	Section 36 Balance of Areas	Sites within this subgroup are located in the southern area of Section 36. They do not have unique site-type characteristics or contamination patterns. COCs in the soil exceeding human health SEC include OCPs and chloroacetic acid. This subgroup is also characterized by the potential presence of agent and agent-filled UXO.
	Burial Trenches	Sites within this subgroup consist of trenches that are located in Sections 30 and 32 related to munitions testing and disposal. COCs in the soil exceeding human health SEC include chromium and lead. The sites are also characterized by the potential presence of HE-filled UXO.

Table 5.4-12 Summary of Contaminant Concentrations Within the Soil Exceedance Volumes

Medium Group/ Subgroup	Contaminants of Concern	Range of Concentrations Within Exceedance Volume[1] (ppm)	Average Concentration Within Exceedance Volume[1] (ppm)	Exceedance Depth (ft)[2]
North Plants				
Human Health	Arsenic	312–10,000	2,800	1
Biota	Dieldrin	0.01–2.9	0.13	1
	Endrin	0.003–0.09	0.01	
	Arsenic	2.8–260	41	
	Mercury	0.05–2.9	0.32	
Toxic Storage Yards				
Human Health	Chloroacetic	80–134	115	6
	Acid	270–4,000	1,600	
	Arsenic			
Biota	Arsenic	BCRL–140	3.6	
	Mercury	BCRL–30	0.15	
Lake Sediments				
Human Health	Aldrin	BCRL–31	11.8	3
	Dieldrin	BCRL–3.4	0.7	
	Chlordane	BCRL–57	1.8	
Biota	Aldrin	BCRL–2.7	0.060	
	Dieldrin	BCRL–2.9	0.069	
	Chlordane	BCRL–9.3	0.056	
	DDE	BCRL–1.3	0.018	
	DDT	BCRL–3.0	0.35	
	Mercury	BCRL–18	0.43	
	Arsenic	BCRL–16	0.69	
Surficial Soil				
Human Health	Aldrin	0.048–390	17	1
	Dieldrin	0.001–560	27	
	Lead (firing ranges)	Not Available	Not Available	
Biota	Aldrin	BCRL–3.0	0.016	1
	Dieldrin	BCRL–3.5	0.057	
	Endrin	BCRL–13	0.039	

Table 5.4-12 Summary of Contaminant Concentrations Within the Soil Exceedance Volumes

Medium Group/ Subgroup	Contaminants of Concern	Range of Concentrations Within Exceedance Volume[1] (ppm)	Average Concentration Within Exceedance Volume[1] (ppm)	Exceedance Depth (ft)[2]
Ditches/Drainage Area				
Biota	Aldrin	BCRL–0.094	0.005	1
	Dieldrin	BCRL–2.2	0.27	
	Endrin	BCRL–2	0.053	
	DDE	BCRL–0.78	0.027	
	DDT	BCRL–0.32	0.01	
	Arsenic	BCRL–50	6.6	
	Mercury	BCRL–1.9	0.16	
Basin A				
Human Health	Aldrin	BCRL–720	42	
	Dieldrin	BCRL–2,600	150	
	Endrin	BCRL–3,200	110	
	Isodrin	BCRL–160	9	
	Chlordane	BCRL–2,900	100	
	Arsenic	BCRL–28,000	350	
	Chromium	BCRL–98	13	
	DDT	BCRL–105	3	
	DDE	BCRL–21	1.4	
	Mercury	BCRL–11,000	140	
Biota	Aldrin	BCRL–1.9	0.04	
	Dieldrin	BCRL–3.6	0.53	
	Endrin	BCRL–3.0	0.10	
	Arsenic	BCRL–230	25	
	Mercury	BCRL–54	0.67	
	DDT	BCRL–0.73	0.01	
	DDE	BCRL–0.71	0.01	
Basin F Wastepile				
Human Health[3]	Aldrin	0.1–3,100	Not Available	NA
	Dieldrin	0.1–700	Not Available	
	Endrin	9.2–900	Not Available	
	Isodrin	3.16–3,000	Not Available	
	Chloroacetic	110–760	Not Available	
	Acid	3,4–110	Not Available	
	1,2-Dichloroethane DCPD	1,500–2,000	Not Available	

Table 5.4-12 Summary of Contaminant Concentrations Within the Soil Exceedance Volumes

Medium Group/ Subgroup	Contaminants of Concern	Range of Concentrations Within Exceedance Volume[1] (ppm)	Average Concentration Within Exceedance Volume[1] (ppm)	Exceedance Depth (ft)[2]
Former Basin F				
Human Health	Aldrin	BCRL–2,900	260	10
	Dieldrin	BCRL–1,100	130	
	Endrin	BCRL–710	47	
	Isodrin	BCRL–10,000	360	
	Chloroacetic	BCRL–7,000	960	
	Acid	BCRL–20,000	670	
	DCPD			
Secondary Basins				
Human Health	Aldrin	BCRL–180	21.6	
	Dieldrin	BCRL–120	28.2	
	Chlordane	BCRL–3.0	0.68	
	Endrin	BCRL–8.4	2.1	
	Chromium[4]	BCRL–120		
	Arsenic	BCRL–140	9.8	
	Mercury	BCRL–1.6	0.17	
Biota	Aldrin	BCRL–2.7	0.08	
	Dieldrin	BCRL–3.4	0.69	
	Endrin	BCRL–0.57	0.07	
	DDE	BCRL–1.0	0.006	
	Arsenic	BCRL–56	10	
	Mercury	BCRL–0.23	0.086	
Chemical Sewers				
Human Health	Aldrin	BCRL–20,000	Not Available	10
	Dieldrin	BCRL–200	Not Available	
	Isodrin	BCRL–1,000	Not Available	
	DDT	BCRL–500	Not Available	
	Chloroacetic	BCRL–230	Not Available	
	Acid	BCRL–32,000	Not Available	
	DBCP	BCRL–4,000	Not Available	
	HCCPD	BCRL–200	Not Available	
	Carbon	BCRL–400	Not Available	
	Tetrachloride	BCRL–740	Not Available	
	Chloroform			
	Arsenic			

Table 5.4-12 Summary of Contaminant Concentrations Within the Soil Exceedance Volumes

Medium Group/ Subgroup	Contaminants of Concern	Range of Concentrations Within Exceedance Volume[1] (ppm)	Average Concentration Within Exceedance Volume[1] (ppm)	Exceedance Depth (ft)[2]
Complex Trenches[5]				
Human Health	Aldrin	BCRL–40	Not Available	14
	Isodrin	BCRL–27	Not Available	
	Chlordane	BCRL–150	Not Available	
	DBCP	BCRL–6.7	Not Available	
	Chromium	BCRL–5,200	Not Available	
	Lead	BCRL–10,000	Not Available	
	Mercury	BCRL–860	Not Available	
	Arsenic	BCRL–4,500	Not Available	
Biota	Aldrin	BCRL–0.19	Not Available	
	Dieldrin	BCRL–3	Not Available	
	Endrin	BCRL–4.7	Not Available	
	DDE	BCRL–2.9	Not Available	
	DDT	BCRL–0.18	Not Available	
	Arsenic	BCRL–98	Not Available	
	Mercury	BCRL–70	Not Available	
Shell Trenches[5]				
Human Health	Aldrin	BCRL–1,000	Not Available	10
	Dieldrin	BCRL–500	Not Available	
	Endrin	BCRL–400	Not Available	
	Isodrin	BCRL–1,000	Not Available	
	Chlordane	BCRL–70	Not Available	
	DBCP	BCRL–700	Not Available	
	HCCPD	BCRL–40,000	Not Available	
Hex Pit[5]				
Human Health	Aldrin	BCRL–1,000	Not Available	10
	Dieldrin	BCRL–500	Not Available	
	Endrin	BCRL–400	Not Available	
	Isodrin	BCRL–1,000	Not Available	
	Chlordane	BCRL–70	Not Available	
	HCCPD	BCRL–40,000	Not Available	

Table 5.4-12 Summary of Contaminant Concentrations Within the Soil Exceedance Volumes

Medium Group/ Subgroup	Contaminants of Concern	Range of Concentrations Within Exceedance Volume[1] (ppm)	Average Concentration Within Exceedance Volume[1] (ppm)	Exceedance Depth (ft)[2]
Sanitary Landfills				
Human Health	Aldrin	BCRL–420	2.5	12
	Dieldrin	BCRL–300	3.0	
	Endrin	BCRL–38	0.31	
	Isodrin	BCRL–27	0.16	
	Chlordane	BCRL–3.1	0.02	
	DDT	BCRL–61	0.44	
	Chromium	BCRL–1,800	18	
	Lead	BCRL–8,600	65	
	Cadmium	BCRL–1,100	5.8	
Biota	Aldrin	BCRL–3.2	0.09	
	Dieldrin	BCRL–2.6	0.17	
	DDE	BCRL–5.6	0.19	
	DDT	BCRL–61	1.3	
	Endrin	BCRL–20	0.39	
	Arsenic	BCRL–120	5.5	
	Mercury	BCRL–3.5	0.11	
Section 36 Lime Basins				
Human Health	Aldrin	BCRL–1,700	190	10
	Dieldrin	BCRL–780	90	
	Endrin	BCRL–400	41	
	Isodrin	BCRL–400	48	
	Chlordane	BCRL–240	25	
	DDE	BCRL–13	1.9	
	DDT	BCRL–2.6	0.06	
	Arsenic	BCRL–900	100	
	Mercury	BCRL–56	5.4	
Buried M-1 Pits				
Human Health	Aldrin	BCRL–27	0.55	10
	Dieldrin	BCRL–36	0.82	
	Isodrin	BCRL–7.1	0.099	
	HCCPD	BCRL–1,300	44	
	DCPD	BCRL–7,800	195	
	Cadmium	BCRL–2,400	320	
	Arsenic	27–100,000	17,000	
	Mercury	1.3–83,000	4,300	

Table 5.4-12 Summary of Contaminant Concentrations Within the Soil Exceedance Volumes

Medium Group/ Subgroup	Contaminants of Concern	Range of Concentrations Within Exceedance Volume[1] (ppm)	Average Concentration Within Exceedance Volume[1] (ppm)	Exceedance Depth (ft)[2]
South Plants Central Processing Area				
Human Health	Aldrin	BCRL–15,000	580	10
	Dieldrin	BCRL–6,300	210	
	Endrin	BCRL–3,700	67	
	Isodrin	BCRL–300	19	
	Chlordane	BCRL–1,500	15	
	Chloroacetic	BCRL–350	13	
	Acid	BCRL–300	7.5	
	DDT	BCRL–5,300	28	
	HCCPD	BCRL–14,000	275	
	DBCP	BCRL–140	1.9	
	Carbon	BCRL–40,000	580	
	Tetrachloride	BCRL–970	6.7	
	Chloroform	BCRL–14,000	230	
	DCPD	BCRL–540	5.1	
	Arsenic	BCRL–280	20	
	Cadmium	BCRL–7,100	310	
	Chromium	BCRL–17,000	300	
	Lead			
	Mercury			
Biota	Aldrin	BCRL–3.4	0.19	
	Dieldrin	BCRL–3.4	0.73	
	Endrin	BCRL–1.2	0.029	
	DDE	BCRL–1.6	0.023	
	DDT	BCRL–8.6	0.03	
	Arsenic	BCRL–289	11	
	Mercury	BCRL–56	2.04	
South Plants Ditches				
Human Health	Aldrin	0.60–4,400	270	
	Dieldrin	0.71–805	58	
	Isodrin	BCRL–23	2.3	
	Chlordane	BCRL–6.3	0.4	
	Chromium	BCRL–62	12	
	Endrin	BCRL–3.4	0.17	
	DDE	BCRL–2.1	0.20	
	DDT	BCRL–10	0.4	
	Arsenic	BCRL–6.1	0.42	
	Mercury	BCRL–15	0.30	
Biota	Aldrin	BCRL–2.3	0.11	
	Dieldrin	BCRL–2.7	0.69	
	Endrin	BCRL–0.31	0.038	
	DDE	BCRL–3.2	0.12	
	DDT	BCRL–0.81	0.047	
	Mercury	BCRL–2.5	0.10	

Table 5.4-12 Summary of Contaminant Concentrations Within the Soil Exceedance Volumes

Medium Group/ Subgroup	Contaminants of Concern	Range of Concentrations Within Exceedance Volume[1] (ppm)	Average Concentration Within Exceedance Volume[1] (ppm)	Exceedance Depth (ft)[2]
South Plants Balance of Areas				
Human Health	Aldrin	BCRL–6,900	14	10
	Dieldrin	0.67–1,500	33	
	Endrin	BCRL–46	1.6	
	Isodrin	BCRL–390	18	
	Chlordane	BCRL–370	4.2	
	DDE	BCRL–9.7	0.53	
	DDT	BCRL–140	1.4	
	HCCPD	BCRL–2,000	23	
	Chromium	BCRL–2,200	62	
	Lead	BCRL–4,900	340	
	Mercury	BCRL–8,600	500	
Biota	Aldrin	BCRL–3.5	0.037	
	Dieldrin	BCRL–3.6	0.32	
	Endrin	BCRL–1.17	0.011	
	DDE	BCRL–1.02	0.006	
	DDT	BCRL–1.7	0.15	
	Arsenic	BCRL–180	0.73	
	Mercury	BCRL–41	0.065	
Buried Sediments				
Human Health	Dieldrin	26.1–53	40	10
	Chlordane	BCRL–8.9	0.8	
Sand Creek Lateral				
Human Health	Aldrin	BCRL–400	27.8	2
	Dieldrin	BCRL–140	18.5	
	Isodrin	BCRL–4.0	0.24	
	Chlordane	BCRL–9.7	0.42	
	Chloroacetic Acid	230	Not Applicable	
	Chromium	BRCL–490	180	
	Lead	BCRL–2,000	800	
	DDE	BCRL–4.7	0.04	
	DDT	BCRL–6.0	1.0	
Biota	Aldrin	BCRL–3.7	0.30	
	Dieldrin	BCRL–3.6	0.44	
	Endrin	BCRL–3.8	0.087	
	DDE	BCRL–4.7	0.095	
	DDT	BCRL–6.0	0.10	
	Arsenic	BCRL–190	5.8	
	Mercury	BCRL–2.3	0.13	

Table 5.4-12 Summary of Contaminant Concentrations Within the Soil Exceedance Volumes

Medium Group/ Subgroup	Contaminants of Concern	Range of Concentrations Within Exceedance Volume[1] (ppm)	Average Concentration Within Exceedance Volume[1] (ppm)	Exceedance Depth (ft)[2]
Section 36 Balance of Areas				
Human Health	Aldrin	BCRL–120	11	10
	Dieldrin	BCRL–140	24	
	Endrin	BCRL–46	5.3	
	Isodrin	BCRL–37	1.6	
	Chlordane	BCRL–140	2.2	
	Chloroacetic	BCRL–320	52	
	Acid	BCRL–1.8	0.10	
	DDE	BCRL–23	0.20	
	DDT	BCRL–16	2.4	
	Arsenic	BCRL–50	0.46	
	Mercury			
Biota	Aldrin	BCRL–2.2	0.061	
	Dieldrin	BCRL–3.5	0.010	
	Endrin	BCRL–3.1	0.12	
	Chlordane	BCRL–11	0.84	
	DDE	BCRL–1.6	0.010	
	DDT	BCRL–8.6	0.028	
	Arsenic	BCRL–39	3.85	
	Mercury	BCRL–56	0.5	
Burial Trenches				
Human Health	Chromium	BCRL–39	20	10
	Lead	BCRL–3,400	190	

1 Concentrations listed are based on the samples present within the respective exceedance volumes only. For modeled sites, the range and average represent estimated contaminant concentrations for the modeled exceedance volume. See Section 7.1.4 for more discussion on soil contaminant modeling.

2 Human health exceedance depths represent the maximum depth of any detected human health exceedances.

3 Concentrations inferred from remedial investigations sampling at Former Basin F prior to interim response action.

4 Present above human health SEC in one sample in NCSA-4a.

5 Concentrations for these sites represent samples taken throughout the site. Limited information is available for soil concentrations within the disposal trenches proper.

6.0 Summary of Site Risks

A risk assessment is a scientific procedure used to estimate the potential adverse effects on human health and the environment from exposure to chemicals. At a CERCLA site, a baseline risk assessment is prepared and serves as the basis for evaluating risks posed from contamination if no remedial actions are taken. The resulting level of risk is called the baseline risk, i.e., an estimate of risk that might exist if no remediation or institutional controls were applied at a site. At RMA, a risk assessment called the Integrated Endangerment Assessment/Risk Characterization (IEA/RC) was performed and used as the baseline risk assessment. In this instance, the IEA/RC defined baseline to include the completion of the soil-related IRAs (e.g., Basin F, Lime Basins) and enforcement of the FFA's use restrictions. The FFA prohibits residential development; potable use of groundwater and surface water; agricultural activities for the purpose of raising livestock, crops, or vegetables; and the consumption of fish and game taken from RMA. Therefore, these uses were not considered during the IEA/RC. The relevant IRAs (Table 2.4-1) were implemented in accordance with the FFA to prioritize the selection of some of the more highly contaminated sites for remedial action and reduce or eliminate the risk for exposure to contaminated soil prior to the selection of the final remedial action. The risk assessment methodology used during the IEA/RC was initiated prior to the publication of EPA risk assessment guidance (OERR-EPA 1989). However, this methodology does incorporate the exposure assumptions and toxicity assessment methods specified in EPA guidance and fulfills EPA's requirement of estimating risk based on a reasonable maximum exposure (RME).

The IEA/RC was the result of a progressive series of endangerment assessment analyses initiated by the Biota RI (ESE 1989), the Human Health Exposure Assessment (HHEA), and the HHEA Addendum. These initial evaluations served as screening assessments for the protection of human health and preliminary estimations of biota risk, and provided the basic building blocks of the IEA/RC report, which is divided into two evaluations, the Human Health Risk Characterization (HHRC) and the Ecological Risk Characterization (ERC). Both of these evaluations are summarized in the final report.

The general methodology of the risk assessment process involves the following steps: identify the COCs, perform the exposure and toxicity assessments, and perform the risk characterization. The more than 50,000 groundwater, surface water, sediment, soil, air, and biota samples collected during the past decade were used to evaluate which chemicals were of concern to human health and the environment and to develop the risk assessment.

6.1 Human Health Risk Characterization

Soil at RMA is the primary medium by which humans can be exposed to contamination on post, due to land-use restrictions and/or limitations on the uses of other environmental media specified in the FFA and the Rocky

Mountain Arsenal National Wildlife Refuge Act of 1992. Remedial measures for on-post groundwater will augment the soil remedy and facilitate long-term remediation of groundwater. Risk-based criteria for groundwater established by the ROD for the Off-Post Operable Unit are used for the on-post boundary treatment systems.

The objectives of the HHRC were to develop risk-based soil criteria protective of people who might visit or work at RMA, evaluate the uncertainty associated with these criteria, characterizthe potential risks to these people, and evaluate where these risks exist at RMA to guide the remedial decisions. Two types of health effects were evaluated, potential cancer (carcinogenic) risks and potential health effects other than cancer. The context for interpreting cancer risk estimates is provided by EPA in CERCLA regulations and guidance: Acceptable exposure levels for a carcinogenic compound are those levels that result in an increased cancer risk between 1 in 10,000 (or 1×10^{-4}) and 1 in 1,000,000 (or 1×10^{-6}). These estimated carcinogenic risks are usually termed "excess lifetime cancer risks," which means there is an increased chance of an individual developing cancer over 30 years of exposure over a 70-year life span to the carcinogenic chemicals in "excess" of the normal cancer rate. (The normal cancer rate determined by the American Cancer Society is about one in three persons.)

Noncancer (noncarcinogenic) risk estimates are expressed in terms of a hazard index (HI) for **chronic**, **subchronic**, and **acute exposure durations**. A concern for adverse health effects may occur when an HI value, the sum of chemical-specific hazard quotients (HQs), exceeds 1.0. However, the value of any given HI does not provide an estimate of the probability of any adverse effects that may occur (unlike a cancer risk estimate). An HI of 1.0 represents the highest level of chronic exposure that is unlikely to result in adverse effects. For values of HI greater than 1.0, the potential for adverse effects to occur increases as the HI value increases.

6.1.1 Identification of Contaminants of Concern

Contaminants in the RI and Endangerment Assessment programs were selected as target analytes if they satisfied all of the following criteria:

- Quantities handled or disposed at RMA
- Acute toxicity and carcinogenic potential
- Persistence in the environment
- Identification as a breakdown product from Army surety agents
- The presence of the chemical in other monitoring or investigatory programs ongoing at RMA

A total of 64 contaminants were identified as target analytes from a list of more than 650 chemical constituents. These target contaminants were subsequently evaluated in the HHEA report. The HHEA served as a basis for identifying COCs that would become the focus of a more detailed evaluation of risk during the IEA/RC.

Based on the evaluation conducted during the HHEA, 27 soil COCs were ultimately selected for evaluation in the HHRC (Table 6. 1-1). These chemicals, which are expected to contribute the majority of projected risks at RMA, were identified based on pre-established selection criteria as follows:

1. Include all COCs designated as Category A (Exposure Index >10) in the HHEA.
2. Include all COCs with carcinogenic weight of evidence classifications designations A or B.
3. Include all COCs with carcinogenic weight of evidence classification designation C and potency factors.
4. Consider treatability to exclude chemicals from the COC list.
5. Consider isolated detections to exclude chemicals.
6. Include all COCs listed on the Land Ban Disposal Restriction List.
7. Include all COCs with RCRA soil criteria.
8. Consider the state's request to include DIMP and isopropylmethyl phosphonate (IMPA). (DIMP and IMPA are predominantly groundwater contaminants and were therefore not included on the final COC list.)
9. Group by chemical class to reduce COCs.
10. Consider frequency of detection.
11. Consider essential nutrients.
12. Consider concentration and toxicity.
13. Consider historical information.
14. Consider special exposure routes.
15. Consider Army agent degradation products.
16. Consider co-occurrence with other COCs to exclude chemicals.
17. Consider bioconcentration, mobility, and persistence.
18. Consider detections in laboratory blanks in comparison to concentrations detected on site. (Fluoroacetic acid, which was considered a COC in drafts of the IEA/RC report, was removed as a COC in this analysis because on-post detections of this chemical were similar in concentration to detections in laboratory blanks.)

6.1.2 Exposure Assessment

The objective of the human health exposure assessment is to estimate the type and magnitude of exposure to COCs by human populations through the characterization of the exposure setting (i.e., potential land uses) and current and future potentially exposed populations, identification of exposure pathways, and estimation of the exposure point concentrations.

6.1.2.1 Characterization of Exposure Setting and Potentially Exposed Populations

The identification of potentially exposed populations at RMA required consideration of potential site land uses. The FFA indicates the Parties' goal that significant portions of RMA will be available for open space for public benefit, including, but not limited to, wildlife habitat(s) and park(s). By the enactment of the Rocky Mountain

Arsenal National Wildlife Refuge Act of 1992, future land-use options will involve an open space scenario dominated by the formation of a nature preserve and wildlife refuge that includes parks and recreational areas.

Given the land-use projections identified above, two land-use options were identified that formed the basis for defining target receptor populations: open space, which includes nature preserve, wildlife refuge, and recreational park scenarios, and economic development, which includes commercial and industrial scenarios. Following passage of the Rocky Mountain Arsenal National Wildlife Refuge Act, economic development would only apply in limited areas along the western boundary of RMA. Based on the open space land-use projection, three receptor populations were evaluated in the HHRC, biological workers, regulated/casual visitors, and recreational visitors. Based on the economic development land-use projection, two worker populations, industrial and commercial workers, were selected for evaluation. Figure 6.1-1 is a diagram showing the land-use scenarios and the potentially exposed populations associated with them. For both open space and economic development land-use options, risks were calculated assuming that exposure would occur at a given site or, in the case of the boring-by-boring analysis, at an individual soil boring.

6.1.2.2 Identification of Exposure Pathways

An exposure pathway describes the course a chemical or physical agent takes from the contaminant source to the exposed receptor. A complete exposure pathway includes a source area, a means of transport in the environment, an exposure point, and a receptor. At RMA, direct and indirect exposure pathways were evaluated. The direct pathways included ingesting contaminated soil (ingestion), coming into contact with contaminated soil (dermal absorption), or breathing contaminated dust particles (inhalation). The indirect pathways included inhalation of contaminated vapors in open areas (e.g., during work performed outdoors) and enclosed spaces (e.g., in basements). Dermal contact with metals in soil was not evaluated for any receptor population due to negligible contaminant absorption through this exposure pathway.

The five potentially exposed populations/subpopulations and their respective current and future exposure pathways included the following:

- Biological Worker, e.g., a wildlife biologist working on the refuge – All direct pathways and open space vapor inhalation
- Regulated/Casual Visitor, e.g., someone (adult or child) visiting the wildlife refuge – All direct pathways and open space vapor inhalation
- Recreational Visitor, e.g., someone (adult or child) jogging or playing on areas of the wildlife refuge – All direct pathways and open space vapor inhalation
- Commercial Worker, e.g., a person working inside a building on the wildlife refuge – All direct pathway and enclosed space vapor inhalation
- Industrial Worker, e.g., a person working outside and potentially exposed to soil – All direct and indirect pathways

Figure 6.1-2 depicts the potential exposure pathways for each human receptor population and Table 6.1-2 lists the soil horizons (soil depth interval) for each exposure pathway evaluated.

6.1.2.3 Estimation of Exposure Point Concentrations

The chemical concentration to which an individual could be exposed is known as the exposure point concentration. To characterize potential chronic (long-term risk, i.e., 7 to 70 years) human health risks at RMA, both location-specific (i.e., 178 discrete sites on RMA) and sample-specific (boring-by-boring) risks were quantified. The complete data set used for the estimation of these exposure point concentrations was issued on computer diskettes and distributed with the IEA/RC report.

Human health risks were estimated for the location-specific analysis using representative contaminant concentrations calculated for each of the 178 sites evaluated in the HHRC. The concentration term used to estimate exposure was calculated by several different methods to give a range of potential risks. A mean exposure concentration term ($C_{rep,mean}$) was calculated as the simple arithmetic mean of the samples as representative of a potential average exposure for each of the 178 locations. (This method is no longer recommended by EPA.) The 95 percent upper confidence limit (95% UCL) on the site sample arithmetic mean ($C_{rep,upper}$) was calculated to establish the RME risks. The 95% UCL was calculated in accordance with EPA guidance (OSWER-EPA 1992) and this represents EPA's preferred method to calculate concentration terms.

For the location-specific analysis, concentrations based on **composited samples** (i.e., samples collected from borings from the 0-ft to 1 -ft interval mixed with samples from a deeper interval). These concentrations were estimated by doubling the concentration detected in the 0-ft to 1 -ft interval, using the conservative assumption of 50 percent dilution by clean soil collected from the deeper samples. Concentrations reported for samples that were not composited (i.e., samples collected from the 0-ft to 1 -ft interval and analyzed without the addition of deeper soil) were not doubled because these concentrations were not potentially diluted by deeper, clean soil.

For the boring-by-boring analysis, potential risks were evaluated using the maximum contaminant concentration (C_{max}) at a given boring for a specific depth interval or at a given surficial soil sample location. Surficial soil sample results were included in the boring-by-boring analysis to supplement results from the deeper sample intervals. The objective of the surficial soil sampling program was to identify any contamination that may have occurred as a result of windblown contamination from source areas using composited samples from randomly selected sample locations at the 0-inch to 2-inch depth interval. Because the samples were composited from within this one interval, the effects of dilution caused by mixing soil from deeper intervals was avoided. The inclusion of these results in the boring-by-boring analysis are intended to offer insight into the variability of contamination at RMA and facilitate the identification of contaminant hot spots. The use of

analytical results from composited samples may have reduced the overall conservatism of the boring-by-boring analysis, which assumes that cumulative chronic exposures would occur at any individual boring location and at the specific depths where the maximum concentration occurred. However, the surficial soil results do supplement the subsurface boring evaluation, and may be more relevant to the evaluation of direct contact exposure risks for some receptors (e.g., visitor populations) than corresponding results for deeper soil intervals.

6.1.2.4 Exposure Parameters

Exposure parameters are combined with chemical-specific exposure point concentrations and toxicity data to characterize each of the five potential routes of human exposure to COCs at RMA. Some exposure parameters, such as body weight and frequency of exposure, are applicable to all exposure pathways. Other parameters, however, such as soil ingestion rate and molecular diffusivity, are used only for specific exposure routes. The probabilistic analysis developed for the IEA/RC assumes chronic exposures (greater than 7 years). However, potential risks associated with shorter-term exposures (i.e., acute exposures occurring on a single day or subchronic exposures lasting more than 1 day but less than 7 years) were calculated during the HHEA using deterministic methods (i.e., using fixed exposure parameters).

The exposure parameters used in this evaluation are fixed or probabilistic (Tables 6.1-3 through 6.1-5). Probabilistic parameters are characterized by a distribution of values, while the fixed parameters are represented by a single value. Probability distributions and the fixed numerical estimates are defined based on an extensive literature search and data review. A detailed description of the individual exposure parameters and the development of their specific distributions is contained in Appendix B of the IEA/RC report. The deterministic exposure parameters used for the development of the acute and subchronic **preliminary pollutant limit values** (PPLVs) are presented in Tables 6.1-6 and 6.1-7, respectively. A detailed description of these parameters is provided in the HHEA Addendum report.

6.1.3 Toxicity Assessment

The objective of the toxicity assessment is to derive toxicological criteria that can be used in the calculation of potential risk from exposure to COCs in terms of carcinogenic and noncarcinogenic effects.

Carcinogenic effects result, or are suspected to result, in the development of different types of cancer. EPA assumes a nonthreshold mechanism for carcinogens; accordingly, any amount of exposure to a carcinogenic chemical is assumed to have a potential for producing a carcinogenic response in the exposed individual. EPA has a carcinogenic-classification system that uses weight of evidence to classify the likelihood that a chemical is a human carcinogen. The classifications are as follows:

A Human Carcinogen

B 1 Probable human carcinogen; limited human data are available

B2 Probably human carcinogen; sufficient evidence in animals and inadequate or no evidence in humans

C Possible human carcinogen

D Not classified as to human carcinogen

E Evidence of noncarcinogenicity for humans

Carcinogenic toxicity values used in the HHRC were developed by the EPA Cancer Assessment Group and obtained from EPA-derived sources that include the Integrated Risk Information System database and the Health Effects Summary Table. These values are based on cancer slope factors. Slope factors are chemical-specific, experimentally derived potency values that are used to calculate the risk of cancer resulting from exposure to carcinogenic chemicals. A higher value implies a more potent carcinogen. Slope factors and carcinogenic doses based on a 1×10^{-6} excess cancer risk for the COCs are summarized in Table 6.1-8 for both oral and inhalation routes.

Noncarcinogenic effects, or any health impact other than cancer, may result from short-term (i.e., acute and subchronic), or long-term (chronic) exposures. For most noncarcinogenic effects, protective mechanisms within an individual are assumed to exist that must be overcome before there is an adverse effect. The level above which effects may occur is called a threshold level. In developing dose-response values for noncarcinogenic effects, i.e., the reference dose (RfD), EPA's goal is to identify the highest no observed adverse effect level (NOAEL), the upper bound of the tolerance range (generally regarded as safe), or the lowest observed adverse effect level (LOAEL) from well-designed human or animal studies. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. To account for uncertainty associated with the toxicity studies, uncertainty factors (UFs) are incorporated to adjust this level. The RfDs for COCs at RMA are summarized in Table 6.1-9 for both the oral and inhalation exposure routes for chronic exposures. (Acute and subchronic exposures from RMA media were evaluated in the HHEA Addendum report.)

The chronic reference doses listed in Table 6.1-9 pertain to lifetime or other long-term exposures (i.e., 7 years to lifetime). However, for noncarcinogenic chemicals, chronic exposure is not a prerequisite for toxicity to be manifested; even a single exposure or shorter-duration exposure may be sufficient to produce adverse effects. More recently, EPA has begun developing acute and subchronic reference doses, which are useful for characterizing potential noncarcinogenic effects associated with shorter-term exposures (i.e., acute and subchronic). Acute and subchronic reference doses are used to evaluate the potential noncarcinogenic effects of exposure periods lasting 1 day or more than 1 day but less than 7 years.

Development of acute and subchronic reference doses parallels the development of chronic reference doses; the distinction is one of exposure duration. If acute or subchronic data are not available and a chronic RfD derived from chronic data exists, the chronic RfD is adopted as the acute or subchronic RfD. There is no application of an uncertainty factor to account for differences in exposure duration in this instance. The critical toxicity factors (D_T values) used for the acute and subchronic PPLVs are listed in Table 6.1-10.

Toxicity profiles for each of the COCs were published in the HHEA. Toxicity profiles for each RMA target contaminant were generated from current toxicological literature and include considerations of dose, routes of exposure, types of adverse effects manifested, transport, and fate and a quantitative evaluation of a D_T value. Each profile is composed of seven sections that address the following elements:

- Summary
- Chemical and physical properties
- Transport and fate
- Health effects
- Toxicity to wildlife and domestic animals
- Regulations and standards
- D_T value

The toxicity factors contained in the toxicity profiles were revised if current values contained in the Integrated Risk Information System or the Health Effects Summary Table differed from those contained in the HHEA toxicity profile. Tables 6.1-8 and 6.1-9 list the toxicity factors used in the IEA/RC.

6.1.4 Risk Characterization

PPLVs, which are risk-based concentrations of chemicals in soil that are considered protective of human health given a defined set of exposure and toxicity assumptions, were used to estimate risks to human health. For noncarcinogens, PPLVs are defined as soil concentrations unlikely to pose adverse health effects. For carcinogens, PPLVs are defined as soil concentrations protective of human health at a specified cancer risk level. PPLVs are a function of media intake rates, exposure frequencies and durations, partition coefficients, physiological parameters (e.g., breathing rates, body rates, skin surface areas), pharmacokinetic parameters (e.g., contaminant absorption fractions), and toxicity data.

6.1.4.1 Calculation of PPLVs

Probabilistic PPLVs were computed for each of the five potentially exposed populations via the direct and indirect exposure pathways. In addition, because exposure to contaminants may occur from a number of exposure routes, cumulative direct and indirect PPLVs were also calculated over all the single pathways. Acute/subchronic deterministic and chronic probabilistic approaches differ in their use of exposure assumptions. The exposure parameters used in the estimation of probabilistic PPLVs are characterized by a

distribution of values or ranges of exposures potentially occurring within the population. It is assumed that some individuals have a high level of exposure and others have a lower level. The exposure parameters used in the estimation of deterministic PPLVs (i.e., nonprobabilistic) are the fixed numerical estimates that correspond to a reasonable maximally exposed individual (RME). EPA defines the RME as the highest exposure that is reasonably expected to occur at a site and in practice is estimated by combining upper bound fixed values for some but not all exposure parameters.

During the HHRC, both 5th and 50th percentile cumulative direct PPLVs (Tables 6.1-11 and 6.1-12, respectively) were calculated for each of the five receptor populations. The 5th percentile defines the RME PPLV (i.e., there is 95 percent confidence that the PPLV will be protective at the specified risk level), and the 50th percentile represents the median PPLV estimate (i.e., there is 50 percent confidence that the PPLV will not exceed the specified risk level). The remediation decisions are based on the 5th percentile PPLV, which corresponds to a reasonable maximum exposure (and risk) evaluation. The lowest (more protective) cumulative direct PPLVs were generally derived for the biological worker. The only exceptions are related to the PPLVs calculated for certain volatile organic compounds (i.e., benzene, carbon tetrachloride, chloroacetic acid, chlorobenzene, and toluene); for these compounds, the lowest PPLVs were derived for the industrial worker.

The single-pathway PPLVs used to derive the cumulative PPLVs are summarized in Tables 6.1-13 through 6.1-17. As shown in these tables, the majority of the cumulative direct PPLVs were derived based on a carcinogenic endpoint. The dermal absorption pathway accounts for the majority of the cumulative risk for most of the organic COCs. The only exceptions are aldrin, dieldrin, DDE, endrin, isodrin, chlordane, DDT, and DCPD, for which soil ingestion is the driver exposure pathway, and DCPD and HCCPD, for which soil particulate inhalation is the driver exposure pathway for some populations/subpopulations.

For aldrin, soil ingestion is the driver exposure pathway for the biological worker, recreational visitor, regulated/casual visitor, and commercial worker subpopulations. For dieldrin, soil ingestion is the driver exposure pathway for the biological worker, regulated/casual visitor, and commercial worker subpopulations. For DDE, endrin, and isodrin, soil ingestion is the driver exposure pathway for the biological worker and commercial worker subpopulations. For chlordane, DDT, and DCPD, soil ingestion is the driver exposure pathway for the commercial worker subpopulation.

For DCPD, inhalation is the driver exposure pathway for all populations/subpopulations except the commercial worker, for which ingestion is the driver exposure pathway. For HCCPD, inhalation is the driver exposure pathway for all populations except the recreational visitor, for which dermal exposure is the driver exposure pathway.

Soil ingestion and particulate inhalation are the driver pathways for metals. (As explained in Section 6.1.2.2, dermal absorption was not quantified for metals.) Soil ingestion represents the driver pathway for arsenic, lead, and mercury, and particulate inhalation represents the driver pathway for cadmium and chromium.

6.1.4.2 Determination of Carcinogenic and Noncarcinogenic Risks

Once PPLVs were calculated, they were combined with exposure point concentrations to calculate excess lifetime carcinogenic risks and noncarcinogenic HIs. As noted in Section 6.1, these excess lifetime cancer risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a 1 in 1 million chance of developing cancer as a result of site-related exposure to a carcinogen over 30 years of exposure over a 70-year life span under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the HQ (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's RfD). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the HI can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

For carcinogens, cumulative risks (representing all exposure pathways and COCs) were compared to an acceptable risk range that is no greater than 1×10^{-6} to 1×10^{-4}. For carcinogens causing health effects in addition to cancer and for noncarcinogens, potential adverse health effects were identified where HI values exceeded 1.0, below which is considered the safe, or benchmark, level. As stated by EPA (OSWER-EPA 1991 b), where the cumulative site risk to an individual based on the RME for both current and future land-use scenarios is less than 1×10^{-4}, and the HQ is less than 1.0, action generally is not warranted; however, when risk reduction is warranted, the remediation goals should be towards 1×10^{-6} risk-based concentrations.

Location-Specific Risks and HIs

RME risks were calculated for each of the 178 sites using $C_{rep,upper}$ concentrations and PPLVs. During the HHRC, site risks were calculated for Horizon 0 (0-ft to 1-ft depth interval), Horizon 1 (0-ft to 10-ft depth interval), and Horizon 2 (> 10 ft to groundwater). Because Horizon 0 results were not graphically displayed in the IEA/RC report, this section mainly focuses on the results for that horizon. More information on site risks for Horizons 1 and 2, as well as results for surficial soil (0 inches to 2 inches), can be found in the IEA/RC report.

PPLVs were derived for each of the five potentially exposed populations/subpopulations evaluated in the risk characterization. Table 6.1-18 lists the number of site $C_{rep,upper}$ values exceeding the corresponding PPLV for

Horizon 0. As shown in this table, only five carcinogenic contaminants have $C_{rep,upper}$ estimates exceeding a 1 x 10^{-4} cancer risk PPLV: aldrin, chlordane, dieldrin, arsenic, and DBCP. For noncarcinogens, only chloroacetic acid, endrin, isodrin, and chromium have $C_{rep,upper}$ values exceeding the corresponding PPLV (assuming an HI of 1.0 as the target criterion).

The results of the HHRC indicate that site-specific cancer risks and HIs were highest in Horizons 0 and 1 for the biological worker (open space option) and industrial worker (economic development land-use option). Given these findings, and the fact that the biological worker exposure setting is most reflective of anticipated future land uses at RMA, the following summary is based on results obtained for the biological worker. These results indicate that potential cancer risks are highest in the following areas, which are generally located in the central portions of RMA:

- Chemical Sewers (site SP10)
- Lime Basins, including sites SP1E (Buried M-1 Pits) and NC1B (Section 36 Lime Basins)
- South Plants, with sites SP3A (ditch), SP1A (Central Processing Area), and SP3B (concrete salt storage pad) exhibiting the highest risks
- Former Basin F (site NC3)
- Sanitary/Process Water Sewers (site NC8A)
- Basin A (site NC1A)
- Shell Trenches (site C1A)

The generalized locations of these sites are depicted on Figure 6.1-3. Exceedances of 1 x 10^{-4} cancer risk levels are limited to the sites listed above (the Basin F Wastepile was not evaluated separately, but would fall into this category) (Figure 6.1-4). The results for noncarcinogenic endpoints (HIs) exhibit similar trends; however, more sites exceed an HI of 1.0 than those identified above (e.g., one sanitary landfill and additional sites in South Plants [Figure 6.1-5]).

Summary of Principal Chemical Risk Drivers

Figures 6.1-6 and 6.1-7 summarize cancer risks and HIs associated with the $C_{rep,\ upper}$ concentrations for Horizon 0. As shown in these figures, the number of exceedances shown for the biological worker at Horizon 0 is larger than for any of the other populations; however, the cumulative direct PPLVs (summarized in Table 6.1-11) are generally lower (and are thus drivers) for the biological worker. As indicated in Section 3 of the IEA/RC report, Horizon 1 C_{rep} concentrations show slightly higher cancer risks and HIs than for Horizon 0, probably because the indirect soil vapor inhalation pathways were not evaluated for shallow depth intervals. As is also indicated in the IEA/RC report, Horizon 2 C_{rep} concentrations revealed far lower cancer risks and HIs (relative to results for Horizons 0 and 1). No site exceedances of a 10^{-4} cancer risk level were identified for either the biological or

industrial workers. Only 2.2 percent (four sites) of Horizon 2 site cancer risks calculated for the industrial worker exceed 10^{-6}; similar trends are exhibited for HI endpoints.

For cancer risk endpoints, DBCP, aldrin, arsenic, and dieldrin are the primary contributors to the total estimated risks for the biological worker at Horizon 1. It should be noted, however, that the apparent major contribution of DBCP stems in large part from the elevated observation at the Chemical Sewers (site SP1 0), where the DBCP cancer risk was 7.6×10^{-3} and the HI was 0.016. The influence of arsenic on total cancer risks for Buried M-1 Pits (site SP1E) and some North Plants agent storage sites (sites NP5 and NP6) is expected as arsenic is a component of the agent compounds that were stored or disposed in these areas. For noncarcinogenic risk endpoints, DBCP, aldrin, and arsenic account for the majority of the total estimated HIs.

No cancer risk estimates exceed 10^{-4} at Horizon 2. However, for those sites with Horizon 2 cancer risks exceeding 10^{-6}, chloroform and benzene are the major contributors to the total estimated risks. For those sites with HIs exceeding 1.0, DBCP, DCPD and HCCPD account for the majority of the total estimated HIs.

Detailed data regarding the contribution of individual chemicals to total site risks and HIs are provided in the additivity reports, which can be accessed using the HHRC software provided in Appendix D of the IEA/RC report.

Summary of Pathway Risk Drivers

Carcinogenic and noncarcinogenic risks estimated for the biological worker and other open space land-use option receptors were attributed primarily to the direct soil exposure pathways (soil ingestion and dermal absorption; see Tables 6.1-13 through 6.1-17). In contrast to trends identified for the biological worker, the soil vapor inhalation pathway was the dominant exposure pathway for the driver COCs identified for industrial (and commercial) workers.

A sensitivity analysis was conducted for the HHRC to rank the influence of several distributed input parameters on the variability of the cumulative direct PPLVs for aldrin, dieldrin, DBCP, arsenic, and chlordane. These chemicals were chosen because of their strong contributions to overall risk at RMA. The sensitivity analysis considered both biological and industrial worker receptors (representing open space and economic development land-use options, respectively) for both cancer risk and HI endpoints. Standardized regression coefficients and full-model partial correlation coefficients were computed for each input parameter to provide two separate measures of a parameter's influence on the variability of the direct exposure pathway PPLVs.

The eight distributed input parameters used for the direct PPLV calculations included the following:

TE	Exposure duration (years) (for carcinogens only)
DW	Annual frequency of exposure (days/year)

TM	Daily exposure rate (hours/day)
RAF_{dermal}	Relative absorption factor for dermal absorption (unitless)
$RAF_{ingestion}$	Relative absorption factor for ingestion (unitless)
CSS	Dust loading factor ($\mu g/m^3$)
SC	Skin soil covering (mg/cm^3)
SI	Soil ingestion (mg/day)

The results of this analysis indicate that variability in exposure duration is consistently the dominant contributor to variability in the direct carcinogenic PPLV, followed by soil ingestion. Soil ingestion is also a dominant contributor to variability in the direct noncarcinogenic PPLV. Other influential parameters include RAF_{dermal}, $RAF_{ingestion}$, and soil covering.

Risks for the boring-by-boring analysis were characterized using the following sampling data:

- Surficial soil results (samples collected from a 0- to 2-inch soil-depth interval in areas outside of designated sites)
- Boring-by-boring results (maximum contaminant concentrations detected in each soil-depth interval for individual borings located within designated sites)

Surficial Soil Results

Figure 6.1-8 shows the incremental cancer risks estimated for the biological worker using surficial soil (0-inch to 2-inch depth interval) results. This map indicates only three surficial soil locations with incremental cancer risks exceeding 10^{-4}: one occurs east of Basin C, one occurs in Basin A, and one occurs in the southern area of Section 36. Similar trends are apparent for HIs; of the 493 non-zero observations, only three surficial soil locations have incremental HIs exceeding 1.0. The surficial soil results supplement the subsurface boring evaluation discussed below, and may be more relevant to the evaluation of direct contact exposure risks for open space land-use option receptors than corresponding results for deeper soil intervals (in particular, the recreational and regulated/casual visitor subpopulations).

Boring-Specific Risks and HIs

The findings of the boring-specific evaluation for Horizons 0 and 1 basically parallel those described for the site analysis summarized above in that exceedances of a 1×10^{-4} cancer risk level (Figures 6.1-9 and 6.1-10) or an HI of 1.0 (Figures 6.1-11 and 6.1-12) at individual borings are generally limited to the following areas located in the central portions of RMA: South Plants, Sewer Systems, Lime Basins, Former Basin F, Basin A, and the Complex Trenches located in Section 36. Isolated exceedances of a 1×10^{-4} cancer risk were also identified at borings located in Basin C, Sand Creek Lateral, the North Plants Agent Storage Areas, and the sanitary landfill near the Rail Yard (located in the western portion of RMA). The boring-specific HI results exhibit similar trends.

Figures 6.1-13 and 6.1-14 show the composite of carcinogenic and noncarcinogenic chronic risk exceedances, as well as acute risk exceedances.

For all receptors evaluated in the HHRC, the major contaminants contributing to potential cancer risks were aldrin, DBCP, arsenic, and dieldrin. For noncancer risk endpoints, DBCP, aldrin, and arsenic account for the majority of the total estimated HIs.

Acute and Subchronic Risk Evaluation

In the probabilistic evaluation, PPLVs were calculated to be protective of chronic (long-term) exposures. However, it is possible that exposures to COCs at RMA could be short term, such as exposures occurring only on a single day (acute), or exposures lasting more than 1 day but less than 7 years (subchronic). These PPLVs, originally calculated for the HHEA Addendum, are summarized in Tables 6.1-19 and 6.1-20. The cumulative direct acute and subchronic PPLVs are protective of exposure via three pathways, soil ingestion, particulate inhalation, and dermal contact with soil. The PPLVs presented in these tables are the same as those originally calculated, with two exceptions: PPLVs for aldrin and dieldrin were recalculated during the HHRC to reflect updated toxicity criteria and the dermal relative absorption factor (all receptor scenarios) and soil covering factor (visitor populations only) were revised.

In general, and particularly for the biological and industrial worker populations, the acute and subchronic PPLVs shown in Tables 6.1-19 and 6.1-20 are higher than the corresponding chronic noncarcinogenic 5th percentile PPLVs (Tables 6.1-13 through 6.1-17). This finding is expected because the body can generally tolerate a higher contaminant dose over a short (e.g., acute) duration than over a long (chronic) duration for a given dose rate. However, for the recreational and regulated/casual visitor exposure settings, acute/subchronic PPLVs for some chemicals are lower than corresponding chronic noncarcinogenic 5th percentile PPLVs. Figure 6.1-15 shows sample locations exceeding an HI of 1.0 for all COCs having acute PPLV values.

6.2 Ecological Risk Characterization

Ecological risk characterization focuses on chemicals that, because of their toxicity, may adversely affect biota populations, individuals of threatened or endangered species, or the species diversity in a community. For these effects to occur, toxic chemicals must be present in the environment, potential biota receptors must be present and they must be engaged in activities that would expose them to chemicals that are not only present, but bioavailable (Figure 6.2-1). The sections below summarize the steps of the ERC at RMA, which are similar to the HHRC steps.

6.2.1 Identification of Contaminants of Concern

Fourteen chemicals detected on RMA were selected as of concern to biota: aldrin, dieldrin, chlordane, endrin, DDT, dichlorodiphenyldichloroethene (DDE), mercury, arsenic, cadmium, chlorophenylmethylsulfide (CPMS), chlorophenylmethylsulfone ($CPMSO_2$), copper, DBCP, and DCPD. The biota COCs were selected on the basis of criteria (toxicity, persistence, amount used or produced at RMA, and areal extent of contamination) developed collectively by the Army, EPA, USFWS, and Shell to focus on the potential main risk drivers.

Of the 14 biota COCs considered in the ERC, six (aldrin, dieldrin, endrin, DDT, DDE, and mercury) are known to biomagnify substantially, and seven do not biomagnify substantially or at all (arsenic, cadmium, CPMS, $CPMSO_2$, copper, DBCP, and DCPD). Chlordane can biomagnify (usually in the form of its metabolites), but was not treated quantitatively as such because no tissue sample data were available for this chemical. Biomagnification means that each successive organism in the food chain (e.g., from plant to insect, mouse, and hawk) will have a higher concentration of the chemical in its body tissue.

6.2.2 Exposure Assessment

Numerous ecological studies have been performed at RMA, particularly by USFWS in the 1960s, the Army in the 1970s to mid- 1980s, and by Shell, USFWS, and the Army in the late 1980s and 1990s to identify the ecological receptors that may be exposed to the biota COCs and to determine the effects of this exposure. Using the data from these studies, several food webs were constructed to represent the biota food chains present at RMA. For the purposes of the IEA/RC, a food web is a collection of food chains that all culminate in a single top predator. Five such food webs were evaluated for RMA, each headed by different predators:

- Bald eagle
- American kestrel
- Great horned owl
- Great blue heron
- Shorebird

The following types of biota were selected to represent the various feeding levels (trophic boxes) in these RMA food webs and were evaluated from past varied studies where tissues were collected for analysis of COC concentrations:

- Earthworms
- Insects (represented by grasshoppers and ground beetles)
- Small birds (represented by vesper sparrows, western meadowlarks, and mourning doves)
- Small mammals (represented by deer mice and 13-lined ground squirrels)
- Medium mammals (represented by desert cottontails and black-tailed prairie dogs)
- Water birds (represented by mallards, blue-winged teal, and American coots)

- Shorebirds (represented by killdeer)
- Large fish (represented by northern pike and largemouth bass)
- Small fish (represented by channel catfish, black/brown bullheads, and bluegills)
- Aquatic invertebrates
- Plankton
- Terrestrial and aquatic plants

The data on tissue concentrations of contaminants were used to both document the nature and extent of contamination in biota and to provide tissue data that could be used in the ERC process described in Section 6.2.4. The exposure assessment included the estimation of exposure area soil concentrations; the estimation of species- and chemical-specific biomagnification factors (BMFs) based on bioaccumulation factors (BAFs) that describe the amount of COC transfer from food to consumers; and the identification of dietary items, fraction of items consumed, and feed rates. Exposure area soil concentrations were calculated based on an area-wide average (i.e., an arithmetic mean) concentration, an "area" being defined as an organism's estimated foraging or exposure area. The area-averaged concentration was computed from spatially interpolated soil concentrations in the 0-ft to 1-ft depth interval (except for the prairie dog's exposure area, which incorporated a vertical average for the 0-ft to 20-ft depth interval). The interpolated soil concentrations were calculated on a square grid with 100-ft spacing using surrounding actual soil sample concentration data and the inverse distance-squared algorithm. Before the soil data were interpolated, values that were below certified reporting limits (BCRL) were replaced with estimated values based on nearby detections when the surrounding data were sufficient using the inverse distance-squared algorithm. Because the spatial interpolation of BCRL data proceeded iteratively, a previously estimated BCRL value may have been included with nearby detections to estimate a replacement value for a BCRL at a different location (see Appendix C of the IEA/RC report for a detailed description of the spatial interpolation of BCRL data). Specifically, exposure area soil concentrations were estimated in three steps: spatial interpolation of BCRL data, interpolation of soil concentrations onto an RMA-wide grid, and averaging of interpolated data within an exposure area to compute exposure area soil concentrations. A best estimate of the exposure range of each receptor was obtained from the literature and represented by a circle (to facilitate the modeling of average risk) within which an individual receptor was assumed to be exposed. By centering the exposure range circle for a given receptor on a grid block and averaging the soil values within grid blocks that fell half or more within the circle, an average exposure concentration was estimated. This process was repeated for each grid block over the entire RMA area.

The BMF used at RMA represents a ratio between the concentration of a chemical in biota tissue (generally represented as the "whole-body concentration," which includes the whole animal for small mammals, such as deer mice, and the skinned/eviscerated carcass for medium mammals, such as prairie dogs) and that in soil. Three different methods of calculating the BMF were used in evaluating potential risk at RMA, which yielded

differing BMF values for four COC categories (Table 6.2-1). The differences reflect the uncertainties associated with the data as well as the alternate methods used to derive the BMFs. Because the BMFs resulted in varying risk estimations, the SFS (see Section 6.2.4.3) will attempt to resolve uncertainties about the spatial extent of potential excess exposure and resulting subpopulation risk to biota compared to the three ranges of risk derived from the three BMFs.

Once a BMF was developed for a particular chemical/receptor combination, it was multiplied by the estimated exposure soil concentration in each block to obtain an estimated tissue concentration for the ecological receptor centered on that grid block. Data on dietary fractions and feed rates were obtained from the literature and from studies conducted at RMA. Where appropriate, the RMA-specific dietary data were used instead of literature values; however, if RMA data were not available, preference was given to literature dietary information from geographic and habitat types most similar to those at RMA. The exposure assessment parameters (Table 6.2-2) were based on best estimates of averages and were used to calculate potential tissue concentrations and dosages based on ingestion of contaminated soil and prey.

6.2.3 Toxicity Assessment

Literature data on chemical toxicity that include biota COC concentrations associated with some type of adverse health effect were used as numerical thresholds against which risk was evaluated. Reported effects on reproduction were preferred because these have the most obvious connection with detrimental population impacts; however, nonreproductive effects, such as behavioral toxicity, may also be important, but these effects are more difficult to evaluate and quantify. Other such toxicological endpoints were considered from a qualitative perspective. For all of the receptors evaluated, both tissue-based (i.e., maximum allowable tissue concentrations, or MATCs) and dose-based (i.e., toxicity-reference values, or TRVs) threshold values were sought in the literature. Each of the values found in the literature was evaluated as to its appropriateness for use as a threshold value (NOAELs and no observed effects levels, or NOELs, were the preferred endpoints). UFs were applied to the final literature-based pre-UF MATCs and pre-UF TRVs to help ensure adequate protection of biota populations. UFs were developed for the MATC and the TRV (Table 6.2-3) approaches in parallel (i.e., it was decided to apply the same rationale and values for each derivation process).

UFs were developed for four categories as follows:

- Intertaxon variability in toxicological responses to contaminants when extrapolating from the species used in an experimental study to a target species at RMA
- Extrapolation from the duration of an experimental study to the chronic exposure being assessed at RMA

- Extrapolation from a toxicity endpoint in an experimental study to the desired no adverse effects endpoint for the ecological risk assessment at RMA
- Modifying factors to account for additional sources of uncertainty

The final UF, the product of the results of these four categories, is divided into the pre-UF MATC or pre-UF TRV critical value to determine a final MATC or TRV (Table 6.2-4). The total uncertainty (final UF) applied for the derivation of TRVs ranged from 4 to 7,500 and the total uncertainty for MATCs ranged from 1.5 to 375. However, if the final UF exceeded 400, a final UF of 400 was used. The total uncertainty ranges for the main risk driver, aldrin/dieldrin, was much tighter: 4 to 30 for the aldrin/dieldrin TRVs (Table 6.2-5) and 1.5 to 30 for the aldrin/dieldrin MATCs (Table 6.2-6).

The MATCs represent maximum whole-body concentrations of bioaccumulative chemicals that are unlikely to cause harmful effects to specific receptors. The MATCs, expressed as the weight of contaminant per unit of body weight (mg/kg-bw), were derived from literature data on tissue concentrations associated with the presence or absence of observed toxicological effects in biological test species (to produce pre-UF MATCs), and then adjusted with the COC/receptor-specific UF to produce final MATCs.

The final TRVs represent estimates of a daily dose (mg/kg-bw-day) that are likely to be without an appreciable risk of harmful effects to target receptors. The TRVs computed for the IEA/RC follow an approach that is different from that described in the Off-Post Operable Unit Endangerment Assessment/FS for RMA (Harding Lawson Associates 1992); however, both RMA approaches are similar to the methodology used by EPA to compute RfDs for assessing risks to human health.

The final toxicological threshold values, MATCs and TRVs, are compared to the site-specific exposure measurements (i.e., population mean contaminant tissue concentrations and doses) to estimate potential risk to biota populations (Section 6.2.4.1). The toxicological threshold values are intended to be protective of biota populations and individual bald eagles at RMA.

The final tissue- and dose-based threshold values selected for the characterization of risk are shown in Table 6.2-4. When both tissue-based and dose-based threshold values were available, the value with the lower UF was selected. When the uncertainty was equal, the TRV was selected because it avoided the use of a BMF, which introduced uncertainty of its own. Where two values were calculated, the value that is shown in bold face was used to estimate risk.

6.2.4 Risk Characterization

6.2.4.1 Methods

The characterization of potential risk from the biota COCs to terrestrial receptors was performed by integrating the exposure assessment and the toxicity assessment with a Geographic Information System (GIS) to produce a series of maps that display areas of potential risk (i.e., HQs or HIs greater than 1.0).

For the tissue-based approach, estimated tissue concentrations were compared directly with a tissue-based toxicity threshold value to calculate an HQ, which represented an estimate of potential risk in a grid block for the chemical/receptor combination being investigated. This approach is represented by the following equation:

$$HQ = \frac{\text{Tissue Concentration}}{MATC}$$

Alternatively, if the dose-based approach was used, the dose to the receptor being investigated was estimated and compared to a dose-based toxicity threshold value to calculate an HQ. The dose-based approach is represented by the following equation:

$$HQ = \frac{\text{Dose}}{TRV}$$

The HQ equations presented above are a generalized representation of those actually used in the ERC. Appendix C of the IEA/RC report contains a detailed description of the equations used. The risk characterization processes were repeated for all grid blocks and for all chemical/receptor combinations for which biomagnification factors were calculated. There were variations from these approaches for chemicals having no tissue data, for predators that were not sampled for nonbioaccumulative COCs, and for aquatic food chains. These variations are also described in Appendix C of the IEA/RC report.

An HQ greater than 1.0 indicated a potential risk from a particular chemical. The sum of all HQs for a single receptor resulted in an HI, which indicates the potential risk from all biota COCs to that receptor. HQs and HIs were mapped using GIS to show the geographic extent of areas having potential risk (Figures 6.2-2 through 6.2-5).

The degree to which the results of the risk characterization were consistent with the ecological measurement endpoints on observable field effects identified within the ecological database available for RMA was also evaluated. Ecological measurement endpoints were selected at the community, population, and individual levels of ecosystem organization. The community-level measurement endpoints considered were species richness and trophic diversity; these provide information on the assessment endpoint of biological structural

diversity of the RMA and regional ecosystem. Population-level measurement endpoints were relative abundance, reproductive success, and morbidity; these provide information on the assessment endpoint of population robustness. Selected biomarkers (i.e., acetylcholinesterase inhibition and eggshell thinning) were examined at the individual level, but evaluated as measurement endpoints for extrapolation to population effects. Endpoints at the individual level are appropriate for evaluating adverse effects on individuals of threatened or endangered species (e.g., bald eagle), which by definition have populations reduced to the level where individuals are important.

6.2.4.2 Results

Quantitative results were calculated for all five of the predators (bald eagle, American kestrel, great horned owl, great blue heron, and shorebird) heading the food webs developed for RMA and for four of the trophic boxes in their food webs (small bird, small mammal, medium mammal, and water bird). Other trophic boxes, including all strictly aquatic organisms in the RMA lakes, were not evaluated quantitatively because toxicity threshold values for these biota COCs/trophic box combinations were not available in the literature. The results of the terrestrial risk characterization are presented primarily in maps, which best show the spatial variability of the estimated potential risk. Figures 6.2-2 and 6.2-3, which illustrate the number of receptors having potential risk, are based on the Shell BMF because Shell BMF results were intermediate between the Army and EPA BMF results. Many other such maps are available in the IEA/RC report (Section 4 and Appendix C.3). In viewing these maps, it should be remembered that a small hot spot (identified by only a few borings) or a large relatively clean area can affect the soil concentrations interpolated for several surrounding grid blocks. These grid blocks in turn can affect the estimated exposure soil concentrations for many grid blocks, particularly for receptors with large exposure ranges such as raptors. Such species are likely to have sizable areas of potential risk because very high contaminant concentrations in hot spots around the manufacturing plants and basins were averaged over large exposure ranges. If the high contaminant concentrations in just these hot spots were reduced, then the areal extent of potential risk, as well as the magnitude of HQs and HI s, would be reduced. Conversely, if large relatively clean areas are included in the estimation of exposure soil concentrations, the effect could be a dilution of concentration attributed to hot spots.

Potential risk varied depending on the BMF used, the chemical or chemical group being considered, and receptor (trophic box) being evaluated. Differences in risk among receptors for a given chemical were partly due to differences in the toxicity threshold values, and especially due to differences in the exposure range size. Figure 6.2-2 shows the number of representative trophic boxes that have HIs greater than 1.0 in various parts of RMA. This figure shows that the areas of potential risk to the greatest number of species tend to be smaller and located toward the center of RMA, even though the specific receptors subject to potential risk in one area may be different from those subject to potential risk elsewhere. Terrestrial areas where all trophic boxes are expected to be at potential risk (based on cumulative risk from all of the COCs combined) are most of the

central sections of RMA, including South Plants; Basins A, B, C, D, and F; and the northernmost upland areas adjacent to the South Lakes area. Pesticides (especially aldrin/dieldrin) are the primary biota COCs contributing to biota risk at RMA, as shown in Figure 6.2-3. This figure shows the number of trophic boxes having an HI greater than 1.0 for aldrin/dieldrin, DDT/DDE, and endrin based on soil exposure and the Shell BMF approach. Metals are also significant contributors to biota risk.

The degree to which potential risk predicted by the EPA, Shell, and Army BMFs differed for a single COC/receptor combination based on the TRV (dose-based) approach is shown for aldrin/dieldrin in Figure 6.2-4 for the great horned owl and in Figure 6.2-5 for the small mammal. The effect of the small mammal's much smaller exposure range can be seen by comparing Figure 6.2-4 with Figure 6.2-5. Receptors with larger exposure ranges generally show greater areas of potential risk, and receptors with smaller exposure areas tend to show smaller areas of potential risk that more directly reflect specific areas of higher soil contamination. The areas depicted in the maps do not necessarily denote the extent of magnitude or severity of potential risks to biota, nor do they depict the ecological relevance of the potential risks to local populations. The ecological relevance of the potential risks will be addressed as part of remedial design and incorporate the ongoing USFWS biomonitoring program, as well as the SFS and other evaluations being performed by the BAS (see Section 6.2.4.3). EPA defines ecological relevance generally in terms of "population sustainability and community integrity" for both current and future exposure and risk.

The potential risk to predators at the top of food webs having aquatic food chains is shown in Table 6.2-7. These risks are tabulated because a single risk value was calculated for all the lakes combined. In combining measured tissue concentrations from the various lakes, feeding was assumed to be proportional to the size of the lake. Table 6.2-7 shows that potential risk from aquatic food chains is greatest to the great blue heron.

The results of the quantitative ERC were also compared with the results of evaluating potential ecological effects such as impacts on reproduction, species abundance, and species diversity. No strong trends in any of these data indicated populational effects. However, because sampling was concentrated in contamination areas, average tissue concentrations exceeded the MATC (which represents the tissue-based toxicity threshold value) for dieldrin, mercury (for this COC, the **detection limit** also exceeded the MATC), and DDE. Likely adverse effects of RMA contamination have been observed in individual animals collected at RMA, but these effects were not apparent in the available data collected for wildlife populations as a whole at RMA. The available data were obtained from studies that had varying purposes and degrees of ability to discern contaminant effects on local populations. It should be noted that the state and EPA disagreed with the ability to draw conclusions on wildlife populations or on the effects of RMA contaminants to individual animals from the available data. In accordance with the Conceptual Remedy, all Parties, through their representatives on the BAS, will continue

to evaluate the SFS and USFWS biomonitoring studies and provide information to risk managers on the status and health of biota at RMA in terms of the need to refine design boundaries to include additional locations where biota risks were deemed to be excessive. This process will continue during the remedial design after the ROD is signed (see Section 6.2.4.3).

The potential risk from all COCs combined covered most of RMA for at least one species. However, a number of considerations should be taken into account when evaluating this risk. For example, the risk from mercury is overestimated for RMA because all mercury was assumed to be in its most toxic and bioavailable form, methyl mercury, although this is not the most prevalent form at RMA. Conversely, because chlordane was not quantitatively modeled as a bioaccumulative COC, its risks to biota may be underestimated. For terrestrial and aquatic receptors, there are uncertainties inherent in the toxicity threshold values used and in the estimated tissue concentrations that were compared to these threshold values. The uncertainties in threshold values are mostly reflected in the magnitude of UFs used to derive each TRV or MATC. For terrestrial receptors, uncertainties in estimated tissue concentrations result primarily from uncertainties in the estimates of the exposure soil concentration and the BMF.

The available ecological data used to evaluate ecological effects were also subject to uncertainty resulting from the short-term nature of many of the studies, lack of sufficient precision of the results, and study designs that were not always oriented toward correlating ecological parameters with contaminant concentrations. As noted previously, not all the Parties agreed with the appropriateness of the ecological data used in this comparison.

6.2.4.3 Continuing Biological Studies

Generally, the results of the ERC showed that the areas of highest potential risk are located in the central portions of RMA and are associated with major chemical manufacturing processes or a disposal area that contains the greatest concentration of contaminants. Although the Army, Shell, and EPA approaches all agree regarding excessive risk (i.e., HQ or HI greater than 1.0) to wildlife in the central areas of RMA, they differ in their estimates of areas and magnitudes of potential ecological risk in other parts of RMA. The major variation is due to the use of different BMFs (as calculated by the Army, EPA, and Shell) to estimate exposure. Because of the scientific differences of opinion concerning the best approach to determine field BMFs at RMA, the SFS was established. Phase I of the SFS is designed to determine whether unacceptable levels of exposure (i.e., risk) exist within the Area of Dispute (Figure 6.2-6). The Area of Dispute is defined as the difference in the areas of potential aldrin/dieldrin risk (HQ greater than 1.0, based on MATC) to small mammals based on the Army and EPA approaches and was delineated for the primary purpose of sample collection in Phase I of the SFS. It may or may not reflect the area of uncertainty in terms of excessive risk to biota, although this is also coincidentally the ROD Area of Contamination (AOC) boundary. If Phase I of the SFS indicates that unacceptable risks to biota are likely,

the SFS may proceed with Phase II under RMA Council direction to collect additional tissue and soil data to estimate field BMFs for selected species.

The goal of biota remediation is to achieve appropriate remediation such that it is protective of biota health (i.e., sustainability of local subpopulations and individuals of threatened or endangered species). HIs were used in the IEA/RC to provide a semiquantitative characterization of predicted risks to biota at RMA. In general, HIs less than 1.0 denote the absence of excessive risk to biota populations. HIs greater than 1.0 may indicate potential adverse risks to biota populations; the greater the HI, the greater the potential risk.

To demonstrate spatial representation of biota risk, a series of additional risk maps (pre- and post-remediation) are presented for the American kestrel and great horned owl using the Army and EPA BMF approaches (Figures 6.2-7 through 6.2-14). These residual risk maps show locations and relative magnitudes of estimated biota risks due to exposure to the bioaccumulative COCs (excluding mercury) following proposed remediation. Residual risk areas will be evaluated by the BAS as potential locations for additional ecotoxicological studies.

Mean HIs for the American kestrel and great horned owl were estimated within the pre-remediation areas identified as having an HI greater than 1.0 using the Army and EPA BMF approaches based on a semiquantitative analysis of the pre- and post-remediation risk maps (Figure 6.2-7 through 6.2-14). Several general conclusions about the pre- and post-remediation risks to biota and associated uncertainty can be made from this semiquantitative analysis as follows:

- EPA mean HI estimates were an average of about 3 times higher than the Army mean HI estimates based on differences in the BMFs (ranging from about 2 to 4 times higher; American kestrel had the highest difference).
- Pre-remediation mean HIs ranged from about 2 to 120 using Army BMFs and about 7 to 270 using EPA BMFs (bald eagle was the highest in both cases).
- Post-remediation mean HIs ranged from 1 to 7 using Army BMFs and about 4 to 16 using EPA BMFs (bald eagle was the highest in both cases). The residual risk maps show that in general residual risks remain adjacent to the ROD's biota remediation areas (shown as the shaded areas in Figure 6.2-6) and that the highest ranges of residual risk are located adjacent to the southwest section of the green-shaded areas.
- In general, both the Army and EPA methods show at least a 10-fold reduction in risk for all species of concern following remediation of the shaded areas shown in Figure 6.2-6.

While the SFS is being conducted, certain areas of more highly contaminated surficial soil, which represent the areas in which all three BMF approaches yielded HQs greater than 1.0 (using the MATC approach) for aldrin/dieldrin for small mammals, as well as some additional areas north of Former Basin F and areas identified by USFWS as priority areas (i.e., known areas of high contamination and posing a threat to wildlife based on field observations), have been identified as candidates for initial focused remediation and are identified as the green-

shaded areas in Figure 6.2-6. The process outlined in the Conceptual Remedy and summarized below permits the further investigation of other identified areas of potential residual risk outside the green-shaded areas in order to more accurately characterizactual biota risk and impacts and to refine design boundaries if warranted. This process includes the following:

- The BAS of technical experts (e.g., ecotoxicologists, biologists, range/reclamation specialists) from the Parties will focus on the planning and conduct of both the USFWS biomonitoring programs and the SFS/risk assessment process. The BAS will provide interpretation of results and recommendations to the Parties' decision makers.
- The ongoing USFWS biomonitoring programs and the SFS/risk assessment process will be used to refine design boundaries for surficial soil and aquatic contamination to be remediated.
  - Phase I and the potential Phase II of the SFS will be used to refine the general areas of surficial soil contamination concern. The field BMFs from Phase II will be used to quantify ecological risks in the Area of Dispute, identify risk-based soil concentrations considered safe for biota, and thus refine the area of excess risks (Figure 6.2-6).
  - Pursuant to the FFA process, USFWS will conduct detailed site-specific exposure studies of contaminant effects and exposure (tissue levels and Army-provided abiotic sampling) on sentinel or indicator species of biota (including the six key species identified in the IEA/RC report as appropriate). These studies will address both the aquatic resources and at least the surficial soil in and around the Area of Dispute. These site-specific studies will be used in refining contamination impact areas in need of further remediation.
  - Results from both the SFS/risk assessment process and the site-specific studies will be considered in risk-management decisions, which may further refine the areas of surficial soil and aquatic contamination to be remediated. (In the event of a conflict between management of RMA as a wildlife refuge and performance of remedial response actions, the Rocky Mountain Arsenal National Wildlife Refuge Act indicates that response actions will take priority.)
- The BAS will serve as a technical resource to the Parties' decision makers by using technical expertise in analyzing, and potentially collecting, data sufficient to support design refinement for surficial soil areas and aquatic resources that will break unacceptable exposure pathways in consideration of minimizing habitat disturbance. Further, it will assess through monitoring the efficacy of remedies in breaking unacceptable pathways to biota. If any additional sites are identified, the remedy will be implemented as follows:
  - It will be staged to allow habitat recovery.
  - It will be performed first on locations selected through a balance of factors such as:
    - The Parties agree an area has a negative impact on or excessive risk to fish or wildlife.
    - The effort will not be negated by recontamination from other remediation activities.
    - The existing fish and wildlife resource value.
  - It will include revegetation of a type specified by USFWS; if the initial revegetation is not successful, the appropriate adjustments will be made and revegetation again implemented.
  - It will provide that the locations and timing of remediation are to be determined with consideration of and in coordination with USFWS refuge management plans and activities.

6.3 Uncertainty Analysis

Several sources of uncertainty must be considered in the evaluation of the HHRC and ERC results. Model parameter distributions were developed based on empirical data, and in instances where empirical data were

lacking, best professional judgment was incorporated. In addition, when uncertainty in the empirical data for a given parameter warranted conservative assumptions, these assumptions were incorporated into the exposure and risk estimations.

6.3.1 Human Health Risk Characterization

6.3.1.1 Chemical Database

Contributing to the chemical database uncertainty are the different analytical techniques used by the RI Phase I and Phase II programs for some of the organic chemicals. Phase I employed gas chromatography/mass spectrometry (GC/MS), and Phase II employed more precise GC methods. The Phase I techniques made use of higher detection limits; thus, chemicals present at lower levels may not have been detected. In a few cases, Phase I samples required dilution to facilitate analysis, and the dilution may have masked the presence of some compounds by raising the effective detection level. When necessary, an expanded suite of Phase II analyses and/or additional GC/MS analyses were used to ensure that all target analytes were evaluated. Some other limitations associated with the chemical database are soil sample collection, tentatively identified compounds, unidentified compounds, and Army agent contamination. Uncertainties associated with soil sample collection can under- or overestimate risk. Tentatively identified and unidentified compounds were not considered in the risk characterization and the detections of Army chemical agent reported in the chemical database were not quantitatively evaluated. Potential risk may have been underestimated based on the exclusion of agent and tentatively identified compounds from the evaluations.

6.3.1.2 Exposure Point Concentration

Uncertainties associated with the exposure point concentrations include the estimation method used to approximate site concentration values used to calculate risk. In accordance with EPA guidance, representative soil concentrations were estimated using the arithmetic mean ($C_{rep,mean}$). The uncertainty in these estimates was characterized by reporting the 95 percent upper and lower confidence limits (95% UCL and 95% LCL, respectively) on the mean. The 95% UCL ($C_{rep,upper}$) was used to estimate the RME risks. Conservative assumptions were also employed to address potential dilution effects when soil boring samples were composited and to calculate the boring-by-boring risk estimates; the highest detected concentration of the COC was used regardless of the depth of the sample.

6.3.1.3 Land-Use and Exposure Scenarios

Uncertainty exists regarding the likelihood that the land uses evaluated will in fact occur under a future development scenario at RMA. Land use at RMA is currently limited to commercial, industrial, recreational, and open space (i.e., nature preserve/wildlife refuge) uses. The land-use designations were based on information obtained from several governmental agencies overseeing and directing land use within their respective jurisdictions surrounding RMA. The FFA restricts the ownership, use, and transfer of property at

RMA now and into the future. Consistent with the FFA, certain future land uses at RMA are not considered foreseeable, such as residential and agricultural development. It is for this reason that certain pathways of exposure (e.g., potable and agricultural use of groundwater, surface water and sediment exposures, and consumption pathways) were not evaluated at RMA. The uncertainties associated with the human health exposure scenarios evaluated in the IEA/RC as related to land use, target receptors, spatial exposure patterns, and exposure pathways could result in an over- or underestimation of risk.

6.3.1.4 Human Health Toxicity Estimates

The toxicity factors (D_T; the dose-response parameter based on the slope factor or RfD) used in the HHRC were designated as a fixed parameter to maintain consistency with established EPA toxicity factors used in CERCLA risk assessments. However, a large degree of uncertainty is known to be associated with the toxicity factors. This uncertainty could lead to an over- or underestimation of risk. The major sources of uncertainty include the following:

- Extrapolation of toxicity factors from effects observed at high doses administered in a laboratory setting to effects observed at relatively low doses expected from human contact with the chemical in environmental media
- Use of short-term toxicity studies to predict the effects of long-term (chronic) exposures and vice versa
- Use of animals to predict the effects of contaminant exposure on humans where adequate human data are lacking
- Use of toxicity data from laboratory animals (homogeneous populations) and healthy humans to predict the effects observed in a general population, which included individuals having a wide range of sensitivities

As indicated in "Guidelines for Carcinogenic Risk Assessment," the cancer slope factors generated from the linearized multistage extrapolation procedure lead to what is considered a "plausible upper limit to the risk that is consistent with some proposed mechanisms of carcinogenesis. Such an estimate, does not necessarily give a realistic prediction of the cancer risk. The true value of the risk is unknown, and may be as low as zero" (EPA 1986). Descriptions of the uncertainties associated with the toxicity factors are contained in Appendix B and Appendix E of the IEA/RC report.

6.3.1.5 Exposure Parameters and PPLVs

The variability and uncertainty in the PPLVs were estimated by developing probabilistic distributions for each of the HHRC model's parameters. The variability in the parameter distribution refers to the real variation in possible parameter values, which may be spatial (e.g., soil density), temporal (e.g., dust loading), physiological (e.g., body weight, skin surface areas) or due to the effects of other factors such as behavior. Uncertainty is that part of the parameter distribution resulting from random sampling variation and other sources of potential error. Uncertainty increases the overall spread of the distribution and may also result in bias, both intentional (e.g., conservative assumptions) and unintentional (unknown). There was substantial uncertainty about the

representativeness of data for parameters describing human exposures (e.g., soil intake parameters, time-dependent exposure parameters). In general, however, conservative assumptions were made. Ages and activities associated with the open space visitor land-use options were characterized using available empirical data and professional judgment. Although survey data were used to characterize time and activity patterns for the refuge worker population and biological worker subpopulation in order to improve the confidence in the analysis, the representativeness of the resulting distributions for current and future exposed populations at RMA remains uncertain. The datasets compiled for these populations or subpopulations may under-represent exposures for some portion of the future RMA population and over-represent for some other portion. It is not possible to determine with certainty whether data representativeness in the risk evaluations imparted a conservative or underconservative bias to the results. Summaries of the major uncertainties associated with the PPLV equation parameters are presented in Tables 6.3-1 through 6.3-3.

The variation in the HHRC model parameters is reflected in the spread of the PPLV distribution. Because the uncertainty and/or variability in many key probabilistic parameters is higher for particular chemicals or for exposed populations, the resulting PPLV distributions corresponding to these chemicals and land uses have a wider spread. A detailed description of the PPLV distribution variability is described in Appendix E of the IEA/RC report.

6.3.1.6 Risk Estimates

The PPLV-based risk estimations were based on a target cancer risk of 1×10^{-6} or an HQ of 1.0 and exposure point concentrations representing the C_{max}, $C_{rep,mean}$, and $C_{rep,upper}$ (the different risk calculation methods are available via the HHRC model). When the cancer risk estimates are based on the 5th percentile PPLV and the $C_{rep,upper}$, the results can be considered as upper bound estimates of potential risk.

In the IEA/RC, both carcinogenic risks and noncarcinogenic HQs are assumed to be additive, consistent with current risk assessment guidance. There are several limitations associated with this assumption. Due to these limitations, the potential to over- or underestimate risk cannot be firmly established. In summing cancer risks, the underlying assumption is that there is an independence of action (i.e., effect to organ, tissue, etc.) by the chemicals involved and that there are no synergistic or antagonistic chemical interactions. Uncertainty is also associated with summing cancer risks for multiple chemicals that have differing weights of evidence for human carcinogenicity (i.e., Group A versus Group C carcinogens; see Section 6.1.3). Because little or no information on antagonistic or synergistic effects was available for the RMA COCs, noncarcinogenic effects from multiple chemicals were also assumed to be additive. A limitation with the additive approach used for the IEA/RC is that the COC-specific HQs were not segregated by major toxic effect prior to summing to derive the HI;

however, this simplifying step may not have introduced large degrees of uncertainty because most of the noncancer effects were attributed to a single COC (dieldrin).

6.3.2 Ecological Risk Characterization

6.3.2.1 Chemical Database

The same uncertainties associated with the chemical database that were identified for the HHRC apply to the ERC. However, the database used for the ERC also included results associated with biota sample collection and analysis. Despite the relative abundance of site-specific field data to characterize ecological risk at RMA, the need to work with data from sampling programs designed for other purposes (e.g., to establish nature and extent of contamination) may have been less than ideal for the estimation of exposure soil concentrations and BMFs. It is difficult to know if the use of these data resulted in an over- or underestimation of potential risks to biota. The biota species sampled on RMA were chosen from species that best represented the uptake of contaminants from environmental media and the subsequent transfer, via food consumption, through food chains to top predators. Uncertainty is associated with the use of these biota samples to derive RMA-specific BMFs. Some uncertainty is also associated with the more scattered peripheral abiotic sampling where heterogeneous soil contamination occurs, and where detection limits, in some cases, exceeded the risk-based concentrations. These factors, along with lesser sampling density and little collocation of tissue and soil samples, added to the uncertainties associated with the chemical database.

6.3.2.2 Exposure Pathways

Exposure pathways were selected to include the predominant pathways of exposure believed to exist at RMA. Those selected for the food-web model included food consumption, dermal exposure to surface water by organisms, ingestion of water by some terrestrial organisms, and sediment and soil ingestion by some aquatic and terrestrial organisms. Exposure pathways excluded from the food-web model included inhalation of contaminant vapors and particulates and dermal exposure to contaminants from soil contact. These exposure pathways are implicitly contained in the BMF because measured tissue concentrations (from sampled biota species) are the result of cumulative exposure by all pathways. Additional uncertainties related to the exposure pathways are presented in Section 6.3.2.4.

6.3.2.3 Exposure Concentrations

Most of the uncertainty regarding exposure concentrations centers on the estimated exposure area concentrations used to calculate terrestrial risk. Aquatic risk was estimated directly from measured tissue concentrations and therefore was not based on quantitative exposure concentrations in aquatic media. Terrestrial tissue concentrations, dose, and risk are theoretically dependent on exposure soil concentrations (ESCs), i.e., the concentration in soil that is bioavailable and accessed by an individual during exposure activity. The ESC is, for all practical purposes, unverifiable in the field; therefore, it is represented by

estimated exposure area soil concentration, i.e., the average soil concentration in a specified depth profile within a circular species-specific exposure area. Two types of uncertainty occur when applying ESC to estimate risk. "Representation uncertainty" refers to the uncertainty in adequately representing spatial and temporal scales of the ESC by exposure area soil concentration, and "estimation uncertainty" refers to the uncertainty in analytically estimating the exposure area soil concentration based on available data. Representation uncertainty explains the difference between true exposure concentration for an individual and the exposure area concentration for a typical (mean) individual. Unfortunately, representation uncertainty is for all practical purposes unquantifiable and irreducible, because the detailed information on individual organisms (and their prey) required for its calculation cannot be practically obtained. Estimation uncertainty explains the differences between the true exposure area soil concentration in a given area or for a given individual, and the estimated exposure area soil concentration based on available sampling and analytical data.

The empirical mathematical constant used to relate exposure area soil concentration to tissue concentration is the BMF. BMF is therefore defined as a correlation based on the variable exposure area soil concentration and not on actual exposure soil concentration. The BMF values determined purely from literature data, rather than site-specific data from RMA, will describe the relationship between tissue concentration and a different dose-based quantity than ESC, and therefore may create more or less bias if used with ESC to predict risk at RMA. Uncertainty is also associated with the BMF based on the use of site-specific information (e.g., RMA-soil and biota data collected at different times and locations and for various purposes). The uncertainty associated with the exposure concentration, including the estimation of BMFs, will be further ascertained by review of the findings gathered from the SFS and the ongoing USFWS biomonitoring studies.

6.3.2.4 Ecological Toxicity Estimates

MATC and TRV uncertainty was incorporated quantitatively by use of UFs as discussed in Section 6.2.3. The UFs were applied to add a margin of safety to the extrapolated toxicity measures. The UF protocol included factors to account for four categories of uncertainty: intertaxon variability, study duration, toxicity effect levels (study endpoints), and other modifying factors (including nine subcategories) that were multiplied to arrive at the total estimated uncertainty.

In addition to the uncertainty incorporated in the UFs are potentially unrecognized or unquantifiable sources of uncertainty. These include the following:

- Representativeness of toxicity endpoint tissue concentration data from one species relative to other species in the trophic box
- Differences in metabolic rate, body size, and physiology between test and target species
- Differences in feeding habits and behavioral patterns in test v. target species
- Differences in the life stage of the organisms tested v. those exposed

- Seasonal differences in response to toxicants (e.g., "fat" versus "lean" times)
- Difficulty in adequately estimating exposure concentrations (including environmental variability in time and space)
- The possibility that exposed organisms may avoid, or be attracted to, contaminated media (e.g., pesticide-debilitated prey) and so may not show effects seen in laboratory tests (Suter 1993)
- Inability to quantify the other stresses that biota may face (e.g., climate, food supplies, background levels of toxicants, habitat disturbance, and other manmade causes)
- The possibility that exposure pathways, in addition to ingestion, are significant
- The fact that there are no standard measures of effect, patterns of dosing, durations of exposure, etc., so comparison across studies/ecosystems is obscured or confounded

6.3.2.5 Risk Estimates

Toxicological effects from multiple chemicals were assumed to be additive, consistent with the risk assessment procedures used for human health. This assumes independence of action, i.e., no net synergistic or antagonistic effects, since these effects are poorly understood with the limited toxicological data available. This practice of additivity without a toxicological basis (i.e., common mechanism of action or target organ effect) is protective but scientifically questionable; however, some means of evaluating the potential cumulative effects of exposure was required and EPA guidance requires such an approach in the absence of site-specific data on additivity. Hence, the individual HQs for each COC were summed to estimate the total risk (HI) for each trophic box. It is difficult to determine whether this procedure over- or underestimated risks to biota. As noted in the IEA/RC report, a range of potential risk was presented for the bioaccumulative COC because three different BMFs were employed. Because of the overall uncertainty associated with each of the parameters incorporated in the food-web model and the toxicity threshold values, it is difficult to state with certainty at this time which of the three BMF approaches best estimated risk to biota at RMA. Additionally, it is possible that actual residual risk to biota of an excessive nature may occur in some cases following remediation based on the uncertainty associated with the food-web risk modeling process and its application to delineated areas proposed for remediation. Again, the uncertainty associated with the risk estimates will be further ascertained by review of the findings gathered from the SFS and the ongoing USFWS biomonitoring studies.

6.3.2.6 Ecological Measurement Endpoints

The presence of potential ecological risk was given further perspective by considering it together with available field data on ecological endpoints. The available data on ecological status and health used to evaluate ecological endpoints are also subject to uncertainty. In this context, uncertainty results from the following:

- The short-term nature of many of the studies relative to the cycles of natural variability
- Estimation of quantitative ecological parameters at levels of precision that may not be biologically and/or statistically significant and/or use of endpoints that may not have been sensitive enough to discern the various potential human health risks to biota

- Study designs that did not precisely and quantitatively correlate ecological parameters with parameters related to contaminant concentrations
- Study designs that did not precisely quantify all parameters that might have positively or negatively affected the ecological data

Appendix E of the IEA/RC report presents a detailed discussion on the assumptions, limitations, and uncertainties associated with each of the uncertainty categories listed above.

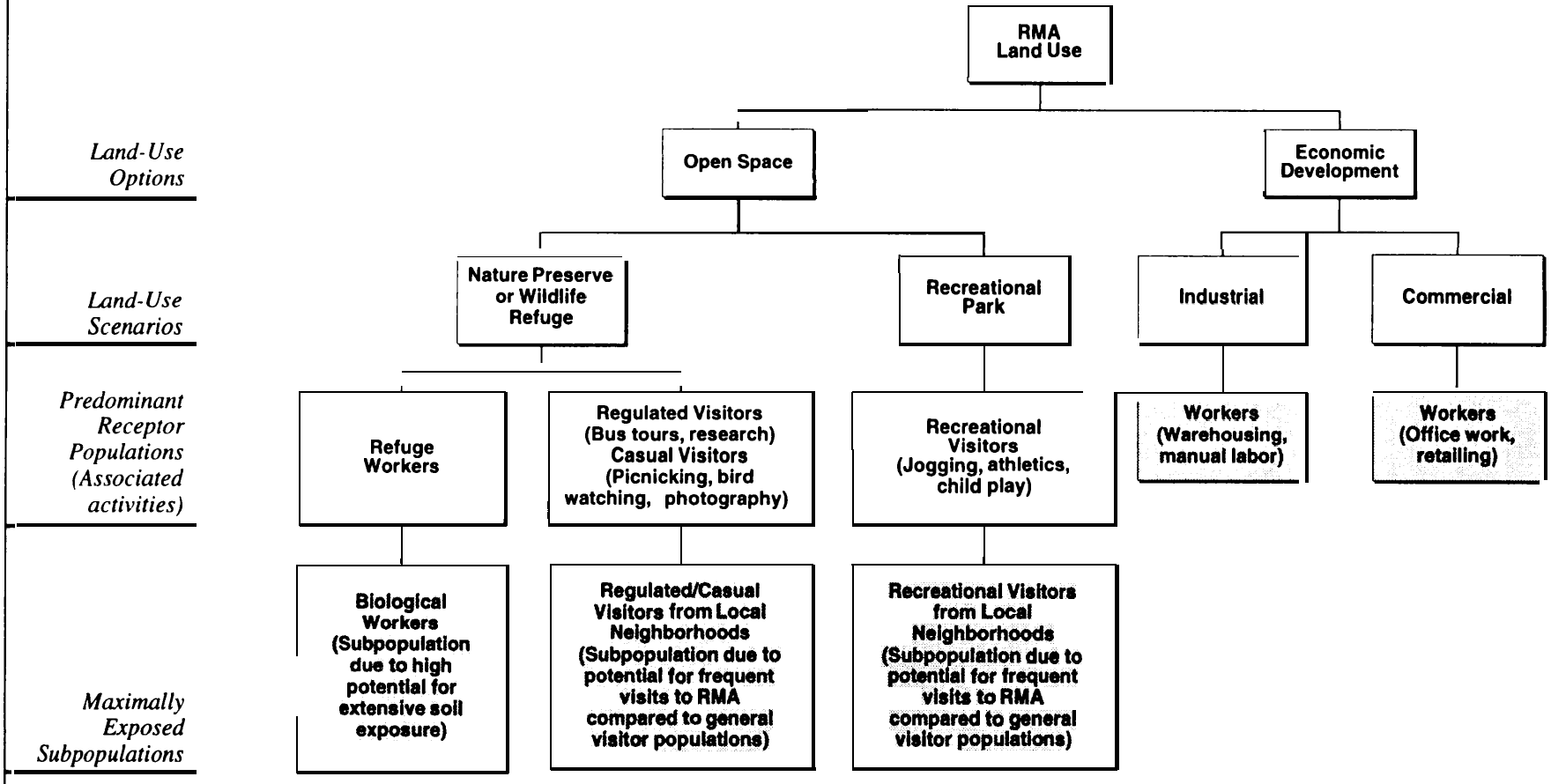
6.4 Conclusions

Both the human health and the ecological risk assessment results are based on probabilistic methodologies. The probabilistic methods account for the variability in literature and field data for the various parameters used to quantify exposure and risk and at least partially reflect the uncertainty associated with these parameters. The use of this methodology and the discussions of uncertainty increases the understanding the risk characterization by clarifying the uncertainties associated with the input values and their implications on estimated risks.

The results of the risk assessment, as presented in the IEA/RC report, indicate that potential risks exist for both human and ecological receptors. The contaminants that are the major contributors to overall potential risks are similar for both receptor groups, i.e., the OCPs. Likewise, the areas that pose the greatest potential risks to both receptor groups are in the central core region of RMA. It is very important to remember that the potential risks presented in this report are based on current and historical contamination evaluated under present or future land-use scenarios. However, data from some of the areas at RMA that have undergone interim remediation (e.g., capping to eliminate possible exposure pathways for receptors) were not revised to reflect the remediation; the actual risks are, therefore, likely to be lower than the risks presented in the IEA/RC report.

Areal extents of biota remediation that are needed to reduce or prevent excessive risks to ecological health are not completely known at present, but will be further refined as part of remedial design and incorporate ongoing ecotoxicological evaluations by the BAS. Recommendations regarding the nature and extent of excessive risks to biota will be presented by the BAS to RMA risk managers for inclusion in soil remedial actions to reduce risks to acceptably healthy levels in accordance with EPA Superfund guidance, the Rocky Mountain Arsenal National Wildlife Refuge Act, and the selected remedy.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

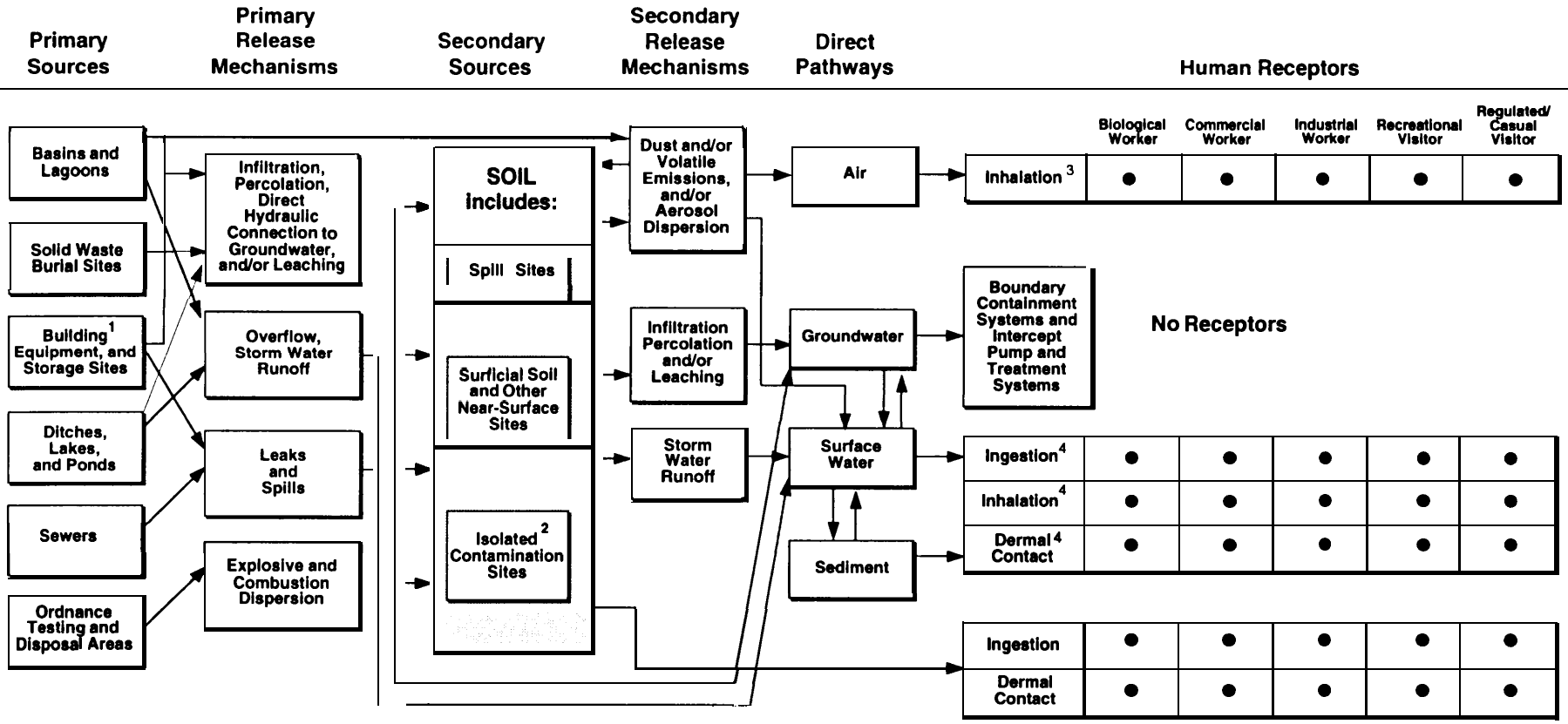


1 - Receptor populations/subpopulations shown in shaded boxes were evaluated in this risk assessment

Figure 6.1-1

Projected Land-Use Scenarios for RMA[1]

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corporation



1 - Building, Equipment, and Storage Sites include only the soils present at these sites, not the structures themselves.
2 - Isolated Contamination Sites are not generally considered sources in the sense that they could provide releases to the environment.
3 - Enclosed space vapor inhalation evaluated for commercial and industrial populations only. Open space vapor inhalation evaluated for all populations except commercial workers.
4 - Only ephemeral lake sediments evaluated.

Figure 6.1-2
RMA Site Conceptual Model for Human Receptors

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corporation

RMA ROD 6.96 jb

Legend

- RMA Boundary
- SAR Site Boundary[1]
- Munitions Testing
- Agent Storage
- Lake Sediments
- Ditches/Drainage Areas
- Basins (A–F)
- Sewer Systems
- Disposal Trenches
- Sanitary Landfills
- Lime Basins
- South Plants
- Buried Sediments/Ditches
- Section 36 Balance of Areas
- Burial Trenches
- RMA Balance of Areas[2]
- Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]RMA Balance of Areas site designation includes all RMA areas not shaded.

N

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

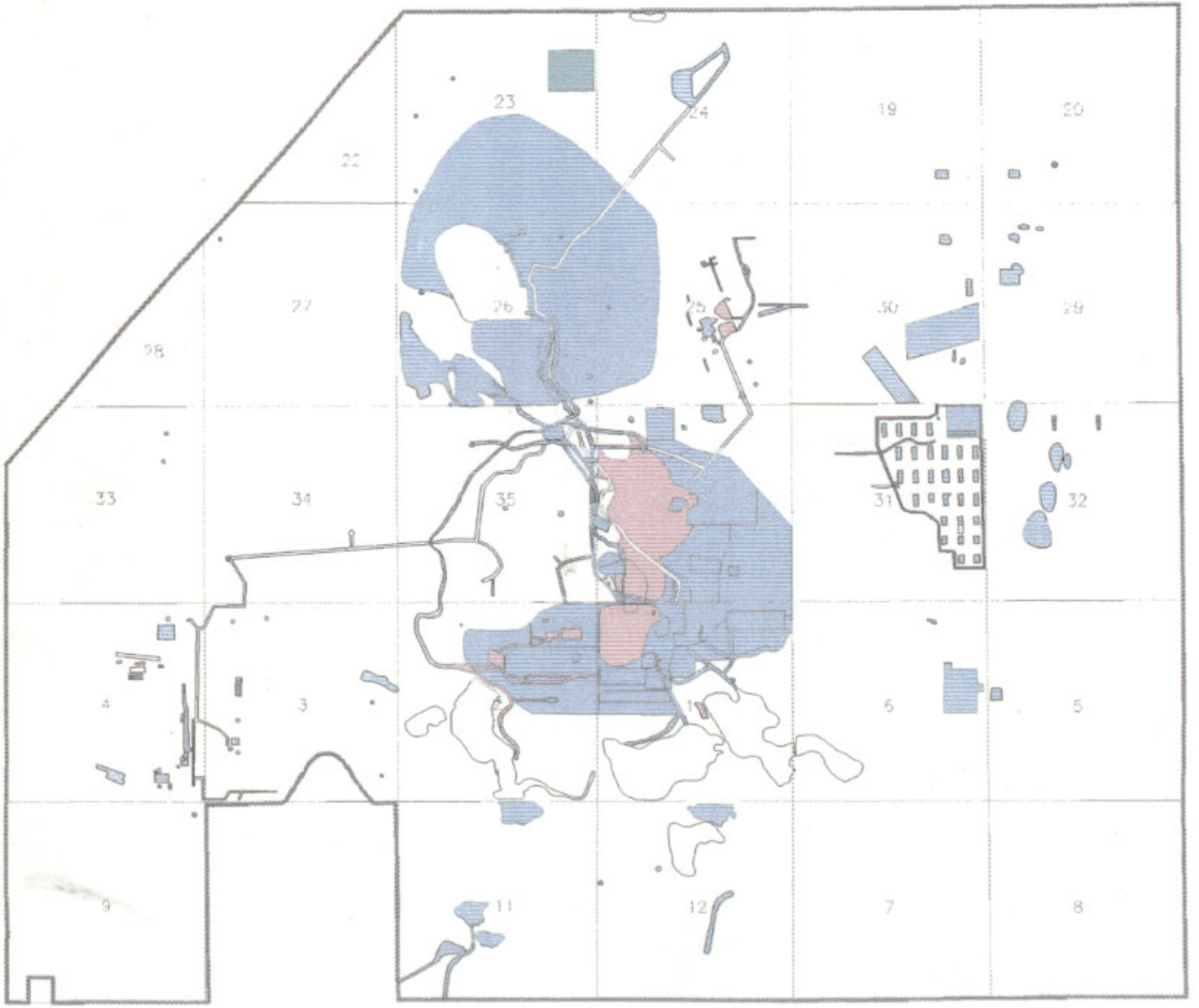
June 1996

Figure 6.1–3

RMA Site Designations used in the HHRC

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corporation

File Name: C:\SOILS\ROD\RCD61-2
Date 6/06/96
Drawn by XG
Checked by SA



Legend

- RMA Boundary
- SAR Site Boundary[1]
- CR > 10^{-4}
- 10^{-6} < CR ≤ 10^{-4}
- CR ≤ 10^{-6}
- COCs Reported Below CRLs
- 5 Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and $C_{rep,upper}$ for 0-ft to 1-ft depth interval.

-N-

1500 0 1500 3000 Feet

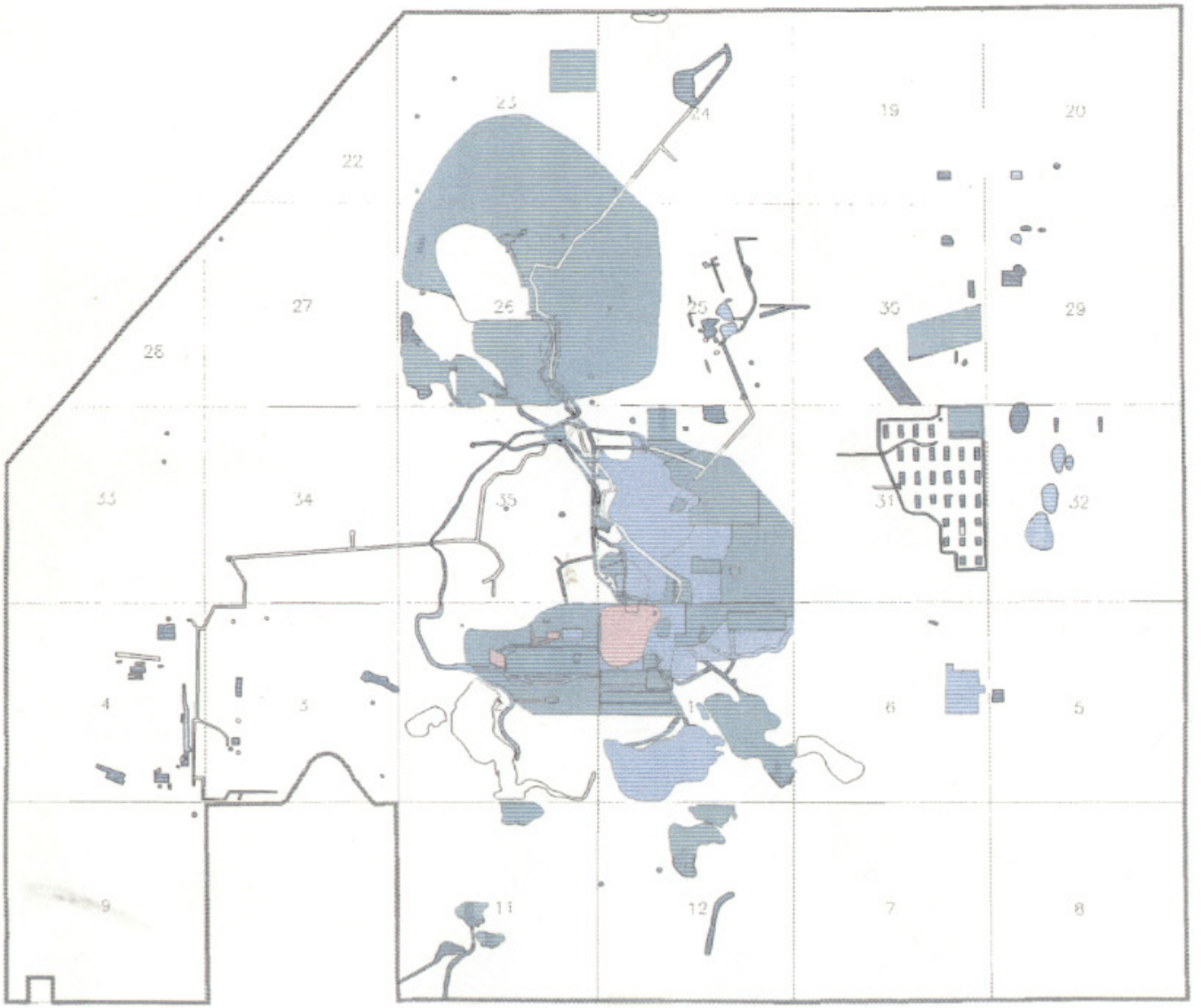
Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 6.1-4

Total Site Cancer Risks for Biological Worker,[2] Horizon 0

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\EI-HOR1
Date 6/06/96
Drawn by XG
Checked by SA



Legend

- RMA Boundary
- SAR Site Boundary[1]
- HI > 10
- 1 < HI ≤ 10
- HI ≤ 1
- COCs Reported Below CRLs
- 5 Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and $C_{rep,upper}$ for 0–ft to 1–ft depth interval.

-N-

1500 0 1500 3000 Feet

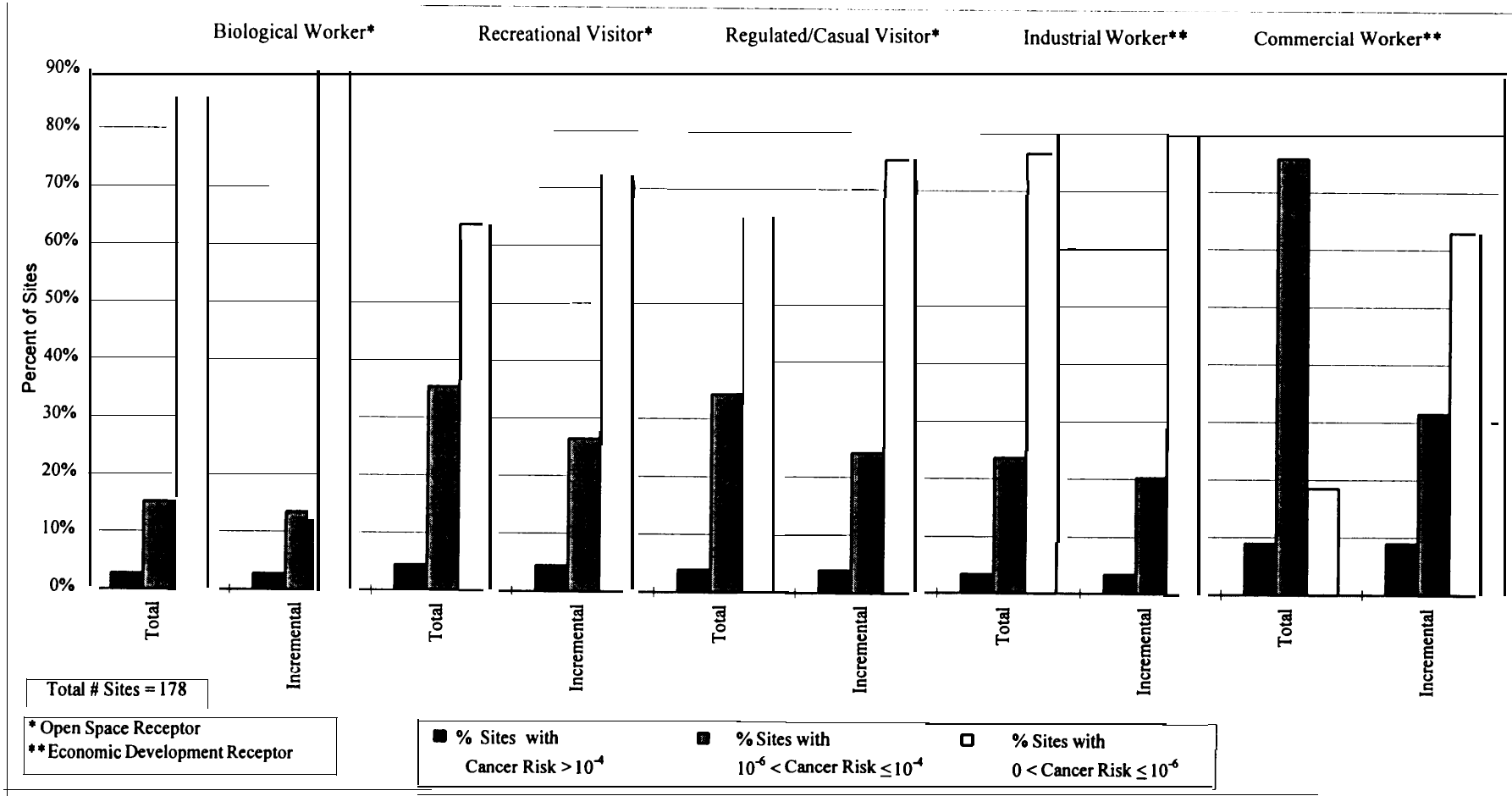
Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 6.1–5

Total Site Hazard Indices for Biological Worker,[2] Horizon 0

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\HI-HOR1
Date 6/06/96
Drawn by XG
Checked by SA



Note: Incremental risk is equal to the total minus the risk attributable to indicator (background) levels of metal COCs.

Figure 6.1-6

Cancer Risk Summary for All Receptors Based on Site-Specific ($C_{rep,\ upper}$) Results, Horizon 0

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corporation

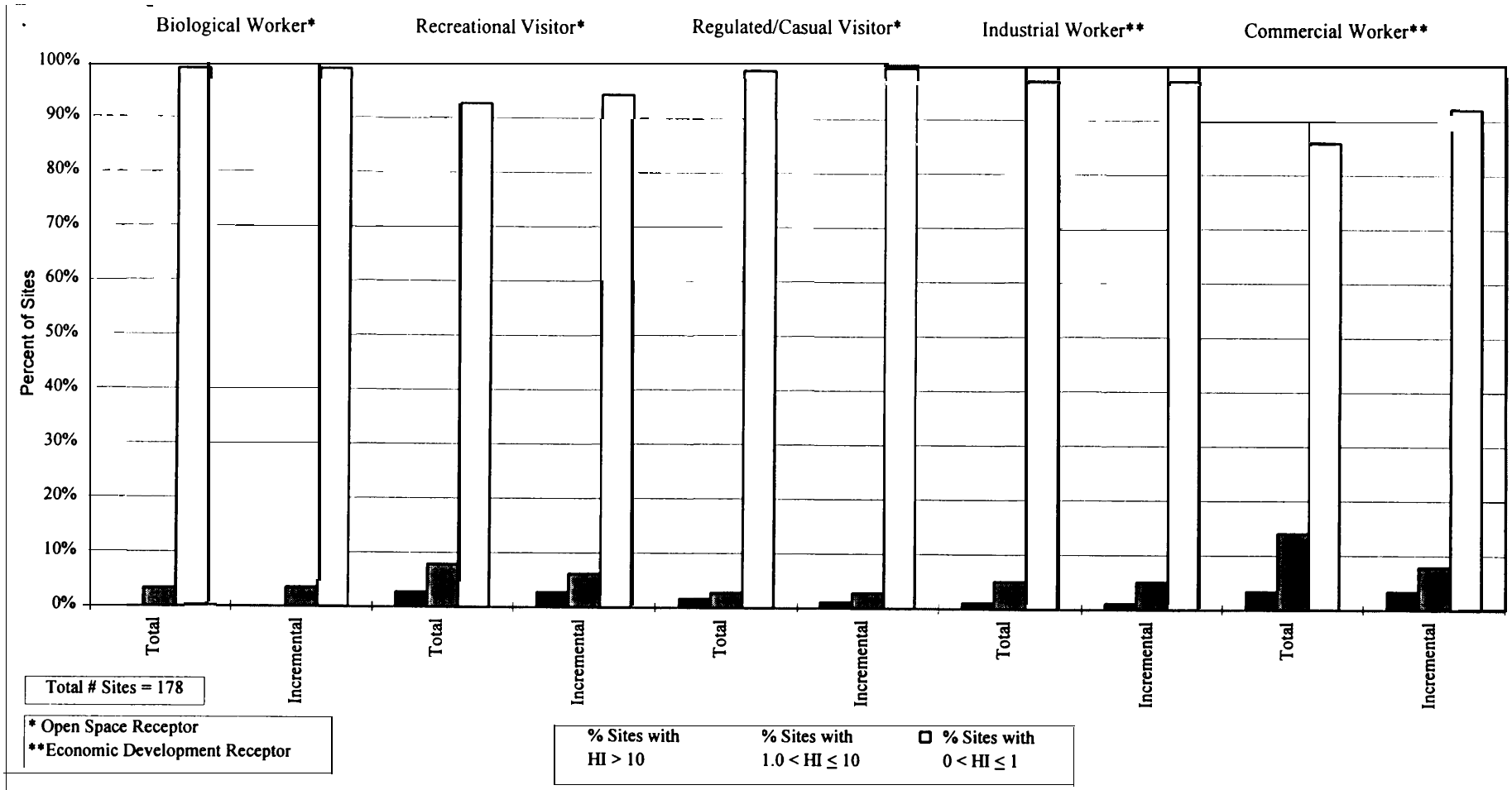
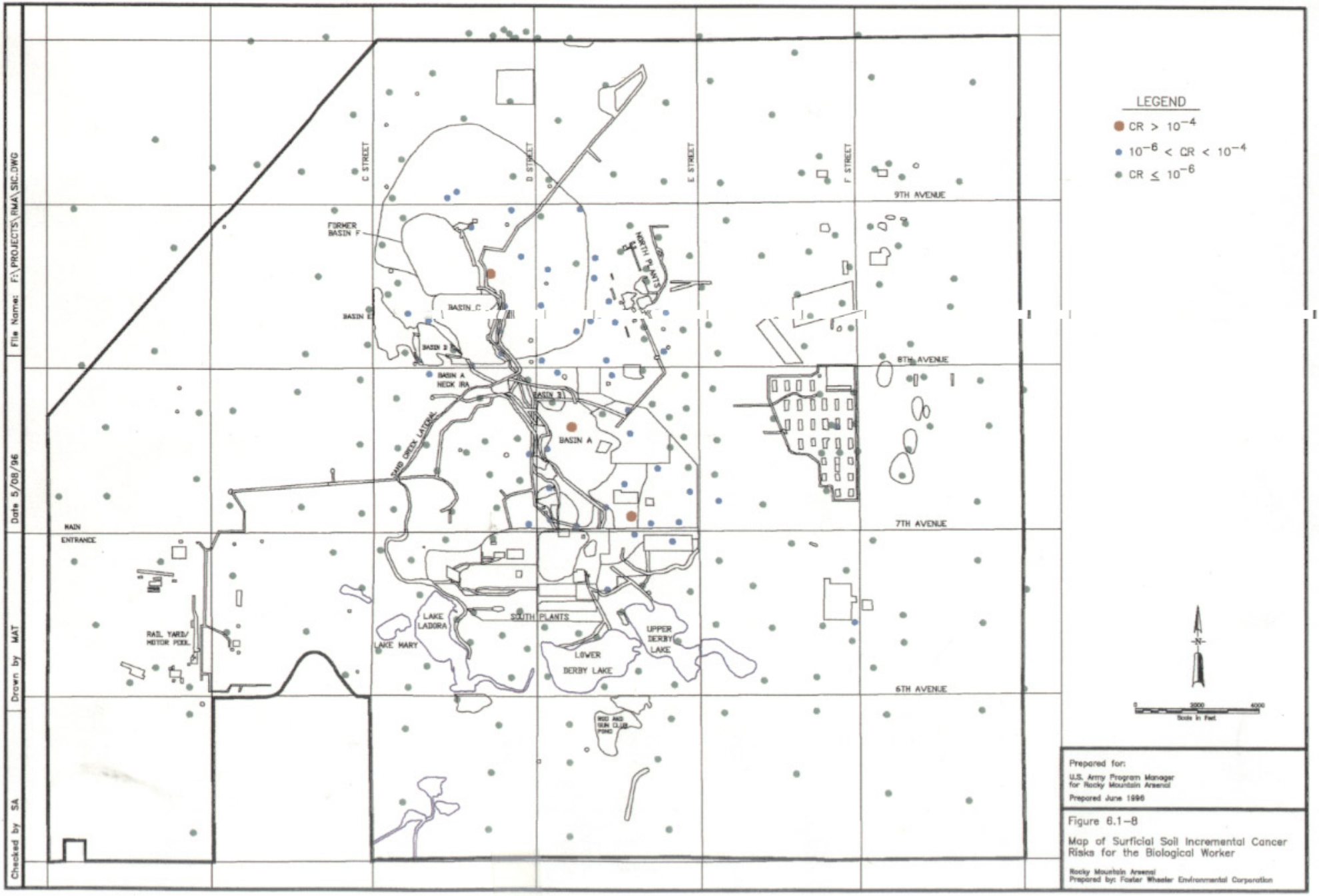


Figure 6.1-7

Hazard Index Summary for All Receptors Based on Site-Specific ($C_{rep,upper}$) Results, Horizon 0

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corporation



Prepared for:
U.S. Army Program Manager for Rocky Mountain Arsenal
Prepared June 1996

Figure 6.1-8

Map of Surficial Soil Incremental Cancer Risks for the Biological Worker

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corporation

Legend

RMA Boundary

SAR Site Boundary[1]

Human Health Exceedance Area
Cancer Risk ≥ 10E−4

Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and C_{max} on boring by boring basis for 0−ft to 1−ft depth interval.

-N-

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 6.1−9

Human Health Carcinogenic Exceedance Areas,[2] Horizon 0

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\E01
Date 6/06/96
Drawn by XG
Checked by SA

Legend

RMA Boundary

SAR Site Boundary[1]

Human Health Exceedance Area
Cancer Risk ≥ 10E−4

Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and C_{max} on boring by boring basis for 0−ft to 1−ft depth interval.

N

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 6.1−9

Human Health Carcinogenic Exceedance Areas,[2] Horizon 0

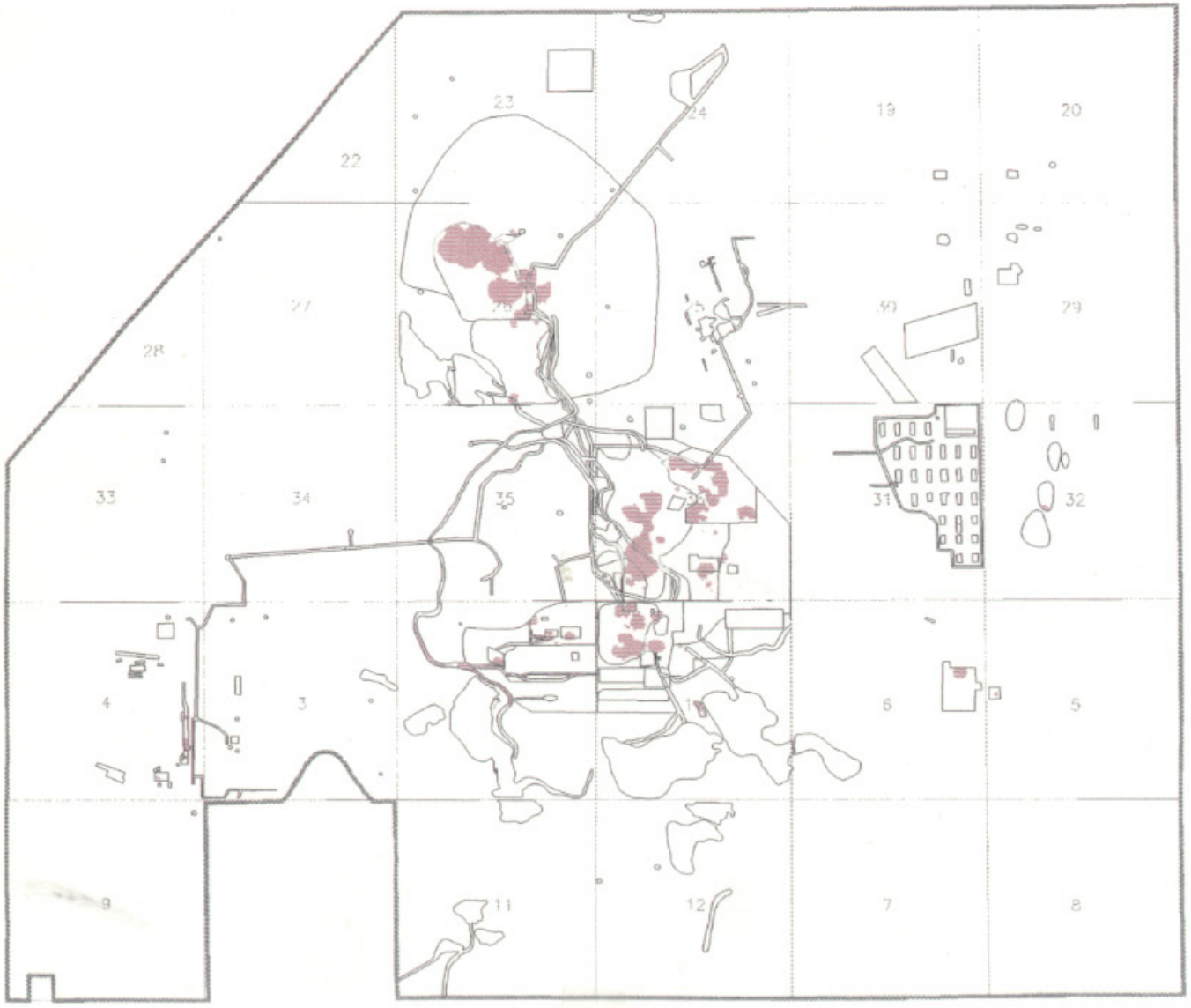
Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\E101

Date 6/06/96

Drawn by XG

Checked by SA



Legend

RMA Boundary

SAR Site Boundary[1]

Human Health Exceedance Area
Chronic HI ≥ 1.0

5 Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and C_{max} on boring by boring basis for 0-ft to 1-ft depth interval.

-N-

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 6.1-11

Human Health Noncarcinogenic Exceedance Areas,[2] Horizon 0

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\HI01
Date 6/06/96
Drawn by XG
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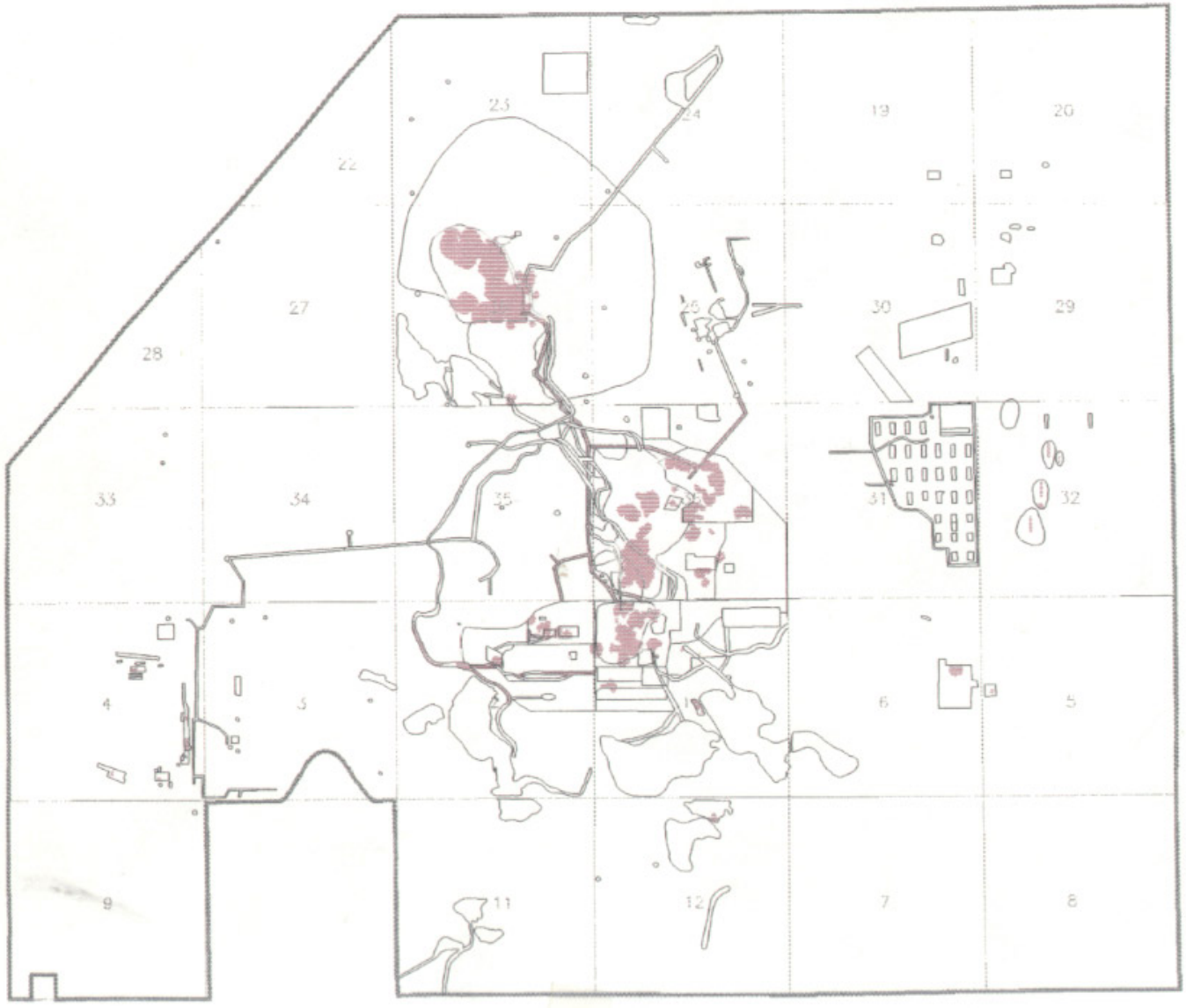


Legend

RMA Boundary

SAR Site Boundary[1]

Human Health Exceedance Area
Chronic HI ≥ 1.0

5 Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and C_{max} on boring by boring basis for 0-ft to 10-ft depth interval.

-N-

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 6.1-12

Human Health Noncarcinogenic Exceedance Areas,[2] Horizon 1

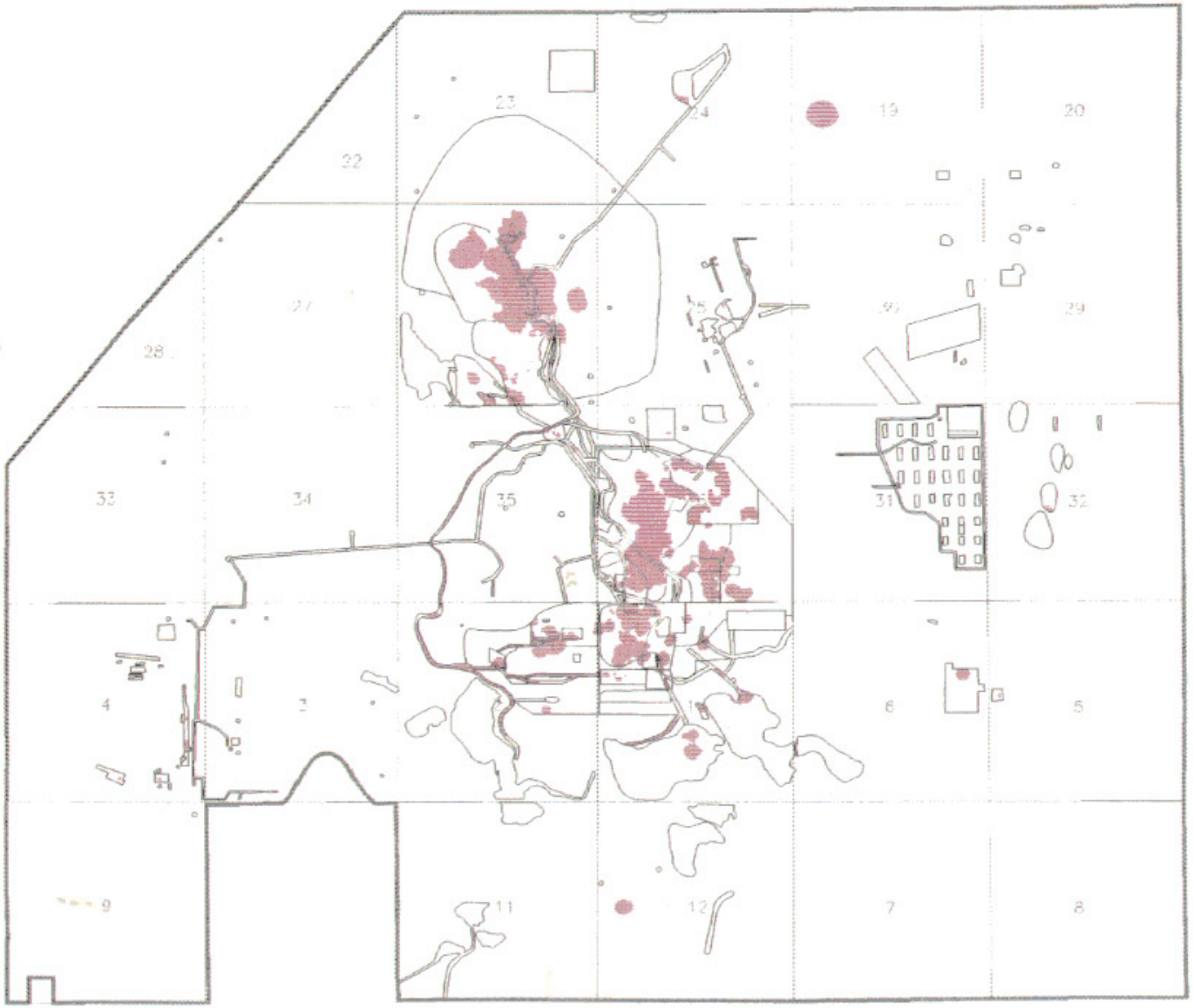
Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\HI

Date 6/06/96

Drawn by XG

Checked by SA



Legend

RMA Boundary

SAR Site Boundary[1]

Human Health Exceedance Area
Cancer Risk ≥ 10E−4,
Chronic HI ≥ 1.0, or Acute HI ≥ 1.0

Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and C_{max} on boring by boring basis for 0−ft to 1−ft depth interval.

N

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 6.1−13

Human Health Exceedance Areas,[2] Horizon 0

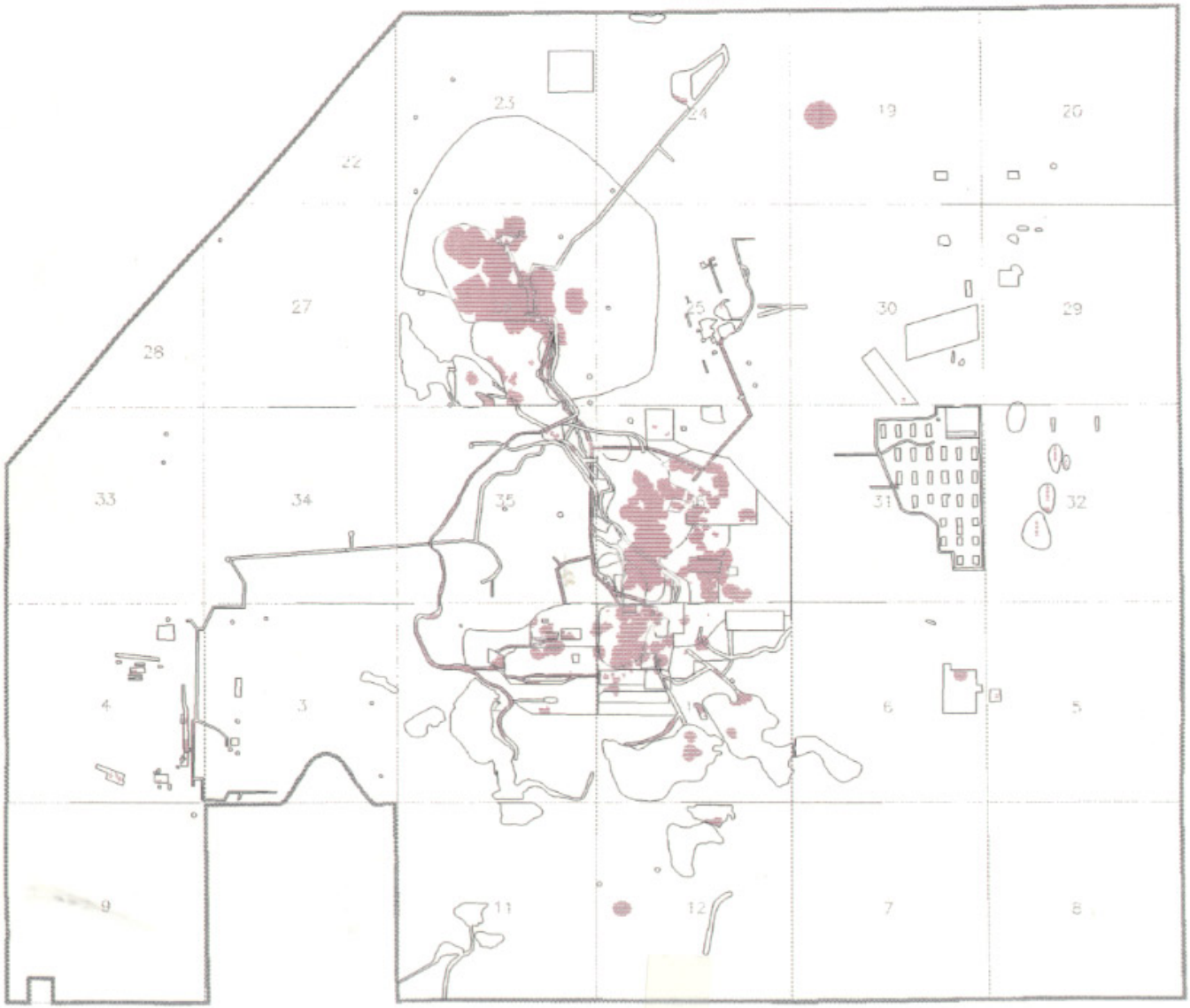
Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\ACT01

Date 6/06/96

Drawn by XG

Checked by SA



Legend

RMA Boundary

SAR Site Boundary[1]

Human Health Exceedance Area
Cancer Risk ≥ 10E−4,
Chronic HI ≥ 1.0, or Acute HI ≥ 1.0

Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and C_{max} on boring by boring basis for 0−ft to 10−ft depth interval.

-N-

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 6.1−14

Human Health Exceedance Areas,[2] Horizon 1

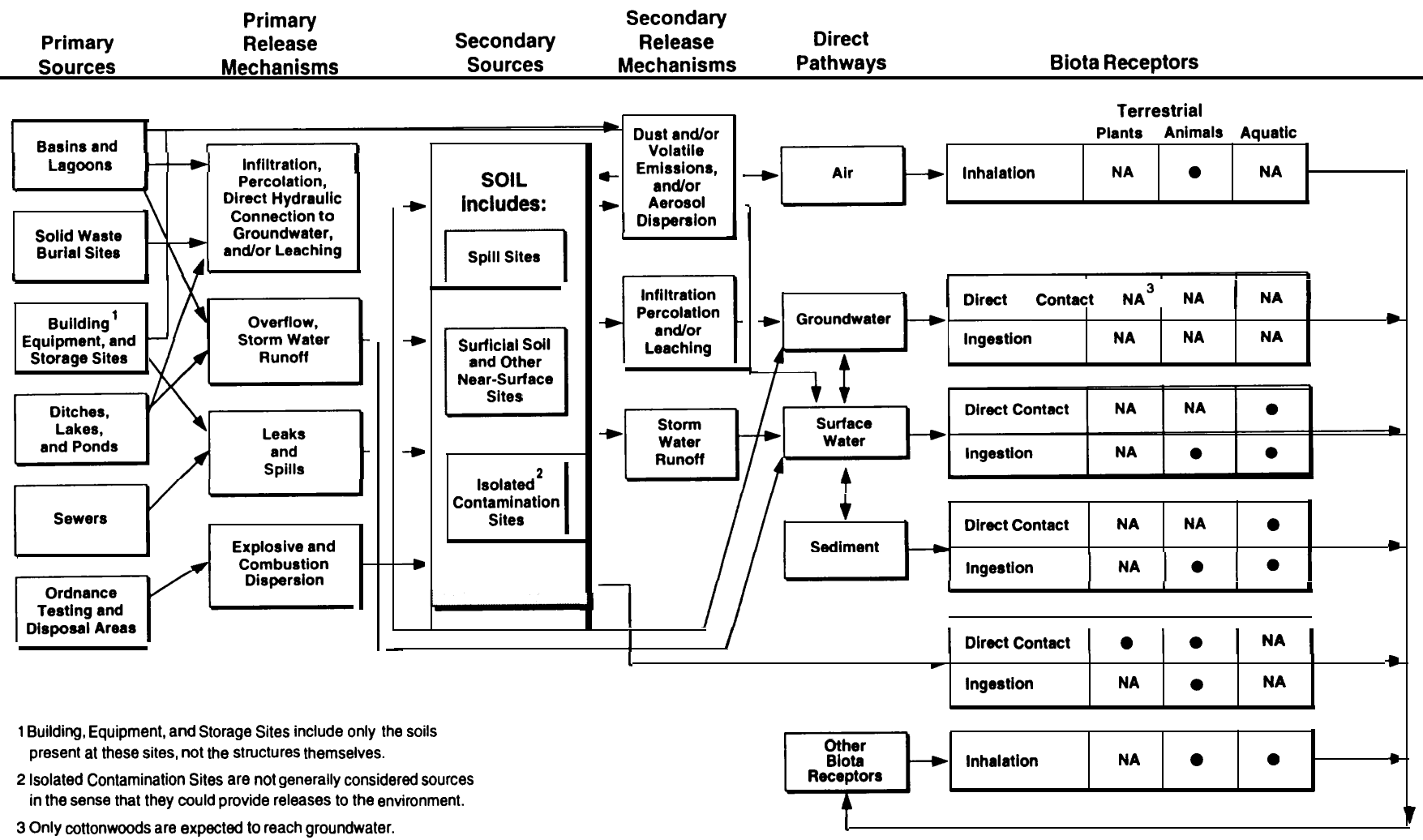
Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\AREAS2

Date 6/06/96

Drawn by XG

Checked by SA



1 Building, Equipment, and Storage Sites include only the soils present at these sites, not the structures themselves.

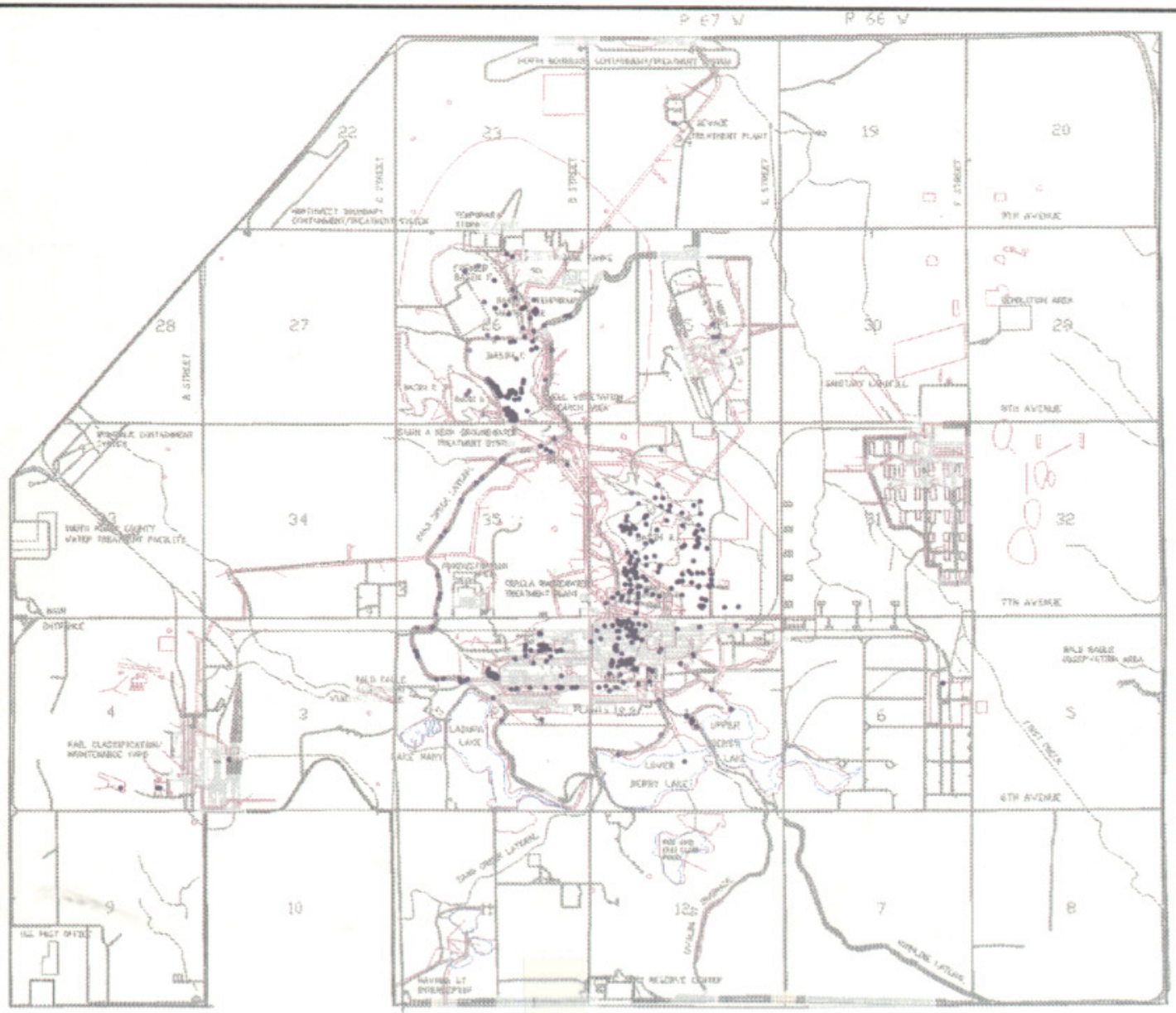
2 Isolated Contamination Sites are not generally considered sources in the sense that they could provide releases to the environment.

3 Only cottonwoods are expected to reach groundwater.

NA - Not applicable.

Figure 6.2-1
RMA Site Conceptual Model for Ecological Receptors

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corporation



Legend

- SAR Site
- 31 Section Number
- Section Line
- Drainage
- Road
- Railroad
- • Sample Exceeds Acute Criteria HI* ≥ 1.0, 0 – 1 foot depth interval

*Cumulative HI developed using deterministic exposure parameters presented in Table 6.1–6 on environmental soil data, for all COCs with acute PPLV values (Table 6.1–19)

N

0 2000 4000
Scale in Feet

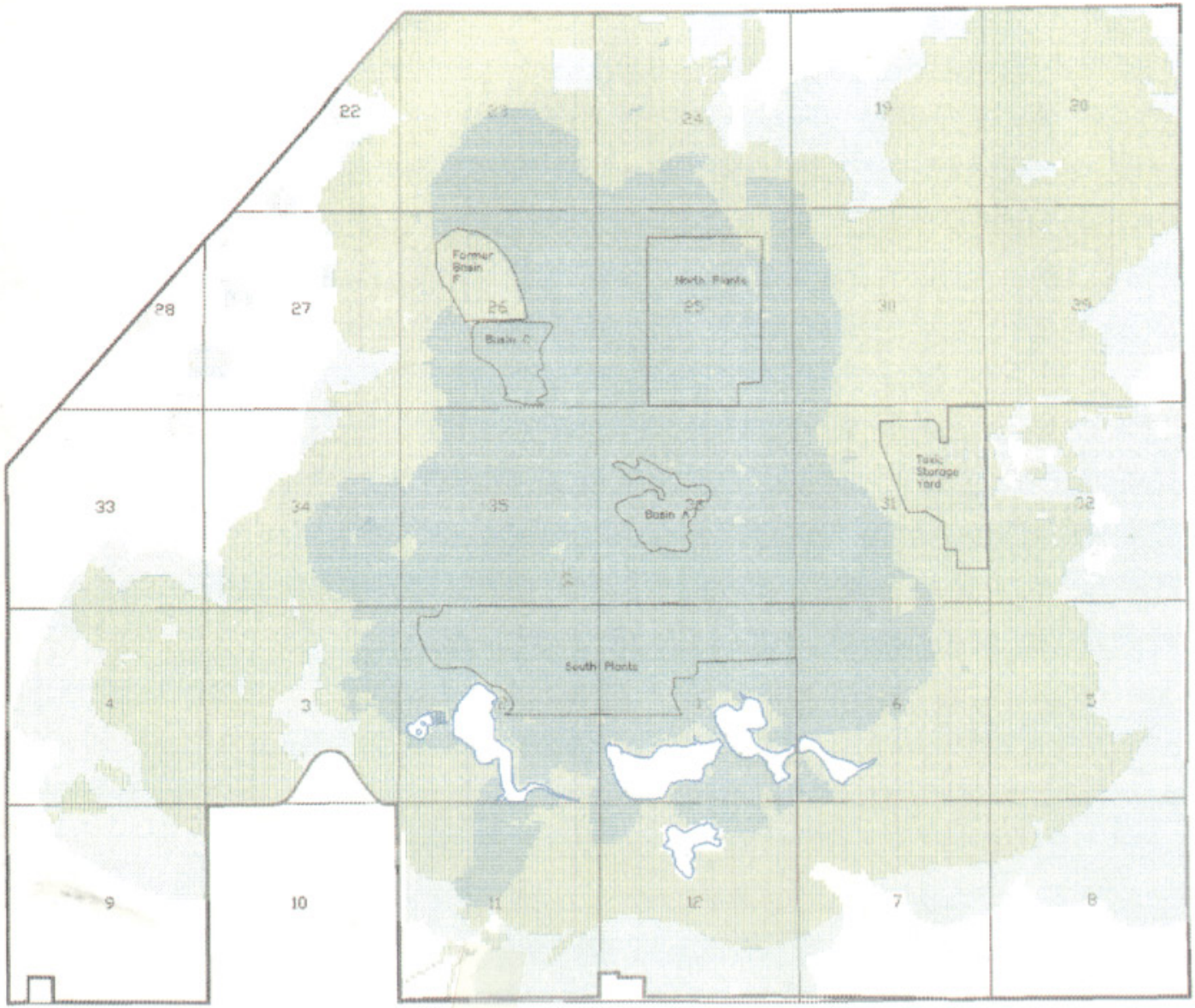
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal
June 1996

Figure 6.1–15

Acute Exceedance Sample Locations

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

Checked by SA | Drawn by JLS | Date 6/06/96 | File Name: F:\PROJECTS\ARSENAL\ROD\EXCEED.DWG



Legend

1 trophic box with HI > 1

2-4 trophic boxes with HI > 1

5-7 trophic boxes with HI > 1

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

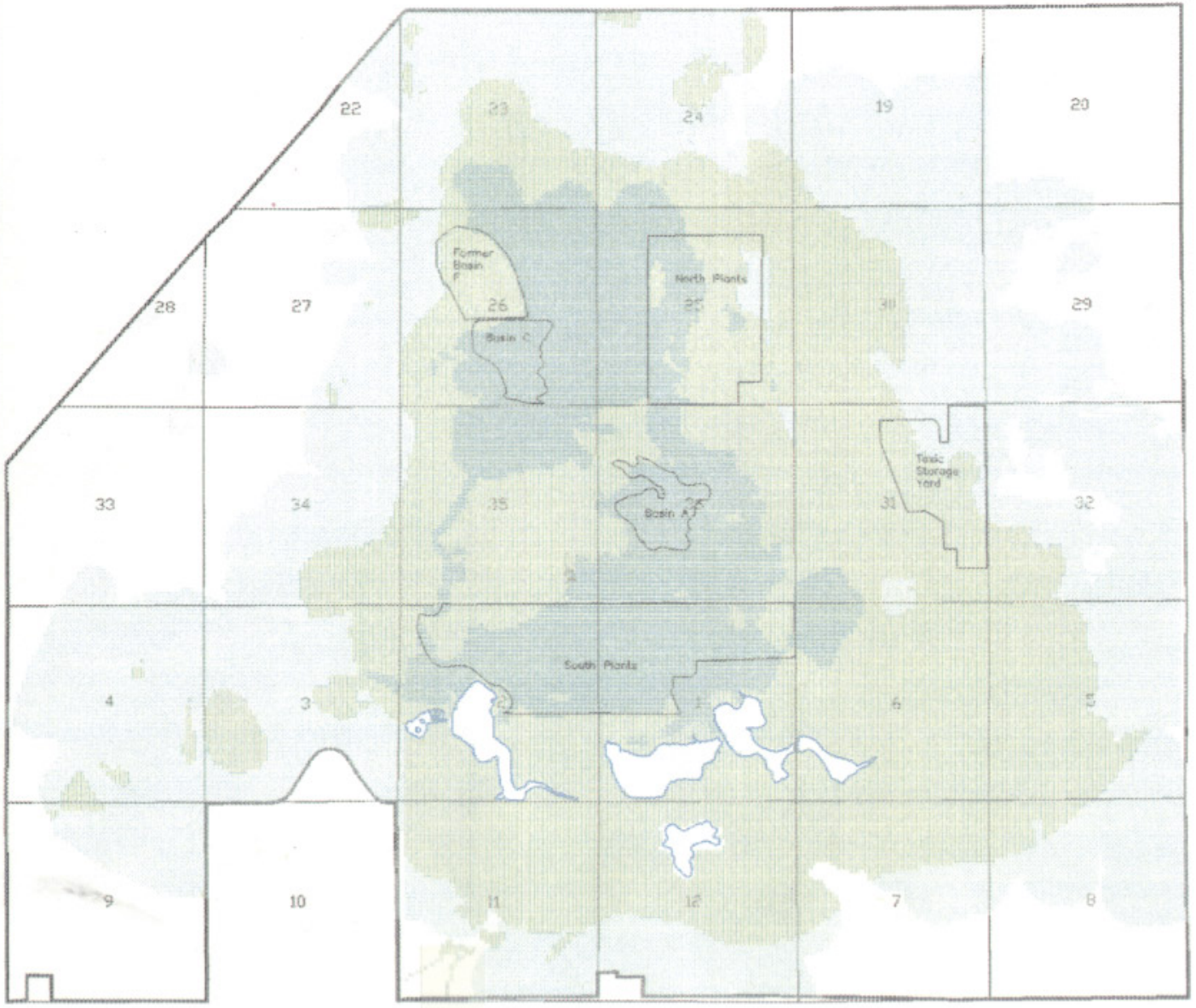
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

June 1996

Figure 6.2-2
Number of Trophic Boxes with Soil Hazard Indices Greater than 1.0 for All COCs Combined Based on the Shell Approach

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\ALLCHEM1.DWG
Date 5/14/96
Drawn by JLS
Checked by SA



Legend

1 trophic box with HI > 1

2-4 trophic boxes with HI > 1

5-7 trophic boxes with HI > 1

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:

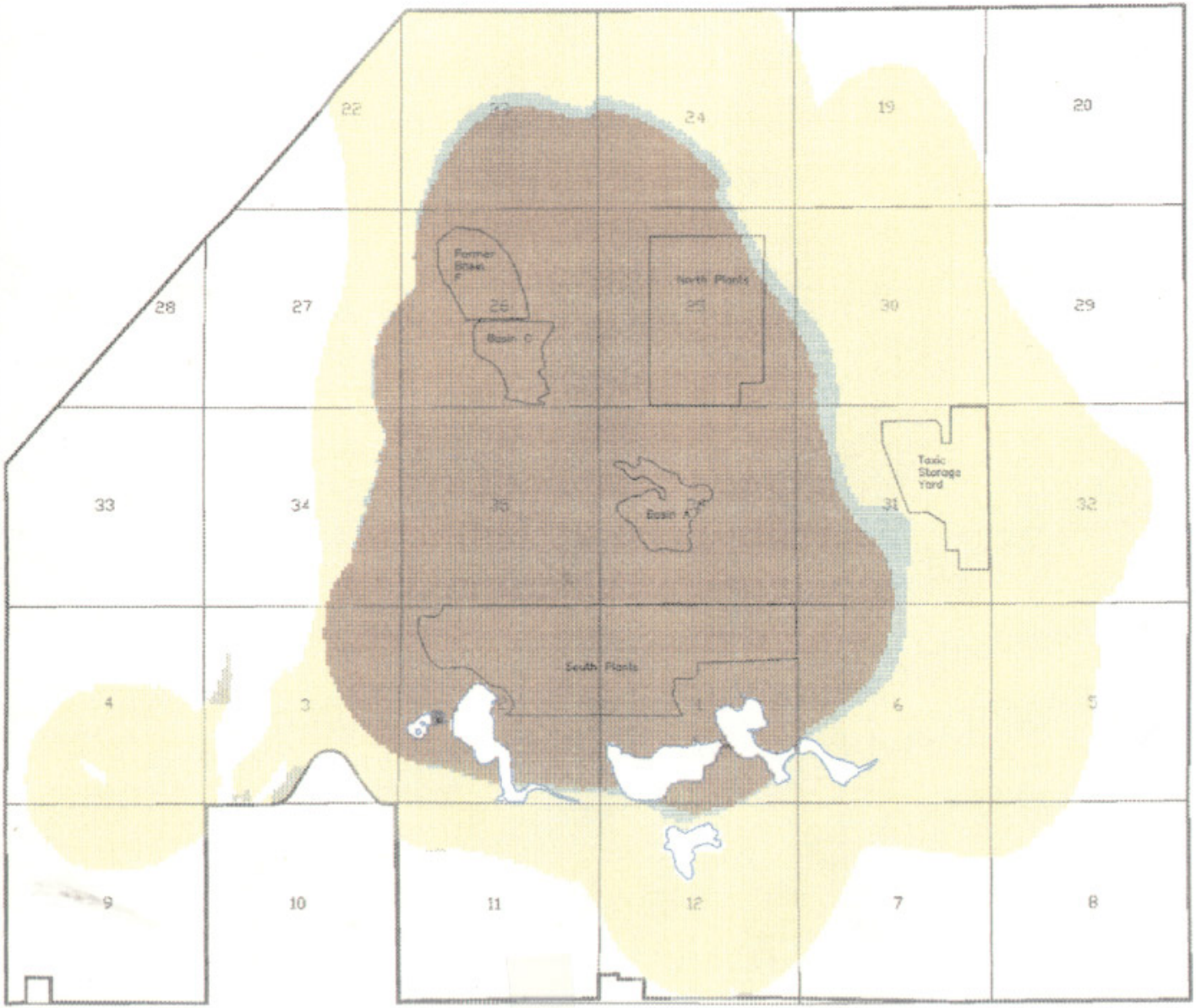
U.S. Army Program Manager
for Rocky Mountain Arsenal

June 1996

Figure 6.2-3
Number of Trophic Boxes with Soil Hazard Indices Greater than 1.0 for Aldrin/Dieldrin, DDT/DDE, and Endrin Combined Based on the Shell Approach

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\POD\OCP1.DWG
Date 5/14/96
Drawn by JLS
Checked by SA



Legend

- EPA Approach
- Army and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HQ > 1 in the areas indicated

- Lake
- 31 Section Number
- Section Line

N

0 2000 4000
Scale in Feet

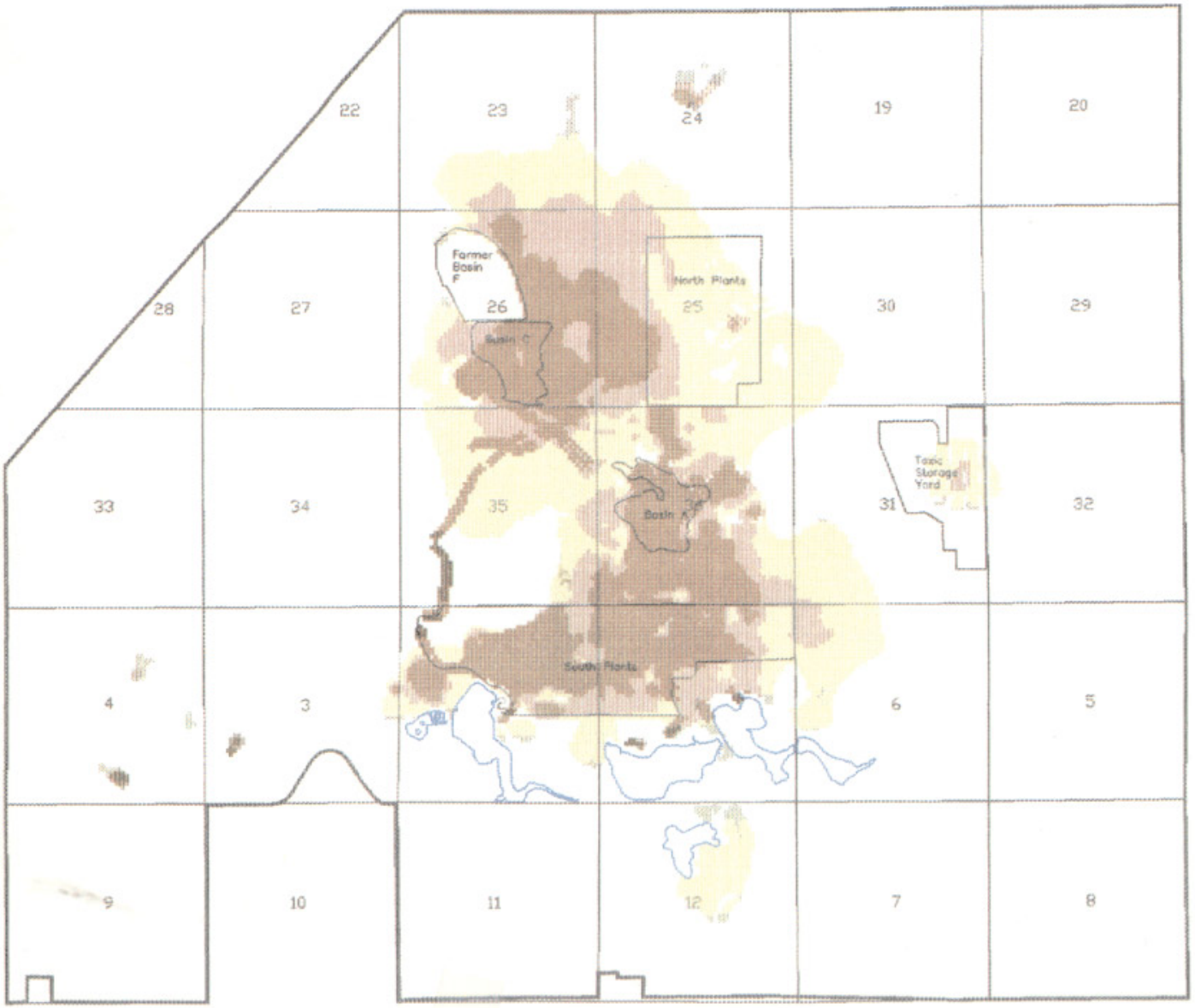
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

June 1996

Figure 6.2-4
Aldrin/Dieldrin Hazard Quotient Map (HQ>1) for the Great Horned Owl Trophic Box Based on Exceedance of TRV and using the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\OW_DRIN.DWG
Date 8/14/96
Drawn by JLS
Checked by SA



Legend

- EPA Approach
- Shell and EPA Approaches
- Army and Shell and EPA Approaches

Colors show which approaches result in HQ > 1 in the areas indicated

- Lake
- 31 Section Number
- Section Line

N

0 2000 4000
Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

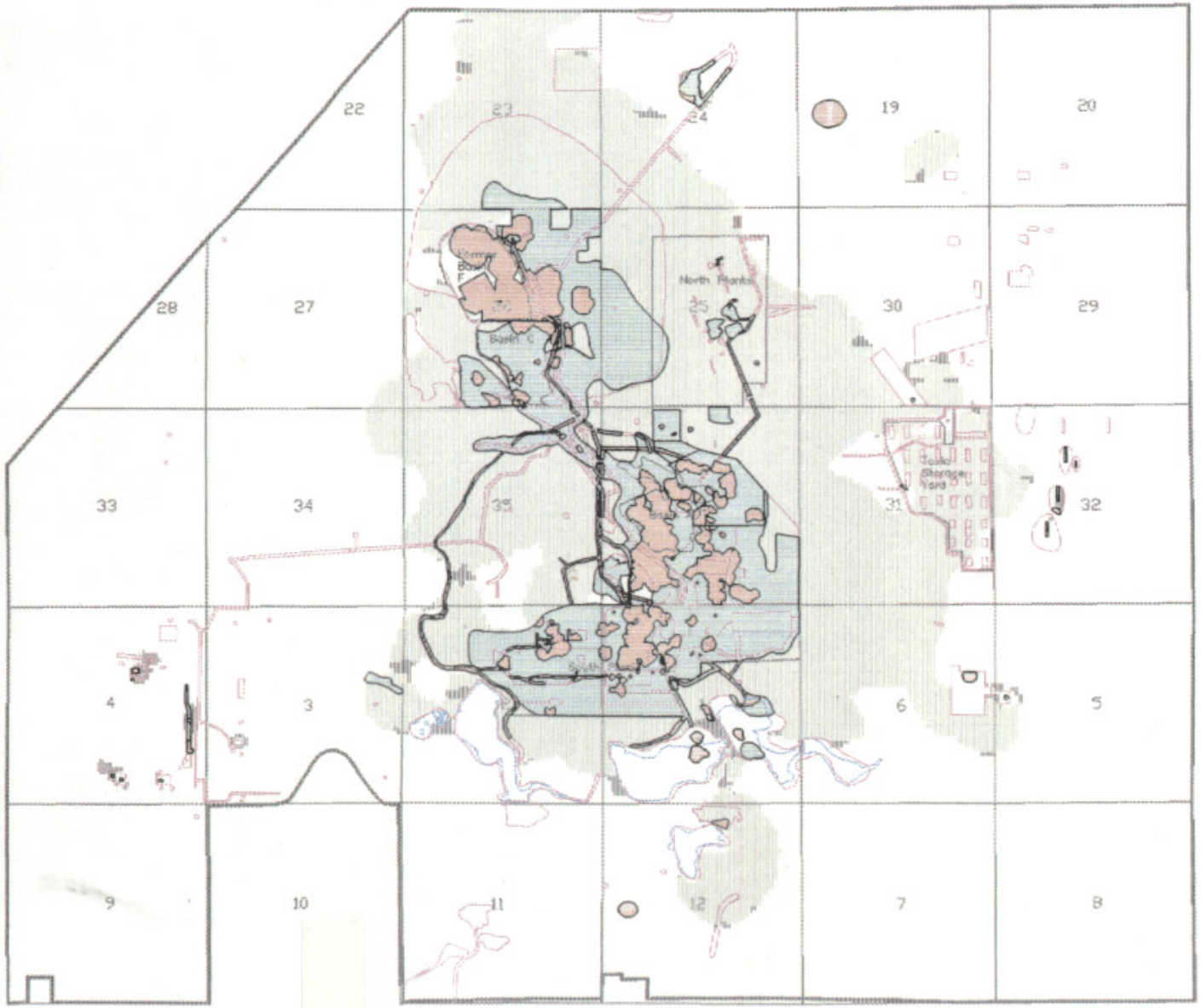
June 1996

Figure 6.2-5

Aldrin/Dieldrin Hazard Quotient Map (HQ>1) for the Small Mammal Trophic Box Based on Exceedance of TRV and using the Army, EPA, and Shell Approaches

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\SHL_DRIN.DWG
Date 5/14/96
Drawn by JLS
Checked by SA



Legend

- Area of Dispute and Prey Study Area based on MATC
- Biota Risk Area[1]
- Human Health Exceedance Area (Cancer Risk ≥ 1.0E−4; Chronic or Acute HI ≥ 1.0)
- SAR Site Boundary[2]
- Lake
- 31 Section Number
- Section Line

[1] The area in which EPA, Shell, and Army models all show small mammal HI > 1.0 for aldrin/dieldrin.

[2] Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

N

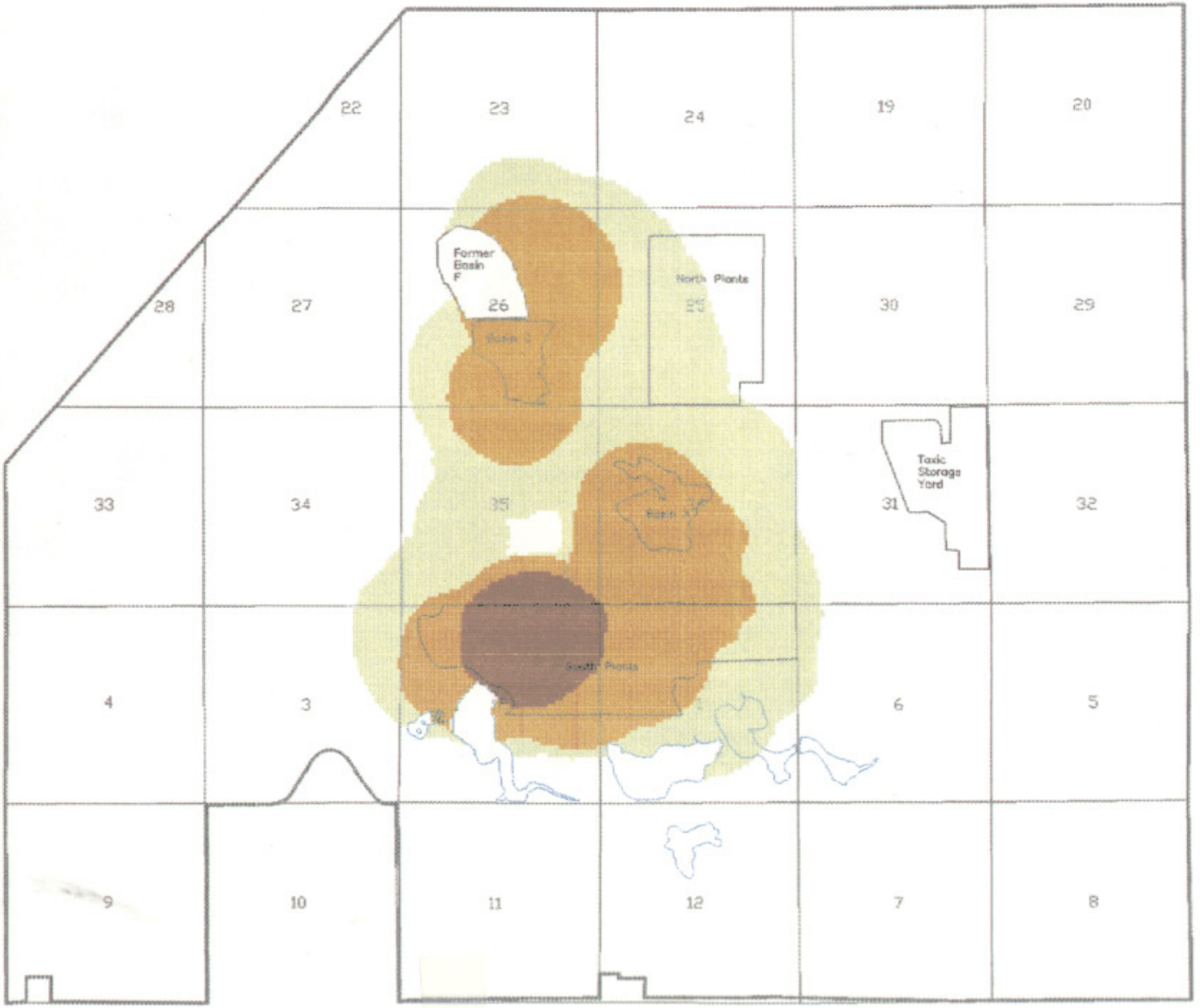
0 2000 4000
Scale in Feet

Prepared for:
U.S. Army Program Manager for Rocky Mountain Arsenal
June 1996

Figure 6.2–6
Human Health and Biota Risk Areas

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

Checked by SA | Drawn by JLS | Date 6/06/96 | File Name: F:\PROJECTS\ARSENAL\ROD\BIO_REM3.DWG



Legend

1 < HI < 10

10 ≤ HI < 100

HI ≥ 100

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

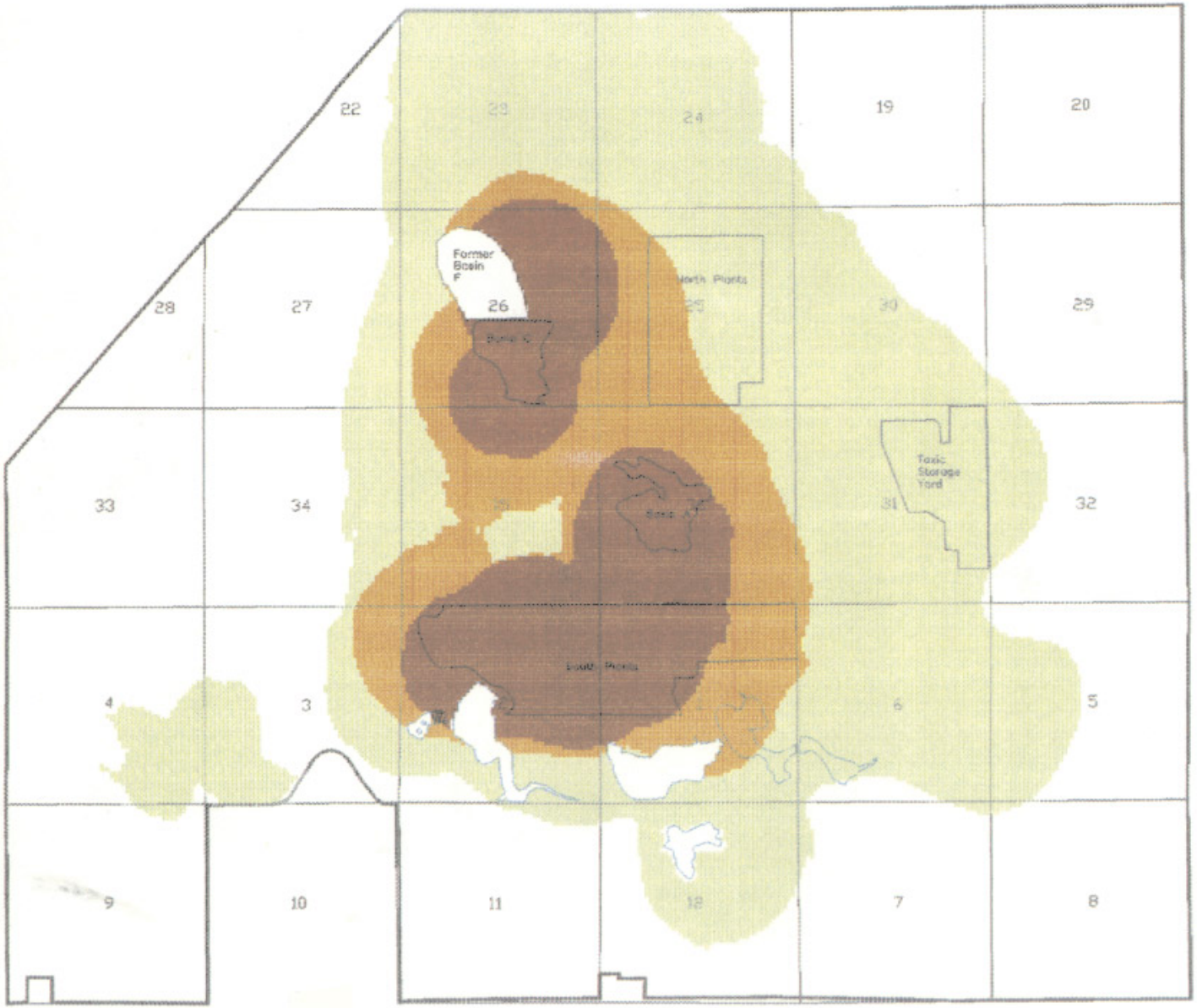
June 1996

Figure 6.2–7

Pre–Remediation Risk Distribution using Army BMF for American Kestrel

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\KESARMY.DWG
Date 5/10/96
Drawn by JLS
Checked by SA



Legend

- 1 < HI < 10
- 10 ≤ HI < 100
- HI ≥ 100

Lake

31 Section Number

Section Line

N

0 2000 4000
Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

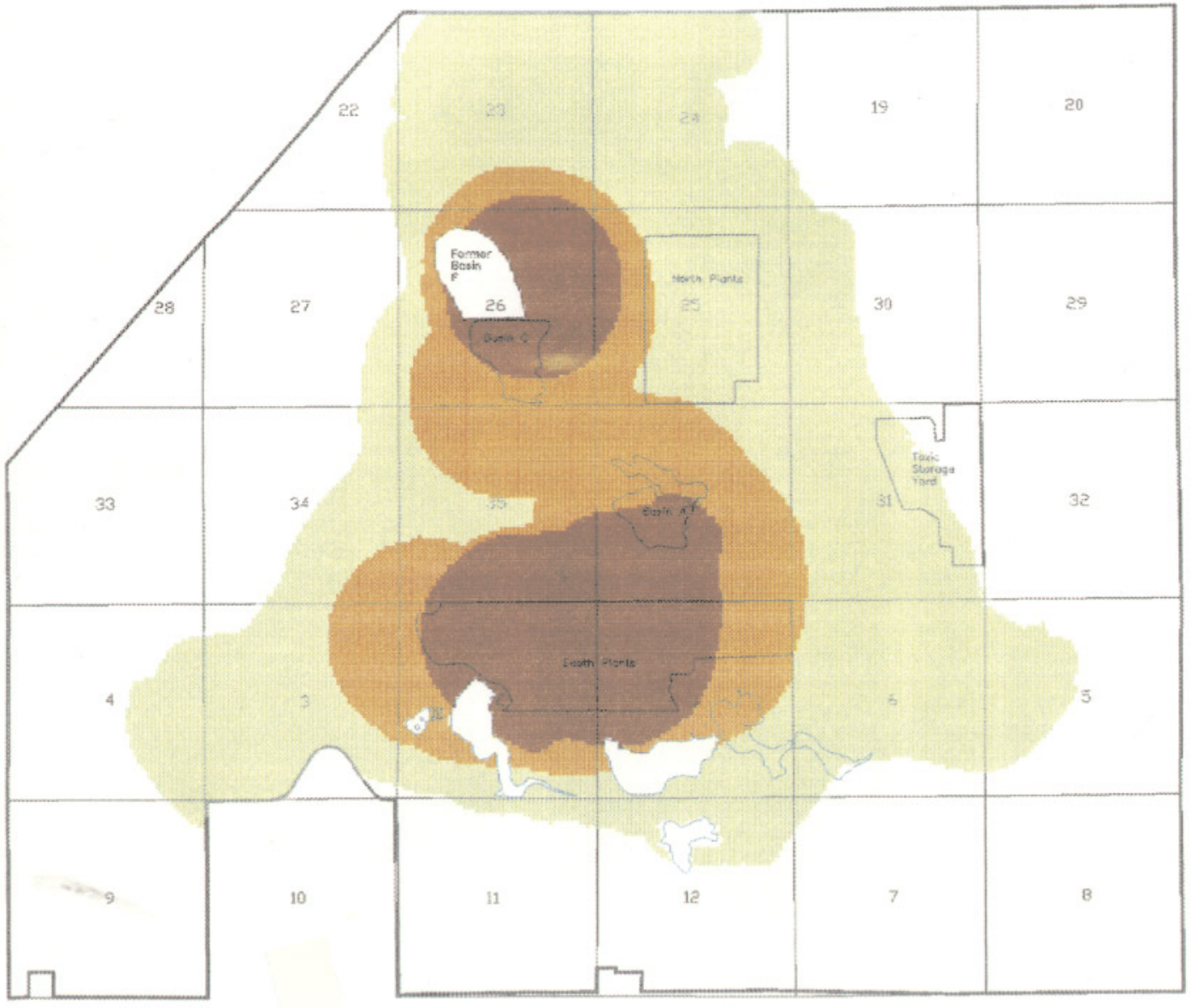
June 1996

Figure 6.2-8

Pre-Remediation Risk Distribution using EPA BMF for American Kestrel

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

Checked by SA | Drawn by JLS | Date 5/10/96 | File Name: F:\PROJECTS\ARSENAL\ROD\KESEPA.DWG



Legend

1 < HI < 10

10 ≤ HI < 100

HI ≥ 100

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

June 1996

Figure 6.2-9

Pre-Remediation Risk Distribution using Army BMF for Great Horned Owl

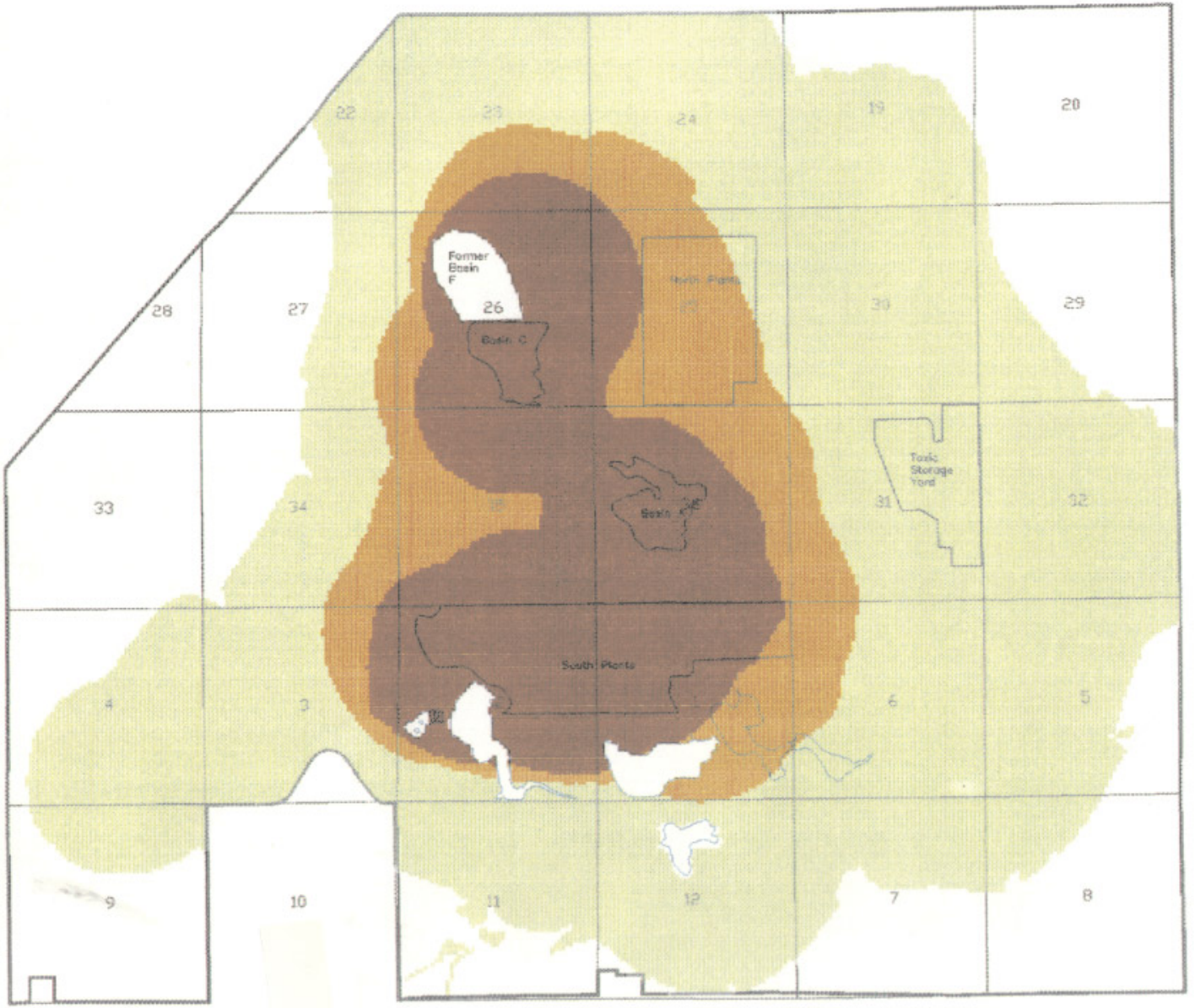
Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\OWLARMY.DWG

Date 5/10/96

Drawn by JLS

Checked by SA



Legend

1 < HI < 10

10 ≤ HI < 100

HI ≥ 100

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

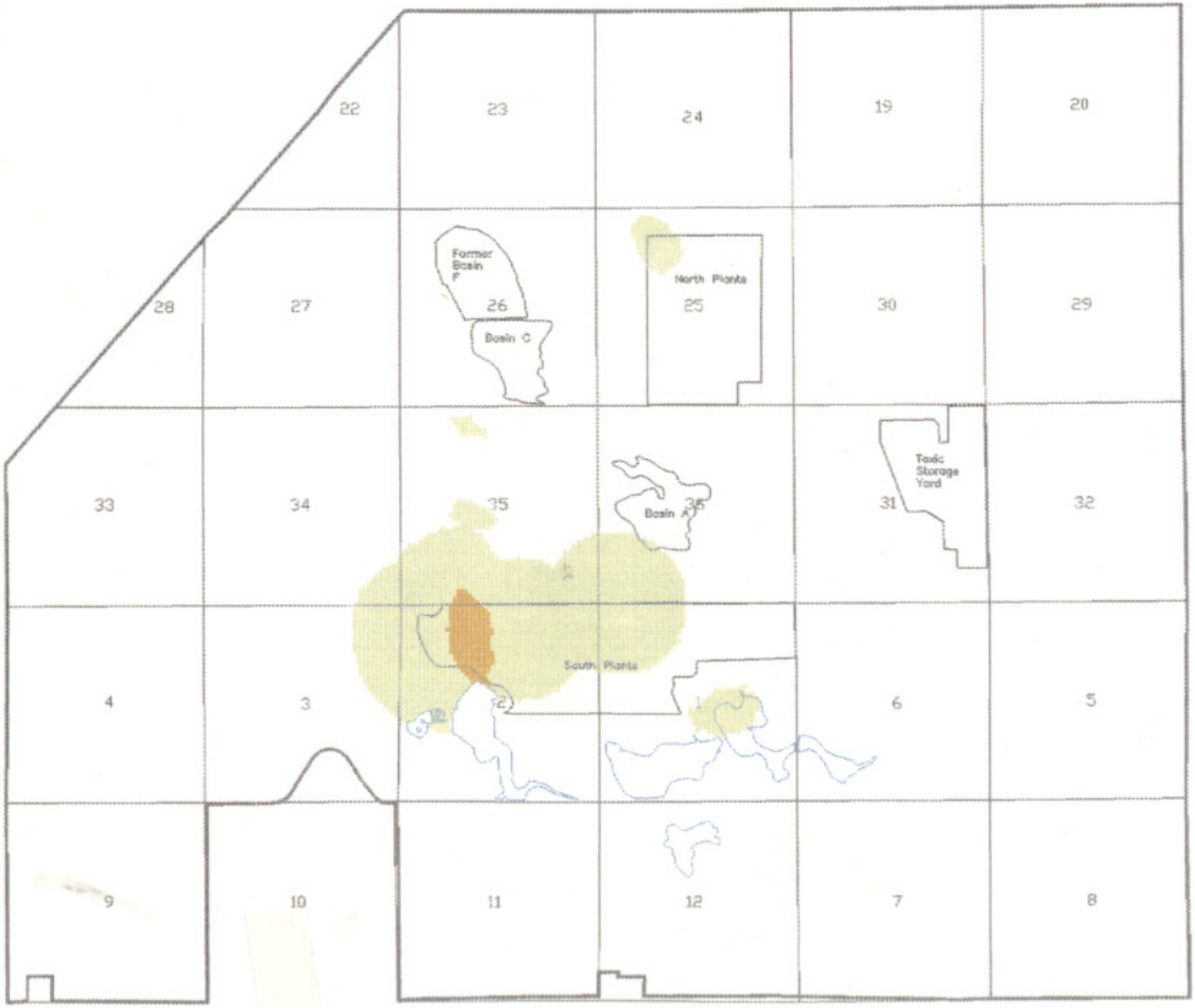
June 1996

Figure 6.2-10

Pre-Remediation Risk Distribution using EPA BMF for Great Horned Owl

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\OWLEPA.DWG
Date 5/10/96
Drawn by JLS
Checked by SA



Legend

1 < HI < 10

10 ≤ HI < 100

HI ≥ 100

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

June 1996

Figure 6.2-11

Residual Risk Distribution using
Army BMF for American Kestrel

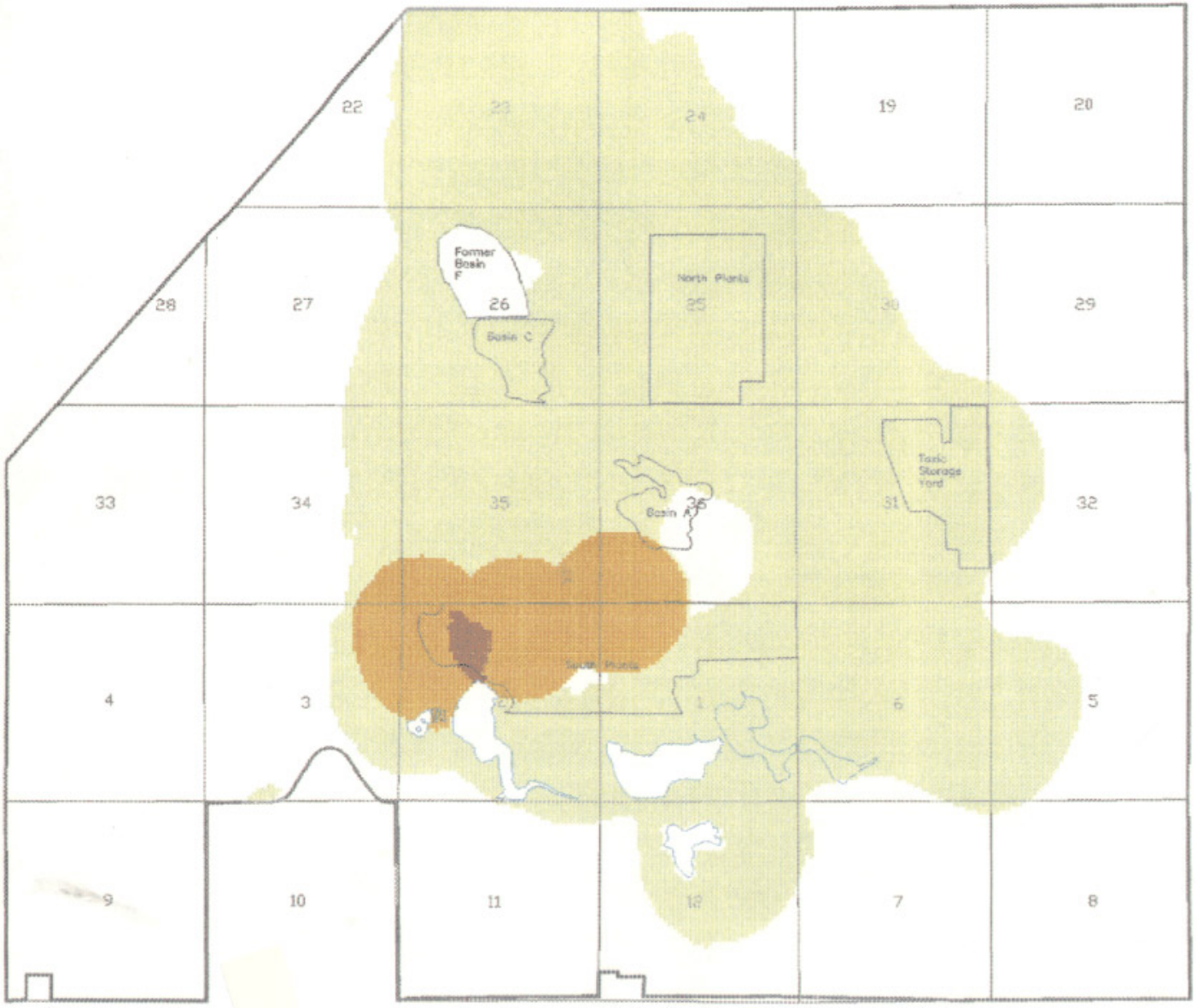
Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\KESARMYC.DWG

Date 8/10/96

Drawn by JLS

Checked by SA



Legend

- $1 < HI < 10$
- $10 \leq HI < 100$
- $HI \geq 100$

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

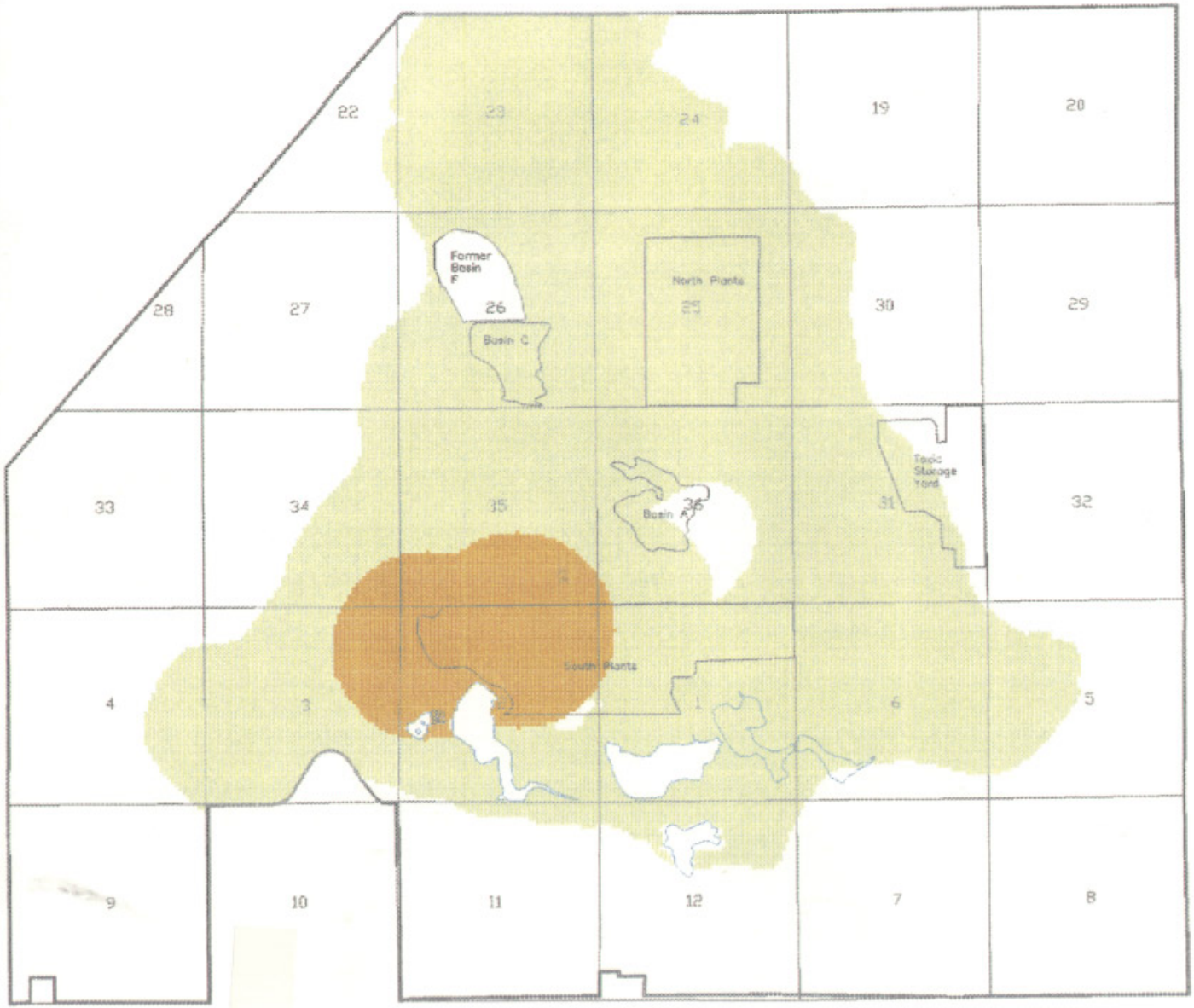
June 1996

Figure 6.2–12

Residual Risk Distribution using
EPA BMF for American Kestrel

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\KESEPAC.DWG
Date 5/10/96
Drawn by JLS
Checked by SA



Legend

1 < HI < 10

10 ≤ HI < 100

HI ≥ 100

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

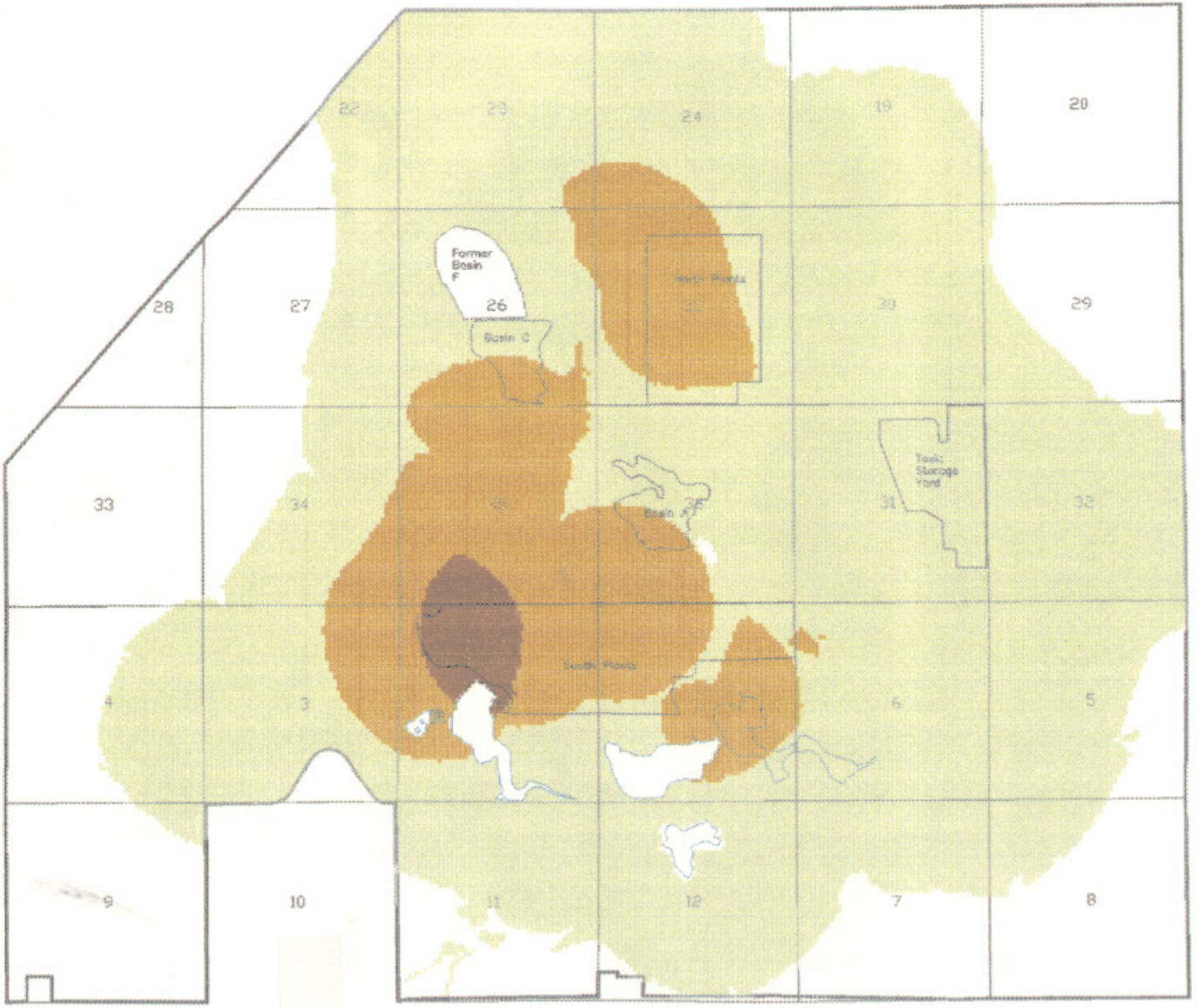
June 1996

Figure 6.2–13

Residual Risk Distribution using
Army BMF for Great Horned Owl

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

Checked by SA | Drawn by JLS | Date 5/10/96 | File Name: F:\PROJECTS\ARSENAL\ROD\OWLARMYC.DWG



Legend

1 < HI < 10

10 ≤ HI < 100

HI ≥ 100

Lake

31 Section Number

Section Line

N

0 2000 4000

Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

June 1996

Figure 6.2-14

Residual Risk Distribution using
EPA BMF for Great Horned Owl

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

Checked by SA | Drawn by JLS | Date 5/10/96 | File Name: F:\PROJECTS\ARSENAL\ROD\OWLEFAC.DWG

Table 6.1-1 Chemicals of Concern for the IEA/RC

Aldrin
Arsenic
Benzene
Cadmium
Carbon Tetrachloride
Chlordane
Chloroacetic Acid
Chlorobenzene
Chloroform
Chromium
DBCP
DCPD
DDE
DDT
1,2-Dichlororethane
1,1-Dichloroethylene
Dieldrin
Endrin
HCCPD
Isodrin
Lead
Mercury
Methylene Chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Toluene
TCE

Table 6.1-2 Soil Horizons and Exposure Pathways Evaluated for the HHRC

		Open Space Option Receptor		Economic Development Option Receptor	
Soil Horizon	Depth Interval	Biological Worker	Local Neighborhood Regulated/Casual and Recreational Visitor	Industrial Worker	Commercial Worker
Surficial Soil	0–2 inches[1]	Dir	Dir	Dir	Dir
Horizon 0	0–1 ft[2]	Dir	Dir	Dir	Dir
Horizon 1	0–10 ft[2]	Dir, Ind (Open Space)	Dir (Open Space)	Dir, Ind (Open and Enc. Space)	Dir, Ind (Enc. Space)
Horizon 2	>10 ft–Groundwater[2]	Ind (Open Space)	Not Evaluated	Ind (Open and Enc. Space)	Ind (Enc. Space)

[1] Risks for this depth horizon were calculated on a boring-by-boring basis using results of surficial soil samples collected in areas peripheral to designated sites. The surficial soil interval (0–2 inches) is not a subset of Horizon 0 (0–1 ft).

[2] Cumulative risks for these soil horizons were calculated on both a site-specific basis (representing both direct and indirect pathway exposures) and a boring-by-boring evaluation (representing direct exposure pathways only).

Dir Denotes direct soil exposure pathway evaluation (soil ingestion, dermal contact, and particulate inhalation). Dermal contact with metals in soil was not evaluated for any receptors due to negligible contaminant absorption from this exposure route.

Ind Denotes indirect vapor inhalation pathway evaluation for open space and/or enclosed space (e.g., enclosed basement structures). Both open and enclosed space soil vapor inhalation exposures were not considered to be significant for shallower depth intervals due to volatilization loss, and therefore were not evaluated for surficial soil and Horizon 0.

Table 6.1-3 Time-Dependent and Other Parameter Values

Parameter	Distribution Family	Mean	Value 50%	95%
Exposure Time (TM) (hours/day)				
Reg/casual visitor	Lognormal	2.47	1.87	6.34
Recreational visitor	Lognormal	1.8	1.38	4.96
Biological worker	Fixed Value	8		
Commercial worker	Normal	7.42	7.42	12.8
Industrial worker	Normal	7.42	7.42	12.8
Exposure Frequency (DW) (days/year)				
Reg/casual visitor	Lognormal	34.9	29.6	76.1
Recreational visitor	Lognormal	63.14	43.3	181
Biological worker	Normal	225	225	242
Commercial worker	Normal	236	236	241
Industrial worker	Normal	236	236	241
Exposure Duration (TE) (years)				
Reg/casual visitor	Lognormal	10.1	5.45	33.8
Recreational visitor	Lognormal	10.1	5.45	33.7
Biological worker	Truncated Normal	7.18	7.18	18.7
Commercial worker	Lognormal	4.38	2.32	14.8
Industrial worker	Lognormal	4.38	2.32	14.8
Basement				
Length (m)	Uniform	10	10	16.3
Width (m)	Uniform	8.5	8.5	13.45
Ventilation Flow Rate (cm^3/sec)	Triangular	617500	617500	1008960
Percent Organic Carbon (fraction) (Aquatic) in Sediments	Lognormal	0.1197716	0.1039339	0.2496338
Percent Organic Carbon (fraction) (Terrestrial) in Sediments	Lognormal	0.0038779	0.003735	0.0058623
Soil Density	Normal	1.45315	1.45315	1.752022
Soil Porosity (fraction)	Normal	0.45164	0.45164	0.5644193
Soil Temperature (celsius)	Fixed Value	9.9		
Soil Moisture (unitless)	Exponential	0.07099	0.04921	0.2126
Respiratory Deposition				
Vapor (fraction)	Fixed Value	1		
Particulate (fraction)	Fixed Value	0.85		

Table 6.1-4 Chemical-Specific Parameter Values

Chemical		Molecular Weight (g/mole)		Molecular Diffusivity (cm^2/sec)		Soil/Water Partition Coefficient (L/kg) Mean	50%	95%		Vapor Pressure (ATM) Mean	50%	95%		Henry's Law Constant (unitless) Mean	50%	95%
Aldrin	F	364.3	F	0.0407	A	298100	151800	1027000	A	5.84E-08	2.78E-08	2.07E-07	D	0.000306	0.0003033	0.0005831
Arsenic	F	74.92	F	NA	A	179.9	55.76	691		NA	NA	NA		NA	NA	NA
Benzene	F	78.11	F	0.0819	A	19034	158.1	461.3	E	0.104	0.107	0.1514207	E	0.00533	0.00533	0.007074
Cadmium	F	112.4	F	NA	A	169.9	59.2	645.2		NA	NA	NA		NA	NA	NA
Carbon Tetrachloride	F	153.8	F	0.0750	A	513	457.1	.1007	E	0.124	0.124	0.159	E	0.0237	0.0237	0.0356600
Chlordane	F	409.8	F	0.0404	A	280900	156900	925600	A	1.76E-07	4. 14E-08	6.79E-07	A	0.0002760	0.0001186	0.0010061
Chloroacetic Acid	F	94.5	F	NA	A	1.787	1.66	3.125	B	0.0004323	0 .0004323	0.0008136	A	1.28E-08	8.36E-09	3.81E-08
Chlorobenzene	F	112.5	F	0.0676	A	611.3	508.9	1378	C	0.0151	0.0151833	0.0166427	E	0.00363	0.00363	0.0044410
Chloroform	F	119.4	F	0.0834	A	86.01	81.29	141.3	E	0.241	0.241	0.3084536	E	0.0031	0.0031	0.0042152
Chromium (VI)	F	52	F	NA	A	20.91	11.16	70.52		NA	NA	NA		NA	NA	NA
DDE	F	318	F	0.00440	A	667800	579500	1392000	E	8.69E-09	8.69E-09	1.07E-08	D	7.35E-04	7.28E-04	1.41E-03
DDT	F	354.5	F	0.0423	A	1425000	653400	5099000	A	4.82E-10	3.4 1E-10	1.34E-09	D	3.49E-05	3.47E-05	6.03E-05
DBCP	F	236.4	F	0.0600	A	310.2	245.4	756.5	B	0.0053025	0 .0053025	0.0099803	A	6.61E-04	6.55E-04	1.27E-03
1,2-Dichloro-ethane	F	98.96	F	0.0856	A	38.45	36.17	64.31	E	0.0825	0.0825	0.122	A	0.0033426	0.0031828	0.0053260
1,1-Dichloro-ethylene	F	96.95	F	0.0744	A	63.13	59.57	104.4	A	0.763	0.763	0.8791	A	0.01598	0.01485	0.02792
DCPD	F	132.2	F	0.0562	A	274300	153300	904200	B	0.009292	0.009292	0.0174892	A	0.0539400	0.0330400	0.168400
Dieldrin	F	380.9	F	0.0416	A	64170	42190	190300	A	3.44E-09	1.38E-09	1.27E-08	D	3.5 1E-05	3.48E-05	6.85E-05
Endrin	F	380.9	F	0.0416	A	201600	140100	569900	D	2.50E-09	2.48E-09	4.62E-09	D	4.71E-06	4.67E-06	8.81E-06
HCCPD	F	273	F	0.0522	A	274300	153300	904200	E	0.000107	0.000107	0.0001481	A	0.0225900	0.021068	0.0389100

Table 6.1-4 Chemical-Specific Parameter Values

Chemical		Molecular Weight (g/mole)		Molecular Diffusivity (cm^2/sec)		Soil/Water Partition Coefficient (L/kg) Mean	50%	95%		Vapor Pressure (ATM) Mean	50%	95%		Henry's Law Constant (unitless) Mean	50%	95%
Isodrin	F	364.9	F	0.407	A	298100	151800	1027000	A	5.84E-08	2.78E-08	2.07E-07	D	0.000306	0.000304	0.000583
Lead	F	207.2	F	NA	A	6386000	3371	2012000		NA	NA	NA		NA	NA	NA
Mercury	F	200.6	F	NA	A	149.1	115.3	375.8		NA	NA	NA		NA	NA	NA
Methylene Chloride	F	84.94	F	0.0958	A	14.97	14.13	24.75	C	0.3347	0.327	0.5479	E	0.00236	0.00236	0.0035476
1,1,2,2-Tetra-chloroethane	F	167.9	F	0.0958	A	14.97	14.13	24.75	C	0.00725	0.00725	0.0100956	E	0.000415	0.000415	0.0005565
Tetrachloro-ethylene	F	165.9	F	0.00798	A	577.8	457.1	1409	E	0.0207	0.0207	0.0282022	D	0.0185	0.0184	0.0334
Toluene	F	92.13	F	0.0736	A	494.5	417.4	1088	C	0.0323333	0.0328564	0.0399016	C	0.00625	0.0063042	0.0068655
TCE	F	131.4		0.0749	A	455.9	317.4	1287	E	0.0826	0.0826	0.1.27	C	0.0092333	0.0093961	0.0125647

Table 6.1-4 Chemical-Specific Parameter Values

Chemical	RAF Dermal (RfD)				RAF Dermal (CPF)				RAF Oral (RfD)				RAF Oral (CPF)			
		Mean	50%	95%		Mean	50%	95%		Mean	50%	95%		Mean	50%	95%
Aldrin	B	0.00291	0.00291	0.00497	B	0.00291	0.00291	0.00497	B	0.45	0.45	0.63	B	0.45	0.45	0.63
Arsenic		NA	NA	NA		NA	NA	NA	B	0.71	0.71	0.971	B	0.71	0.71	0.971
Benzene	B	0.775	0.775	0.9775	B	0.775	0.775	0.9775	B	0.805	0.805	0.9805	B	0.805	0.805	0.9805
Cadmium		NA	NA	NA		NA	NA	NA	F	1	1	1		NA	NA	NA
Carbon Tetrachloride	B	0.845	0.845	0.9845	B	0.845	0.845	0.9845	B	0.84	0.84	0.984	B	0.84	0.84	0.984
Chlordane	B	0.023	0.023	0.041	B	0.023	0.023	0.041	B	0.805	0.805	0.9805	B	0.805	0.805	0.9805
Chloroacetic Acid	B	0.845	0.845	0.9845		NA	NA	NA	B	0.84	0.84	0.984		NA	NA	NA
Chlorobenzene	B	0.845	0.845	0.9845	B	0.845	0.845	0.9845	B	0.84	0.84	0.984		NA	NA	NA
Chloroform	B	0.75	0.75	0.93	B	0.845	0.845	0.9845	B	0.84	0.84	0.984	B	0.74	0.74	0.92
Chromium (VI)		NA	NA	NA		NA	NA	NA	F	1	1	1	F	1	1	1
DDE	B	0.022	0.022	0.04	B	0.022	0.022	0.04	B	0.805	0.805	0.9805	B	0.805	0.805	0.9805
DDT	B	0.022	0.022	0.04	B	0.022	0.022	0.04	B	0.805	0.805	0.9805	B	0.805	0.805	0.9805
DBCP	B	0.845	0.845	0.9845	B	0.845	0.845	0.9845	B	NA	NA	NA	B	0.84	0.84	0.984
1,2-Dichloro-ethane	B	0.845	0.845	0.9845	B	0.845	0.845	0.9845	B	NA	NA	NA	B	0.84	0.84	0.984
1,1-Dichloro-ethylene	B	0.845	0.845	0.9845	B	0.845	0.845	0.9845	B	0.84	0.84	0.984	B	0.84	0.84	0.984
DCPD	B	0.022	0.022	0.04		NA	NA	NA	B	0.805	0.805	0.9805		NA	NA	NA
Dieldrin	B	0.0056	0.0056	0.00956	B	0.0056	0.0056	0.00956	B	0.8	0.8	0.98	B	0.8	0.8	0.98
Endrin	B	0.022	0.022	0.04		NA	NA	NA	B	0.805	0.805	0.9805		NA	NA	NA
HCCPD	B	0.058	0.058	0.076		NA	NA	NA	B	0.805	0.805	0.9805		NA	NA	NA
Isodrin	B	0.022	0.022	0.04		NA	NA	NA	B	0.805	0.805	0.9805		NA	NA	NA
Lead		NA	NA	NA		NA	NA	NA	B	0.65	0.65	0.964		NA	NA	NA
Mercury		NA	NA	NA		NA	NA	NA	B	0.545	0.545	0.9545		NA	NA	NA

Table 6.1-4 Chemical-Specific Parameter Values

Chemical		RAF Dermal (RfD) Mean	50%	95%		RAF Dermal (CPF) Mean	50%	95%		RAF Oral (RfD) Mean	50%	95%		RAF Oral (CPF) Mean	50%	95%
Methylene Chloride	B	0.845	0.845	0.9845	B	0.845	0.845	0.9845	B	0.84	0.84	0.984	B	0.84	0.84	0.984
1,1,2,2-Tetra-chloroethane	B	0.845	0.845	0.9845	B	0.845	0.845	0.9845	B	0.84	0.84	0.984	B	0.84	0.84	0.984
Tetrachloro-ethylene	B	0.845	0.845	0.9845	B	0.845	0.845	0.9845	B	0.84	0.84	0.984	B	0.84	0.84	0.984
Toluene	B	0.91	0.91	0.991		NA	NA	NA	B	0.88	0.88	0.988		NA	NA	NA
TCE	B	0.845	0.845	0.9845	B	0.74	0.74	0.92	B	0.84	0.84	0.984	B	0.73	0.73	0.91

(A) Lognormal Distribution
(B) Uniform Distribution
(C) Triangular Distribution
(D) Uniform-Triangular Distribution
(E) Normal Distribution
(F) Fixed
(G) The cancer potency factor relative absorption factor differs from the reference dose relative absorption factor.

NA Not Applicable

Table 6.1-5 Summary of Data Sources for PPLV Direct and Indirect Equation Parameters

Parameter	Data Source (s)
Basement Parameters	
Area	Professional Judgment
Volume	Professional Judgment
Volume/Area Ratio	Professional Judgment
Depth	Professional Judgment
Ventilation Rate	Commerce City and Denver 1988 Uniform Building Codes Handbook
Time for Air Exchange	Computed as function of ventilation and basement volume
Body Weight	OHEA-EPA 1989 —Exposure Factors Handbook
Breathing Rate (BR, DINH, RB)	Professional Judgment (EPA 1985)
Density of Arsenal Soils	RMA-Specific —Walsh 1988 —SCS 1987
Dust Loading Factor (CSS)	General Literature RMA-Specific —Comprehensive Monitoring Program
Henry's Law Constant	General Literature
Molecular Weight	General Literature
Percent Organic in Aquatic Sediments	RMA-Specific —Walsh 1988
Fraction Organic Carbon in Soils	RMA-Specific —Walsh 1988

Table 6.1-5 Summary of Data Sources for PPLV Direct and Indirect Equation Parameters

Parameter	Data Source (s)
Refuge Worker Time-Dependent Variables	RMA-Specific (Shell 1991) —Shell/Army Refuge Worker Survey
Relative Absorption Factor (RAF)	
Dermal	General Literature OHEA-EPA 1991 —Interim Guidance for Dermal Exposure Assessment
Oral	General Literature
Respiratory Disposition	General Literature EPA 1982 —Air Quality Criteria for Particulate Matter and Sulfur Oxides (Denver specific data)
Soil Covering	General Literature Professional Judgment OHEA-EPA 1991 —Interim Guidance for Dermal Exposure Assessment
Soil Ingestion	General Literature Professional Judgment OSWER-EPA 1991a —Risk Assessment Guidance (OSWER Directive)
Soil Moisture Content	RMA-Specific —Comprehensive Monitoring Program —Remedial Investigation for RMA
Soil Temperature	Regional Annual Average Temperature
Soil to Water Partition Coefficient (K_{oc}) Normalized to Organic Carbon	General Literature

Table 6.1-5 Summary of Data Sources for PPLV Direct and Indirect Equation Parameters

Parameter	Data Source (s)
Skin Surface Area (SX)	Professional Judgment EPA 1985
Total Soil Porosity	Calculated from soil and particle density
Vapor Pressure	General Literature

Table 6.1-6 RME Estimates For Acute Exposure

Parameter Name	Regulated/Casual Visitors		Recreational Visitors		Commercial Workers	Industrial Workers
Soil Ingestion	2-1/2 yr	250 mg/day	2-1/2 yr	250 mg/day	100 mg/day	100 mg/day
Breathing Rate	2-1/2 yr	4.2 l/min	2-1/2 yr	8.3 l/min	4.8 m^3/day	20 m^3/day
Dust Load Factor		0.042 mg/m^3		0.042 mg/m^3	0.021 mg/m^3	0.042 mg/m^3
Pulmonary Retention		0.75		0.75	0.75	0.75
Pulmonary Absorption		1 (100 percent)		1 (100 percent)	1 (100 percent)	1 (100 percent)
Daily Exposure Period		8 hours		8 hours	8 hours	8 hours
Annual Exposure Frequency		NA	NA	NA	NA	NA
Lifetime Exposure Duration		NA	NA	NA	NA	NA
Skin Surface Area	2-1/2 yr	2,100 cm^2	2-1/2 yr	2,100 cm^2	1,120 cm^2	3,200 cm^2
Soil Covering		0.51 mg/cm^2		0.51 mg/cm^2	0.11 mg/cm^2	1.5 mg/cm^2
Soil Matrix Factor		1.0		1.0	1.0	1.0
Dermal Absorption		0.01 (metals)	0.01 (metals)		0.01 (metals)	0.01 (metals)
		0.10 (organics)	0.10 (organics)		0.10 (organics)	0.10 (organics)
Body Weight		Child: 10th percentile(M&F)[1]	Child: 10th percentile(M&F)[1]		Adult: 70 kg	Adult: 70 kg

NA Not Applicable.

[1] Determined from the average of the male and female 10th percentile bodyweights as summarized in OHEA-EPA (1989).

Table 6.1-7 RME Estimates For Subchronic Exposure

Parameter Name	Regulated/Casual Visitors		Recreational Visitors		Commercial Workers	Industrial Workers
Soil Ingestion	2-1/2 yr 6 yr	250 mg/day 250 mg/day	2-1/2 yr 6 yr	250 mg/day 250 mg/day	100 mg/day	100 mg/day
Breathing Rate	2-1/2 yr 6 yr	4.2 l/min 13.3 l/min	2-1/2 yr 6 yr	8.3 l/min 20.3 l/min	4.8 m^3/day	20 m^3/day
Dust Load Factor		0.042 mg/m^3		0.042 mg/m^3	0.021 mg/m^3	0.042 mg/m^3
Pulmonary Retention		0.75		0.75	0.75	0.75
Pulmonary Absorption		1 (100 percent)		1 (100 percent)	1 (100 percent)	1 (100 percent)
Daily Exposure Period		8 hours		8 hours	8 hours	8 hours
Annual Exposure Frequency		108 day/year		108 days/year	253 days/year	253 days/year
Lifetime Exposure Duration		7 years		7 years	7 years	7 years
Q-Factor		7 years		7 years	7 years	7 years
Skin Surface Area	2-1/2 yr 6 yr	2,100 cm^2 2,500 cm^2	2-1/2 yr 6 yr	2,100 cm^2 2,500 cm^2	1,120 cm^2	3,200 cm^2
Soil Covering		0.51 mg/cm^2		0.51 mg/cm^2	0.11 mg/cm^2	1.5 mg/cm^2
Soil Matrix Factor		1.0		1.0	1.0	1.0
Dermal Absorption		0.01 (metals) 0.10 (organics)		0.01 (metals) 0.10 (organics)	0.01 (metals) 0.10 (organics)	0.01 (metals) 0.10 (organics)
Body Weight		Child: 10th percentile(M&F)[1]		Child: 10th percentile(M&F)[1]	Adult: 70 kg	Adult: 70 kg

NA Not Applicable.

[1] Determined from the average of the male and female 10th percentile bodyweights as summarized in OHEA-EPA (1989).

Table 6.1-8 Carcinogenic Dose-Response Data

Chemical	Weight of Evidence Classification[1]	Exposure Route	Cancer Slope Factor (mg/kg/day)	Carcinogenic Dose for 10^{-6} risk (mg/kg-day)
Aldrin	B2	Oral	1.7E+01	5.90E-08
		Inhalation	1.7E+01	5.90E-08
Arsenic	A	Oral	1.75E+00	5.70E-07
		Inhalation	1.5E+01	6.70E-08
Benzene	A	Oral	2.90E-02	3.40E-05
		Inhalation	2.90E-02	3.40E-05
Cadmium	B1	Oral	NA[2]	NA
		Inhalation	6.30E+00	1.60E-07
Carbon Tetrachloride	B2	Oral	1.30E-01	7.70E-06
		Inhalation	5.25E-02	1.90E-05
Chlordane	B2	Oral	1.30E+00	7.70E-07
		Inhalation	1.30E+00	7.70E-07
Chloroacetic Acid	NE[3]	Oral	NA	NA
		Inhalation	NA	NA
Chlorobenzene	D			
Chloroform	B2	Oral	6.10E-03	1.60E-04
		Inhalation	8.00E-02	1.20E-05
Chromium (VI)	A	Oral	NA	NA
		Inhalation	4.20E+01	2.40E-08
DBCP	B2	Oral	1.40E+00	7.10E-07
		Inhalation	2.40E-03	4.20E-04
DCPD	NE	Oral	NA	NA
		Inhalation	NA	NA
DDE	B2	Oral	3.40E-01	2.90E-06
		Inhalation	3.40E-01[4]	2.90E-06
DDT	B2	Oral	3.40E-01	2.90E-06
		Inhalation	3.40E-01	2.90E-06
1,2-Dichloroethane	B2	Oral	9.10E-02	1.10E-05
		Inhalation	9.10E-02	1.10E-05
1,1-Dichloroethylene	C	Oral	6.00E-01	1.70E-06
		Inhalation	1.80E-01	5.70E-06
Dieldrin	B2	Oral	1.60E+01	6.20E-08
		Inhalation	1.60E+01	6.20E-08
Endrin	D			
HCCPD	D			
Isodrin	NE	Oral	NA	NA
		Inhalation	NA	NA
Lead	B2	Oral	NA	NA
		Inhalation	NA	NA
Mercury	D			
Methylene Chloride	B2	Oral	7.50E-03	1.30E-04
		Inhalation	1.60E-03	6.10E-04
1,1,2,2-Tetrachloroethane	C	Oral	2.00E-01	5.00E-06
		Inhalation	2.00E-01	5.00E-06
Tetrachloroethylene	B2	Oral	5.10E-02	2.00E-05
		Inhalation	1.80E-03	5.50E-04

Table 6.1-8 Carcinogenic Dose-Response Data

Chemical	Weight of Evidence Classification[1]	Exposure Route	Cancer Slope Factor (mg/kg/day)	Carcinogenic Dose for 10^{-6} risk (mg/kg-day)
Toluene	D			
TCE	B2	Oral	1.10E-02	9.10E-05
		Inhalation	5.90E-03	1.70E-04

[1] A = Human carcinogen.
B1/B2 = Probable human carcinogen.
B1 = Indicates limited human data are available.
B2 = Indicates sufficient evidence in animals and inadequate or no evidence in humans.
C = Possible human carcinogen.
D = Not classifiable as a carcinogen.

[2] NA denotes Not Applicable.

[3] NE denotes no Weight of Evidence Classification Assigned.

[4] Inhalation cancer slope factor for DDE not available. Value shown is direct extrapolation from oral pathway.

Table 6.1-9 Chronic Noncarcinogenic Dose-Response Data

Chemical	Route of Exposure	Chronic RfD (mg/kg-day)
Aldrin	Oral	3.00E-05
	Inhalation	3.00E-05[1]
Arsenic	Oral	3.00E-04
	Inhalation	3.00E-04[1]
Benzene	Oral	NA[2]
	Inhalation	NA
Cadmium	Oral, water	5.00E-04
	Oral, food	1.00E-03
Carbon Tetrachloride	Oral	7.00E-04
	NA	7.00E-04[1]
Chlordane	Oral	6.00E-05
	Inhalation	6.00E-05[1]
Chloroacetic Acid	Oral	2.00E-03
	Inhalation	2.00E-03[1]
Chlorobenzene	Oral	2.00E-02
	Inhalation	5.00E-03
Chloroform	Oral	1.00E-02
	Inhalation	1.00E-02[1]
Chromium (VI)	Oral	5.00E-03
	Inhalation	6.00E-07
DBCP	Oral	2.00E-04
	Inhalation	6.00E-05[3]
DCPD	Oral	3.00E-02
	Inhalation	6.00E-05
DDE	Oral	NA
	Inhalation	NA
DDT	Oral	5.00E-04
	Inhalation	5.00E-04[1]
1,2-Dichloroethane	Oral	NA
	Inhalation	NA
1,1-Dichloroethylene	Oral	9.00E-03
	Inhalation	9.00E-03[1]
Dieldrin	Oral	5.00E-05
	Inhalation	5.00E-05 [1]
Endrin	Oral	3.00E-04
	Inhalation	3.00E-04[1]
HCCPD	Oral	7.00E-03
	Inhalation	2.00E-05
Isodrin	Oral	7.00E-05
	Inhalation	7.00E-05

Table 6.1-9 Chronic Noncarcinogenic Dose-Response Data

Chemical	Route of Exposure	Chronic RfD (mg/kg-day)
Lead	Oral	1.40E-03
	Inhalation	4.30E-04
Mercury	Oral	3.00E-04
	Inhalation	9.00E-05 [3]
Methylene Chloride	Oral	6.00E-02
	Inhalation	8.60E-01
1,1,2,2-Tetrachloroethane	Oral	NA
	Inhalation	NA
Tetrachloroethylene	Oral	1.00E-02
	Inhalation	1.00E-02 [1]
Toluene	Oral	2.00E-01
	Inhalation	1.10E-01 [3]
TCE	Oral	NA
	Inhalation	NA

1 Inhalation RfD for chemical not available. Value shown is direct extrapolation from oral pathway.
2 NA denotes Not Available.
3 Inhalation RfD extrapolated from RfC, assuming inhalation of 20 cubic meters/day and body weight of 70 kg.

Table 6.1-10 D_T Values For Acute and Subchronic Exposure

Contaminant	Acute		Subchronic	
	D_TING (mg/kg-day)	D_TINH (mg/kg-day)	D_TING (mg/kg-day)	D_TINH (mg/kg-day)
Aldrin	1.0E-04	1.0E-04	1.0E-04	1.0E-04
Arsenic	8.0E-03	2.9E-04	1.0E-03	2.9E-04
Atrazine	1.0E-02	1.0E-02	5.0E-03	5.0E-03
Benzene	NA	NA	NA	NA
Benzothiazole	NA	NA	NA	NA
BCHPD	NA	NA	NA	NA
Cadmium	4.0E-03	1.4E-01	5.0E-04	5.0E-04
Carbon tetrachloride	4.0E-01	1.8E-01	7.0E-03	2.7E-02
Chlordane	6.0E-03	6.0E-03	6.0E-05	1.4E-04
Chloroacetic acid	NA	NA	2.0E-02	2.0E-02
Chlorobenzene	2.0E-01	2.0E-01	2.0E-01	5.0E-02
Chloroform	1.8E-01	4.3E-01	1.0E-02	6.8E-03
CPMS	NA	NA	NA	NA
Chlorophenylmethyl sulfoxide	NA	NA	NA	NA
$CPMSO_2$	NA	NA	NA	NA
Chromium VI	1.0E-01	1.0E-01	2.0E-02	5.7E-06
Copper	NA	NA	NA	NA
DBCP	5.0E-03	5.0E-03	NA	NA
DDE	NA	NA	NA	NA
DDT	5.0E-04	5.0E-04	5.0E-04	5.0E-04
1,1-Dichloroethane	NA	NA	1.0E+00	1.0E+00
1,2-Dichlorethane	NA	NA	NA	NA
1,1-Dichlorethylene	2.0E+00	1.0E+00	9.0E-03	2.3E-02
1,2-Dichloroethylene	NA	NA	1.0E-01	1.0E-01
DCPD	NA	NA	3.0E-01	6.0E-04
Dieldrin	1.0E-04	1.0E-04	1.0E-04	1.0E-04
DIMP	8.0E-01	8.0E-01	8.0E-01	8.0E-01
Dimethyl disulfide	NA	NA	NA	NA
Dimethylmethyl phosphonate	NA	NA	NA	NA

Table 6.1-10 D_T Values For Acute and Subchronic Exposure

Contaminant	Acute		Subchronic	
	D_TING (mg/kg-day)	D_TINH (mg/kg-day)	D_TING (mg/kg-day)	D_TINH (mg/kg-day)
Dithiane	NA	NA	NA	NA
Endrin	2.0E-03	2.0E-03	5.0E-04	5.0E-04
Ethylbenzene	3.0E+00	3.0E+00	1.0E+00	2.8E-01
Fluoroacetic acid	NA	NA	NA	NA
HCCPD	NA	NA	7.0E-02	2.0E-04
Isodrin	NA	NA	NA	NA
Isopropylmethyl phosphonic acid	NA	NA	NA	NA
Isopropylmethyl phosphonate	NA	NA	NA	NA
Lead	NA	NA	NA	NA
Lewisite	NA	NA	NA	NA
Lewisite oxide	NA	NA	NA	NA
Malathion	2.0E-02	2.0E-02	2.0E-02	2.0E-02
Mercury(inorganic)	2.0E-01	2.0E-01	3.0E-04	8.5E-05
Methylene chloride	1.0E+00	4.9E+00	6.0E-02	8.5E-01
Methyl isobutyl ketone	NA	NA	5.0E-01	2.0E-01
NDMA	NA	NA	NA	NA
1,4-Oxathiane	NA	NA	NA	NA
Parathion	NA	NA	6.0E-03	6.0E-03
Sarin	NA	NA	NA	5.7E-07
Sulfur mustard	NA	NA	NA	NA
Supona	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethylene	2.0E-01	1.9E+00	1.0E-01	1.7E-01
Thiodiglycol	NA	NA	NA	NA
Toluene	2.0E+00	4.3E+00	2.0E+00	5.7E-01
1,1,1-Trichloroethane	1.0E+01	4.0E-01	9.0E-01	2.8E+00
1,1,2-Trichloroethane	6.0E-02	4.0E-02	4.0E-02	4.0E-02
TCE	2.4E+00	4.3E-01	2.5E+00	2.5E+00
Vapona	NA	NA	NA	NA

Table 6.1-10 D_T Values For Acute and Subchronic Exposure

Contaminant	Acute		Subchronic	
	D_TING (mg/kg-day)	D_TINH (mg/kg-day)	D_TING (mg/kg-day)	D_TINH (mg/kg-day)
M-xylene	4.0E+00	4.0E+00	4.0E+00	1.0E+00
O,p-Xylene	4.0E+00	4.0E+00	4.0E+00	8.5E-02
Zinc	NA	NA	2.0E-01	2.0E-01

NA Dose-response data not available from EPA.
D_TING Allowable dose for ingestion
D_TING Allowable dose for inhalation

Table 6.1-11 Summary of Chronic Cumulative Direct Soil PPLVs for the 5th Percentile[1,2] Page 1 of 1

	Receptor-Specific Soil PPLVs (Units: mg/kg)				
	Open Space Populations			Economic Development Populations	
Chemical	Biological Worker	Regulated/ Casual Visitor	Recreational Visitor	Industrial Worker	Commercial Worker
Aldrin	**7.16E-01**	1.16E+01	3.29E+00	3.02E+00	4.71E+00
Benzene	1.18E+01	5.76E+01	1.30E+01	**1.04E+01**	2.26E+02
Carbon Tetrachloride	2.51E+00	1.32E+01	2.69E+00	**2.33E+00**	5.14E+01
Chlordane	**3.72E+00**	5.39E+01	1.09E+01	7.58E+00	2.66E+01
Chloroacetic Acid*	1.01E+02	8.13E+02	2.34E+02	**7.71E+01**	1.88E+03
Chlorobenzene*	9.66E+02	6.95E+03	2.55E+03	**8.45E+02**	1.68E+04
Chloroform	**4.82E+01**	3.23E+02	8.91E+01	4.84E+01	1.11E+03
DDE	**1.25E+01**	1.77E+02	3.05E+01	1.87E+01	1.26E+02
DDT	**1.35E+01**	1.51E+02	3.60E+01	3.61E+01	9.58E+01
DBCP	**2.01E-01**	1.17E+00	2.52E-01	2.36E-01	4.51E+00
1,2-Dichloroethane	**3.23E+00**	1.74E+01	3.75E+00	3.39E+00	7.07E+01
1,1-Dichloroethylene	**5.16E-01**	2.82E+00	7.33E-01	5.21E-01	1.02E+01
DCPD*	**3.69E+03**	6.11E+04	2.91E+04	6.65E+03	5.83E+04
Dieldrin	**4.14E-01**	6.45E+00	1.96E+00	1.40E+00	2.54E+00
Endrin*	**2.32E+02**	2.99E+03	8.65E+02	3.18E+02	1.12E+03
HCCPD*	**1.06E+03**	1.47E+04	6.16E+03	1.78E+03	1.67E+04
Isodrin*	**5.24E+01**	6.43E+02	2.15E+02	7.39E+01	2.51E+02
Methylene Chloride	**3.53E+01**	2.06E+02	4.58E+01	4.43E+01	7.78E+02
1,1,2,2-Tetrachloroethane	**1.45E+00**	1.94E+00	9.61E+00	1.49E+00	3.31E+01
Tetrachloroethylene	**5.43E+00**	3.57E+01	6.26E+00	5.87E+00	1.30E+02
Toluene*	9.46E+03	6.48E+04	2.11E+04	**7.22E+03**	1.38E+05
TCE	**2.84E+01**	1.78E+02	3.98E+01	2.90E+01	6.27E+02
Metals (Indicator Level[3])					
Arsenic (IL = 10 ppm, >driving PPLV)	**4.17E+00**	7.91E+01	3.68E+01	2.60E+01	2.60E+01
Cadmium (IL = 2.0 ppm)	**5.01E+01**	8.55E+02	2.17E+02	2.12E+02	1.87E+03
Chromium (IL = 40 ppm, >driving PPLV)	**7.52E+00**	1.29E+02	3.28E+01	3.23E+01	2.36E+02
Lead* (IL = 40 ppm)	**2.17E+03**	4.77E+04	2.65E+04	4.46E+03	7.06E+03
Mercury* (IL = 0.1 ppm)	**5.74E+02**	9.85E+03	5.49E+03	1.24E+03	1.35E+03

* Denotes a noncarcinogen. No asterisk denotes PPLV based on carcinogenic slope factors for both oral and inhalation pathways.

1 Cumulative direct PPLVs represent a cancer risk level of 10^{-6} for carcinogens; the PPLV at a 10^{-4} cancer risk is 100 times higher than the values shown in this table. Values in bold face represent the driver PPLVs for the corresponding receptor population.

2 Summaries of dominant exposure pathways comprising the cumulative (5th percentile) direct PPLV are provided in Appendix Section B.4.1 of the IEA/RC report for each receptor population evaluated (Appendix Tables B.4.1-1 through B.4.1-5). As shown in these tables, the majority of PPLVs listed above reflect the carcinogenic endpoint. Also, for most chemicals, dermal absorption was the driver exposure pathway. The only exceptions were certain OCPs (aldrin, DDE, endrin, and isodrin), for which soil ingestion was the driver pathway, and metals, for which ingestion or inhalation pathways were drivers.

3 Indicator level is the assumed background concentration for the inorganic COCs.

Table 6.1-12 Summary of Chronic Cumulative Direct Soil PPLVs for the 50th Percentile[1] Page 1 of 1

	Receptor-Specific Soil PPLVs (Units: mg/kg)				
	Open Space Populations			Economic Development Populations	
Chemical	Biological Worker	Regulated/ Casual Visitor	Recreational Visitor	Industrial Worker	Commercial Worker
Aldrin	**4.27E+00**	1.10E+02	9.43E+01	1.52E+01	3.89E+01
Benzene	**3.43E+01**	6.21E+02	3.26E+02	1.04E+02	1.53E+03
Carbon Tetrachloride	**7.69E+00**	1.28E+02	6.75E+01	1.94E+01	3.05E+02
Chlordane	**1.97E+01**	3.30E+02	2.35E+02	5.03E+01	2.53E+02
Chloroacetic Acid*	2.19E+02	2.84E+03	1.31E+03	**1.67E+02**	2.60E+03
Chlorobenzene*	2.19E+03	2.88E+04	1.28E+04	**1.61E+03**	2.50E+04
Chloroform	**1.91E+02**	3.08E+03	1.66E+03	4.58E+02	7.48E+03
DDE	**7.13E+01**	1.28E+03	8.10E+02	1.95E+02	8.22E+02
DDT	**6.49E+01**	1.29E+03	1.01E+03	2.20E+02	9.01E+02
DBCP	**7.24E-01**	1.24E+01	6.21E+00	1.89E+00	2.89E+01
1,2-Dichloroethane	**1.07E+01**	1.88E+02	9.14E+01	2.99E+01	3.99E+02
1,1-Dichloroethylene	**1.57E+00**	2.94E+01	1.52E+01	4.53E+00	6.83E+01
DCPD*	**8.12E+03**	2.17E+05	2.09E+05	1.66E+04	1.33E+05
Dieldrin	**2.45E+00**	5.73E+01	4.81E+01	8.42E+00	2.27E+01
Endrin*	**6.42E+02**	1.28E+04	6.72E+03	6.81E+02	3.41E+03
HCCPD*	**2.22E+03**	6.12E+04	4.05E+04	6.80E+03	3.32E+04
Isodrin*	**1.48E+02**	2.67E+03	1.56E+03	1.55E+02	7.76E+02
Methylene Chloride	**1.27E+02**	2.04E+03	1.19E+03	3.51E+02	5.32E+03
1,1,2,2-Tetrachloroethane	**5.16E+00**	9.04E+01	4.55E+01	1.32E+01	1.97E+02
Tetrachloroethy lene	**1.92E+01**	3.64E+02	1.86E+02	5.33E+01	7.51E+02
Toluene*	2.04E+04	1.74E+05	9.02E+04	**1.46E+04**	1.76E+05
TCE	**1.03E+02**	1.84E+03	8.83E+02	2.79E+02	4.62E+03
Metals (Indicator Level[2])					
Arsenic (IL = 10 ppm, >driving PPLV)	**2.64E+01**	9.38E+02	9.02E+02	1.38E+02	2.44E+02
Cadmium (IL = 2.0 ppm)	**3.10E+02**	1.24E+04	1.36E+04	2.34E+03	2.19E+04
Chromium (IL = 40 ppm, >driving PPLV)	**4.72E+01**	1.89E+03	2.16E+03	3.56E+02	4.21E+03
Lead* (IL = 40 ppm)	**7.22 E+03**	2.37E+05	2.18E+05	1.68E+04	2.40E+04
Mercury* (IL = 0.1 ppm)	**1.80E+03**	6.82E+04	6.81E+04	4.35E+03	5.96E+03

* Denotes a noncarcinogen. No asterisk denotes PPLV based on carcinogenic slope factors for both oral and inhalation pathways.

1 Cumulative direct PPLVs represent a cancer risk level of 10^{-6} for carcinogens; the PPLV at a 10^{-4} cancer risk is 100 times higher than the values shown in this table. Values in bold face represent the driver PPLVs for corresponding receptor population.

2 Indicator level is the assumed background concentration for the inorganic COCs.

Table 6.1-13 Summary of 5th Percentile Direct Single-Pathway PPLVS for the Biological Worker[1]

Chemical Name	Soil Ingestion SPPLV	Soil Inhalation SPPLV	Dermal Absorption SPPLV	Cumulative Direct PPLV-CARC[2]	Cumulative Direct PPLV-NONCARC[2]
Aldrin	**7.64E-01**	9.56E+01	1.30E+01	7.16E-01	7.12E+01
Benzene	1.29E+02	1.02E+04	**1.30E+01**	1.18E+01	NA
Carbon Tetrachloride	8.14E+01	1.20E+04	**2.59E+00**	2.51E+00	3.63E+01
Chlordane	2.71E+01	7.18E+02	**4.34E+00**	3.72E+00	5.51E+01
Chloroacetic Acid	3.98E+03	3.74E+05	**1.04E+02**	NA	1.01E+02
Chlorobenzene	4.12E+04	9.36E+05	**9.91E+02**	NA	9.66E+02
Chloroform	4.58E+03	1.12E+04	**4.90E+01**	4.82E+01	4.41E+02
DDE	**1.96E+01**	1.88E+03	3.53E+01	1.25E+01	NA
DDT	3.02E+01	1.84E+03	**2.47E+01**	1.35E+01	4.09E+02
DBCP	2.96E+00	1.27E+05	**2.16E-01**	2.01E-01	9.75E+00
1,2-Dichloroethane	1.13E+02	6.97E+03	**3.32E+00**	3.23E+00	NA
1,1-Dichloroethylene	1.84E+01	3.61E+03	**5.31E-01**	5.16E-01	4.52E+02
Dicyclopentadiene	3.72E+04	**4.24E+03**	1.20E+05	NA	3.69E+03
Dieldrin	**5.90E-01**	4.02E+01	1.43E+00	4.14E-01	5.77E+01
Endrin	**2.43E+02**	3.76E+04	6.47E+03	NA	2.32E+02
Hexachlorocyclopentadiene	9.74E+03	**1.41E+03**	7.48E+03	NA	1.06E+03
Isodrin	**1.02E+02**	4.42E+03	1.10E+02	NA	5.24E+01
Methylene Chloride	9.51E+02	3.95E+05	**3.66E+01**	3.53E+01	3.11E+03
1,1,2,2-Tetrachloroethane	2.30E+01	1.51E+03	**1.55E+00**	1.45E+00	NA
Tetrachloroethylene	6.05E+02	5.13E+05	**5.48E+00**	5.43E+00	5.47E+02
Toluene	4.69E+05	1.00E+06	**9.75E+03**	NA	9.46E+03
Trichloroethylene	1.41E+03	1.08E+05	**2.90E+01**	2.84E+01	NA
Arsenic	**4.36E+00**	9.56E+01	0.00E+00	4.17E+00	4.76E+02
Cadmium	3.47E+04	**5.01E+01**	0.00E+00	5.01E+01	5.29E+02
Chromium	3.47E+05	**7.52E+00**	0.00E+00	7.52E+00	3.87E+01
Lead	**2.22E+03**	9.28E+04	0.00E+00	NA	2.17E+03
Mercury	**6.24E+02**	7.17E+03	0.00E+00	NA	5.74E+02

1 Values reported as mg/kg. Values are 5th percentile PPLVs, based on a 10^{-6} risk level for carcinogens, and an HI of 1.0 for noncarcinogens. Values in bold face represent the driver exposure pathway.

2 Where a chemical is both a carcinogen (CARC) and noncarcinogen (NONCARC), the single-pathway PPLVs summarized represent the carcinogenic endpoint.

Table 6.1-14 Summary of 5th Percentile Direct Single-Pathway PPLVS for the Recreational Visitor[1]

Chemical Name	Soil Ingestion SPPLV	Soil Inhalation SPPLV	Dermal Absorption SPPLV	Cumulative Direct PPLV-CARC[2]	Cumulative Direct PPLV-NONCARC[2]
Aldrin	**6.36E+00**	4.79E+02	6.93E+00	3.29E+00	4.63E+02
Benzene	5.74E+03	8.62E+04	**1.30E+01**	1.30E+01	NA
Carbon Tetrachloride	3.29E+03	1.91E+05	**2.69E+00**	2.69E+00	8.65E+01
Chlordane	5.14E+01	5.67E+02	**1.41E+01**	1.09E+01	1.59E+02
Chloroacetic Acid	5.30E+04	1.00E+06	**2.35E+02**	NA	2.34E+02
Chlorobenzene	6.36E+05	1.00E+06	**2.56E+03**	NA	2.55E+03
Chloroform	8.26E+04	1.21E+05	**8.39E+01**	8.91E+01	1.17E+03
DDE	4.48E+02	7.35E+03	**3.29E+01**	3.05E+01	NA
DDT	7.98E+02	1.93E+04	**3.78E+01**	3.60E+01	1.62E+03
DBCP	1.50E+02	1.00E+06	**2.52E-01**	2.52E-01	2.32E+01
1,2-Dichloroethane	5.57E+03	1.11E+05	**3.75E+00**	3.75E+00	NA
1,1-Dichloroethylene	5.05E+01	5.65E+03	**7.44E-01**	7.33E-01	1.06E+03
Dicyclopentadiene	3.85E+05	**4.49E+04**	1.05E+05	NA	2.91E+04
Dieldrin	3.48E+01	6.24E+02	**2.08E+00**	1.96E+00	4.70E+02
Endrin	9.83E+03	1.43E+05	**9.55E+02**	NA	8.65E+02
Hexachlorocyclopentadiene	7.88E+04	1.50E+04	**1.21E+04**	NA	6.16E+03
Isodrin	2.02E+03	1.07E+05	**2.41E+02**	NA	2.15E+02
Methylene Chloride	2.17E+04	1.00E+06	**4.59E+01**	4.58E+01	7.30E+03
1,1,2,2-Tetrachloroethane	2.70E+03	5.03E+04	**1.94E+00**	9.61E+00	NA
Tetrachloroethylene	9.93E+03	1.00E+06	**6.27E+00**	6.26E+00	1.28E+03
Toluene	1.00E+06	1.00E+06	**2.21E+04**	NA	2.11E+04
Trichloroethylene	2.06E+04	4.31E+05	**3.99E+01**	3.98E+01	NA
Arsenic	**6.16E+01**	9.15E+01	00.0E+00	3.68E+01	5.84E+03
Cadmium	3.96E+04	**2.19E+02**	00.0E+00	2.17E+02	6.53E+03
Chromium	3.96E+05	**3.28E+01**	00.0E+00	3.28E+01	3.55E+02
Lead	**2.75E+04**	7.08E+05	00.0E+00	NA	2.65E+04
Mercury	**5.91E+03**	7.70E+04	00.0E+00	NA	5.49E+03

1 Values reported as mg/kg. Values are 5th percentile PPLVs, based on a 10^{-6} risk level for carcinogens, and an HI of 1.0 for noncarcinogens. Values in bold face represent the driver exposure pathway.

2 Where a chemical is both a carcinogen (CARC) and noncarcinogen (NONCARC), the single-pathway PPLVs summarized represent the carcinogenic endpoint.

Table 6.1-15 Summary of 5th Percentile Direct Single-Pathway PPLVS for the Regulated/Casual Visitor[1]

Chemical Name	Soil Ingestion SPPLV	Soil Inhalation SPPLV	Dermal Absorption SPPLV	Cumulative Direct PPLV-CARC[2]	Cumulative Direct PPLV-NONCARC[2]
Aldrin	**2.32E+01**	3.68E+02	2.48E+01	1.16E+01	1.09E+03
Benzene	4.05E+03	1.36E+05	**5.85E+01**	5.76E+01	NA
Carbon Tetrachloride	1.17E+03	9.73E+04	**1.34E+01**	1.32E+01	2.86E+02
Chlordane	2.91E+02	5.99E+03	**6.69E+01**	5.39E+01	5.82E+02
Chloroacetic Acid	5.62E+04	1.00E+06	**8.25E+02**	NA	8.13E+02
Chlorobenzene	7.37E+05	1.00E+06	**7.07E+03**	NA	6.95E+03
Chloroform	2.34E+04	7.49E+04	**3.29E+02**	3.23E+02	4.41E+03
DDE	3.66E+02	1.16E+04	**3.52E+02**	1.77E+02	NA
DDT	1.11E+03	1.56E+04	**1.77E+02**	1.51E+02	5.89E+03
DBCP	7.20E+01	1.00E+06	**1.19E+00**	1.17E+00	7.76E+01
1,2-Dichloroethane	1.24E+03	4.40E+04	**1.77E+01**	1.74E+01	NA
1,1-Dichloroethylene	2.05E+02	2.28E+04	**2.86E+00**	2.82E+00	3.49E+03
Dicyclopentadiene	1.00E+06	**7.81E+04**	3.91E+05	NA	6.11E+04
Dieldrin	**9.24E+00**	3.17E+02	2.28E+01	6.45E+00	9.39E+02
Endrin	1.15E+04	3.43E+05	**4.09E+03**	NA	2.99E+03
Hexachlorocyclopentadiene	2.48E+05	**2.24E+04**	5.18E+04	NA	1.47E+04
Isodrin	3.04E+03	3.27E+05	**8.17E+02**	NA	6.43E+02
Methylene Chloride	1.33E+04	1.00E+06	**2.09E+02**	2.06E+02	2.37E+04
1,1,2,2-Tetrachloroethane	5.74E+02	2.00E+04	**9.78E+00**	1.94E+00	NA
Tetrachloroethylene	2.52E+03	1.00E+06	**3.62E+01**	3.57E+01	3.82E+03
Toluene	1.00E+06	1.00E+06	**7.44E+04**	NA	6.48E+04
Trichloroethylene	1.25E+04	6.80E+05	**1.80E+02**	1.78E+02	NA
Arsenic	**1.03E+02**	3.43E+02	0.00E+00	7.91E+01	9.97E+03
Cadmium	2.90E+04	**8.80E+02**	0.00E+00	8.55E+02	1.30E+04
Chromium	1.00E+06	**1.29E+02**	0.00E+00	1.29E+02	7.38E+02
Lead	**5.01E+04**	1.00E+06	0.00E+00	NA	4.77E+04
Mercury	**1.05E+04**	1.58E+05	0.00E+00	NA	9.85E+03

1 Values reported as mg/kg. Values are 5th percentile PPLVs, based on a 10^{-6} risk level for carcinogens, and an HI of 1.0 for noncarcinogens. Values in bold face represent the driver exposure pathway.

2 Where a chemical is both a carcinogen (CARC) and noncarcinogen (NONCARC), the single-pathway PPLVs summarized represent the carcinogenic endpoint.

Table 6.1-16 Summary of 5th Percentile Direct Single-Pathway PPLVS for the Industrial Worker[1]

Chemical Name	Soil Ingestion SPPLV	Soil Inhalation SPPLV	Dermal Absorption SPPLV	Cumulative Direct PPLV-CARC[2]	Cumulative Direct PPLV-NONCARC[2]
Aldrin	9.96E+00	1.29E+02	**4.50E+00**	3.02E+00	1.19E+02
Benzene	3.25E+03	7.59E+04	**1.04E+01**	1.04E+01	NA
Carbon Tetrachloride	8.19E+02	2.18E+04	**2.33E+00**	2.33E+00	2.96E+01
Chlordane	1.04E+02	3.06E+03	**8.20E+00**	7.58E+00	6.23E+01
Chloroacetic Acid	5.99E+04	6.82E+005	**7.72E+01**	NA	7.71E+01
Chlorobenzene	5.77E+04	1.00E+06	**8.58E+02**	NA	8.45E+02
Chloroform	1.52E+04	2.68E+04	**4.87E+01**	4.84E+01	3.73E+02
DDE	6.58E+01	3.57E+03	**2.64E+01**	1.87E+01	NA
DDT	3.49E+02	6.48E+03	**4.06E+01**	3.61E+01	4.70E+02
DBCP	6.98E+01	4.81E+05	**2.37E-01**	2.36E-01	7.99E+00
1,2-Dichloroethane	1.12E+03	1.26E+04	**3.40E+00**	3.39E+00	NA
1,1-Dichloroethylene	1.10E+02	1.25E+04	**5.23E+01**	5.21E-01	3.28E+02
Dicyclopentadiene	3.60E+05	**7.84E+03**	4.95E+04	NA	6.65E+03
Dieldrin	8.94E+00	9.10E+01	**1.69E+00**	1.40E+00	1.06E+02
Endrin	4.78E+03	2.22E+05	**3.41E+02**	NA	3.18E+02
Hexachlorocyclopentadiene	1.71E+05	**2.38E+03**	7.44E+03	NA	1.78E+03
Isodrin	1.62E+03	8.32E+03	**7.82E+01**	NA	7.39E+01
Methylene Chloride	1.53E+04	6.99E+05	**4.44E+01**	4.43E+01	2.25E+03
1,1,2,2-Tetrachloroethane	5.42E+02	1.12E+04	**1.49E+00**	1.49E+00	NA
Tetrachloroethylene	2.39E+03	6.30E+05	**5.88E+00**	5.87E+00	4.05E+02
Toluene	1.00E+06	1.00E+06	**7.32E+03**	NA	7.22E+03
Trichloroethylene	2.19E+03	2.09E+05	**2.94E+01**	2.90E+01	NA
Arsenic	**3.03E+01**	1.83E+02	0.00E+00	2.60E+01	8.67E+02
Cadmium	1.28E+04	**2.15E+02**	0.00E+00	2.12E+02	1.05E+03
Chromium	1.28E+05	**3.23E+01**	0.00E+00	3.23E+01	7.30E+01
Lead	**4.60E+03**	1.52E+05	0.00E+00	NA	4.46E+03
Mercury	**1.43E+03**	8.95E+03	0.00E+00	NA	1.24E+03

1 Values reported as mg/kg. Values are 5th percentile PPLVs, based on a 10^{-6} risk level for carcinogens, and an HI of 1.0 for noncarcinogens. Values in bold face represent the driver exposure pathway.

2 Where a chemical is both a carcinogen (CARC) and noncarcinogen (NONCARC), the single-pathway PPLVs summarized represent the carcinogenic endpoint.

Table 6.1-17 Summary of 5th Percentile Direct Single-Pathway PPLVS for the Commercial Worker[1]

Chemical Name	Soil Ingestion SPPLV	Soil Inhalation SPPLV	Dermal Absorption SPPLV	Cumulative Direct PPLV-CARC[2]	Cumulative Direct PPLV-NONCARC[2]
Aldrin	**4.81E+00**	5.76E+03	2.43E+02	4.71E+00	2.04E+02
Benzene	9.47E+02	2.36E+05	**2.97E+02**	2.26E+02	NA
Carbon Tetrachloride	1.11E+03	2.30E+05	**5.40E+01**	5.14E+01	6.24E+02
Chlordane	**4.96E+01**	1.77E+04	5.75E+01	2.66E+01	2.16E+02
Chloroacetic Acid	1.38E+04	1.00E+06	**2.19E+03**	NA	1.88E+03
Chlorobenzene	8.24E+04	1.00E+06	**2.15E+04**	NA	1.68E+04
Chloroform	1.33E+04	9.56E+04	**1.23E+03**	1.11E+03	8.93E+03
DDE	**1.43E+02**	2.83E+05	1.07E+03	1.26E+02	NA
DDT	**1.06E+02**	2.83E+05	9.87E+02	9.58E+01	1.92E+03
DBCP	4.72E+01	1.00E+06	**4.98E+00**	4.51E+00	1.84E+02
1,2-Dichloroethane	5.78E+02	8.76E+04	**8.06E+01**	7.07E+01	NA
1,1-Dichloroethylene	8.66E+01	4.36E+04	**1.16E+01**	1.02E+01	7.74E+03
Dicyclopentadiene	**9.55E+04**	1.79E+05	9.20E+05	NA	5.83E+04
Dieldrin	**2.58E+00**	7.75E+03	1.75E+02	2.54E+00	2.26E+02
Endrin	**1.16E+03**	1.00E+06	2.96E+04	NA	1.12E+03
Hexachlorocyclopentadiene	2.02E+05	**2.08E+04**	1.47E+05	NA	1.67E+04
Isodrin	**2.57E+02**	4.75E+05	1.09E+04	NA	2.51E+02
Methylene Chloride	6.51E+03	1.00E+06	**8.84E+02**	7.78E+02	5.06E+04
1,1,2,2-Tetrachloroethane	3.20E+02	3.83E+04	**3.69E+01**	3.31E+01	NA
Tetrachloroethylene	1.32E+03	1.00E+06	**1.44E+02**	1.30E+02	8.75E+03
Toluene	1.00E+06	1.00E+06	**1.91E+05**	NA	1.38E+05
Trichloroethylene	1.18E+04	1.00E+06	**6.63E+02**	6.27E+02	NA
Arsenic	**2.61E+01**	8.38E+03	0.00E+00	2.60E+01	1.30E+03
Cadmium	5.56E+04	**1.93E+03**	0.00E+00	1.87E+03	1.70E+03
Chromium	6.15E+04	**3.28E+02**	0.00E+00	3.26E+02	7.82E+02
Lead	**7.11E+03**	1.00E+06	0.00E+00	NA	7.06E+03
Mercury	**1.36E+03**	2.39E+05	0.00E+00	NA	1.35E+03E

1 Values reported as mg/kg. Values are 5th percentile PPLVs, based on a 10^{-6} risk level for carcinogens, and an HI of 1.0 for noncarcinogens. Values in bold face represent the driver exposure pathway.

2 Where a chemical is both a carcinogen (CARC) and noncarcinogen (NONCARC), the single-pathway PPLVs summarized represent the carcinogenic endpoint.

Table 6.1-18 Summary of Sites with C_{rep} Values Exceeding 5th Percentile PPLVs in Horizon 0

Chemical[1, 2]	Number of Sites with Chemical-Specific $C_{rep,upper}$ Concentrations Exceeding 5th Percentile PPLVs				
	Biological Worker	Regulated/ Casual Visitor	Recreational Visitor	Industrial Visitor	Commercial Worker
Aldrin	**10**	**1**	**3**	**7**	**5**
Benzene	0	0	0	0	0
Carbon Tetrachloride	0	0	0	0	0
Chlordane	**4**	**2**	**2**	**4**	**2**
Chloroacetic Acid	**1**	0	**1**	**1**	0
Chlorobenzene	0	0	0	0	0
Chloroform	0	0	0	0	0
DBCP	**1**	**1**	**1**	**1**	**1**
DCPD	0	0	0	0	0
DDE	0	0	0	0	0
DDT	0	0	0	0	0
1,2-Dichloroethane	0	0	0	0	0
1,1-Dichloroethylene	0	0	0	0	0
Dieldrin	**9**	**2**	**4**	**5**	**4**
Endrin	**2**	0	0	**2**	0
HCCPD	0	0	0	0	0
Isodrin	**3**	0	0	**2**	0
Methylene Chloride	0	0	0	0	0
1,1,2,2-Tetrachloroethane	0	0	0	0	0
Tetrachloroethy lene	0	0	0	0	0
Toluene	0	0	0	0	0
Trichloroethylene	0	0	0	0	0
Arsenic	**5**	**1**	**1**	**4**	**3**
Cadmium	0	0	0	0	0
Chromium	**5**	0	**1**	**2**	0
Lead	0	0	0	0	0
Mercury	0	0	0	0	0

1 Boldface type indicates exceedances of 10^{-4} cancer risk or HIs of 1.0.

2 For carcinogens, exceedances of 1×10^{-4} risk levels are noted. For noncarcinogens, exceedances of a target HI of 1.0 are given.

Table 6.1-19 Summary of Acute RME PPLVs for Cumulative Direct Soil Exposure Pathway[1]

Chemical	Receptor-Specific Soil PPLVs (Units: mg/kg)			
	Biological/ Industrial Worker	Regulated/ Casual Visitor	Recreational Visitor	Commercial Visitor
Aldrin[2]	5.6E+01	**3.8E+00**	**3.8E+00**	6.9E+01
Benzene	ND	ND	ND	ND
Carbon Tetrachloride	4.8E+04	**1.1E+04**	**1.1E+04**	2.5E+05
Chlordane	7.2E+02	**1.7E+02**	**1.7E+02**	3.7E+03
Chloroacetic Acid	ND	ND	ND	ND
Chlorobenzene	2.4E+04	**5.6E+03**	**5.6E+03**	1.2E+05
Chloroform	2.2E+04	**5.0E+03**	**5.0E+03**	1.1E+05
DDE	ND	ND	ND	ND
DDT	6.0E+01	**1.4E+01**	**1.4E+01**	3.1E+02
DBCP	6.0E+02	**1.4E+02**	**1.4E+02**	3.1E+03
1,2-Dichloroethane	ND	ND	ND	ND
1,1-Dichloroethylene	2.4E+04	**5.6E+03**	**5.6E+03**	1.2E+05
Dicyclopentadiene	ND	ND	ND	ND
Dieldrin[2]	4.7E+01	**3.7E+00**	**3.7E+00**	6.9E+01
Endrin	2.4E+02	**5.6E+01**	**5.6E+01**	1.2E+03
Hexachlorocyclopentadiene	ND	ND	ND	ND
Isodrin	ND	ND	ND	ND
Methylene Chloride	1.2E+05	**2.8E+04**	**2.8E+04**	6.2E+05
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
Tetrachloroethylene	2.4E+04	**5.6E+03**	**5.6E+03**	1.2E+05
Toluene	2.4E+05	**5.6E+04**	**5.6E+04**	[3]
TCE	2.9E+05	**6.7E+04**	**6.7E+04**	[3]
Metals				
Arsenic	3.4E+03	**3.0E+02**	**3.0E+02**	5.4E+03
Cadmium	1.9E+03	**1.5E+02**	**1.5E+02**	2.8E+03
Chromium	4.7E+04	**3.8E+03**	**3.8E+03**	6.9E+04
Lead	ND	ND	ND	ND
Mercury	9.4E+04	**7.7E+03**	**7.7E+03**	1.4E+05

[1] Based on an HI of 1.0, and using the exposure assumptions listed in Appendix Table B.6-1 of the IEA/RC report. Values in bold face represent the driver PPLVs for the corresponding receptor population.

[2] RME PPLVs for aldrin and dieldrin were recalculated using an RfD recently updated by EPA (OHEA-EPA 1992) (1.0×10^{-4} mg/kg-day; see Appendix Table B.6-3 in the IEA/RC); this criterion supersedes the value used in the HHEA Addendum. These recalculated PPLVs also reflect the following: (1) dermal RAFs for aldrin and dieldrin were revised to equal 0.0052 and 0.1, respectively, consistent with the assumptions used in the IEA/RC; and (2) concomitant with this revision of the aldrin/dieldrin dermal RAFs, the soil covering assumed for recreational and regulated/casual visitor populations was revised to equal 1.0 mg/cm^2, consistent with recent EPA dermal exposure assessment guidance.

[3] PPLV is greater than 1×10^6 mg/kg, indicating that the allowable soil concentrations are equivalent to exposure to pure compound over all direct soil pathways at the soil intake rates assumed for this analysis.

ND Not Developed; EPA dose-response information not available.

Table 6.1-20 Summary of Subchronic RME PPLVs for Cumulative Direct Soil Exposure Pathway[1]

Chemical	Receptor-Specific Soil PPLVs (Units: mg/kg)			
	Biological/ Industrial Worker	Regulated/ Casual Visitor	Recreational Visitor	Commercial Visitor
Aldrin[2]	8.0E+01	**2.7E+01**	**2.7E+01**	1.0E+02
Benzene	ND	ND	ND	ND
Carbon Tetrachloride	1.2E+03	**1.4E+03**	**1.4E+03**	6.3E+03
Chlordane	1.0E+01	**1.2E+01**	**1.2E+01**	5.4E+01
Chloroacetic Acid	3.5E+03	**3.9E+03**	**3.9E+03**	1.8E+04
Chlorobenzene	3.5E+04	**3.9E+04**	**3.9E+04**	1.8E+05
Chloroform	1.7E+03	**2.0E+03**	**2.0E+03**	9.0E+03
DDE	ND	ND	ND	ND
DDT	8.7E+01	**9.8E+01**	**9.8E+01**	4.5E+02
DBCP	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1-Dichloroethylene	1.6E+03	**1.8E+03**	**1.8E+03**	8.1E+03
Dicyclopentadiene	3.4E+04	**5.4E+04**	**5.4E+04**	2.0E+05
Dieldrin[2]	6.8E+01	**2.6E+01**	**2.6E+01**	1.0E+02
Endrin	8.7E+01	**9.8E+01**	**9.8E+01**	4.5E+02
Hexachlorocyclopentadiene	8.8E+03	**1.3E+04**	**1.3E+04**	5.1E+04
Isodrin	ND	ND	ND	ND
Methylene Chloride	1.0E+04	**1.2E+04**	**1.2E+04**	5.4E+04
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
Tetrachloroethylene	1.7E+04	**2.0E+04**	**2.0E+04**	9.0E+04
Toluene	3.5E+05	**3.9E+05**	**3.9E+05**	[3]
TCE	4.3E+05	**4.9E+05**	**4.9E+05**	[3]
Metals				
Arsenic	6.7E+02	**2.7E+02**	**2.7E+02**	9.9E+02
Cadmium	3.4E+02	**1.4E+02**	**1.4E+02**	5.0E+02
Chromium	**7.2E+02**	2.4E+03	2.4E+03	5.3E+03
Lead	ND	ND	ND	ND
Mercury	2.0E+02	**8.2E+01**	**8.2E+01**	3.0E+02

1 Based on an HI of 1.0. Values in bold face represent the driver PPLVs for the corresponding receptor population.

2 RME PPLVs for aldrin and dieldrin were recalculated using an RfD recently updated by EPA (OHEA-EPA 1992) (1.0×10^{-4} mg/kg-day; see Appendix Table B.6-3 in the IEA/RC report); this criterion supersedes the value used in the HHEA Addendum. These recalculated PPLVs also reflect the following: (1) dermal RAFs for aldrin and dieldrin were revised to equal 0.0052 and 0.1, respectively, consistent with the assumptions used in the IEA/RC; and (2) concomitant with this revision of the aldrin/dieldrin dermal RAFs, the soil covering assumed for recreational and regulated/casual visitor populations was revised to equal 1.0 mg/cm^2, consistent with recent EPA dermal exposure assessment guidance.

3 PPLV is greater than 1×10^6 mg/kg, indicating that the allowable soil concentrations are equivalent to exposure to pure compound over all direct soil pathways at the soil intake rates assumed for this analysis.

ND Not Developed; EPA dose-response information not available.

Table 6.2-1 Mean BMF Calculated by Alternate Methods[1]

Trophic Box	BMF by the Army Calibration Procedure Mean BMF	BMF_{obs} by the Shell Collocated Distributions Approach Mean BMF	BMF_{obs} by the (EPA) Modified Paired Data Approach Mean BMF
Aldrin/Dieldrin			
Soil	1	1	1
Terrestrial Plant	1.6E-02	6.0E-02	1.8E-01
Worm	2.3E-01	1.0E+00	2.5E+00
Insect	7.4E-02	9.7E-02	4.2E-01
Small Bird	2.1E-01	2.7E-01	6.8E-01
Small Mammal	2.7E-01	5.9E-01	3.0E+00
Medium Mammal	3.8E-01	2.7E-01	1.9E+00
Herptile	2.4E+00	2.4E+00	7.7E+00
Kestrel	2.6E+00	4.9E+00	2.3E+01
Owl	8.0E+00	6.9E+00	4.1E+01
Shorebird	3.6E+00	2.3E+00	6.2E+00
Heron	2.9E+00	3.0E+00	8.6E+00
Eagle	6.1E+00	4.4E+00	2.8E+01
DDE/DDT			
Soil	1	1	1
Terrestrial Plant	6.6E-01	9.2E-01	5.2E+00
Worm	1.4E+00	1.1E+00	7.8E+00
Insect	7.5E-01	9.9E-01	3.9E+01
Small Bird	5.4E-01	8.1E-01	3.3E+00
Small Mammal	4.6E-01	6.5E-01	2.8E+00
Medium Mammal	4.9E-01	3.1E+00	6.0E+00
Herptile	1.3E+00	2.5E+00	6.3E+00
Kestrel	9.9E+00	1.4E+01	5.5E+01
Owl	3.2E+01	1.7E+02	3.4E+02
Shorebird	4.8E+01	6.0E+01	1.5E+02
Heron	1.1E+01	1.8E+01	4.2E+01
Eagle	1.9E+01	1.2E+02	2.2E+02

Table 6.2-1 Mean BMF Calculated by Alternate Methods[1]

Trophic Box	BMF by the Army Calibration Procedure	BMF_{obs} by the Shell Collocated Distributions Approach	BMF_{obs} by the (EPA) Modified Paired Data Approach
	Mean BMF	Mean BMF	Mean BMF
Endrin			
Soil	1	1	1
Terrestrial Plant	1.4E-01	2.1E-01	1.3E+00
Worm	4.0E-01	2.4E-01	1.1E+00
Insect	1.0E-01	5.3E-02	3.6E-01
Small Bird	1.1E-01	1.3E-01	9.1E-01
Small Mammal	1.7E-01	2.7E-01	1.5E+00
Medium Mammal	3.3E-02	3.6E-01	1.2E+00
Herptile	1.0E+00	9.0E-01	1.5E+00
Kestrel	1.9E-01	2.6E-01	1.3E+00
Owl	8.8E-02	4.0E-01	1.4E+00
Shorebird	9.9E-01	6.0E-01	1.1E+00
Heron	1.1E-01	1.0E-01	1.6E-01
Eagle	6.7E-02	4.0E-01	1.3E+00
Mercury			
Soil	1	1	1
Terrestrial Plant	3.5E-02	1.6E-01	3.1E-01
Worm	6.2E-01	4.0E-01	8.1E-00
Insect	1.1E-02	1.3E-01	2.7E-01
Small Bird	1.1E-01	1.9E-01	3.4E-01
Small Mammal	5.5E-01	1.5E-02	1.7E-01
Medium Mammal	2.8E-01	3.3E-01	7.3E+00
Herptile	6.0E-01	7.8E-01	8.2E-01
Kestrel	3.2E-01	6.8E-02	1.8E-01
Owl	2.6E-01	2.4E-01	4.8E+00
Shorebird	1.2E+0	1.6E-01	1.8E-02
Heron	6.8E-01	7.2E-01	7.6E-01
Eagle	2.3E-01	2.6E-01	5.4E+00

[1] For the three BMF_{obs} methods, kestrel, owl, heron, and eagle BMFs were calculated with the food-web model because there are no available field data. For these four trophic boxes:

$$BMF_{obs(k)} = BAF_{lit(k)} * SUM_{(j)(FR(k,j)} * BMF_{obs(j)}$$

where:
$BMF_{obs(k)}$ is the BMF for predator trophic box k
$BAF_{lit(k)}$ is the literature-derived BAF distribution for trophic box k
$SUM_{(j)}$ is the summation function over the argument j
$FR_{(k,j)}$ is the mass fraction of predator k's food from prey trophic box j
$BMF_{obs(j)}$ is the BMF for prey trophic box j

Biota	Chemical	Distribution	Mean*	Std. Dev.	LOG Mean	LOG Std Dev.	End Point
Parameter = Bioaccumulation Factor (BAF)							
Small Bird	Aldrin/Dieldrin	Normal	6.6	1.8			
	Endrin	Lognormal	1.0	1.6	0.000	0.470	
	DDE/DDT	Uniform	NA	NA			7.7, 29
	Arsenic	Uniform	NA	NA			0.3, 3
	Mercury	Triangular	0.33	NA			0.001, 2
Small Mammal	Aldrin/Dieldrin	Uniform	NA	NA			0.64, 1.6
	Endrin	Lognormal	0.08	1.0	-2.526	0.001	
	DDE/DDT	Uniform	NA	NA			0.44, 0.98
	Arsenic	Lognormal	0.19	4.7	-1.684	1.543	
	Mercury	Triangular	22.5	NA			0.001, 50
Medium Mammal	Aldrin/Dieldrin	Uniform	NA	NA			0.64, 3.2
	Endrin	Lognormal	0.16	1.1	-1.833	0.095	
	DDE/DDT	Uniform	NA	NA			0.44, 0.98
	Arsenic	Lognormal	0.19	4.7	-1.684	1.543	
	Mercury	Triangular	22.5	NA			0.001, 50
Water Bird	Aldrin/Dieldrin	Normal	16	5.1			
	Endrin	Lognormal	1.0	1.6	0.000	0.470	
	DDE/DDT	Normal	96	26.2			
	Arsenic	Uniform	NA	NA			0.3, 3
	Mercury	Lognormal	4.1	3.4	1.411	1.224	
Kestrel	Aldrin/Dieldrin	Normal	10.5	1.2			
	Endrin	Lognormal	1.0	1.6	0.000	0.470	
	DDE/DDT	Uniform	NA	NA			7.7, 29
	Arsenic	Uniform	NA	NA			0.3, 3
	Mercury	Triangular	0.33	NA			0.001, 2
Owl	Aldrin/Dieldrin	Normal	21.1	3.4			
	Endrin	Lognormal	1.0	1.6	0.000	0.470	
	DDE/DDT	Lognormal	43.7	2.4	3.777	0.875	
	Arsenic	Uniform	NA	NA			0.3, 3
	Mercury	Triangular	0.33	NA			0.001, 2
Shorebird	Aldrin/Dieldrin	Normal	13.3	4.2			
	Endrin	Lognormal	1.0	1.6	0.000	0.470	
	DDE/DDT	Uniform	NA	NA			7.7, 29
	Arsenic	Uniform	NA	NA			0.3, 3
	Mercury	Triangular	0.33	NA			0.001, 2
Heron	Aldrin/Dieldrin	Normal	16	5.1			
	Endrin	Lognormal	1.0	1.6	0.000	0.470	
	DDE/DDT	Normal	93.5	20			
	Arsenic	Uniform	NA	NA			0.3, 3
	Mercury	Lognormal	4.1	3.4	1.411	1.224	

Biota	Chemical	Distribution	Mean*	Std. Dev.	LOG Mean	LOG Std Dev.	End Point
Parameter = Bioaccumulation Factor (BAF)							
Bald Eagle	Aldrin/Dieldrin	Normal	15.9	3.9			
	Endrin	Lognormal	1.0	1.6	0.000	0.470	
	DDE/DDT	Lognormal	27.1	2.4	3.300	0.875	
	Arsenic	Uniform	NA	NA			0.3, 3
	Mercury	Triangular	0.33	NA			0.001, 2

* Mean = arithmetic mean for normal distribution, geometric mean for lognormal distribution, and apex for triangular distribribution

Predator	Prey Item	Biomass Fraction*
Parameter = Dietary Fractions (FR)		
Terrestrial Food Chain		
Small Birds	Soil	0.057
	Terrestrial Plants	0.113
	Earthworm	0.116
	Insect	0.714
Small Mammals	Soil	0.020
	Terrestrial Plants	0.866
	Earthworm	0.008
	Insect	0.106
Medium Mammal	Soil	0.074
	Terrestrial Plants	0.926
	Insect	0.000
Kestrel	Soil	0.029
	Insect	0.184
	Small Mammal	0.665
	Small Bird	0.122
Owl	Soil	0.029
	Small Mammal	0.121
	Medium Mammal	0.830
	Small Bird	0.020
Heron	Soil	0.036
	Reptile	0.060
	Small Mammal	0.013
	Water	0.071
	Aquatic Plant	0.000
	Aquatic Invertebrates	0.024
	Small Fish	0.186
	Large Fish	0.604
	Amphibian	0.006
Bald Eagle	Soil	0.029
	Small Mammal	0.000
	Medium Mammal	0.936
	Small Bird	0.003
	Waterbird	0.030
	Large Fish	0.002
Aquatic Food Chain		
Water bird	Water	0.019
	Sediment	0.038
	Aquatic Plant	0.942
	Aquatic Invertebrates	0.001

Predator	Prey Item	Biomass Fraction*
Shorebird	Terrestrial Plants	0.007
	Insect	0.728
	Sediment	0.160
	Aquatic Invertebrates	0.105

* Fractions reported as zero are pathways considered to be relatively inconsequential to model output due to their small values.

Biota	Distribution	Mean*	Std. Dev.	LOG Mean	LOG Std Dev.
Parameter = Feed Rate (R)	kg/kg body weight/day				
Water Bird	Normal	0.07602	0.0245		
Small Bird	Fixed	0.0879			
Small Mammal	Fixed	0.12			
Medium Mammal	Fixed	0.096			
Shorebird	Lognormal	0.0879	1.652	-2.4315	0.50189
Kestrel	Normal	0.08913	0.02689		
Owl	Normal	0.08913	0.02689		
Heron	Normal	0.08913	0.02689		
Bald Eagle	Normal	0.08913	0.02689		

* Mean = Arithmetic mean for normal distribution, geometric mean for lognormal distribution, and apex for triangular distribribution.

Biota	Chemical	Distribution	Value
Parameter = Maximum Allowable Tissue Concentration (MATC)			
Small Bird	Aldrin/Dieldrin	Fixed	0.15
	Endrin	Fixed	0.052
	DDE/DDT	Fixed	0.14
	Mercury	Fixed	0.017
Small Mammal	Aldrin/Dieldrin	Fixed	0.19
	Endrin	Fixed	NA
	DDE/DDT	Fixed	0.22
	Mercury	Fixed	NA
Medium Mammal	Aldrin/Dieldrin	Fixed	0.19
	Endrin	Fixed	NA
	DDE/DDT	Fixed	0.22
	Mercury	Fixed	NA
Reptile	Aldrin/Dieldrin	Fixed	NA
	Endrin	Fixed	NA
	DDE/DDT	Fixed	NA
	Mercury	Fixed	NA
Kestrel	Aldrin/Dieldrin	Fixed	0.73
	Endrin	Fixed	0.052
	DDE/DDT	Fixed	4.3
	Mercury	Fixed	0.017
Owl	Aldrin/Dieldrin	Fixed	0.76
	Endrin	Fixed	0.087
	DDE/DDT	Fixed	0.53
	Mercury	Fixed	0.017
Water bird	Aldrin/Dieldrin	Fixed	0.24
	Endrin	Fixed	0.09
	DDE/DDT	Fixed	0.18
	Mercury	Fixed	0.01
Shorebird	Aldrin/Dieldrin	Fixed	0.15
	Endrin	Fixed	0.052
	DDE/DDT	Fixed	1.4
	Mercury	Fixed	0.011
Heron	Aldrin/Dieldrin	Fixed	0.87
	Endrin	Fixed	0.043
	DDE/DDT	Fixed	15
	Mercury	Fixed	0.011
Bald Eagle	Aldrin/Dieldrin	Fixed	0.41
	Endrin	Fixed	0.031
	DDE/DDT	Fixed	2.2
	Mercury	Fixed	0.0083

Biota	Chemical	Distribution	Value
Parameter = Toxicity Reference Values (TRV)			
Terrestrial Plant	Arsenic	Fixed	1.9
Small Bird	Aldrin/Dieldrin	Fixed	0.028
	Endrin	Fixed	0.002
	DDE/DDT	Fixed	0.003
	Mercury	Fixed	0.0019
	Arsenic	Fixed	0.38
	Copper	Fixed	0.96
	Cadmium	Fixed	0.24
	DCPD	Fixed	8.9
	Chlordane	Fixed	0.035
	CPMS	Fixed	NA
	$CPMSO_2$	Fixed	NA
	DBCP	Fixed	0.17
Small Mammal	Aldrin/Dieldrin	Fixed	0.004
	Endrin	Fixed	0.010
	DDE/DDT	Fixed	0.029
	Mercury	Fixed	0.0014
	Arsenic	Fixed	0.038
	Copper	Fixed	0.75
	Cadmium	Fixed	0.045
	DCPD	Fixed	2.8
	Chlordane	Fixed	0.10
	CPMS	Fixed	0.24
	$CPMSO_2$	Fixed	0.27
	DBCP	Fixed	0.05
Medium Mammal	Aldrin/Dieldrin	Fixed	0.004
	Endrin	Fixed	0.010
	DDE/DDT	Fixed	0.029
	Mercury	Fixed	0.0014
	Arsenic	Fixed	0.038
	Copper	Fixed	0.75
	Cadmium	Fixed	0.045
	DCPD	Fixed	2.8
	Chlordane	Fixed	0.10
	CPMS	Fixed	0.24
	$CPMSO_2$	Fixed	0.27
	DBCP	Fixed	0.05

NA Data not available to calculate a TRV.

Biota	Chemical	Distribution	Value
Kestrel	Aldrin/Dieldrin	Fixed	0.01
	Endrin	Fixed	0.002
	DDE/DDT	Fixed	0.04
	Mercury	Fixed	0.0019
	Arsenic	Fixed	0.38
	Copper	Fixed	0.96
	Cadmium	Fixed	0.24
	DCPD	Fixed	8.9
	Chlordane	Fixed	0.035
	CPMS	Fixed	NA
	$CPMSO_2$	Fixed	NA
	DBCP	Fixed	0.17
Owl	Aldrin/Dieldrin	Fixed	0.004
	Endrin	Fixed	0.003
	DDE/DDT	Fixed	0.008
	Mercury	Fixed	0.0019
	Arsenic	Fixed	0.38
	Copper	Fixed	0.96
	Cadmium	Fixed	0.24
	DCPD	Fixed	8.9
	Chlordane	Fixed	0.035
	CPMS	Fixed	NA
	$CPMSO_2$	Fixed	NA
	DBCP	Fixed	0.17
Water brid	Aldrin/Dieldrin	Fixed	0.027
	Endrin	Fixed	0.003
	DDE/DDT	Fixed	0.004
	Mercury	Fixed	0.00094
	Arsenic	Fixed	0.38
	Copper	Fixed	0.96
	Cadmium	Fixed	0.24
	DCPD	Fixed	3.2
	Chlordane	Fixed	3.1
	CPMS	Fixed	NA
	$CPMSO_2$	Fixed	NA
	DBCP	Fixed	0.17
Shorebird	Aldrin/Dieldrin	Fixed	0.022
	Endrin	Fixed	0.002
	DDE/DDT	Fixed	0.008
	Mercury	Fixed	0.00094
	Arsenic	Fixed	0.38
	Copper	Fixed	0.96
	Cadmium	Fixed	0.24
	DCPD	Fixed	8.9
	Chlordane	Fixed	0.035
	CPMS	Fixed	NA

Biota	Chemical	Distribution	Value
	$CPMSO_2$	Fixed	NA
	DBCP	Fixed	0.17
Heron	Aldrin/Dieldrin	Fixed	0.03
	Endrin	Fixed	0.003
	DDE/DDT	Fixed	0.004
	Mercury	Fixed	0.00094
	Arsenic	Fixed	0.38
	Copper	Fixed	0.96
	Cadmium	Fixed	0.24
	DCPD	Fixed	8.9
	Chlordane	Fixed	0.035
	CPMS	Fixed	NA
	$CPMSO_2$	Fixed	NA
	DBCP	Fixed	0.17
Bald Eagle	Aldrin/Dieldrin	Fixed	0.002
	Endrin	Fixed	0.001
	DDE/DDT	Fixed	0.005
	Mercury	Fixed	0.00063
	Arsenic	Fixed	0.19
	Copper	Fixed	0.48
	Cadmium	Fixed	0.10
	DCPD	Fixed	5.3
	Chlordane	Fixed	0.035
	CPMS	Fixed	NA
	$CPMSO_2$	Fixed	NA
	DBCP	Fixed	0.17

NA Data not available to calculate a TRV.

Table 6.2-3 Uncertainty Factor Protocol

Basis for Uncertainty	Uncertainty Value Assigned	
Intertaxon Variability Extrapolation Category—		
Same species		
Same genus, different species	2	
Same family, different genus		
Same order, different family	4	
Same class, different order	5	
Study Duration Extrapolation Category—		
Chronic studies where contaminants attained equilibrium	1	
Chronic studies where equilibrium not attained or possibly not attained, including subchronic studies	5	
Acute studies	20	
Study Endpoint Extrapolation Category—		
	Nonlethal	Lethal
No observed effects level	NOEL: 1	NOEL: 3
No observed adverse effects level	NOAEL: 1	NOAEL: 3
Lowest observed effects level	LOEL: 3	LOEL: 10
Lowest observed adverse effects level	LOAEL: 5	LOAEL: 10
Frank effects level	FEL: 10	FEL: 15
Modifying Factor Category—		
Threatened and endangered species	0 or 2	
Relevance of endpoint to ecological health	-1 to 0	
Extrapolating lab to field	0 to 2	
Study had co-contaminants	-1 to +1	
Endpoint was unclear	-2 to +2	
Study species was obviously highly sensitive	-2 to +2	
Ratios used to get from organ or egg to whole body	0 to 2[1]	
Intraspecific variability	0 to 2	

[1] Used only for MATC (not TRV) uncertainty factor development.

Table 6.2-4 Toxicity Threshold Values Selected for Representative Receptors (Trophic Boxes)[1, 2, 3]

	American Kestrel		Bald Eagle		Great Horned Owl		Great Blue Heron		Shorebird		Water Bird		Small Bird		Small Mammal		Medium Mammal		Reptile		Terrestrial Plant	
Chemical	MATC	TRV	MATC	TRV	MATC	TRV	MATC	TRV	MATC	TRV	MATC	TRV	MATC	TRV	MATC	TRV	MATC	TRV	MATC	TRV	MATC	TRV
Aldrin/ Dieldrin	0.73	**0.01**	0.41	**0.002**	0.76	**0.004**	**0.87**	0.027	0.15	**0.022**	**0.24**	0.027	0.15	**0.028**	0.19	**0.004**	0.19	**0.004**		NA		
DDT/DDE	**4.27**	0.04	**2.17**	0.005	**0.53**	0.008	**15**	0.004	**1.38**	0.008	**0.18**	0.004	0.14	**0.003**	0.22	**0.029**	0.22	**0.029**		NA		
Endrin	**0.05**	0.002	**0.03**	0.001	**0.09**	0.003	**0.09**	0.003	**0.05**	0.002	0.09	**0.003**	**0.05**	0.002	NA	**0.01**	NA	**0.01**		NA		
Mercury	0.02	**0.002**	0.01	**0.001**	0.02	**0.002**	0.01	**0.001**	0.01	**0.001**	**0.01**	0.001	0.02	**0.002**	NA	**0.001**		**0.001**		NA		
Arsenic		0.378		0.189		0.378		0.378		0.378		0.378		0.378		0.038		0.038		NA		1.9
Copper		0.96		0.48		0.96		0.96		0.96		0.96		0.96		0.75		0.75		NA		
Cadmium		0.24		0.103		0.24		0.24		0.24		0.24		0.24		0.045		0.045		NA		
DCPD		8.889		5.333		8.889		8.889		8.889		3.2		8.889		2.833		2.833		NA		
Chlordane		0.035		0.035		0.035		0.035		0.035		3.125		0.035		0.1		0.1		NA		
CPMS		ND		ND		ND		ND		ND		ND		ND		0.235		0.235		NA		
$CPMSO_2$		ND		ND		ND		ND		ND		ND		ND		0.272		0.272		NA		
DBCP		0.167		0.167		0.167		0.167		0.167		0.167		0.167		0.05		0.05		NA		

[1] Values shown in bold face were selected for use in the estimation of potential risk based on their total uncertainty and whether or not use of a BAF was necessary.

[2] Tissue-based approach was used for calculation of risk from mercury to shorebird from aquatic food chains; other trophic boxes with mixed food chains (bald eagle and great blue heron) used the same approach for aquatic and terrestrial food chains.

[3] MATC values are presented in mg/kg, and TRVs are presented in mg/kg-bw-day.

Table 6.2-5 Toxicity Reference Value (Post-UF)[1]

Aldrin/Dieldrin	Critical Value	Intertaxon (1)	Study Duration (Q2)	Study Endpoints (Q3)	Modifying Factor[2] (U)	T&E	Endpoint Relevance	Lab to Field	Co-Contam.	Unclear Endpoint	ID. Sensitive Species	Intraspecific Variability
American Kestrel	0.04	1	1	1	4			1		2		1
Bald Eagle	0.05	5	1	1	6	2		1	0	2		1
Great Horned Owl	0.06	4	1	1	4			1	0	2		1
Great Blue Heron	0.4	5	1	3	1		-1	1				1
Shorebird	0.22	5	1	1	2			1				1
Waterbird	0.4	5	1	3	1		-1	1				1
Small Bird	0.28	5	1	1	2			1				1
Sm. Mammal	0.06	4	1	1	4			2		1		1
Med. Mammal	0.06	4	1	1	4			2		1		1
Reptile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Trophic Box	Total UF	Final TRV
American Kestrel	4	0.010
Bald Eagle	30	0.002
Great Horned Owl	16	0.004
Great Blue Heron	15	0.027
Shorebird	10	0.022
Waterbird	15	0.027
Small Bird	10	0.028
Sm. Mammal	16	0.004
Med. Mammal	16	0.004
Reptile	NA	NA

1	Values reported as mg/kg bw.
2	If $0 \leq U < 1$, it was replaced with 1; if $U < 0$, it was replaced with 0.5.
Final TRV	Critical value/total UF
NA	Not Available
Total UF	1*Q2*Q3*U
TRV	Toxicity Reference Value
U	Sum of factors to right
UF	Uncertainty Factor

Table 6.2-6 Post-Uncertainty MATC[1]

Aldrin/Dieldrin	Critical Value	Intertaxon (1)	Study Duration (Q2)	Study Endpoints (Q3)	Modifying Factor[2] (U)	T&E	Endpoint Relevance	Lab to Field	Co-Contam.	Unclear Endpoint	ID. Sensitive Species	Tissue to Whole-Body Ratio	Intraspecific Variability
American Kestrel	2.9	1	1	1	4			1		2			1
Bald Eagle	12.2	5	1	1	6	2		1		2			1
Great Horned Owl	12.2	4	1	1	4			1		2			1
Great Blue Heron	1.3	1	1	3	0.5			0	-1				0
Shorebird	2.9	5	1	1	4			1		2			1
Waterbird	7.1	5	1	3	2		-1	1				1	1
Small Bird	2.9	5	1	1	4			1		2			1
Mammal	4.5	4	1	1	6			2		2		1	1

Trophic Box	Total UF	Final MATC
American Kestrel	4	0.73
Bald Eagle	30	0.41
Great Horned Owl	16	0.76
Great Blue Heron	1.5	0.87
Shorebird	20	0.15
Waterbird	30	0.24
Small Bird	20	0.15
Mammal	24	0.19

[1] Values reported as mg/kg bw.
[2] If $0 \leq U < 1$, it was replaced with 1; if $U < 0$, it was replaced with 0.5.
Total UF 1*Q2*Q3*U
U Sum of factors to right
Final TRV Critical value/total UF

Table 6.2-7 HQs and HIs for Exposure through Aquatic Food Chains

Trophic Box	Hazard Quotients for Aldrin/Dieldrin	Hazard Quotients for DDT/DDE	Hazard Quotients for Endrin	Hazard Quotients for Mercury	Hazard Index
Water bird	2.87	1.66	0.63	6.75	11.91
Shorebird	0.19	2.60	1.17	8.30	12.26
Great Blue Heron	2.28	1.06	0.63	15.63	19.60
Bald Eagle	0.93	0.17	0.03	0.21	1.34

Table 6.3-1 Uncertainties Potentially Influencing Assigned Distributions for Soil Intake Parameters

Soil Covering		Soil Ingestion		Dust Loading	
Population and Age Class	Uncertainties	Population and Age Class	Uncertainties	Population and Age Class	Uncertainties
Regulated/Casual Visitor 0 to < 1	• Judgment distribution	Regulated/Casual Visitor 0 to < 1	• Assumed minimal (1 mg/day)	Regulated/Casual and Recreational Visitor All Ages	• Assumed outdoor ambient exposure • Representation of activities by ambient outdoor dust loading conditions • Data measurement error
1 to < 7	• Data measurement error • Extrapolation of sample patch to entire surface area • Data representation of age distribution and activities	1 to < 7	• Judgment 95th percentile (EPA default) • Data median (literature) • Data measurement error • Data representation of age and activities		
7 to < 18	• Data measurement error • Extrapolation of sample patch to entire surface area • Data representation of age and activities	7 to < 75	• Judgment 95th percentile (EPA default) • Shape extrapolated from literature distribution for child		

Table 6.3-1 Uncertainties Potentially Influencing Assigned Distributions for Soil Intake Parameters

Soil Covering		Soil Ingestion		Dust Loading	
Population and Age Class	Uncertainties	Population and Age Class	Uncertainties	Population and Age Class	Uncertainties
18 to < 75	• Data measurement error • Extrapolation of sample patch to entire surface area • Data representation of age and activities				
Recreational Visitor 0 to < 1	• Judgment distribution	0 to < 1	• Assumed minimal (1 mg/day)		
1 to < 7	• Data measurement error • Extrapolation of sample patch to entire surface area • Data representation of age and activities	1 to < 7	• Judgment 95th percentile (EPA default) • Data median (literature) • Data measurement error • Data representation of age and activities		

Table 6.3-1 Uncertainties Potentially Influencing Assigned Distributions for Soil Intake Parameters

Soil Covering		Soil Ingestion		Dust Loading	
Population and Age Class	Uncertainties	Population and Age Class	Uncertainties	Population and Age Class	Uncertainties
7 to < 18	• Data measurement error • Extrapolation of sample patch to entire surface area (data representat iveness) • Representation of age and activities (study representat iveness)	7 to < 75	• Judgment 95th percentile (EPA default) • Shape extrapolated from literature distribution (child)		
18 to < 75	• Data measurement error • Extrapolation of sample patch to entire surface area (data representativeness) • Representation of age and activities (study representativeness)				

Table 6.3-1 Uncertainties Potentially Influencing Assigned Distributions for Soil Intake Parameters

Soil Covering		Soil Ingestion		Dust Loading	
Population and Age Class	Uncertainties	Population and Age Class	Uncertainties	Population and Age Class	Uncertainties
Commercial Worker	• Theoretical estimate of mean, judgment range	Commercial Worker	• Judgment 50th and 95th percentile	Commercial Worker	• Assumed indoor exposure • Dust loading data measurement error • Outdoor/indoor attenuation data measurement error
Industrial Worker	• Judgment 95th percentile (EPA default) • Distribution shape extrapolated from biological/ maintenance worker	Industrial Worker	• Judgment 95th percentile • Shape extrapolated from literature distribution (child)	Industrial Worker	• Assumed ambient outdoor exposure • Representation of activities by ambient conditions • Data measurement error
Biological/ Maintenance Worker	• Data representation of time spent in activities • Data representation of soil covering to projected activities • Judgment estimate of indoor soil covering distribution	Biological Worker	• Data representation of time spent in activities • Judgment based activity specific distributions	Biological Worker	• Data representation of time spent in activities

Table 6.3-2 Uncertainties Potentially Influencing Assigned Distributions for Time-Dependent Exposure Parameters

Population	TM (Hours/Day)	DW (Days/Year)	TE (Years/Lifetime)
Regulated/Casual Visitor	• Representativeness of chosen activities for neighborhood population • Representativeness of data-based mean for activity-specific distributions • Judgment-based distribution shape • Representativeness of participation rate in multiple daily activities • Representativeness of national means for percent participation in each activity and duration of each activity	• No data specific to visitation of RMA neighborhood subpopulation • Intentional conservative estimation bias • Judgment-based distribution for number of activity days/year • Judgment-based distribution for fraction of activity days occurring at RMA	• Representativeness of PSCo data for neighborhood subpopulation (PSCo 1989) • Positive bias (overestimation) due to analysis method, which under-represents low TE values in population • Negative bias (underestimation) due to moves within same county
Recreational Visitor	• Representativeness of chosen activities for neighborhood population • Representativeness of data-based mean for activity-specific distributions • Judgment-based distribution shape • Representativeness of participation rate in multiple daily activities • Representativeness of national means for percent participation in each activity and duration of each activity	• Intentional conservative estimation bias • Representativeness of chosen activities for neighborhood subpopulation • Representativeness of western region and national means for percent participation in activity • Representativeness of national distribution of number of jogging days per week and assumption of 52 weeks per year for neighborhood subpopulation • Judgment-based distribution for number of activity days/year for some activity-specific distributions • Judgment-based distribution for fraction of activity days occurring at RMA	• Representativeness of PSCo data for neighborhood subpopulation (PSCo 1989) • Positive bias (overestimation) due to analysis method, which under-represents low TE values in subpopulation • Negative bias (underestimation) due to moves within same county
Commercial/Industrial Worker	• Representativeness of national data on hours spent at work	• Incorporation of judgment estimates for vacation time and holidays • Representativeness of western region data on job absence rates (BNA 1974–90)	• Representativeness of Mountain States Employer's Council mean job turnover data used to obtain distribution mean (MSEC 1981–90) • Representativeness of national data on occupational turnover used to obtain distribution shape

Table 6.3-2 Uncertainties Potentially Influencing Assigned Distributions for Time-Dependent Exposure Parameters

Population	TM (Hours/Day)	DW (Days/Year)	TE (Years/Lifetime)
Biological Worker	• Representativeness of on-site work schedule of interviewed personnel at three refuges	• Representativeness of on-site work schedule of interviewed personnel at three refuges	• Representativeness of job tenure history of interviewed personnel at three refuges (Bureau of the Census 1987) • Censored data (current tenure was longer than reported at time of survey)

Table 6.3-3 Uncertainties Potentially Influencing Assigned Distributions for Chemical-Specific Parameters[1]

Henry's Law Constant (K_H)[2]		Soil to Water Partition Coefficient Normalized to Organic Carbon K_{oc} (Kd)[3]		Vapor Pressure (V_P)[2]	
Chemical Group	Uncertainties	Chemical Group	Uncertainties	Chemical Group	Uncertainties
Aldrin Endrin 1,1,2,2-Tetrachloroethane DDT DDE Chlordane HCCPD	• Representation of RMA temperature regime • Experimental measurement error • < 6 data points	Aldrin Endrin 1,2-Dichloroethane Methylene Chloride	• Experimental measurement error • < 6 data points	Endrin Chlorobenzene Chlordane	• Experimental measurement error • Representation of RMA temperature regime • ≤ 6 data points
Isodrin	• Representation of RMA temperature regime • Experimental measurement error • No data, extrapolation across chemicals	Isodrin 1,1-Dichloroethylene HCCPD DCPD DBCP	• Experimental measurement error • ≤ 2 data points • Extrapolation across chemicals	1,1-Dichloroethy lene 1,1,2,2-Tetrachloroethane DDE HCCPD	• Experimental measurement error • Representation of RMA temperature regime • ≤ 6 data points • Intentional conservative bias in estimation of SD
DCPD DBCP Chloroacetic Acid	• Representation of RMA temperature regime • Experimental measurement error • No data, extrapolation based on vapor pressure and solubility	Chloroacetic Acid	• ≤ 2 data points • Extrapolation from other partitioning information	Isodrin Chloroacetic DCPD DBCP	• Experimental measurement error • Representation of RMA temperature regime • 2 data points • Judgment range

Table 6.3-3 Uncertainties Potentially Influencing Assigned Distributions for Chemical-Specific Parameters[1]

Henry's Law Constant (K_H)[2]		Soil to Water Partition Coefficient Normalized to Organic Carbon K_{oc} (Kd)[3]		Vapor Pressure (V_P)[2]	
Chemical Group	Uncertainties	Chemical Group	Uncertainties	Chemical Group	Uncertainties
Dieldrin Toluene Benzene Chloroform 1,2-Dichloroethane 1,1-Dichloroethylene Methylene Chloride Carbon Tetrachloride Tetrachloroethylene Chlorobenzene TCE	• Representation of RMA temperature regime • Experimental measurement error	Dieldrin Toluene Benzene Chloroform Carbon Tetrachloride 1,1,2,2-Tetrachloroethane Tetrachloroethylene Chlorobenzene TCE DDT DDE Chlordane Arsenic* Cadmium* Chromium* Lead* Mercury*	• Experimental measurement error	Aldrin Dieldrin Toluene Benzene Chloroform 1,2-Dichloroethane Methylene Chloride Carbon Tetrachloride Tetrachloroethylene TCE DDT	• Experimental measurement error • Representation of RMA temperature regime

[1] See IEA/RC report (Appendix E) for discussion of types of uncertainties.
[2] K_H[2] and V_P[2] not defined for metals.
[3] Kd (distribution coefficient) used for organic COCs lacking K_{oc} data.

7.0 Description of the Feasibility Study Process and the Remedial Alternatives Developed

7.1 Summary of the Feasibility Study Process

The FS process involved two major phases: the Development and Screening of Alternatives and the Detailed Analysis of Alternatives. Each contaminated environment at RMA (water, structures, and soil) was subdivided into several medium groups of similarly contaminated groundwater plumes, structures, or soil sites to organize and streamline the FS process.

At the outset of the Development and Screening of Alternatives, Remedial Action Objectives (RAOs) were identified. These goals provide general guidance for the FS by identifying the contaminants and media of interest, potential exposure pathways, and preliminary remediation goals. For the On-Post Operable Unit, RAOs were developed for water, structures, and soil based on the results of the IEA/RC, an evaluation of ARARs specified in federal and state environmental laws and regulations, and the provisions of the FFA. (ARARs are listed in Appendix A.) The human health and biota remediation goals are to achieve appropriate remediation such that the selected remedy is protective of both humans and biota.

During the Development and Screening of Alternatives, a wide range of alternatives was evaluated for each medium group with respect to effectiveness, implementability, and cost. Those alternatives retained for further consideration were evaluated during the Detailed Analysis of Alternatives against a set of threshold and primary balancing criteria defined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (see Section 8). Also taken into account were RMA-specific considerations such as Army safety procedures and USFWS guidance regarding the future use of the site as a national wildlife refuge.

A range of alternatives including no action, institutional controls, containment, and treatment options was developed for each of the water, structures, and soil medium groups. The No Action alternative (as required by EPA) and the No Additional Action alternative were also developed and used as a baseline against which other alternatives were evaluated. The No Action alternative represents current site conditions with no remedial actions undertaken, ongoing, or planned and IRAs discontinued. The No Additional Action alternative involves no action beyond the IRAs currently being implemented on post.

Once the alternatives for each group were evaluated with respect to the seven threshold and primary balancing criteria, the comparative performance of each alternative was evaluated and a range of alternatives was retained for each medium group/subgroup to use in the development of sitewide alternatives. Tables 7.1-1, 7.1-2, and 7.1-3 present descriptions of all individual technologies used to develop the respective sitewide alternatives for the water, structures, and soil medium groups. It should be noted that the No Action and No Additional Action alternatives

were developed for each contaminated medium, but were eliminated from consideration during the comparative analysis conducted for sitewide alternatives because they were not sufficiently protective.

All of the alternatives that were identified have several features in common as follows:

- Land-Use Restrictions – The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 restricts current and future land use, specifies that the U.S. government shall retain ownership of RMA, and prohibits certain activities such as agriculture, use of on-post groundwater as a drinking source, and consumption of fish and game taken at RMA. Continued restriction on land use or access are included as an integral component of all on-post alternatives. Long-term management includes access restrictions to capped and covered areas to ensure the integrity of the containment systems.
- Five-Year Review – In accordance with CERCLA, a review will be performed a minimum of every 5 years after initiation of remedial action to ensure that the various remedial actions where contamination continues to exist, such as the capped areas or the hazardous waste landfill, remain protective of human health and the environment and comply with ARARs.
- Site Monitoring – The Army will continue to conduct air, groundwater, and surface water monitoring programs at RMA, and will continue to fund USFWS to conduct on-post wildlife monitoring programs. Samples will be collected periodically to assess the effectiveness of the remedy for protection of human health and the environment. The actual compliance monitoring program for each of the environmental media will be finalized during the remedial design.
- Revegetation – Any time vegetation is disturbed during remedial construction, the disturbed areas will be revegetated consistent with a USFWS refuge management plan.
- Long-Term Operation and Maintenance – Areas that are remediated will be operated and maintained as required. Management activities may include maintaining capped and covered areas or operating the on-post hazardous waste landfill or groundwater treatment systems.
- On-Post Water Supply – A sufficient on-post water supply will be maintained to support remedial actions (revegetation, habitat enhancement, maintenance of lake levels).

7.1.1 Area of Contamination

An AOC is defined by EPA (OSWER-EPA 1989b) as the areal extent (or boundary) of contiguous contamination. Such contamination must be continuous, but may contain varying types and concentrations of hazardous substances. For on-site disposal, placement occurs when wastes are moved from one AOC into another AOC. Placement does not occur when wastes are left in place or moved within a single AOC.

Placement does not occur when wastes are:

- Treated in situ
- Capped in place
- Consolidated within the AOC
- Processed within the AOC (but not in a separate unit, such as a tank) to improve its structural stability (e.g., for capping or to support heavy machinery

Placement does occur when wastes are:

- Consolidated from different AOCs into a single AOC

- Moved outside of an AOC (e.g., for treatment or storage) and returned to the same or a different AOC
- Excavated from an AOC, placed in a separate unit, such as an incinerator or tank that is within the AOC, and redeposited into the same AOC

If placement does not occur, land disposal restrictions (LDRs) are not applicable to the Superfund action. Correspondingly, if placement on site does occur, LDRs would be applicable to the Superfund action.

At RMA, an AOC was defined that encompasses all principal threat exceedance areas, the majority of human health exceedance areas, and wildlife risk areas defined by the study area that is the subject of the SFS. The boundaries of the AOC are shown on Figure 7.1-1.

7.1.2 Corrective Action Management Unit

Several of the proposed alternatives for the On-Post Operable Unit include the construction and operation of a new on-post hazardous waste landfill for disposal of principal threat and human health exceedance soil and debris as defined in the Detailed Analysis of Alternatives report. Some of this material is RCRA-listed or potentially RCRA-characteristic hazardous waste (based on TCLP). Therefore, during the development of the Detailed Analysis of Alternatives, it was determined that a Corrective Action Management Unit (CAMU) would be required (EPA 1993). The CAMU will incorporate a future hazardous waste landfill, a Basin F Wastepile drying unit, and an appropriate waste staging and/or management area(s). The CAMU was designated by CDPHE under authority of and in accordance with CHWMA. The CAMU designation provides for landfilling of hazardous wastes and movement of waste into the CAMU from anywhere on post, within or outside the AOC, including treatment units. This ROD also provides for use of the CAMU rule as an ARAR for several remedial alternatives (see Appendix A).

The basis for designation of a CAMU and the requirements for the CAMU that are to be specified as part of the designation are provided in 6 CCR 1007-3, Section 264.552. In addition, Section 264.552(a)(3) specifies that where remediation waste placed into a CAMU is hazardous waste, the CAMU shall comply with Part 265, Subparts B, C, D, and E of 6 CCR 1007-3 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities [TSDFs]). When such remediation wastes are to remain in place after closure, Section 264.552(a)(3) also requires compliance with the siting requirements for hazardous waste disposal sites (6 CCR 1007-2, Part 2). The new hazardous waste landfill is the only facility within the CAMU to which these siting requirements apply; however, the CAMU may include additional areas as necessary to implement other actions.

A draft CAMU Designation Document (CDD) was submitted to CDPHE on January 12, 1996. It was resubmitted with additional information on March 15, 1996 and was followed by a public comment period. A public hearing was held April 17, 1996, and the comment period closed May 20, 1996. The CDD contains a discussion of the

guidelines to be used for the designation of the RMA CAMU as well as a discussion of the operational, monitoring, closure, and post-closure guidelines that will be implemented following designation of the CAMU.

The following decision-making criteria were addressed in designating the CAMU:

- Facilitation of the remedy
- Risks to human health and the environment
- Justification of inclusion of uncontaminated area
- Containment of remediation waste remaining after closure
- Expeditious timing of remedial activity implementation
- Application of treatment technologies
- Minimization of land area where wastes remain in place

CDPHE designated the CAMU by way of the final CDD (Harding Lawson Associates 1996) and a Corrective Action Order. The CAMU boundaries are shown in Figure 7.1-1.

7.1.3 Development of Criteria for Evaluating Soil Contamination

The NCP (EPA 1990a) indicates that acceptable exposure levels for suspected carcinogens are "generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}" and that the 10^{-6} level shall be used as the point of departure for determining remediation goals. EPA (OSWER-EPA 1991b) indicates that action generally is not warranted for sites with additive excess cancer risks less than 10^{-4} and an HI less than 1.0 for noncarcinogenic contaminants. Therefore, the human health SEC for contaminated soil were defined as the additive excess cancer risks of COCs equal to 10^{-4} and/or additive noncarcinogenic HIs equal to 1.0. The boring-by-boring analysis was used to identify the areas of each site, if any, that exceeded the human health SEC and were therefore candidates for remediation. Sites with contaminant concentrations that result in exceedances of these criteria are termed exceedance sites, and their contaminants and resultant volumes are referred to as exceedance COCs and exceedance volumes. Table 7.1-4 presents the human health SEC, which are based on a 10^{-4} cumulative excess cancer risk and noncarcinogenic HI of 1.0 (the criteria ultimately selected in the Detailed Analysis of Alternatives). The human health SEC are based on the lower of the industrial or biological worker PPLVs for each COC. Acute risk criteria were used as human health SEC where they were lower than the corresponding chronic risk human health SEC.

The NCP (EPA 1990a) and EPA guidance documents also develop the concept of a principal threat. Although EPA guidance allows for considerable interpretation in identifying specific sites or areas as principal threats, the EPA fact sheet "Guide to Principal Threat and Low-Level Threat Wastes" (OERR-EPA 1991) provides the following general definition of principal threats:

> ...those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include

> liquids or other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compounds. No "threshold level" of toxicity/risk has been established to equate to "principal threat." However, where toxicity and mobility of source material combine to pose a potential [excess] cancer risk of 10^{-3} or greater, generally treatment alternatives should be evaluated.

In addition, the guidance includes a determination as to whether a source material is a principal threat waste:

> ...should be based on the inherent toxicity as well as a consideration of the physical state of the material (e.g., liquid), the potential mobility of the wastes in the particular environmental setting, and the liability and degradation products of the material. However, this concept of principal threat waste should not necessarily be equated with risks posed by site contaminants via various exposure pathways.

Principal threats, as defined in EPA's "Guide to Selecting Superfund Remedial Actions" (1990b), include the following:

- Areas contaminated with relatively high concentrations of toxic compounds
- Liquids and other highly mobile materials
- Contaminated media (e.g., sediment or soil) that pose a significant risk of excessive exposure
- Media containing contaminants several orders of magnitude above health-based levels

The objective of identifying the principal threat wastes is to focus the remediation on the areas of highest risk to human health and the environment. This focused approach is especially appropriate to RMA because many sites combine large areas of minimal or low-level contamination with small areas of high-level contamination that fall within the definition of principal threats being several orders of magnitude above health-based levels. Because 10^{-4} was set as the human health SEC, the principal threat criteria for RMA soil were established at a 10^{-3} excess cancer risk and a noncarcinogenic HI of 1,000. These criteria are listed by COC in Table 7.1-4. It should be noted and emphasized that the principal threat criteria are risk-management endpoints for use in directing and prioritizing remedial activities; only the SEC denote protective boundaries based on risks (with varying uncertainties) to health. The areas of RMA that exceed the human health SEC and principal threat criteria are shown in Figure 7.1-1.

7.1.4 Soil Volume Modeling and Estimation

Most of the soil alternatives that were evaluated make use of a volume or area estimate to accurately analyze the proposed remedial actions and to develop costs. These volume or area estimates were developed based on the above-described exceedance criteria.

Human health exceedance volume estimates were generated by one of two methods. The distribution of contaminants in some sites was modeled using a commercial software package (TECHBASE). A three-dimensional model, represented by an array of blocks, was created for each site and was bounded vertically by the ground-surface elevation at the time of sampling and depth of the water table (or to a maximum 10-ft depth based on the exposure assessment performed as part of the IEA/RC) and laterally by the site boundary as defined in the Remedial Investigation Summary Report. The modeling routine then searched within a defined volume (based on sample

distribution within the site) around each block and used a three-dimensional inverse distance squared algorithm to estimate contaminant concentrations in each block.

Modeled soil concentrations were compared to the human health SEC to identify blocks to be included in the human health exceedance volume for each site. Similarly, soil concentrations were compared to the principal threat criteria to identify blocks to be included in **principal threat exceedance** volume. Concentrations were evaluated to account for potential cumulative effects of multiple contaminants, and all soil located between ground surface and the deepest exceedance block was counted in the exceedance volume. Areas were estimated by projecting all exceedance blocks to the surface and contouring around the surface projection. Perimeters were also estimated from these projections.

Additional volumes and areas were calculated for sites not considered amenable to modeling. In general, if modeling was subject to great uncertainty due to the physical characteristics of a site, highly heterogeneous or uneven spatial contamination, or limited data availability, information from the Study Area Reports (as summarized in the Remedial Investigation Summary Report) was used for volume and area calculations. A boring-by-boring analysis was performed to identify individual sample exceedances, and depth and lateral extents were projected halfway to the next nonexceedance sample. Volumes and areas were calculated using physical dimensions as listed in the Study Area Reports and measured distances between exceedance and nonexceedance samples.

Biota exceedance volumes were developed based on the potential biota risk areas as identified through the risk assessment process described in Section 6.2. The volume was calculated by multiplying the potential risk area by 1 ft (depth). The potential risk area for a site is defined as the entire biota exceedance area within the boundaries of a site, less any human health exceedance area, to avoid double-counting of the volume.

Potential agent and UXO areas were determined from boundaries presented in the Remedial Investigation Summary Report. Potential volume was calculated using these areas and the depths presented in the Detailed Analysis of Alternatives report. The expected agent or UXO volume of soil reflects a 0.1 percent factor to estimate actual agent or UXO occurrence within the potential volume. In addition, UXO surface debris volume was calculated by multiplying the potential UXO area by 1 ft (depth); the result is considered the maximum potential debris volume. For each site, overlap between agent, UXO, or UXO debris volume and human health or biota volume was calculated. Exceedance volumes were adjusted to prevent double-counting of soil volumes. UXO debris volume may include human health and/or biota exceedance volume. Actual human health exceedance volume or biota exceedance volume would increase to the previously unadjusted volume if less than the maximum potential debris volume is encountered.

The volume and area estimates that resulted from these calculations represent the soil quantities used for all soil alternative detailing. Volume increases due to commonly used excavation practices (such as sidesloping, bottom leveling, and perimeter rounding), although expected to be small, were not included in these calculations. Table 7.1-5 lists human health, principal threat, excess biota, agent, UXO, and UXO debris volumes for each soil medium group, and Table 7.1-6 lists the corresponding areas for each soil medium group.

7.2 Remedial Alternatives for Groundwater

7.2.1 Description of Medium

As described in Section 5, contaminated groundwater plumes were detected primarily in the vicinity of the basins, North and South Plants, and the northern and western sections of RMA (Figure 5.4-3). Plumes are generally moving to the north and northwest. Groundwater contaminant plumes predominantly consist of organic compounds (solvents, chloroform, dieldrin, DIMP, DCPD, DBCP, and organosulfur compounds) and fluoride and chloride salts (Tables 5.4-1 through 5.4-5). The overall concentrations and configurations of the plumes suggest that the greatest contaminant releases to the UFS have occurred from Basin A and the Lime Settling Basins, the South Plants chemical sewer, South Plants Tank Farm and production area, the Army and Shell Trenches in Section 36, and the Former Basin F. Plumes emanating from the Motor Pool/Rail Yard and North Plants areas are other sources of contaminant releases to the UFS.

Four groundwater alternatives were developed based on the contaminant concentrations in the individual plumes and evaluated against the remedial alternative screening criteria (see Section 8). A range of alternatives was developed and analyzed for each plume group. These alternatives included no action, continued operation of existing systems, and groundwater extraction and treatment approaches. Alternatives selected for each plume group were combined into four sitewide alternatives that were evaluated and compared against the screening criteria. Groundwater flow modeling utilizing commercially available software (MODFLOW), as summarized in the South Plants/Basin A groundwater flow model report (Foster Wheeler Environmental 1995c), was conducted to assess flow patterns and estimate flow and extraction rates in the South Plants and Basin A areas.

7.2.2 Remedial Action Objectives

The following RAOs were established for on-post groundwater at RMA:

Human Health

- Ensure that the boundary containment and treatment systems protect groundwater quality off post by treating groundwater flowing off RMA to the specific remediation goals identified for each of the boundary systems.
- Develop on-post groundwater extraction/treatment alternatives that establish hydrologic conditions consistent with the preferred soil alternat ives and also provide long-term improvement in the performance of the boundary control systems.

Ecological Protection

- Ensure that biota are not exposed to biota COCs in surface water in concentrations capable of causing acute or chronic toxicity.

7.2.3 Description of Sitewide Remedial Alternatives for Groundwater

Flow of surface water at RMA occurs through a network of streams, lakes, and canals, and flow of groundwater occurs within the alluvium and the uppermost weathered portion of the Denver Formation (UFS). Deeper water-bearing units within the Denver Formation (CFS) are separated from the UFS by low-permeability confining units. Depending on site-specific hydrological characteristics, varying degrees of hydraulic interchange are possible between surface water and groundwater and between the UFS and CFS. In general, analytical and hydraulic data indicate little hydraulic interchange between the UFS and CFS.

The following are considerations for all water alternatives:

- Chloride is expected to attenuate naturally at the NBCS, where it currently exceeds the remediation goal of 250 mg/l. It has been estimated that chloride concentrations will attenuate to concentrations less than the remediation goal at the north boundary within 30 years (MK 1996). Assessment of chloride concentrations will occur during the 5-year site reviews.
- The remediation goal of 540 mg/l for sulfate at the NBCS represents the natural background concentration. It is estimated that sulfate will attenuate to the remediation goal within approximately 25 years (MK 1996). Assessment of sulfate concentrations will occur during the 5-year site reviews.
- NDMA has been detected in the North Boundary Plume Group and at the NBCS. Monitoring for NDMA using a method detection limit of 20 parts per trillion (ppt) is ongoing. If the current monitoring program identifies an NDMA problem, potential design modifications (both on post and at the boundary or adjacent to the boundary) required to achieve the remediation goal at the RMA boundary will be prepared during the remedial design. Any upgrades required for existing treatment systems to address the remediation goal will be incorporated into the remedial actions.

7.2.3.1 Alternative 1 – Boundary Systems

Under Alternative 1, the three boundary systems all continue to operate and the systems installed as IRAs are discontinued. The boundary systems are the following:

- Northwest Boundary Containment System (NWBCS)
- North Boundary Containment System (NBCS)
- Irondale Containment System (ICS)

Each of the boundary systems includes groundwater extraction and reinjection systems and a treatment system that removes organic contaminants through carbon adsorption; the NWBCS and NBCS include slurry walls for containment and control of groundwater flow. The total amount of water currently treated at the boundary systems is about 1 billion gallons per year. Boundary systems will continue to operate as necessary to achieve remedial action objectives until remediation is complete, and the CERCLA Wastewater Treatment Plant continues to operate as needed to support remedial activities.

Under Alternative 1, the following IRAs are discontinued: the Basin F extraction system, the Basin A Neck extraction and treatment system (including breaching of the slurry wall to allow groundwater flow), the Rail Yard extraction system, and the Motor Pool extraction system. Monitoring of boundary system influent and effluent concentrations and groundwater monitoring continue. In addition, caps or covers installed in South Plants and Basin A as part of the soil remedy minimize infiltration of precipitation, thereby reducing contaminant migration through lowering of the water table (passive dewatering).

The components of this alternative are summarized in Table 7.2-1. The total estimated cost for this alternative (in 1995 dollars) is $111 million (present worth cost of $80 million). A breakdown of capital and operations and maintenance (O&M) costs is presented in Table 7.2-2. Operations are assumed to continue for at least 30 years.

The operation of each of the boundary systems is detailed below.

Northwest Boundary Containment System

Under Alternative 1, operation of the NWBCS for the Northwest Boundary Plume Group continues. The NWBCS is designed to capture and treat organic contaminants, primarily dieldrin, in groundwater approaching the northwest boundary. The NWBCS includes extraction wells, a slurry wall, reinjection wells, and a GAC adsorption system. When the system was constructed, a slurry wall was installed along the northwest boundary to minimize migration of the contaminated groundwater flowing across that boundary. This wall, constructed of soil/bentonite and originally measuring 1,425 ft long by 3 ft wide by approximately 30 ft deep, was subsequently extended by an additional 665 ft in the northeast direction to intercept groundwater flowing through the alluvial channel to the northeast. The slurry wall extension was keyed a minimum of 10 ft into the existing slurry wall and the extension ranged from 28 to 35 ft deep.

Five extraction wells were also added to the original system, two along the slurry wall, and three southwest of the system. Four reinjection wells were installed to the southeast of the newly installed extraction wells to maintain a separation between contaminants migrating to the north versus contaminants migrating to the northwest and to push groundwater toward the NWBCS along a small, localized groundwater divide. One additional extraction well was added to the southwest extension in early 1996 in response to hydrological changes associated with increased pumping rates in off-post SACWSD water supply wells and decreased infiltration rates at the Havana Ponds (south of Lake Mary and Lake Ladora in Section 11). The southwest extension currently extracts 425 gpm and reinjects approximately 230 gpm; the balance (195 gpm) is reinjected at the original NWBCS system. The rest of the NWBCS extracts and reinjects approximately 600 gpm and 795 gpm, respectively, for a total system flow of approximately 1,025 gpm.

Groundwater is pumped from the extraction wells to the influent sump adjacent to the treatment building. The treatment system consists of three identical GAC vessels, two of which are operated in parallel; the third is used as a

backup unit. Each vessel contains 40,000 lbs (1,400 cubic ft) of GAC, is operated in an upflow mode, and has a design capacity of 500 gpm and a residence time of 22 minutes. Treated water is currently discharged into an effluent sump from which the water is pumped (using two 500-gpm pumps) through a recharge header pipe to the reinjection (recharge) wells. The system includes two 500-gpm backup pumps. There are 25 recharge wells that range in depth from approximately 40 ft to 60 ft below the ground surface.

The NWBCS generates two sidestreams requiring treatment or disposal, spent carbon and filter solids. The spent carbon in the adsorbers is removed and regenerated at an off-post facility. The filter solids are drummed and disposed in a landfill regulated by RCRA and CHWMA.

North Boundary Containment System

Under Alternative 1, operation of the NBCS for the North Boundary Plume Group continues, but the operation of the extraction well that is currently part of the Basin F Groundwater IRA is discontinued. The NBCS is a pump-and-treat system that consists of 35 extraction wells approximately 35 ft deep, 12 of which are currently operating, and a soil/bentonite slurry wall 6,740 ft long, 3 ft wide, and 30 ft deep. The extracted water is treated at the treatment plant with GAC and recharged through 15 reinjection trenches. The NBCS was upgraded as part of the IRA for this system. The upgraded system has an improved treatment system, 5 new recharge trenches installed in 1990, and 10 recharge trenches installed in 1988. The trenches parallel the line of extraction wells and are located about 45 ft north of the existing soil/bentonite slurry wall. The existing 38 recharge wells are not in operation, but can be used as backups if needed. The trenches were installed close to the slurry wall to better maintain a reverse gradient.

The NBCS treatment system originally included prefiltration units, three 30,000-lb GAC adsorbers operated in parallel, and a combination of cartridge and bag postfilters. Treated effluent is discharged to a sump for groundwater recharge. The treatment plant has undergone minor operational changes (associated mostly with carbon handling) and now has two 20,000-lb GAC adsorbers operated in series; a third unit is available as a backup. The GAC units operate in downflow mode, and the carbon usage is approximately 100,000 lbs per year. The total capacity of the modified extraction/treatment system is estimated to be 450 gpm. Flow through the treatment plant currently averages 270 gpm.

The NBCS generates two sidestreams requiring treatment or disposal, spent carbon and filter solids. The spent carbon in the adsorbers is removed and regenerated at an off-post facility. The filter solids are drummed and disposed in a landfill regulated by RCRA and CHWMA.

Water levels in the Former Basin F area have been declining for years. The new cap and soil covers in this area will cause the water level to drop further.

Irondale Containment System

Originally, the ICS consisted of two rows of extraction wells and one row of recharge wells. A number of modifications to the ICS system configuration were completed by 1991. The extraction systems have changed as some wells have reached cleanup goals and more contaminated wells have been added to the system. Six of the original extraction wells are currently operating as extraction wells and three of the original extraction wells have been converted to injection wells. Nine new recharge wells, which reduce the water table depression caused by heavy SACWSD pumping rates and which enlarge the zone of captured groundwater on the south edge of the ICS, were installed south of the original system. Additionally, four new extraction wells, three of which are currently operating, were installed 2,000 ft upgradient of the original ICS in an area of greater saturated thickness than the original ICS extraction wells.

Under Alternative 1, all groundwater extracted from the Western Plume Group is treated at the ICS. The water is collected in an influent sump and is treated with GAC adsorption before being reinjected into the aquifer. The treatment plant has three existing treatment trains, each capable of treating a maximum of 700 gpm, although historically only two of the trains have been run simultaneously. The treatment system consists of three identical GAC vessels, two of which are operated in parallel; the third is used as a backup unit. Each vessel contains 40,000 lbs of GAC, is operated in an upflow mode, and has a design capacity of 700 gpm and a corresponding residence time of 15 minutes. Alternative 1 does not include the operation of the two IRA systems (Motor Pool and Rail Yard) that feed into the ICS.

The ICS generates two sidestreams requiring treatment or disposal, spent carbon and filter solids. The spent carbon in the adsorbers is removed and regenerated at an off-post facility. The filter solids are drummed and disposed in a landfill regulated by RCRA and CHWMA.

7.2.3.2 Alternative 2 – Boundary Systems/IRAs

Under Alternative 2, all boundary systems continue to operate as for Alternative 1. Passive dewatering is accomplished through installation of the soil caps and covers. In addition, all the IRAs continue to operate as follows:

- The systems in the Motor Pool and Rail Yard areas continue to extract groundwater and pipe it to the ICS for treatment.
- The Basin F Groundwater IRA continues to extract water north of Basin F for treatment at the Basin A Neck IRA System.
- Under the Basin A Neck IRA, water migrating from Basin A continues to be extracted at Basin A Neck and treated by carbon adsorption. A slurry wall helps control contaminant migration. Water from north of Basin F (Basin F Groundwater IRA) is treated by air stripping and carbon adsorption at Basin A Neck.
- The CERCLA Wastewater Treatment Plant continues to operate as needed to support remedial activities.

Operation of the internal groundwater extraction IRA systems continue as necessary until remedial action objectives are met. The other systems operate as necessary to achieve remedial action objectives until remediation is complete. Groundwater and system influent and effluent monitoring continue under this alternative.

The Rail Yard and Motor Pool IRA systems include seven extraction wells to intercept DBCP contamination and two extraction wells to intercept a TCE plume, respectively. These wells became operational in September 1991. Five of the seven wells in the Rail Yard IRA are currently pumping at a total rate of approximately 230 gpm; the two other wells are backup extraction wells and have not been used. The two wells in the Motor Pool area are currently pumping approximately 100 gpm. The groundwater that is extracted from the Motor Pool Area and Rail Yard extraction wells is pumped from the wells through a metering station to a manifold and then flows via an 8-inch-pipeline to the ICS.

To allow for the additional flow at the ICS, the capacity of this system was increased by bringing the third GAC bed on line, although this option has not been required with present flow rates (the ICS is treating approximately 1,030 gpm as of August 1995). With all three trains operating in parallel, the ICS has a maximum design capacity of 2,100 gpm.

The Basin F Groundwater IRA was implemented to capture contamination moving north out of the Basin F Area. Water is extracted using one well at a rate of 1 to 4 gpm and is then piped to the Basin A Neck IRA system where it is treated prior to reinjection into the Basin A Neck recharge trenches.

The Basin A Neck IRA is a pump-and-treat system that intercepts and treats contamination in groundwater as it moves northwest from Basin A. The extraction system consists of seven alluvial wells that currently pump a total flow of approximately 20 gpm. Three gravel-filled recharge trenches (160 ft, 170 ft, and 180 ft in length) are located across the more permeable, deeper portions of the Basin A Neck. A soil/bentonite slurry wall extends 830 ft across the Basin A Neck between the extraction wells and the recharge trenches to limit recirculation of water between the two systems and inhibit any flow of contaminants not captured by the extraction wells. Treated water from the CERCLA Wastewater Treatment Plant is conveyed to the Basin A Neck treatment plant by an underground pipeline, combined with effluent from the plant at a maximum rate of 5 gpm, and reinjected in the Basin A Neck reinjection trenches. The CERCLA Wastewater Treatment Plant treats water in a semibatch mode on an as-needed basis.

Groundwater extracted from both the Basin A Neck and the Basin F Groundwater IRAs is treated at the Basin A Neck IRA treatment facility. Approximately 1 to 4 gpm of groundwater from the Basin F Groundwater IRA is filtered and then treated in an air stripper. The vapor emissions from the air stripper are treated by two vapor-phase GAC vessels operated in series and an additional backup unit. The effluent from the air stripper is combined with the Basin A Neck IRA influent and treated by pre-filtration through a multimedia filter followed by adsorption in two 2,000-lb carbon vessels in series (one backup vessel is on standby). The GAC effluent is filtered through multimedia filters and

discharged to a 3,000-gallon effluent tank. Water from the tank is then filtered through 5-micron bag filters and pumped to the recharge trenches.

The Basin A Neck IRA treatment system generates two sidestreams requiring treatment or disposal, spent carbon and filter solids. The spent carbon in the adsorbers is removed and regenerated at an off-post facility. The filter solids are disposed in a landfill regulated by RCRA and CHWMA.

The components of this alternative are summarized in Table 7.2-1. The total estimated cost for this alternative (in 1995 dollars) is $139 million (present worth cost of $98 million). A breakdown of capital and O&M costs is presented in Table 7.2-2. Operations under this alternative are assumed to continue for at least 30 years.

7.2.3.3 Alternative 3 – Boundary Systems/IRAs/On-Post Dewatering

Alternative 3 includes all components described for Alternative 2. In addition, the water table in the Basin A and South Plants areas is lowered by installing a network of dewatering wells (**active dewatering**) in the central areas of South Plants and Basin A and by installing caps or soil covers in the same area as part of the soil remedy (passive dewatering). Extracted water is treated in a new treatment system by air stripping and GAC adsorption and is then reinjected. Concurrently, groundwater in the South Tank Farm Plume is treated by active **in situ biological treatment**. The South Tank Farm Plume is monitored for the presence of LANPL and, if freely drainable product accumulates to a sufficient thickness, this product is separated and treated. Treatment system and groundwater monitoring is conducted.

Alternative 3 involves removing the most contaminated portions of the Basin A Plume Group, lowering and maintaining future groundwater levels beneath Basin A, and dewatering the South Plants groundwater mound, including the South Plants North Source and South Plants Southeast Plumes. Based on modeling results (see Foster Wheeler Environmental 1995c) for the proposed well layout in Basin A and South Plants, an initial pumping rate of approximately 80 gpm will be used for the first 10 years to reduce the groundwater mound. After 10 years, a pumping rate of 35 gpm will be used to maintain groundwater elevations. Dewatering is accomplished using a system of **horizontal wells** that are installed prior to the initiation of structures medium remedial activities. The caps are installed as part of the soil remedy. The successful operation of the alternative relies on the active extraction/dewatering of the aquifer to reverse horizontal gradients and induce inward flow to the dewatering well system.

The operational goal under Alternative 3 for Basin A is to actively dewater contaminated portions of the soil and the alluvial aquifer. During the first decade (Phase I), the extraction system removes an estimated 60 gpm and the water table is artificially lowered 20 ft or more in the center of Section 36, and to a lesser degree in other areas beneath

Basin A. It is estimated that the long-term pumping rate sufficient to maintain this depressed water level is approximately 20 gpm in Basin A once the soil cap or cover is in place (Phase II). The Basin A Neck IRA intercept system continues to operate and extracts contaminants that are downgradient and beyond the influence of the dewatering system. The dewatering systems are expected to be installed prior to installation of the Basin A and South Plants soil covers, which are to be completed as part of the soil remedy.

Under Alternative 3, dewatering and in situ biotreatment occur concurrently in the South Plants area. Because horizontal wells are used, dewatering under the South Plants Central Processing Area can be initiated before or during demolition or capping activities. The water table is lowered approximately 20 ft through extraction of 20 gpm during the first 10 years (Phase I). The water level is then maintained through extraction of 15 gpm in Phase II. The use of horizontal wells provides flexibility in the overall cleanup of South Plants because the wells can be installed from outside the other construction and demolition areas. The concurrent treatment for the South Tank Farm Plume involves in situ biodegradation of benzene. Water is extracted from the South Tank Farm Plume source area at a rate of 10 gpm. The extracted groundwater is transferred to a collection tank and then reinjected after the appropriate amounts of hydrogen peroxide and nutrients have been added; reinjecting the water flushes the plume as it enhances biological growth and degradation of contaminants in the subsurface. When the northernmost cell (Cell I) of the in situ biotreatment system becomes inefficient after several years due to dewatering of the South Plants area, three of the injection wells in Cell I are converted to extraction wells and become part of the overall dewatering system. The remainder of the in situ system continues to operate for an estimated 10 years.

Each of the proposed extraction systems under Alternative 3 requires installation of performance monitoring wells. Groundwater-quality and water-level data from the newly installed performance monitoring wells are used to evaluate the effectiveness and operation of the extraction/dewatering system. The final location of the wells is based upon review of existing well locations and screened intervals. Where appropriate, existing wells are utilized in place of construction of new monitoring wells.

The components of this alternative are summarized in Table 7.2-1. The total estimated cost for this alternative (in 1995 dollars) is $179 million (present worth cost of $130 million). A breakdown of capital and O&M costs is presented in Table 7.2-2. Operations under this alternative are assumed to continue for at least 30 years.

7.2.3.4 Alternative 4 – Boundary Systems/IRAs/Intercept Systems

Alternative 4 includes all components of Alternative 2 as well as groundwater extraction from the Section 36 Bedrock Ridge Plume in an interceptor configuration followed by treatment at the existing Basin A Neck IRA (which includes air stripping and GAC adsorption). Treated water is reinjected to the aquifer through the existing recharge trenches. The interceptor configuration is designed to prevent further migration of the Section 36 Bedrock Ridge Plume northeast

out of the Basin A area towards the First Creek drainage. Alternative 4 is accomplished in conjunction with the soil remedy, which includes caps or soil covers over the Basin A and South Plants areas, and caps and slurry walls associated with the Shell Trenches and the Army Complex Trenches.

Groundwater-quality and water-level data are collected and used to evaluate the effectiveness and operation of the Bedrock Ridge and Basin A Neck systems. It is assumed that there are sufficient existing wells in both areas to be used for performance monitoring, so no new wells are installed. Wells closed during the implementation of the soil remedy will be replaced if required to maintain adequate performance monitoring. Further evaluation of the hydraulic control provided by the entire system (wells, caps, and slurry walls) will be performed during the remedial design.

Alternative 4 also includes groundwater monitoring of the CFS. Monitoring of the CFS is to be conducted in the South Plants area, the Basin A area, and close to Basin F. Data from these wells are assessed to determine whether contaminant levels within the CFS are increasing or migrating significantly with time. Due to poor construction or documentation of well-installation techniques, screened intervals, and bentonite-seal locations, approximately 30 to 40 CFS wells are closed and abandoned. Both groundwater and system monitoring continues.

Water levels in Lake Ladora, Lake Mary, and Lower Derby Lake will be maintained to support aquatic ecosystems. The biological health of the ecosystems will continue to be monitored. Lake-level maintenance or other means of hydraulic containment or plume control will be used to prevent South Plants plumes from migrating into the lakes at concentrations exceeding CBSGs in groundwater at the point of discharge. Groundwater monitoring will be used to demonstrate compliance.

The components of this alternative are summarized in Table 7.2-1. The total estimated cost for this alternative is $146 million (present worth cost of $104 million). A breakdown of capital and O&M costs is presented in Table 7.2-2. Operations under this alternative are assumed to continue for at least 30 years.

7.3 Description of Sitewide Remedial Alternatives for Structures

7.3.1 Description of Medium

As described in Section 5 and detailed in the structures inventory tables (Tables 5.4-6 through 5.4-9), approximately 94 percent of the remaining 798 structures at RMA were identified as potentially contaminated based on previous use or location in manufacturing areas. To date, 525 structures at RMA have been demolished. The debris has been disposed off post or is awaiting disposal.

7.3.2 Remedial Action Objectives

The RAOs for structures were developed based on potential risks, both physical and chemical, to human and ecological receptors through the potential exposure pathways of inhalation, dermal contact, or ingestion of contaminants potentially present in, or emanating from, structures at RMA. They were also based on the potential for the movement of contaminants through soil, air, or water from structures. The RAOs for the structures medium are as follows:

Human Health

- Prevent contact with the physical hazards and contaminant exposure associated with structures.
- Limit inhalation of asbestos fibers to applicable regulatory standards.
- Limit releases or migration of COCs from structures to soil or water in excess of remediation goals for those

Equipment and structures for which the Army has responsibility will be handled as follows:

- Equipment – PCB fluids will be drained and sent off post for disposal in compliance with applicable TSCA regulations. PCB-contaminated equipment will be disposed in the new on-post hazardous waste landfill that meets TSCA requirements. The equipment will be disposed under one of three possible scenarios:
  - Identified and disposed as part of the ongoing PCB IRA.
  - Identified under the PCB IRA but disposed under the final structures cleanup.
  - Agent-decontaminated materials to be disposed under the final structures cleanup.
- Structures – The PCB contamination in No Future Use structural materials will be identified in the PCB IRA completion report. Based on a 50 parts per million (ppm) action level, structural materials will be addressed in one of two ways:
  - Structural materials with PCB concentrations of 50 ppm or above that exist above the ground elevation, as well as contaminated parts of ground floor slabs and foundations that will be removed, will be identified prior to demolition, segregated during demolition, and disposed in the on-post TSCA-compliant hazardous waste landfill. Similar materials with PCB concentrations less than 50 ppm will be disposed according to use history as described in the alternative detailing.
  - PCB-contaminated sections of ground floor slabs or foundations at or below grade that are not required to be demolished as part of the remediation and with PCB concentrations of less than 50 ppm will be left in place. However, slabs or foundation materials with PCB concentrations of 50 ppm or greater will be removed during demolition and disposed in the new TSCA-compliant hazardous waste landfill.

Army Future Use structures have been managed for occupancy under current environmental and worker protection regulations. There is no evidence of PCB contamination in this medium group.

Potential PCB contamination in Shell structures are to be identified through visual evidence, and will be disposed in accordance with TSCA requirements and guidance. Structures and equipment for which Shell has responsibility are so indicated in Tables 5.4-6 through 5.4-9 and will be handled as follows:

- All Shell buildings to be demolished during the final remedy will be inspected for equipment containing fluids potentially contaminated with PCBs prior to demolition. Potentially contaminated fluids will be drained and sent off post for disposal in compliance with applicable TSCA regulations. Equipment that contained these fluids, as well as all other equipment, will be disposed in the on-post TSCA-compliant hazardous waste landfill. Significant Contamination History structures will be demolished and the resulting debris will be placed in the new on-post TSCA-compliant hazardous waste landfill. Other Contamination History structures will be evaluated by Shell and EPA for any visual evidence of leaks or spills. If observed in areas where potential PCB releases may be reasonably expected to occur, the affected debris will be disposed in the on-post TSCA-compliant hazardous waste landfill. Examples of this type of visual evidence would include stains near equipment potentially containing PCB fluids or stains in buildings where there are numerous instances of equipment potentially containing PCB-contaminated fluids. Further details of this work will be addressed at the remedial design stage.
- All fluorescent-light ballasts will be disposed at an off post-disposal facility in accordance with applicable TSCA regulations.

Shell does not have responsibility for any structures within the Future Use or Agent History Groups.

Most of the demolition at RMA will consist of dismantling (i.e., reducing a standing building to a pile of debris), using a combination of demolition techniques and equipment such as a backhoe with a thumb attachment, a wrecking ball and crane, or a crane and clamshell, or by performing piece-by-piece disassembly, sawing, or crushing. Additional techniques, such as structural undermining or explosives demolition, may be appropriate in some cases. Standard dust-suppression measures consistent with the remediation goals are used throughout the demolition process to meet state and federal requirements.

As the structural debris is removed, materials are segregated for purposes of recycling and waste classification. Economically recyclable materials, such as scrap metals, are collected for salvage. Structural materials not salvaged are placed in a bermed dirt or concrete staging area. The debris is segregated into potentially hazardous and nonhazardous waste as the structure is dismantled and placed in separate containment areas. The debris is sized for disposal concurrent with stockpiling to limit the amount of settling in the landfill or consolidation area. Due to the potential hazards, these handling activities are limited for Agent History structures.

The debris is then transported by truck to the disposal site. Debris from Agent History structures is monitored for the presence of agent and treated, as necessary, before disposal in the hazardous waste landfill. Agent-contaminated structures will be handled in compliance with AR 385-61, AR 50-6, and Department of Defense regulations in effect at the time of remediation. Action must be taken to treat the agent contamination within the structure or debris to a level consistent with Army regulations (3X or 5X) so it may be properly disposed. Debris from the Significant Contamination and Other Contamination History structures are taken directly to the hazardous waste landfill, depending on the remedial alternative. Floor slabs and foundations at or below grade for the Other Contamination History and Significant Contamination History Groups are left in place unless they must be removed to provide access to underlying contaminated soil (i.e., the slabs and foundations of structures located in the South Plants Central Processing Area within principal threat or human health soil exceedance areas, which are removed to a depth of 5 ft along with the contaminated soil). Floor slabs not removed are broken in place to prevent water ponding and are contained beneath the soil covers specified for the specific areas in which they occur (see Section 7.4).

7.3.3.1 Alternative 1 – Landfill/Cap In Place

Alternative 1 addresses each of the three No Future Use medium groups as follows:

- No Future Use, Significant Contamination History – The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the on-post hazardous waste landfill.
- No Future Use, Other Contamination History – The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris consolidated and capped in one of three places: the Rail Yard, North Plants, or the South Plants Central Processing Area. Multilayer caps are used for containment of the debris.

- No Future Use, Agent History – The structures are dismantled using dust controls and air monitoring, the debris monitored for the presence of Army chemical agent and caustic washed as necessary, and the resulting debris disposed in the on-post hazardous waste landfill. Spent caustic wash is treated in an evaporator/crystallizer; the resulting waste salts are drummed and disposed in the on-post hazardous waste landfill.

The components of this alternative are summarized in Table 7.3-1. The total estimated cost of this alternative (in 1995 dollars) is $114 million (present worth cost of $106 million). A breakdown of capital and O&M costs for each component of this alternative is presented in Table 7.3-2. This alternative requires approximately 2 years for implementation.

7.3.3.2 Alternative 2 – Landfill/Consolidate

Alternative 2 addresses each of the three No Future Use medium groups as follows:

- No Future Use, Significant Contamination History – The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the on-post hazardous waste landfill.
- No Future Use, Other Contamination History – The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris transported to the Basin A consolidation area for use as gradefill.
- No Future Use, Agent History – The structures are dismantled using dust controls and air monitoring, the debris monitored for the presence of Army chemical agent and caustic washed as necessary, and the resulting debris disposed in the on-post hazardous waste landfill. Spent caustic wash is treated in an evaporator/crystallizer; the resulting waste salts are drummed and disposed in the on-post hazardous waste landfill.

The components of this alternative are summarized in Table 7.3-1. The total estimated cost of this alternative (in 1995 dollars) is $112 million (present worth cost of $104 million). A breakdown of capital and O&M costs for each component of this alternative is presented in Table 7.3-2. This alternative requires approximately 2 years for implementation.

7.3.3.3 Alternative 3 – Landfill

Alternative 3 addresses each of the three No Future Use medium groups as follows:

- No Future Use, Significant Contamination History – The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the on-post hazardous waste landfill.
- No Future Use, Other Contamination History – The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the on-post hazardous waste landfill.
- No Future Use, Agent History – The structures are dismantled using dust controls and air monitoring, the debris monitored for the presence of Army chemical agent and caustic washed as necessary, and the resulting debris disposed in the on-post hazardous waste landfill. Spent caustic wash is treated in an evaporator/crystallizer; the resulting waste salts are drummed and disposed in the on-post hazardous waste landfill.

The components of this alternative are summarized in Table 7.3-1. The total estimated cost of this alternative (in 1995 dollars) is $118 million (present worth cost of $109 million). A breakdown of capital and operating and maintenance costs for each component of this alternative is presented in Table 7.3-2. This alternative requires approximately 2 years for implementation.

7.4 Description of Sitewide Remedial Alternatives for Soil

7.4.1 Description of Medium

As described in Section 5, the majority of contamination is present in the trenches, disposal basins, and the South Plants manufacturing area, covering approximately half of the central six sections of RMA (Figure 5.4-1 and Tables 5.4-11 and 5.4-12). The highest contaminant concentrations tend to occur in soil within 5 ft of the ground surface, although exceptions are noted, particularly at sites where burial trenches, disposal basins, or manufacturing complexes are located. In general, contaminant distribution is significantly influenced most by the physical and chemical properties of the contaminants, the environmental media through which they are transported, and the characteristics of the sources (i.e., former manufacturing and disposal practices).

7.4.2 Remedial Action Objectives

The RAOs identified for the soil medium are the following:

Human Health

- Prevent ingestion of, inhalation of, or dermal contact with soil or sediments containing COCs at concentrations that generate risks in excess of 1×10^{-4} (carcinogenic) or an HI greater than 1.0 (noncarcinogenic) based on the lowest calculated reasonable maximum exposure (5th percentile) PPLV values (which generally represent the on-site biological worker population).
- Prevent inhalation of COC vapors emanating from soil or sediments in excess of acceptable levels, as established in the HHRC.
- Prevent migration of COCs from soil or sediment that may result in off-post groundwater, surface water, or windblown particulate contamination in excess of off-post remediation goals.
- Prevent contact with physical hazards such as UXO.
- Prevent ingestion of, inhalation of, or dermal contact with acute chemical agent hazards.

Ecological Protection

- Ensure that biota are not exposed to COCs in surface water, due to migration from soil or sediment, at concentrations capable of causing acute or chronic toxicity via direct exposure or bioaccumulation.
- Ensure that biota are not exposed to COCs in soil and sediments at toxic concentrations via direct exposure or bioaccumulation.

7.4.3 Description of Sitewide Remedial Alternatives for Soil

The implementation of any soil alternative is tied to structures remediation because most of the structures at RMA are located in areas of soil contamination. In such areas, structures must be demolished before components of the soil remedy, such as excavation or the construction of containment systems, can be implemented.

PCB-contaminated soil at RMA was identified under the PCB IRA program. The remedial activities for PCB-contaminated soil are dependent on the concentration and location as follows:

- The three PCB-contaminated soil areas identified by the PCB IRA with concentrations of 250 ppm or greater will be removed. The limits of contamination will be determined based on visual evidence with immunoassay field confirmation sampling (SW-846).
- There are five PCB-contaminated soil areas identified by the PCB IRA with concentrations from 50 ppm to below 250 ppm. These areas will receive a minimum of 3 ft of soil cover, and the PCB-contaminated soil there will be left in place. The soil cover will be maintained as part of the wildlife refuge and is subject to the institutional controls of the FFA.
- No remaining areas of PCB-contaminated soil with concentrations above 50 ppm have been identified by the PCB IRA. If necessary, any suspected PCB soil contamination areas will be characterized further during the remedial design. If additional PCB-contaminated soil is found in concentrations of 50 ppm or above, the Army will determine any necessary remedial action in consultation with EPA.
- PCB-contaminated soil that is excavated under any soil alternative is disposed in the on-post TSCA-compliant landfill.

7.4.3.1 Alternative 1 – Caps/Covers

Alternative 1 involves the **containment** of 1,200 acres through the installation of a cap and the landfilling of 290,000 bank cubic yards (BCY) of contaminated soil. Under this alternative, **multilayer caps** are installed to contain contaminated soil. The capped areas are located in the central portions of RMA (Figure 7.4-1). The existing cover for the Former Basin F Subgroup is augmented to improve performance and meet EPA guidance governing caps and covers. A composite cap is constructed over the existing cover for the Basin F Wastepile. Approximately 17.8 million BCY of borrow materials are required as backfill and gradefill to achieve the design grades for capping, and an additional 11.3 million BCY of borrow (clay and common fill) are required for construction of the caps.

In addition to capping, all sewer manholes are plugged with cement. Slurry walls are used in conjunction with caps for the Complex Trenches, Shell Trenches, Hex Pit, and Buried M-1 Pits Subgroups to augment the containment of these sites. The groundwater inside the contained area is pumped and treated if necessary.

Areas outside the central portions of RMA that are suspected to have potential chemical agent or UXO presence are screened and cleared. Any **excavated** agent-contaminated soil identified during **agent monitoring** is treated by caustic washing and then landfilled. In addition, any identified HE-filled (high explosive) or agent-filled UXO is excavated, packaged, and **transported** off post to an existing Army facility for detonation and disposal (unless the UXO is unstable and must be detonated on post) or other demilitarization process. The 200,000 BCY of contaminated soil and debris from several sites in the eastern and western portions of RMA are excavated and placed in the on-post hazardous waste landfill along with debris from **munitions screening** operations. The

110,000 BCY of human health exceedances from the Surficial Soil, Lake Sediments, and Agent Storage Medium Groups are also landfilled.

Soil posing risk to biota is generally capped as discussed above. No action is undertaken for soil that potentially poses risks to biota that is located outside of the capped area including Upper Derby Lake and the Surficial Soil, Ditches/Drainage Areas, and Agent Storage Medium Groups. The soil in these areas is sampled periodically. No action (other than monitoring) is conducted for the aquatic lake sediments. Ongoing monitoring of biota in these areas will be conducted in support of design refinement/design characterization.

The components of this alternative are summarized in Table 7.4-1. The total estimated cost for this alternative (in 1995 dollars) is $542 million (present worth cost of $386 million). A breakdown of capital and O&M costs for each component of this alternative is presented in Table 7.4-2. This alternative requires approximately 17 years for implementation.

7.4.3.2 Alternative 2 – Landfill/Caps

Alternative 2 involves containment of approximately 490 acres through the installation of multilayer caps and the landfilling of 2 million BCY of contaminated soil. The areas outside the central portion of RMA are excavated and landfilled. The 110,000 BCY of human health exceedances from the Lake Sediments, Surficial Soil, and Agent Storage Medium Groups are landfilled. Any excavated agent-contaminated soil identified during monitoring is treated by caustic washing and then landfilled. In addition, any HE-filled or agent-filled UXO identified through geophysical surveys or other screening methods are excavated, packaged, and transported off-post to an existing Army facility for detonation and disposal (unless the UXO is unstable and must be detonated on post) or other demilitarization process. Chemical sewer lines in the central portion of the South Plants complex and within the Complex Trenches are plugged with cement and the sanitary sewer manholes are plugged. The remaining chemical sewers and associated contaminated soil are excavated and placed in the on-post hazardous waste landfill.

A 390-acre area in the central portion of RMA is covered with multilayer caps. The capped areas consist of human health exceedance areas and areas with residual contamination in Section 36, the South Plants Central Processing Area, and the Former Basin F (Figure 7.4-2). The existing cover for the Former Basin F Subgroup is augmented to improve performance and meet EPA guidance governing caps and covers. A composite cap is constructed over the existing cover for the Basin F Wastepile. Approximately 8.8 million BCY of borrow materials are required as backfill and gradefill to achieve the design grades for capping, and an additional 3.9 million BCY of borrow (clay and common fill) are required for construction of the caps.

Slurry walls are used in conjunction with caps for the Complex Trenches, Shell Trenches, Hex Pit, and Buried M-1 Pits Subgroups to augment the containment of these sites. The groundwater inside the contained area is pumped and treated if necessary to maintain lowered water table elevations.

Soil posing risk to biota within the central six sections of RMA is generally excavated and landfilled as discussed above. No action is undertaken for soil that potentially poses risks to biota that is located outside of the capped area including Upper Derby Lake and the Surficial Soil, Ditches/Drainage Areas, and Agent Storage Medium Groups. Although a residual risk to biota exists outside the capped area, the magnitude of the residual risk is comparatively low (see Section 6.2.4.3) and the short-term destruction of habitat is minimized. The soil in these areas is sampled periodically. No additional action other than monitoring is conducted for the aquatic lake sediments. Ongoing monitoring of biota in these areas will be conducted in support of design refinement/design characterization.

The components of this alternative are summarized in Table 7.4-1. The total estimated cost for this alternative (in 1995 dollars) is $383 million (present worth cost of $276 million). A breakdown of capital and O&M costs for each component of this alternative is presented in Table 7.4-2. This alternative requires approximately 16 years for implementation.

7.4.3.3 Alternative 3 – Landfill

Alternative 3 involves the containment of 3.4 million BCY of contaminated soil in an on-post hazardous waste landfill. Approximately 100 acres of principal threat or human health exceedance soil areas are contained with a multilayer cap instead of being landfilled, and 300 acres are capped (multilayer cap), after removing the human health exceedance volume and landfilling, to address residual contamination (Figure 7.4-3).

Contaminated soil from nearly all of the sites (3.4 million BCY total) is excavated and landfilled. Chemical sewers and associated contaminated soil are excavated and placed in the on-post hazardous waste landfill. The 87,000 BCY of human health exceedance volume from the Surficial Soil Medium Group, soil with human health exceedances in the Agent Storage Medium Group (2,900 BCY), and human health exceedances and soil that may pose a risk to biota from the Lake Sediments (including portions of Upper Derby Lake) and Ditches/Drainage Areas Medium Groups (90,000 BCY) are also excavated and landfilled. Any excavated agent-contaminated soil identified during monitoring is treated by caustic washing and then landfilled. The excavation of the Former Basin F, Buried M-1 Pits, Shell Trenches, and Hex Pit Subgroups requires the use of vapor- and odor-suppression measures such as foam, liners, or a transportable structure.

The sanitary sewer manholes are plugged. Any HE-filled (high explosive) and agent-filled UXO identified through geophysical surveys or other screening methods are excavated, packaged, and transported off post to an existing

Army facility for detonation and disposal (unless the UXO is unstable and must be detonated on post) or other demilitarization process.

The Basin F Wastepile and the Complex Trenches Subgroups are left in place and capped. A composite cap is constructed over the existing cover for the Basin F Wastepile. Following the excavation and landfilling of human health exceedances, 390 acres in Section 36, South Plants Central Processing Area, and the Former Basin F are capped (multilayer caps). Approximately 10.1 million BCY of borrow materials are required as backfill and gradefill to achieve the design grades for capping, and an additional 3.86 million BCY of borrow are required for construction of the cap.

Slurry walls are used in conjunction with the caps for the Complex Trenches Subgroup to augment the containment of this site. The groundwater inside the contained area is pumped and treated.

Soil posing risk to biota within the central six sections of RMA is generally excavated and landfilled as discussed above. No action is undertaken for soil that potentially poses risks to biota in the Surficial Soil Medium Group, but the soil in this area is sampled periodically. Although a residual risk to biota exists in this medium group, the magnitude of the residual risk is comparatively low (see Section 6.2.4.3) and the short-term destruction of habitat is minimized. No action other than monitoring is conducted for the aquatic lake sediments. Ongoing monitoring of the biota in these areas will be conducted in support of design refinement/design characterization.

The components of this alternative are summarized in Table 7.4-1. The total estimated cost for this alternative (in 1995 dollars) is $576 million (present worth cost of $384 million). A breakdown of capital and O&M costs for each component of this alternative is presented in Table 7.4-2. This alternative requires approximately 22 years for implementation.

7.4.3.4 Alternative 4 – Consolidation/Caps/Treatment/Landfill

Alternative 4 involves **consolidation** of 1.5 million BCY of soil with low levels of contamination into Basin A, Former Basin F, and the South Plants Central Processing Area; capping or covering of 1,100 acres of contaminated soil; landfilling of 1.7 million BCY of soil and debris; and treatment of 207,000 BCY of soil by solidification/ stabilization (Figure 7.4-4). This alternative also includes a contingent soil volume of 150,000 BCY that may be landfilled. The locations of the contingent volume will be based on visual field observations such as soil stains, presence of barrels, or newly discovered evidence of contamination. In addition, 14 samples from North Plants, Toxic Storage Yards, Lake Sediments, Sand Creek Lateral, and Burial Trenches Medium Groups and up to 1,000 additional confirmatory samples may be used to identify the contingent soil volume requiring landfilling.

Approximately 180,000 BCY of principal threat soil in the Former Basin F are treated by in situ solidification/stabilization, and 26,000 BCY of principal threat and human health exceedance soil from the Buried M-1 Pits are excavated, solidified, and placed in the on-post landfill. Excavation of the Buried M-1 Pits will be conducted using vapor- and odor-suppression measures.

Approximately 1,000 BCY of principal threat material from the Hex Pit are treated using an innovative thermal technology. The remaining 2,300 BCY are excavated and disposed in the on-post hazardous waste landfill. Remediation activities will be conducted using vapor- and odor-suppression measures as required. Treatability testing will be performed during remedial design to verify the effectiveness of the innovative thermal process and establish operating parameters for the design of the full-scale operation. The innovative thermal technology must meet the treatability study technology evaluation criteria as described in the dispute resolution agreement (PMRMA 1996). Treatment will be revised to a solidification/stabilization technology if all evaluation criteria for the innovative thermal technology are not met. Treatability testing for solidification will be performed to verify the effectiveness of the solidification process and determine appropriate solidification/stabilization agents. Treatability testing and technology evaluation will be conducted in accordance with EPA guidance (OSWER-EPA 1989a) and EPA's "Guide for Conducting Treatability Studies Under CERCLA" (1992).

The approximately 650,000 BCY of highly contaminated soil from the Basin F Wastepile and the Section 36 Lime Basins Subgroups is excavated (using vapor- and odor-suppression measures) and disposed in triple-lined cells within the on-post hazardous waste landfill. Soil from the Basin F Wastepile not passing the EPA paint filter test (SW-846, Method 9095) will be reduced to acceptable moisture-content levels by using a dryer in an enclosed structure. Any contaminants released from the soil during drying will be captured and treated.

Approximately 1 million BCY of human health exceedance soil from other sites throughout RMA, as well as debris from UXO clearance operations, are landfilled under this alternative. Any excavated agent-contaminated soil identified during monitoring is treated by caustic washing and then landfilled. In addition, any identified HE-filled and agent-filled UXO are excavated, packaged, and transported off post to an existing Army facility for detonation and disposal (unless the UXO is unstable and must be detonated on post) or other demilitarization process.

Slurry walls are used in conjunction with the caps for the Shell Trenches and Complex Trenches Subgroups to augment the containment of these sites. For the purposes of conceptual design and costing during the FS, it was assumed that the groundwater inside the contained area is pumped and treated at the Basin A Neck treatment system (this assumption will be reevaluated during the remedial design). The Shell Trenches and Complex Trenches caps are designed to be RCRA-equivalent caps. The complex trenches cap includes a 6-inch-thick formed concrete layer. The sanitary sewer manholes and the chemical sewers located in the South Plants Central Processing Area

and Complex Trenches are plugged. The remaining human health exceedance soil and chemical sewer debris are excavated and placed in the landfill.

Soil posing a potential risk to biota within the Secondary Basins as well as the North Plants Manufacturing Area is contained in place using 2-ft-thick soil covers. Soil posing a potential risk to biota within the Ditches/Drainage Areas, Sanitary Landfills, Section 36 Balance of Areas, Sand Creek Lateral, South Plants, and some of the Lake Sediments and Surficial Soil Medium Groups/Subgroups are consolidated as gradefill soil within Basin A, South Plants Central Processing Area, or Former Basin F and are contained beneath the cap or soil covers for those sites. The construction of the cap and covers of these three areas requires approximately 5.7 million BCY of gradefill to provide sufficient slope for proper drainage. Other sites require an additional 3.1 million BCY of backfill and gradefill to achieve design grades for caps/covers. An additional 5.1 million BCY of borrow material are required for construction of all caps/covers. The Former Basin F cap is designed to be RCRA-equivalent. Basin A and the South Plants Central Processing Area are contained with a 4-ft-thick soil cover and, respectively, a 6-inch-thick formed concrete layer and 1-ft-thick crushed concrete layer for prevention of biota intrusion.

The South Plants Balance of Areas is covered with a variable-thickness soil cover. The former human health exceedance area is covered with a 3-ft-thick soil cover and the former potential risk to biota area is covered with a 1-ft-thick soil cover. Prior to placing this cover, two composite samples per acre will be collected to ensure that the soil under the 1-ft-thick soil cover does not exceed human health or principal threat criteria. If the residual soil is found to exceed these levels, the 3-ft-thick cover will be extended over these areas or the exceedance soil will be excavated and landfilled. The top 1 ft of the entire soil cover area will be constructed using uncontaminated soil from the on-post borrow areas.

The Section 36 Balance of Areas will also be covered with a variable-thickness soil cover. The former human health exceedance area is covered with a 2-ft-thick soil cover and the former potential risk to biota area is covered with a 1-ft-thick soil cover.

Soil posing risk to biota is generally excavated and consolidated within the Basin A and South Plants Central Area covers or placed beneath the Basin F cap. No action is undertaken for soil that potentially poses risks to biota that is located outside of this area, i.e., soil within the Lake Sediments or Surficial Soil Medium Groups. Although a residual risk to biota exists in these areas, the magnitude of the residual risk is comparatively low (see Section 6.2.4.3) and the short-term destruction of habitat is minimized. These areas are sampled periodically. No action (other than monitoring) is conducted for the aquatic lake sediments. Ongoing monitoring of the biota in these areas will be conducted in support of design refinement/design characterization.

The components of this alternative are summarized in Table 7.4-1. The total estimated cost for this alternative (in 1995 dollars) is $566 million (present worth cost of $401 million). A breakdown of capital and O&M costs for each component of this alternative is presented in Table 7.4-2. This alternative requires approximately 17 years for implementation.

7.4.3.5 Alternative 5 – Caps/Treatment/Landfill

Alternative 5 is composed of the following features: capping of 530 acres of contaminated soil, landfilling of 4 million BCY of soil and debris, and treatment of 1.1 million BCY of contaminated soil (Figure 7.4-5).

Approximately 1.1 million BCY of principal threat soil are treated by **thermal desorption**, **incineration**, or **solidification/stabilization**. The majority of the soil treated by thermal desorption is from the Basin F Wastepile, Former Basin F and South Plants Central Processing Area Subgroups. The excavation of soil from both the Basin F Wastepile and Former Basin F for treatment may require use of vapor- and odor- suppression measures. Soil in the Shell Trenches and Hex Pit Subgroups (103,000 BCY) is excavated and treated by incineration. The excavation of both the Shell Trenches and Hex Pit also requires use of vapor- and odor-suppression measures. All soil treated by thermal desorption or incineration is placed in the on-post hazardous waste landfill.

A total of 27,000 BCY of soil contaminated with inorganic contaminants are treated by solidification. The majority of the soil to be solidified is excavated from the Buried M-1 Pits Subgroup, which requires vapor- and odor-suppression measures during excavation.

The Complex Trenches Subgroup is left in place and contained with a multilayer cap and slurry walls. The groundwater inside the contained area is pumped and treated as necessary.

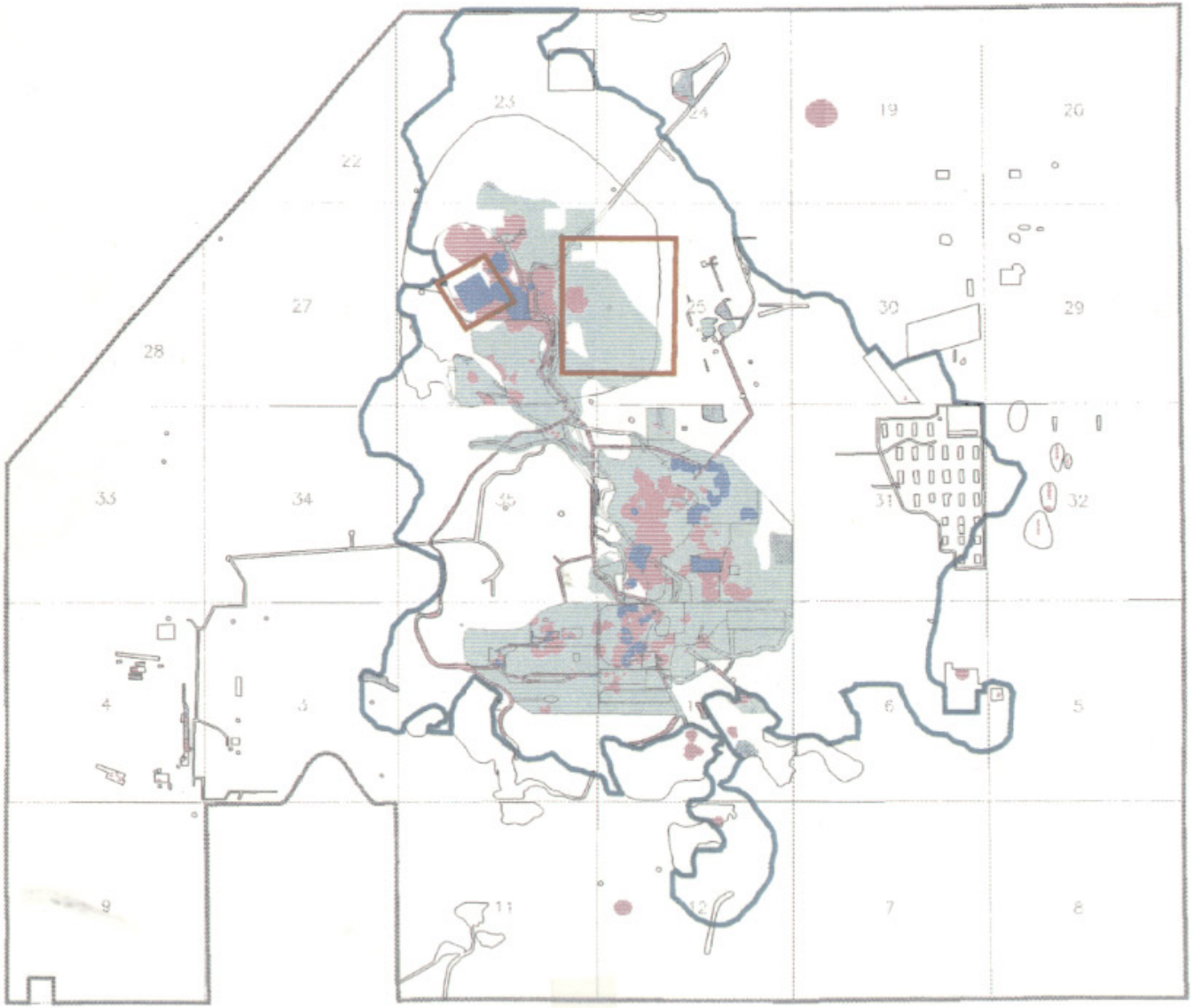
Following the excavation of human health exceedance volumes for treatment or disposal, 530 acres in Section 36, the South Plants Central Processing Area, and the Former Basin F are capped (multilayer caps). Approximately 10.5 million BCY of borrow materials are required as gradefill to achieve the design grade for the caps, and an additional 3.9 million BCY of borrow are required for construction of the caps.

Approximately 4 million BCY of contaminated soil, primarily from sites outside of the central portions of RMA, as well as debris from UXO clearance operations, are landfilled under this alternative. The incinerated soil and debris and the thermally desorbed soil are also placed in the on-post hazardous waste landfill. Any agent-contaminated soil identified during screening is treated by caustic washing and then landfilled. In addition, any identified HE-filled and agent-filled UXO is excavated, packaged, and transported off post to an existing Army facility for detonation and disposal (unless the UXO is unstable and must be detonated on post) or other demilitarization

process. The sanitary sewer manholes are plugged. The chemical sewers and any associated contaminated soil are excavated and placed in the on-post hazardous waste landfill. The 87,000 BCY of human health exceedance volume from the Surficial Soil Medium Group are also landfilled.

Soil posing risk to biota within the central six sections of RMA is generally excavated and landfilled. An additional 1,600 acres of soil representing a potential risk to the great horned owl are addressed through agricultural practices, which reduces the level of contamination in near-surface soil. No action other than monitoring is conducted for the aquatic lake sediments. Ongoing monitoring of biota in these areas will be conducted in support of design refinement/design characterization.

The components of this alternative are summarized in Table 7.4-1. The total estimated cost for this alternative (in 1995 dollars) is $1.01 billion (present worth cost of $542 million). A breakdown of capital and O&M costs for each component of this alternative is presented in Table 7.4-2. This alternative requires approximately 28 years for implementation.



Legend

- RMA Boundary
- SAR Site Boundary[1]
- Principal Threat Exceedance Area Cancer Risk ≥ 10E−3 or HI ≥ 1000
- Human Health Exceedance Area Cancer Risk ≥ 10E−4, Chronic HI ≥ 1.0, or Acute HI ≥ 1.0
- Biota Risk Area
- Section Number
- Area of Contamination Boundary
- CAMU Boundary

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Based on RME exposure parameters and C_{max} on boring by boring basis for 0-ft to 10-ft depth interval.

-N-

1500 0 1500 3000 Feet

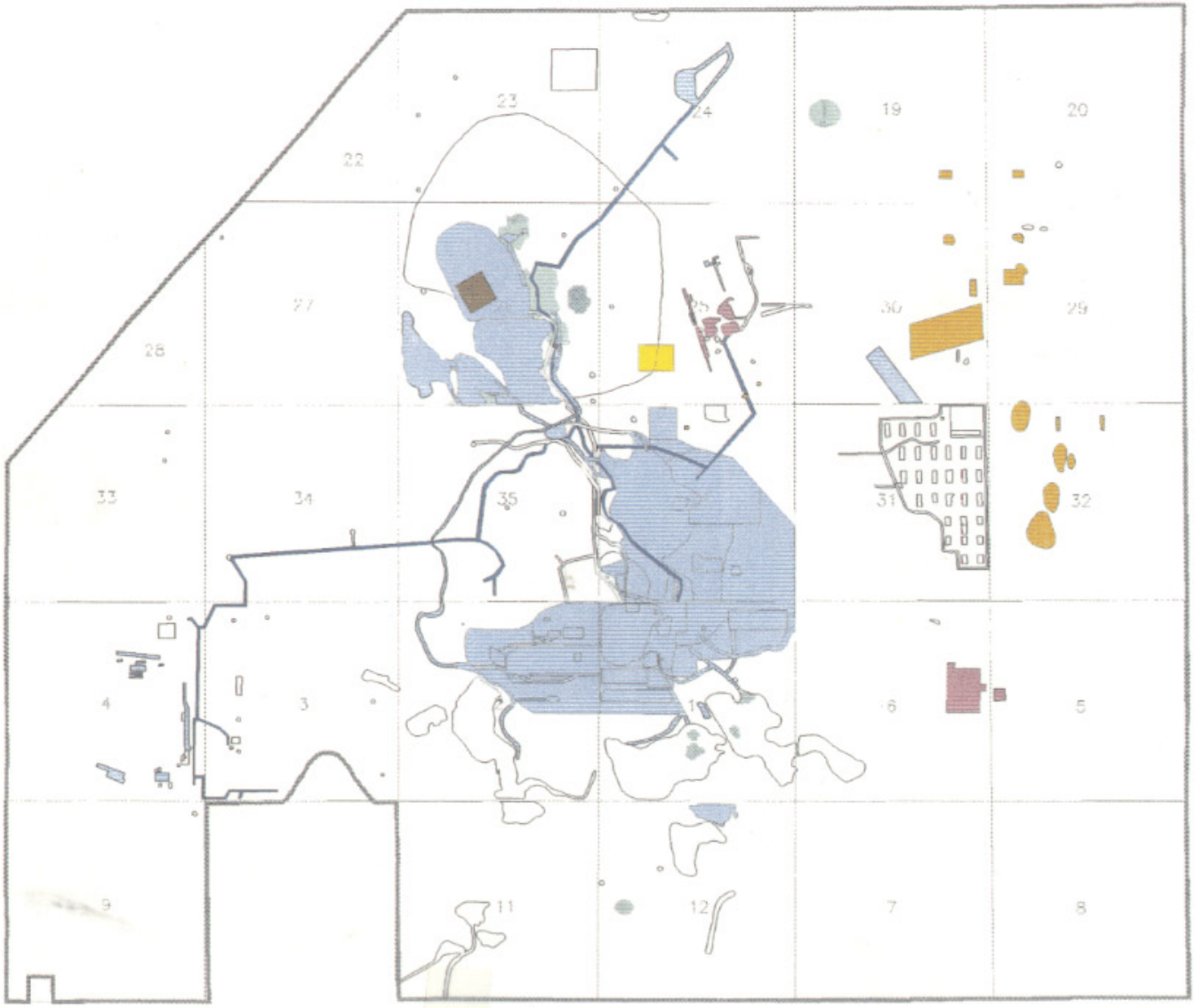
Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 7.1-1

Human Health Exceedance Areas and Biota Risk Area[2]

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\FIG711
Date 6/06/96
Drawn by XG
Checked by SA



Legend

- RMA Boundary
- SAR Site Boundary[1]
- Capped Areas
- Landfill Site
- Areas to be Landfilled
- Agent Screening Area (Caustic wash/landfill)
- UXO Screening Area (Detonation/landfill)
- Basin F Wastepile Cap
- Access Restrictions
- 5 Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

-N-

1500 0 1500 3000 Feet

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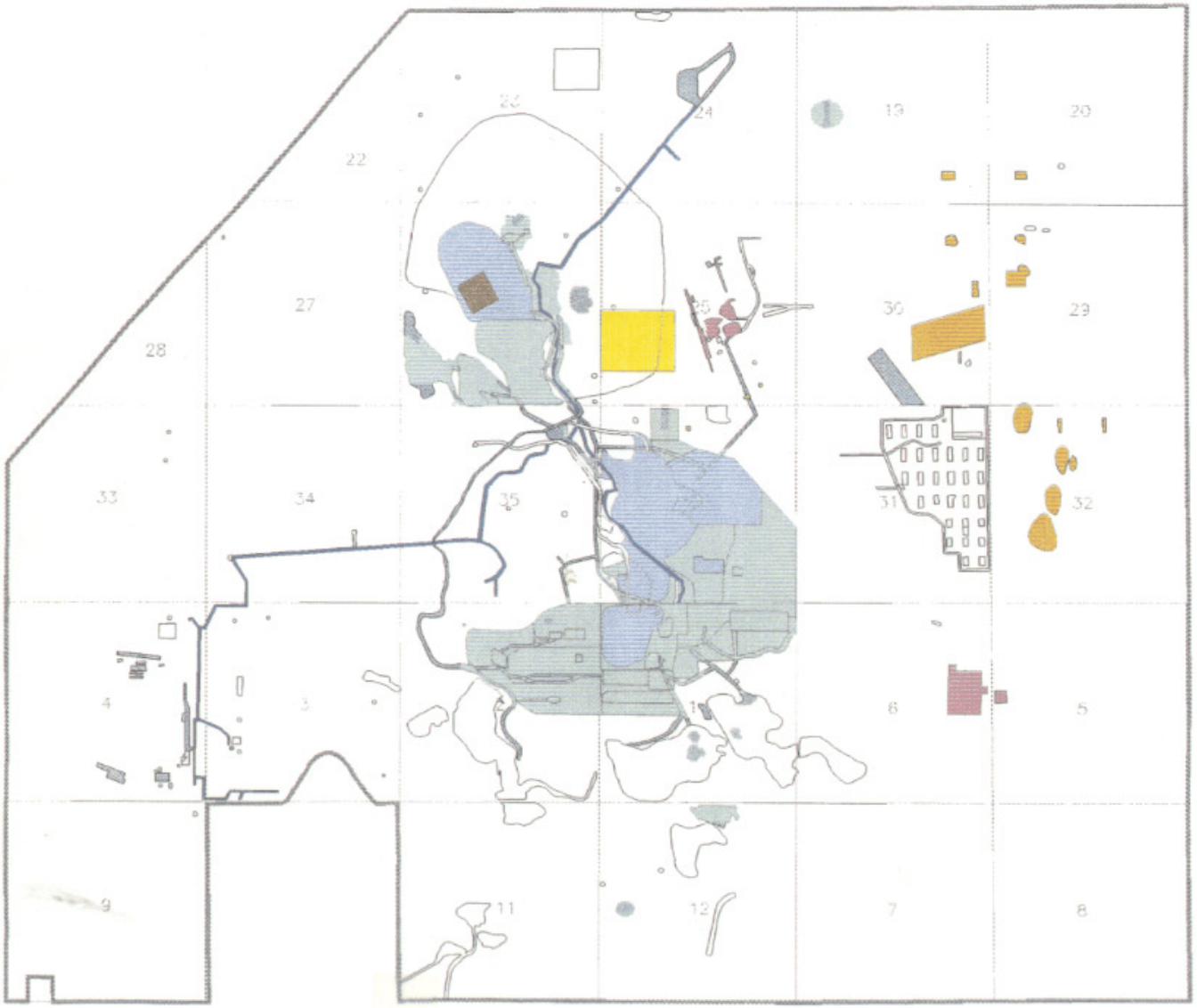
Figure 7.4-1

Caps/Covers Alternative

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\SOIL_FS1
Date 6/06/96
Drawn by XG
Checked by SA



Legend

- RMA Boundary
- SAR Site Boundary[1]
- Capped Areas
- Landfill Site
- Areas to be Landfilled
- Agent Screening Area (Caustic wash/landfill)
- UXO Screening Area (Detonation/landfill)
- Basin F Wastepile Cap
- Access Restrictions
- 5 Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

-N-

1500 0 1500 3000 Feet

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Figure 7.4-2

Landfill/Caps Alternative

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\SOIL_ES2
Date 6/06/96
Drawn by XG
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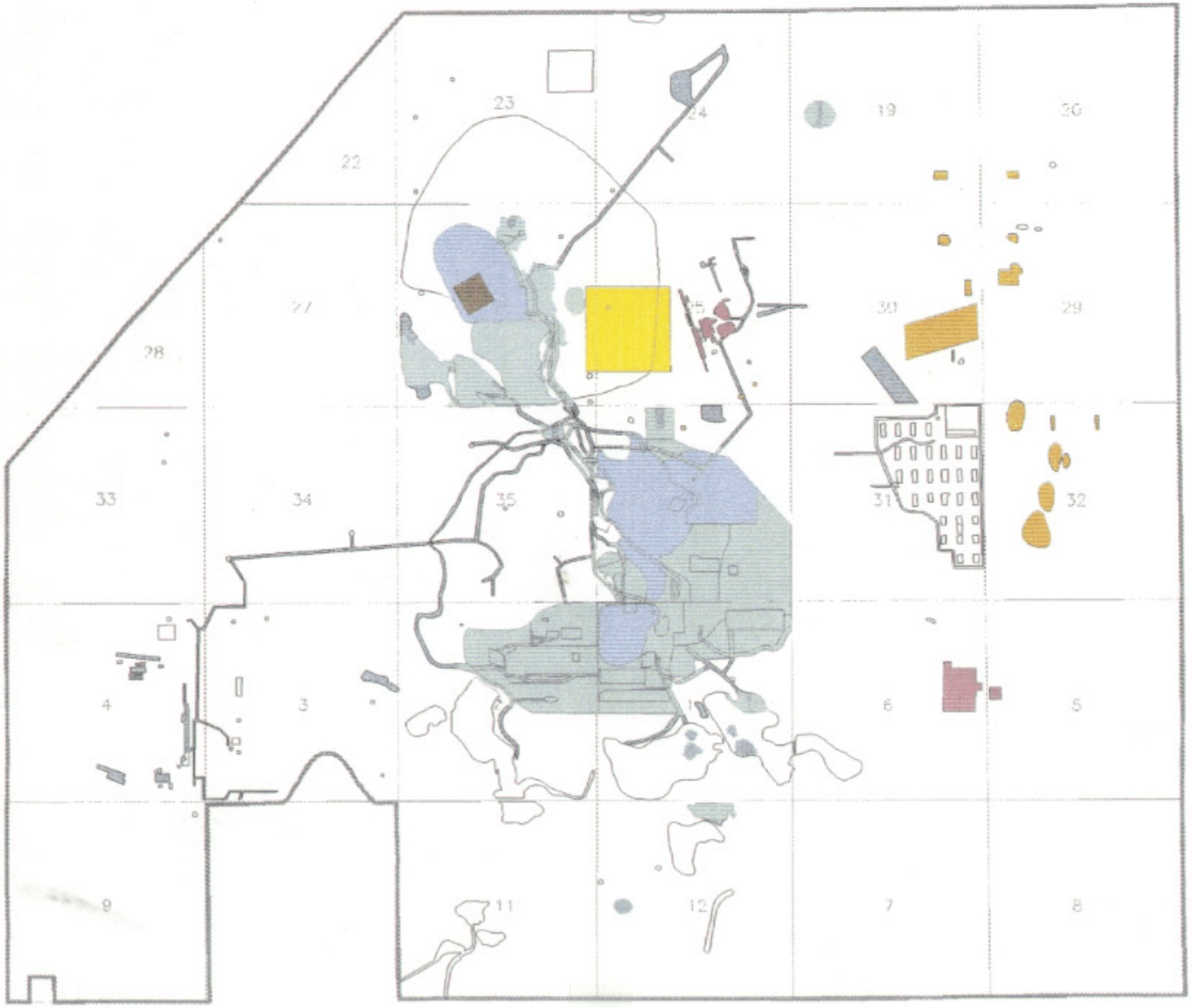

Legend

- RMA Boundary
- SAR Site Boundary[1]
- Capped Areas following Landfill
- Landfill Site
- Areas to be Landfilled
- Agent Screening Area (Caustic wash/landfill)
- UXO Screening Area (Detonation/landfill)
- Basin F Wastepile Cap
- 5 Section Number

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

-N-

1500 0 1500 3000 Feet

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Figure 7.4-3

Landfill Alternative

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\SOIL_ES3
Date 6/06/96
Drawn by XG
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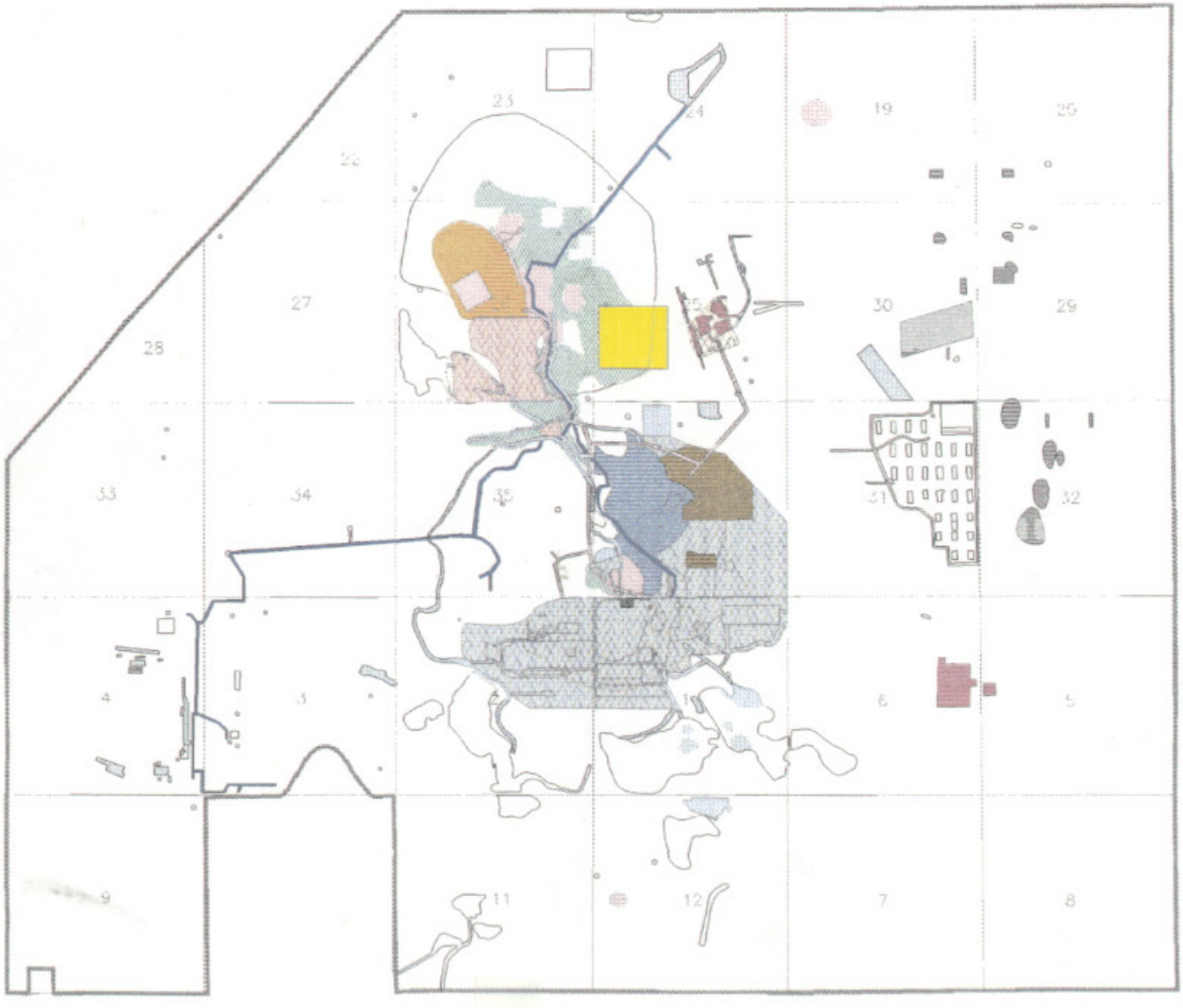

Legend

- RMA Boundary
- SAR Site Boundary[1]
- In-situ Solidification of Principal Threat Volume; RCRA-Equivalent Cap
- RCRA-Equivalent Caps
- Direct Solidification/Stabilization
- Innovative Thermal Treatment (Hex Pit)
- Basin A Consolidation Area
- Landfill Human Health Soil,[2] Consolidation of Biota Soil
- Landfill Human Health Soil[3]
- Landfill Site
- Soil Covers
- Agent Screening Area (Caustic wash/landfill)
- UXO Screening Area (Detonation/landfill)
- Surficial Soil Consolidation
- Access Restrictions
- 5 Section Number

[1] Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a)

[2] Debris from the Sanitary Landfills Medium Group will be consolidated.

[3] Wastepile material will be dried prior to landfilling, if necessary, to pass EPA paint filter test.

-N-

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 7.4-4

Consolidation/Caps/Treatment/ Landfill Alternative

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\SOIL_ES4
Date 6/06/96
Drawn by XG
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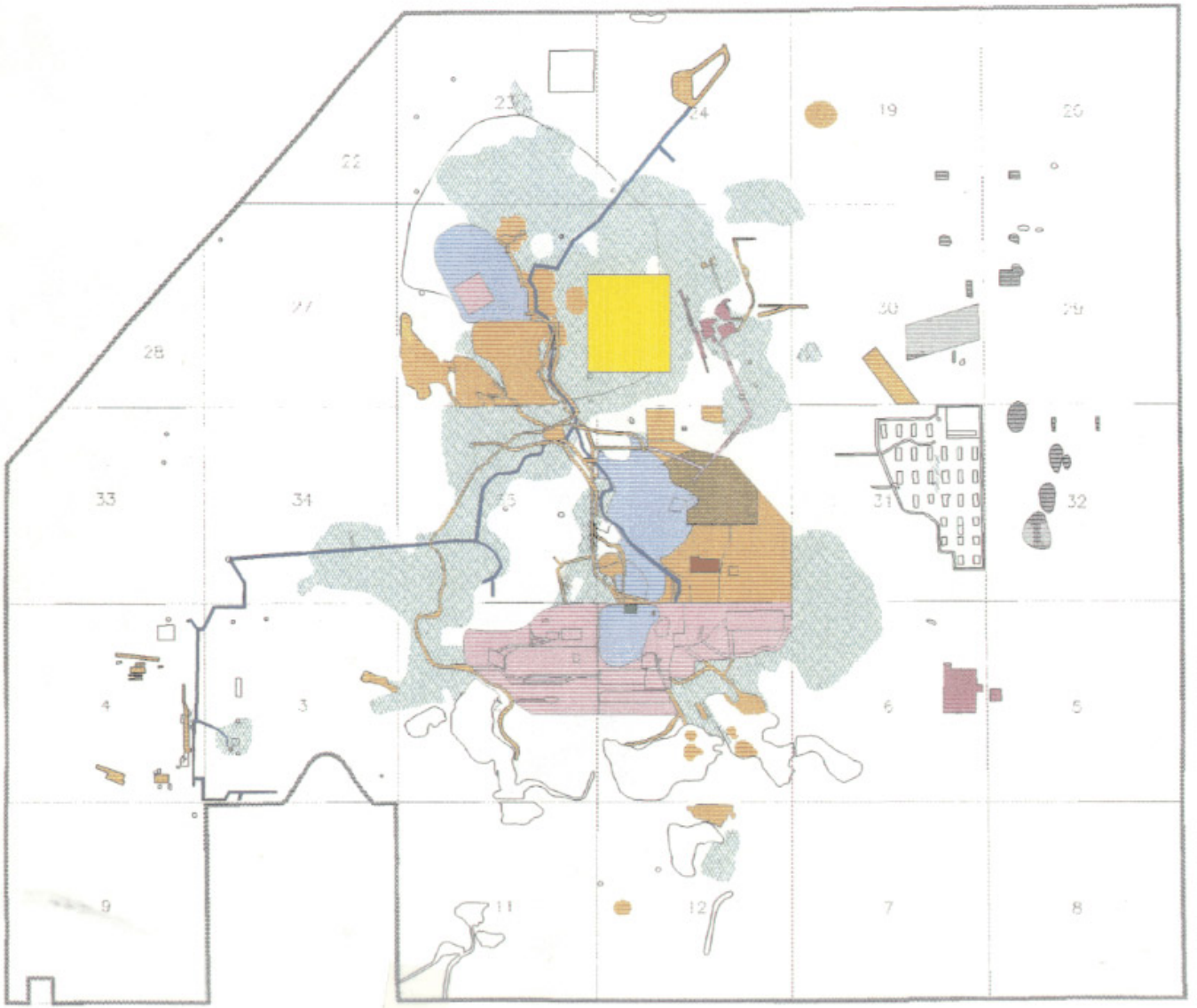


Legend

- RMA Boundary
- SAR Site Boundary[1]
- Landfill and Cap following[2] Thermal Desorption of Principal Threat Volumes in Basin A, Former Basin F, South Plants Central Processing
- Thermal Desorption of Wastepile or Principal Threat Volume; Landfill
- Incineration
- Landfill Site
- Areas to be Landfilled
- Cap
- Direct Solidification/Stabilization
- Agent Screening Area (Caustic wash/landfill)
- UXO Screening Area (Detonation/landfill)
- In Situ Agricultural Practices
- Access Restrictions
- 5 Section Number

-N-

[1]Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a).

[2]Solidification/Stabilization of Principal Threat Volume with inorganic exceedance for South Plants Central Processing Area.

1500 0 1500 3000 Feet

Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 7.4-5

Caps/Treatment/Landfill Alternative

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\SOIL_ES5
Date 6/06/96
Drawn by XG
Checked by SA

Table 7.1-1 Description of Water Technologies[1]

Technology	Description
Dewatering	Dewatering involves the withdrawal of groundwater from an underground water-bearing zone, effectively lowering the water table in an area. A lower water table separates contamination in soil near the surface from groundwater. Prior to dewatering, groundwater levels are close to the ground surface. In areas of shallow groundwater, it is relatively easy for chemical spills or contaminants in soil near the surface to migrate down to the groundwater. Following dewatering, contaminated soil and groundwater are separated from each other and further contamination of groundwater is reduced. Dewatering is also used in construction and demolition activities in areas of shallow groundwater to stabilize subsurface soil. For example, before an old building and its basement can be demolished, the ground around it is dewatered. Once an area is dewatered, heavy equipment can be used and water is prevented from filling up the excavation. Dewatering also reduces the chances that the underground walls will cave in on workers.
Granular-Activated Carbon Adsorption	GAC adsorption refers to the removal of dissolved contaminants from an aqueous stream, although it may also be applied to gaseous streams. In the GAC process, water containing dissolved organic compounds is brought into contact with GAC, onto which the organic compounds preferentially adsorb. The attraction of organic molecules in solution to the surface of the carbon is dependent on the strength of the molecular attraction between the carbon and the organic contaminant, the molecular weight of the contaminant, the type and characteristics of the carbon, the surface area of the carbon, and the pH and temperature of the solution. The GAC process option can be used as a single treatment technology or as one of a series of treatments designed to optimally address a contaminant mixture in a treatment process train.
Air Stripping	Air stripping is an effective and proven method for removal of volatile organic compounds from water. The process involves the removal of the volatiles from an aqueous stream by mass transfer through countercurrent contact of the stream with air. Air stripping is a means for transferring the contamination from the liquid phase to gas (vapor). The gases are collected and require additional treatment.

Table 7.1-1 Description of Water Technologies[1]

Technology	Description
In Situ Biological Treatment	In situ biodegradation, or biological treatment, takes advantage of naturally occurring microorganisms in the aquifer that are capable of breaking down and destroying contaminants. In situ means "in place;" the term is appended to the name of this technology because the degradation occurs underground in the aquifer. The microorganisms that make this treatment technology work are already present in the aquifer, but they are not plentiful enough to significantly decrease the concentration of contaminants in the aquifer. To encourage their growth, oxygen and nutrients containing nitrogen are added to the aquifer. This is done by extracting some of the groundwater, adding chemicals to the water, and then reinjecting it into the aquifer. The microorganism population increases after the nutrients are added. The contaminants serve as a source of food for the microorganisms, with the result that the contaminants are destroyed.
Groundwater Extraction/Reinjection	Groundwater extraction methods may be used to collect contaminated groundwater from aquifers for surface treatment and reinjection, to dewater excavations in areas with a shallow water table, and/or to contain a plume of contaminated groundwater. The design of the extraction system is determined by site-specific conditions and the intended purpose of the system. For example, an intercept system may be designed to capture either the leading edge of a plume or the most contaminated portion of the plume. Under a mass-reduction approach, an extraction system is designed to capture the central mass or most contaminated portion of the plume. In addition to removing the mass of contamination, a mass reduction or dewatering approach eliminates contact between overlying contaminated soil and groundwater by lowering the water table. The layout, pumping rates, well spacing, etc., all differ for each of these examples depending on the desired effect. The groundwater extraction technology under consideration is extraction wells, with provisions for trenches/drains if needed. The reinjection method under consideration is a recharge trench. Extracted water is pumped to a treatment facility and the effluent from treatment is reinjected. Recharge trenches are excavated to a depth sufficient to convey water to the water table and may use any type of buried conduit used to convey liquids by gravity flow.

[1] Detailed discussion of all water remediation technologies considered is presented in the Detailed Analysis of Alternatives report.

Table 7.1-2 Description of Structures Technologies[1]

Technology	Description
Structures Demolition	Structures demolition involves the physical dismantling of structures, sizing of debris, and separation of salvageable materials. Dismantling requires the use of medium to heavy equipment to demolish a structure, i.e., to take it apart piece by piece. The structure is broken up using bulldozers, backhoes, wrecking balls, clamshells, universal processors with cutting shears or other similar types of equipment. Contaminants are not treated through this process, but the volume is decreased and converted to a more workable form for subsequent treatment or disposal. Dust-control measures are commonly taken during the operation, generally consisting of spraying or misting water over the work area. Dismantling is applicable to all types and sizes of structures as well as pipes and tanks.
Salvage	Salvage consists of recycling scrap metal, process equipment, and piping. It represents an opportunity to reduce disposal costs and minimize waste streams. Materials that are salvaged include metal structure materials (rebar, support beams, etc.) and process equipment and piping. In addition, salvage includes the recycling of any metal materials that are stockpiled in "boneyards" on post. All metal materials from Army-owned structures are salvaged through the Defense Reutilization and Marketing Office. Metal materials may either be resold to salvage companies, recycled on or off post, or redistributed to Army facilities.
On-Post Landfill	A landfill securely contains contaminated structure debris by providing a physical barrier both above and below the contaminated material. The low-permeability cover protects human and biota receptors from direct contact with the contaminants, and the low-permeability liner restricts contaminant mobility, protecting the underlying soil and groundwater. The landfill technology is applicable primarily for the disposal of untreated soil and debris, but may also be used for the disposal of treated debris and soil/debris mixtures. In addition, oversize materials removed during materials-handling activities for both soil and structures treatment alternatives will also require placement in a landfill.
Caustic Washing of Agent-Contaminated Structure Debris	Caustic washing is a physical/chemical treatment process in which agent-contaminated structural debris is excavated, mixed with caustic wash fluids in an aboveground unit to degrade agent, and then separated from the fluids. The process is carried out at ambient temperature and atmospheric pressure. The makeup of the treatment solution is based upon suspected contaminants and suspected contaminant concentrations. At RMA this process is based upon the suspected presence of GB, VX, lewisite, and mustard. Although there are chemical treatment alternatives that more effectively treat each individual contaminant, this process has been designed to treat all aforementioned compounds and generate by-products of greatly reduced toxicity.

Table 7.1-2 Description of Structures Technologies[1]

Technology	Description
Multilayer Cap	A multilayer cap reduces both the migration of hazardous substances into the surrounding environment by minimizing deep percolation through the contaminated media and the potential for direct exposures by humans or biota to contaminated media through containment (i.e., the isolation of the contaminated media). From top to bottom, a multilayer cap generally consists of three layers: a 4-ft-thick soil/vegetation layer designed to minimize erosion and promote drainage; a 1-ft-thick layer of crushed concrete or cobbles as a biota barrier serving to protect the underlying low-permeability soil layer; and a 2-ft-thick layer of compacted, low-permeability soil. The cap is constructed with sufficient slope to prevent ponding of rainwater. The vegetation used for the top layer consists of locally adapted perennial grasses and low-growing plants selected to minimize erosion and discourage burrowing animals from using the cover as habitat.

1 Detailed discussion of all structures remediation technologies considered is presented in the Detailed Analysis of Alternatives report.

Table 7.1-3 Description of Soil Technologies[1]

Technology	Description
Excavation	Excavation is the removal of soil, debris, drums, pipes, tanks, or any other solid material from the ground. Examples of conventional excavation equipment are bulldozers, backhoes, clamshells, drag lines, front-end loaders, and scrapers. Excavated soil is loaded and transported to a disposal area or treatment facility. Backfilling (using on-post borrow material) and reclamation is required following excavation. Additional process requirements for excavation may include dust suppression, control of air emissions, dewatering, or removal of debris or UXO.
Soil Cover	A soil cover isolates the contaminated media from potential receptors, such as humans or biota, thereby preventing direct exposures through direct contact. A soil cover consists of a variable-thickness layer of soil and may include crushed or formed concrete layers as biota/excavation barriers. Soil covers may be sloped for erosion control and are vegetated with locally adapted perennial grasses and low-growing plants. A soil cover is not intended to provide a low-permeability barrier to infiltration.
Multilayer Cap	A multilayer cap reduces both the migration of hazardous substances into the surrounding environment by minimizing deep percolation through the contaminated media and the potential for direct exposures by humans or biota to contaminated media through containment (i.e., the isolation of the contaminated media). From top to bottom, a multilayer cap generally consists of three layers: a 4-ft-thick soil/vegetation layer designed to minimize erosion and promote drainage; a 1-ft-thick layer of crushed concrete or cobbles as a biota barrier to protect the underlying low-permeability soil layer; and a 2-ft-thick layer of compacted, low-permeability soil. The cap is constructed with sufficient slope to prevent ponding of rainwater. The vegetation used for the top layer consists of locally adapted perennial grasses and low-growing plants selected to minimize erosion and discourage burrowing animals from using the cover as habitat.
Slurry Wall	Slurry walls are vertical barriers that serve to impede the lateral flow of contaminated groundwater. The installation of a slurry wall entails the excavation of a trench, placement of the slurry mixture in the trench, and addition of fill material in the slurry-filled trench. The slurry wall mixture (commonly backfill soil, bentonite, and water) is selected based on compatibility and optimization concerns. The completed slurry wall acts as a low-permeability barrier to lateral groundwater flow. Slurry walls may be installed around sites in conjunction with a multilayer cap to form an isolation cell around the contaminated soil.

Table 7.1-3 Description of Soil Technologies[1]

Technology	Description
Composite Cap	A composite cap reduces both the migration of hazardous substances into the surrounding environment by minimizing infiltration through the contaminated soil and the potential for direct exposures by both humans and biota to contaminated media through containment (i.e., the isolation of the contaminated media). A composite cap consists of multiple layers including a soil/vegetative layer and a flexible-membrane liner overlying a layer of compacted clay. The composite cap design used in the soil alternatives includes a biota-intrusion barrier, drainage layers (sand and geotextile), and a geogrid for stability. The cap is constructed with sufficient slope to prevent ponding of rainwater, and the vegetation used for the top layer consists of locally adapted perennial grasses and low-growing plants selected to minimize erosion and discourage burrowing animals from using the cover as habitat.
On-Post Landfill	A landfill securely contains contaminated soil by providing a physical barrier both above and below the contaminated material. The low-permeability cover protects human and ecological receptors from direct contact with the contaminants, and the low-permeability liner restricts contaminant mobility, protecting the underlying soil and groundwater. The landfill technology is applicable primarily for the disposal of untreated soil and debris, but may also be used for the disposal of treated debris and soil/debris mixtures. In addition, oversize materials removed during materials handling activities for both soil and structures treatment alternatives will also require placement in a landfill.
Thermal Desorption	Thermal desorption uses heat to physically separate volatile (and some semivolatile) organic compounds from soil or sludge. In general, the operating temperature of the desorber (95°C to 540°C) is not high enough to oxidize or destroy the organic compounds to any significant extent, i.e., the desorber separates the organic contaminants so that the secondary combustion chamber may destroy them. Offgas from the secondary combustion chamber is treated for particulates and acid-gas emissions. Thermal desorption also volatilizes some metals; the extent of volatilization is a function of the selected operating temperature. For example, at the higher range of thermal desorption temperatures, mercury is almost entirely volatilized and arsenic is partially removed. Thermal desorption, however, cannot be used as a treatment technology for inorganic contaminant remediation.
Off-Post Demilitarization of UXO	Off-post demilitarization of UXO involves excavation, packaging, and transportation of the UXO to an appropriate Army facility for demilitarization. This process, applicable to any UXO identified involves shipping HE or agent-filled UXO that is safe or rendered safe to an Army

Technology	Description
Caustic Washing of Agent-Contaminated Soil	Caustic washing is a physical/chemical treatment process in which agent-contaminated soil is excavated, mixed with caustic wash fluids in an aboveground unit to degrade agent, and then separated from the fluids. The process is carried out at ambient temperature and atmospheric pressure. The makeup of the treatment solution is based upon suspected contaminants and suspected contaminant concentrations. At RMA, this process is based upon the suspected presence of GB, VX, lewisite, and mustard. Although there are chemical treatment alternatives that more effectively treat each individual contaminant, this process has been designed to treat all aforementioned compounds and generate byproducts of greatly reduced toxicity.
Incineration	Incineration is a high-temperature process that uses either direct or indirect heat exchange to alter or destroy organic contaminants in soil, sludge, sediment, or debris. In general, the operating temperature of the incinerator (640°C to 1,000°C) is high enough to destroy the contaminants by oxidation or pyrolysis. Natural organic material is also burned out of the soil matrix. Incineration will remove, but not destroy, volatile metals such as mercury and arsenic. Off gas from the incinerator passes through a cyclone separator to remove particulates. Residual organic contaminants are destroyed in a secondary combustion chamber. Off gas from the secondary combustion chamber is treated for particulates and acid-gas emissions.
Stabilization/ Solidification	Solidification/stabilization processes use additives, or binding agents, to limit the mobility of contaminants and improve the physical characteristics of the waste by eliminating free liquids and producing a solid with high structural integrity. Although solidification/stabilization has historically addressed inorganic contamination through the use of cement-based agents, the advent of specialized additives has broadened the applicability to media containing both inorganic and organic contamination. Solidification/stabilization can be accomplished using ex situ or in situ processes. Ex situ processes rely on mechanical mixing equipment, such as a pug mill, to properly mix the contaminated soil with the binding agents. Mixing for in situ processes is accomplished using auger or rotor mixers. The binding agents are either placed on the soil surface and are drawn in by the mixing equipment or are injected through nozzles in the augers. An overlapping drilling pattern is used to obtain complete contact with the contaminated soil volume.
Agricultural Practices (Landfarming)	This technology consists of using landfarming techniques either with farm machinery (V-ripper, plow, and disk) or a soil stabilizer along with seeding to facilitate stabilization and attenuation of contaminants in surface soils (0-ft to 1 -ft depth interval). Mixing surface contamination with the soil below is expected to promote contaminant loss and to reduce both contaminant exposure to surface receptors and migration of contaminants by surface dust dispersion.

Table 7.1-3 Description of Soil Technologies[1]

Technology	Description
Pipe Plugging	This process option consists of filling the interior of pipes with grout. The purpose is to eliminate this contaminant migration pathway and immobilize contamination within the pipe, reducing its mobility. The technique involves using a mobile grout plant to mix and inject the plugging material into the pipe. The pipes to be plugged are first drained of any residual liquids, and any fittings that block the grout are cut from the pipe run. Aboveground pipe sections are cut into manageable lengths of 100 ft for diameters up to 12 inches and 50 ft for diameters up to 36 inches. The grout is pumped into the pipe run from the low end until it exits the high end, which is closed once grout starts coming out. The lower end is then closed off, and the grout is allowed to harden. Pumping grout from the low end to the high end helps to prevent the formation of voids.

[1] Detailed discussion of all soil remediation technologies considered is presented in the Detailed Analysis of Alternatives report.

Table 7.1-4 Site Evaluation Criteria and Principal Threat Criteria for Soil

Contaminants of Concern	Principal Threat Criteria[2]	Chronic Risk-Based Criteria 0- to 1 0-ft Interval		Acute and Subchronic Risk-Based Criteria 0- to 1-ft Interval (where lower than chronic)
		Site Evaluation Criteria[2]	Preliminary Remediation Goals[2]	Site Evaluation Criteria[2]
Aldrin	720	71	0.72	3.8
Benzene	10,400	1,040	10	
Carbon Tetrachloride[1]	2,300	30	2.3	
Chlordane[1]	3,700	55	3.7	12
Chloroacetic Acid[1]	77,000	77	77	
Chlorobenzene[1]	850,000	850	850	
Chloroform[1]	48,000	370	48	
DDE	13,000	1,300	13	
DDT[1]	14,000	410	14	14
DBCD	200	8	0.2	
1,2-Dichloroethane	3,200	320	3.2	
1,1-Dichloroethene	520	52	0.52	
DCPD[1]	NA	3,700	3,700	
Dieldrin	410	41	0.41	3.7
Endrin[1]	230,000	230	230	56
HCCPD[1]	NA	1,100	1,100	
Isodrin[1]	52,000	52	52	
Methylene Chloride[1]	35,000	2,300	35	
1,1,2,2-Tetrachloroethane	1,500	150	1.5	
Tetrachloroethy lene[1]	5,400	410	5.4	
Toluene[1]	NA	7,200	7,200	
TCE	28,000	2,800	28	
Arsenic	4,200	420	4.2	270
Cadmium[1]	24,000	530	50	140
Chromium[1]	7,500	39	7.5	
Lead[1]	NA	2,200	2,200	
Mercury[1]	570,000	570	570	82

1 SEC based on noncarcinogenic PPLV.
2 Units presented in parts per million.

Table 7.1-5 Soil Exceedance Volumes by Medium Group[1,2]

Medium Group/Subgroup	Human Health Exceedance Volume[3] (BCY)	Principal Threat Exceedance Volume (BCY)	Excess Biota Volume; 0-1 ft (BCY)	Expected Agent Volume (BCY)	Expected UXO Volume (BCY)	UXO Debris Volume[4] (BCY)
Munitions Testing	0	0	0		450	89,000
North Plants	220	0	17,000	61		
Toxic Storage Yards	2,700	0	0	220		
Lake Sediments	19,000	0	19,000			
Ditches/Drainage	0	0	23,000			
Surficial Soil	87,000	1,500	460,000			
Basin A	160,000	32,000	88,000	710	94	47,000
Basin F Wastepile	600,000	600,000	0			
Secondary Basins	32,000	0	140,000			
Former Basin F	740,000	180,000	0			
Sanitary/Process Water Sewers	0	0	0			
Chemical Sewers	86,000	46,000	0	69		
Complex Trenches	400,000	400,000	0	1,300	1,300	130,000
Shell Trenches	100,000	100,000	0			
Hex Pit	3,300	3,300	0			
Sanitary Landfills[5]	14,000	0	23,000			
Section 36 Lime Basins	54,000	9,000	0	91		
Buried M-1 Pits	26,000	22,000	0	29		
S.P. Central Processing[6]	110,000	38,000	27,000	160		
S.P. Ditches	33,000	3,400	22,000			
S.P. Balance of Areas	130,000	11,000	510,000	160	50	5,000
Buried Sediments	16,000	0	0			
Sand Creek Lateral	15,000	0	90,000			
Section 36 Balance of Areas	64,000	0	140,000	300	160	78,000
Burial Trenches	28,000	0	0	12	550	57,000
Total	2,700,000	1,400,000	1,600,000	3,100	2,600	410,000

1 All volumes presented to two significant figures. Detailed volume calculations are available in the administrative record (Foster Wheeler 1996).

2 Individual volumes presented here may differ from those presented in the Detailed Analysis of Alternatives report (Volume IV, Appendix A) due to adjustments for overlap between exceedance categories. The total volume listed for each medium group remains consistent with those presented in the Detailed Analysis of Alternatives report.

3 The human health exceedance volume includes the principal threat exceedance volume.

4 The UXO debris volume includes human health exceedance volume as follows: Basin A, 16,500 BCY; Complex Trenches, 43,000 BCY; Section 36 Balance of Areas, 15,000 BCY; and Burial Trenches, 4,000 BCY.

5 This medium group also contains 380,000 BCY of nonhazardous soil and debris.

6 Exceedance volumes are based on a 5-ft depth cutoff due to difficulties in deeper excavation at this site. Additional exceedance volumes for the 5-ft to 10-ft depth interval are 32,000 BCY human health volume, including 17,000 BCY principal threat volume.

Table 7.1-6 Soil Exceedance Areas by Medium Group[1]

Medium Group/Subgroup	Human Health Exceedance Area (sy)	Principal Threat Exceedance Area (sy)	Excess Biota Area (sy)[2]	Potential Agent Area (sy)	Potential UXO Area (sy)
Munitions Testing	0	0	0		270,000
North Plants	330	0	50,000	28,000	
Toxic Storage Yards	1,700	0	0	130,000	
Lake Sediments	45,000	0	57,000		
Ditches/Drainage	0	0	70,000		
Surficial Soil	260,000	4,500	1,400,000		
Basin A	320,000	35,000	260,000	430,000	140,000
Basin F Wastepile	75,000	75,000	0		
Secondary Basins	92,000	0	410,000		
Former Basin F	350,000	110,000	0		
Sanitary/Process Water Sewers	0	0	0		
Chemical Sewers	100,000	49,000	0	76,000	
Complex Trenches	130,000	120,000	0	390,000	390,000
Shell Trenches	32,000	32,000	0		
Hex Pit	860	860	0		
Sanitary Landfills	12,000	0	69,000		
Section 36 Lime Basins	34,000	6,700	0	34,000	
Buried M-1 Pits	8,700	8,700	0	8,700	
S.P. Central Processing	140,000	42,000	80,000	98,000	
S.P. Ditches	50,000	5,500	65,000		
S.P. Balance of Areas	170,000	8,100	1,500,000	48,000	15,000
Buried Sediments	7,900	0	0		
Sand Creek Lateral	34,000	0	270,000		
Section 36 Balance of Areas	150,000	0	430,000	90,000	230,000
Burial Trenches	12,000	0	0	7,100	170,000
Total	2,000,000	500,000	4,700,000	1,300,000	1,200,000

[1] All areas presented to two significant figures. Detailed area calculations are available in the administrative record.

[2] Biota areas have been calculated to account for overlap with human health exceedance area and potential UXO area.

Table 7.2-1 Description of Water Alternatives

Alternative 1 Boundary Systems	Alternative 2 Boundary Systems / IRAs	Alternative 3 Boundary Systems / IRAs / Dewatering	Alternative 4 Boundary Systems / IRAs / Intercept Systems
Boundary systems continue to operate, but all on-post groundwater IRAs are dismantled. The ICS captures water from the Western Plume Group, the NWBCS captures water from the Northwest Boundary Plume Group, and the NBCS captures water from the North Boundary Plume Group.	Boundary systems continue to operate as in Alternative 1 and the on-post groundwater IRAs remain in operation. The IRAs include the two capture systems at the Motor Pool and Rail Yard area in the Western Plume Group that extract water and pump it for treatment at the ICS, the capture system north of Basin F in the North Boundary Plume Group that extracts water for treatment at the Basin A Neck System, and the Basin A Neck IRA that captures and treats water migrating from Basin A.	Boundary systems and IRAs continue to operate as in Alternative 2. Dewatering and treatment systems are installed to remove the contaminated central portions of the South Plants Plume Group and Basin A Plume Group groundwater. Dewatering accelerates lowering of the water table in South Plants and Basin A; the extracted water is treated in a new system. The South Tank Farm Plume in South Plants is treated separately by in situ biological treatment.	Boundary systems and IRAs continue to operate as in Alternative 2. Additionally, an extraction system is installed in the Section 36 Bedrock Ridge area to minimize contaminant migration from this part of the Basin A Plume Group. The extracted water is piped to the Basin A Neck system. Groundwater plumes in the South Plants area are monitored and lake-level maintenance or other means of hydaulic containment will be used to prevent South Plant plumes from migrating into the lakes at concentrations exceeding CBSGs.

Table 7.2-2 Capital and O&M Costs for Water Alternatives[1, 2]

Plume Group	Capital Total Cost	Capital PW Cost[3]	Operating Total Cost	Operating PW Cost[3]	Total Total Cost	Total PW Cost[3]
Alternative 1						
Northwest Boundary	0	0	32,500,000	21,500,000	32,500,000	21,500,000
Western	0	0	5,940,000	4,890,000	5,940,000	4,890,000
North Boundary	0	0	51,200,000	33,900,000	51,200,000	33,900,000
Basin A	28,500	28,500	3,280,000	2,340,000	3,308,500	2,368,500
South Plants	0	0	3,270,000	2,340,000	3,270,000	2,340,000
On-Post Water Supply[4]	15,000,000	14,600,000	0	0	15,000,000	14,600,000
Total	15,000,000	14,600,000	96,200,000	65,000,000	111,000,000	80,000,000
Alternative 2						
Northwest Boundary	0	0	32,500,000	21,500,000	32,500,000	21,500,000
Western	0	0	5,940,000	4,910,000	5,940,000	4,910,000
North Boundary	80,000	80,000	51,400,000	34,100,000	51,480,000	34,180,000
Basin A	0	0	30,700,000	20,500,000	30,700,000	20,500,000
South Plants	0	0	3,270,000	2,340,000	3,270,000	2,340,000
On-Post Water Supply[4]	15,000,000	14,600,000	0	0	15,000,000	14,600,000
Total	15,100,000	14,700,000	124,000	83,400,000	139,000,000	98,000,000
Alternative 3						
Northwest Boundary	0	0	32,500,000	21,500,000	32,500,000	21,500,000
Western	0	0	5,940,000	4,910,000	5,940,000	4,910,000
North Boundary	80,000	80,000	51,400,000	34,100,000	51,480,000	34,180,000
Basin A	7,050,000	6,940,000	41,300,000	27,600,000	48,350,000	34,540,000
South Plants	5,740,000	5,740,000	20,000,000	14,100,000	25,740,000	19,840,000
On-Post Water Supply[4]	15,000,000	14,600,000	0	0	15,000,000	14,600,000
Total	27,900,000	27,400,000	151,000,000	102,000,000	179,000,000	130,000,000
Alternative 4						
Northwest Boundary	0	0	32,500,000	21,500,000	32,500,000	21,500,000
Western	0	0	5,940,000	4,910,000	5,940,000	4,910,000
North Boundary	80,000	80,000	51,400,000	34,100,000	51,480,000	34,180,000
Basin A	3,540,000	3,540,000	29,800,000	19,800,000	33,340,000	23,340,000
South Plants	80,000	80,000	7,400,000	5,100,000	7,480,000	5,180,000
On-Post Water Supply[4]	15,000,000	14,600,000	0	0	15,000,000	14,600,000
Total	18,700,000	18,300,000	127,000,000	85,400,000	146,000,000	104,000,000

1 Detailed discussion of cost estimates is presented in the Detailed Analysis of Alternatives report.
2 All costs presented in 1995 dollars.
3 Present-worth calculations are based on a 3 percent discount rate.
4 Based on acquisition of a water supply of 1,500 acre-feet. Final on-post water requirements will be determined in the water management plan during remedial design.

Table 7.3-1 Description of Structures Alternatives

Alternative 1 Landfill/Cap in Place	Alternative 2 Landfill/Consolidate	Alternative 3 Landfill
• *No Future Use, Significant Contamination History:* The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the on-post hazardous waste landfill. • *No Future Use, Other Contamination History:* The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris consolidated and capped (multilayer caps) in one of three places: the Rail Yard, North Plants, or the South Plants Central Processing Area. • *No Future Use, Agent History:* The structures are dismantled using dust controls and air monitoring, the debris monitored for the presence of Army chemical agent and caustic washed as necessary, and the resulting debris disposed in the on-post hazardous waste landfill.	• *No Future Use, Significant Contamination History:* The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the on-post hazardous waste landfill. • *No Future Use, Other Contamination History:* The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the Basin A consolidation area. • *No Future Use, Agent History:* The structures are dismantled using dust controls and air monitoring, the debris monitored for the presence of Army chemical agent and caustic washed as necessary, and the resulting debris disposed in the on-post hazardous waste landfill.	• *No Future Use, Significant Contamination History:* The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the on-post hazardous waste landfill. • *No Future Use, Other Contamination History:* The structures are dismantled using dust controls, metals salvaged (if appropriate), and the remaining debris disposed in the on-post hazardous waste landfill. • *No Future Use, Agent History:* The structures are dismantled using dust controls and air monitoring, the debris monitored for the presence of Army chemical agent and caustic washed as necessary, and the resulting debris disposed in the on-post hazardous waste landfill.

Table 7.3-2 Capital and O&M Costs for Structures Alternatives[1, 2]

Medium Group	Capital Total Cost	Capital PW Cost[3]	Operating Total Cost	Operating PW Cost[3]	Total Total Cost	Total PW Cost[3]
Alternative 1						
No Future Use, Significant Contamination History	1,088,000	1,014,000	13,206,000	12,252,000	14,294,000	13,266,000
No Future Use, Other Contamination History	72,000	68,000	38,728,000	35,685,000	38,800,000	35,753,000
No Future Use, Agent History	5,888,000	5,517,000	55,323,000	51,345,000	61,211,000	56,862,000
Total	7,048,000	6,599,000	107,257,000	99,282,000	114,000,000	106,000,000
Alternative 2						
No Future Use, Significant Contamination History	1,088,000	1,014,000	13,206,000	12,252,000	14,294,000	13,266,000
No Future Use, Other Contamination History	0	0	36,636,000	34,030,000	36,636,000	34,030,000
No Future Use, Agent History	5,888,000	5,517,000	55,323,000	51,345,000	61,21 1,000	56,862,000
Total	6,976,000	6,531,000	105,165,000	97,627,000	112,000,000	104,000,000
Alternative 3						
No Future Use, Significant Contamination History	1,088,000	1,014,000	13,206,000	12,252,000	14,294,000	13,266,000
No Future Use, Other Contamination History	4,112,000	3,834,000	37,847,000	35,098,000	41,959,000	38,932,000
No Future Use, Agent History	5,888,000	5,517,000	55,323,000	51,345,000	61,211,000	56,862,000
Total	11,088,000	10,365,000	106,376,000	98,695,000	118,000,000	109,000,000

1 Detailed discussion of cost estimates is presented in the Detailed Analysis of Alternatives report.
2 All costs presented in 1995 dollars.
3 Present-worth calculations are based on a 3 percent discount rate.

Table 7.4-1 Description of Soil Alternatives

Medium Groups/ Subgroups	Alternative 1 Caps/Covers[1]	Alternative 2 Landfill/Caps[1]	Alternative 3 Landfill[1]	Alternative 4 Consolidation/Caps/ Treatment/Landfill	Alternative 5 Caps/Treatment/ Landfill[1]
Munitions Testing	Munitions screening; off-post detonation of UXO; landfill debris and soil above TCLP.	Munitions screening; off-post detonation of UXO; landfill debris and soil above TCLP.	Munitions screening; off-post detonation of UXO; landfill debris and soil above TCLP.	Munitions screening; off-post detonation of UXO; landfill debris and soil above TCLP.	Munitions screening; off-post detonation of UXO; landfill debris and soil above TCLP.
North Plants	Landfill human health exceedance; agent monitoring during excavation; caustic washing; install soil cover over soil posing risk to biota and processing area.	Landfill human health exceedance; agent monitoring during excavation; caustic washing; install soil cover over soil posing risk to biota and processing area.	Landfill human health exceedance; agent monitoring during excavation; caustic washing; install soil cover over soil posing risk to biota and processing area.	Landfill human health exceedance; agent monitoring during excavation; caustic washing; install soil cover over soil posing risk to biota and processing area.	Landfill human health exceedance; agent monitoring during excavation; caustic washing; install soil cover over soil posing risk to biota and processing area.
Toxic Storage Yards	Landfill human health exceedance; utilize New Toxic Storage Yard for borrow area; agent monitoring during excavation and site preparation; caustic washing.	Landfill human health exceedance; utilize New Toxic Storage Yard for borrow area; agent monitoring during excavation and site preparation; caustic washing.	Landfill human health exceedance; utilize New Toxic Storage Yard for borrow area; agent monitoring during excavation and site preparation; caustic washing.	Landfill human health exceedance; utilize New Toxic Storage Yard for borrow area; agent monitoring during excavation and site preparation; caustic washing.	Landfill human health exceedance; utilize New Toxic Storage Yard for borrow area; agent monitoring during excavation and site preparation; caustic washing.
Lake Sediments	Landfill human health exceedances; additional action determined by Parties based on continuing monitoring of biota in these areas.	Landfill human health exceedances; additional action determined by Parties based on continuing monitoring of biota in these areas.	Landfill human health exceedances and soil posing risk to biota (Upper Derby Lake); deferral to USFWS for aquatic sediments.	Landfill human health exceedances and consolidate soil posing risk to biota (Upper Derby Lake); deferral to USFWS for aquatic sediments.	Landfill human health exceedances and soil posing risk to biota (Upper Derby Lake); deferral to USFWS for aquatic sediments.

Table 7.4-1 Description of Soil Alternatives

Medium Groups/ Subgroups	Alternative 1 Caps/Covers[1]	Alternative 2 Landfill/Caps[1]	Alternative 3 Landfill[1]	Alternative 4 Consolidation/Caps/ Treatment/Landfill	Alternative 5 Caps/Treatment/ Landfill[1]
Surficial Soil	Landfill human health exceedances; additional action determined by Parties based on continuing monitoring of biota in these areas.	Landfill human health exceedances; additional action determined by Parties based on continuing monitoring of biota in these areas.	Landfill human health exceedances; additional action determined by Parties based on continuing monitoring of biota in these areas.	Landfill human health exceedances; consolidate soil posing risk to biota in Basin A, Former Basin F, and South Plants; additional action determined by Parties based on continuing monitoring of biota in these areas.	Agricultural practices for soil posing risks to biota and landfill human health exceedances.
Ditches/Drainage Areas	Additional action determined by Parties based on continuing monitoring of biota in these areas.	Additional action determined by Parties based on continuing monitoring of biota in these areas.	Landfill soil posing risk to biota.	Consolidate soil posing risk to biota in Basin A.	Landfill soil posing risk to biota.
Basin A	Cap principal threat and human health exceedances and soil posing risk to biota.	Cap principal threat and human health exceedances and soil posing risk to biota.	Landfill principal threat and human health exceedances; cap entire site including soil posing risk to biota.[2]	Construct soil cover with concrete barrier over principal threat and human health exceedances and soil posing risk to biota; consolidate soil posing risk to biota/structural debris from other sites.	Thermal desorption of principal threat soil; landfill human health including treated soil; cap entire site including soil posing risk to biota.[2]
Basin F Wastepile	Modify existing cap according to RCRA requirements (composite cap).	Modify existing cap according to RCRA requirements (composite cap).	Modify existing cap according to RCRA requirements (composite cap).	Landfill entire wastepile (principal threat exceedance) in triple-lined cell (excavate with vapor control) after drying saturated materials.	Thermal desorption of entire wastepile (principal threat exceedance) (excavate with vapor control); landfill treated soil.

Medium Groups/ Subgroups	Alternative 1 Caps/Covers[1]	Alternative 2 Landfill/Caps[1]	Alternative 3 Landfill[1]	Alternative 4 Consolidation/Caps/ Treatment/Landfill	Alternative 5 Caps/Treatment/ Landfill[1]
Former Basin F	Modify existing cap to RCRA-equivalent cap.	Modify existing cap to RCRA-equivalent cap.	Landfill principal threat and human health exceedances (excavate under vapor enclosure); cap entire site.	In situ solidification/ stabilization of principal threat exceedance volume; cap entire site with RCRA-equivalent cap.	Thermal desorption of principal threat soil (excavate under vapor enclosure); landfill human health exceedances including treated soil; cap entire site.
Secondary Basins	Cap human health exceedances and soil posing risk to biota.	Landfill human health exceedances and soil posing risk to biota.	Landfill human health exceedances and soil posing risk to biota.	Landfill human health exceedances; install soil cover over soil posing risk to biota.	Landfill human health exceedances and soil posing risk to biota.
Sanitary/Process Water Sewers	Plug remaining manholes.	Plug remaining manholes.	Landfill sewer lines.	Plug remaining manholes.	Plug remaining manholes.
Chemical Sewers	Plug sewer lines.	Plug sewer lines in South Plants Central Processing Area and Complex Trenches; landfill remaining principal threat and human health exceedances.[2]	Landfill principal threat and human health exceedances.[2]	Plug sewer lines in South Plants Central Processing Area and Complex Trenches; landfill remaining principal threat and human health exceedances.[2]	Thermal desorption of principal threat soil; landfill human health exceedances including treated principal threat soil.[2]
Complex Trenches	Cap principal threat and human health exceedances and soil posing risk to biota and install a slurry wall around disposal trenches.	Cap principal threat and human health exceedances and soil posing risk to biota and install a slurry wall around disposal trenches.	Cap principal threat and human health exceedances and soil posing risk to biota and install a slurry wall around disposal trenches.	Cap (RCRA-equivalent cap with concrete barrier) principal threat and human health exceedances and soil posing risk to biota and install a slurry wall around disposal trenches.	Cap principal threat and human health exceedances and soil posing risk to biota and install a slurry wall around disposal trenches.

Medium Groups/ Subgroups	Alternative 1 Caps/Covers[1]	Alternative 2 Landfill/Caps[1]	Alternative 3 Landfill[1]	Alternative 4 Consolidation/Caps/ Treatment/Landfill	Alternative 5 Caps/Treatment/ Landfill[1]
Shell Trenches	Modify existing cover and install slurry wall around trenches.	Modify existing cover and install slurry wall around trenches.	Landfill trenches after materials handling (excavate with vapor control).	Modify existing cover to be RCRA-equivalent cap and modify existing slurry wall around trenches.	Incinerate trenches; landfill treated soil (excavate with vapor control).
Hex Pit	Install cap and slurry wall around trenches.	Install cap and slurry wall around trenches.	Landfill disposal pit after materials handling (excavate with vapor control).	Treatment of approximately 1,000 bcy of principal threat material using an innovative thermal technology and landfill remaining soil (excavate with vapor control). Treatment will be revised to a solidification/ stabilization technology if all evaluation criteria for the innovative thermal technology are not met.	Incinerate disposal pit; landfill treated soil (excavate with vapor control).
Sanitary Landfills	Cap entire site.	Landfill human health exceedances, debris, and soil posing risk to biota.	Landfill human health exceedances, debris, and soil posing risk to biota.	Landfill human health exceedances; consolidate debris and soil posing risk to biota in Basin A.	Landfill human health exceedances, debris, and soil posing risk to biota.
Section 36 Lime Basins	Modify existing cover.	Modify existing cover.	Landfill principal threat and human health exceedances; cap entire site.[2]	Landfill principal threat and human health exceedances in triple-lined cell; repair existing soil cover.[2]	Landfill principal threat and human health exceedances; cap entire site.[2]

Medium Groups/ Subgroups	Alternative 1 Caps/Covers[1]	Alternative 2 Landfill/Caps[1]	Alternative 3 Landfill[1]	Alternative 4 Consolidation/Caps/ Treatment/Landfill	Alternative 5 Caps/Treatment/ Landfill[1]
Buried M-1 Pits	Install cap and slurry wall around entire site.	Install cap and slurry wall around entire site.	Landfill principal threat and human health exceedances (excavate with vapor control).[2]	Solidification/ stabilization and landfill of principal threat and human health exceedances (excavate with vapor control).[2]	Solidification/ stabilization and landfill of principal threat and human health exceedances (excavate with vapor control).[2]
South Plants Central Processing Area	Cap principal threat and human health exceedances and soil posing risk to biota.	Cap principal threat and human health exceedances and soil posing risk to biota.	Landfill principal threat and human health exceedances; cap entire site including soil posing risk to biota.[2]	Landfill principal threat and human health exceedances (excavate to depth of 5 feet); construct soil cover with biota barrier over entire site including soil posing risk to biota; consolidate soil posing risk to biota from other South Plants sites.[2]	Thermal desorption and solidification of principal threat exceedances; landfill human health exceedances including treated soil; cap entire site including soil posing risk to biota.[2]
South Plants Ditches	Cap principal threat and human health exceedances and soil posing risk to biota.	Landfill principal threat and human health exceedances and soil posing risk to biota.	Landfill principal threat and human health exceedances and soil posing risk to biota.	Landfill principal threat and human health exceedances; consolidate soil posing risk to biota into excavated areas; install soil cover (variable thickness) over entire site.	Thermal desorption of principal threat soil; landfill human health exceedances, including treated soil and soil posing risk to biota.
South Plants Balance of Areas	Cap principal threat and human health exceedances and soil posing risk to biota.	Landfill principal threat and human health exceedances and soil posing risk to biota.[2,3]	Landfill principal threat and human health exceedances and soil posing risk to biota.[2,3]	Landfill principal threat and human health exceedances; consolidate soil posing risk to biota into excavated areas; install soil cover (variable thickness) over entire site.[2,3]	Thermal desorption of principal threat soil; landfill human health exceedances, including treated soil and soil posing risk to biota.[2,3]

Medium Groups/ Subgroups	Alternative 1 Caps/Covers[1]	Alternative 2 Landfill/Caps[1]	Alternative 3 Landfill[1]	Alternative 4 Consolidation/Caps/ Treatment/Landfill	Alternative 5 Caps/Treatment/ Landfill[1]
Buried Sediments	Cap human health exceedances.	Landfill human health exceedances.	Landfill human health exceedances.	Landfill human health exceedances.	Landfill human health exceedances.
Sand Creek Lateral	Cap human health exceedances and soil posing risk to biota.	Landfill human health exceedances and soil posing risk to biota.	Landfill human health exceedances and soil posing risk to biota.	Landfill human health exceedances; consolidate soil posing risk to biota into Basin A.	Landfill human health exceedances and soil posing risk to biota.
Section 36 Balance of Areas	Cap human health exceedances and soil posing risk to biota.	Landfill human health exceedances and soil posing risk to biota.[2,3]	Landfill human health exceedances and soil posing risk to biota.[2,3]	Landfill human health exceedances; consolidate soil posing risk to biota into Basin A; install soil cover (variable thickness) over entire site.[2,3]	Landfill human health exceedances and soil posing risk to biota.[2,3]
Burial Trenches	Landfill human health exceedances.[2,3]	Landfill human health exceedances.[2,3]	Landfill human health exceedances.[2,3]	Landfill human health exceedances.[2,3]	Landfill human health exceedances.[2,3]

[1] Cap consists of a clay/soil cap unless otherwise noted.
[2] Agent monitoring during excavation and treatment of any soil containing agent by caustic washing.
[3] Munitions screening prior to excavation, off-post detonation of any munitions encountered, and landfilling of munitions debris and associated soil above TCLP.

Table 7.4-2 Capital and O&M Costs for Soil Alternatives[1]

	Capital Cost	O&M Cost

Table 7.4-2 Capital and O&M Costs for Soil Alternatives[1]

	Capital Cost		O&M Cost		Total Cost	
Medium Group/Subgroup	Total Cost	Present Worth[2]	Total Cost	Present Worth[2]	Total Cost	Present Worth[2]
Sitewide Alternative 2 - Landfill/Caps						
Munitions Testing	$5,930,000	$5,130,000	$258,000	$110,000	$6,190,000	$5,240,000
North Plants	$2,160,000	$1,610,000	$1,360,000	$581,000	$3,520,000	$2,190,000
Toxic Storage Yards	$3,230,000	$2,790,000	$391,000	$167,000	$3,620,000	$2,960,000
Lake Sediments	$3,100,000	$2,000,000	$55,600	$23,800	$3,160,000	$2,020,000
Surficial Soil	$11,400,000	$7,510,000	$246,000	$105,000	$11,600,000	$7,620,000
Ditches/Drainage Areas	$0	$0	$0	$0	$0	$0
Basin A	$55,900,000	$49,000,000	$3,580,000	$1,530,000	$59,500,000	$50,500,000
Basin F Wastepile	$8,280,000	$6,190,000	$6,360,000	$2,720,000	$14,600,000	$8,910,000
Secondary Basins	$12,900,000	$8,290,000	$487,000	$208,000	$13,400,000	$8,500,000
Former Basin F	$38,200,000	$25,600,000	$2,730,000	$1,170,000	$40,900,000	$26,800,000
Sanitary/Process Water Sewers	$344,000	$280,000	$0	$0	$344,000	$280,000
Chemical Sewers	$12,000,000	$10,000,000	$608,000	$260,000	$12,600,000	$10,260,000
Complex Trenches	$40,100,000	$27,700,000	$6,970,000	$2,980,000	$47,100,000	$30,700,000
Shell Trenches	$2,980,000	$2,440,000	$2,650,000	$1,140,000	$5,630,000	$3,580,000
Hex Pit	$677,000	$590,000	$984,000	$421,000	$1,660,000	$1,010,000
Sanitary Landfills	$29,700,000	$21,500,000	$1,210,000	$520,000	$30,900,000	$22,000,000
Section 36 Lime Basins	$4,680,000	$3,490,000	$1,200,000	$513,000	$5,880,000	$4,000,000
Buried M-1 Pits	$1,680,000	$1,420,000	$1,020,000	$435,000	$2,700,000	$1,860,000
South Plants Central Processing Area	$17,400,000	$13,800,000	$1,820,000	$780,000	$19,200,000	$14,600,000
South Plants Ditches	$4,780,000	$3,670,000	$162,000	$69,400	$4,940,000	$3,740,000
South Plants Balance Of Areas	$47,600,000	$36,000,000	$2,130,000	$912,000	$49,700,000	$36,900,000
Buried Sediments	$1,890,000	$1,590,000	$45,400	$19,400	$1,940,000	$1,610,000
Sand Creek Lateral	$9,370,000	$6,200,000	$303,000	$130,000	$9,670,000	$6,330,000
Section 36 Balance Of Areas	$26,100,000	$18,600,000	$1,350,000	$576,000	$27,500,000	$19,200,000
Burial Trenches	$6,900,000	$5,460,000	$266,000	$114,000	$7,170,000	$5,570,000
Total	$347,000,000	$261,000,000	$36,200,000	$15,500,000	$383,000,000	$276,000,000

Table 7.4-2 Capital and O&M Costs for Soil Alternatives[1]

	Capital Cost		O&M Cost		Total Cost	
Medium Group/Subgroup	Total Cost	Present Worth[2]	Total Cost	Present Worth[2]	Total Cost	Present Worth[2]
Sitewide Alternative 3 - Landfill						
Munitions Testing	$5,790,000	$4,860,000	$197,000	$70,700	$5,990,000	$4,930,000
North Plants	$2,120,000	$1,590,000	$1,310,000	$470,000	$3,430,000	$2,060,000
Toxic Storage Yards	$3,030,000	$2,620,000	$215,000	$77,000	$3,250,000	$2,700,000
Lake Sediments	$4,320,000	$2,550,000	$84,500	$30,300	$4,400,000	$2,580,000
Surficial Soil	$11,200,000	$7,440,000	$188,000	$67,500	$11,400,000	$7,510,000
Ditches/Drainage Areas	$4,270,000	$2,830,535	$114,000	$40,854	$4,380,000	$2,870,000
Basin A	$74,300,000	$61,600,000	$4,810,000	$1,720,000	$79,100,000	$63,300,000
Basin F Wastepile	$8,310,000	$5,850,000	$6,360,000	$2,280,000	$14,700,000	$8,130,000
Secondary Basins	$12,700,000	$7,450,000	$373,000	$134,000	$13,100,000	$7,600,000
Former Basin F	$138,000,000	$85,900,000	$4,450,000	$1,600,000	$142,000,000	$87,500,000
Sanitary/Process Water Sewers	$10,300,000	$8,390,000	$26,600	$9,516	$10,300,000	$8,400,000
Chemical Sewers	$17,800,000	$14,900,000	$415,000	$149,000	$18,200,000	$15,000,000
Complex Trenches	$40,600,000	$22,800,000	$6,970,000	$2,500,000	$47,600,000	$25,300,000
Shell Trenches	$35,300,000	$24,100,000	$221,000	$79,300	$35,500,000	$24,200,000
Hex Pit	$4,770,000	$4,020,000	$7,300	$2,620	$4,780,000	$4,020,000
Sanitary Landfills	$30,000,000	$16,100,000	$929,000	$333,000	$30,900,000	$16,400,000
Section 36 Lime Basins	$10,100,000	$7,130,000	$1,430,000	$511,000	$11,500,000	$7,640,000
Buried M-1 Pits	$6,890,000	$5,800,000	$83,900	$30,100	$6,970,000	$5,830,000
South Plants Central Processing Area	$28,600,000	$21,900,000	$2,270,000	$815,000	$30,900,000	$22,700,000
South Plants Ditches	$4,710,000	$3,510,000	$124,000	$44,500	$4,830,000	$3,550,000
South Plants Balance Of Areas	$46,600,000	$34,000,000	$1,570,000	$562,000	$48,200,000	$34,600,000
Buried Sediments	$1,870,000	$1,530,000	$34,800	$12,500	$1,900,000	$1,540,000
Sand Creek Lateral	$9,230,000	$6,110,000	$232,000	$83,200	$9,460,000	$6,190,000
Section 36 Balance Of Areas	$25,500,000	$14,800,000	$914,000	$328,000	$26,400,000	$15,100,000
Burial Trenches	$6,770,000	$4,490,000	$199,000	$71,200	$6,970,000	$4,560,000
Total	$543,000,000	$372.000.000	$33.500.000	$12.000.000	$576,000,000	$384,000,000

Table 7.4-2 Capital and O&M Costs for Soil Alternatives[1]

	Capital Cost		O&M Cost		Total Cost	
Medium Group/Subgroup	Total Cost	Present Worth[2]	Total Cost	Present Worth[2]	Total Cost	Present Worth[2]
Sitewide Alternative 4 - Consolidation/Caps/Treatment/Landfill						
Munitions Testing	$6,150,000	$5,320,000	$379,000	$157,000	$6,530,000	$5,480,000
North Plants	$2,120,000	$1,580,000	$1,340,000	$557,000	$3,460,000	$2,140,000
Toxic Storage Yards	$3,160,000	$2,730,000	$334,000	$139,000	$3,490,000	$2,870,000
Lake Sediments	$3,790,000	$2,440,000	$81,700	$33,900	$3,870,000	$2,470,000
Surficial Soil	$20,000,000	$13,500,000	$361,000	$150,000	$20,400,000	$13,700,000
Ditches/Drainage Areas	$2,410,000	$1,600,000	$0	$0	$2,410,000	$1,600,000
Basin A	$52,900,000	$42,500,000	$4,330,000	$1,800,000	$57,200,000	$44,300,000
Basin F Wastepile	$130,000,000	$92,300,000	$2,180,000	$904,000	$132,000,000	$93,200,000
Secondary Basins	$7,840,000	$5,350,000	$2,010,000	$835,000	$9,850,000	$6,190,000
Former Basin F	$83,200,000	$52,800,000	$4,210,000	$1,750,000	$87,400,000	$54,600,000
Sanitary/Process Water Sewers	$344,000	$289,000	$0	$0	$344,000	$289,000
Chemical Sewers	$12,000,000	$10,400,000	$619,000	$257,000	$12,600,000	$10,700,000
Complex Trenches	$47,000,000	$31,100,000	$8,370,000	$3,480,000	$55,400,000	$34,600,000
Shell Trenches	$2,850,000	$2,330,000	$3,400,000	$1,410,000	$6,250,000	$3,740,000
Hex Pit	$5,180,000	$4,480,000	$9,800	$4,100	$5,190,000	$4,480,000
Sanitary Landfills	$14,600,000	$11,200,000	$58,600	$24,300	$14,700,000	$11,200,000
Section 36 Lime Basins	$8,170,000	$6,090,000	$326,000	$135,000	$8,500,000	$6,230,000
Buried M-1 Pits	$24,000,000	$20,100,000	$192,000	$79,800	$24,200,000	$20,200,000
South Plants Central Processing Area	$18,900,000	$15,400,000	$2,950,000	$1,220,000	$21,900,000	$16,600,000
South Plants Ditches	$3,020,000	$2,390,000	$142,000	$58,900	$3,160,000	$2,450,000
South Plants Balance Of Areas	$34,900,000	$27,600,000	$4,960,000	$2,060,000	$39,900,000	$29,700,000
Buried Sediments	$1,830,000	$1,540,000	$66,800	$27,700	$1,900,000	$1,570,000
Sand Creek Lateral	$4,720,000	$3,130,000	$62,400	$25,900	$4,780,000	$3,160,000
Section 36 Balance Of Areas	$19,100,000	$13,600,000	$3,500,000	$1,450,000	$22,600,000	$15,100,000
Burial Trenches	$7,100,000	$6,140,000	$377,000	$157,000	$7,480,000	$6,300,000
Contingent Soil Volume	$9,860,000	$8,020,000	$637,000	$265,000	$10,500,000	$8,300,000
Total	$525,000,000	$384,000,000	$40,900,000	$17,000,000	$566,000,000	$401,000,000

Table 7.4-2 Capital and O&M Costs for Soil Alternatives[1]

	Capital Cost		O&M Cost		Total Cost	
Medium Group/Subgroup	Total Cost	Present Worth[2]	Total Cost	Present Worth[2]	Total Cost	Present Worth[2]
Sitewide Alternative 5 - Caps/Treatment/Landfill						
Munitions Testing	$5,710,000	$4,800,000	$174,000	$52,300	$5,880,000	$4,850,000
North Plants	$2,130,000	$1,590,000	$1,310,000	$393,000	$3,440,000	$1,980,000
Toxic Storage Yards	$3,020,000	$2,610,000	$214,000	$64,100	$3,230,000	$2,670,000
Lake Sediments	$4,300,000	$2,000,000	$74,600	$22,400	$4,370,000	$2,020,000
Surficial Soil	$11,700,000	$6,680,000	$166,000	$49,900	$11,900,000	$6,730,000
Ditches/Drainage Areas	$4,230,000	$2,570,000	$101,000	$30,200	$4,330,000	$2,600,000
Basin A	$73,300,000	$50,200,000	$13,300,000	$4,000,000	$86,600,000	$54,200,000
Basin F Wastepile	$87,200,000	$63,000,000	$206,000,000	$61,900,000	$293,000,000	$125,000,000
Secondary Basins	$ 12,500,000	$6,550,000	$329,000	$98,800	$12,800,000	$6,650,000
Former Basin F	$151,000,000	$98,600,000	$53,400,000	$16,000,000	$204,000,000	$115,000,000
Sanitary/Process Water Sewers	$344,000	$297,000	$0	$0	$344,000	$297,000
Chemical Sewers	$19,200,000	$16,100,000	$12,800,000	$3,850,000	$32,000,000	$20,000,000
Complex Trenches	$40,800,000	$22,900,000	$6,970,000	$2,090,000	$47,800,000	$25,000,000
Shell Trenches	$52,000,000	$31,100,000	$37,100,000	$11,100,000	$89,100,000	$42,200,000
Hex Pit	$5,490,000	$4,490,000	$1,220,000	$367,000	$6,710,000	$4,860,000
Sanitary Landfills	$29,700,000	$14,000,000	$820,000	$246,000	$30,500,000	$14,200,000
Section 36 Lime Basins	$10,100,000	$5,450,000	$1,410,000	$424,000	$11,510,000	$5,870,000
Buried M-1 Pits	$13,600,000	$10,800,000	$9,090,000	$2,730,000	$22,700,000	$13,500,000
South Plants Central Processing Area	$29,800,000	$24,300,000	$13,000,000	$3,890,000	$42,800,000	$28,200,000
South Plants Ditches	$4,740,000	$3,640,000	$781,000	$234,000	$5,520,000	$3,870,000
South Plants Balance Of Areas	$46,300,000	$36,100,000	$3,480,000	$1,040,000	$49,800,000	$37,100,000
Buried Sediments	$1,860,000	$1,130,000	$30,700	$9,210	$1,890,000	$1,140,000
Sand Creek Lateral	$9,150,000	$5,380,000	$205,000	$61,500	$9,360,000	$5,440,000
Section 36 Balance Of Areas	$25,200,000	$13,400,000	$840,000	$252,000	$26,000,000	$13,700,000
Burial Trenches	$6,700,000	$5,150,000	$177,000	$53,000	$6,880,000	$5,200,000
Total	$650.000.000	$433.000.000	$363,000,000	$109,000,000	$1,012,000,000	$542,000,000

[1] All costs presented in 1995 dollars.

[2] Present-worth calculations based on a 3 percent discount rate.

8.0 Comparative Analysis of Alternatives

The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to the others and to identify the tradeoffs to be made in selecting the preferred alternatives. A preferred alternative was developed for each contaminated medium (groundwater, structures and soil) because the interactions among potential soil alternatives and water or structures alternatives were most effectively addressed in this manner.

The NCP identifies nine criteria to be used in the evaluation of remedial alternatives during the Detailed Analysis of Alternatives (Figure 8.0-1). Criteria 1 and 2 (Overall Protection of Human Health and the Environment, and Compliance with ARARs) are considered "threshold criteria" that must be met by the preferred alternative. Criteria 3 through 7 (Short-Term Effectiveness; Long-Term Effectiveness; Reduction of Toxicity, Mobility, or Volume through Treatment; Implementability; and Cost) are considered "balancing criteria" because they are used to achieve the best overall solution, taking into account technical, cost, institutional, and risk concerns. As required by EPA guidance, costs are compared on a present worth basis. The present worth cost is the amount of principal (in current dollars) needed to yield the total cost over the desired time frame; it accounts for interest gained on principal invested at the start of the project and the cost of inflation over the life of the project. Criteria 8 and 9 (State Acceptance and Community Acceptance) are used to evaluate the feasibility of implementing an alternative in terms of its acceptance by regulatory agencies and the community.

8.1 Comparative Analysis of Alternatives for Groundwater

The four groundwater alternatives compared in this section all include continued operation of the boundary containment and treatment systems that are currently operational at RMA. Three of the four alternatives (Alternatives 2, 3, and 4) involve continued operation of the existing IRAs, and two alternatives (Alternatives 3 and 4) include construction of additional on-post extraction and treatment systems. The No Action alternative (which involves discontinuing the existing boundary systems) was evaluated in the FS, but because it does not achieve the threshold criteria (overall protection of human health and the environment and compliance with ARARs), it was not retained as a potential remedy. A summary of the comparative analysis of the groundwater alternatives is provided in Table 8.1-1.

8.1.1 Overall Protection of Human Health and the Environment

All four groundwater alternatives are protective of human health and the environment because groundwater is treated at the RMA boundary and because restrictions for potable on-post water use imposed by the FFA are observed. Nonpotable uses of on-post groundwater were not anticipated and risk was therefore not considered

in the HHRC for such uses. A risk evaluation would be performed prior to any future nonpotable use to ensure that such use is protective of human health and the environment.

A greater degree of protection is provided by Alternative 3 (Boundary Systems/IRAs/Dewatering), which reduces on-post migration through additional on-post extraction and treatment systems. The operation of the dewatering and extraction systems will reduce flow through Basin A Neck, reduce the South Plants groundwater mound, limit migration into the lakes, and prevent flow through the Section 36 bedrock ridge. Migration is also reduced by the on-post systems included in Alternatives 2 (Boundary Systems/IRAs) and 4 (Boundary Systems/IRAs/Intercept Systems). Because Alternative 4 includes an additional on-post system (the Section 36 Bedrock Ridge Extraction System), it is slightly more protective than Alternative 2. Alternatives 2 and 4 also result in a natural lowering of the water table in South Plants when combined with the soil covers or caps in this area. Lowering of the water table will reduce further spreading of contamination, thereby protecting human health and the environment. Alternative 1 (Boundary Systems) is adequately protective of human health and the environment, but is slightly less protective than the other three alternatives because it only addresses groundwater contamination at the boundaries. Site reviews will be conducted every 5 years to evaluate the effectiveness of the remedies and ensure protection of human health and the environment.

8.1.2 Compliance with ARARs

All four alternatives, if selected, are expected to meet chemical-specific ARARs identified for each treatment system and comply with action- and location-specific ARARs. The remediation goals for chloride and sulfate at the NBCS will be achieved through natural attenuation. The goal for sulfate will be the natural background concentration. Assessment of the chloride and sulfate concentrations will occur at the 5-year site review. Monitoring and assessment of NDMA contamination will occur in support of potential design refinement/design characterization to achieve the remediation goals specified for boundary groundwater treatment systems.

8.1.3 Long-Term Effectiveness and Permanence

All four alternatives provide a high degree of long-term effectiveness and permanence because operation of the boundary systems eliminates the potential for off-post exposure and because restrictions for potable on-post water use imposed by the FFA are observed. Nonpotable uses of on-post groundwater were not anticipated and risk was therefore not considered in the HHRC for such uses. A risk evaluation would be performed prior to any future nonpotable use to ensure that such use is protective of human health and the environment.

Boundary system operations are proven, effective, and reliable, and treatment residuals are safely disposed off post. All alternatives also reduce contaminant migration through passive dewatering, a result of a reduction of

infiltration and removal of water from process and fire protection pipes in the areas of South Plants and Basin A that will be covered as a part of the selected soil remedy. Additionally, Alternative 2 reduces contaminant migration through operation of the IRAs. Alternative 3 achieves contaminant reduction through active dewatering as well as operation of the on-post IRAs. Alternative 4 reduces contaminant migration through continued operation of the IRAs and the Section 36 Bedrock Ridge Extraction System.

8.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Operation of the boundary systems, which is a component of all four alternatives, provides substantial reduction in toxicity, mobility, or volume through treatment of contaminated groundwater; approximately 1 billion gallons per year of water are currently being treated at the systems. Alternatives 2, 3, and 4 provide additional reduction in toxicity, mobility, or volume because they involve operation of the IRAs and additional on-post extraction/treatment systems. Compared to Alternative 1, Alternatives 2 and 4 treat approximately 170 million additional gallons per year, while Alternative 3 treats an additional 215 million gallons per year for the first 10 years and 190 million gallons per year for the next 20 years. On-post treatment under Alternatives 2, 3, or 4 will be continued until remediation is complete.

All alternatives achieve reductions in contaminant mobility and volume through passive dewatering, which is a result of installation of the soil covers or caps in the Basin A and South Plants areas. Mobility and volume are not reduced through treatment but through passive methods. Alternative 3 achieves the most rapid reduction in toxicity, mobility, or volume through active dewatering, which lowers the water table, thereby reducing migration and leaching of residual contamination from soil. Alternative 4 is slightly more effective in reducing toxicity than Alternative 2 because the additional volume of contaminated water that is extracted and treated is small. Alternative 4 also reduces or prevents the mobility of contaminants in groundwater, thus reducing/preventing their migration into the First Creek alluvial channel.

8.1.5 Short-Term Effectiveness

All four alternatives are protective of workers, the community, and the environment during the construction and implementation phases. Alternative 2 has the least impact as it is already in place and involves no additional actions. Alternatives 1 and 4 have minimal potential impacts. For Alternative 1, these impacts are associated with demolition of the existing IRAs; for Alternative 4, they are associated with drilling and construction of the Section 36 Bedrock Ridge Extraction System. Alternative 3 involves more intrusive activities than the other three alternatives, but it can still be implemented within a fairly short time period and with minimal negative impact to workers, the community, and the environment.

8.1.6 Implementability

Alternative 2 is most easily implemented because it involves continued operation of all existing systems without any additional construction or demolition. Alternatives 1 and 4 are slightly more difficult to implement than Alternative 2 because they involve installation of a small extraction and piping system (Alternative 4) or demolition of the existing IRAs (Alternative 1). Alternative 3 is the most difficult to implement since it requires installation of horizontal well networks and a new treatment system. All of the alternatives use available technologies that are both technically and administratively implementable, although horizontal wells are an innovative technology. The monitoring systems included in each alternative will allow evaluation of the effectiveness of the remedy, and additional actions could be implemented readily if monitoring indicated that ARARs were not being met.

8.1.7 Cost

The total present worth costs for the groundwater alternatives range from $80 million to $130 million (1995 dollars). Alternative 1 has the lowest cost at $80 million, Alternatives 2 and 4 have comparable present worth costs at $98 million and $104 million, respectively, and Alternative 3 is the most expensive alternative at $130 million. A breakdown of O&M costs for the components of each alternative is presented in Table 7.2-2.

8.1.8 State Acceptance

The state of Colorado has been actively involved throughout the RI/FS and remedy selection process for the On-Post Operable Unit. The state was provided the opportunity to comment on the RI/FS documents and on the Proposed Plan, and has taken part in numerous public meetings, including the public meeting on November 18, 1995, to inform the public of the content of the Proposed Plan. Written comments received from the state during the public comment period indicate their concern about the water-supply issue, the Medical Monitoring Program, the Trust Fund, and hydraulic control of the lakes in the South Lakes area.

Responses to the state's comments are provided in the Responsiveness Summary (Section 12).

8.1.9 Community Acceptance

Interested members of the public, including individual citizens, representatives of the local communities, and representatives of national groups, have been actively involved in reviewing the FS and evaluating potential remedial alternatives for the past 2 years as a result of the outreach program described in Section 3. The preferred groundwater alternative for the On-Post Operable Unit was presented to the public in the Proposed Plan, which provides a brief summary of all of the alternatives evaluated during the Detailed Analysis of Alternatives phase of the FS. The original comment period of 60 days was extended to 90 days at the request of some commenters.

The concerns expressed by the public included the water-supply issue, the adequacy of the selected remedy and the monitoring program, the implementation of the Medical Monitoring Program, the establishment of the Trust Fund, and presence of NDMA in groundwater.

Responses to the communities comments are provided in the Responsiveness Summary. (Section 12).

8.1.10 Conclusions

All four groundwater alternatives provide adequate protection of human health and the environment through continued operation of the boundary systems. Alternative 3 is more protective than the other alternatives because it removes the largest amount of contaminants and most rapidly reduces the potential for additional on-post migration. Alternative 4 is more protective than Alternative 2 because it involves additional treatment beyond the existing IRAs, and Alternative 2 is more protective than Alternative 1.

All alternatives will comply with ARARs and all provide equivalent long-term effectiveness and permanence. Alternative 3 provides the greatest reduction in toxicity, mobility, or volume through treatment, but it is less effective in the short term and less implementable than the other three alternatives because it involves construction of new extraction and treatment systems. Alternative 4 provides a greater reduction in toxicity, mobility, or volume through treatment than Alternatives 1 or 2, but it is slightly less effective in the short term and is slightly less implementable than Alternative 2. The short-term effectiveness and implementability of Alternative 1 is similar to that of Alternative 4, but Alternative 1 provides the least reduction in toxicity, mobility, or volume through treatment of contaminated groundwater.

Alternative 1 has the lowest present worth cost because all existing IRAs are discontinued, while Alternative 3 has the highest cost because it involves the most new construction and treatment. The costs of Alternatives 2 and 4 lie between Alternatives 1 and 3. Alternative 4 provides a small amount of additional treatment compared to Alternative 2 at a slightly higher cost.

Alternative 4 is superior to the other groundwater remedial alternatives for the On-Post Operable Unit for the following principal reasons:

- Alternative 4 is preferable to Alternatives 1 and 2 because it provides additional reduction of toxicity, mobility, or volume of contaminated groundwater at a reasonable cost and with minimal short-term effects. It is also readily implementable.
- Although Alternative 3 provides greater reduction of toxicity, mobility, and volume than Alternative 4, it is less readily implementable than Alternative 4. Furthermore, when considered in conjunction with the preferred soil alternative and the continued operation of the boundary groundwater containment and treatment systems, Alternative 3 provides limited added benefit compared to Alternative 4 at a higher cost.

8.2 Comparative Analysis of Alternatives For Structures

The three structures alternatives compared in this section involve removing all No Future Use structures and disposing the debris in the on-post hazardous waste landfill. All structures alternatives include the completion or continuation of structures IRAs as described in Section 7.3.3. The ultimate disposal method for the structures medium groups is chosen based on the following approach:

- The Agent History Group must be disposed in the hazardous waste landfill to comply with Army regulations.
- The Significant Contamination History Group contains structures with use histories that indicate a possibility of significant contamination. This group is disposed in the hazardous waste landfill.
- For the Other Contamination History Group, the disposal options include capping in place, consolidation in Basin A, or disposal in the on-post hazardous waste landfill.

The No Action Alternative (which involves leaving all structures in place) was evaluated in the FS, but it was not retained as a potential remedy because it did not achieve a threshold criterion (overall protection of human health and the environment). A summary of the comparative analysis of the structures alternatives is provided in Table 8.2-1.

8.2.1 Overall Protection of Human Health and the Environment

All three structures alternatives are protective of human health and the environment because all potentially contaminated structures are demolished and disposed to prevent exposure to humans or wildlife. Alternative 3 (Landfill) is slightly more protective than Alternative 2 (Landfill/Consolidate) because all structural debris is placed in the on-post hazardous waste landfill. Alternative 2 is in turn slightly more protective than Alternative 1 (Landfill/Cap in Place) because the debris that is not landfilled is consolidated at one location under a thick soil cover that includes a layer of concrete. Agent-contaminated debris is treated as necessary under all three alternatives, but other treatment is not undertaken because there is a potential for increased worker exposures at no added benefit.

8.2.2 Compliance with ARARs

All three structures alternatives comply with the chemical-, action- and location-specific ARARs listed in Appendix A.

8.2.3 Long-Term Effectiveness and Permanence

All three structures alternatives provide adequate long-term effectiveness and permanence. Removal and disposal of the structures involves significantly less long-term risk than leaving the structures in place and restricting access to them. Additionally, the majority of the structures must be removed to accommodate the soil remedial alternatives. Because structure debris is contained by capping or landfilling, there is low residual risk.

Because high levels of contamination are not expected to be associated with the majority of the structures, the long-term risks associated with waste management are expected to be low. Adequate controls are provided, and the permanence of the solution is verified by long-term monitoring. Alternatives 2 and 3 are slightly more effective in the long term than Alternative 1 because the structural debris is consolidated into central locations (the landfill and, for Alternative 2, Basin A) rather than remaining dispersed under several caps that require additional long-term maintenance.

8.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

All three structures alternatives reduce contaminant toxicity, mobility, or volume through treatment. Demolition of structures reduces the standing volume. Capping or landfilling the structural debris reduces the mobility of contaminants through engineering controls, although this reduction may be compromised should the cap or landfill leak. Caustic washing irreversibly reduces the toxicity, mobility, and volume of Army chemical agent through treatment, but produces a hazardous liquid sidestream that will be treated on post. Alternative 3 is slightly more effective in reducing mobility than Alternative 2 because the structural debris is contained in a landfill, and Alternative 2 is slightly more effective in reducing mobility than Alternative 1 because the debris is consolidated into two central locations rather than dispersed under several caps that require additional long-term maintenance.

8.2.5 Short-Term Effectiveness

All three structures alternatives provide equal short-term effectiveness. Air monitoring and dust controls are required during demolition, transportation, and disposal. Worker protection will be required for physical hazards associated with dismantling and for chemical hazards associated with caustic washing and handling of agent-contaminated debris. Remediation is completed within 3 to 4 years under all three alternatives. Because high levels of contamination are not expected to be associated with the majority of the structures, the risks associated with short-term worker and community exposure are expected to be low for all alternatives.

There are unique concerns for structures with potential Army chemical agent presence. After demolishing the structures, caustic washing is administered to debris, as necessary, and the debris is disposed in the on-post hazardous waste landfill to comply with Army agent regulations. Because the highest probability of encountering agent residues is in process piping and tanks, which are currently being treated and removed as part of the chemical process-related IRA activities, the potential for encountering agent associated with building materials is low. Thus, short-term risks during such remediation activities are considered low for all alternatives.

8.2.6 Implementability

All three structures alternatives are generally technically and administratively feasible, although Alternatives 2 and 3 are more implementable because there are regulatory concerns with capping structural debris in place (Alternative 1). Implementation of structures remediation will require coordination with the remediation scheduled for other environmental media. However, because the time frame during which structures are to be demolished is relatively short, structures remediation should not hinder the remainder of the remediation efforts. The structures demolition must begin in the areas in which soil remediation is planned so that the soil remediation schedule is not delayed. Structures covered under any chemical weapons agreements may need to be removed to comply with the requirements of these agreements.

Significant Contamination History Group and Agent History Group structural debris will be placed into the on-post hazardous waste landfill as demolition proceeds. Accordingly, the landfill must be constructed and in operation prior to the commencement of demolition activities. Other Contamination History Group debris may be placed in the Basin A consolidation area, which requires minimal preparation; in the on-post hazardous waste landfill, which must be ready before demolition begins; or in the areas to be capped, which require minimal preparation. In general, structures must be removed before the soil remedy can be implemented.

8.2.7 Cost

The present worth costs (1995 dollars) are similar for all three alternatives ($106 million for Alternative 1, $104 million for Alternative 2, and $109 million for Alternative 3) because the alternatives only differ with regard to the disposal method for the Other Contamination History Group debris. There are several ongoing structures IRAs whose costs also contribute significantly to the total cost of structures remediation. The total estimated structures IRA costs are $76,000,000, of which $41,000,000 will be spent by the completion of the ROD (and is not included in the above costs), and an additional $35,000,000 will be spent in post-ROD removal actions (not included in the above costs). A breakdown of capital and O&M costs for the components of each alternative is presented in Table 7.3-2.

8.2.8 State Acceptance

The state has been actively involved throughout the RI/FS and remedy selection process for the On-Post Operable Unit. The state was provided the opportunity to comment on the RI/FS documents and on the Proposed Plan, and has taken part in numerous public meetings, including the public meeting on November 18, 1995, to inform the public of the content of the Proposed Plan. Written comments received from the state during the public comment period indicate that there were no major concerns regarding the structures remedy.

Responses to the state's comments are provided in the Responsiveness Summary (Section 12).

8.2.9 Community Acceptance

Interested members of the public, including individual citizens, representatives of the local communities, and representatives of national groups, have been actively involved in reviewing the FS and evaluating potential remedial alternatives for the past 2 years as a result of the outreach program described in Section 3. The preferred structures alternative for the On-Post Operable Unit was presented to the public in the Proposed Plan, which provides a brief summary of all of the alternatives evaluated during the Detailed Analysis of Alternatives phase of the FS. This original comment period of 60 days was extended to 90 days at the request of some commenters.

The concerns expressed by the public included questions with regards to the adequacy of the structures sampling and analytical program. Responses to the community's comments are provided in the Responsiveness Summary (Section 12).

8.2.10 Conclusions

All three structures alternatives provide adequate protection of human health and the environment. Treatment technologies are generally not included because of the exposure risks to workers and the limited benefits for all but the Agent History Group. On-post hazardous waste landfilling for the Significant Contamination History Group is a protective remedy that is included in all three alternatives. The long-term effectiveness of Alternatives 2 and 3 is higher than Alternative 1, which relies on caps in several disposal locations. All three alternatives are equivalent with respect to reduction of toxicity, mobility, or volume through treatment or engineering controls and short-term effectiveness. For Alternative 1, regulatory concerns remain about capping Other Contamination History Group debris in place, which makes its implementibility less certain. Consolidation or landfilling of Other Contamination History Group debris (under Alternatives 2 and 3, respectively) is implementable and cost effective.

Alternative 2 is superior to the other structures alternatives for the On-Post Operable Unit for the following principal reasons:

- Alternatives 2 and 3 are preferable to Alternative 1 because they are more implementable and structural debris is consolidated into one or two disposal locations.
- Alternative 2 is more desirable than Alternative 3 because the Other Contamination History Group structural debris is used as fill in Basin A, reducing the amount of clean borrow needed and reducing the total volume to be landfilled. This alternative is also slightly less costly than Alternative 3.

8.3 Comparative Analysis of Alternatives for Soil

The five soil alternatives that are compared in this section involve a combination of containment (as a principal element) and treatment technologies to reduce contamination. A summary of the comparative analysis of the soil alternatives is provided in Table 8.3-1.

As described in Section 7.1.3, the criteria for evaluating soil contamination helped focus the evaluation of potential remedial activities on areas of highest risk to human health and the environment. Alternatives were developed to include treatment of principal threat volumes, where practicable, with containment or institutional controls being enacted for the balance of the exceedance areas. The sheer volume of contaminated soil present on the site precludes a remedy in which all contaminants could be excavated and cost effectively treated.

8.3.1 Overall Protection of Human Health and the Environment

The five alternatives for soil provide overall protection of human health through a combination of containment and treatment. Alternatives 1 (Caps/Covers), 2 (Landfill/Caps), and 3 (Landfill) provide for protection of human health primarily through containment of human health exceedances, which interrupts exposure pathways and reduces the migration of contaminants to groundwater and the atmosphere. Alternatives 4 (Consolidation/Caps/Treatment/Landfill) and 5 (Caps/Treatment/Landfill) address portions of the most contaminated soil through treatment, but still rely on capping and landfilling to protect human health in the majority of the contaminated areas.

Under each of the five alternatives, the protection of wildlife is generally accomplished through containment of portions of the core areas of RMA that may pose a risk to biota by capping, covering, or landfilling. These actions interrupt the potential for biota exposure, and also prevent burrowing animals from coming into contact with contaminated soil. Outside the core area, these alternatives address surficial soil with low levels of contamination using two different approaches. Alternative 5 includes the treatment of approximately 1,600 acres through agricultural practices, which reduces the level of OCPs in near-surface soil but results in the disturbance of habitat over widespread areas of RMA. The other four alternatives address low-level surficial soil contamination by continued monitoring only, thereby avoiding the disruption of wildlife in these areas during remedial activities and habitat restoration.

Alternatives 3, 4, and 5 are more protective than Alternatives 1 or 2 because larger volumes of contaminated soil are contained in a secure landfill and/or treated. Alternatives 3 and 4 offer equivalent overall protectiveness because there is a tradeoff between landfilling a greater total volume under Alternative 3 versus landfilling the Basin F Wastepile and treating more material under Alternative 4. Alternative 5 is more protective than the other alternatives because more material is treated.

8.3.2 Compliance with ARARs

Each of the five alternatives complies with chemical-, action-, and location-specific ARARs. The number of ARARs, and the difficulties associated with demonstrating compliance with these ARARs, are substantially

higher for Alternative 5 based on the complexity of the alternative and the use of thermal treatment technologies.

8.3.3 Long-Term Effectiveness and Permanence

Each of the five alternatives results in minimal residual risk based on the adequacy and reliability of controls offered by each alternative. All five alternatives rely on containment of a significant portion of the contaminated soil to protect human health and the environment, requiring long-term maintenance and monitoring activities. Long-term management also includes access restrictions to capped and covered areas to ensure the integrity of the containment systems. Alternatives 4 and 5 leave smaller volumes of contaminated soil (approximately 8 percent and 40 percent of the human health exceedance volume, respectively, are treated) with lower levels of contamination requiring long-term controls; however, these alternatives still rely on containment of large volumes of contaminated soil (92 and 60 percent, respectively). Alternative 5 also includes the treatment of approximately 1,600 acres through agricultural practices, which reduces the level of OCPs in near-surface soil but results in the disturbance of habitat over widespread areas of RMA. The containment systems for the five alternatives are adequate and reliable for long-term protection of human health and the environment.

Alternative 1 addresses both highly contaminated soil and large volumes of contaminated soil through containment in place. The installation of caps/covers provides adequate protection for human health and wildlife by eliminating exposure to contaminated soil. The caps provide long-term reduction in the migration of contaminants to groundwater. Based on the operation of the existing groundwater systems and the groundwater removal systems to be installed as part of the selected water alternative, this alternative provides long-term effectiveness and a low residual risk. A residual risk may exist for biota because surficial soil that may pose a risk to biota is left in place and monitored. However, widespread areas of wildlife habitat are not disturbed to address this residual risk.

Alternatives 2 and 3 both rely on containment systems that effectively protect humans and biota from exposure to contaminated soil. The bottom liner of a landfill controls the migration of leachate. Landfill covers and caps both provide long-term protection by preventing infiltration into the contaminated materials and releases to the atmosphere. These two alternatives provide similar levels of long-term protection and minimal long-term risks, although landfilling does provide, by virtue of the liner, an increased level of containment than a cap does. Both of these alternatives involve potential risk for biota because surficial soil that may pose a risk to biota is left in place and monitored; however, widespread areas of habitat are not disturbed to address this residual risk.

Alternatives 4 and 5 treat portions of the most contaminated soil, thereby reducing the level of contamination in the soil requiring long-term controls. However, both alternatives use similar containment systems as the other three alternatives to address large volumes of lower-level contamination (92 percent and 60 percent of the human health exceedance volume, respectively). Alternative 5 does treat a larger volume of soil, primarily through treatment of the Basin F Wastepile, but still relies on containment of a large volume of soil to provide long-term protection. Alternatives 4 and 5 provide similar levels of long-term protection, but do not eliminate the need for long-term monitoring and maintenance of capped and landfilled areas.

8.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 4 and 5 provide the greatest reduction in toxicity, mobility, or volume through treatment. These alternatives permanently reduce the toxicity, mobility, or volume of contaminated soil through treatment of 207,000 and 1.1 million BCY of soil, respectively, and they reduce the mobility of contaminants in the remaining soil through containment with caps, soil covers, and landfills. The other three alternatives provide reduction in mobility through containment; however, Alternative 1 provides somewhat lower reduction in mobility because Alternatives 2 and 3 include landfilling of some of the contaminated soil, which provides some measure of additional containment of contaminants and reduction in mobility compared to capping. Ultimately, however, all containment alternatives rely on the effectiveness of the caps and soil covers to reduce infiltration.

8.3.5 Short-Term Effectiveness

The short-term effectiveness of the five alternatives is primarily governed by the risks posed during remedial actions and the time required until remediation goals are achieved. Short-term effectiveness decreases as a result of the increase in risks during remedial actions and the longer time frames for implementation of the more complex remedial alternatives.

Alternatives 1 and 2 have minimal to low short-term risks as the central portions of RMA (with high levels of contamination) are capped in place. Thus, the risks to workers and the surrounding community from the excavation, transportation, and treatment/disposal of soil with high-level contamination are avoided. The implementation time of these alternatives is approximately 17 and 16 years, respectively. Alternative 2 includes the landfilling of 2 million BCY of contaminated soil (instead of containment in place), but the risks associated with excavation, transportation, and disposal of this soil are not significantly increased compared to capping based on the low levels of contamination in the soil to be landfilled. These two alternatives address soil in the core area of RMA that may pose a risk to biota through containment, but do not entail additional remedial actions for surficial soil that may pose a risk to biota, which is left in place and monitored. In this manner, widespread areas of habitat are not disturbed to address soil with a low residual risk.

The other three alternatives involve excavation and treatment/disposal of portions of the most contaminated soil, which increases the short-term risks to workers and the community. Alternative 4 removes a smaller volume of highly contaminated soil, and therefore exhibits lower risks due to excavation, transportation, and disposal activities than Alternatives 3 or 5, which present the highest short-term risk to workers and the community. Under these alternatives, the largest volume of highly contaminated areas is excavated for treatment and/or disposal, requiring specialized vapor- and odor-suppression measures to minimize the release of contaminants. The implementation time frame for Alternative 5 is the longest at approximately 28 years. Although steps can be taken to control short-term risks during remedial actions under these three alternatives, the short-term effectiveness for these alternatives is lower than for Alternatives 1 or 2. Negative-pressure vapor enclosures are one approach to controlling vapors and odors that may be emitted from several areas to be excavated under Alternatives 3, 4, and 5. Work within enclosures would require extensive worker protection and could present significant hazards to workers. Although the air within the enclosure is collected and treated, or, where an enclosure was not used, other measures could be taken to mitigate short-term risks, the short-term risks of contaminant release associated with excavating these areas cannot be completely eliminated.

8.3.6 Implementability

The implementability of the five alternatives varies from easy for Alternatives 1 and 2, which are readily constructed using common construction equipment, to difficult for Alternative 5. This alternative presents difficulties in the construction and operation of the treatment technologies, which have not been implemented at any other site in the country at the scale required at RMA. The implementability of Alternatives 3 and 4 is moderate.

Alternatives 1 and 2 are both considered easy to implement because they consist of the proven and available technologies of capping and landfilling and because they do not require the use of vapor controls. Alternatives 3 and 4 involve a similar level of difficulty in the excavation, transportation, and disposal of large volumes of highly contaminated soil. Alternative 4, which makes use of readily available mobile equipment for treatment of soil by solidification/stabilization, is implementable. Implementability of the innovative thermal technology for the Hex Pit will be determined during remedial design treatability testing. Consolidation of some soil potentially posing risk to biota (as a source of gradefill) decreases the cost and disruption of habitat for borrow areas. Alternative 5 is the most difficult to implement and requires the longest time frame based on the difficulties with implementation of vapor controls, if necessary, and treatment technologies. There is a high level of uncertainty in the performance of thermal technologies on the complex contaminant mixtures and high salt levels in some principal threat soil, leading to a potential for failure to meet the treatment specifications and a potential for extensive shut-down time to modify and maintain the system.

8.3.7 Cost

The estimated present worth cost (in 1995 dollars) for Alternative 2 is the lowest at $276 million. The present worth cost for Alternative 1 is estimated to be $386 million, followed by Alternatives 3 and 4 at $384 and $401 million, respectively. The estimated present worth cost for Alternative 5 is the highest at $542 million for soil remediation. A breakdown of capital and O&M costs for the components of each alternative is presented in Table 7.4-2.

The greatest overall cost uncertainty is associated with the remediation of soil, and the uncertainty is higher for alternatives that include excavation and treatment than for alternatives that minimize the handling of highly contaminated soil through containment in place. The level of cost uncertainty is relatively low for Alternatives 1, 2, and 4 because demonstrated construction and excavation technologies are used. The cost uncertainty associated with Alternative 3 is moderate as demonstrated technologies are used for containment, although large volumes of highly contaminated soil are excavated. Alternative 5 entails the highest degree of cost uncertainty due to the use of complex treatment technologies and the excavation, transportation, treatment, and disposal of large volumes of highly contaminated soil.

8.3.8 State Acceptance

The state has been actively involved throughout the RI/FS and remedy selection process for the On-Post Operable Unit. The state was provided the opportunity to comment on the RI/FS documents and on the Proposed Plan, and has taken part in numerous public meetings, including the public meeting on November 18, 1995, to inform the public of the content of the Proposed Plan. Written comments received from the state during the public comment period indicate their concerns about the Medical Monitoring Program, the Trust Fund, and treatment of the Hex Pit.

Responses to the state's comments are provided in the Responsiveness Summary (Section 12).

8.3.9 Community Acceptance

Interested members of the public, including individual citizens, representatives of the local communities, and representatives of national groups, have been actively involved in reviewing the FS and evaluating potential remedial alternatives for the past 2 years as a result of the outreach program described in Section 3. The preferred soil alternative for the On-Post Operable Unit was presented to the public in the Proposed Plan, which provides a brief summary of all of the alternatives evaluated during the Detailed Analysis of Alternatives phase of the FS. The original comment period of 60 days was extended to 90 days at the request of some commenters.

The concerns expressed by the public included questions related to the Medical Monitoring Program, the Trust Fund, the adequacy of the selection remedy and the monitoring program, and concerns regarding the potential presence of dioxin. Responses to the community's comments are provided in the Responsiveness Summary (Section 12).

8.3.10 Conclusions

Alternative 1 provides the level of protection of human health and wildlife required under CERCLA by preventing exposures to contaminated soil. In addition, this alternative has minimal short-term risks since the central portions of RMA (with high levels of contamination) are capped in place, thereby avoiding the risks from excavation, transportation, and treatment/disposal of soil with high-level contamination. The mobility of the contaminants is reduced by minimizing the amount of infiltration that may mobilize the contaminants from the soil to the groundwater and eliminating the airborne migration pathway. However, no action is taken to reduce the toxicity or volume of the contaminated soil. The implementation time frame for Alternative 1 is less than the other alternatives, although its cost is higher than Alternative 2. The overall effectiveness of Alternative 1 is somewhat lower than the other alternatives based on the lower reduction in mobility resulting from capping as compared to landfilling or the destruction of contaminants through treatment. However, all alternatives rely on capping/landfilling of the majority of the contaminated soil to provide long-term risk reduction.

Alternative 2 protects humans and biota by providing a physical barrier, through capping and landfilling, to prevent exposures and reduce the amount of infiltration that may mobilize contaminants to groundwater. Caps/covers and landfills provide effective containment of the contaminated soil. The contaminated soil from the outlying sections of RMA that is landfilled poses a minor risk to workers and the community during excavation and transportation due to the low level of contamination in the soil. Soil in the core area of RMA with high levels of contamination (such as the Basin A, Disposal Trenches, and Basin F Medium Groups and South Plants Central Processing Area Subgroup) is left in place and capped. The mobility of the contaminants in these areas is further reduced by minimizing the infiltration through the contaminated soil and eliminating the airborne migration pathway. The overall effectiveness of Alternative 2 is high because it provides effective containment of the contaminants by balancing the short-term risks of excavation with long-term effectiveness.

Alternative 3 protects humans and biota by providing a physical barrier that prevents exposure through landfilling and capping. However, significant risks are posed to workers and the community during excavation and transportation of large volumes of highly contaminated soil. Although vapor- and odor-suppression measures are used during the excavation of several sites, the short-term risks associated with excavation of contaminated soil cannot be completely eliminated. The mobility of the contaminants is eliminated by placing

the contaminated soil in the landfill, but no action is taken to reduce the toxicity or volume of the contaminated soil. The overall effectiveness of Alternative 3 is moderate because it provides low long-term risk but entails high short-term risks during excavation and transportation of highly contaminated soil.

Alternative 4 protects humans and biota by treating some principal threat materials and providing a physical barrier (i.e., caps, soil covers, and landfill) to prevent exposure. Mobility of the contaminants is reduced by minimizing the amount of infiltration into the contaminated soil below the caps or in the landfill. The toxicity and mobility of contaminated soil is reduced through treatment of some principal threats by solidification/stabilization. Increased short-term risks are posed to workers and the community during excavation, transportation, and landfill of highly contaminated soil. The risks associated with excavation are reduced, but are not eliminated, through the use of vapor- and odor-suppression measures at several excavation areas. In addition, placement of soil excavated from the Basin F Wastepile and Section 36 Lime Basins in a triple-lined landfill cell provides added assurance of containment. The consolidation of 1.5 million BCY of contaminated soil in Basin A, Basin F, and the South Plants Central Processing Area prior to capping these sites lowers the cost of obtaining borrow materials and reduces the area disturbed for borrow. The implementability of this alternative is moderate because highly contaminated soil is excavated. However, the overall effectiveness of Alternative 4 is high because it provides low long-term risk, compensating for the increased short-term risk during excavation.

Alternative 5 treats areas of highly contaminated soil, thereby reducing the contaminant toxicity, mobility, or volume. However, workers and the community are exposed to the highest short-term risks under Alternative 5 (compared to other alternatives) during excavation, transportation, and treatment. Although vapor- and odor-suppression measures are used during the excavation of several sites, the short-term risks associated with excavation of highly contaminated soil cannot be completely eliminated. The mobility of the contaminants is minimized by placing the contaminated soil in a landfill. However, this alternative has a low overall effectiveness based on the high short-term risks during remedial actions and the longer time frame (a minimum of 14 years) until actions are completed. In addition, the implementability of this alternative is very difficult because of the large volume of highly contaminated soil (including the Basin F Wastepile) to be treated by thermal treatment.

Alternative 4 is superior to the other soil remedial alternatives for the On-Post Operable Unit for the following principal reasons:

- Alternative 4 is preferable to Alternatives 1, 2, and 3 because it provides additional reduction of toxicity, mobility, or volume of contaminated soil through some treatment with minimal short-term effects and more secure containment of the Basin F Wastepile materials in a new triple-lined landfill cells. Alternative 4 is also readily implementable.

- Although Alternative 5 provides greater reduction of toxicity, mobility, or volume through more treatment than Alternative 4, it is much less readily implementable than Alternative 4 because the treatment technologies identified have never been used at the scale required at RMA. Furthermore, Alternative 5 is significantly more costly than Alternative 4, and the uncertainty of execution related to schedule and budget is much higher for Alternative 5 than for Alternative 4.

1 Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled.

2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not a remedy will meet all federal and state environmental laws and standards and/or provides grounds for a waiver.

3 Short-Term Effectiveness addresses the period of time needed to complete the remedy and any adverse effects to human health and the environment that may be caused during the construction and implementation of the remedy.

4 Long-Term Effectiveness and Permanence refers to the ability of a remedy to provide reliable protection of human health and the environment over time.

5 Reduction of Toxicity, Mobility, or Volume through Treatment refers to the preference for a remedy that through treatment reduces health hazards, the movement of contaminants, or the quantity of contaminants at the site.

6 Implementability refers to the technical and administrative feasibility of a remedy. This includes the availability of materials and services needed to carry out a remedy. also includes coordination of federal, state, and local governments to work together to clean up the site.

7 Cost evaluates the estimated capital, operating, and maintenance costs of each alternative in comparison to other equally protective alternatives.

8 State Acceptance indicates whether the state agrees with, opposes, or has no comment on the preferred alternative.

9 Community Acceptance includes determining which components of the alternatives interested persons in the community support, have reservations about, or oppose. This assessment may not be completed until public comments on the Proposed Plan are reviewed.

Figure 8.0-1

Cleanup Evaluation Criteria

Rocky Mountain Arsenal
Prepared by Foster Wheeler Environmental Corporation

Table 8.1-1 Comparative Analysis of Water Alternatives

Criteria	Alternative 1 Boundary Systems	Alternative 2 Boundary Systems/ IRAs (No Additional Action)	Alternative 3 Boundary Systems/ IRAs/Dewatering	Alternative 4 Boundary Systems/ IRAs/Intercept Systems
Overall Protection of Human Health and the Environment	*Protective.* Provides protection through operation of boundary systems.	*Protective.* Provides protection through operation of boundary systems and minimizes on-post migration through operation of IRAs.	*Protective.* Provides protection through boundary systems and minimizes on-post migration through operation of IRAs and additional on-post systems.	*Protective.* Provides protection through boundary systems and minimizes on-post migration through operation of IRAs and additional on-post systems.
Compliance with ARARs	*Complies* with action-, chemical-, and location-specific ARARs through active treatment and natural attenuation of inorganics.	*Complies* with action-, chemical-, and location-specific ARARs through active treatment and natural attenuation of inorganics.	*Complies* with action-, chemical-, and location-specific ARARs through active treatment and natural attenuation of inorganics.	*Complies* with action-, chemical-, and location-specific ARARs through active treatment and natural attenuation of inorganics.
Long-Term Effectiveness and Permanence	*Low residual risk.* Potential for off-post exposure is lowered. No on-post exposure due to FFA restrictions. Long-term monitoring required; contaminant migration reduced through passive dewatering.	*Low residual risk.* Potential for off-post exposure is lowered. No on-post exposure due to FFA restrictions. Long-term monitoring required; contaminant migration reduced through IRAs, source capture, and passive dewatering.	*Low residual risk.* Potential for off-post exposure is lowered. No on-post exposure due to FFA restrictions. Long-term monitoring required; contaminant migration reduced through IRAs, source capture, and active dewatering.	*Low residual risk.* Potential for off-post exposure is lowered. No on-post exposure due to FFA restrictions. Long-term monitoring required; contaminant migration reduced through IRAs, source capture, and passive dewatering.
Reduction of Toxicity, Mobility, or Volume (TMV)	*TMV reduced at boundary.* Contaminants removed by GAC adsorption, reducing toxicity and volume.	*TMV reduced at boundary and on post.* Contaminants removed by GAC adsorption and air stripping, reducing toxicity and volume; source capture at Basin A Neck and passive dewatering limit migration.	*TMV reduced at boundary and on post.* Contaminants removed by GAC adsorption and air stripping, reducing toxicity and volume; dewatering and source capture significantly limit migration and mobility.	*TMV reduced at boundary and on post.* Contaminants removed by GAC adsorption and air stripping, reducing toxicity and volume; source capture and passive dewatering limit mobility.

Selected alternative

Table 8.1-1 Comparative Analysis of Water Alternatives

Criteria	Alternative 1 Boundary Systems	Alternative 2 Boundary Systems/ IRAs (No Additional Action)	Alternative 3 Boundary Systems/ IRAs/Dewatering	**Alternative 4 Boundary Systems/ IRAs/Intercept Systems**
Short-Term Effectiveness	*Effective*. Minimal negative impact; achieves RAOs.	*Effective*. No additional impact associated with continued operation; achieves RAOs.	*Effective*. Minimal negative impact associated with installation of dewatering system; achieves RAOs.	***Effective*. Minimal negative impact associated with installation of extraction system; achieves RAOs.**
Implementability	*Technically and administratively feasible.*	*Technically and administratively feasible.* No additional construction involved.	*Technically and administratively feasible.* Treatment by proven technologies except for in situ biological treatment in South Plants.	***Technically and administratively feasible.* Treatment by proven technologies.**
Present Worth Cost	$80 million	$98 million	$130 million	**$104 million**
Conclusion	*Not selected*. Meets evaluation criteria, but provides less protection than other alternatives.	*Not selected*. Meets evaluation criteria, but does not provide additional control and protection beyond what is currently in place.	*Not selected*. Meets evaluation criteria and provides additional on-post controls, but at higher cost than the other alternatives.	***Selected*. Meets evaluation criteria and is consistent with the proposed soil alternative. Provides adequate on-post controls at minimal added cost.**

Selected alternative

Criteria	Alternative 1 Landfill/Cap in Place	**Alternative 2** **Landfill/Consolidate**	Alternative 3 Landfill
Overall Protection of Human Health and the Environment	*Protective*. Debris is contained by capping or landfilling. Agent debris is treated as necessary.	***Protective*. Debris is contained by consolidation or landfilling. Agent debris is treated as necessary.**	*Protective*. Debris is contained by landfilling. Agent debris is treated as necessary.
Compliance with ARARs	*Complies* with action-, chemical-, and location-specific ARARs.	***Complies* with action-, chemical-, and location-specific ARARs.**	*Complies* with action-, chemical-, and location-specific ARARs.
Long-Term Effectiveness and Permanence	*Low residual risk*. Structural debris is contained by capping or landfilling. Adequate controls; long-term monitoring is required. Habitat is improved at site but limited at landfill.	***Low residual risk*. Structural debris is containeby consolidation or landfilling. Adequate controls; long-term monitoring is required. Habitat is improved at site but limited at landfill.**	*Low residual risk*. Structural debris is contained by landfilling. Adequate controls; long-term monitoring is required. Habitat is improved at site but limited at landfill.
Reduction of Toxicity, Mobility, or Volume (TMV)	*TMV Reduced*. Capping or landfilling reduces mobility. Reduction in mobility may be reversed if cap or landfill leaks. Caustic wash irreversibly reduces TMV of agent, but produces a hazardous liquid sidestream that must be treated.	***TMV Reduced*. Consolidation or landfilling reduces mobility. Reduction in mobility reversed if consolidation area or landfill leaks. Caustic wash irreversibly reduces TMV of agent, but produces a hazardous liquid sidestream that must be treated.**	*TMV Reduced*. Landfilling reduces mobility. Reduction in mobility may be reversed if landfill leaks. Caustic wash irreversibly reduces TMV of agent, but produces a hazardous liquid side-stream that must be treated.

Selected alternative

Criteria	Alternative 1 Landfill/Cap in Place	Alternative 2 Landfill/Consolidate	Alternative 3 Landfill
Short-Term Effectiveness	*Effective*. Dust controls needed for demolition. Worker protection necessary for physical hazards associated with dismantling and for chemical hazards associated with caustic washing and handling agent-contaminated debris. Habitat improved at site, limited at disposal areas. RAOs achieved in 3 to 4 years.	*Effective*. Dust controls needed for demolition. Worker protection necessary for physical hazards associated wi th dimantling and for chemical hazards associated with caustic washing and handlig agent-contaminated debris. Habitat improved at site, limited at disul areas. RAOs achieved in 3 to years.	*Effective*. Dust controls needed for demolition. Worker protection necessary for physical hazards associated with dismantling and for chemical hazards associated with caustic washing and handling agent-contaminated debris. Habitat improved at site, limited at disposal areas. RAOs achieved in 3 to 4 years.
Implementability	*Technically and administratively feasible*. Regulatory concerns with capping.	*Technically and administratively feasible*.	*Technically and administratively feasible*.
Present Worth Cost[1]	$106 million	$104 million	$109 million
Conclusion	*Not selected*. Meets evaluation criteria and is consistent with soil remedial alternatives. Not identified as the preferred alternative due to regulatory concerns over capping debris from Other Contamination History structures.	*Selected*. Meets evaluation criteria and is consistent with soil remedial alternatives.	*Not selected*. Meets evaluation criteria and is consistent with soil remedial alternatives. Not identified as the preferred alternative because it is less cost effective than Alternative 2.
Selected alternative			

[1]These costs do not include $35 million in post ROD removal actions.

Table 8.3-1 Comparative Analysis of Soil Alternatives

Criteria	Alternative 1 Caps/Covers	Alternative 2 Landfill/Caps	Alternative 3 Landfill	**Alternative 4 Consolidation/Caps/ Treatment/Landfill**	Alternative 5 Caps/Treatment/ Landfill
Overall Protection of Human Health and the Environment	*Protective*. Exposures to humans and animals prevented by containing contaminated soil in place.	*Protective*. Exposures to humans and animals prevented by containing contaminated soil in place.	*Protective*. Exposures to humans and animals prevented by containing contaminated soil in place.	**_Protective_. Exposures to humans and animals prevented by containing contaminated soil in place and by treating some of the principal threat volume.**	*Protective*. Exposures to humans and animals prevented by containing contaminated soil in place and by treating principal threat volume.
Compliance with ARARs	*Complies* with action-, chemical-, and location-specific ARARs.	*Complies* with action-, chemical-, and location-specific ARARs.	*Complies* with action-, chemical-, and location-specific ARARs.	**_Complies_ with action-, chemical-, and location-specific ARARs.**	*Complies* with action-, chemical-, and location-specific ARARs. More difficult due to action-specific ARARs regarding treatment.
Long-Term Effectiveness and Permanence	*Minimal residual risk*. Relies on caps and groundwater controls to prevent migration and exposure.	*Minimal residual risk*. Relies primarily on caps and groundwater controls, with some landfilling, to prevent migration and exposure.	*Minimal residual risk*. Relies on landfilling, with some caps and groundwater controls to prevent migration and exposure.	**_Minimal residual risk_. Relies on treatment of some highly contaminated soil, groundwater controls, and capping/landfilling to prevent migration and exposure.**	*Minimal residual risk*. Relies on treatment of most of the highly contaminated soil and landfilling/capping to prevent migration and exposure.
Reduction of Toxicity, Mobility, or Volume (TMV)	*TMV Reduced*. Mobility reduced through containment; no toxicity or volume reduction.	*TMV Reduced*. Mobility reduced through containment; no toxicity or volume reduction.	*TMV Reduced*. Mobility reduced through containment; no toxicity or volume reduction	**_TMV Reduced_. TMV of some highly contaminated soil reduced through treatment; relies on containment for most mobility reduction.**	*TMV Reduced*. TMV of the most highly contaminated soil reduced through treatment; relies on containment for additional mobility reduction.

Selected alternative

Table 8.3-1 Comparative Analysis of Soil Alternatives

Criteria	Alternative 1 Caps/Covers	Alternative 2 Landfill/Caps	Alternative 3 Landfill	Alternative 4 Consolidation/Caps/ Treatment/Landfill	Alternative 5 Caps/Treatment/ Landfill
Short-Term Effectiveness	*Effective.* Minimal short-term risk. No excavation or potential releases.	*Effective.* Low short-term risk. High-risk sites not excavated; minimal potential for releases.	*Effective.* Moderate short-term risk. All sites excavated and transported with high potential for releases.	*Effective.* Moderate short-term risk. Some high-risk sites excavated and transported; moderate potential for releases.	*Effective.* Higher short-term risk. Most high-risk sites excavated, transported, and treated; large volumes of less contaminated soil moved; high potential for releases.
Implementability	*Implementable.* Easy to construct caps on schedule; short time to complete.	*Implementable.* Easy to construct caps and landfill for soil with low levels of contamination; short time to complete.	*Moderate implementability.* Construction and permitting of large landfill for highly contaminated material may delay schedule.	*Moderate implementability.* Construction and permitting of large landfill for highly contaminated material may delay schedule.	*Difficult implementability.* Construction and permitting of large landfill and thermal treatment facility may delay schedule. Problems in excavation, treatment, and emissions control; longest time to complete.
Present Worth Cost	Total: $386 million	Total: $276 million	Total: $384 million	Total: $401 million	Total: $542 million
Conclusion	*Not selected.* Higher long-term risks and no substantial cost savings compared to other alternatives.	*Not selected.* Higher long-term risk, although low cost.	*Not selected.* High short-term risks without improving long-term protection, which ultimately relies on containment.	*Selected.* Cost effective; balances short-term risks with higher long-term protection.	*Not selected.* High cost, short-term risks, and difficult to implement.

Selected alternative

9.0 Identification of the Selected Remedy

The selection of the preferred remedy for remediation of groundwater, structures, and soil for the On-Post Operable Unit was based on the NCP evaluation criteria, which are described in Figure 8.0-1 and discussed with respect to each of the alternatives evaluated in Sections 8.1 through 8.3. As a result of these evaluations, the selected remedy for the On-Post Operable Unit consists of implementing Groundwater Alternative 4, Structures Alternative 2, and Soil Alternative 4. These selected alternatives are described in detail in Section 7. Remediation goals for the selected remedy satisfies the evaluation of statutory requirements under CERCLA as described in Section 10.

9.1 Groundwater Alternative 4 – Boundary Systems/IRAs/Intercept Systems

The selected groundwater alternative is Alternative 4. This alternative includes operation of all existing boundary systems and on-post groundwater IRA systems, installation of a new extraction and piping system, and development of an extended monitoring program. The specific components of the alternative are as follows:

- Operation of the three boundary systems, the NBCS, NWBCS, and ICS, continues. These systems include extraction and recharge systems, slurry walls (NBCS and NWBCS) for hydraulic controls, and carbon adsorption for removal of organics. The systems will be operated until shut-off criteria, as described below, are met.
- Operation of existing on-post groundwater IRA systems continues. The Motor Pool and Rail Yard IRA systems, which pipe water to ICS for treatment, will be shut down when shut-off criteria, as described below, are met. The Basin F extraction system continues to extract water that is treated at the Basin A Neck system and the Basin A Neck system continues to extract and treat water from Basin A until shut-off criteria are met.
- A new extraction system will be installed in the Section 36 Bedrock Ridge area. Extracted water will be piped to the Basin A Neck system for treatment (e.g., by air stripping or carbon adsorption).
- Water levels in Lake Ladora, Lake Mary, and Lower Derby Lake will be maintained to support aquatic ecosystems. The biological health of the ecosystems will continue to be monitored.

  Lake-level maintenance or other means of hydraulic containment or plume control will be used to prevent South Plants plumes from migrating into the lakes at concentrations exceeding CBSGs in groundwater at the point of discharge. Groundwater monitoring will be used to demonstrate compliance.
- Confined aquifer wells are monitored in the South Plants, Basin A, and Basin F areas. Specific monitoring wells will be selected during remedial design.
- Those monitoring wells installed in the confined aquifer that may represent pathways for migration from the unconfined aquifer (approximately 30–40 wells) are closed and sealed; replacement wells will be installed if the Parties jointly determine that specific wells to be closed are necessary for future monitoring.
- Chloride and sulfate are expected to attenuate naturally to the CSRGs.
- Monitoring and assessment of NDMA contamination will be performed in support of design refinement/design characterization to achieve remediation goals specified for the boundary groundwater treatment systems.

CSRGs were established for each containment/treatment system on the basis of ARARs and health-based criteria. The ARAR-based values were either Colorado Basic Standards for Groundwater (CBSGs), federal maximum contaminant levels (MCLs), or non-zero maximum contaminant level goals (MCLGs). The health-based values are to-be-considered criteria (TBCs) and were based on EPA health advisories and/or EPA Integrated Risk Information System database criteria. All of the boundary CSRGs are consistent with those derived for the ROD for the Off-Post Operable Unit (Harding Lawson Associates 1995). CSRGs were developed for each of the existing boundary and IRA systems, depending on the specific contaminants found upgradient of each system and whether the systems were on post or at the boundary. Tables 9.1-1, 9.1-2, 9.1-3, and 9.1-4 present the CSRGs for the three boundary systems, and the Basin A Neck system. Where the CSRG is below the detection limit, the detection limit is listed next to the CSRG. Except where technically impractical, the detection limit is less than the CSRG.

Criteria for shutting down boundary systems and internal systems have also been developed and are provided as follows:

- Existing wells within the boundary and off-post containment systems can be removed from production when concentrations of constituents detected in the well are less than the ARARs listed in Appendix A and/or it can be demonstrated that discontinuing operation of a well would not jeopardize the containment objective of the systems as identified by the remediation goals described above and the CSRGs listed in Tables 9.1-1, 9.1-2, and 9.1-3. Wells removed from production and monitoring wells upgradient and downgradient of the boundary and off-post containment systems will be monitored quarterly for a period of 5 years to determine whether contaminants have reappeared; however, those wells turned off for hydraulic purposes will not be subject to the quarterly monitoring requirements. Boundary and off-post containment system extraction wells removed from production for water-quality reasons will be placed back into production if contaminant concentrations exceed ARARs. Wells with concentrations less than ARARs can remain in production if additional hydraulic control is required.
- Existing wells within the internal containment systems can be removed from production when concentrations of constituents detected in the wells are less than ARARs listed in Appendix A and/or it can be demonstrated that discontinuing operation of a well would not jeopardize the containment objective of the systems as identified by the CSRGs listed in Table 9.1-4. Wells removed from production and monitoring wells upgradient and downgradient of the internal containment systems will be monitored quarterly for a period of 5 years to determine whether contaminants have reappeared; however, those wells turned off for hydraulic purposes will not be subject to the quarterly monitoring requirements. Internal containment system extraction wells removed from production for water-quality reasons will be placed back into production if contaminant concentrations exceed ARARs. Wells with concentrations less than ARARs can remain in production if additional hydraulic control is required.
- Shell and the Army will operate the ICS for 2 years or until the Rail Yard/Motor Pool plumes no longer require containment at the ICS.

Figure 9.1-1 illustrates the selected alternative. Additional detail on this alternative is provided in the Detailed Analysis of Alternatives report.

9.2 Structures Alternative 2 – Landfill/Consolidate

Structures Alternative 2 is the selected alternative for the structures medium. This alternative applies to all No Future Use structures, i.e., structures in the Other Contamination History, Significant Contamination History, and Agent History Groups. Under this alternative, the following activities will occur:

- All No Future Use structures will be demolished.
- Agent History structures will be monitored for the presence of Army chemical agent, and treated by caustic washing as necessary prior to disposal.
- Both Agent History and Significant Contamination History Group structural debris will be disposed in the on-site hazardous waste landfill.
- Other Contamination History Group structural debris will be used as grade fill in Basin A, which will subsequently be covered as part of the soil remediation.
- Structural assessments and review of ACM and PCB contamination status and disposition of ACM or PCB-contaminated materials will be performed as described in Section 7.3.3.
- Process-related equipment not remediated as part of the Chemical Process-Related Activities IRA will be disposed in the on-post hazardous waste landfill.

An inventory of structures in each medium group is presented in Tables 5.4-6, 5.4-7, 5.4-8, and 5.4-9. Refinement of the Future Use structures inventory will be completed during remedial design. Most of the demolition at RMA will consist of dismantling with standard dust-suppression measures Remediation goals and standards have been identified for each medium group (see Table 9.5-1). The Other Contamination History Group structural debris is disposed by consolidation in Basin A. This procedure includes transporting the debris to the consolidation area and using it as a portion of the gradefill required by the soil remediation. When the consolidation area has been regraded, it will be covered as part of the soil remediation. Significant Contamination History Group and Agent Contamination History Group structural debris is disposed in the on-post hazardous waste landfill. The slabs and foundations of structures located in the South Plants Central Processing Area within principal threat or human health soil exceedance excavation areas are removed to a depth of 5 ft. In most cases, floor slabs and foundations for the Other Contamination History and Significant Contamination History Groups are left behind after demolition (unless contaminated soil is to be excavated from beneath the slabs or foundations). Floor slabs are broken to prevent water ponding. Additional detail on this alternative is provided in the Detailed Analysis of Alternatives Report.

9.3 Soil Alternative 4 – Consolidation/Caps/Treatment/Landfill

The selected soil alternative is Alternative 4. This alternative includes consolidation of 1.5 million BCY of soil with low levels of contamination into Basins A and F and the South Plants Central Processing Area; capping or soil cover of contaminated soil in the Basins, South Plants, North Plants, and Section 36 sites (including Shell and Complex Trenches); treatment (primarily by in situ solidification/stabilization) of 207,000 BCY of

principal threat soil; and on-post landfilling of 1.7 million cubic yards of soil and debris, including the Basin F Wastepile. The specific components of this alternative are listed below and are summarized in Table 9.3-1:

- On-Post Hazardous Waste Landfill – Construction of a RCRA- and TSCA-compliant hazardous waste landfill on post.
- Former Basin F – Treatment of approximately 180,000 BCY of principal threat soil in the Former Basin F to a depth of 10 ft (measured from below the base of the overburden) using in situ solidification/stabilization to reduce the mobility of the contaminants and minimize further contamination of groundwater. The mixture of solidification agents will be determined during remedial design by treatability testing. This treatability testing will be used to verify the effectiveness of the treatment process and establish operating parameters for the design of the full-scale operation. The entire site is capped (including the Basin F Wastepile footprint) with a RCRA-equivalent cap that includes a biota barrier.
- Basin F Wastepile – Excavation of approximately 600,000 BCY of principal threat soil and liner materials from the wastepile and containment in dedicated triple-lined landfill cells at the on-post hazardous waste landfill facility. Excavation is conducted using vapor- and odor-suppression measures as necessary. If the wastepile soil fails EPA's paint filter test, the moisture content of the soil will be reduced to acceptable levels by using a dryer in an enclosed structure. Any volatile organics (and possibly some semivolatile organics) released from the soil during the drying process are captured and treated; however, the main objective of this process is drying. Prior to excavation of the wastepile, overburden from the existing cover is removed and set aside. The excavation area is backfilled with on-post borrow material and stockpiled overburden.
- Basin A – Construction of a soil cover consisting of a 6-inch-thick layer of concrete and a 4-ft-thick soil/vegetation layer over the principal threat and human health exceedance soil and soil posing a potential risk to biota, and consolidation of debris and soil posing a potential risk to biota and structural debris from other sites. No RCRA-listed or RCRA-characteristic waste from outside the AOC will be placed in Basin A. Any UXO encountered will be removed and transported off post for detonation (unless the UXO is unstable and must be detonated on post) or other demilitarization process.
- South Plants Central Processing Area – Excavation and landfill of principal threat and human health exceedance soil to a depth of 5 ft and caustic washing and landfill of any agent-contaminated soil found during monitoring. Backfill excavation and placement of a soil cover consisting of a 1-ft-thick biota barrier and a 4-ft-thick soil/vegetation layer over the entire site to contain the remaining human health exceedance soil and soil posing a potential risk to biota. Soil posing a potential risk to biota from other portions of South Plants may be used as backfill and/or gradefill prior to placement of the soil cover.
- South Plants Ditches – Excavation and landfill of principal threat and human health exceedance soil. Excavation of soil posing a potential risk to biota and consolidation under the South Plants Central Processing Area soil cover. Backfill excavated area with on-post borrow material. These sites are contained under the South Plants Balance of Areas soil cover.
- South Plants Balance of Areas – Excavation (maximum depth of 10 ft) and landfill of principal threat and human health exceedance soil and caustic washing and landfill of any agent-contaminated soil found during monitoring. Any UXO encountered will be excavated and transported off post for detonation (unless the UXO is unstable and must be detonated on post) or other demilitarization process. Excavation of soil posing a potential risk to biota and consolidation as backfill and/or gradefill under the South Plants Central Processing Area soil cover and/or for use as backfill for excavated areas within this medium group. The former human health exceedance area is covered with a 3-ft-thick soil cover and the former potential risk to biota area is covered with a 1-ft-thick soil cover. Prior to placing this cover, two composite samples per acre will be collected to verify that the soil under the 1-ft-thick soil cover does not exceed human health or principal threat criteria. If the residual soil is found to exceed these levels, the 3-ft-thick cover will be extended over these areas or the

exceedance soil will be excavated and landfilled. The top 1 ft of the entire soil cover area will be constructed using soil from the on-post borrow areas.

- Section 36 Balance of Areas – Excavation and landfill of human health exceedance soil and UXO debris and excavation and consolidation to Basin A of soil posing a potential risk to biota. The consolidated material is contained under the Basin A cover and the human health excavation area is backfilled with on-post borrow material. Prior to excavation, a geophysical survey is conducted to locate potential UXO. Any UXO encountered will be excavated and transported off post for detonation (unless the UXO is unstable and must be detonated on post) or other demilitarization process. Caustic washing and landfill of any agent-contaminated soil found during monitoring. The former human health exceedance area is covered with a 2-ft-thick soil cover and the former potential risk to biota area is covered with a 1-ft-thick soil cover.

- Secondary Basins – Excavation and landfill of human health exceedance soil. The excavated area is backfilled with on-post borrow material. A 2-ft-thick soil cover is placed over the entire area of Basins B, C, and D, including the potential biota risk area.

- Complex Trenches – Construction of a RCRA-equivalent cap, including a 6-inch-thick layer of concrete, over the entire site. Installation of a slurry wall into competent bedrock around the disposal trenches. Dewatering within the slurry wall is assumed for purposes of conceptual design and will be reevaluated during remedial design. Soil excavated for the slurry wall trench is graded over the surface of the site and is contained under the cap. Prior to installing the slurry wall and cap, a geophysical survey is conducted to locate potential UXO within construction areas. Any UXO encountered will be removed and transported off post for detonation (unless the UXO is unstable and must be detonated on post) or other demilitarization process.

- Shell Trenches – Modification of the existing soil cover to be a RCRA-equivalent cap with a biota barrier. Expansion of the existing slurry wall around the trenches. Dewatering within the slurry wall is assumed for purposes of conceptual design and will be re-evaluated during remedial design. Soil excavated for the slurry wall trench is graded over the surface of the site and is contained under the cap.

- Hex Pit – Treatment of approximately 1,000 BCY of principal threat material using an innovative thermal technology. The remaining 2,300 BCY are excavated and disposed in the on-post hazardous waste landfill. Remediation activities are conducted using vapor- and odor-suppression measures as required. Treatability testing will be performed during remedial design to verify the effectiveness of the innovative thermal process and establish operating parameters for the design of the full-scale operation. The innovative thermal technology must meet the treatability study technology evaluation criteria described in the dispute resolution agreement (PMRMA 1996). Solidification/stabilization will become the selected remedy if all evaluation criteria for the innovative thermal technology are not met. Treatability testing for solidification will be performed to verify the effectiveness of the solidification process and determine appropriate solidification/stabilization agents. Treatability testing and technology evaluation will be conducted in accordance with EPA guidance (OSWER-EPA 1989a) and EPA's "Guide for Conducting Treatability Studies under CERCLA" (1992).

- Section 36 Lime Basins – Excavation and containment of principal threat and human health exceedance soil in a triple-lined landfill cell at the on-post hazardous waste landfill facility. Prior to excavation of exceedance soil, overburden from the existing cover is removed and set aside. The excavated area is backfilled with clean borrow and the soil cover is repaired. Caustic washing and landfill of any agent-contaminated soil found during monitoring.

- Buried M-1 Pits – Approximately 26,000 BCY of principal threat and human health exceedance soil is treated by solidification/stabil ization and then landfilled. The mixture of solidification/stabilization agents will be determined during remedial design by treatability testing. This treatability testing will be used to verify the effectiveness of the treatment process and establish operating parameters for the design of the full-scale operation. Excavation is conducted using vapor- and odor-suppression

measures. Caustic washing and landfill of any agent-contaminated soil found during monitoring. The excavated area is backfilled with clean borrow.

- Burial Trenches – UXO in these sites is located using a geophysical survey, excavated, and transported off post for detonation (unless the UXO is unstable and must be detonated on post) or other demilitarization process. Excavation and landfill of human health exceedance soil and backfill with on-post borrow material. Caustic washing and landfill of any agent-contaminated soil found during monitoring. Removal and landfill of munitions debris and nearby soil in excess of TCLP.
- Chemical Sewers – For sewers located within the South Plants Central Processing Area and Complex Trenches area, the sewer void space is plugged with a concrete mixture to prohibit access to these lines and eliminate them as a potential migration pathway for contaminated groundwater. The plugged sewers are contained beneath the soil cover or cap in their respective sites. For sewers located outside the South Plants Central Processing Area and Complex Trenches areas, sewer lines and principal threat and human health exceedance soil are excavated and landfilled. Any agent-contaminated soil found during monitoring is caustic washed and landfilled. Prior to excavation of exceedance soil, overburden is removed and set aside. The excavated area is backfilled with on-post borrow material and the overburden replaced.
- Sanitary/Process Water Sewers – Void space inside sewer manholes is plugged with a concrete mixture to prohibit access and eliminate the manholes as a potential migration pathway for contaminated groundwater. Aboveground warning signs are posted every 1,000 ft along the sewer lines to indicate their location underground.
- North Plants – Excavation and landfill of human health exceedance soil. Any agent-contaminated soil found during monitoring is caustic washed and landfilled. The excavated area is backfilled with on-post borrow material. A 2-ft-thick soil cover is placed over the soil posing a potential risk to biota and the footprint of the North Plants processing area.
- Toxic Storage Yards – Excavation and landfill of human health exceedance soil. Any agent-contaminated soil found during monitoring is caustic washed and landfilled. The excavated area is backfilled with on-post borrow material. The New Toxic Storage Yards are used as a borrow area for both low-permeability soil and structural fill.
- Munitions Testing – UXO in these sites is located using a geophysical survey, excavated, and transported off post for detonation (unless the UXO is unstable and must be detonated on post) or other demilitarization process. Removal and landfill of munitions debris and nearby soil in excess of TCLP.
- Lake Sediments – Excavation and landfill of human health exceedance soil and excavation and consolidation of soil posing risk to biota from Upper Derby Lake to Basin A. The excavated human health exceedance area is backfilled with on-post borrow material and the consolidated material is contained under the Basin A cover. Aquatic sediments are left in place and the area is monitored to ensure that the sediments continue to pose no unacceptable risk to aquatic biota.
- Ditches/Drainage Areas – Excavation and consolidation to Basin A of soil posing a potential risk to biota. The consolidated material is contained under the Basin A cover. The excavated area is backfilled with on-post borrow material.
- Sanitary Landfills – Excavation and landfill of human health exceedance soil and excavation and consolidation to Basin A of landfill debris and soil posing a potential risk to biota. The consolidated material is contained under the Basin A cover. The excavated area is backfilled with on-post borrow material.
- Buried Sediments – Excavation and landfill of human health exceedance soil. The excavated area is backfilled with on-post borrow material.

- Sand Creek Lateral – Excavation and landfill of human health exceedance soil and excavation and consolidation to Basin A of soil posing a potential risk to biota. The consolidated material is contained under the Basin A cover. The excavated area is backfilled with on-post borrow material.
- Surficial Soil – Excavation and landfill of human health exceedance soil and excavation and consolidation to Basin A or Former Basin F of soil posing a potential risk to biota from this medium group and excavation and landfill of soil from the pistol and rifle ranges. The consolidated material is contained under the Basin A cover or Basin F cap, and the human health exceedance area is backfilled.
- Excavation and disposal in the on-post TSCA-compliant landfill of PCB-contaminated soil (three areas identified by the PCB IRA with concentrations of 250 ppm or greater). Soil identified with concentrations ranging from 50 to 250 ppm will be covered with at least 3 ft of soil (five areas identified by the PCB IRA).
- Contingent Volume – Excavation and landfill of up to 150,000 BCY of additional volume to be identified based on visual field observations. An additional 14 samples from North Plants, Toxic Storage Yards, Lake Sediments, Sand Creek Lateral, and Burial Trenches and up to 1,000 additional confirmatory samples may be used to identify the contingent soil volume requiring excavation.
- Remedy components for all sites include reconditioning the surface soil and revegetating areas disturbed during remediation with locally adapted perennial vegetation.

Exceedance volumes for all medium groups are listed in Table 7.1-5. For sites with excavation as part of the selected remedy, the exceedance volume is considered the volume to be excavated and no confirmatory sampling will occur during implementation, other than to identify contingent volume.

Additional detail on this alternative is provided in the Detailed Analysis of Alternatives report. Figure 9.3-1 shows the selected sitewide soil remedy; Figures 9.3-2, 9.3-3, and 9.3-4 show the major excavation areas and cap or cover components of the selected soil remedy; and Figure 9.3-5 shows the areas where exceedance volumes are left in place and the type of containment systems used in those areas following implementation of the selected remedy. Tables 9.3-2 and 9.3-3 show the disposition of exceedance volumes and Table 9.3-4 details the capped/covered areas for the selected soil remedy. A process will be presented in future implementation documents that will allow for independent confirmation that volumes (defined spatially) are removed. The process will allow for verification by the state or EPA during remedial action.

9.4 Additional Components of the Selected Remedy

The Army, Shell, EPA, USFWS, and state of Colorado have agreed to several additional components that will be included in the overall on-post remedy. These components have been considered in the selection of the preferred alternatives and are as follows:

- Provision of $48.8 million held in trust to provide for the acquisition and delivery of 4,000 acre-feet of potable water to SACWSD and the extension of the water-distribution lines from an appropriate water supply distribution system to all existing well owners within the DIMP plume footprint north of RMA as defined by the detection limit for DIMP of 0.392 parts per billion (ppb). In the future, owners of any domestic wells, new or existing, found to have DIMP concentrations of 8 ppb (or other relevant CBSG at the time) or greater will be connected to a water-distribution system or provided a deep well

or other permanent solution. The Army and Shell have reached an Agreement in Principle with SACWSD, enclosed as Appendix B of this ROD, regarding this matter.

- In compliance with NEPA, PMRMA will separately evaluate the potential impacts to the environment of both the acquisition of a water supply for SACWSD and for extension of water-distribution lines.
- The Army and Shell will fund ATSDR to conduct an RMA Medical Monitoring Program in coordination with CDPHE. The program's nature and scope will include baseline health assessments and be determined by the on-post monitoring of remedial activities to identify exposure pathways, if any, to any off-post community.

  A Medical Monitoring Advisory Group (MMAG) has been formed to evaluate information concerning exposure pathways and identify and recommend appropriate public health actions to CDPHE and ATSDR and to communicate this information to the community. CDPHE and ATSDR will use the recommendations of the MMAG to jointly develop an appropriate medical monitoring plan and jointly define the trigger for when such a plan will take effect. Any human health assessment completed by CDPHE and ATSDR will be formally reviewed by the Parties and the MMAG prior to issuance to the public. The MMAG includes representatives from the affected communities, regulatory agencies, local governments, Army, Shell, USFWS, and independent technical advisors. Any necessary technical advisors will be identified in coordination with CDPHE and funded through ATSDR.

  The primary goals of the Medical Monitoring Program are to monitor any off-post impact on human health due to the remediation and provide mechanisms for evaluation of human health on an individual and community basis, until such time as the soil remedy is completed. On behalf of the communities surrounding RMA, the MMAG will develop and submit to CDPHE and ATSDR specific recommendations defining goals, objectives, and the methodology of a program designed to respond effectively to RMA-related health concerns of the community.

  Elements of the program could include medical monitoring, environmental monitoring, health/community education or other tools. The program design will be determined through an analysis of community needs, feasibility, and effectiveness.

- Trust Fund – During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund to help ensure the long-term operation and maintenance of the remedy once the remedial structures and systems are installed. In response to this interest, the Parties have committed to good-faith best efforts to establish a Trust Fund for the operation and maintenance of the remedy, including habitat and surficial soil. Such operation and maintenance activities will include those related to the new hazardous waste landfill; the slurry walls, caps, and soil and concrete covers; all existing groundwater pump-and-treat systems; the groundwater pump-and-treat system to intercept the Section 36 Bedrock Ridge Plume; the maintenance of lake levels or other means of hydraulic containment; all monitoring activities required for the remedy; design refinement for on-post surficial soil as described in Section 9.4; and any revegetation and habitat restoration required as a result of remediation.

  These activities are estimated to cost approximately $5 million per year (in 1995 dollars). The principal and interest from the Trust Fund would be used to cover these costs throughout the lifetime of remedial program.

  The Parties recognize that establishment of such a Trust Fund may require special legislation and that there are restrictions on the actions federal agencies can take with respect to proposing legislation and supporting proposed legislation. In addition to the legislative approach, the Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remediation sites. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

  A trust fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency

participation), local governments, affected communities, and other interested stakeholders, and will be convened within 90 days of the signing of the ROD.

Notwithstanding these uncertainties, it is the intent of the Parties that if the Trust Fund is created it will include the following:

A clear statement that will contain the reasons for the creation of the Trust Fund and the purposes to be served by it.

A definite time for establishing and funding the Trust Fund, which the Parties believe could occur as early as 2008, when the remedial structures and systems may have been installed.

An appropriate means for competent and reliable management of the Trust Fund, including appropriate criteria for disbursements from the Trust Fund to ensure that the money will be properly used for the required purposes.

- Continued operation of the CERCLA Wastewater Treatment Plant to support the remediation activities.
- Stored, drummed waste identified in the waste management element of the CERCLA Hazardous Waste IRA may be disposed in the on-post hazardous waste landfill in accordance with the CDD (Harding Lawson Associates 1996).
- Continued monitoring, as part of design refinement, for areas that may pose a potential risk to biota as outlined in the following process:
  - The BAS of technical experts (such as ecotoxicologists, biologists, and range/reclamation specialists) from the Parties will focus on the planning and conduct of both the USFWS biomonitoring programs and the SFS/risk assessment process. The BAS will provide interpretation of results and recommendations for design refinements to the Parties' decision makers.
  - The ongoing USFWS biomonitoring programs and the SFS/risk assessment process will be used to refine design boundaries for surficial soil and aquatic contamination to be remediated.
    - Phase I and the potential Phase II of the SFS will be used to refine the general areas of surficial soil contamination concern. The field BMFs will be used to quantify ecological risks in the Area of Dispute, identify risk-based soil concentrations considered safe for biota, and thus refine the area of excess risks (Figure 6.2-6).
    - Pursuant to the FFA process, USFWS will conduct detailed site-specific exposure studies of contaminant effects and exposure (tissue levels and Army-provided abiotic sampling) on sentinel or indicator species of biota (including the six key species identified in the IEA/RC report as appropriate). These studies will address both the aquatic resources and at least the surficial soil in and around the Area of Dispute. These site-specific studies will be used in refining contamination impact areas in need of further remediation.
    - Results from both the SFS/risk assessment process and the site-specific studies will be considered in risk-management decisions, which may further refine the areas of surficial soil and aquatic contamination to be remediated. (In the event of a conflict between management of RMA as a wildlife refuge and performance of remedial response actions, the Rocky Mountain Arsenal National Wildlife Refuge Act indicates that response actions will take priority.)
  - The BAS will serve as a technical resource to the Parties' decision makers by using technical expertise in analyzing, and potentially collecting, data sufficient to support design refinement for surficial soil areas and aquatic resources that will break unacceptable exposure pathways in consideration of minimizing habitat disturbance. Further, it will assess through monitoring the efficacy of remedies in breaking unacceptable pathways to biota. If any additional sites are identified, the remedy will be implemented as follows:

  - It will be staged to allow habitat recovery.
  - It will be performed first on locations selected through a balance of factors such as:
    - The Parties agree an area has a negative impact on or excessive risk to fish or wildlife.
    - The effort will not be negated by recontamination from other remediation activities.
    - The existing fish and wildlife resource value.
  - It will include revegetation of a type specified by USFWS; if the initial revegetation is not successful, the appropriate adjustments will be made and revegetation again implemented.
  - It will provide that the locations and timing of remediation are to be determined with consideration of and in coordination with USFWS refuge management plans and activities.
- The SFS, biomonitoring programs, and recommendations of the BAS will be used to refine the areas of remediation during remedial design.

- Any UXO encountered during remediation will be excavated and transported off post for detonation (unless the UXO is unstable and must be detonated on post) or other demilitarization process.
- Within 180 days after issuance of the Notice of Availability for the ROD, the Army will append to the ROD a complete, detailed schedule for completion of activities associated with the selected remedy. The schedule will identify the enforceable project milestone dates for design activities. Future design documents will detail milestone dates for implementation activities. Revisions to this schedule will be initiated prior to the start of each fiscal year to allow adequate time for review and concurrence by the Parties.

9.5 Remediation Goals and Standards

The treatment components of the selected groundwater remedy will meet the CSRGs presented in Tables 9.1-1 through 9.1-4, and the components of the selected soil and structures remedy will meet the remediation goals and standards presented in Table 9.5-1. The selected remedies will comply with the performance standards as provided in Appendix A (ARARs).

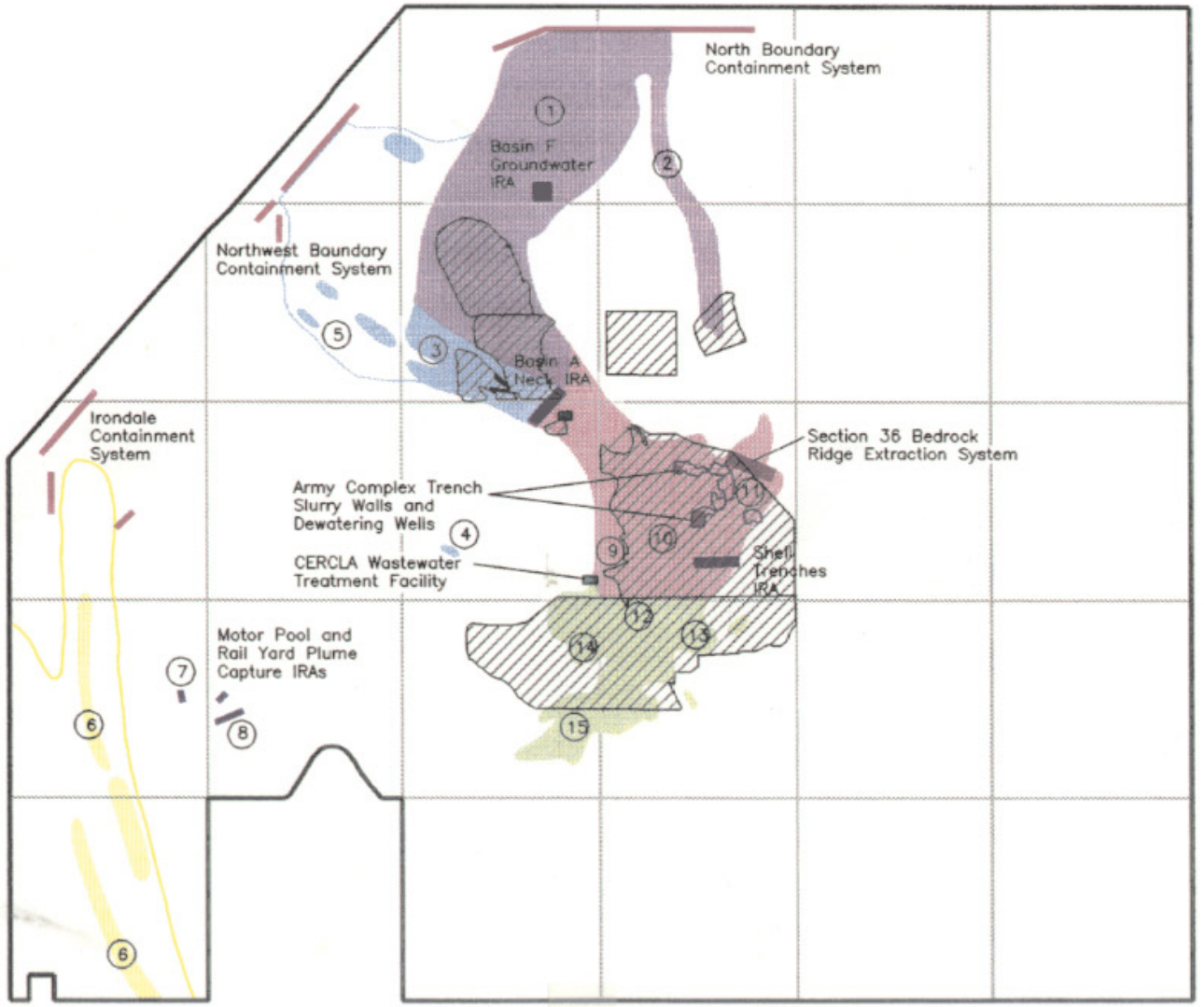
9.6 Cost of the Selected Remedy

The total estimated cost (in 1995 dollars) for the selected remedy is $2.2 billion (present worth $1.8 billion). Table 9.6-1 presents the capital and O&M costs for the selected alternatives. The time required for implementation is approximately 17 years, with groundwater system operations continuing for at least 30 years. The implementation of the remedy could be accelerated if funding is available that exceeds $100 million/year.

9.7 Long-Term Operations

Long-term operations are those ongoing activities that will be performed after the initial remediation work is completed and that will continue after EPA releases the site to USFWS as a wildlife refuge. These include monitoring and maintaining containment systems, such as the caps and the landfill, and continuing the operation of groundwater treatment systems.

Soil sites where covers or caps are constructed will be inspected on a regular basis, and damage to the vegetative cover or any eroded soil will be repaired. Long-term management also includes access restrictions to capped and covered areas to ensure the integrity of the containment systems. Where human health exceedances are left in place at soil sites, groundwater will be monitored,



LEGEND

- Boundary System
- Treatment System
- Existing IRA
- Slurry Wall
- Groundwater extraction well
- Capped/Covered Area

North Boundary Plume Group
- (1) Basins C and F Plume
- (2) North Plants Plume

Northwest Boundary Plume Group (Outlined in blue:)
- (3) Basin A Neck Plume
- (4) & (5) Sand Creek Lateral Plumes

Western Plume Group
- (6) Western Plume (Outlined in yellow:)
- (7) Motor Pool Plume
- (8) Rail Yard Plume

Basin A Plume Group
- (9) South Plants North Plume
- (10) Basin A Plume
- (11) Section 36 Bedrock Ridge Plume

South Plants Plume Group
- (12) South Plants North Source Plume
- (13) South Plants Southeast Plume
- (14) South Plants Southwest Plume
- (15) South Tank Farm Plume

[1] Colored portions of plumes indicate summed total organic concentrations above 100 ug/l.

N

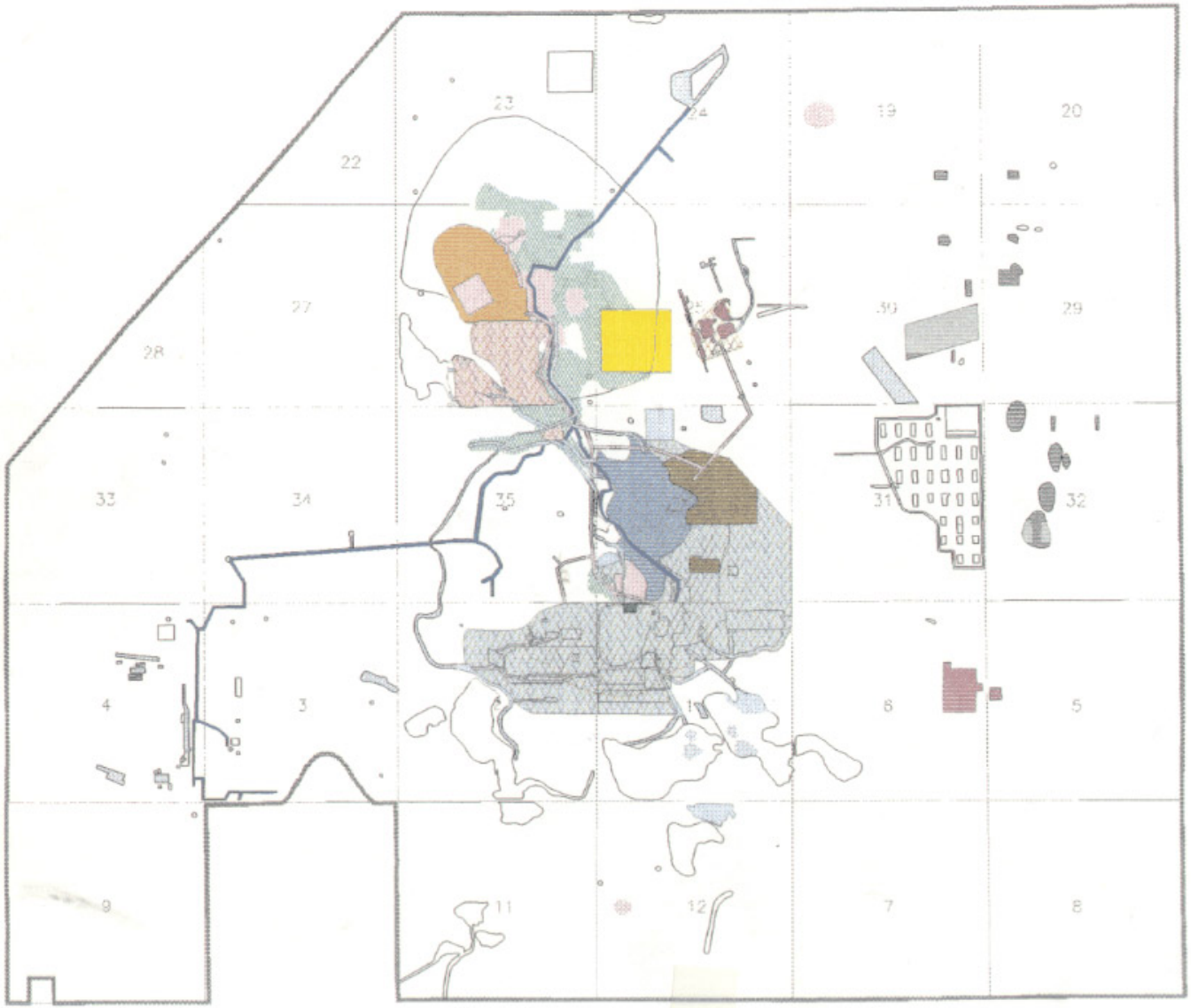
0 3000
Scale in Feet

Prepared for:
Office of the Program Manager
for Rocky Mountain Arsenal
June 1996

FIGURE 9.1-1
Alternative 4: Continued Operation of Existing Boundary Systems and IRAs and Extraction from Section 36 Bedrock Ridge

Prepared by:
Foster Wheeler Environmental Corporation

File Name: F:\PROJECTS\RMA\F9_1-1.DWG
Date 6/06/96
Drawn by TH/JLS
Checked by SA



Legend

- RMA Boundary
- SAR Site Boundary[1]
- In-situ Solidification of Principal Threat Volume; RCRA-Equivalent Cap
- RCRA-Equivalent Caps
- Direct Solidification/Stabilization
- Innovative Thermal Treatment (Hex Pit)
- Basin A Consolidation Area
- Landfill Human Health Soil,[2] Consolidation of Biota Soil
- Landfill Human Health Soil[3]
- Landfill Site
- Soil Covers
- Agent Screening Area (Caustic wash/landfill)
- UXO Screening Area (Detonation/landfill)
- Surficial Soil Consolidation
- Access Restrictions
- 5 Section Number

[1] Study Area Report (see Remedial Investigation Summary Report, Ebasco 1992a)

[2] Debris from the Sanitary Landfills Medium Group will be consolidated.

[3] Wastepile material will be dried prior to landfilling, if necessary, to pass EPA paint filter test.

-N-

1500 0 1500 3000 Feet

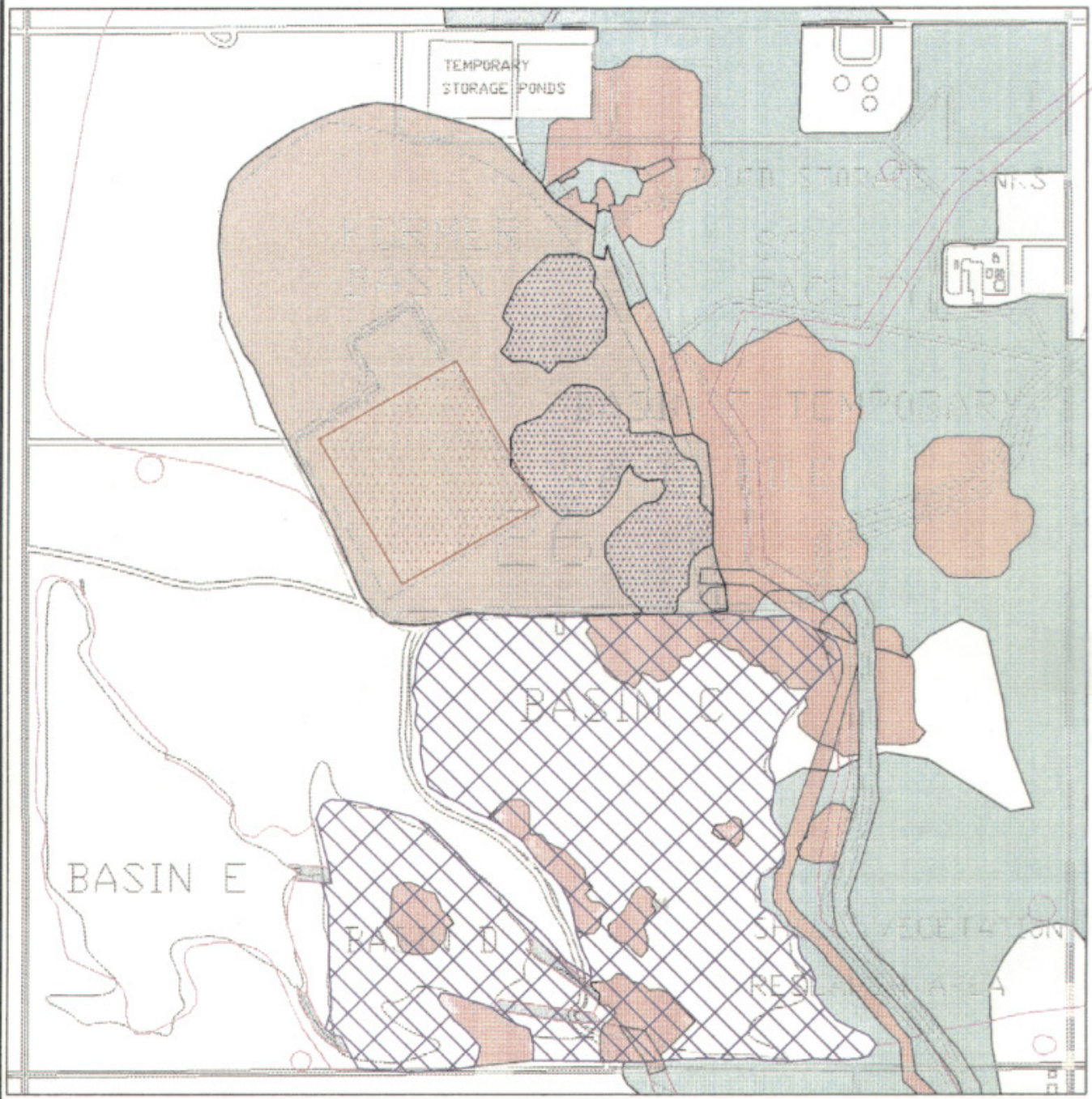
Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

Figure 9.3-1

Selected Soil Remedy Consolidation/Caps/Treatment/Landfill

Foster Wheeler Environmental Corporation
June 1996

File Name: C:\SOILS\ROD\F09931
Date 6/06/96
Drawn by XG
Checked by SA



Legend

- Former Basin F Solidification Area
- RCRA–Equivalent Cap
- Human Health and Principal Threat Excavation Area
- Biota Excavation Area
- Basin F Wastepile Excavation
- 2–Foot Soil Cover Area
- SAR Site Boundary (Study Area Report; see Remedial Investigation Summary Report, Ebasco 1992a.)
- 31 Section Number
- Section Line
- Drainage
- Road
- Railroad

N

0 400 800
Scale in Feet

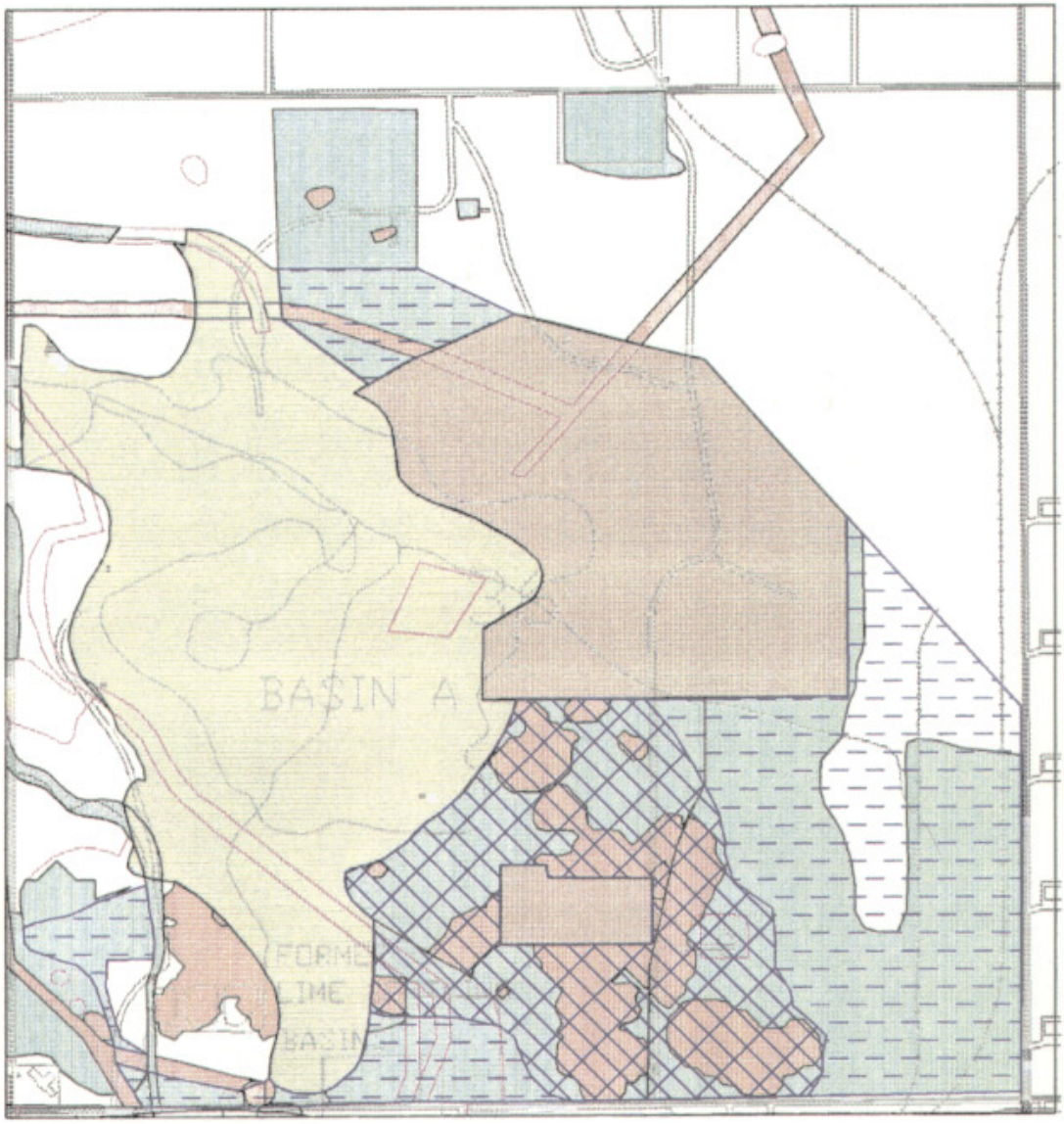
Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

Prepared June 1996

Figure 9.3–2
Section 26 Excavation Areas and Cap/Cover Components

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\SEC26_EX.DWG
Date 6/06/96
Drawn by JLS
Checked by SA



Legend

- Basin A Consolidation Area with 4-Foot Soil Cover/6-Inch Concrete Layer
- RCRA-Equivalent Caps
- Human Health and Principal Threat Excavation Area
- Biota Excavation Area
- 2-Foot Soil Cover Area
- 1-Foot Soil Cover Area
- SAR Site Boundary (Study Area Report; see Remedial Investigation Summary Report, Ebasco 1992a.)
- 31 Section Number
- Section Line
- Drainage
- Road
- Railroad

N

0 500 1000
Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

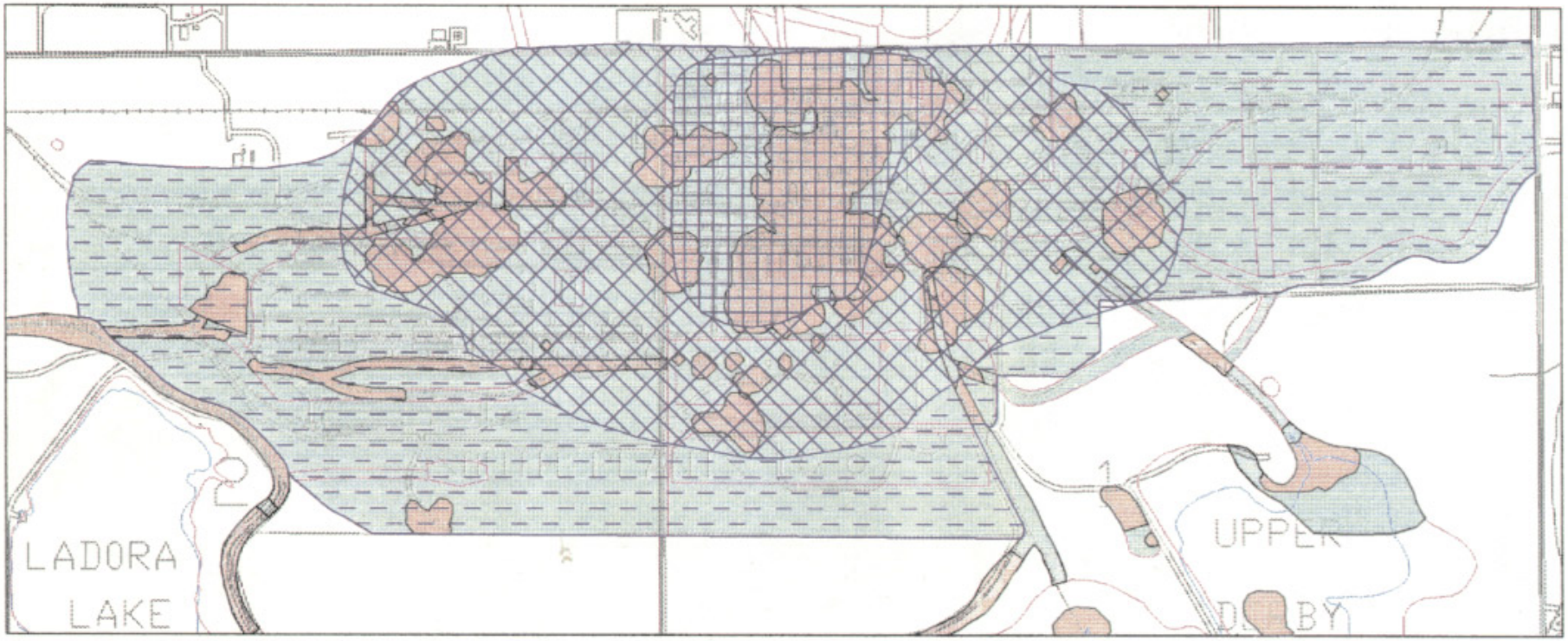
Prepared June 1996

Figure 9.3-3

Section 36 Excavation Areas and Cap/Cover Components

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\SEC36_EX.DWG
Date 6/06/96
Drawn by JLS
Checked by SA



Legend

- Human Health and Principal Threat Excavation Area
- Biota Excavation Area
- South Plants Central Processing Area Cover (4-foot soil cover with biota barrier)
- 3-Foot Soil Cover Area
- 1-Foot Soil Cover Area
- SAR Site Boundary (Study Area Report; see Remedial Investigation Summary Report, Ebasco 1992a.)
- 31 Section Number
- Section Line
- Drainage
- Road
- Railroad

N

0 500 1000
Scale in Feet

Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

Prepared June 1996

Figure 9.3-4

South Plants Excavation Areas and Cover Components

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\SP_EX.DWG
Date 6/06/96
Drawn by JLS
Checked by SA

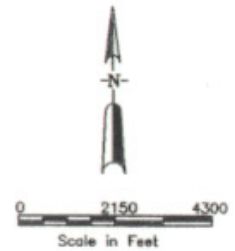
Legend

- Principal Threat Exceedance Area
- Human Health Exceedance Area[1]
- Biota Exceedance Area
- RCRA–Equivalent Cap[2]
- Soil Cover[2, 3]
- 31 Section Number
- Section Line

[1] Exceedance soil in South Plants Central Processing Area remains below the 5–ft depth of excavation.

[2] RCRA–equivalent caps and Basin A and South Plants Central Processing Area soil covers include a biota–intrusion layer.

[3] Soil covers vary in thickness from 1 to 4 ft.



Prepared for:
U.S. Army Program Manager
for Rocky Mountain Arsenal

Prepared June 1996

Figure 9.3–5

Containment Systems for Exceedances Remaining in Place following Remediation

Rocky Mountain Arsenal
Prepared by: Foster Wheeler Environmental Corp.

File Name: F:\PROJECTS\ARSENAL\ROD\RMA_EX.DWG
Date 5/17/96
Drawn by JLS
Checked by SA

Table 9.1-1 CSRGs for the Northwest Boundary Containment System

Chemical Group/Compound	Containment System Remediation Goals (µg/l)	
VHOs (Volatile Halogenated Organics)		
Trichloroethylene	3[1]	
Chloroform	6[2]	
OPHBGs (Organophosphorous Compounds; Isopropylmethyl Phosphonofluoridate (GB) Agent Related)		
DIMP (Diisopropylmethyl phosphonate)	8[2]	
Other Organics		
NDMA (n-Nitrosodimethylamine)	0.007[4]	(0.033)[3]
OCPs (Organochlorine Pestic ides)		
Dieldrin	0.002[2]	(0.05)[3]
Endrin	0.2[2]	
Isodr in	0.06[1]	
Arsenic	2.35[1]	

[1] Health-based value from the ROD for the Off-Post Operable Unit (Harding Lawson Associates 1995).
[2] Colorado Basic Standards for Groundwater. The Basic Standards for Groundwater, 5 CCR 1002.8, Section 3.11.
[3] Current certified reporting limit or practical quantitation limit readily available from a certified commercial laboratory.
[4] Risk-based value from Integrated Risk Information System (OHEA-EPA 1995).

Table 9.1-2 CSRGs for the Irondale Containment System

Chemical Group/Compound	Containment System Remediation Goals (µg/l)
VHOs (Volatile Halogenated Organics)	
Trichloroethylene	5[1,2]
Other Organics	
DBCP (Dibromochloropropane)	0.2[1,2]

Colorado Basic Standards for Groundwater. The Basic Standards for Groundwater, 5 CCR 1002.8, Section 3.11.
Federal maximum contaminant levels, 40 CFR 141.

Table 9.1-3 CSRGs for the North Boundary Containment System

Chemical Group/Compound	Containment System Remediation Goals (µg/l)	
VHOs (Volatile Halogenated Organics)		
1,2-Dichloroethane	0.4[1]	(1.0)[5]
1,2-Dichloroethylene	70[1,2]	
Carbon tetrachloride	0.3[1]	(0.99)[5]
Chloroform	6[1]	
Methylene chloride	5[1,2,6,7]	
Tetrachloroethylene	5[1,2]	
Trichloroethylene	3[3]	
VHCs (Volatile Hydrocarbon Compounds)		
DCPD (Dicyclopentadiene)	46[3]	
VAOs (Volatile Aromatic Organics)		
Benzene	3[3]	
Xylenes	1,000[3]	
Toluene	1,000[1,2]	
OSCMs (Organosulfur Compounds; Mustard Agent Related)		
1,4-Oxathiane	160[3]	
Dithiane	18[3]	
OSCHs (Organosulfur Compounds; Herbicide Related)		
Chlorophenylmethyl sulfide	30[4]	
Chlorophenylmethyl sulfone	36[4]	
Chlorophenylmethyl sulfoxide	36[4]	
OPHGBs (Organophosphorous Compounds; Isopropylmethyl Phosphonofluoridate (GB) Agent Related)		
DIMP (Diisopropylmethyl phosphonate)	8[1]	
OPHPs (Organophosphorous Compounds; Pesticide Related)		
Atrazine	3[1,2]	
Malathion	100[3]	

Table 9.1-3 CSRGs for the North Boundary Containment System

Chemical Group/Compound	Containment System Remediation Goals (µg/l)	
OCPs (Organochlorine Pesticides)		
Aldrin	0.002[1]	(0.05)[5]
Dieldrin	0.002[1]	(0.05)[5]
Endrin	0.2[1]	
Isodrin	0.06[3]	
Other Organics		
DBCP (Dibromochloropropane)	0.2[1,2]	
NDMA (N-Nitrosodimethylamine)	0.007[6]	(0.033)[5]
Arsenic	2.35[3]	
Anions		
Fluoride	2,000[1,10]	
Chloride	250,000[1,8]	
Sulfate	540,000[1,8,9]	

1 Colorado Basic Standards for Groundwater. The Basic Standards for Groundwater, 5 CCR 1002.8, Section 3.11.
2 Federal maximum contaminant levels, 40 CFR 141.
3 Health-based value from the ROD for the Off-Post Operable Unit (Harding Lawson Associates 1995).
4 EPA Region VIII Health Advisory value.
5 Current certified reporting limit or practical quantitation limit readily available from a certified commercial laboratory.
6 Risk-based level from the Integrated Risk Information System (OHEA-EPA 1995).
7 Methylene chloride is a common laboratory contaminant and analytical anomalies may be observed during compliance monitoring.
8 As described in Section 7.2.2, chloride and sulfate are expected to attenuate naturally, achieving remediation goals with time.
9 Inorganic CSRG for sulfate may be the natural background concentration.
10 The federal MCL for fluoride is 4,000 µg/l.

Table 9.1-4 CSRGs for the Basin A Neck IRA Treatment System

Chemical Group/Compound	Containment System Remediation Goals (µg/l)	
VHOs (Volatile Halogenated Organics)		
1,2-Dichloroethane	0.4[1]	(1.1)[4]
1,1,1-Trichloroethane	200[1,2]	
1,1-Dichloroethylene	7[1,2]	
Carbon tetrachloride	0.3[1]	(1.0)[4]
Chlorobenzene	100[1,2]	
Chloroform	6[1]	
Tetrachloroethylene	5[1,2]	
Trichloroethylene	5[1,2]	
VHCs (Volatile Hydrocarbon Compounds)		
Dicyclopentadiene	46[3]	
VAOs (Volatile Aromatic Organics)		
Benzene	5[1,2]	
OPHPs (Organophosphorus Compounds; Pesticide Related)		
Atrazine	3[1,2]	
SHOs (Semivolatile Halogenated Organics)		
Hexachlorocyclopentadiene	50[1]	
OCPs (Organochlorine Pesticides)		
DDT (Dichlorodiphenyltrichloroethane	0.1[1]	
Dieldrin	0.002[1]	(0.1)[4]
Endrin	0.2[1]	
OSCHs (Organosulfur Compounds; Herbicide Related)		
Chlorophenylmethylsulfide	30[3]	
Chlorophenylmethylsulfone	36[3]	
Chlorophenylmethylsulfoxide	36[3]	
Dicyclopentadiene	46[3]	
OSCMs (Organosulfur Compounds; Mustard Agent Related)		
1,4-Oxathiane	160[3]	
Dithiane	18[3]	

Table 9.1-4 CSRGs for the Basin A Neck IRA Treatment System

Chemical Group/Compound	Containment System Remediation Goals (µg/l)
Arsenic	50[1,2]
Mercury	2[1,2]

[1] Colorado Basic Standards for Groundwater. The Basic Standards for Groundwater, 5 CCR 1002.8, Section 3.11.
[2] Federal maximum contaminant levels, 40 CFR 141.
[3] Health-based value from the ROD for the Off-Post Operable Unit (Harding Lawson Associates 1995).
[4] Current practical quantitation limit or certified reporting limit.

Table 9.3-1 Summary of the Selected Soil Remedy

Medium Groups/Subgroups	Remedial Action
Munitions Testing	Munitions screening; off-post detonation of UXO (450 BCY); landfill debris and soil above TCLP (89,000 BCY).
North Plants	Landfill human health exceedance (220 BCY); agent monitoring during excavation; caustic washing; construct soil cover over biota risk area and processing area footprint (160,000 SY).
Toxic Storage Yards	Landfill human health exceedance (2,700 BCY); utilize New Toxic Storage Yard for borrow area; agent monitoring during site excavation and preparation; caustic washing.
Lake Sediments	Landfill human health exceedances (19,000 BCY); consolidate soil posing risk to biota from Upper Derby Lake (19,000 BCY) into Basin A or South Plants; deferral to USFWS for aquatic sediment.
Surficial Soil	Landfill human health exceedances (87,000 BCY); consolidate soil posing risk to biota in Basin A/Former Basin F/South Plants (460,000 BCY).
Ditches/Drainage Areas	Consolidate soil posing risk to biota in Basin A (23,000 BCY).
Basin A	Construct soil cover with formed concrete layer over principal threat and human health exceedances and soil posing risk to biota (670,000 SY); consolidate debris and soil posing risk to biota (790,000 BCY) and structural debris (160,000 BCY) from other sites.
Basin F Wastepile	Landfill entire wastepile (principal threat exceedance) (600,000 BCY) in triple-lined cell (with vapor controls) after drying saturated materials.
Former Basin F	In situ solidification/stabilization of principal threat volume (180,000 BCY); construct RCRA-equivalent cap over entire site (including Basin F Wastepile footprint) (525,000 SY).
Secondary Basins	Landfill human health exceedances (32,000 BCY); construct soil cover over soil posing risk to biota (520,000 SY).
Sanitary/Process Water Sewers	Plug remaining manholes.
Chemical Sewers	Plug sewer lines in South Plants Central Processing Area and Complex Trenches; landfill remaining principal threat and human health exceedances (64,000 BCY).
Complex Trenches	Construct RCRA-equivalent cap with formed concrete layer over principal threat and human health exceedances and soil posing risk to biota (390,000 SY) and install a slurry wall around disposal trenches.
Shell Trenches	Modify existing cover to be a RCRA-equivalent cap (32,000 SY) and modify existing slurry wall around trenches.

Table 9.3-1 Summary of the Selected Soil Remedy

Medium Groups/Subgroups	Remedial Action
Hex Pit	Treatment of buried material (1,000 BCY) using an innovative thermal technology (with vapor controls); landfill remaining volume (2,300 BCY). Solidification/stabilization will become the selected remedy if all evaluation criteria for the innovative thermal technology are not met.
Sanitary Landfills	Landfill human health exceedances (14,000 BCY); consolidate debris and soil posing risk to biota in Basin A (410,000 BCY).
Section 36 Lime Basins	Landfill principal threat and human health exceedances in triple-lined cell (54,000 BCY); repair existing soil cover.[1]
Buried M-1 Pits	Solidification of principal threat and human health exceedances (26,000 BCY) and landfill (with vapor controls).[1]
South Plants Central Processing Area	Landfill principal threat and human health exceedances (110,000 BCY); construct soil cover over entire site including soil posing risk to biota (220,000 SY); consolidate soil posing risk to biota from other sites (370,000 BCY).[1]
South Plants Ditches	Landfill principal threat and human health exceedances (33,000 BCY); consolidate soil posing risk to biota into excavated areas or South Plants Central Processing Area (22,000 BCY); construct soil cover over entire site (120,000 SY).
South Plants Balance of Areas	Landfill principal threat and human health exceedances (130,000 BCY); consolidate soil posing risk to biota into excavated areas or South Plants Central Processing Area (510,000 BCY); construct soil cover over entire site (1,700,000 SY).[1,2]
Buried Sediments	Landfill human health exceedances (16,000 BCY).
Sand Creek Lateral	Landfill human health exceedances (15,000 BCY); consolidate soil posing risk to biota into Basin A (90,000 BCY).
Section 36 Balance of Areas	Landfill human health exceedances and debris (140,000 BCY); consolidate soil posing risk to biota into Basin A (140,000 BCY); construct soil cover over entire site (850,000 SY).[1,2]
Burial Trenches	Landfill human health exceedances and debris (85,000 BCY).[1,2]
Contingent Volume	Landfill identified volume (up to 150,000 BCY).

[1] Agent monitoring during excavation and treatment of any soil containing agent by caustic solution washing.
[2] Munitions screening prior to excavation, off-post detonation of any munitions encountered, and landfill munitions debris/soil above TCLP.

Table 9.3-2 Final Disposition of Soil Exceedance Volumes[1]

Medium Group/Subgroup	RCRA Landfill[2]	Enhanced RCRA Landfill[2]	Consolidation in Basin A	Consolidation in Basin F	Consolidation within South Plants	Treatment[3]	Caustic Washing and Landfill	UXO Demilitarization Off Post
Munitions Testing	89,000							450
North Plants	220						61	
Toxic Storage Yards	2,700						220	
Lake Sediments	19,000		19,000					
Ditches/Drainage Areas			23,000					
Surficial Soil	87,000		109,000	351,000				
Basin A								5
Basin F Wastepile		600,000						
Secondary Basins	32,000							
Former Basin F[3]						180,000		
Sanitary/Process Water Sewers								
Chemical Sewers	64,000						20	
Complex Trenches								130
Shell Trenches								
Hex Pit[3]	2,300					1,000		
Sanitary Landfills	14,000		406,000					
Section 36 Lime Basins		54,000					91	
Buried M-1 Pits[3]						26,000	29	
South Plants Central Processing Area	110,000						160	
South Plants Ditches	33,000				22,000			
South Plants Balance of Areas	135,000				510,000		160	50
Buried Sediments	16,000							
Sand Creek Lateral	15,000		90,000					
Section 36 Balance of Areas	142,000		140,000				300	160
Burial Trenches	85,000							550
Totals	847,000	654,000	787,000	351,000	532,000	207,000	1,040	1,340

[1] All volumes given in bank cubic yards. The soil volumes referenced in this table are summarized in Table 7.1-5, and are based on the TECHBASE software and other calculations. All soil volumes referenced in this table are subject to the addition of "contingent volumes" based on findings during implementation of remedial activities.

[2] Landfill volume does not include contingent soil volume (up to 150,000 BCY), structures demolition debris, treated material volume, or landfill daily cover.

[3] Treatment detailed as follows: Former Basin F, in situ solidifcation; Hex Pit, innovative thermal; Buried M-1 Pits, solidification and landfill.

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Table 9.3-3 Untreated Soil Exceedance Volumes Remaining In Place[1,2]

Medium Group/Subgroup	Human Health	Principal Threat	Biota	Agent	UXO	UXO Debris	Consolidated Soil from Other Sites	Total Volume Remaining in Place
Munitions Testing								
North Plants			17,000					17,000
Toxic Storage Yards								
Lake Sediments								
Ditches/Drainage Areas								
Surficial Soil								
Basin A	160,000	32,000	88,000	710	89	47000[3]	787,000	1,080,000
Basin F Wastepile								
Secondary Basins			140,000					140,000
Former Basin F	560,000						351,000	911,000
Sanitary/Process Water Sewers								
Chemical Sewers	21,500	11,500		49				21,500
Complex Trenches	400,000	400,000		1,300	1,170	130,000[4]		532,000
Shell Trenches	100,000	100,000						100,000
Hex Pit								
Sanitary Landfills								
Section 36 Lime Basins								
Buried M-1 Pits								
South Plants Central Processing Area	32,000[5]	17,000[5]	27,000				370,000	429,000
South Plants Ditches								
South Plants Balance of Areas							162,000	162,000
Buried Sediments								
Sand Creek Lateral								
Section 36 Balance of Areas								
Burial Trenches				12				
Totals	1,270,000	561,000	272,000	2,070	1,260	177,000	1,670,000	3,390,000

[1] All volumes given in bank cubic yards.

[2] All volumes remaining in place are contained beneath soil covers or caps.

[3] Debris volume remaining includes 17,000 BCY human health exceedance volume and 30,000 BCY of biota risk volume.

[4] Debris volume remaining includes 43,000 BCY human health exceedance volume and 87,000 BCY of biota risk volume.

[5] Remaining volume at a depth greater than 5 ft.

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Table 9.3-4 Cap and Soil Cover Components[1]

Medium Group/Subgroup	RCRA-Equivalent Caps	Soil Covers: 4 ft minimum thickness	3 ft minimum thickness	2 ft minimum thickness	1 ft minimum thickness
Munitions Testing					
North Plants				157,000	
Toxic Storage Yards					
Lake Sediments					
Ditches/Drainage Areas					
Surficial Soil					
Basin A[2]		667,000			
Basin F Wastepile					
Secondary Basins				523,000	
Former Basin F	525,000				
Sanitary/Process Water Sewers					
Chemical Sewers					
Complex Trenches[2]	390,000				
Shell Trenches	32,000				
Hex Pit					
Sanitary Landfills					
Section 36 Lime Basins					
Buried M-1 Pits					
South Plants Central Processing Area		230,000			
South Plants Ditches[3]					
South Plants Balance of Areas			826,000		1,010,000
Buried Sediments					
Sand Creek Lateral					
Section 36 Balance of Areas				345,000	506,000
Burial Trenches					
Totals	947,000	897,000	826,000	1,030,000	1,520,000

[1] All areas given in square yards.

[2] Cap or cover includes a 6-inch formed concrete layer.

[3] South Plants Ditches sites are included under the South Plants Balance of Areas cover area.

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
RCRA/TSCA Hazardous Waste Landfill	Munitions Testing; Secondary Basins; Chemical Sewers; Sanitary Landfills; South Plants Central Processing Area; South Plants Ditches; South Plants Balance of Areas; Buried Sediments; Sand Creek Lateral; Section 36 Balance of Areas; Burial Trenches; Buried M-1 Pits; Hex Pit; North Plants; Toxic Storage Yards; Lake Sediments; Surficial Soil; No Future Use Structures, Significant Contamination History; No Future Use Structures, Agent History	Landfill • Standard: Landfill principal threat and human health soil exceedance volumes, UXO debris, agent-contaminated material, and structural debris. • Standard: Design landfill to meet state 1,000-year siting criteria. • Standard: Ensure all material disposed in landfill passes EPA paint filter test. Cap • Standard: Minimize infiltration by limiting the hydraulic conductivity of the clay/synthetic composite barrier layer (1×10^{-7} cm/sec or less for clay layer). • Standard: Meet or exceed all RCRA, TSCA, and state requirements. Liner • Standard: Minimize percolation by limiting the hydraulic conductivity of the compacted clay layer to 1×10^{-7} cm/sec or less. • Standard: Install two composite liners, each consisting of 3 ft of compacted clay and a synthetic liner. • Standard: Meet or exceed all RCRA, TSCA, and state requirements.	RCRA/TSCA regulations; State RCRA regulations; CAMU Designation Document

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
Enhanced RCRA Hazardous Waste Landfill	Basin F Wastepile; Section 36 Lime Basins	Landfill • Standard: Landfill principal threat and human health soil exceedance volumes and agent-contaminated material. • Standard: Design landfill to meet state 1,000-year siting criteria. • Standard: Ensure all material disposed in landfill passes EPA paint filter test. Cap • Standard: Minimize infiltration by limiting the hydraulic conductivity of the clay/synthetic composite barrier layer (1×10^{-7} cm/sec or less for clay layer). • Standard: Meet or exceed all RCRA, TSCA, and state requirements. Enhanced liner • Standard: Minimize percolation by limiting the hydraulic conductivity of the compacted clay layer to 1×10^{-7} cm/sec or less. • Standard: Install two composite liners, each consisting of 3 ft of compacted clay and a synthetic liner, and one additional composite liner. • Standard: Meet or exceed all RCRA and state requirements.	RCRA regulations; State RCRA regulations; CAMU Designation Document

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
RCRA-Equivalent Cap	Former Basin F; Complex (Army) Trenches w/concrete layer; Shell Trenches	• Ensure cap performance is equivalent to RCRA landfill cap with these objectives: – Standard: Allow no greater range of infiltration through the cap than the range of infiltration that would pass through an EPA-approved RCRA cap. – Standard: Prevent contact between hazardous materials and humans/biota by using biota barriers and maintaining institutional controls. – Goal: Serve as effective long-term barriers. – Standard: Demonstrate cap performance equivalent to a RCRA landfill cap according to an EPA- and state-approved demonstration that will include comparative analysis and field demonstration. • Goal: Maximize runoff and minimize ponding. • Standard: Maintain cover percolation less than or equal to the percolation of the underlying native soil. • Goal: Minimize erosion by wind and water. • Goal: Prevent damage to integrity of cap by biota and humans. • Goal: Maintain cover of locally adapted perennial vegetation.	State and federal RCRA regulations
UXO Clearance	Munitions Testing; Basin A; Section 36 Balance of Areas; Complex (Army) Trenches; Burial Trenches; South Plants Balance of Areas	• Standard: Identify, transport off post, neutralize, and destroy explosives/explosive residue. • Standard: Ensure excavation of all identified munitions-contaminated soil exceeding TCLP (Munitions Testing and Burial Trenches) and munitions debris and disposal in the on-post RCRA landfill.	Army surety safety and UXO regulations

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
Agent Decontamination	North Plants; Toxic Storage Yard; Section 36 Balance of Areas; Buried M-1 Pits; Burial Trenches; South Plants Central Processing Area; South Plants Balance of Areas; Section 36 Lime Basins; Chemical Sewers; No Future Use Structures, Agent History	• Standard: Certify 3X decontamination or caustic wash of soil and structural debris to achieve 3X decontamination. • Standard: Ensure disposal of 3X-decontaminated soil and structural debris in the on-post RCRA landfill.	Army surety safety regulations
Soil Cover (South Plants Consolidation Area)	South Plants Central Processing Area; South Plants Ditches; South Plants Balance of Areas	• Standard: Consolidate biota soil exceedance volume in South Plants Central Processing Area. • Standard: Maintain minimum cover thickness of 4 ft. • Goal: Minimize infiltration through cover. • Goal: Maximize runoff and minimize ponding. • Standard: Maintain cover percolation less than or equal to the percolation of the underlying native soil. • Goal: Minimize erosion by wind and water. • Goal: Prevent damage to integrity of cover by biota and humans. • Standard: Prevent biota and humans from accessing underlying contaminated soil by using biota barriers and maintaining institutional controls. • Goal: Maintain cover of locally adapted perennial vegetation.	Detailed Analysis of Alternatives; EPA guidance

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
Soil Cover with Concrete Layer (Basin A Consolidation Area)	Basin A; Lake Sediments; Surficial Soil; Section 36 Balance of Areas; Sand Creek Lateral; Sanitary Landfills; Ditches/Drainage Areas; No Future Use Structures, Other Contamination History	• Standard: Consolidate biota soil exceedence volume and structural debris in Basin A. • Standard: Maintain minimum cover thickness of 4 ft. • Goal: Maximize runoff and minimize ponding. • Standard: Maintain cover percolation less than or equal to the percolation of the underlying native soil. • Goal: Minimize erosion by wind and water. • Goal: Prevent damage to integrity of cover by biota and humans. • Standard: Prevent biota and humans from accessing underlying contaminated soil by using biota barriers and maintaining institutional controls. • Goal: Maintain cover of locally adapted perennial vegetation.	Detailed Analysis of Alternatives; EPA guidance
Soil Cover	Secondary Basins; North Plants; South Plants Ditches; South Plants Balance of Areas; Section 36 Balance of Areas	• Standard: Maintain minimum cover thicknesses specified in Section 9.3 of ROD. • Goal: Maximize runoff and minimize ponding. • Standard: Maintain cover percolation less than or equal to the percolation of the underlying native soil. • Goal: Minimize erosion by wind and water. • Goal: Prevent damage to integrity of cover by biota. • Standard: Prevent humans from accessing underlying contaminated soil by maintaining institutional controls. • Goal: Maintain cover of locally adapted perennial vegetation.	Detailed Analysis of Alternatives; EPA guidance
Solidification/ Stabilization	Former Basin F	• Standard: Comply with requirements of Basin F closure plan and design documents.	State RCRA regulations; EPA guidance

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
Innovative Thermal Technology	Hex Pit	• Standard: Design to achieve 90% or greater destruction of contaminants. • Standard: Landfill all treatment residuals and untreated material in the on-post hazardous waste landfill.	EPA guidance
Solidification/ Stabilization	Buried M-1 Pits	• Standard: Design to reduce contaminant concentrations in leachate; a 90 to 99% reduction in contaminant concentrations in leachate is a general guidance and may be varied within a reasonable range considering the effectiveness of the technology and the cleanup goals for the site. • Goal: Design treatability testing to achieve a 90% reduction in contaminant concentrations in leachate. • Standard: Landfill all solidified material in the on-post RCRA landfill. • Standard: Provide adequate unconfined compressive strength after solidification/stabilization to meet disposal requirements.	EPA guidance
Plugging	Sanitary/Process Water Sewers; Chemical Sewers	• Standard: Interrupt exposure pathway by permanently plugging all Sanitary Sewer manholes. • Standard: Interrupt exposure pathway by permanently plugging all chemical sewer lines and manholes not excavated.	Detailed Analysis of Alternatives

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
Slurry Wall	Complex (Army) Trenches; Shell Trenches	• Goal: Minimize groundwater flow across the slurry wall with a design goal 1x 10^{-7} cm/sec hydraulic conductivity. • Goal: Construct slurry wall with sufficient thickness to withstand maximum hydraulic gradient. • Goal: Construct slurry wall with materials that are compatible with the surrounding groundwater chemistry. • Goal: Minimize migration by keying the slurry wall in an underlying low permeability strata. • Goal: Dewater as necessary to ensure containment.	Detailed Analysis of Alternatives
Drying	Basin F Wastepile	• Standard: Ensure dried material passes EPA paint filter test. • Standard: Comply with requirements of Basin F closure plan and design documents.	State regulations
Excavation	Munitions Testing; Secondary Basins; Chemical Sewers; Sanitary Landfills; South Plants Central Processing Area; South Plants Ditches; South Plants Balance of Areas; Buried Sediments; Sand Creek Lateral; Section 36 Balance of Areas; Burial Trenches; Hex Pit Buried M-1 Pits; North Plants; Toxic Storage Yards; Lake Sediments; Section 36 Lime Basins; Surficial Soil; Ditches/Drainage Areas; Basin F Wastepile	• Standard: Excavate all contaminated soil identified in the ROD for treatment, landfilling, or consolidation that corresponds to the areal and vertical extent detailed by the soil volume calculations in the administrative record.	State regulations; EPA guidance

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
PCB Removal		Equipment • Standard: Remediate in accordance with PCB IRA requirements. Structures • Standard: Remove structural materials with PCB concentrations of 50 ppm or greater that exist above ground level, as well as contaminated parts of floor slabs and foundations identified for removal, and dispose in the on-post TSCA-compliant landfill. • Standard: PCB-contaminated sections of floor slabs or foundations that are not identified for removal, and that have PCB concentrations of less than 50 ppm, will be left in place. Soil • Standard: Interrupt exposure pathway with a minimum of 3 ft of soil in the five areas identified as having PCB contamination <250 ppm. • Standard: Removal of contamination >250 ppm in the three areas identified by the PCB IRA and disposal in on-post TSCA-compliant landfill. • Standard: If necessary, any suspected PCB soil contamination areas will be characterized further during remedial design. If additional PCB-contaminated soil is found with concentrations of 50 ppm or greater, the Army will determine any necessary remedial action in consultation with EPA.	TSCA PCB regulations
Asbestos Removal		• Standard: Removal of asbestos and ACM to attain TSCA requirements.	TSCA asbestos regulations; State regulations

Table 9.5-1 Remediation Goals and Standards for the On-Post Operable Unit

Technology	Medium Group/Subgroup	Remediation Goals[1] and Standards[2]	Primary Components of Rationale[3]
Groundwater Treatment System	Groundwater	• Standard: Capture and treat contaminated groundwater to meet or exceed CSRGs as specified in the ROD.	CBSG, MCL, MCLG, Risk-based criteria
Structure Demolition	No Future Use Structures, Agent History	• Standard: Certify 3X decontamination or caustic wash to achieve 3X decontamination.	State regulations; Army surety safety regulations
Structure Demolition	No Future Use Structures, Significant Contamination History; No Future Use Structures, Other Contamination History	• Standard: Demolish all structural material identified in the ROD for landfilling or consolidation.	State regulations
Air Emissions Control	All medium groups	• Goal: Control emissions, as necessary, during remediation. • Standard: Control emissions and odors for Basin F Wastepile excavation and Former Basin F remediation, in accordance with Basin F closure plan and design documents. • Standard: Meet air quality and odor standards that are ARARs. • Goal: Control air emissions as necessary to attain criteria that will be developed via an air pathway analysis program that will ensure that the remedial action will be protective of human health and the environment and minimize nuisance odors.	

[1] A broadly defined remediation objective supported by regulatory requirement, regulatory guidance, on agreement by the Parties. Typically, goals are less quantitative or measurable than standards.

[2] A quantitative or physical objective for remediation design that is based on a regulatory requirement, regulatory guidance, standard practice, or agreement by the Parties.

[3] This column indicates only a reference to ARARs in Appendix A as a portion of the rationale used to support the remediation goal. It does not include ARARs, nor is it intended to replace any ARARs. A complete listing of ARARs is presented in Appendix A.

Table 9.6-1 Total Estimated Cost for the Selected Remedy[1,2]

	Capital		Operating and Maintenance		Total Cost	
Cost Element	Total Cost[3]	Present Worth Cost	Total Cost[3]	Present Worth Cost	Total Cost[3]	Present Worth Cost
Soil	$530 million	$380 million	$41 million	$17 million	$570 million	$400 million
Water	$19 million	$18 million	$130 million	$85 million	$150 million	$100 million
Structures[4]	$7 million	$6.5 million	$140 million	$130 million	$150 million	$140 million
Pre-ROD Costs[5]	$750 million	$750 million	—	—	$750 million	$750 million
PMRMA Mission Support	$550 million	$430 million	—	—	$550 million	$430 million
Total Cost	$1.9 billion	$1.6 billion	$310 million	$230 million	$2.2 billion	$1.8 billion

1 Detailed cost information is provided in the Detailed Analysis of Alternative report.
2 All costs presented in 1995 dollars.
3 Total cost does not account for inflation over the time frame for remediation.
4 Structures cost includes $35 million to complete ongoing IRAs.
5 Pre-ROD costs include RI/FS and IRA costs and are listed to illustrate the total costs for complete remediation of RMA.

10.0 Statutory Determinations

This section describes how the selected remedy meets statutory requirements and complies with CERCLA and NCP requirements.

10.1 Consistency with the Statutory Requirements of CERCLA in Section 121

The selected remedy complies with Section 121 of CERCLA as described below.

10.1.1 Protection of Human Health and the Environment

The selected remedy will result in the remediation of the On-Post Operable Unit contaminated groundwater, structures, and soil consistent with the RAOs established for these media. It will eliminate, reduce, or control risks posed through each exposure pathway by engineering controls, treatment, or institutional controls so that cumulative site risks are reduced to acceptable levels. All human health, principal threat, and biota risk is being addressed by the selected remedy, thus resolving the risks at the On-Post Operable Unit. Additional biota studies are being performed in support of design refinement in areas (termed the Area of Dispute) where the potential risks to biota have not been agreed upon. There will be no unacceptable short-term risks or cross-media impacts caused by implementation of the remedy.

10.1.1.1 Groundwater

The groundwater remedial actions proposed under Alternative 4 will address the potential risks to human health and the environment by continuing treatment of groundwater at the boundary systems (NWBCS, NBCS, and ICS) as well as the on-post groundwater IRA systems (Basin A Neck, Motor Pool/Rail Yard, and North of Basin F IRAs), and through construction of a new groundwater extraction system northeast of the Army Complex Trenches (in the Section 36 Bedrock Ridge area). The toxicity, mobility, and volume of contaminated groundwater will be reduced through activated carbon (primarily) and air stripping treatment technologies. The extent of NDMA groundwater contamination and potential design refinements to achieve the remediation goals are currently being evaluated (see Section 7.2.2).

Contaminant concentrations at the RMA boundary will be reduced to meet or surpass the CSRGs, which represent applicable federal or state standards and are consistent with the ROD for the Off-Post Operable Unit. Consumption of groundwater or surface water on post will be restricted by institutional controls in accordance with the FFA. Nonpotable uses of on-post groundwater were not anticipated and risk was therefore not considered in the HHRC for such uses. A risk evaluation would be performed prior to any future nonpotable use to ensure that such use would be protective of human health and the environment. Continued monitoring of shallow (unconfined aquifer) and deeper (confined aquifer) groundwater and 5-year reviews of the site will be used to evaluate the effectiveness of the remedy. Water levels in Lake Ladora, Lake Mary, and Lower Derby

Lake will be maintained to support aquatic ecosystems. The biological health of the ecosystems will continue to be monitored. Lake-level maintenance or other means of hydraulic containment or plume control will be used to prevent South Plants plumes from migrating into the lakes at concentrations exceeding CBSGs in groundwater at the point of discharge. Groundwater monitoring will be used to demonstrate compliance.

10.1.1.2 Structures

The structures remedial actions proposed under Alternative 2 will address the potential risks to human health and the environment by demolishing and disposing of all No Future Use structures (approximately 94 percent of all remaining structures at RMA, which include all contaminated and potentially contaminated structures). As the structural debris is removed, materials are segregated for purposes of recycling and waste classification. Economically recyclable materials such as scrap metals are collected for salvage. Demolition debris from structures in the Significant Contamination History Group will be placed in the on-post hazardous waste landfill. Structures in the Agent History Group will be monitored following demolition, and any debris showing agent contamination will be treated; all debris from this group will then be placed in the on-post hazardous waste landfill. Debris from structures in the Other Contamination History Group will be used as fill under the cover in Basin A. Chemical process-related equipment, ACM, and PCB contamination not addressed during IRAs will be segregated during demolition and disposed in the on-post hazardous waste landfill (see Section 7.3.3).

These remedial actions achieve the structures remedial action objectives and reduce the mobility of contaminants through containment in the on-post hazardous waste landfill or under the Basin A cover. The potential for exposure to humans or biota is thereby controlled. Toxicity is reduced through treatment of agent-contaminated structural debris by caustic washing.

10.1.1.3 Soil

The soil remedial actions proposed under Alternative 4 will address the potential risks to human health and the environment using a combination of containment (as a principal element) and treatment technologies. A discussion of the human health and ecological risks is presented in Section 6.1 and Section 6.2, respectively. Approximately 180,000 BCY of principal threat soil at the Former Basin F site will be treated to a depth of 10 ft below the base of the overburden by in situ solidification/stabilization and the site will be contained with a RCRA-equivalent cap. All soil/sludge from the Buried M-1 Pits will be treated by ex situ solidification/ stabilization, followed by placement in the on-post hazardous waste landfill. Approximately 1,000 BCY of principal threat soil from the Hex Pit will be treated using an innovative thermal technology. Solidification/stabilization will become the selected remedy for the Hex Pit if all evaluation criteria for the innovative thermal technology are not met. These treatment actions, in addition to the more than 11 million

gallons of contaminated liquids from the Former Basin F already treated by incineration as part of the Basin F IRA, will achieve permanent reductions in the toxicity, mobility, or volume of some highly contaminated soil. Although the selected remedy in large part is a containment remedy, these treatment components satisfy CERCLA statutory preference for treatment. The large volume of contaminated soil present on the site precludes a remedy in which all contaminants could be excavated and cost-effectively treated.

Approximately 1.7 million BCY of contaminated soil from a number of soil medium groups at RMA (Basin F Wastepile, Section 36 Lime Basins, South Plants Central Processing Area, South Plants Ditches, South Plants Balance of Areas, Secondary Basins, Munitions Testing, Chemical Sewers, Sanitary Landfills, Lake Sediments, Surficial Soil, Buried Sediments, Sand Creek Lateral, Section 36 Balance of Areas, and Burial Trenches) will be contained in the on-post hazardous waste landfill. Another 1.5 million BCY of soil that may pose a risk to biota will be excavated and used as fill under the Basin A and South Plants soil covers and Basin F RCRA-equivalent cap. The Army and Shell Trenches will be contained in place with slurry walls and RCRA-equivalent caps. Soil covers will be constructed over all of the South Plants area; the processing areas of the North Plants; all of Basins A, B, C and D; and the Section 36 Balance of Areas. PCB-contaminated soil will be remediated as described in Section 9.3. These containment actions, in conjunction with institutional controls, will prevent exposure of humans to contaminants, reduce exposure of biota to contaminants, and reduce contaminant mobility.

10.1.1.4 Additional Components of the Remedy

Additional actions described in Section 9.4 that contribute to protection of human health and the environment and are an integral part of the on-post remedy are the following:

- Provision of $48.8 million held in trust to provide for the acquisition and delivery of 4,000 acre-feet of potable water to SACWSD and the extension of water-distribution lines from an appropriate municipal water supply distribution system to all existing well owners within the DIMP plume footprint north of RMA as defined by the detection limit for DIMP of 0.392 parts per billion. The Army and Shell have reached an Agreement in Principle with SACWSD, enclosed as Appendix B of this ROD, regarding this matter.
- In compliance with NEPA, PMRMA will separately evaluate the potential impacts to the environment of both the acquisition of a replacement water supply for SACWSD and for the extension of water-distribution lines.
- The Army and Shell will fund ATSDR to conduct an RMA Medical Monitoring Program in coordination with CDPHE. The primary goals of the Medical Monitoring Program are to monitor any off-post impact on human health due to the remediation and provide mechanisms for evaluation of human health on an individual and community basis until such time as the soil remedy is completed. Elements of the program could include medical monitoring, environmental monitoring, health/community education, or other tools. The program design will be determined through an analysis of community needs, feasibility, and effectiveness.
- Trust Fund – During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund to help ensure

the long-term operation and maintenance of the remedy once the remedial structures and systems have been installed. In response to this interest, the Parties have committed to good-faith best efforts to establish a Trust Fund for the operation and maintenance of the remedy, including habitat and surficial soil. Such operation and maintenance activities will include those related to the new hazardous waste landfill; the slurry walls, caps, and soil and concrete covers; all existing groundwater pump-and-treat systems; the groundwater pump-and-treat system to intercept the Section 36 Bedrock Ridge Plume; the maintenance of lake levels or other means of hydraulic containment; all monitoring activities required for the remedy; design refinement for areas that may pose a potential risk to biota as described in Section 9.4; and any revegetation and habitat restoration required as a result of remediation.

These activities are estimated to cost approximately $5 million per year (in 1995 dollars). The principal and interest from the Trust Fund would be used to cover these costs throughout the lifetime of the remedial program.

The Parties recognize that establishment of such a Trust Fund may require special legislation and that there are restrictions on the actions federal agencies can take with respect to proposing legislation and supporting proposed legislation. In addition to the legislative approach, the Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remediation sites. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

A trust fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders, and will be convened within 90 days of the signing of the ROD.

Notwithstanding these uncertainties, it is the intent of the Parties that if the Trust Fund is created it will include the following:

- A clear statement that will contain the reasons for the creation of the Trust Fund and the purposes to be served by it.
- A definite time for establishing and funding the Trust Fund, which the Parties believe could occur as early as 2008, when the remedial structures and systems may have been installed.
- An appropriate means for competent and reliable management of the Trust Fund, including appropriate criteria for disbursements from the Trust Fund to ensure that the money will be properly used for the required purposes.

- Restrictions on land use or access are incorporated as part of this ROD. The Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 and the FFA restrict future land use, and prohibit certain activities such as agriculture, use of on-post groundwater as a drinking source, and consumption of fish and game taken at RMA. Continued restrictions on land use or access are included as an integral component of all on-post alternatives. Long-term management includes access restrictions to capped and covered areas to ensure the integrity of the containment systems.
- Continued operation of the CERCLA Wastewater Treatment Plant to support the remediation activities.
- Stored, drummed waste identified in the waste management element of the CERCLA Hazardous Wastes IRA may be disposed in the on-post hazardous waste landfill in accordance with the CDD (Harding Lawson Associates 1996).
- Continued monitoring as part of remedial design to refine the remediation of surficial soil and lake sediments that may pose a potential risk to wildlife (see Section 6.2.4.3).

10.1.2 Compliance with ARARs

A comprehensive listing of chemical-, location-, and action-specific ARARs and TBCs that are pertinent to the selected remedy were developed and are presented in Appendix A. The identified ARARs and TBCs address the water, soil, and structures at RMA. A summary of location- and chemical-specific ARARs for the selected remedy is presented in Tables 10.1-1 and 10.1-2, respectively. A summary of action-specific ARARs related to the selected remedy is presented in Table 10.1-3. Not every action specified in the summary of action-specific ARARs (Table 10.1-3) will apply to every activity in the selected remedy. For example, ARARs regarding air emissions during demolition do not apply to GAC adsorption of contaminants from groundwater.

The identified ARARs and TBCs comply with Section 121(d) of CERCLA. ARARs were identified according to the procedures outlined in the most recent EPA guidance (OERR-EPA 1988a, b; OSWER-EPA 1989b, c) and the NCP.

10.1.2.1 Chemical-Specific ARARs

RMA chemical-specific ARARs set concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. Such ARARs either set protective cleanup levels for the COCs in the designated media or indicate an appropriate level of discharge based on health- and risk-based analyses and technological considerations. Chemical-specific ARARs were established for individual groundwater treatment systems, surface water, soil, and structures and are presented in Appendix A and are summarized in Table 10.1-2. The selected remedy will comply with all chemical-specific ARARs, which are described below by medium.

Water

RMA groundwater and surface water ARARs include federal standards based on the following regulatory programs:

- Safe Drinking Water Act (SDWA) MCLs: 40 CFR 141 Subparts B and G, 40 CFR 143.3
- SDWA Maximum Contaminant Level Goals: 40 CFR 141 Subpart F
- Clean Water Act (CWA) Water Quality Criteria: 33 USC Section 1313
- RCRA MCLs: 40 CFR Section 264.94

With respect to state standards, ARARs cited include any state provisions that are equivalent to or more stringent than federal requirements:

- Colorado Rules and Regulations Pertaining to Hazardous Waste
- Colorado Basic Standards for Groundwater
- Colorado Primary Drinking Water Regulations
- Colorado Basic Standards and Methodologies for Surface Water

ARARs and TBCs for groundwater and surface water were identified by evaluating the current lists of target contaminants addressed by the groundwater and surface water monitoring programs and identifying corresponding standards, regulations, or requirements.

Structures

TSCA establishes cleanup levels for PCB spills occurring after May 4, 1987 and EPA (OERR-EPA 1990) presents cleanup standards that may serve as TBCs for PCB-contaminated structural surfaces and debris. The LDR Best Demonstrated Available Technology (BDAT) levels are ARARs for structural debris if placement occurs. Placement considerations are detailed in Section 7.1.1.

Soil

The proposed RCRA Corrective Action Rule example action levels (55 FR 30798, July 27, 1990), LDR Universal Treatment Standard (UTS) and TSCA PCB Spill Cleanup Policy (40 CFR Part 761 Subpart G), are TBC values for soil and sediments at RMA. LDR BDAT levels (40 CFR Part 268) are cited ARARs if placement occurs. Several other Colorado and federal laws and regulations set specific values for certain contaminants in specific media, but no laws other than TSCA, Clean Air Act, and RCRA set specific values that are likely ARARs or TBCs for RMA soil and sediments. EPA proposed soil treatment standards in the UTS rule on September 14, 1993, but deferred action on soil LDRs when that rule was finalized; consequently, UTSs are TBCs with respect to soil at RMA. In addition, there are no chemical-specific standards set by SDWA or CWA or the state equivalents for soil and sediments. TSCA establishes guidance on action levels for PCBs in soil.

Air

RMA chemical-specific ARARs for air include the following: National Ambient Air Quality Standards (40 CFR 50) and National Emission Standards for Hazardous Air Pollutants (40 CFR 61). State standards that are equivalent or more stringent than federal requirements are also considered ARARs, specifically the Colorado Ambient Air Standards (5 CCR 1001-5 Regulation 3 and 5 CCR 1001-14) and Control of Hazardous Air Pollutants (5 CCR 1001-8).

10.1.2.2 Location-Specific ARARs

RMA location-specific ARARs are those requirements that restrict, depending upon the location or characteristics of the site and the requirements that apply to it, remedial activities or limit allowable contaminant levels. Examples of such regulations include siting laws for hazardous waste facilities, laws regarding activities in wetlands or floodplains, and laws regarding preservation of historic or cultural sites. The selected remedy will comply with all location-specific ARARs, which are listed in Appendix A and summarized in Table 10.1-1.

10.1.2.3 Action-Specific ARARs

RMA action-specific ARARs and TBCs are standards that restrict or control specific remedial activities related to the management of hazardous substances or pollutants. These requirements are triggered by a particular remedial activity, not by specific chemicals or the location of the activity. There may be several ARARs for any specific action. These action-specific ARARs do not in themselves determine the appropriate remedial alternative, but indicate performance levels to be achieved by an alternative. The selected remedy will comply with all action-specific ARARs, which are listed in Appendix A and summarized in Table 10.1-3.

10.1.2.4 Other Requirements

In addition to the chemical-, location-, and action-specific ARARs and TBCs cited above, there are a number of other requirements and potential requirements that constrain or direct remedial actions at RMA. These additional items are detailed in Appendix A and include the following:

- Federal Facility Agreement
- Endangered Species Act
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- Army UXO and agent management and disposal requirements
- Chemical Weapons Convention

10.1.3 Cost Effectiveness

Cost effectiveness is determined by evaluating three of the five balancing criteria to determine overall effectiveness: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost effective.

Proportional to cost, the selected remedy for groundwater, structures, and soil provides the best overall effectiveness of all the alternatives considered. The selected remedy will achieve the remedial action objectives for the contaminated media and greatly reduce the toxicity, mobility, or volume of contamination. The remedy makes use of proven technologies that will be protective over the long term and minimize or mitigate short-term impacts during remediation. The selected remedy is therefore cost effective in mitigating risks posed at the site by contaminated groundwater, structures and soil.

10.1.4 Utilization of Permanent Solutions to the Maximum Extent Practicable

The selected remedy for the On-Post Operable Unit makes use of proven treatment and containment technologies for the most highly contaminated soil and structures at RMA, and makes use of reliable groundwater treatment technologies. Approximately 207,000 BCY of contaminated soil will be treated, and

more than 1.8 million BCY of soil and structural debris will be contained in a new RCRA- and TSCA-compliant hazardous waste landfill to be constructed on post. Groundwater treatment will continue at a rate of several hundred million gallons per year until shut-off criteria are met, at which time pumping rates may be reduced.

Although the selected remedy in large part is a containment remedy, this remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable. Components of the selected remedy satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. The large volume of contaminated soil present on the site precludes a remedy in which all contaminants could be excavated and cost effectively treated. The selected remedy has received state and community acceptance.

10.2 State and Community Acceptance

10.2.1 State Acceptance

The state of Colorado concurs with the selected remedy for RMA as providing the best balance of the nine criteria. The state also concurs with the selected ARARs.

10.2.2 Community Acceptance

Based on comments to the Proposed Plan, community members view the remedy as an acceptable approach to reduce risks at a reasonable cost, with the proviso that an additional water supply, Medical Monitoring Program, and Trust Fund be established as described in Section 9.4. Some community members feel that additional treatment of soil should be performed.

10.3 Consistency with NCP

The process used to select the remedy for RMA is consistent with the NCP. Specifically, alternatives were first identified and screened from a broad range of alternatives that achieved the RAOs and then evaluated against the nine evaluation criteria presented in the NCP (see Section 8). Also in accordance with the NCP, the selected remedy fulfills the following requirements:

- It will be protective of human health and the environment.
- It will attain ARARs or provide grounds for invoking a waiver.
- It will be cost effective (provided that it first satisfies the threshold criteria).
- It will use permanent solutions to the maximum extent practicable.

10.4 Consistency with NEPA

Implementation of the selected remedy is in compliance with NEPA. Numerous studies conducted in support of the FS process have indicated that there are no likely significant environmental impacts. Therefore, in accordance with the procedures contained in Army Regulation 200-2, PMRMA is advising the public that the remediation program is in compliance with NEPA and that no further documentation is necessary. However, PMRMA will separately evaluate the potential impacts to the environment of both the acquisition of a replacement water supply by SACWSD and for the extension of water-distribution lines.

10.5 Summary

The preferred remedy for the On-Post Operable Unit includes Groundwater Alternative 4, Structures Alternative 2, and Soil Alternative 4. The remedy was selected in accordance with the requirements of CERCLA and the NCP. The remedial actions that comprise the selected remedy will reduce the toxicity, mobility, or volume of contamination and address the risks to human health and the environment through treatment and institutional controls for contaminated groundwater; demolition, treatment (as necessary for Army agent), and containment for all No Future Use structures; and a combination of containment (as a principal element) and treatment technologies for contaminated soil.

Table 10.1-1 Summary of Location-Specific ARARs for the Selected Alternatives

ARAR/TBC	Requirement	Citation	Description
Location-Specific	Protection of Wetlands	Executive Order 11990 42 USC Section 1344 40 CFR Part 230, Subpart H 33 CFR Parts 320-330 40 CFR 6.302(a) 40 CFR 6, Appendix A, Sections 3(a) and 3(a)	Requires consideration of impacts to wetlands in order to minimize their destruction, loss, or degradation, and to preserve/enhance wetland values. Potentially applicable to activities which would impact wetlands
	Protection of Floodplains	Executive Order 11988 40 CFR 257.3-1(a) 40 CFR 264.18(b) 6 CCR 1007-3, 264.18(b) 40 CFR 6. Appendix A 40 CFR 6.302(b) Section 3(a), 3(b), and 3(b)(4) 44 FR 43239 (July 24, 1979)	Potentially applicable to activities occurring within the 100-year floodplain.
	Endangered Species Act	16 USC 1531	Establishes requirements for the protection of federally listed threatened and endangered species and their habitat. Potentially applicable to activities which could affect threatened or endangered species or their habitat. Note: the Endangered Species Act, along with the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act, are not ARARs, but independently apply to remedial activities.
	RCRA Subtitle C - Location Standards	40 CFR 264.18(a) 6 CCR 1007-3, 264.18(a) 6 CCR 1007-2, Part 2	New treatment facilities, storage facilities, or hazardous waste disposal facilities should not be within 200 ft of a fault. Facilities should not be located in areas prone to earthquakes, floods, fire, or other disasters that could cause a breakdown of the public water system.
	Fish and Wildlife Coordination Act and Wild and Scenic Rivers Act	16 USC Part 661-663 40 CFR 6.302 (e) and (g) 16 USC 1274 et seq.	Fish or wildlife resources that may be affected by actions resulting in control or structural modification of any natural stream or body of water should be protected. Federal agencies taking such actions must consult with USFWS. The Wild and Scenic Rivers Act established requirements for water resource projects affecting wild, scenic or recreational rivers in the National Wild and Scenic Rivers system. Applicable to area(s) affecting stream or river.

ARAR/TBC	Requirement	Citation	Description
	National Historic Preservation Act	16 USC 470 aa et seq. 36 CFR 800 44 FR 6068	The National Historic Preservation Act identifies procedures for protection of Historically and Culturally Significant Properties, including Colorado's delegated responsibilities under the act. Applicable to historically or culturally significant properties.
	Prehistoric, historic, or archeological sites owned or controlled by a federal agency	36 CFR 60 36 CFR 63 Proposed 36 CFR 66	Department of Interior regulations for determining site eligibility for the National Register of Historic Places and standards for data recovery should be complied with.
	Historical, prehistoric, and archeological resources and State register of Historic Places Act	CRS § 24-80-401 et seq. CRS §24-80.1-101 et seq.	Consultation with the Colorado Historic Society, the State Archaeologist, and State Register of Historic Places is required before an action is taken.
	Cultural resource owned or controlled by a federal agency	35 FR 8921	Executive Order 11593: Any federal agency controlling culturally significant resources is the designated leader in the preservation of those resources. This order ensures that all culturally significant resources located on an agency's property are protected. The federal agencies are responsible for identifying, evaluating, and nominating (where appropriate) to the National Register of Historic Places all culturally significant resources found on their land.
	Archeological or historic site owned or controlled by a federal agency	16 USC 469 et seq.	The Archeological and Historic Preservation Act of 1974 requires that a federal agency notify the Secretary of Interior regarding any agency project that will destroy a significant archeological site. The Secretary of the notifying agency may support data recovery programs to preserve the resource.

ARAR/TBC	Requirement	Citation	Description
	Historically significant property owned and managed by the U.S. Army	Army Regulation 420 32 CFR 650.181 to 193 Technical Manual 5-801-1 Technical Note 78-17 32 CFR 229	U.S. Department of the Army has procedures and standards for preserving historically significant properties and procedures for implementing the Archeological Resources Protection Act. Department of the Army Regulations 420 prescribe Army policy procedures and responsibilities for compliance with the National Historic Preservation Act of 1966, as amended, for maintaining the preservation of historically significant sites, the hiring of qualified personnel to manage the sites, and the conduct of state-of-the-art preservation standards regarding personnel and projects for accomplishment of the historic preservation program. This regulation also requires that each installation prepare a historic preservation plan or have documentation on file indicating that no resources appropriate for such management planning exist.
	Archaeological resources on U.S. Department of the Army installations	16 USC 470 aa et seq.	The Archeological Resources Protection Act of 1979 establishes criminal and civil penalties for anyone damaging archeological resources. This act also allows the Secretary of the Army to issue excavation permits for archeological resources.
	Prehistoric, historic, or archeological sites owned or controlled by the U.S. Army	16 USC 470a 36 CFR 800	The National Historic Preservation Act of 1966 requires the Secretary of the Interior to inventory, evaluate, and nominate (where appropriate) significant properties to the National Register of Historic Places.
		43 CFR 3	Preservation of American antiquities: Provides for the protection of historic or prehistoric remains of any object of any antiquity on federal lands.
		43 CFR 7 36 CFR 296	Protection of archeological resources: Provides for the protection of archeological resources located on public lands.
		Executive Order No. 11593, May 13, 1971, 36 FR 8921, Section 2(b)	According to Executive Order No. 11593, each federal agency shall exercise caution to ensure that any such property that might qualify for inclusion is not inadvertently transferred, sold, demolished, substantially altered, or allowed to deteriorate significantly.

ARAR/TBC	Requirement	Citation	Description
		16 USC 470 aa et seq. 36 CFR 60.6	Based on the historical and field inventory information, the significance of all identified sites should be evaluated following criteria set forth in 36 CFR 60.6 and in accordance with guidelines from the Colorado State Historic Preservation Office before conducting any ground-altering activity. The act also requires the Army agency to consult with the Advisory Council on historic issues that may affect those significant properties. A federal agency should take into account the effect of the project on any National Register-listed or eligible property and is directed to complete an appropriate data recovery program before such a site is damaged or destroyed.
	National Historic Landmark Program	36 CFR 65	The National Historic Landmark Program was established to identify and designate National Historic Landmarks and encourage the long range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.
	Colorado Requirements for Siting of Hazardous Waste Disposal Sites	6 CCR 1007-2, Part 2	State siting requirements control the location, design, and design performance of hazardous waste disposal sites. Such disposal sites must be located and designed in a manner that ensures long-term protection of human health and the environment. Disposal sites must be designed to prevent adverse effects on: • Groundwater • Surface water • Air quality • Public health and the environment
	National Wildlife Refuge System Administration Act	16 USC 668dd et seq.	The National Wildlife Refuge Administration Act prohibits the taking or possessing any fish, bird, mammal, or other wild vertebrate or invertebrate animals or part or nest or egg thereof within any such area; or enter, use, or otherwise occupy any such area for any purpose; unless such activities are performed by persons authorized to manage such area or unless such activities are permitted.

Table 10.1-2 Summary of Chemical-Specific ARARs for the Selected Alternatives

ARAR/TBC	Requirement	Citation	Description
Chemical Specific	Safe Drinking Water Act	40 CFR 141	Drinking water standards that apply to specific contaminants and have been determined to have an adverse effect on human health. These standards, expressed as MCLs and MCLGs, are potential ARARs for groundwater and/or surface water cleanup and replacement standards
	Colorado Primary Drinking Water Regulations	5 CCR 1003-1	
	Clean Water Act Ambient Water Quality Criteria	Guidance Criteria 33 USC Sections 1313-1314	Federal Water Quality Criteria established for the protection of human health and or aquatic organisms are not enforceable; however, Section 121(d)(2)(A) of CERCLA states that remedial actions must attain FWQC where they are relevant and appropriate under the circumstances of a release or threatened release.
	RCRA MCLs	40 CFR Section 264.94	Concentration limits for hazardous constituents in groundwater used for the protection of groundwater.
	Colorado Rules and Regulations Pertaining to Hazardous Waste	6 CCR 1007-3	Provides definitions and the general and specific standards necessary for the storage, treatment, and disposal of hazardous waste.
	Colorado Basic Standards for Groundwater	5 CCR 1002-8	Statewide standards and a system of classifying groundwater and adopting water quality standards for such classifications to protect existing and potential uses of groundwater.
	Colorado Basic Standards and Methodologies for Surface Water	5 CCR 1002-8	Basic standards and an antidegradation rule for maintaining and improving the quality of surface waters in Colorado.
	RCRA Corrective Action Rule	40 CFR Part 264 Subpart S 6 CCR 1007-3, Part 264, Subpart(s) 55 FR 30798, July 27, 1990 (TBC)	Corrective action standards proposed to establish a comprehensive regulatory framework for implementing the EPA's corrective action program under RCRA. The proposed standards include constituent-specific concentration levels for the protection of groundwater and soil.
	PCB Remedial Action Guidance	Guidance on Remedial Actions for Superfund Sites with PCB Contamination 40 CFR 761 Subpart G (TBC)	Provides recommended approach for evaluating and remediating Superfund sites with PCB contamination. Provide spill cleanup requirements for PCB spills that occurred after May 4, 1987.
	National Ambient Air Quality Standards	40 CFR 50	Sources cannot cause or contribute to an exceedance of a national ambient air quality standard.

Table 10.1-2 Summary of Chemical-Specific ARARs for the Selected Alternatives

ARAR/TBC	Requirement	Citation	Description
	National Emissions Standards for Hazardous Air Pollutants	40 CFR 61, Subpart M	No visible emissions allowed unless alternative waste management procedures followed.
	Colorado Ambient Air Quality Standard	5 CCR 1001-5, Regulation 3 5 CCR 1001-14	Sources cannot cause or contribute to an exceedance of a national or Colorado ambient air quality standard.
	Colorado Standards for Control of Hazardous Air Pollutants	5 CCR 100 1-8	Standard for hazardous air pollutants not to be exceeded.

ARAR/TBC	Requirement	Citation	Description
Action-Specific	Worker Protection		
	Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites. Note: OSHA regulations are independently applicable regulatory requirements, not ARARs.
		29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA.
		29 CFR 1926 Subpart P	29 CFR 1926 Subpart P provides guidelines for workers engaged in activities related to construction and utilization of trenches and ditches.
	Worker exposure	ACGIH 1991-1992 (TBC) NIOSH 1990 (TBC) 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH.
	Air Emissions		
	Particulate emissions	5 CCR 100 1–3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2, Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. In addition, no off-site transport of particulate matter is allowed. Fugitive dust-control measures will be written into workplans in consultation with the state. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.

ARAR/TBC	Requirement	Citation	Description
	Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61 42 USC Section 7412	Emission of certain hazardous air pollutants is controlled by NESHAPs. Remediation activities could potentially cause emission of hazardous air pollutants. National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
	Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
	Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the specified limits.
	Air emissions from diesel-powered vehicles associated with excavation and backfill operations	5 CCR 1001-15, Regulation 12	Colorado Diesel-Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state.
	Standards for asbestos waste disposal	40 CFR 61 Subpart M	Prevents discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing waste; requires disposal of asbestos-containing waste as soon as possible at disposal site; requires transport vehicles be marked appropriately during loading and unloading operations.
	PM/CO Emissions	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.

ARAR/TBC	Requirement	Citation	Description
	Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Remediation activities must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
		5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70 percent.
	Design/installation of caps/covers	Final Covers on Hazardous Waste Landfills and Surface Impoundments (EPA/530/SW-89/047) (TBC)	Caps and covers must be designed and installed to prevent wind dispersal of hazardous wastes. They should be designed, constructed, and installed as specified in this EPA report.
	Smoke and opacity	5 CCR 100 1-3, Regulation 1, Section II.A	Remedial activities must be conducted in a manner that will not allow or cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
	<u>Waste Characterization</u>		
	Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Section 260.30-31 40 CFR 261.2 6 CCR 1007-3 Section 261.2 40 CFR 261.4 6 CCR 1007-3 Section 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be – Disposed – Burned or incinerated

ARAR/TBC	Requirement	Citation	Description
			– Accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material that is – Used in a manner constituting disposal – Burned for energy recovery – Reclaimed – Speculatively accumulated • Waste-like material is material that is considered inherently waste-like.
	Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories: industrial wastes, community wastes, commercial wastes, special wastes, and inert material.
	Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Section 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Wastes generated during remedial activities must be characterized and evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR 261 • Determine whether the waste is identified in 40 CFR 261 by testing the waste according to specified test methods or by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used.
	<u>Waste Management</u>		
	Discharge of liquid wastes	40 CFR Part 122 40 CFR Part 125 40 CFR Part 129 40 CFR 262 40 CFR 264	Any wastewater generated during remedial activities will be routed to the on-post CERCLA Wastewater Treatment Plant if it is not hazardous waste and will not interrupt the existing treatment system. If wastewater is routed to the on-post treatment plant, it must be treated in accordance with NPDES requirements.

ARAR/TBC	Requirement	Citation	Description
	Asbestos waste handling management	40 CFR 61, Subpart M	Prevents discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; requires disposal of asbestos-containing waste as possible at disposal site; requires transport vehicles be marked appropriately during loading and unloading operations.
		5 CCR 1001-10, Regulation Part B, Section 8. B.III.c.8	Asbestos waste will be managed according to applicable substantive requirements for asbestos handling, transportation, and storage.
	Asbestos waste storage management	6 CCR 1007-2, Part B, Section 5.4	Asbestos waste will be managed according to applicable substantive requirements for asbestos storage.
	PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs and walls; have impervious floors with curbs (no floor drains expansion joints or other openings); and be located above 100-year floodplain (applies to PCBs at concentrations of 50 ppm or greater)
			Temporary storage (<30 days) of PCB containers containing nonliquid PCBs, such as contaminated soil, rags, debris, need not comply with above requirements. Containers must be dated when they are placed in storage.
			All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.
	PCB decontamination standards	40 CFR 761.79	PCB containers to be decontaminated by triple rinsing of internal surfaces with solvent containing <50 ppm PCB.

ARAR/TBC	Requirement	Citation	Description
	PCB chemical waste landfilling standards	40 CFR 761.75	Landfill must be located in thick, relatively impermeable soil formation or on soil with high clay and silt content; synthetic membranes must be used when these conditions cannot be met. In addition, other structural requirements include avoidance of location in a floodplain; required runon/runoff structures if below the 100-year floodplain; and ground/surface water monitoring for specified parameters. PCB wastes must be segregated from wastes not chemically compatible with PCBs.
			The landfill must include a leachate monitoring system.
	PCB incineration standards	40 CFR 761.70	Incineration requirements for nonliquid PCB apply to PCB concentrations >50 ppm and include specified dwell times; combustion efficiency of 99.9999 percent; process record/monitoring requirements; automatic shut-off standards; a maximum mass air emission of 0.001 g PCB per kg of PCB entering the incinerator.
	TSCA-PCB design standards	40 CFR 761 Subpart D	On-post hazardous waste landfills shall be designed and operated in compliance with applicable substantive requirements of 40 CFR 761 Subpart D.
	Treatment, storage, or disposal of RCRA hazardous waste.	Part 264.100 (e)(2) 6 CCR 1007-3 Section 264.100(e)(2)	Corrective action program.
		Part 264 Subpart I 6 CCR 1007-3 Part 264 Subpart I	Applicability of the requirements of containers.
		Part 264 Subpart F 6 CCR 1007-3 Part 264 Subpart F	Corrective action for solid waste management units.
		Part 264 Subpart J 6 CCR 1007-3 Part 264 Subpart J	Applicability of the requirements for tanks or tank systems.

ARAR/TBC	Requirement	Citation	Description
		Part 264 Subpart L 6 CCR 1007-3 Part 264 Subpart L	Design and operating requirements for waste piles.
		Part 264 Subpart M 6 CCR 1007-3 Part 264 Subpart M	Design and operating requirements for land treatment.
		Part 264 Subpart N 6 CCR 1007-3 Part 264 Subpart N	Design and operating requirements for landfills.
		Part 264 Subpart O 6 CCR 1007-3 Part 264 Subpart O	Applicability of incinerator requirements.
		Part 264.16 (a)(1) 6 CCR 1007-3 Section 264.16(a)(1)	Personnel training.
		Part 264.31 (a) 6 CCR 1007-3 Section 264.31(a)	Facility design and operation requirements.
		Part 264.51 (a) 6 CCR 1007-3 Section 264.51(a)	Purpose and implementation of contingency plans.
		Part 264.52 (a) 6 CCR 1007-3 Section 264.52(a)	Content of contingency plans.
		Part 264 Subpart cc 6 CCR 1007-3 Part 264 Subpart cc	Air emission standards for tanks.

ARAR/TBC	Requirement	Citation	Description
	Management of Remediation Wastes		
	Corrective action management units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S 6 CCR 1007-2, Part 2	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
	Temporary Units	6 CCR 1007-3 Section 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
	Detonation of UXO Containing High Explosives	AR 75-15 AR-385-10 AR 385-64 AMC-R 385-100	If UXO is encountered during excavation, workers must comply with the substantive requirements of AMC-R 385-100, AR 75-15, AR 385-10, and AR 385-64.
	UXO detonation	AR 75-15	HE UXO will be detonated in compliance with the substantive requirements of AR 75-15 regarding demilitarization of class V materials.
	On-post detonation of UXO	40 CFR 264 Subpart X 6 CCR 1007-3 Section 264 Subpart X	On-post detonation of UXO must comply with the substantive requirements of the environmental performance standards described in 40 CFR 264 Part 264, including 264.601 (6 CCR 1007-3 Section 264.601) and substantive portions of the monitoring, analysis, reporting, and corrective action requirements of 40 CFR 264.602 (6 CCR 1007-3, Section 264.602).

ARAR/TBC	Requirement	Citation	Description
	Chemical Agent Decontamination		
	Agent decontamination	AR 385-61 AR 50-6	Decontamination of chemical agent-contaminated material must comply with the requirements of AR 385-61 and AR 50-6.
	Decontamination and Disposal Standards for Chemical Agents	AR 385-61 AR 50-6	Army regulations provide standards for decontamination of items exposed to chemical agents. Material, equipment, and clothing that has been decontaminated to the 3X level may be landfilled in a RCRA-approved hazardous waste landfill.
	Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris generated during remedial activities must be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris if placement occurs. In certain cases, the debris may no longer be subject to RCRA Subtitle C regulation after treatment.
	On-post land disposal of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268 EPA/540/G-89/006 (TBC)	Based upon a determination of whether the disposal technique constitutes placement, LDRs-UTS may be applicable. If placement occurs, the on-site disposal facility must comply with the substantive requirements of 40 CFR Part 264 (6 CCR 1007-3 Part 264) and 40 CFR Part 268 (6 CCR 1007-3 Part 268).
	Treatment, storage, or disposal of hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264	If remedial activities at RMA generates hazardous wastes, the wastes must be treated and stored in accordance with RCRA regulations.
		40 CFR Part, Subpart L 6 CCR 1007-3 Section 264, Subpart L 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes stored in stockpiles that are determined to be RCRA hazardous wastes must be stored, treated, and disposed in compliance with RCRA regulations, including LDRs-UTS if placement occurs.
		40 CFR Part 264, Subpart I 6 CCR 1007-3, Section 264, Subpart I Section 264.171-173	Applicability of the requirements for containers.

ARAR/TBC	Requirement	Citation	Description
	Stormwater Management		
	Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters must be conducted in compliance with the stormwater management regulations.
	Dredged Material Management		
	Discharge of Dredged Materials	40 CFR 230 Subpart B	Dredging operations in wetland areas must be managed in accordance with the applicable requirements based on the impacts resulting from specific dredged material discharges associated with sediment removal activities.
	Certification of Federal Licenses and Permits (401 Certification)	33 USC Section 1341 Section 401 of Clean Water Act	Provides for state review of facility operations for the purposes of ensuring that applicable effluent limitations or other limitations or other applicable water quality requirements will not be violated.
	Wastewater Treatment/Disposal		
	Discharge of wastewater to the treatment plant	40 CFR Part 122 40 CFR Part 125 40 CFR Part 129	Any wastewater generated during cleanup or remedial actions will be directed to the on-post RMA wastewater treatment plant and treated in accordance with NPDES requirements.
		40 CFR Part 262 6 CCR 1007-3 Part 262	Wastewater that is determined to be a hazardous waste must be treated in accordance with the provisions of RCRA.
		40 CFR Part 264 6 CCR 1007-3 Part 264	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
		40 CFR Part 144.13(c) 40 CFR Part 146	Injection trenches and wells must be constructed per the requirements of EPA's Underground Injection Control Program.

ARAR/TBC	Requirement	Citation	Description
	Monitoring		
	Groundwater monitoring	40 CFR 264 Subpart F 6 CCR 1007-3 Part 264 Subpart F 2 CCR 402-2, Rule 10 RCRA Groundwater Monitoring TEGD (TBC)	Groundwater monitoring will be conducted for the presence of hazardous constituents in the groundwater downgradient from solid waste management units. Monitoring wells should be constructed and installed according to the requirements of 2 CCR 402-2, Rule 10 and the guidance in the RCRA Groundwater Monitoring TEGD.
		6 CCR 1007-3	Colorado groundwater regulations specify requirements for determining background groundwater quality.
	Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five feet or more exceed the sound levels established for the specified time periods and zones."

11.0 Documentation of Significant Changes

The Proposed Plan indicated that the preferred remedy for the Hex Pit would be identified prior to the ROD and that remedies being considered involved solidification and thermal treatment technologies. As this ROD details, the selected remedy for the Hex Pit is treatment using an innovative thermal technology. Treatment will be applied to approximately 1,000 BCY of principal threat material; the remaining 2,300 BCY of soil will be excavated and disposed in the on-post hazardous waste landfill. Process performance will be evaluated through treatability testing during remedial design. Solidification/stabilization will become the selected remedy if all evaluation criteria for the innovative thermal technology are not met.

There are no other significant changes to the ROD. However, overall remedy implementation time frames and present worth costs presented in the ROD differ slightly from those presented in the Proposed Plan due to modifications in scheduling and funding limitation assumptions.

12.0 Responsiveness Summary

12.1 Introduction

This section contains the Army's responses to comments submitted in regard to the Proposed Plan for the On-Post Operable Unit at RMA. Comments were received from CDPHE, EPA, USFWS, Shell, city and county governments, environmental action groups, and private citizens.

PMRMA solicited comments regarding the On-Post Operable Unit Proposed Plan during a 3-month-long public comment period (October 16, 1995 to January 15, 1996). The Proposed Plan and the primary supporting documentation[1] were made available to the public for the entirety of the public comment period. These documents were available at seven city and county libraries in the area as well as at the EPA Region VIII library. These documents, as well as the complete administrative record, were also available at the JARDF, which is located at the west entrance to RMA at 72nd Avenue and Quebec Street. A public meeting was held on November 18, 1995 to present and discuss the Proposed Plan with citizens and public officials. This Responsiveness Summary was prepared to respond to oral and written questions or concerns received by the Army during the public comment period.

The public meeting was held at RMA from approximately 9:00 a.m. to 12:30 p.m. Those in attendance included representatives from the Army, the Army's contractor (Foster Wheeler Environmental Corporation), Shell, EPA, USFWS, the state of Colorado (CDPHE), Tri-County Health Department, city and county officials, public interest groups, and citizens. A Court Reporter and Notary Public reported the proceedings of the meeting in a stenographic transcript, included as Section 12.6 and available for review in the JARDF. An agenda was prepared for the meeting and provided to attendees along with a copy of the Proposed Plan. A video, *Taking Action for the Future: The Proposed Cleanup Plan for Rocky Mountain Arsenal*, was presented that summarized the information provided in the Proposed Plan and a brief talk was given that described the rationale behind the selection of the preferred alternatives. A site tour of RMA was also made available to all attendees; technical experts accompanied the tours to explain ongoing remedial operations and to answer questions.

12.2 History of Community Relations Activities

The Army began developing its Community Involvement Program in the 1980s as the first environmental investigations were initiated. As part of this program, the Army has conducted one-on-one interviews and informal

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[1] Human Health Exposure Assessment for Rocky Mountain Arsenal (Ebasco 1990), Remedial Investigation Summary Report (Ebasco 1992a), Development and Screening of Alternatives Report (Ebasco 1992b), Human Health Exposure Assessment Addendum for Rocky Mountain Arsenal (Ebasco 1992c), Integrated Endangerment Assessment/Risk Characterization (Ebasco 1994), and Detailed Analysis of Alternatives Report (Foster Wheeler Environmental 1995a).

group meetings, solicited input using surveys and questionnaires, and pursued phone contacts to identify interested citizens and organizations, assess public perceptions of the issues, and determine appropriate mechanisms for engaging in two-way communication.

Educational outreach efforts have included developing several publications that describe current investigations and available remedial technologies, making literature regarding the on-post cleanup effort available to the public, and conducting open houses and public meetings. An example of a current publication includes "Update," which has been distributed to all (approximately 125,000) households within a 10-mile radius of the installation on a quarterly basis since 1990. Various topics are discussed in this quarterly pamphlet including RMA technical information and history, wildlife viewing tour schedules, educational programs, and recycling programs. The Army has also made the comprehensive documentation generated during the cleanup process available to the public in the JARDF, in the information repository maintained at the EPA Region VIII library, and at the Adams County, Aurora, Commerce City, Denver, Lakewood, Montbello, and Park Hill[2] libraries.

The Army held one of its largest public open houses in January 1994, following the release and distribution of the draft Detailed Analysis of Alternatives report for the On-Post Operable Unit. Regulatory agencies represented at the event were EPA, CDPHE, and Tri-County Health Department. The two primary responsible parties, Shell and the U.S. Army, were also represented, as were members of USFWS. The purpose of the event was to allow the public one-on-one experience with federal, state, and local professionals who could explain in simple terms the positions of their organizations in the various aspects of the cleanup. Videos were shown that detailed, in easy-to-understand terms, the various technologies outlined in the draft Detailed Analysis of Alternatives report. As part of the open house, the Army also offered site tours of RMA to the 1,000 citizens who attended.

Prior to April 1994, various public meetings and workshops were coordinated with interested citizens through the TRC, which was established under CERCLA guidelines. The committee, initiated at RMA in 1989, was comprised of representatives from local health and regulatory agencies, community residents, and local government. In November 1993, the TRC opened its meetings to the public. In April 1994, the Department of Defense directed military installations involved in environmental cleanup to form RABs. The RAB at RMA serves as a forum to exchange information and establish dialog among the communities, regulatory agencies, and the Army.

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[2] Only the Proposed Plan and the Final Detailed Analysis of Alternatives report were available for review at Park Hill Library.

Other tools used by the Army to keep the public informed have included the issuance of press releases and hotline phone numbers that provide callers with up-to-date information about cleanup operations. In addition, Army representatives visit area libraries, schools and grocery stores on a regular basis to distribute flyers and brochures dealing with public meetings and cleanup and recreational activities available at RMA.

The Proposed Plan was presented to the public on October 16, 1995. Press releases were sent to a variety of local and state news media, including the Rocky Mountain News and The Denver Post. The October 1995 edition of "Update," summarized the information provided in the Proposed Plan and was sent to all households within a 10-mile radius of RMA. Legal notice of the comment period, which at that time ran from October 16 through December 15, 1995, was published in The Denver Post on October 18, 1995 and in the Rocky Mountain News October 20, 1995. It was republished in mid-December in both newspapers when the comment period was extended.

At the December 7, 1995 RAB meeting it was decided to extend the public comment period for 1 month, i.e., to January 15, 1996, at the request of some commenters. Verbal and/or written comments were accepted by PMRMA both before and after the public meeting up to the deadline of January 15, 1996.

12.3 Responses to Comments

The remainder of this section consists of the Army's responses to written questions and comments received during the public comment period.

Since 1989, all remedial investigation activities at RMA have been performed in accordance with the FFA signed by the Army, EPA, USFWS, ATSDR, Shell, U.S. Department of the Interior, and U.S. Department of Justice. By signing the FFA, these entities were made part of all decision processes at RMA. The state of Colorado elected not to sign the FFA, but has played an active role in the decision-making processes for the On-Post Operable Unit. Throughout the RI/FS process, CDPHE (previously known as Colorado Department of Health) has been involved and has provided the Army with comments on the various aspects of the remediation at RMA.

Responses to comments are presented in the following order, based on the originator of comment:

Section	Topic
12-1	Responses to CDPHE Comments Dated January 19, 1996
12-2	Responses to EPA Comments Dated January 4, 1996
12-3	Responses to USFWS Comments Dated January 19, 1996
12-4	Responses to Shell Comments Dated January 19, 1996
12-5	Responses to City and County Government Comments —Adams County —City and County of Denver —Northern Community Coalition

12-6 Responses to Environmental Action Group Comments
—League of Women Voters
—Sierra Club
12-7 Public Meeting Transcript
12-8 Responses to Citizen Comments

A glossary of acronyms used in Section 12 is provided as part of the general table of contents.

Glossary

Active Dewatering – Lowering the water table by pumping and extraction or other water-removal methods.

Acute Exposure – Based on the exposure model developed for RMA, an exposure duration of 1 to 14 days.

Agent – A solid, liquid, or gas that through its chemical properties produces lethal or damaging effects on man, animals, material, or plants or that produces a screening or signaling smoke. Examples of chemical agents at RMA include Sarin (GB), a nerve agent, and mustard (HD), a blistering agent.

Agent Monitoring – Analytical technique used during excavation to survey soil for the presence of Army chemical agent.

Agricultural Practices – A process that involves tilling the soil with farm machinery and seeding it with locally adapted vegetation in a manner consistent with RMA refuge management plan. Agricultural practices have been shown to reduce the level of surficial soil contamination.

Air Monitoring – Collection of air samples that are analyzed for key contaminants to ensure that allowable concentrations are not exceeded.

Air Stripping – As it applies to groundwater treatment, extracting contaminated groundwater and pumping to an air stripper, which is a tall, hollow vessel. The water is pumped to the top of the vessel and allowed to splash down to the bottom. As the water passes through the air, contaminants are transferred from the water to the air, which is in turn treated before it is discharged to the atmosphere.

Alternative – An option for cleaning up a site.

Applicable or Relevant and Appropriate Requirements (ARARs) – Federal and state legal requirements that a selected remedy for a site will meet, such as allowable levels of chemicals in water.

Bioaccumulation – The amplification of the concentration of a chemical between the initial source (e.g., water, soil, or sediment) and a specified target species or trophic box. A bioaccumulative chemical can increase in concentration in a living organism as the organism breathes contaminated air, drinks contaminated water, or consumes contaminated food.

Biomagnification – The process by which tissue concentrations of bioaccumulative chemicals increase as a chemical passes up the food chain (e.g., from plant to insect, mouse, and hawk). It is measured as the ratio of the concentration of a chemical in an organism to the concentration in the diet of the organism.

Boundary System – Groundwater extraction, containment, and treatment system at RMA boundaries. There are three such systems, the Irondale, Northwest, and North boundary systems.

Cap – An in-place containment technology. The standard cap design consists of a layer of soil/vegetation, a crushed layer of concrete or cobbles, and a layer of low-permeability soil. Caps are sloped for erosion control and are vegetated with locally adapted perennial grasses and low-growing plants.

Caustic Washing – A treatment process in which agent-contaminated soil or structural debris is treated with caustic (high pH) fluids to degrade the agent compounds.

CERCLA – Comprehensive Environmental Response, Compensation and Liability Act. Also known as Superfund, a law passed in 1980 that establishes a program to identify inactive hazardous waste sites, ensure they are cleaned up, evaluate damages to natural resources, and create claims procedures for parties remediating the sites.

Chronic Exposure – Based on the exposure model developed for RMA, an exposure duration of 7 to 30 years.

Composite Sample – A representative sample that has been combined from several samples of the same medium. In this sampling method, samples are systematically collected either vertically and/or horizontally from a medium and thoroughly mixed together to form a representative sample. Examples of composite samples are depth composites often used in subsurface soil sampling and area composites used in surficial soil sampling.

Conceptual Remedy – Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal. Signed by the Parties on June 13, 1995, it outlines the general approach for the remediation of RMA. The Conceptual Remedy was the result of dispute resolution (as provided in the FFA) and formed the basis for the Detailed Analysis of Alternatives report and Proposed Plan.

Consolidation – Movement of soil with low levels of contamination to areas proposed for capping or covering. The consolidated soil is placed underneath the cap or cover to develop slopes so that surface-water runoff can be controlled and collected.

Containment – A remedial action that interrupts exposure pathways through the use of physical barriers and reduces the spread of contamination.

Contaminant of Concern (COC) – A chemical selected for evaluating potential human or animal health effects. Selection is based on concentration, toxicity, and site-specific information.

Cover – A layer of clean soil that isolates contamination in place, thereby preventing exposure to humans and animals. A soil cover consists of a variable thickness layer of soil and may include crushed or formed concrete layers as biota/excavation barriers. Soil covers may be sloped for erosion control and are vegetated with locally adapted perennial grasses and low-growing plants.

Detection Limit – The lowest concentration of a chemical that can be distinguished from the background response of an analytical instrument.

Dismantling – Controlled demolition of a structure using heavy equipment. Contaminants are not treated in this process, but the volume of structural material is decreased and converted into a more workable form for disposal.

Dust Controls – An action, such as spraying water or foam, used to control the emission of dust (e.g., during excavation activities).

EPA Paint Filter Test – A test that demonstrates the presence or absence of free liquid in waste material to be landfilled (based on a test method in SW 846, Method 9095).

Ex Situ – Not in the original place (Latin). With reference to hazardous waste treatment, this refers to excavation or extraction from the ground prior to treatment.

Excavation – The removal of soil, debris, drums, pipes, tanks, or any other solid material from the ground.

Exposure Duration – The amount of time a receptor is exposed to a chemical.

Exposure Pathway – The pathway a chemical travels from the source to the individual. At RMA, two pathways were evaluated, direct (consuming, contacting, or breathing contamination) and indirect (breathing contaminated vapors).

Extraction System – A system of wells used to remove groundwater from an aquifer.

Feasibility Study (FS) – An investigation that recommends the selection of a protective, cost-effective alternative for remediation. It usually is begun during the Remedial Investigation (RI); together these investigations are commonly referred to as the RI/FS.

Federal Facility Agreement (FFA) – A legal document that sets the framework for cleanup at RMA.

Gas Chromatography/Mass Spectrometry (GC/MS) – A laboratory analytical method used to detect organics in soil or water.

Geophysical Survey – A technique used to locate buried metal, such as unexploded ordnance, using nonintrusive instruments that measure various properties of subsurface materials.

Granular Activated Carbon (GAC) – A treatment method used to remove organic chemicals from contaminated groundwater.

Habitat Modifications – The exclusion of biota from contaminated areas by installing physical barriers (e.g., a chain-link fence) or changing the quality of the habitat (e.g., sowing grasses that are less attractive to biota as an environment in which to live).

Hazard Index (HI) – A value that represents the summation of hazard quotients for a particular chemical for all exposure pathways evaluated.

Hazard Quotient (HQ) – The ratio of the estimated actual daily chemical intake (dose) to the estimated allowable daily intake that is not likely to cause adverse health effects.

Hazardous Waste Landfill – A secure disposal facility that is specially designed, operated, closed, and monitored to control the potential release of hazardous substances into the environment.

Horizontal Well – A well that is drilled with a major portion of its length parallel to the ground surface and that could be used to capture contamination in plumes.

Human Health Exceedance – At RMA, soil posing risk to human health as determined by concentrations of chemicals present above action levels developed in the Integrated Endangerment Assessment/Risk Characterization for carcinogens (an excess lifetime cancer risk of 10^{-4}) and noncarcinogens (a hazard index of 1.0).

Hydrology – The science dealing with the properties, distribution, and circulation of water.

ICP Metals – Metals detected by Inductively Coupled Plasma, a laboratory analytical method.

Implementability – The ability to execute and complete the remedial actions required under an alternative. Evaluation of implementability includes, for example, considering the availability of materials and skilled workers.

In Situ – In the original place (Latin). With reference to hazardous waste treatment, this refers to treatment in the ground (i.e., without excavation or extraction).

In Situ Biological Treatment – An in-place biodegradation process that takes advantage of the naturally occurring micro-organisms in the aquifer. Oxygen and nutrients containing nitrogen are added to the aquifer so that organisms grow more numerous. As the population increases, the organisms turn to the contamination present in the aquifer as a source of food, thereby breaking down and destroying the contamination.

In Situ Vitrification – A thermal treatment process using electrical current to melt soil or sludges in place, resulting in a chemically inert and stable glass product.

Incineration – A treatment technology involving destruction of waste or contamination by controlled burning at high temperatures.

Inorganic – Pertaining to or composed of chemical compounds that do not contain carbon as the principal element, i.e., matter other than plant or animal.

Interim Response Action (IRA) – A remedial measure that is implemented in an expedited time frame before the final remedy and that has been determined to be necessary and appropriate for the site.

Maximum Contaminant Level (MCL) – The maximum permissible level of a contaminant in water delivered to users of a public water system as specified in the Safe Drinking Water Act. MCLs are enforceable water-quality standards and are applicable or relevant and appropriate requirements for groundwater remediation.

Medium *(pl. media)* – A specific environment such as groundwater, surface water, soil, sediment, or air.

Medium Groups – Similarly contaminated soil sites, groundwater plumes, or structures.

Migration Pathway – The way in which a chemical moves through the environment. For example, a constituent in soil may be susceptible to transport by wind suspension as fugitive dust, by alluvial erosion during periods of seasonal and/or episodic surface-water runoff, or by dissolving in infiltrating rainwater.

Multi layer Cap – A cap that prevents exposure to humans and animals by isolating the contamination. From top to bottom, it generally consists of three layers: a 4-ft-thick soil/vegetation layer, a 1 -ft-thick layer of crushed concrete or cobbles, and a 2-ft-thick layer of compacted low-permeability soil to provide long-term minimization of infiltration.

Munitions Screening – Technique used prior to excavation to survey soil for the presence of munitions (weapons and ammunition) and/or munitions debris.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – The federal regulations that govern the implementation of CERCLA.

National Priorities List – A list published by the U.S. Environmental Protection Agency that ranks all of the CERCLA sites in order of priority for remediation.

Operable Unit – Term for a geographic area or a separate activity undertaken as part of a cleanup conducted under CERCLA.

Organic – Pertaining to or composed of compounds that contain carbon as a principal element.

Organizations – The U.S. Army, U.S. Environmental Protection Agency, U.S. Agency for Toxic Substances and Disease Registry, U.S. Fish and Wildlife Service, U.S. Department of Justice, and Shell Oil Company. They signed the Federal Facility Agreement.

Parties – U.S. Department of the Army, Shell Oil Company, State of Colorado, U.S. Environmental Protection Agency, and U.S. Fish and Wildlife Service. They oversee the remedial process at RMA.

Passive Dewatering – Lowering the water table without actively removing the water by pumping and extraction or other methods. It is accomplished by limiting the infiltration of water across an area using controls such as a cap or cover or elimination of water utilities.

Plume – An area of contaminated groundwater containing one or more chemicals at concentrations that exceed remediation goals.

Preliminary Pollutant Limit Value (PPLV) – Risk-based concentrations of chemicals in soil that are considered protective of human health given a defined set of exposure and toxicity assumptions.

Principal Threat Exceedance – At RMA, soil that is considered to be highly toxic or highly mobile that would pose a significant risk to human health should an exposure occur (i.e., more than 10^{-3} excess lifetime cancer risk or a hazard index of 1,000).

Probabilistic PPLVs – Risk-based concentrations of chemicals in soil developed to represent the likelihood of a potential effect on an organism as a result of exposure to a chemical constituent. In a probabilistic evaluation, a range of input values can be assigned to reflect variability, the shape of the range defined, and a prescribed certainty assigned to a range of results, thereby providing an informed context within which risks can be managed. At RMA, for example, the use of a 5th percentile preliminary pollutant limit value (PPLV) would protect 95 percent of an exposed human population.

RCRA-Equivalent Cap – A cap with physical barriers that achieve the performance standards of a cap as described in the Resource Conservation and Recovery Act, a law that regulates the management of hazardous waste from point of generation to disposal. A multilayer cap was assumed to be RCRA equivalent in this ROD for purposes of costing alternatives.

Receptor – The animal or person for which potential exposure and risk to a chemical is evaluated.

Record of Decision (ROD) – A public document that records and explains the cleanup alternative(s) to be used at a CERCLA site. It is based on information from the Remedial Investigation/Feasibility Study, public comments, and community concerns.

Remedial Investigation (RI) – A study that reports the types, amounts, and locations of contamination at a site.

RF Heating – A thermal treatment process using radio frequency (RF) energy to heat soil in place, volatilizing contaminants, which are collected at the ground surface.

Slurry Wall – A buried vertical barrier commonly made of a soil and bentonite clay mixture.

Soil Cover – See **Cover**.

Soil Posing Risk to Biota – Area containing a potential risk to biota as defined by a hazard quotient greater than 1.0. The hazard quotient is calculated using a biota risk model based on an animal's foraging range (the average area over which they obtain their food). "Biota" refers to wildlife.

Soil Vapor Extraction – Removes volatile compounds from contaminated soil in the unsaturated zone by applying a vacuum using vapor extraction wells and blowers. Vacuum blowers induce air flow through the soil matrix, stripping volatile compounds from the soil. Contaminated vapor is withdrawn through extraction wells,

collected, and treated. Enhanced soil vapor extraction may use heating elements to include removal of some semivolatile compounds.

Soil Venting – A technique used to extract contaminated vapors from soil above the water table, usually by applying a vacuum to a system of wells.

Solidification/Stabilization – A process in which a hardening agent (such as cement) is combined with contaminated soil. The mixture is allowed to harden, fixing the contaminants in a less leachable form.

Subchronic Exposure – Based on the exposure model developed for RMA, an exposure duration of 2 weeks to 7 years.

Supplemental Field Study (SFS) – An assessment designed to determine whether potential risk to wildlife is present in the area peripheral to the center of RMA.

Surface Heating – General technology name for soil treatment technologies that involve heating soil to volatilize contaminants. During treatment, volatile and semivolatile organic compounds are vaporized from the solid phase and either recovered or destroyed by an off-gas treatment system.

TCLP – Toxicity Characteristic Leaching Procedure. A test used to evaluate whether a waste exhibits characteristics of toxicity as specified in the Resource Conservation and Recovery Act.

Thermal Desorption – A process that uses heat to vaporize (desorb) contamination from solid materials. The air stream generated during the process is treated to remove the contaminants.

Transportation – The movement of structural, soil, or liquid material from a site to disposal or treatment facilities.

Unexploded Ordnance (UXO) – Generic term for military munitions that are potentially active. Munitions are filled with high explosives (HE-filled) or chemical agent.

Unsaturated Zone – The subsurface zone above the water table. Also known as the vadose zone.

Use History – Narratives (e.g., plant operational records, official Army and Shell histories, depositions from operating personnel) that describe how a particular structure was used during its operational history. To focus investigations at RMA, structures were grouped into similarly contaminated (or uncontaminated) medium groups based on use histories.

Vapor- and Odor-Suppression Measures – Vapor-suppressing materials, such as foam or liners, or a transportable structure, used during excavation to control emissions of odors and gases.

Volatile – A chemical constituent that readily evaporates (volatilizes) from a solid or liquid state to a gaseous or vapor state. This process may be enhanced by applying heat or reducing pressure or by a combination of these processes.

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12–1

Responses to CDPHE Comments

STATE OF COLORADO

Roy Romer, Governor
Patti Shwayder, Acting Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION

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RECEIVED
JAN 25 1996
BY
Colorado Department of Public Health and Environment

January 19, 1996

Mr. Charlie Scharmann
Office of the Program Manager
Rocky Mountain Arsenal
AMCPM - RM
Commerce City, CO 80022-1748

Dear Mr. Scharmann:

Please find enclosed the state's comments on the On-Post Proposed Plan. If you have any questions, please don't hesitate to call.

Sincerely,

Barbara Nabors

Barbara Nabors
RMA Project Manager
Hazardous Materials and
Waste Management Division

cc: Laura Williams
Lorraine Ross
Ken Conright
Martin Kosec
Bill Adcock
Ronel Finley
Jonathan Potter
Edward McGrath
Robert Foster
Vicky Peters

9602504-1/1

Colorado Department of Public Health and Environment
Comments on the RMA On-Post Proposed Plan

1. The Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal (Conceptual Agreement) which was signed by the parties on June 13, 1995, paragraph 17, provides that all well owners living within the DIMP plume footprint, defined by the detection limit of .392 ppb, based on the most recent quarterly monitoring results at the time the Record of Decision is signed, will be hooked up to an appropriate water distribution system. This hook up will be paid for by the Army and Shell. It is the State's understanding that all persons within the DIMP plume footprint, including those in the Henderson area and those with deep wells, will be offered a hook up to an appropriate distribution system.

It is also the State's understanding, confirmed by the Army and EPA at the public meeting held in Henderson on December 12, 1995 that Shell and the Army have made a separate and distinct commitment to provide an additional 4,000 acre feet of water to SACWSD, or, if such water is not available, to make a payment in an agreed-upon sum in lieu of water. This commitment is contained in paragraph 16 of the Conceptual Agreement.

2. The Conceptual Agreement, paragraph 18, provides that the Army and Shell will fund ATSDR to conduct an RMA Medical Monitoring Program in coordination with CDPHE. The state wishes to clarify that the Army and Shell are responsible for fully funding the participation of the state and ATSDR in the Medical Monitoring Program.

3. Paragraph 19 of the Conceptual Agreement provides that the Parties commit to good faith best efforts to establish a trust fund for the operations and maintenance of the remedy, including habitat and surficial soils. The Final Detailed Analysis of Alternatives and the Proposed Plan provide that these activities are estimated to cost approximately $5 million per year (in 1995 dollars) and that the principal and interest from the trust fund will be used to cover these costs.

To date, the Army and Shell have failed to identify legal mechanisms that would be necessary to establish the trust fund or otherwise develop basic trust fund details. Given the Conceptual Agreement and widespread stakeholder interest, the state requests that a series of working meetings on the trust fund be set up within the next month.

4. As previously noted to the Army, page 3 of the Proposed Plan contains an error. The Conceptual Agreement provides for RCRA-equivalent caps on Former Basin F, Army Complex and Shell Trenches. A RCRA-equivalent cap is not planned for Basin A.

5. The Proposed Plan states that" [g] roundwater plumes in the South Plants area are monitored and high lake levels are maintained to reduce migration of groundwater into the southern lakes (Page 13, Table 4)." In the Final DAA, the Army states that "[h]ydraulic controls are maintained to prevent contaminants from entering the lakes at levels that could have an adverse effect on biota." These descriptions differ from the Conceptual Agreement language which states that "lake levels. . .or other means of hydraulic containment will be used to prevent South Plants plumes from migrating into the lakes." It is our understanding that the method of hydraulic containment (either lake levels or other) will continue to be discussed and will be addressed prior to the final ROD. The state is encouraged that technical working group meetings are being held to discuss this issue.

6. Contrary to the Proposed Plan and the Detailed Analysis of Alternatives, the Army has not given adequate consideration to innovative treatment technologies for Hex Pit remediation. During negotiations on the Conceptual Agreement, stakeholders expressed a strong desire that a site on the Arsenal be used as a demonstration site to evaluate the use of innovative treatment technologies for other Army/Department of Defense facilities. The Parties contemplated that a variety of technologies would be considered based on a range of factors including effectiveness and cost. In the spirit of the Conceptual Agreement, all relevant factors for innovative technologies at the Hex Pit need to be considered as part of reaching a final decision in the ROD.

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms. Barbara Nabors
Colorado Department of Public
Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado 80222-1530

Dear Ms. Nabors:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan. Responses to your comments are provided below, numbered to correspond to your comments.

1 The U.S. Army and Shell Oil Company (Shell) remain committed to a resolution providing eligible residents with hook-ups as stated in the On-Post Record of Decision (ROD) and the Agreement in Principle with South Adams County Water and Sanitation District (SACWSD) The State is correct in noting that, based on the Agreement in Principle (enclosed) residents with wells within the diisopropyl methylphosphonate (DIMP) footprint will be offered connection to an alternative water supply.

2. To clarify the second part of your comment, the Army and Shell have made a separate and distinct commitment to provide a supplemental water supply to SACWSD. The Agreement in Principle with SACWSD requires that SACWSD water be supplied to consenting drinking water well owners within the DIMP plume footprint by January 1999. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. The Parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon of this office at 303-289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646.

3. To clarify the State's concern of funding for the Medical Monitoring Program as outlined in Paragraph 18 of the Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal, the Army and Shell will fund the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct this effort in coordination with the Colorado Department of Public Health and Environment (CDPHE). The Program's nature and scope will include baseline health assessments and will be determined by the on-post monitoring of remedial activities to identify exposure pathways, if any, to any off-post community. This

Program will continue until the soil remediation is completed. A Medical Monitoring Advisory Group (MMAG) has been established to evaluate specific issues covered by the Medical Monitoring Program. The MMAG is composed of representatives of the Army, Shell, the U.S. Environmental Protection Agency, CDPHE, Tri-County Health Department, ATSDR, the U.S. Fish and Wildlife Service, Denver Health and Hospitals, and the Site-Specific Advisory Board. The MMAG also includes representatives from the communities of Commerce City, Henderson, Denver, Montbello, and Green Valley Ranch.

4. A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders and will be convened within 90 days of the signing of the ROD.

5. The State is correct in noting the error made on page 3 of the Proposed Plan. A Resource Conservation and Recovery Act-equivalent cap is not planned for Basin A. Basin A will be covered with a 6-inch formed concrete layer and a 4-ft soil cover as detailed in Section 9.3 of the ROD.

6. Water levels in Lake Ladora, Lake Mary, and Lower Derby Lake will be maintained to support aquatic ecosystems. The biological health of the ecosystems will continue to be monitored.

Lake-level maintenance or other means of hydraulic containment or plume control will be used to prevent South Plants plumes from migrating into the lakes at concentrations exceeding Colorado Basic Standards for Groundwater (CBSG) in groundwater at the point of discharge. Groundwater monitoring will be used to demonstrate compliance.

7. The Army understands the State's concern of considering innovative treatment technologies for the Hex Pit remediation. Subject to the results of treatability testing and technology evaluation, it has been decided that approximately 1,000 bank cubic yards (BCY) of principal threat material from the Hex Pit will be treated by an innovative thermal technology. Solidification will become the selected remedy if all evaluation criteria for the innovative thermal technology are not met. The remaining 2,3 BCY of material will be excavated and disposed in the on-post hazardous waste landfill.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
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Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Mr. Howard Roitman, Director, Hazardous Material and Waste Management Division,
Colorado Department of Public of Health and Environment, 4300 Cherry Creek Drive,
Denver, Colorado 80222-1530
Ms. Victoria Peters, Attorney General's Office, CERCLA Litigation Unit,
1525 Sherman Street, 5th Floor, Denver, Colorado 80203
Mr. Ira Star, Geotrans Inc., 4888 Pearl East Circle, Suite 300-E,
Boulder, Colorado 80301
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

12–2

Responses to EPA Comments

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

RECEIVED
JAN 12
BY

JAN - 4 1996

Ref: 8EPR-FF

Mr. Charles Scharmann
Office of the Program Manager
for the Rocky Mountain Arsenal
AMXRM-PM, Building 111
Commerce City, Colorado 80022-2180

Re: EPA Comments of the Final On-Post Detailed Analysis of Alternatives (DAA) and Proposed Plan dated October 16, 1995

Dear Mr. Scharmann:

The U.S. Environmental Protection Agency (EPA) has reviewed the Final On-Post Detailed Analysis of Alternatives (DAA) and Proposed Plan which were issued for public comment on October 16, 1995. EPA previously raised fifteen disputes on the draft DAA in a letter dated September 22, 1995, and ten disputes on the draft Proposed Plan in a letter dated October 5, 1995. These disputes have been resolved through the inclusion of changes in the October 16th version of the DAA and proposed plan. EPA appreciates the effort expended by the Army to incorporate EPA's comments into the final documents.

Attached are comments regarding errors and omissions identified in the final DAA and Proposed Plan. These comments should be addressed via an errata sheet to the final DAA or an addendum to the DAA. Some of the comments are pertinent to the draft ROD which is scheduled to be issued this month. In addition, EPA may be submitting additional comments on the ARARs section of the final DAA.

If you have any questions regarding these comments, please contact me at (303) 312-6540.

Sincerely,

Denise M. Link

Denise Link
Superfund Project Manager

Enclosure

9600410-1/1

Printed on Recycled Paper

cc: Laura Williams, EPA
Barbara Nabors, CDPHE
Lorraine Ross, EPA
Mike Anderson, Shell
Ronel Finley, USFWS
Vicky Peters, Co. AGO
Jonathon Potter, Army
Ken Conright, TCHD

Comments on
Final Detailed Analysis of Alternatives Report, Version 4.0
October 1995

GENERAL COMMENTS

It is difficult to correlate the data presented in the spreadsheets in Volume IV with the volumes, areas, and costs presented throughout the text and tables in Volumes II and III due to rounding and volume approximations.

Executive Summary

Page 3-15, first paragraph. Reference is made to figure ES 3-3.1 which shows the AOC. This critical figure is not included in this document. It should be included in the DAA.

Page 11-1, Section 11. Throughout this section, the DAA refers to the volume of contaminated soils in the Basin F Wastepile medium group as 600,000 BCY (580,000 BCY plus 20,000 BCY of contaminated material from the liner and subgrade). Table B4.2-3 shows that only 180,000 BCY of material from the Basin F Wastepile medium group would be disposed in the on-post landfill. Obviously an incorrect volume was used in this table. Consequently, the remediation cost shown in Table B4.2-3 has been underestimated by approximately $100 million. Please correct this discrepancy and confirm that the correct costs were used to determine the total remediation costs.

Soils DAA

Page 11-4, second paragraph. As stated in EPA's letter, dated September 22, 1995, the EPA believes that this paragraph contains conclusions about the operation and performance of the Basin F Waste Pile Systems that are not agreed upon by the EPA and the State. Language pertaining to the operation and performance of the Basin F Waste Pile Systems should be removed from the DAA.

Page 14-24 last paragraph, second sentence. The EPA is concerned by the Army's statement that, "It is assumed that this cap is RCRA-equivalent." The EPA has reviewed existing guidance documents which address the design requirements of a RCRA cap. All of these documents list a minimum three layer configuration consisting of cover, drainage and barrier layers. The Army's proposed cap does not include a drainage layer. A RCRA cap is designed to operate as a complete structure with each layer preforming a specific required function. The drainage layer provides

protection to the barrier layer and the waste below. It does this by conveying water off of the top surface of the barrier layer. This action reduces the hydraulic gradient across the barrier layer to the most minimum level possible. Without a drainage layer being present, as is the case in the Army's proposed cap, water that has infiltrated the cover will collect in the biota barrier. This water will attract root growth from above, increase the hydraulic gradient across the compacted clay barrier layer below and reduce the shear strength or structural stability of the cap.

The EPA would prefer that the Army include a drainage layer in their proposed cap configuration. This action would only minimally impact the capital cost of the cap and it would provide additional protection to the barrier layer.

Water DAA

Page 6-2, first paragraph. This page starts in mid-sentence. Obviously some text is missing. Please correct this error.

Comments on the
Proposed Plan for the Rocky Mountain Arsenal
On-Post Operable Unit
October 1995

Page 8. Ecological Risk Characterization. The Proposed Plan does not adequately describe the results of the Ecological Risk Characterization. The Army did not incorporate the suggested text revision made by EPA with our October 5th comments. The On-Post ROD should describe in more detail where contaminant exposure pathways to wildlife exist and how these pathways will be eliminated or the risk reduced to an acceptable level. In addition, the ROD should contain more detail on the results and conclusions drawn from the ERC. The area of dispute should be explained as well as the process outlined Paragraph 27 a. of the Conceptual Agreement.

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms. Laura Williams
U.S. Environmental Protection Agency
Region VIII
Mail Code 8EPR-F
999- 18th Street, Suite 500
Denver, Colorado 80202-2466

Dear Ms. Williams:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan.

In response to your comment on the Proposed Plan description of the results of the Ecological Risk Characterization, the U.S. Army followed U.S. Environmental Protection Agency (EPA) Guidance on Preparing Superfund Decision Documents, which states the Proposed Plan should be written in a clear and concise manner and should direct the public to the Remedial Investigation/Feasibility Study (RI/FS) report as the primary source of detailed information.

In preparing the Proposed Plan, the Army worked closely with all the Parties to address their dispute items from the draft version of the document. All comments, from each Party, were addressed.

The Army agrees with EPA that the Record of Decision (ROD) should include more detail. The ROD (1) describes in more detail where contaminant exposure pathways to wildlife exist and how either these pathways will be eliminated or the risk will be reduced to an acceptable level, (2) details the conclusions drawn from the Ecological Risk Characterization, (3) defines the Area of Dispute, and (4) outlines the process as first set forth in the Agreement for a Conceptual Remedy for the Cleanup of Rocky Mountain Arsenal (dated June 13, 1995), Paragraph 27a, to be used to monitor and evaluate areas that may pose risk to biota and to refine areas to be remediated

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
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Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Mr. Eduardo Quintana, Assistant Regional Counsel, U.S. Environmental
Protection Agency, One Denver Place, Suite 500, 999-18th Street,
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Mr. Gene Czyzewski, CDM Federal Program Corporation, 1626 Cole Boulevard,
Suite 100, Golden, Colorado 80401
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking Center
Commerce City, Colorado 80022-1748

12–3

Responses to USFWS Comments

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rocky Mountain Arsenal National Wildlife Refuge
Building 111
Commerce City, Colorado 80022-1748
Telephone (303) 289-0232
Fax (303) 289-0579

IN REPLY REFER TO:

January 19, 1996

Mr. Charles Scharmann
Program Manager for Rocky Mountain Arsenal
Building 111
Commerce City, Colorado 80022-1748

Dear Mr. Scharmann:

The U.S. Fish and Wildlife Service has reviewed the Final On-Post Detailed Analysis of Alternatives and the Proposed Plan, which were released for public review in October 1995, and provides the following comments.

Overall, the Service believes that the subject documents adequately portray the Analysis of Alternatives considered, the resolution of disputes raised and the agreements made in reaching the Agreement for a Conceptual Remedy which was signed on June 13, 1995.

Although we believe the documents effectively describe the alternatives and the proposal, there are several areas where further planning and commitments are essential before a Record of Decision (ROD) can be developed for release and concurrence.

Two items included in the Conceptual Remedy which are of major concern to the Service are the development and delivery of on-Post water supplies and the establishment of a trust fund.

Although much attention and discussion has deservedly centered upon the development of off-Post water supplies, equal consideration needs to be given to future on-Post water needs. A dependable source of quality water is vital to maintaining future lake levels and to establish the revegetation essential for restoration and mitigation of contamination and remediation efforts.

Likewise the establishment of a trust fund, as envisioned in the Conceptual Agreement, would provide a continuing contingency to ensure the efficacy of the cleanup as a long term success.

The Service believes that resolution on the design and implementation of these items is an achievable and essential element of the forthcoming ROD. We look forward to working with all Parties towards that goal.

Sincerely,

Ray Rauch
Project Leader

9601915-1/1

Copies Furnished:

Ms. Laura Williams, U.S. Environmental Protection Agency, 999 18th Street, Suite 500, Denver, Colorado 80202
Mr. William McKinney, Shell Oil Company, 1700 Lincoln Street, Suite 4100, Denver, Colorado 80202
Mr. Howard Roitman, Colorado Department of Health and the Environment, 4300 Cherry Creek Drive South, Denver, Colorado 80222-1530
Ms. Barbara Nabors, Colorado Department of Health and Environment, 4300 Cherry Creek Drive South, Denver, Colorado 80222-1530
Mr. Dan McAuliffe, Department of Natural Resources, 1313 Sherman Street, Room 718, Denver, Colorado 80203
Document Tracking Center, Office of the Program Manager for Rocky Mountain Arsenal, Building 111, Commerce City, Colorado 80022-1748

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. Ray Rauch
U.S. Fish and Wildlife Service
Rocky Mountain Arsenal National Wildlife Refuge
Building 613
Commerce City, Colorado 80022-1748

Dear Mr. Rauch:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan.

The Army agrees that the on-post water supply is an important issue, and measures similar to those delineated for off-post alternative water supplies are ongoing to ensure that water of appropriate quality is provided on-post.

During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operations and maintenance of the remedy. The Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the On-Post Record of Decision (ROD). Principal and interest from the Trust Fund would be used to cover the costs of long-term operations and maintenance throughout the lifetime of the remedial program. These costs are estimated to be approximately $5 million per year (in 1995 dollars)

It is the intent of the Parties that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund. The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remedial sites. The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the actions federal agencies can take with respect to such legislation. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

A trust fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders and will be convened within 90 days of the signing of the ROD.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Mr. L. Ronel Finley, Coordinator, U.S. Fish and Wildlife Service, Rocky
Mountain Arsenal, Building 111, Commerce City, Colorado 80022-2180
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

12–4

Responses to Shell Comments

Shell Oil Company

c/o Holme Roberts & Owen LLC
Suite 4100
1700 Lincoln
Denver, Colorado

RECEIVED
JAN 19 1996

January 19, 1996

Mr. Charles T. Scharmann
RMA Committee Coordinator
Office of the Program Manager
Rocky Mountain Arsenal
ATTN: AMCPM-RM
Commerce City CO 80022-1748

Re: Comments on the Final RMA On-Post Proposed Plan

Dear Charlie:

Shell generally agrees with the site-wide remedy selection for the Rocky Mountain Arsenal (RMA), as described in the Final Proposed Plan for the RMA On-Post Operable Unit (October, 1995), and believes that it complies with the requirements of the Federal Facility Agreement and the Agreement for a Conceptual Remedy for the Cleanup of the RMA. Consequently, we have no comments on this document.

If you have any questions or need additional information, please contact me at your convenience.

Yours very truly,

W.J. McKinney
Project Manager
Denver Site Project

WJM: crc

9601910-1/1

cc:
Mr. Kevin T. Blose
Technical Director
Office of the Program Manager
Rocky MountainArsenal
ATTN: AMCPM-RM
Commerce City, CO 80022-1748

Mr. Brian Anderson
Office of the Program Manager
Rocky Mountain Arsenal
ATTN: AMCPM-RME-P
Commerce City, CO 80022-1748

Major Jonathan Potter
Rocky Mountain Arsenal
ATTN: AMCPM-RM
Building 111
Commerce City, CO 80022-1748

Ms. Laura Williams
RMA Coordinator
Environmental Protection Agency
Region VIII, One Denver Place
Mail Code 8EPR-FF
999 18th Street, Suite 801
Denver, CO 80202-2466

Ms. Barbara Nabors
Colorado Department of Public Health
And Environment
Hazardous Materials and Waste Management Div.
4300 Cherry Creek Drive South
Denver, CO 80222-1530

Mr. Ray Rauch
U.S. Fish and Wildlife Service
Rocky Mountain Arsenal
National Wildlife Refuge
Building 613
Commerce City, CO 80022-1748

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. William J. McKinney
Shell Oil Company
c/o Holme Roberts & Owen, LLC
Suite 4100
1700 Lincoln
Denver, Colorado 80203

Dear Mr. McKinney:

Thank you for your letter regarding the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan and your general agreement with the selected site-wide remedy. The U.S. Army understands that Shell Oil Company has no comment on the Proposed Plan.

If you have any questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Readiness is our Profession

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80011-1748
Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Mr. William Adcock, Shell Oil Company, c/o Holme Roberts & Owen, Suite 4100,
1700 Lincoln Street, Denver, Colorado 80203
Mr. M.T. Anderson, Shell Oil Company, c/o Holme Roberts and Owen, Suite 4100,
1700 Lincoln Street, Denver, Colorado 80203
Mr. Edward McGrath, Holme Roberts and Owen, Suite 4100, 1700 Lincoln Street,
Denver, Colorado 80203
Mr. Thomas Cope, Holme Robert and Owen, Suite 4100, 1700 Lincoln Street,
Denver, Colorado 80203
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

12–5

Responses to City and County Government Comments

Adams County

ADAMS COUNTY, COLORADO

DEPARTMENT OF PLANNING AND DEVELOPMENT
ROBERT D. CONEY, DIRECTOR

4955 EAST 74TH AVENUE
(303) 853-7000
FAX (303) 853-7015

COMMERCE CITY, COLORADO 80022-1535

January 19, 1996

On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn: AMCPM-PM/
Col. Eugene H. Bishop
Building 111-RMA
Commerce City, CO 80022-1748

Dear Col. Bishop:

Under the Proposed Plan and Conceptual Agreement, non-hazardous waste from the Rocky Mountain Arsenal is proposed to be placed in the Basin A area for disposal. The placement of this waste would occur without a liner system normally required for such disposal.

It is not clear that this would be a cost effective method of disposal for the Arsenal's non-hazardous wastes. Adams County believes that the Record of Decision should allow the alternative option of off-site disposal of non-hazardous material. This would allow for a study of all the comparative cost and benefits of both on-site and off-site of non-hazardous materials.

This alternative is supported by the Director of Hazardous Materials and Waste Management Division, Colorado Department of Public Health and Environment's, letter to you, dated September 6, 1995. It is also supported by Tri-County Health Department.

Contamination at the Rocky Mountain Arsenal has negatively impacted economic development in the areas surrounding the Arsenal. Using local contractors to transport and dispose of the non-hazardous material would partially offset this negative impact. Off-site disposal would also allow the waste to be disposed of in a RCRA designed facility in segregated cells.

Past interim remedial actions at the Arsenal allowed removal of non-hazardous waste from the Arsenal and disposal of those wastes in facilities within Adams County. Adams County considers these wastes Special Waste and requires that they be placed into segregated cells in a RCRA designed facility.

Should you have any questions concerning these comments, please call. My number is 853-7003.

Sincerely,

Craig Tessmer, Environmental Analyst

cc: County Administrator
Director, Planning and Development

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. Craig Tessmer
Adams County Department of Planning and Development
4955 E. 74th Avenue
Commerce City, Colorado 80022-1535

Dear Mr. Tessmer:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan. Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

Your letter proposes offsite disposal of nonhazardous materials in a Resource Conservation and Recovery Act-designed facility rather than placing it in the Basin A Consolidation Area. The Army understands your concern that this material be disposed properly and believes that the approach of placing the material under the Basin A cover will adequately immobilize any contaminants and provide a cost-effective method for disposal of nonhazardous materials. In addition, a large volume of fill material will be required to construct the Basin A Consolidation Area, and the RMA nonhazardous material will satisfy that need. Furthermore, by using this nonhazardous material onsite, there will be no negative impact from a very large number of trucks moving through the surrounding community. Cost for fill material is also minimized. Therefore, the Army chose to keep the nonhazardous material onsite to be used as fill material for the Basin A Consolidation Area.

In response to your other query about providing business opportunities to local contractors, to the extent that such efforts are consistent with federal contracting guidelines, the Army will continue to make a concerted effort to use local labor and contractors to support remediation activities.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Copies Furnished

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

City and County of Denver

WELLINGTON E. WEBB
Mayor

CITY AND COUNTY OF DENVER

rec'd 24 Jan

DEPARTMENT OF HEALTH AND HOSPITALS

PUBLIC HEALTH
605 BANNOCK STREET
DENVER, COLORADO 80204-4507
PHONE: (303) 436-7300
FAX: (303) 436-5074

January 19, 1996

Program Manager
Rocky Mountain Arsenal
Attn: AMCPM-PM/ Col. Eugene H. Bishop
Building 111-RMA
Commerce City, Colorado 80022-1748

re: On-Post Proposed Plan

Dear Colonel Bishop:

Provided below are the Denver Public Health Department, Environmental Protection Division comments on the Army's Proposed Plan for the Rocky Mountain Arsenal.

General Comments

1. Potential Air Emissions

Any remedial activity that may result in the emission of air pollutants is of concern to Denver. Air emission modeling associated with the SQI has shown that the populated area of maximal total off-post deposition (even though negligible for the SQI) is the Montbello neighborhood. Understandably, the community is extremely concerned about combined emissions from future remedial measures because of the potential for detrimental health effects. In order to ensure the health and safety of onsite workers, visitors to the Arsenal, and the general population, we have previously advised that the characteristics and risks associated with the combined sources of air emissions be considered when evaluating the alternative remedial actions. More specifically, we expect that all dispersion associated with the various sources of emissions would be evaluated by air modeling and that the cumulative effect of all components of the separate sources be included in a Human Health Risk Assessment. This analysis has not yet been performed. Furthermore, we advised that in addition to monitoring emissions at their source and at the boundary of the Arsenal, that air monitoring stations be established within the surrounding communities for baseline and subsequent routine monitoring of indicator pollutants.

2. On-post Detonation of UXO

Component 14 of the Parties' agreement states that if explosives-containing munitions are found, they are to be taken to the closest on-post site for detonation. The DAA report (Vol. VII, page 9-4) indicates that site ESA-4b could be used again for on-site detonations. Is that site suitable today and will it remain so throughout the duration of the remedy, considering the continual development of the Denver International Airport and the vehicular corridor adjacent to the

eastern side of the Arsenal? How and where will agent-containing, unexploded munitions be destroyed?

3. Institutional Controls and Restrictions

As stated in our comments of 9/16/94, we would like to see a comparison of the effects of proposed restrictions associated with the various remedial alternatives on humans and wildlife, both during and after implementation.

4. Trust Fund

The Proposed Plan and the DAA report lack any proposed legal mechanism for the development of a Trust Fund. That mechanism and at least an estimated date when the Fund could be established should have been provided.

5. Human Health Risk Characterization

Since performing the human health risk characterization, DIMP, PCBs, and NDMA have been identified as contaminants of concern beyond the 27 others previously evaluated. More recent analyses of animals and soils have proven the presence of dioxins on the RMA. How will the risks posed by these new COCs be evaluated? After completion of the proposed remediation, how would any future additional contaminated media found to pose a significant risk be addressed?

7. Environmental Justice

Our 9/16/94 response to the Parties' descriptions of five conceptual cleanup approaches, reported several concerns heard from the residents living adjacent to the Arsenal. The Parties' agreement could partially address some concerns, such as medical health monitoring for Montbello residents (Component 18 of the Agreement). However, other concerns also exist:

- How will surrounding property values be effected by the proposed cleanup approach?
- Will education and vocational training opportunities be offered to the community during the remediation of the RMA?
- What emergency response measures will be established to protect the surrounding communities?
- Will the local communities' contractors and work force benefit from the opportunities afforded by the selected remedial actions?

8. Five-Year Reviews

It is not clear when the clock will be started on the five-year review of remedial actions. It is recommended that the reviews be site-specific and the trigger for starting the time clock be the completion of a separate site activity within the total site remedy. For example, review of the protectiveness of the remedy applied to the Army (Complex) Trenches should be performed within five years subsequent to completion of the slurry wall and RCRA-equivalent cap/cover.

9. Prioritization of Remedial Actions

Please see the attached letter, dated January 17, 1996.

Structures Medium

10. Structures Containing Agent

What measures will be taken to prevent accidental releases during the demolition, crushing, sorting, and sizing of debris from potentially agent-contaminated structures? If a release to air occurs at South Plants or elsewhere on RMA, how will the chemical agent's risk to the health and safety of any off-site human population be mitigated?

11. Caustic Washing of Structures and Soil Containing Chemical Agent

The DAA report, Vol. VII, page 9-8 states that "detailed laboratory and pilot scale testing would be necessary before implementing this alternative as this technology has not been well demonstrated and is largely theoretical." The narrative goes on to describe previous testing of this procedure at RMA. Re-formation of GB during the spray drying of the brine [spent caustic] solution, difficulties confirming that the brine was free from agent, and reported exceedance of air emission action levels were reported. At RMA there is potential for several types of chemical agents and other COCs in any batch of material to be treated, which further complicates the process and may require re-treatment. Yet, these implementation difficulties are not discussed elsewhere in the DAA report or the Proposed Plan. Please clarify why this process is the preferred alternative. Where would the treatment facilities be constructed?

Soils Medium

12. Inconsistencies in Soils Volume Estimates

What is the estimated total volume of soils in the South Plants Central Processing Area exceeding Human Health and Principle Threat? Human Health and Principle Threat volumes for soils were estimated in the DAA report for each contaminant of concern between land surface and a depth of 10 feet (or to the water table if it is shallower). (DAA, Vol. IV, pages A-4). Why wasn't the volume for the Proposed Plan's 5-foot depth of excavation detailed in this appendix? Volumes of

the soils media are inconsistently stated among numerous sections of the DAA report, its appendices, and the Mass Balance Logic Flow Diagram. Which are the correct estimates?

13. Firing Ranges

The October 1995 edition of "RMA Update," which was distributed at the same time as the Proposed Plan, includes a map on the front page showing areas of RMA where cleanup activities would be conducted under the Proposed Plan. Two soil remediation areas are depicted in Sections 12 and 19 on that map, which are believed to be firing ranges; these areas are not included in the Proposed Plan's Figure 4 - Preferred Soil Alternative. Please clarify whether these areas will be included in the remedial action.

14. Slurry Wall Construction

The DAA report (Vol. VII, page 6-9) states "for a slurry wall to control groundwater migration, a groundwater removal system is generally installed in conjunction with the slurry wall." We concur. It is recommended that dewatering and treatment of liquids within the Army (Complex) Trenches and the Shell Trenches be retained as an initial, necessary component of the remedy.

15. South Plants Cap/Cover

How was it determined that a biota barrier and 4 or more feet of soil cover would not be needed over the Human Health and Principle Threat exceedance soils that are proposed to be covered in the South Plants Balance of Areas?

16. Biota Barrier

Is it truly protective to use rubble from a demolished RMA structure as a biota barrier without first performing verification sampling and confirming the presumed lack of contamination?

17. Hex Pits

We would like to see an innovative treatment technology be applied to the 3300 cu. yd. of waste in the Hex Pits, if practicable. Of the available treatment alternatives, the alternative posing the least amount of risk to human health and safety is preferable.

18. Southern Lakes

Degradation of the quality of the surface waters in the southern lakes is threatened by the contaminants within the South Plant's plumes. The Proposed plan involves maintaining hydraulic control of the lakes and continued monitoring of groundwater quality and water-level data near the lakes in conjunction with the proposed capping of South Plants. The frequency of monitoring events and the method of controlling lake levels is not discussed. It appears

however, that the proposed alternative would only delay the need to extract/treat ever increasing concentrations of contaminants further from their source area. Should the ability to maintain the lake water levels be compromised (for example, due to the loss of a dam or the result of a severe draught) what response actions would be implemented?

19. Confined Flow System Monitoring

The DAA report offers several hypotheses regarding mechanisms to explain the numerous detections of contaminants in the confined flow system. Additional investigation and characterization of this deeper zone of groundwater contamination appears to be warranted. The proposed establishment of a monitoring well network consisting of 20 existing wells and annual sampling, seems premature and potentially insufficient. Additional wells are needed to assess the lateral extent of contaminant migration. More frequent sampling (such as quarterly sampling over some limited duration) would provide the data needed to better identify and designate a more appropriate monitoring network.

Thank you for extending the public comment period and for considering all comments. If you have any questions, feel free to call (tel. 436-7305).

Sincerely,

John D. Student
Remedial Program Manager
Environmental Protection Division
Denver Public Health Department

attachment

cc: Tom Stauch, Environmental Supervisor, Environmental Protection Division

jds:onpostpp

WELLINGTON E. WEBB
Mayor

CITY AND COUNTY OF DENVER

DEPARTMENT OF HEALTH AND HOSPITALS

PUBLIC HEALTH
605 BANNOCK STREET
DENVER, COLORADO 80204-4507
PHONE: (303) 436-7300
FAX: (303) 436-5074

January 17, 1996

SENT BY FAX (289-0485 & 289-0582)

Program Manager
Rocky Mountain Arsenal
Attn: Mr. Brian Anderson
Environmental Engineering Division
Commerce City, Colorado 80022

re: Sequencing of Remedial Activities

Dear Mr. Anderson:

The Denver Public Health Department, Environmental Protection Division, has reviewed the documentation for the Army's proposed sequence of remedial actions at the Rocky Mountain Arsenal. In general we found the sequence logical. Our exceptions to your priorities are noted on the attached Remedial Activities Rating Sheet.

In addition to addressing the "fixed facilities" subproject group that you have identified, we would like a commitment for early action on the following additional critical path issues:

- medical monitoring program,
- Trust Fund for O&M of remedial actions,
- contingency, health and safety, and emergency response plans, and
- air pathway monitoring program and baseline concentrations.

Please note that this letter supersedes my previous letter to you concerning this subject, dated January 16, 1996. Please discard that letter. Should you have any questions, please feel free to contact me (tel. (303)436-7305).

Sincerely,

John D. Student
Remedial Program Manager
Environmental Protection Division
Denver Public Health Department

cc: Tom Stauch, Environmental Supervisor, Environmental Protection Division

jds:rs-prior(rev)

9602413 -1/1-A

Remedial Activities Rating Sheet

Indicate impression of risk (high/medium/low) and community interest (high/medium/low) for each subproject group. Rate each subproject group between 0 (low priority) and 6 (high priority) with total not to exceed 6 points for all subproject groups combined.

Subproject Group	Risk (H/M/L)	Community Interest (H/M/L)	Comments	Points
Fixed Facilities	NA	NA		NA
Off-Post Water	H	H	If there is exposure this must be addressed ASAP.	1
Section 36	H	H	Shell Trenches and complex Trenches need early remediation.	2
Section 26	M	H	Basin F Wastepile is controlled and final remedy can be delayed.	0
North Plants	L	L	Structures & Soil can be delayed.	0
South Plants	H	H	Hex pits need early remediation. Structures remediation should concentrate early in South Plants in order to accelerate schedule.	3
Other	M	L	Other structures could be delayed if they don't block soils clean-up and access can be controlled. Munitions should be addressed ASAP.	0
			Total	6

Name Environmental Protection Division

Organization Denver Public Health

priority.doc 12/7/95

9602413-1/1-A-a

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. John D. Student
Environmental Protection Division
Denver Public Health Department
605 Bannock Street
Denver, Colorado 80204-4507

Dear Mr Student:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S Army and the public.

Responses to your comments on the Proposed Plan are provided in the enclosure to this letter

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U S Army
Program Manager

Enclosure

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U. S Department of Justice, 999- 18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

Readiness is our Profession

U.S. ARMY RESPONSES TO COMMENTS BY THE CITY AND COUNTY OF DENVER DEPARTMENT OF HEALTH AND HOSPITALS ON THE ROCKY MOUNTAIN ARSENAL ON-POST PROPOSED PLAN

General Comments

1. Potential Air Emissions

Your comment cites air emissions modeling associated with the Rocky Mountain Arsenal (RMA) Submerged Quench Incinerator (SQI) as a way to locate the "maximal" off-post deposition in the Montbello neighborhood. The SQI modeling reflected emissions from a 100-foot stack. Under these circumstances and stable atmospheric boundary layer conditions, maximum concentrations from a high emission source are frequently projected a considerable distance downwind. However, in the future remediation activity projected at RMA, all remediation will be associated with ground-level sources, and the maximum deposition, or ambient concentrations, will occur in the immediate proximity of the work area and will decrease rapidly with distance from the source. This phenomenon was demonstrated in the 1988 Basin F Interim Response Action (IRA) when moderate concentrations of various volatile organic compounds (VOC) and pesticides were detected in the immediate work area and decreased rapidly with distance from the work site.

The prevailing nighttime drainage wind is generally from south to north away from Montbello, and although the worst-case modeling scenario might reflect some higher concentrations in any random direction because of topography, this likely will not occur to the south. The prevailing dispersion pattern and windrose calculated during active remediation of Basin F illustrates this fact It is also true that during daytime hours, heating of the ground can cause the wind flows to reverse, blowing up valley (from north to south). Thus Montbello will be downstream of the Arsenal during these times. However, as noted, the remedial actions will occur at ground level, in the center of the Arsenal, several miles away from the southern RMA boundary. Also, atmospheric conditions will be neutral to unstable, confining impacts to the close proximity to the remediation area. For these reasons, it is anticipated that impacts upon Montbello will be small

A risk assessment conducted immediately after the Basin F IRA (Ebasco Constructors et al., 1989. Basin F Interim Action Close-out Safety Report, Draft Final, August 1989), indicated no risks at the RMA perimeter to public health and safety. As Montbello is at a farther distance and in the opposite direction of prevailing worst-case conditions, and as the past remediation of Basin F most likely reflects worst-case emissions, the Army does not anticipate high concentrations in the direction of Montbello. Recent smaller remediation activities during Pond A and Pond B closures and the South Plants pilot building demolition project provided similar results.

The Army intends to take proper precautions for Montbello and all other RMA perimeter areas when future active remediation commences. Dispersion associated with various sources of emissions will be evaluated by air modeling (as was done in the past), and intensive air monitoring

will be conducted both within the interior and at the perimeter of RMA during active remediation Real-time monitoring will also be conducted close to all remediation sources for the health and protection of workers at RMA.

With respect to monitoring at nearby communities, both for baseline and routinely during remediation activity, a Medical Monitoring Program has been initiated. The primary goals of the Medical Monitoring Program are to monitor any off-post impact on human health due to the RMA remediation and to provide mechanisms for evaluation of health status on an individual and community basis. This Program will continue until the soil remediation is completed. A Medical Monitoring Advisory Group has been established to evaluate specific issues covered by the Medical Monitoring Program. As you are aware, the Group is composed of representatives of the Army, Shell Oil Company, the U.S. Environmental Protection Agency (EPA), the Colorado Department of Public Health and Environment (CDPHE), Tri-County Health Department, the Agency for Toxic Substances and Disease Registry (ATSDR), the U.S. Fish and Wildlife Service (USFWS), Denver Health and Hospitals, and the Site-Specific Advisory Board. The Group also includes representatives from the communities of Montbello, Commerce City, Henderson, Green Valley Ranch, and Denver.

2. On-Post Detonation of Unexploded Ordnance (UXO)

Identified UXO will be transported to an off-post Army facility for detonation or other demilitarization process unless the UXO is unstable and must be detonated on-post. On-post detonation will only be performed if UXO is unstable and cannot be safely transported to Army facilities that specialize in explosives or agent-filled UXO demilitarization. The suitability of on-post UXO detonation sites (including ES A-4b) will be evaluated during remedial design and, if needed, will be in accordance with Army Materiel Command (AMC) Safety Procedures (AMC-R 385-100 and AR 75-15). Site ESA-4b is located more than one mile from the eastern boundary of RMA, much farther than the 2,400 feet suggested in the AMC Safety Procedures. Agent-filled UXO will be transported off-post for demilitarization at an Army facility. Procedures for agent-filled UXO are described in the Final Detailed Analysis of Alternatives (DAA) in Volume VII, pages 9-3 and 9-4. Agent will be removed from the UXO, if possible, following Army regulations (AR 385-61 and AR 50-6).

3. Institutional Controls and Restrictions

The effects of restrictions would be similar for all remedial alternatives both during and after implementation.

4. Trust Fund

During the formation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operation and maintenance of the remedy. The

Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the On-Post Record of Decision (ROD). Principal and interest from the Trust Fund would be used to cover the costs of long-term operation and maintenance throughout the lifetime of the remedial program. The costs are estimated to be approximately $5 million per year (in 1995 dollars).

It is the intent of the Parties that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund. The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remedial sites. The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the actions federal agencies can take with respect to such legislation. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders, and will be convened within 90 days of the signing of the ROD.

5. Human Health Risk Characterization

Polychlorinated biphenyl (PCB)-contaminated soil (identified by the PCB IRA with concentrations of 250 parts per million (ppm) or greater) will be excavated and disposed in the on-post Toxic Substance Control Act-compliant landfill. Soil identified with concentrations ranging from 50 to 250 ppm will be covered.

Aldrin and dieldrin are the principal risk drivers for soil. Contaminated soil will either be placed in a hazardous waste landfill, covered with Resource Conservation and Recovery Act or equivalent caps, covered with concrete caps, or covered with one or more foot of soil (in the case of the least hazardous soil). In addition, institutional controls and biota barriers will be in place to prevent intrusion by humans or animals. These actions will address risk concerns regarding other soil contaminants beyond the 27 compounds identified in the ROD. Groundwater contaminants are addressed by removing sources on-post, pump and treat systems on-post and off-post, attenuation, and alternate water supplies off-post. The combination of these two approaches will address risk concerns both on-post and off-post for any contamination not yet identified as well as PCBs, N-nitrosodimethlylamine (NDMA), and diisopropyl methylphosphonate (DIMP). However, monitoring will continue, and necessary modifications to the remedy will be evaluated, with public input.

In addition to the air monitoring and medical monitoring described in the response to your Comment Number 1, the Army will conduct monitoring of the remedy as it is implemented.

The selected remedy will also undergo a periodic, five-year review, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

If the monitoring or the five-year review reveals additional contamination or that the cleanup approach is inadequate for the protection of human health and the environment, necessary modifications to the remedy will be evaluated, with public input, and will be made at that time.

6. Letter had omitted #6.

7. Environmental Justice

The Army believes that the selected remedy is consistent with the policies and guidelines pertaining to environmental justice. The Army will continue to inform and seek input from elected officials, local chamber groups, schools, stakeholder groups, realtors, and local businesses regarding activities presently underway and those planned for the future. Regarding medical health monitoring for Montbello residents, please see the response to your Comment Number 3, above. The following items are addressed individually:

- The Army understands that RMA has had both perceived and actual impacts on surrounding communities. The Army also believes that RMA has benefitted and contributed to the surrounding communities. The goal of the Army at RMA is to provide for an environmentally safe National Wildlife Refuge that will continue to contribute to a positive image for surrounding communities. RMA has had a very active public outreach program and will continue to work with the public on matters regarding the environmental cleanup program until RMA is fully transitioned to a Refuge. Additionally, the Army and Shell have agreed to provide $48.8 million to purchase a supplemental water supply for South Adams County Water and Sanitation District.

- Education and vocational training opportunities: The Army and the USFWS provide educational opportunities through remediation and wildlife tours, and the Army has recently received accreditation for its environmental education program through the Colorado School of Mines and the Denver Public Schools. These opportunities are expected to continue during the remedial activities. The Army also provides used computer equipment to the public schools in the local communities.

- Emergency response measures: The Army developed a contingency plan for emergencies many years ago and continually reviews the plan to keep it current with activities underway. Emergency plans will be part of the post-ROD remedial design activities. The Parties and the public will be kept informed of these contingency plans as they are written.

- Local contractors and workers: The Army has made and will continue to make a concerted effort, within federal contracting guidelines, to use local contractors and labor to support remediation activities.

8. Five-Year Reviews

A five-year review may be conducted any time within the five-year period after the finalization of the ROD and within each five-year period following. The site will be reviewed as a whole during that review. See also the response to Comment Number 7, above. Five-year reviews are intended to evaluate whether the response action remains protective of humans and the environment. Statutory five-year reviews are required no less often than each five years after the initiation of the remedial action.

9. Prioritization of Remedial Actions

Comment noted. Discussions with the Parties about sequencing remedial activities are ongoing

Structures Medium

10. Structures Containing Agent

There is not sufficient contamination of the structures to generate an off-site air release. On-site workers will be wearing protective equipment during remediation to protect them from any on-site air releases. Therefore, the Army does not anticipate that either the surrounding communities or on-site workers will be exposed to air releases. Monitoring of the workers and air monitoring at work site boundaries and RMA boundaries will be performed to ensure safety. In addition, various dust control measures will be used to ensure no exposures to the surrounding communities

11. Caustic Washing of Structures and Soil Containing Chemical Agent

Caustic washing was selected as the preferred alternative for agent-contaminated soil and structure debris because it effectively treats all agent compounds suspected to be present at RMA Although caustic washing has not been demonstrated at full scale, the associated equipment is well-demonstrated and widely available. Implementation problems (e.g., materials handling, emission control) identified during testing can be overcome through proper engineering controls, and pilot-scale testing will be necessary prior to implementation to determine the proper treatment solution Other treatment alternatives evaluated (e. g., solvent extraction with caustic, incineration) were not cost-effective due to batch operation and high residual disposal cost or high capital cost, and had similar or more difficult implementation concerns. Location of the treatment facilities will be determined during the remedial design.

Soils Medium

12. Soil Volume Estimates

The human health and principal threat exceedance volumes presented in the Detailed Analysis of Alternatives (DAA) (Vol. IV, Tables A-2 and A-3) for the South Plants Central Processing Area are estimated using the agreed-upon 5-ft depth criteria for excavation, and are an exception to the statement "...between the soil surface and a depth of 10 ft...". Exceedance volumes remaining in place between 5 and 10 feet include 32,000 bank cubic yards (BCY) of human health exceedance soil with a 17,000-BCY principal threat exceedance volume. The apparent discrepancies between the DAA text, Appendix A volume tables, and the Mass Balance Logic-Flow Diagram are due to overlapping volumes between human health exceedance volume, estimated agent volume, and UXO debris volume. Volumes presented in the Appendix A tables are total estimated volumes and are not adjusted for volume overlaps. Material quantities and costs were developed from adjusted volumes obtained by subtracting the overlapping volumes from the human health exceedance volume. The Mass Balance Logic-Flow Diagram is correct and in agreement with these adjusted volumes, with the exception of the surficial soil human health exceedance volume, which has been corrected to 87,367 BCY (corrected to include firing ranges volume). Overlapping volumes are discussed in the individual medium group sections (Sections 5-19) in the DAA (Volumes II and III)

13. Firing Ranges

The two soil remediation areas shown in the October 1995 edition of RMA Update and not shown in Figure 4 of the Proposed Plan are the Pistol Range in Section 19 and the Rifle Range in Section 12. These two areas were inadvertently left off Figure 4 but are included in the remedy The selected alternative includes disposal in the on-post landfill of approximately 2,300 BCY of lead-contaminated soil from these sites.

14. Slurry Wall Construction

The necessity of dewatering upgradient of the slurry walls for the Complex Trenches and Shell Trenches will be evaluated during the remedial design If dewatering is included as part of the final design, the extracted water will be treated at an on-post facility (e.g., Basin A Neck treatment facility).

15. South Plants Cap/Cover

The selected alternative states that all modeled human health and principal threat volume in the South Plants Balance of Areas is excavated to a depth of up to 10 feet and disposed in the on-post landfill. No human health or principal threat exceedances are left in place; therefore, a wildlife barrier and 4 or more feet of soil cover are not necessary

16. Biota Barrier

The broken concrete or cobble from demolished structures will either be landfilled in the on-post hazardous waste landfill or consolidated under the Basin A cover. The biota barrier for the Basin A cover consists of a formed concrete layer and does not use any broken concrete or cobble from the on-post structures demolition. Rubble used for other wildlife barriers will be obtained from off-post sources.

17. Hex Pit

Subject to the results of treatability testing and technology evaluation, innovative thermal treatment will be used to treat 1,000 BCY of principal threat material from the Hex Pit. Solidification will become the selected remedy if all evaluation criteria for the innovative thermal technology are not met. The remaining 2,300 BCY of material will be excavated and disposed in the on-post hazardous waste landfill.

18. Southern Lakes

Since the issuance of the On-Post Proposed Plan, a technical working group composed of representatives from the Army, Shell, State, and EPA has been studying existing data from the southern lakes and assessing the need for additional action. No additional action has been determined necessary at this time Water levels in Lake Ladora, Lake Mary, and Lower Derby Lake will be maintained to support aquatic ecosystems. The biological health of the ecosystems will continue to be monitored.

Lake-level maintenance or other means of hydraulic containment or plume control will be used to prevent South Plants plumes from migrating into the lakes at concentrations exceeding Colorado Basic Standards for Groundwater at the point of discharge. Groundwater monitoring will be used to demonstrate compliance.

19. Confined Flow System Monitoring

The proposed monitoring network was established after having reviewed years of confined flow system (CFS) data. Two different reports issued separately by the Army and Shell in 1994 provided extensive information about the wells in the CFS. The Army believes the proposed CFS monitoring network is adequate based on existing information. Increasing the frequency of sampling in the confined aquifer would not provide information to change that opinion, given the extremely low flow rate, typically about 13 feet per year.

Northern Community Coalition

Recycled Paper

Tri-County Health Department

Serving Adams, Arapahoe and Douglas Counties

Hugh Rohrer, M.D., M.P.H.
Director

December 12, 1995

Mr. Charles Scharman, Technical Director
Environmental Engineering
Rocky Mountain Arsenal
Commerce City, Colorado 80022-1748

Dear Charlie:

The Northern Community Coalition (NCC) recently met and discussed the issue of an extension of time for comments on the Proposed Plan for onpost cleanup of the Rocky Mountain Arsenal. Following our discussion the NCC developed a consensus statement of our position concerning an extension of the comment period. That statement is as follows:

> Without a compelling, substantive reason, the time period for receiving comments on the proposed plan should not be extended. Under any circumstances an extension of no more than an additional 30 days should be granted.

If you have any questions about our position feel free to contact me. It is planned that the comments on the Proposed Plan to be offered by the Coalition will be submitted by the December 15, 1995 deadline.

Sincerely,

Chris J. Grant, M.P.H., Ph.D.
Deputy Director

c.c. NCC members

9534801-1/1

Recycled Paper

Tri-County Health Department

Serving Adams, Arapahoe and Douglas Counties

Hugh Rohrer, M.D., MPH.
Director

January 17, 1996

On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn.: AMCPM-PM/Colonel Bishop
Building 111-RMA
Commerce City, Colorado 80022-1748

Dear Colonel Bishop:

Attached are the comments of the Northern Community Coalition on the Proposed Plan. The Coalition includes representatives of Adams County, the City of Commerce City, South Adams County Water and Sanitation District, School District 14, Tri-County Health Department and Representative Jeannie Reeser's office.

We are available to discuss our comments or answer questions you may have. Feel free to contact me if you desire additional discussion. We hope our comments will be useful in bringing to final resolution the matter of the on-post remedy. The community continues to support a protective, timely and effective remedy. The Coalition appreciates the opportunity to comment on the Proposed Plan.

Sincerely,

Chris J. Giant, M.P.H., Ph.D.
Deputy Director

9601914-1/1

COMMENTS OF THE NORTHERN COMMUNITY COALITION
ON THE PROPOSED PLAN FOR CLEANUP OF THE ROCKY MOUNTAIN ARSENAL

January 1996

The Northern Community Coalition (NCC) appreciates the opportunity to comment on the Proposed Plan. For the most part, the Proposed Plan is consistent with the Conceptual Agreement that was developed by the U.S. Army, Shell Oil Company, the State of Colorado, the Environmental Protection Agency, and the U.S. Fish and Wildlife Service on May 9-11, 1995. As the NCC has stated in the past, the remedy outlined in the Conceptual Agreement satisfies the community's goal for a timely remedy that will provide long-term protection of public health, wildlife, and the environment even though it does not actually represent the community's concept of the ideal cleanup. It is, therefore, in the community's best interest to accept the proposed remedies so cleanup can be completed as soon as possible.

Nevertheless, the NCC conditioned its support of the Conceptual Agreement upon the appropriate resolution of certain issues. Satisfactory closure of these issues has not occurred and/or is not incorporated into the Proposed Plan. As a result, the NCC can only support the Proposed Plan if it is modified to include the following:

1. <u>A SATISFACTORY ALTERNATE WATER SUPPLY.</u>

   The NCC's top priority is to obtain replacement of the water supply impacted by the Arsenal. The Coalition cannot support a final on-post ROD unless the remedy selected includes an acceptable replacement supply of water or alternative cash resolution for future replacement. The water supply to be provided must meet the following criteria:

   a. Reliable, long-term, firm annual yield of a satisfactory amount that includes a quantity sufficient to serve the Henderson area;
   b. Potable water quality;
   c. Delivered at an acceptable location for service to the South Adams District;
   d. Fully authorized and permitted;
   e. Completed and delivered in a reasonable period of time;
   f. Assured by a suitable security mechanism; and
   g. Long term quality of the supply is assured by a watershed protection program.

With regard to the alternate water supply, paragraph 16 of the Conceptual Agreement provides:

> The U.S. Army and Shell Oil Company agree to provide or arrange for the provision of 4,000 acre feet of water, the details of which will be worked out between the U.S. Army, Shell Oil Company, and SACWSD. If such water is not available, the U.S. Army and Shell Oil Company will provide payment of an agreed upon amount of money in lieu of water. This obligation will be part of the final remedy and will be incorporated into the on-post ROD.

The NCC has never agreed that 4,000 acre feet is sufficient to replace the supply affected by the Arsenal, particularly if that quantity is also supposed to serve the DIMP plume area including Henderson. Nevertheless, the NCC could support an alternate water supply or an "in lieu of" cash settlement so long as it is <u>mutually</u> acceptable to the Army, Shell, and the South Adams County Water and Sanitation District (as required by the highlighted language above) <u>and</u> the selected water supply or cash settlement is incorporated into the final on-post ROD.

The Army's Proposed Plan departs from the Conceptual Agreement by omitting the very crucial highlighted language, requiring SACWSD's concurrence in the water supply selection. This omission appears to allow the Army and Shell to unilaterally decide what constitutes an acceptable water supply for the community. This is clearly contrary to the Conceptual Agreement and unacceptable to the Coalition.

2. <u>A SATISFACTORY SCHEDULE OF IMPLEMENTATION THAT PRIORITIZES ACTIVITIES ON THE BASIS OF PUBLIC HEALTH AND ACTUAL RISK.</u>

Another key concern of the NCC was timely implementation of the remedy. To be acceptable, the cleanup must be expedited to ensure that it is completed within 10 to 15 years. Further, the cleanup must proceed in a fashion that addresses public health protection first. With this in mind, the Proposed Plan should ensure that the remedy proceeds in the following sequence:

a. Alternate water supply -- The first priority should be to finalize the agreement to provide drinking water to South Adams County Water and Sanitation District. Protection of the drinking water through an alternate supply provides the necessary safety factor in assuring that the exposure pathway from contaminated groundwater to drinking water cannot be completed. The groundwater is currently the most significant direct threat to public health offpost of the RMA.

b. Hazardous Waste Disposal Site -- The design and construction of the hazardous waste disposal site should also be commenced as

soon as feasible as it is key to much of the other planned remediation.

c. Small High Risk Projects -- The smaller high risk projects with less complexity and uncertainty should then be implemented to gain the most benefit for the cost and to gain experience with oversight, monitoring and other issues before undertaking the major projects.

d. Larger High Risk Projects -- Once experience is gained on the small high risk projects, clean up of areas of higher risk with few uncertainties (e.g., the South Plants area) should be implemented. This will help ensure that funds are available to reduce the real risks presented by the RMA.

e. Other Projects -- The low risk, high cost projects should be deferred to the end. The Basin F wastepile is a good example of this type of project. It clearly involves the most complex and costly remediation strategy -- and likely poses the greatest potential cleanup risk to workers and adjacent residents, but is currently stable with a fully effective liner and cap. The Coalition has stated previously that, with enhanced containment, the Basin F wastepile could be left in place. The NCC does not believe that the benefits of excavating the wastepile and redisposing the material in a new RCRA compliant landfill are commensurate with the health and safety risks and the costs of such excavation and redisposal. Furthermore, the Coalition is concerned about the cost growth of such an operation, particularly in the context of materials handling and emissions/odor control. Consequently, if the wastepile is not designated as a low cleanup priority then uncertainties of cost growth and the lack of actual experience to define effective oversight and monitoring of other onpost remediation projects could result in a significant investment of limited funds for little value added in terms of risk reduction.

The NCC is currently engaging in a priority ranking exercise for RMA. The results of that exercise will enable us to present a more specific proposal to the Parties concerning a balance between funding anticipated to be available and individual cleanup project priorities.

3. <u>A SATISFACTORY REMEDIATION OVERSIGHT AND MONITORING PROGRAM.</u>

The long term permanence of the remedy will depend, in large part, upon the quality of engineering and construction of structures such as the landfill and the caps that are proposed. To ensure the necessary high quality of these activities, the Northern Community Coalition insists upon adequate and effective project oversight by qualified

individuals who are responsive to community concerns about the cleanup. It is the Coalition's position that Tri-County Health Department must be closely involved in oversight activities as the community's representative for technical and health and safety issues.

Further, the NCC will insist on offsite ambient monitoring where materials might be excavated that could release noxious and/or hazardous RMA contaminants into the air. The specifics of offsite monitoring should be addressed with the community's input. Additionally, the medical monitoring committee that has been established must be involved in the continuing evaluation of monitoring needs during the cleanup process. The basis and effectiveness of all planned medical monitoring in providing a clear cause-effect relationship between RMA contamination and health effects or changes in biomarkers should be clearly described prior to performing the monitoring.

4. A SATISFACTORY COMMUNITY IMPACT ASSISTANCE PROGRAM.

The Coalition believes that the past activities at the RMA have stigmatized the local community. As a result real estate property values have declined, economic and community growth and development opportunities have been lost and the financial burden for infrastructure, services and education has increased as a result of the presence of RMA. To complete the remedy, the Proposed Plan must address these issues with a satisfactory community assistance program. Such a program is particularly compelling in this instance given the racial, ethnic, and income makeup of the local community and the President's Executive Order on environmental justice (E.O. 12898, February 11, 1994).

Furthermore, it must be remembered that the NCC played a key role in getting the parties to even consider a mutually acceptable Conceptual Agreement. In the process, the NCC backed away from firmly held beliefs in order to encourage compromise among the parties and the stakeholders. Put another way, the NCC elevated the "common good" above its particular special interests. Now that the conceptual agreement has been achieved, the parties should not turn a blind eye to these efforts. Rather, like the NCC, the parties should ensure that the final remedy actually achieves the "common good." it is not enough to simply clean up the contamination and ignore the stigma damages which have clearly been caused by the RMA. Damages to the community have not been addressed. The remedy simply is not complete without including a program for community impact assistance. That program must include:

a. A public outreach program that educates the public on the cleanup activities and the potential risks during cleanup;

b. The joint preparation (by the Army and the NCC) of a written contingency plan including appropriate evacuation procedures;

c. A committment for the parties to work with School District 14 to address the long-term impact to the District of lost property tax revenue from the RMA land.

d. A commitment to hire local labor where qualified individuals are available to fulfill contract labor needs.

5. A SATISFACTORY TRUST FUND.

The trust fund was specifically discussed in the Conceptual Agreement. This fund is necessary to address potential future failures and/or deficiencies in the Proposed Plan and to allow for further cleanup, as appropriate, with the development of new technologies. In short, this fund is critical to the long-term permanence of the remedy.

6. A BASIN A GROUNDWATER DEWATERING CONTINGENCY PLAN.

The "containment" of contaminants in the Basin A area will be partially achieved by dewatering the aquifer underlying Basin A. It is not clear to the NCC that total dewatering will ever occur. As a result, the Proposed Plan should include a contingency plan. If the aquifer underlying Basin A is not dewatered within 10 years, then the remedy must be modified to include a slurry wall to bedrock around the entire Basin A area.

7. THE EXCAVATION OF ALL OF THE WASTE IN THE WESTERN TIER LANDFILLS.

The NCC believes that the waste in the western tier landfills is acting as a continual source of pollution which is contaminating the South Adams County Water and Sanitation District's existing water supply. In order to be effective, the proposed remedy at these landfills must include the complete excavation of all of the waste in the landfills. At various times, the parties have indicated verbally that they intend to implement such a complete excavation. However, given that importance of this issue, the NCC requires that the complete excavation of waste in the western tier landfills be specifically described in the Proposed Plan.

8. BOUNDARY SYSTEMS

For the marginal extra cost relative to the overall strategy, the Army should give additional consideration to Alternative 3 instead of Alternative 4. The length of operation of the boundary systems is one of the more uncertain features of the remediation. Due to the extremely slow dispersal of contaminants, it may make sense to simply eliminate the source of the contamination (i.e., Basin A and South

Plants). Comparison of the cost of adding the treatment at these two sites with the cost of extending the operation of the boundary systems may demonstrate that it is more effective to do the localized treatment. In other words, elimination of the contaminant mass at the Basin A and South Plants shorten the time that the boundary systems will have to oporate?

Most of the contaminants of concern at the boundary systems have extremely low solubilities. The regulatory levels for these materials are, however, also very low. A relatively small amount of this material in contact with the groundwater could leach at a level requiring treatment action for a very long period of time. While the data indicate that there is a down trend of the contaminants reaching the systems, it may be that the contamination levels reach a steady state above that of the regulatory limit and continue for some time. If some major sources of contamination have been eliminated by IRAs, etc., there may indeed be a reason for the steady drop in contamination reaching the boundary. However, if there remain mass sources of low solubility contaminants in contact with the groundwater, the water reaching the treatment systems could remain contaminated for long periods of time. The failure of dieldrin levels in the groundwater to show a decrease over time could be an indication of this mechanism.

9. <u>STRUCTURES</u>

The alternative is worded such that structures with a history of agent use will be demolished, monitored, caustic washed if necessary and disposal in the hazardous waste landfill. It appears to indicate that if monitoring does not identify agent, the material will not be washed but will still be placed in the landfill. If material from these structures does not indicate the presence of agent it should be used as consolidation material for Basin A or disposed of offsite, if feasible, in exchange for clean fill that could be brought on site for Basin A fill. That remedy may also reduce resources necessary for the cap/cover to be constructed at Basin A.

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FAX COVER MEMO

Tri-County Health Department

Serving Adams, Arapahoe and Douglas Counties

Hugh Rohrer, M.D., M.P.H.
Director

DATE 1-19-96 Pgs. (includ. memo) 8

Deliver to: Colonel Bishop / Charlie Schaus Dept.

From: Chris Weiss Dept.

Comments:

Administrative Office □ 7000 East Belleview Avenue □ Suite 301 □ Englewood, Colorado 80111-1628
303/220-9200 □ FAX 303/220-9208

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

REPLY TO
ATTENTION OF

June 11, 1996

Office of the Program Manager

Mr. Chris J. Wiant
Tri-County Health Department
7000 East Belleview Avenue, Suite 301
Englewood, Colorado 80111-1628

Dear Mr. Wiant:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

Your letter was emphatic in that the period for comments on the On-Post Proposed Plan should not be extended without good reason and that, if it were extended, no more than 30 days should be granted In order to allow additional time for comment without excessively delaying the Record of Decision, the comment period was extended by 30 days.

Responses to the Northern Community Coalition's comments are enclosed.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248. Thank you again for your comments

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosures

Readiness is our Profession

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

U.S. ARMY RESPONSES TO COMMENTS OF THE NORTHERN COMMUNITY COALITION ON THE ROCKY MOUNTAIN ARSENAL ON-POST PROPOSED PLAN

1. Alternate Water Supply

The Army believes that the Agreement in Principle regarding a water supply satisfies the criteria identified by your comment. The Army and Shell have reached an Agreement in Principle, enclosed with this letter, with South Adams County Water and Sanitation District (SACWSD) that includes payment of $48.8 million to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume by January 1999. In addition, the Agreement in Principle requires SAC WSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. An independent qualified water resource expert will be selected by SACWSD to direct the selection, acquisition, and implementation of a water supply that can be operational by October 1, 2004. The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon of this office at 303-289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646.

2. Schedule of Implementation that Prioritizes Activities on the Basis of Public Health and Actual Risk

The Army agrees with the basic outline of the Northern Community Coalition's (NCC) schedule, which is to clean up the higher risk areas first and proceed to the lower risk areas. The actual time required to complete the cleanup will depend in part on available funding from Congress as well as on developing and maintaining a cooperative working relationship with the regulatory agencies during design, construction, and operation of the remedy.

The water supply issue is a high priority, and the Army agrees that timely implementation is most important. Please refer to the response to Comment number 1 regarding the schedule for providing the water supply. Landfill design and construction is a prerequisite for accomplishing other remediation tasks and must be started as soon as possible. Moving the Basin F wastepile is a lower priority item because the waste is presently contained.

3. Remediation Oversight and Monitoring Program

It is the Army's policy to use the most qualified personnel to oversee both the construction and quality assurance/quality control of each project for the remediation, as well as to be responsive to community concerns. The U.S. Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE) will provide regulatory oversight. The Tri-County Health Department will be provided opportunities to review remediation activity.

4. Community Impact Assessment Program

The Army is currently reviewing state proposals on air pathway analysis and will ensure that adequate onsite and offsite monitoring occurs during remedial actions that may release vapors or odors.

In addition, a Medical Monitoring Program has been established. The primary goals of the Medical Monitoring Program are to monitor any offpost impact on human health due to the RMA remediation and provide mechanisms for evaluation of health status on an individual and community basis. This Program will continue until the soil remediation is completed. A Medical Monitoring Advisory Group (MMAG) has been established to evaluate specific issues covered by the Medical Monitoring Program. The MMAG is composed of representatives of the Army, Shell, EPA, CDPHE, Tri-County Health Department, the Agency for Toxic Substances and Disease Registry (ATSDR), the U. S. Fish and Wildlife Service (USFWS), Denver Health and Hospitals, and the Site-Specific Advisory Board. The MMAG also includes community representatives from the communities of Commerce City, Henderson, Denver, Green Valley Ranch, and Montbello. If you would like more information on the Medical Monitoring Program or wish to participate as part of the Medical Monitoring Advisory Group, please call Ms. Mary Seawell of CDPHE at 303-692-3327.

The Army understands RMA has had both perceived and actual negative impacts on surrounding communities. The Army also believes RMA has made positive contributions to the surrounding communities. The goal of the Army at RMA is to provide for an environmentally safe National Wildlife Refuge that will continue to contribute to a positive image for surrounding communities The Army has a very active public outreach program and will continue to work with the public on matters regarding the environmental cleanup program until RMA is fully transitioned to a Refuge The USFWS also has a very aggressive public education program complementing the wildlife resources and future plans for RMA. The Army will continue to inform and seek input from elected officials, local chamber groups, schools, stakeholder groups, realtors, and local businesses regarding activities presently underway and those planned for the future.

As part of the Medical Monitoring Program, public outreach will be the MMAG's foremost objective. The Army believes that public education will provide a real understanding of the ongoing cleanup and its associated risks. Also, the Medical Monitoring Plan will include a contingency plan, which will be based on the RMA wide contingency plan already in effect.

Emergency Response Measures: The Army has maintained a contingency plan for emergencies for many years and continues to update it as needed. Emergency plans will be part of the post-ROD remedial design activities. The Parties and the public will be kept informed of these contingency plans as they are written.

Education and Vocational Training Opportunities: The Army and the USFWS provide educational opportunities through remediation and wildlife tours, and the Army has recently

received accreditation for its environmental education program through the Colorado School of Mines and the Denver Public Schools. These opportunities are expected to continue during the remedial activities. The Army also provides used computer equipment to the public schools in the local communities.

Local Labor: The Army has made and will continue to make a concerted effort, within federal contracting guidelines, to use local contractors and labor to support remediation activities

5. Trust Fund

During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operation and maintenance of the remedy. The Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the ROD. Principal and interest from the Trust Fund would be used to cover the costs of long-term operations and maintenance throughout the lifetime of the remedial program. These costs are estimated to be approximately $5 million per year (in 1995 dollars).

It is the intent of the Parties that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remedial sites The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the actions federal agencies can take with respect to such legislation. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated

A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders and will be convened within 90 days of the signing of the ROD.

6. Basin A Groundwater Dewatering Contingency Plan

It appears that this comment refers to "total dewatering" as the dewatering of the saturated alluvium in Basin A. The partial dewatering resulting from construction of the soil cover will be a 10- to 13-foot lowering of the water table. As a result of dewatering, the water table will no longer be in contact with the most contaminated soils, and the groundwater flux out of the Basin A area will be substantially reduced. Groundwater migrating out of Basin A will be captured by the Basin A Neck Treatment System and the Section 36 Bedrock Ridge extraction system.

7. Excavation of All Waste in the Western Tier Landfills

The Western Tier landfills have never been demonstrated to be sources of groundwater contamination: however, complete excavation of these landfills is planned and is described in the ROD. Approximately 6630 bank cubic yards of human health exceedance materials in the landfills will be excavated and placed in the on-post hazardous waste landfill. The remainder of the Western Tier landfill materials have been characterized as nonhazardous debris and will be used as consolidation material in Basin A.

8. Boundary Systems

The Army believes that the Interim Response Actions (IRAs) implemented on-post to control sources and plumes of contamination, as well as the continued operation of the boundary containment systems, have been extremely effective in containing and treating contamination from sources and in treating the contamination that escaped before the IRAs were installed. Evaluation of Alternative 3 shows that active dewatering does not have a substantial impact on boundary system operation and that there is limited cost benefit associated with this alternative. The effectiveness of the selected passive dewatering approach for Basin A and South Plants, combined with boundary system treatment, will be evaluated during the five-year post-ROD remedy review At that time, changes to the remedy will be made as necessary.

The containment and passive dewatering approach will limit the leaching of all soil chemicals, particularly those relatively low-solubility compounds that preferentially sorb to the soil. A primary factor in the decision to use soil containment as part of the on-post remedy was the presence of insoluble compounds in soil.

9. Structures

The NCC's interpretation of how structures materials will be handled is correct. This waste, even without confirmation of agent presence, falls into the "3X" category based on its history and must be landfilled in a Resource Conservation and Recovery Act-equivalent landfill, according to Army regulation

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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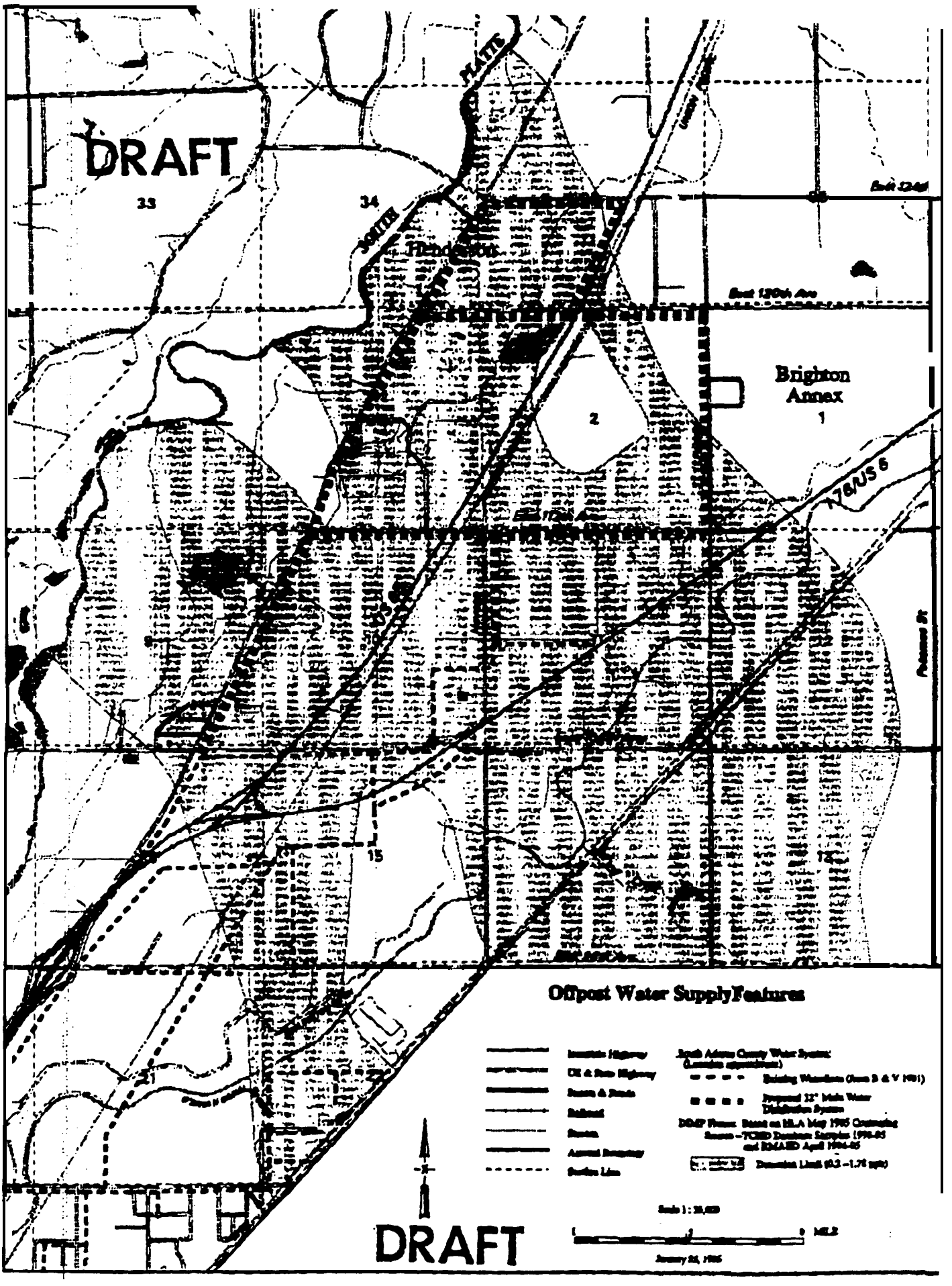

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12–6

Responses to Environmental Action Group Comments

League of Women Voters

THE LEAGUE
OF WOMEN VOTERS
OF COLORADO

1410 Grant, B-204
Denver, Colorado 80203
303•863•0437

rec'd 18 Dec 95

On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn: AMCPM-PM/Col. Eugene H. Bishop
Building 111 --- RMA
Commerce City, CO 80022-1748

Colonel Bishop,

The League of Women Voters of Colorado must congratulate you on your efforts to engage the public in the decision-making process which has led to the On-Post Proposed Plan. Rocky Mountain Arsenal has moved from a facility which refused public admission even to Technical Review Meetings to one which now pays for newspaper advertising in order to encourage participation. Issues under discussion have been brought out into the public whereas in the past they were kept under wraps until resolved by the Parties.

Hopefully, the final decisions will be more acceptable to the public because their concerns have been answered in the process.

Our comments have taken the form of questions which we feel must be answered in the Record of Decision (ROD). Specific contingency and review plans must be built into the ROD in order to demonstrate that these important steps have been carefully planned.

1. If "Placement of hazardous wastes into the Corrective Action Management Unit will not constitute 'land disposal' as defined by RCRA" (page 9) what criteria will be used?

2. Will 4,000 acre feet of water completely replace lost sources of well water? How much money will be paid if water is not available? Will it include costs of water systems or only the water? Who will be parties to the agreement? Will there be payment for economic loss is adequate safe water is not available?

3. One of the more reassuring aspects of the Proposed Plan is the establishment of a trust fund for future expenses. However we feel that the tentative nature of the trust fund wording offers little promise of future commitment. What if proceeds are inadequate to cover costs of future operation, maintenance and/or contamination in spite of remediation? If a trust fund cannot be established, how will this be paid for?

4. If in-situ solidification or any other technology doesn't work and contamination plumes continue to move or to increase in contamination levels, what are the back-up plans?

5. How can medical and biological monitoring be designed to catch early signs of system failure? What steps are to be taken in case of future impact?

6. If innovative technologies are used what is the back-up procedure? How will the public be involved in selection of technology and back-up plans?

We again congratulate you for your impressive public involvement effort during the past year or so. We cannot overstate the importance of continuing that involvement throughout the selection, implementation, monitoring and evaluation processes.

Thank you,

Marilyn Shuey

Marilyn Shuey, President

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms. Marilyn Shuey
The League of Women Voters
of Colorado
1410 Grant, B-204
Denver, Colorado 80203

Dear Ms. Shuey:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

Responses to your specific comments are provided below.

1 U S Environmental Protection Agency (EPA's) goal in establishing the Corrective Action Management Unit (CAMU) Rule, which has been adopted by the State of Colorado in the Colorado Hazardous Waste Management Act (CHWMA), was to "provide remedial decision makers with an added measure of flexibility in order to expedite and improve remedial decisions" while "existing closure regulations and requirements for [Resource Conservation and Recovery Act] RCRA-regulated units, which require closure to occur in a manner that is protective of human health and the environment, remain in effect " Purpose and context of the CAMU Rule 58 Fed Reg 8659 (1993) (to be codified at 40 C F R Parts 260, 263, 264, 265, 268, 270 and 271) The on-site landfill that is central to the CAMU will meet all CHWMA landfill siting, construction, monitoring, and closure requirements

2 The Parties to the On-Post Record of Decision (ROD) have determined that the 4,000 acre-feet water supply is adequate to serve as an additional layer of protection to people north of RMA in the unlikely event that all the caps/covers, liners, and multiple groundwater treatment systems were to fail. The Army and Shell Oil Company (Shell) have reached an Agreement in Principle, enclosed with this letter, with South Adams County Water and Sanitation District (S ACWSD) that includes payment by the Army and Shell to SACWSD in the amount of $48.8 million and requires that SACWSD provide the water to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. The payment will cover the water distribution system as well as acquisition of the water supply. The Army, Shell, and SACWSD believe that the settlement is fair and will permit SACWSD to secure an adequate

water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon of this office at 303-289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646.

3. During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operation and maintenance of the remedy. The Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the On-Post ROD. Principal and interest from the Trust Fund would be used to cover the costs of long-term operation and maintenance throughout the lifetime of the remedial program. These costs are estimated to be approximately $5 million per year (in 1995 dollars).

It is the intent of the Parties that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund. The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remedial sites. The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the actions federal agencies can take with respect to such legislation. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The Strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders and will be convened within 90 days of the signing of the ROD.

4 The extensive site-wide monitoring program that is planned will provide early detection of any problems with either soil or groundwater remediation. Additionally, the required periodic five-year review of the remedy will evaluate whether the remediation is effective and remains protective of human health and the environment. Alternate remediation technologies will be substituted or systems will be added if soil or water problems are discovered.

5. Environmental rather than medical and biological monitoring will be used to detect early signs of system failure. The environmental monitoring program includes soil, groundwater, and air monitoring.

A Medical Monitoring Program for the surrounding communities has also been identified as part of the Proposed Plan to measure health effects, if any, during the remediation. The primary goals of the Medical Monitoring Program are to monitor any off-post impact on human health due to

the RMA remediation and provide mechanisms for evaluation of human health status on an individual and community basis. This Program will continue until the soil remediation is completed. A Medical Monitoring Advisory Group (MMAG) has been established to evaluate specific issues covered by the Medical Monitoring Program. The MMAG is composed of representatives from the Army, Shell, U.S. Environmental Protection Agency, Colorado Department of Public Health and Environment, Tri-County Health Department, U. S. Agency for Toxic Substance and Disease Registry, U.S. Fish and Wildlife Service, Denver Health and Hospitals, and the Site Specific Advisory Board. The MMAG includes representatives from the communities of Commerce City, Henderson, Denver, Montbello, and Green Valley Ranch. The League of Women Voters is also represented on the MMAG.

6. Innovative technologies will go through necessary tests prior to implementation. The public (stakeholders) has been included in discussions of the selected remedy. If it became necessary to modify the selected remedy, an Explanation of Significant Difference or Amendment to the ROD would be issued and would be available for public review and comment.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248. Thank you again for your comments

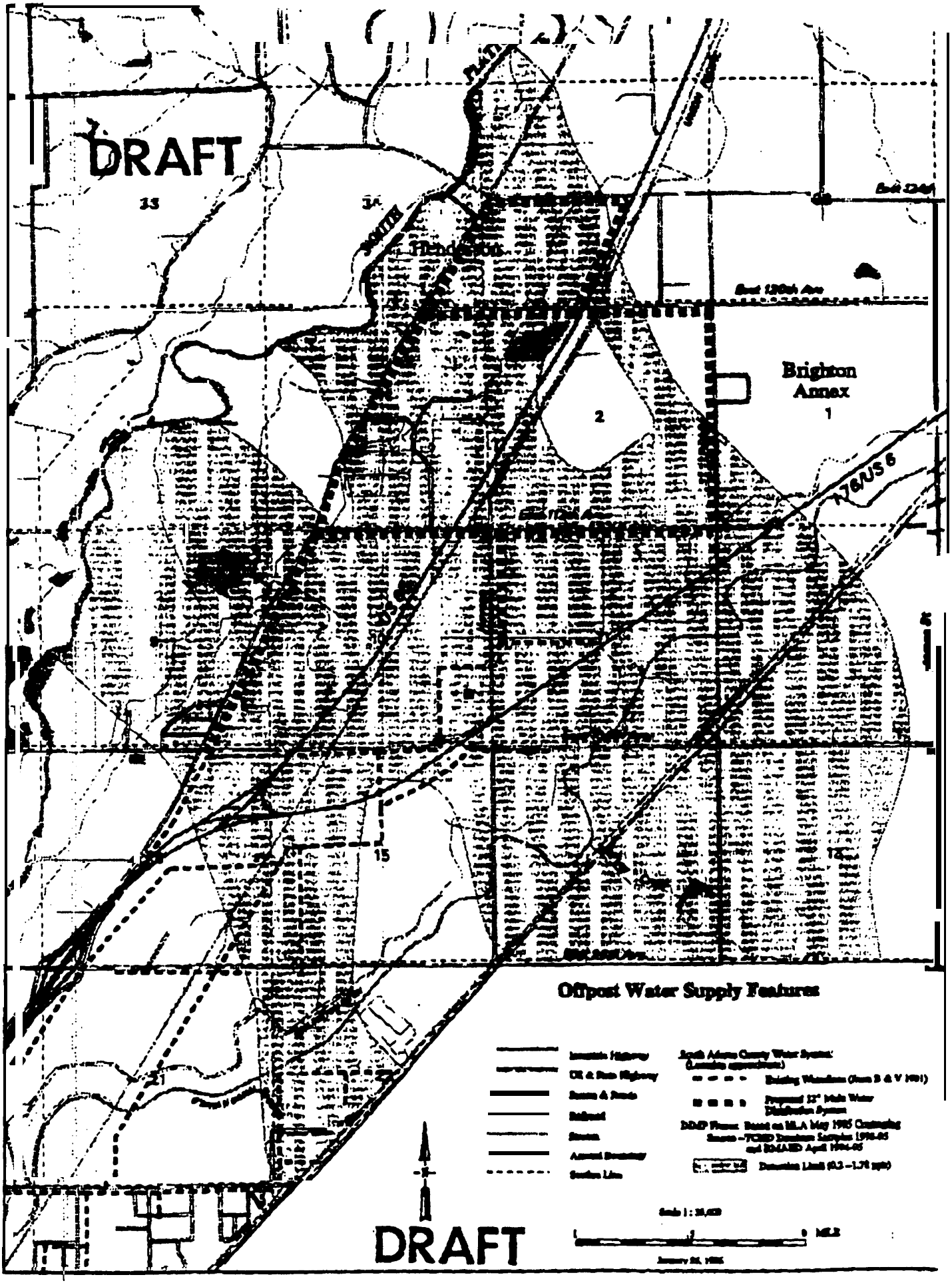
Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748



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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT. -

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms. Gerry Sarconi
League of Women Voters
Adams County Chapter
2681 E. 98th Avenue
Thornton, Colorado 80229

Dear Ms. Sarconi:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan. Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

The Army and Shell Oil Company (Shell) have reached an Agreement in Principle, enclosed with this letter, with South Adams County Water and Sanitation District (SACWSD) that includes payment of $48.8 million to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume by January 1999. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. The Parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon of this office at 303-289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646.

A Medical Monitoring Program for the surrounding communities has also been identified as part of the Proposed Plan to measure health affects, if any, during the remediation. Elements of the Medical Monitoring Program may include medical monitoring, environmental monitoring, or health/community education. Environmental monitoring will be used to evaluate the effectiveness of the remedy. The primary goals of the Medical Monitoring Program are to monitor any off-post impact on human health due to the RMA remediation and provide mechanisms for evaluation of human health status on an individual and community basis. This Program will continue until the soil remediation is completed. A Medical Monitoring Advisory Group (MMAG) has been established to evaluate specific issues covered by the Medical Monitoring Program. The MMAG is composed of representatives from the Army, Shell, U.S. Environmental Protection Agency (EPA), Colorado Department of Public Health and Environment, Tri-County Health Department, Agency for Toxic Substances and Disease Registry.

U.S. Fish and Wildlife Service (USFWS), Denver Health and Hospital, and the Site-Specific Advisory Board. The MMAG also includes representatives from the communities to Commerce City, Henderson, Denver, Montbello, and Green Valley Ranch. The League of Women Voters is also represented on the MMAG.

The Biological Advisory Subcommittee is currently deciding which chemicals to use to evaluate wildlife health at RMA.

The Army is proud of its success in cooperating with the State of Colorado, Shell, EPA, USFWS, and local stakeholders to arrive at a Record of Decision to remediate RMA, and we look forward to working with the stakeholders during the remediation as well. As you know, the ultimate goal of this process is to establish a National Wildlife Refuge at RMA, and the Army intends to maintain the land and natural resources so that the Refuge may flourish.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

League of Women Voters
Adams County
Colorado

Rec'd 18 Dec 95

On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn:AMCPM-PM/Col. Eugene H. Bishop
Building 111 - RMA
Commerce City, CO 80022-1748

Gentlemen,

Thank you for the opportunity to provide comment regarding the proposed remediation of the Rocky Mountain Arsenal.

As you review the options before you, we urge you to consider affected community appeals for adequate water supplies and delivery systems so those stakeholders can plan for their futures with confidence.

We support a medical monitoring program that not only seeks to anticipate and identify problems but also makes such information readily available to the public in a timely manner.

We ask that all parties be vigilant in their duties, meeting or exceeding those requirements regarding the disposal of hazardous waste. And that the remediation of all contaminants be accomplished with the welfare of our citizens as your uppermost consideration.

Finally, we encourage ongoing dialogue between the parties and stakeholders as a way to build a mutual respect and consideration that ultimately translates into a shared vision for the peoples, land and natural resources impacted by the activities at the Rocky Mountain Arsenal.

Respectfully,

Jerry Sarconi
President

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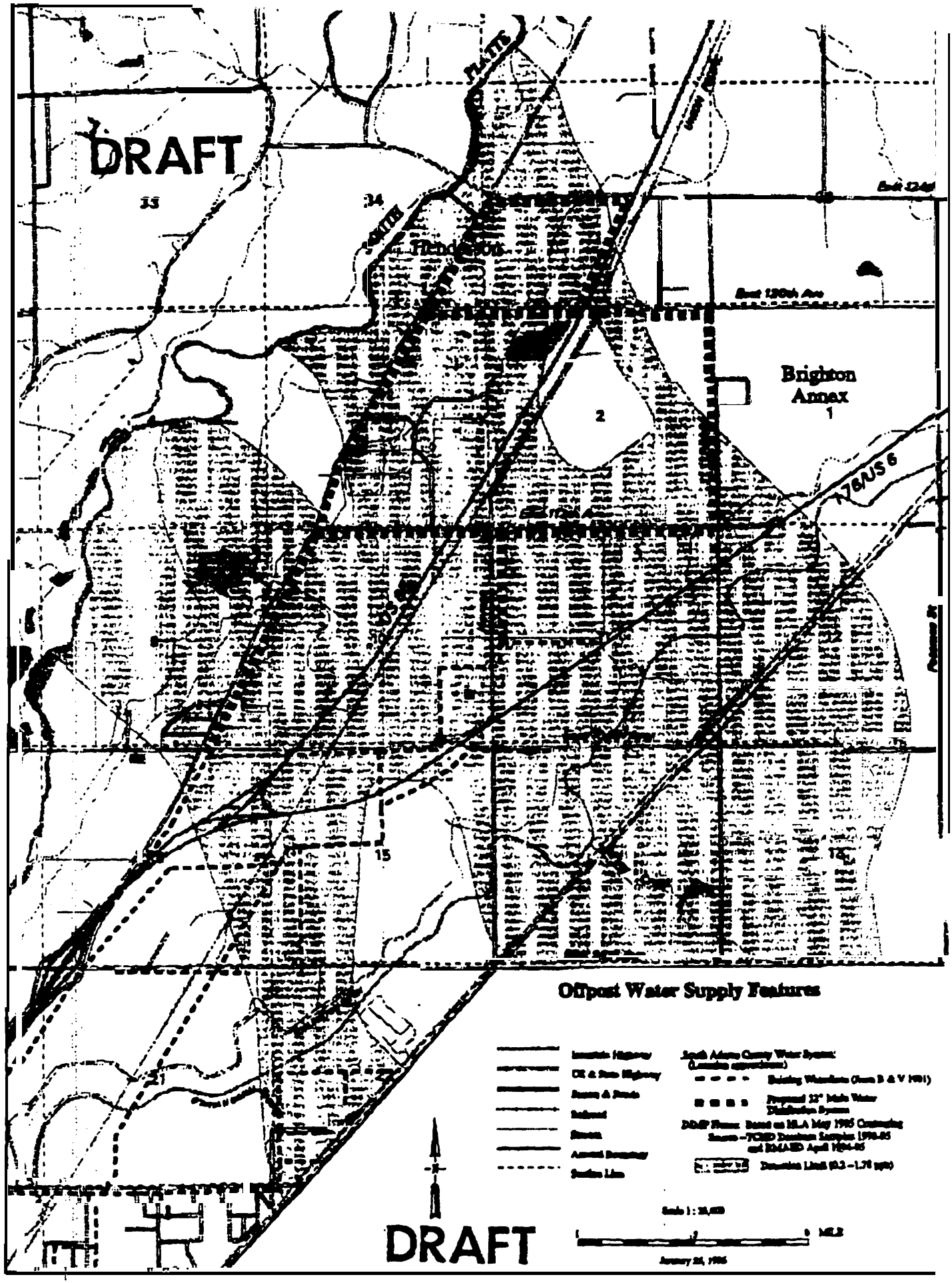

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Sierra Club

December 7, 1995
Rocky Mountain Arsenal Subcommittee
Rocky Mountain Chapter Sierra Club
1452 Northcrest Dr.
Highlands Ranch, CO 80126

Colonel Eugene H.Bishop
Building 111 - Rocky Mountain Arsenal
Commerce City, CO 80022

Sir:

The Rocky Mountain Subcommittee of the Rocky Mountain Chapter of the Sierra Club requests that an extension be granted for the submission of comments regarding the Proposed Plan for the Rocky Mountain Arsenal On-Post Operable Unit. We ask that this extension be for no less that 60 days. This will greatly aid us in our research on this important document.

Thank you for your consideration in this matter.

Sincerely,

Sandra A. Horrocks

Sandra A. Horrocks

RMA Subcommittee Chairperson

9534502-1/1

SIERRA CLUB

Rocky Mountain Chapter
777 Grant Street Suite 606 Denver, Colorado 80203 303-861-8819

December 18, 1995
Colonel Eugene H.Bishop
Building 111 - Rocky Mountain Arsenal
Commerce City, CO 80022

Sir:

It has become apparent to the Rocky Mountain Chapter of the Sierra Club that replacement water for the Off-Post area of the arsenal should be dealt with in the Off-Post ROD and not the On-Post ROD. This was not how the Off-Post area was approached initially. However, problems have arisen which are causing us to call into question the direction given to us to consider Off-Post replacement water part of the On-Post ROD.

To begin, we are not quite sure why replacement water in contaminated areas Off-Post has taken this long to resolve. It was proven many years ago that wells were contaminated, and it should have been a matter of integrity for the U.S.Army and Shell Oil Company to insure that these areas had a permanent alternate water source at that time. The amount of water replaced should have been equal to the amount of water contaminated.

Secondly, in hindsight, we do not understand why replacement water, left to be taken care of during the ROD process, should not have been handled in the Off-Post ROD. After all, the areas where this water is needed is in the Off-Post area. Also, the Off-Post Plan was considering what to do about contaminated underground water. It only makes sense that these problems should have been considered as one, which they are.

Additionally, given the fact that the replacement water is being handled as a part of the On-Post ROD, specific details regarding this water should at least be given. Merely stating that 4000 A. ft. of water will be supplied for this purpose is not enough. This is not equal to the amount of water available to the surrounding communities which has been damaged. It also does not include any detail of how this water would be divided thus opening up all kinds of possibilities for back-room deals to be made perhaps resulting in an unfair percentage of water being given to one community over another.

Finally, making replacement water a part of the On-Post ROD has resulted in the appearance that it is being used as a trading piece for the amount of clean-up that should be taking place on the Rocky Mountain Arsenal (RMA). In otherwords, it seems that if community leaders want enough water to supply their constituents then they must be willing to lower their voices in asking for RMA to be properly cleaned.

The Rocky Mountain Chapter of the Sierra Club is only asking for what is fair following the use and subsequent contamination of one of the most basic rights of all mankind...an

SIERRA CLUB
Rocky Mountain Chapter
777 Grant Street, Suite 606, Denver, Colorado 80203 303 861 8819

adequate and clean water supply. We ask that the signing of the Off-Post ROD be delayed until it can be reopened to include the Off-Post replacement water supply. We also ask that this revision include specific information such as the communities which will receive replacement water and a detail description of how much each community will receive. We see this as the only fair and rational way in which to handle this matter.

We trust that you will give your utmost attention to these concerns, and that we will receive a response to this letter.

Yours truly,

Heidi Arbury

Heidi Arbury

Chairperson - Rocky Mountain Chapter Sierra Club

Brian Andreja

Brian Andreja

Chairperson - Social Justice Committee

Kirk Cunningham

Kirk Cunningham

Chairperson - Water Quality Committee

Sue Maret

Sue Maret

Chairperson - Hazard Waste Committee

Angela Medbury

Angela Medbury

Chairperson - Pesticides Committee

Sandra Horrocks

Sandra Horrocks

Chairperson - RMA Subcommittee

cc: Bill Yellowtail, Regional Administrator, Reg. VIII, Environmental Protection Agency
Roy Romer, Governor, State of Colorado
Gail Schoettler, Lieutenant Governor, State of Colorado
Judge Dana, Judiciary Arbitration Group

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SIERRA CLUB

Rocky Mountain Chapter
777 Grant Street Suite 606 Denver, Colorado 80203 303 • 861• 8819

January 18, 1996
On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn.: AMCPM-PM/ Col. Eugene H. Bishop
Building 111---RMA
Commerce City, CO 80022-1748

Sir:

The Rocky Mountain Arsenal Subcommittee of the Rocky Mountain Chapter of the Sierra Club has reviewed the Proposed Plan for the Rocky Mountain Arsenal On-Post Operable Unit. The following points represent our comments regarding this document. Each area of concern is preceeded with a descriptive subtitle of that area.

Water, Structures and Soil

a. Water

Our viewpoint regarding the alternatives presented for water is most in line with that presented by Alternative 3. We would add that additional treatment, besides carbon filtering at the boundaries and other processing plants, needs to be added due to those chemicals which are not currently being treated such as NDMA and inorganic compounds. Also, there is no mention of the hazardous plume which has recently been identified moving southward off the Arsenal. Remediation of this plume should be a part of the ROD.

Also, we feel that the resolution of community water replacement should have been rectified many years ago. The current amount of water offered for replacement is neither adequate nor acceptable. The water replaced should be equal to the amount which was contaminated by the Arsenal over the last 54 years. The amount for each affected community should be stated up front so there is no possibility of one community making side deals for additional water at another community's expense. The amount of water should also be taken out of any negotiations for remediation at RMA since it is not a negotiable commodity.

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Rocky Mountain Chapter
777 Grant Street Suite 606 Denver, Colorado 80203 303•861•8819

b. Structures

Alternative 3 best meets our expectations for removal of structures. We are concerned that remediation of Basin A will not be satisfied by adding additional contaminated soils and structures to help provide a cap for that area. Acceptance of Alternative 2 would mean supporting the capping of Basin A which we are unable to do. We do support the recycling of as much building material as possible after appropriate detoxification. Those building materials remaining should then be placed in the on-site landfill.

We do have a question regarding the number of structures that will be left standing following remediation. What will 47 structures be used for on a wildlife refuge and which structures are they?

c. Soil

We cannot fully support any alternative proposed for soil remediation. Most of the remediation types proposed do not include treatment. If soils are not detoxified, we presume that remediation of this site will be revisited in the future thus causing further problems for residents in the vicinity of RMA. We see this as an unnecessary expense to taxpayers.

[redacted]

process. It would seem more cost effective to do a slower cleanup (due to the additional initial cost) that would be permanent and not have to be funded again in the future.

Trust Fund

The only guarantee we have that there may be any money for any lingering future problems at RMA is a trust fund. We have been asking that this be guaranteed for several years. Although the Proposed Plan does mention this trust fund, it does not guarantee that it could be implemented. We want to see a guarantee that it will be a reality.

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Rocky Mountain Chapter
777 Grant Street Suite 606 Denver, Colorado 80203 303 • 861 • 8819

Health Monitoring

We are concerned that monitoring of the populace surroundingRMA has not been carried out in the most scientific manner. We have been unhappy with the studies which have been conducted by ATSDR. We feel that studies of this type could be carried out better by the state health department of Colorado in collaboration with a volunteer advisory board. We do believe that the populace in that area deserves some type of assurance that Off-Post medical monitoring will be long-term and so be maintained both during and after remediation.

Additionally, medical monitoring should be designed to satisfy apprehensions about the remediation itself and confirm that the health of the surrounding populace is not being compromised by residence adjacent to RMA. Community trust in this program is essential for medical monitoring to be successful. In otherwards, we wish to see a more thorough and scientifically accurate monitoring program than what we have seen ATSDR provide so far.

Wildlife

Wildlife health and welfare is of particular interest to us, especially when considering that RMA has been designated as a wildlife refuge. We are pleased to see that wildlife monitoring is progressing at RMA after a very slow initial start. We would have thought that some progress on those studies would have been included in this plan to inform the public of the type of research being conducted regarding the effects of the toxic wastes on the wildlife. An explanation of what will be done to protect the wildlife during the remediation should also have been included. We will be interested in reviewing reports of animal health during and after the remedial period to evaluate any differences in health.

Additionally, the Proposed Plan does not mention which chemicals of concern will be used to determine animal health. We anticipate that this means all possible contaminants will be reviewed for wildlife health effects. For example, recent studies indicate elevated levels of the 2,3,7,8-TCDD dioxin were detected in wildlife residing in the South Plants area. This dioxin testing along with testing for other chemicals of concern should be continued in order to provide an ongoing evaluation of overall wildlife health. How can this be guaranteed?

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SIERRA CLUB

Rocky Mountain Chapter
777 Grant Street Suite 606 Denver, Colorado 80203 303 • 861 • 8819

May 30, 1995

To The United States Army, Shell Oil Company, The Environmental Protection Agency, and the State of Colorado,

The Sierra Club has received the Conceptual Agreement Components document generated from the RMA remedy negotiations (5/9 - 5/11/95). We would like to address the following concerns with the agreement:

Global Issues

1) Lack of Detoxification: After spending numerous months reviewing documents and technology alternatives, we are discouraged to see a plan which primarily utilizes containment as the lead remediation technique, rather than treatment of the chemicals of concern. We are of the opinion that innovative technologies show potential utility or clean-up at several of the areas currently slated for proposed landfilling and/or capping. We are concerned that chemicals manufactured on RMA have the potential to contaminate soil and water for many generations.

2) Landfill Utilization: During the clean-up alternatives public comment period, several of our committee members recommended a landfill be sited on the RMA *in lieu* of effective treatment remedies. However, an important component of our recommendation appears to have been overlooked. It was proposed that the landfill serve as an interim measure until an effective technology became available in the future. The current proposal indicates that the landfill would serve as a permanent remedy. This is not acceptable to the Sierra Club. While we see the need to build a landfill, we would like to see it utilized only until adequate technology becomes available for detoxification of the chemicals of concern.

In addition, we believe the current sanitary landfill should be remediated and all waste placed into the new state-of-the-art landfill. In order to guarantee the safety of our future generations, we believe these requests must be addressed.

3) Trust Fund: To guarantee adequate financial resources will be available for the completion of the clean-up, a trust fund must be established. The Sierra Club sees the creation of this fund as a commitment from the responsible parties that they are seriously committed to the surrounding community and to the remediation of this Superfund site.

4) Research and Development: The concept of research being conducted on the RMA is very important to the Sierra Club. We envision the

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SIERRA CLUB

Rocky Mountain Chapter
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Arsenal serving as a national site for innovative technologies to be pilot tested. It is obvious from the lack of detoxifying technologies in the Agreement Components Document that much additional research is needed for effective and safe remediation of chemicals such as Dieldrin. We are pleased to learn that the Hex Pits may serve as a site for technology evaluation and we fully support this idea.

5) Arsenal Tours: We believe it would be prudent of the principle parties to request a halt to public tours on RMA during the clean-up process. As this site clean-up involves movement of hazardous chemicals, the only safeguard against visitor exposure is stoppage of tours during the remediation period.

6) Wildlife Habitat: We would like to advocate protection of wildlife habitats during the remediation efforts. As the Arsenal will become a Wildlife Refuge upon clean-up completion, an assurance of adequate and un-contaminated habitat zones during the process must be provided.

7) Dioxin Testing: The issue of dioxin contamination on the Arsenal has to date not been effectively addressed. The generation of dioxins is possible from incomplete combustion processes or as by-products of chemical manufacturing. Both of these scenarios occurred on RMA. To improve public credibility, it is essential that the PRPs initiate soil sampling for dioxins.

Site Specific Issues

1) Basin A: Foremost, we are concerned that no treatment of soils will take place in this basin prior to capping the area. The potential for ground water contamination might be possible for an indefinite period of time. In all previous proposals, a de-watering and/or slurry wall barrier was recommended. We would advocate dewatering of Basin-A prior to capping. Also, many yards of soil will be placed into Basin A without prior treatment, we would like to see solidification of all soils before adding to this basin to ensure lack of chemical migration.

2) Former Basin F: Although a treatment technology is proposed for this site, we question the effectiveness of soil solidification. This method was not previously discussed during the innovative technology meetings. Also, because only the first ten feet will be treated, the potential for ground water contamination is possible from chemical movement in the lower soil depths.

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Rocky Mountain Chapter
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3) Basin F Wastepile: We are pleased that the wastepile will be stored in a celled landfill. however, we have two areas of concern: (1) lack of detoxification; and (2) odor abatement. The detoxification issue was previously addressed in global issues #1. Odor generation during excavation of the wastepile is a topic which must be addressed. We would like to see air emission monitoring devices in place for the duration of the wastepile excavation. For the protection of the surrounding communities, an enclosure surrounding the excavation sites is advocated.

4) South Plants: The proposed excavation to 5 feet should be increased to ten feet to be fully protective of human health.

5) North Plants: In the Conceptual Agreement Document there is no indication of the depth of soil which will be excavated for placement in the landfill. We would encourage the parties to adhere to a depth no less than 10 feet.

6) Pits/Trenches: The Army and Shell trenches may contain extremely hazardous materials. We would agree with the proposal of expanding the slurry walls prior to capping the sites.

The proposal of utilizing an innovative technology for the remediation of the Hex Pits is supported by the Sierra Club. We would like to see more information as to the options for technologies considered.

M-1 pits: What solidification technology will be used to stabilize the chemicalas ?

7) Chemical Sewers: In the South Plants region, no treatment of chemicals or movement of soil is proposed. We are concerned about continued groundwater contamination if the suggested actions are followed.

8) Groundwater: There are several issues we would like to see addressed in the groundwater proposal.

(a.) Why isn't de-watering still a viable option for the basins ?

(b.) Appropriation of water from alternative sources-what is the current status of this proposal ?

(c.) Boundary system-We would like some written assurance as to the length of time the system will be operational.

(d.) The proposed 4,000 acre feet is inadequate to meet the growing needs of the surrounding communities. We would like to see this allocation increased. Also, we would like some clarification as to who would be responsible for hook-up fees once the main system is installed.

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(9) Surficial Soils: We would like to see a proposal for soil contamination not equivalent to biota exceedance levels. This is a relevant issue in regard to wildlife health on the Arsenal. A provision should be included to account for future data generated from animal studies if lower chemical exposure is shown to cause adverse effects.

(10) Off-post: This is an issue not yet addressed: We would advocate treatment of contaminated soils or landfilling them as an interim action.

(11) Montbello: This is an issue not yet addressed: We would strongly recommend soil and health screening be conducted in this community. It is critical to the PRPs for maintaining community relations.

As we have worked diligently as volunteers on numerous issues relating to the RMA, we hope you will keep us informed as to any modifications of the Conceptual Agreement. We look forward to receiving your written responses addressing these issues. Thank-you.

Sincerely,

Sandy Horrocks

Sandy Horrocks
Sierra Club Rocky Mountain Arsenal Subcommittee Chairperson

recycled paper

GALILEO INTERNATIONAL

To:	Ruthie
Company:	U.S. Army
Phone:	
Fax:	289-0582
From:	Sandy Horrocks
Company:	GALILEO International
Phone:	
Fax:	(303)397-5299 or 5296
Date:	1/19/96
Pages Incl. this cover page:	9

Comments:

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms. Sandra Horrocks
Chairperson, RMA Subcommittee
Sierra Club
Rocky Mountain Chapter
777 Grant Street, Suite 606
Denver, Colorado 80203

Dear Ms. Horrocks and Sierra Club Members:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan. Public input is an important component in the remediation process, and your participation helps maintain the dialogue between the Army and the public.

Your letter dated December 7, 1995, requested that the comment period for the On-Post Proposed Plan be extended by no less than 60 days; other parties requested that there be no extension whatsoever so that the Record of Decision (ROD) would not be delayed. In order to allow additional time for comment without excessively delaying the ROD, the comment period was extended by 30 days.

Your letter dated December 18, 1995, stated your belief that the replacement water for the off-post area of RMA should be dealt within the Off-Post ROD. The alternative water supply is addressed in the On-Post ROD because it is part of the overall on-post remedy, not the off-post remedy The containment portion of the on-post remedy requires leaving some waste in place under a cap or in a hazardous waste landfill. For that reason, the Army decided to provide a separate water supply to alleviate any concerns the public may have about leaving the waste in place The Off-Post ROD was signed by the Army and the U.S. Environmental Protection Agency (EPA), and the State of Colorado concurred on December 19, 1995.

In response to your comment requesting details about an alternative water supply, the Army and Shell have reached an Agreement in Principle, enclosed with this letter, with the South Adams County Water and Sanitation District (SACWSD) that includes payment of $48.8 million by the Army and Shell to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume by January 1999. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs.

If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon of this office at (303) 289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646.

Your letter of January 18, 1996, contained several additional comments on the On-Post Proposed Plan, and the Army's responses are contained in the enclosure to this letter. Also enclosed are responses to your letter dated May 30, 1995.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosures

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U S Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

U.S. ARMY RESPONSES TO COMMENTS ON THE ON-POST PROPOSED PLAN FROM THE SIERRA CLUB, ROCKY MOUNTAIN CHAPTER, DATED JANUARY 18, 1996

1. Water, Structures, and Soil

a. Water

The Army believes Alternative 4 is superior to the other groundwater remedial alternatives for the On-Post Operable Unit for the following principal reasons:

- Alternative 4 is preferable to Alternatives 1 and 2 because it provides additional reduction of toxicity, mobility, or volume of contaminated groundwater at a reasonable cost and with minimal short-term effects. It is also readily implementable.

- Although Alternative 3 provides greater reduction of toxicity, mobility, and volume than Alternative 4, it is less readily implementable than Alternative 4. Furthermore, when considered in conjunction with the preferred soil alternative and the continued operation of the boundary groundwater containment and treatment systems, Alternative 3 provides limited added benefit compared to Alternative 4 at a significantly higher cost.

The Army is currently conducting N-nitrosodimethy lamine (NDMA) treatment studies in water and taking steps to lower the analytical detection limit as required by the Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal (RMA Conceptual Remedy), which was signed by the Parties on June 13, 1995. The Army is continuing to work with its laboratory on this issue. If additional treatment is warranted at the boundary systems, the Army is committed to implementing the appropriate treatment system to meet the Remediation Goals set forth in the Record of Decision (ROD)

Regarding your comment about the "hazardous plume moving southward off the Arsenal", no such groundwater plume has been identified by the extensive groundwater monitoring programs the Army conducts annually. The water table elevation in the southeast corner of RMA is approximately 5,300 feet above mean sea level (ft M S L), and the elevation of the water table at the South Platte River is approximately 5,000 ft M S L Therefore, groundwater flows downhill generally from the southeast corner of RMA toward the South Platte River Superimposed on the regional gradient is a groundwater mound in South Plants The mound is created by leaking pipes, increased recharge from unlined ditches and ponded areas, and may also be the result of natural variations in the permeability of the alluvium and bedrock in the area. Groundwater in the area of the mound flows radially out from the mound in all directions. A groundwater divide occurs at the confluence of the regional flow system and the mound. As a result, groundwater

entering RMA from the southeast is forced to turn either east or west around the South Plants area. Water flowing south from the mound area is forced to change direction and join the regional flow system. The groundwater flow direction in the confined Denver Formation is also from southeast to northwest. Groundwater flow upgradient (southward) from the southern boundary of RMA is physically impossible.

In response to your comment requesting details about an alternative water supply, please see Paragraph 4 of the cover letter attached to these responses.

b. Structures

The Army realizes that there are remaining issues involving the selected remedy for RMA. The concerns about the short-term risks and effects of excavation and treatment were weighed against the potential long-term effects of containing the waste in place. The public has also been concerned about thermal processes such as incineration because of potential emissions. The Army's chosen remedy minimizes the short-term risks of exposure to workers and the community because soil-borne contaminants are left in place. The cap/cover and landfill designs will comply with applicable federal, state, and local regulations. Please see also the response for Comment number 1 c below.

The future-use structures are those necessary for operation of the Refuge and for continued operation and maintenance of the selected remedy. The structures generally are warehouses, bunkers, the firehouse, a new Visitor's Center, a farmhouse, operations and maintenance (O&M) facilities in the vicinity of the present administration building, treatment system structures, and cap and landfill O&M structures. The structures will be used for the purposes of remediation, interpretive tours, and refuge management, including the U.S. Fish and Wildlife Service (USFWS) repositories The USFWS is still in the process of determining the actual number of structures that will be necessary for Refuge management. These structures are indicated in Section 5 of the ROD.

c. Soil

The Army understands your concern that the soil be remediated properly, and believes that the approach of placing the nonhazardous material under the Basin A cover will adequately immobilize contaminants, will be protective of human health and the environment for the long term, and will provide a cost-effective method for disposal of nonhazardous materials. The principal threat and human health exceedance soil will be disposed in the on-post hazardous waste facility at RMA. In addition, a large volume of fill material will be required to construct the Basin A Consolidation Area, and the RMA nonhazardous material will satisfy that need. Furthermore, by using this nonhazardous material onsite, there will be no negative impact from a very large number of trucks moving through the surrounding community to transport nonhazardous waste and potential new fill material.

Your comment references the presentation on alternative remediation technologies during the winter of 1995, and you express concern that some of those technologies could have been used in the selected remedy, as well as expressing a desire for a slower remediation in order to use those technologies The Army has received numerous public comments regarding both these issues through various avenues. Concerns were expressed by the public about many innovative technologies during the public process; many participants preferred proven technologies and minimal disturbance of the site. The Army has considered those concerns in choosing what it believes to be the best remedy for protection of human health and the environment, as well as one that is timely and cost-effective.

2. Trust Fund

During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operation and maintenance of the remedy. The Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the ROD. Principal and interest from the Trust Fund would be used to cover the costs of long-term operation and maintenance throughout the lifetime of the remedial program. These costs are estimated to be approximately $5 million per year (in 1995 dollars).

The Parties intend that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund. The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remediation sites. The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the actions federal agencies can take with respect to such legislation. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated

A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders and will be convened within 90 days of the signing of the ROD.

3. Health Monitoring

The effects on human and wildlife health of many of the compounds produced at RMA have been studied for many years, and this information is available at the Joint Administrative Record Document Facility (JARDF). Studies have been completed by the Agency for Toxic Substances and Disease Registry (ATSDR) independently and in conjunction with the Colorado Department

of Public Health and Environment (CDPHE). These studies showed no conclusive health impact on the communities surrounding RMA. Also, the final Public Health Assessment, produced by ATSDR, should be complete in the summer of 1996.

A Medical Monitoring Program for the surrounding communities has also been identified as part of the On-Post Proposed Plan. The primary goal of the Medical Monitoring Program is to monitor any off-post impact on human health due to the RMA remediation. Elements of the Program could include medical monitoring, environmental monitoring, or health/community education. This Program will continue until the on-post soil remediation is completed. A Medical Monitoring Advisory Group has been established to evaluate specific issues covered by the Medical Monitoring Program. The Group is composed of representatives of the Army, Shell Oil Company, the U.S. Environmental Protection Agency (EPA), CDPHE, Tri-County Health Department, ATSDR, the USFWS, Denver Health and Hospitals, and the Site-Specific Advisory Board. The Group also includes representatives from the communities of Montbello, Commerce City, Henderson, Green Valley Ranch, and Denver. The Army and Shell will fund ATSDR to conduct this effort in coordination with CDPHE. If you would like more information on the Medical Monitoring Program or wish to participate as part of the Medical Monitoring Advisory Group, please call Ms. Mary Seawell of CDPHE at 303-692-3327.

4. Wildlife

Your comment regarding the need for an explanation of what will be done to protect the wildlife during remediation is noted. During the remedial design and implementation phase after the ROD is signed, each project will include measures to minimize the impact on wildlife during implementation; these measures will vary according to the response action being taken. In addition, the USFWS will manage the wildlife populations and, in coordination with the Army and other Parties, monitor the protectiveness of the implementation measures taken.

The Biological Advisory Subcommittee (BAS) is currently evaluating which chemicals to use to evaluate wildlife health at RMA. Dioxin and furan sampling was undertaken by the CDPHE, and these results are currently being evaluated by the BAS.

5. Overall Plan

The Army is interested in public comments and concerns and has made a substantial effort to hear those concerns through the Restoration Advisory Board, the Site-Specific Advisory Board, stakeholder meetings, and also through avenues of public comment such as the comments on the On-Post Proposed Plan. The Army believes it has been consistent in representing the progress of the remedy to the public. In fact, the Army has held more than 20 public meetings and workshops in order to facilitate public input. Regarding your statement that the public was not invited to participate in the drafting of the Agreement for a Conceptual Remedy, the Army and other Parties

considered the public concerns and incorporated many as they drafted the Agreement. The Army believes the selected remedy is responsive to the public's concerns and is protective of human health and the environment.

In response to your last comment regarding the types of technologies reviewed, many technologies including those previously advanced by your organization were reviewed and considered before the selected alternative was chosen.

The May 30, 1995, letter you enclosed was also available and considered in the discussions leading to the June 13, 1995, Agreement for a Conceptual Remedy. Responses to those comments are attached.

U.S. ARMY RESPONSES TO COMMENTS ON THE CONCEPTUAL AGREEMENT COMPONENTS FROM THE SIERRA CLUB, ROCKY MOUNTAIN CHAPTER, DATED MAY 30, 1995

Global Issues

1. Lack of Detoxification

The RMA remedy was selected after considering issues such as short-term versus long-term effects and the preferences of the Parties and stakeholders involved in the process. The remedy includes continued water treatment at the boundaries and at existing internal systems, in situ solidification of Former Basin F, and, subject to the results of treatability testing and technology evaluation, use of innovative thermal technology for treatment of part of the Hex Pit material in addition to landfilling and containment. Extensive monitoring of soil, water, and air will ensure the safety of the public and indicate whether additional action is necessary.

2. Landfill Utilization

The new state-of-the-art, hazardous waste landfill will safely and permanently contain the waste. Monitoring will ensure that operational requirements are met. Please refer to the response to Comment 1 regarding treatment.

The sanitary landfills will be excavated. Human health exceedance material will be disposed in the new landfill. The remaining debris and soil will be consolidated under the Basin A cover.

3. Trust Fund

Please see the response to Comment 2 in your January 18, 1996, letter

4. Research and Development

Treatability studies will be conducted as part of the remedial design phase for the innovative thermal technology selected for a portion of the Hex Pit materials. RMA will not serve as a national site for pilot testing of innovative technologies It should be noted that several treatability studies have been completed for or at RMA, including enhanced soil vapor extraction, radio frequency heating, oxidation, sorption, and in situ biological treatment.

5. Arsenal Tours

RMA tours will continue during the remediation process, but will not be conducted in areas under remediation. Visitor safety will be ensured through controlled access and monitoring.

6. W ldl fe Hab tat

Please see the response to Comment 4 in your January 18, 1996, letter.

7. Dioxin Testing

Dioxin and furan sampling was undertaken by CDPHE, and the analytical results are presently being evaluated by the Biological Advisory Subcommittee. Although the Army believes that the currently identified contaminants of concern include all contaminants representing the greatest potential for risk, other contaminants may become a concern in the future (e.g., dioxin). In such an instance, the contaminant will be evaluated with respect to the remedy selected, designed, or implemented to ensure that the remedy remains protective of human health and the environment.

Site-Specific Issues

1. Basin A: The Army believes that the Basin A remedy will safely contain the waste without the risks associated with removal. You are correct that slurry walls and active dewatering (through) pumping have been proposed. However, groundwater modeling of the area showed that a slurry wall would add only minimal benefit because of the low-permeability soil in the area It should be noted that groundwater migration out of Basin A is very slow. Migration rates will be further reduced through installation of the Basin A cover, which will passively dewater the area. Solidification of soil before placing it in Basin A would not reduce the risk further than containment and passive dewatering will.

2. Former Basin F

Treatability tests will be conducted to ensure that adequate solidification can be achieved. Solidification, combined with capping of the entire Former Basin F site (including the Basin F wastepile footprint), and therefore passive dewatering, will minimize contaminant migration. Due to past and expected future lowering of the water table in this area, chemical movement is not expected to be a problem.

3. Basin F Wastepile

Excavation will be conducted using vapor- and odor-suppression measures as necessary. In the event that the wastepile soil fails EPA's paint filter test, moisture content will be reduced to acceptable levels by using a dryer in an enclosed structure. Volatile organic compounds (and possibly semivolatile organic compounds) released from the soil during the drying process will be captured and treated; however, the main objective of this process is drying. Prior to excavation of the wastepile, overburden from the existing cover will be removed and set aside. The excavated area will be backfilled with on-post borrow material and stockpiled overburden.

4. **South Plants**

The excavation of 5 feet of principal threat and human health exceedance soil in the South Plants Central Processing Area is protective of human health and the environment. Excavation to a greater depth would cause problems such as interferences with sewer lines. The excavated area will be backfilled and protected with an additional 5 feet of soil cover.

5. **North Plants**

Human health exceedance soil will be excavated to a 1-foot depth in North Plants. The entire North Plants area will be contained under a 2-foot soil cover.

6. **Pits/Trenches**

Subject to the results of treatability testing and technology evaluation, approximately 1,000 bank cubic yards (BCY) of principal threat material from the Hex Pit will be treated using an innovative thermal technology. Solidification will become the selected remedy if evaluation criteria for the innovative technology are not met. The remaining 2,300 BCY will be excavated and disposed in the on-post hazardous waste landfill.

The mixture of solidification/stabilization agent to be used for the M-1 Pits will be determined through treatability testing during remedial design.

7. **Chemical Sewers**

For sewers located within the South Plants Central Processing Area and Complex Trenches area, the sewer void space will be plugged with a concrete mixture to prohibit access to these lines and to eliminate them as a potential migration pathway for contaminated groundwater The plugged sewers will be contained beneath the soil cover or cap in their respective sites.

8. **Groundwater**

(a) The containment actions in Basin A and Basin F will result in passive dewatering (lowering of the water table through minimized infiltration). No further dewatering is necessary to achieve the required groundwater levels.

(b) Please refer to the response to Comment 1a in the January 18, 1996, letter.

(c) Shutoff criteria have been developed for the boundary systems to ensure that the systems will operate until water at the boundary has met these very specific criteria.

(d) Please refer to the response to Comment 1a in the January 18, 1996, letter.

9. **Surficial Soils**

The Biological Advisory Subcommittee (BAS) will continue to evaluate potential impacts on biota and recommend additional areas for remediation if necessary. In the event additional remediation is necessary, only the areas would change, not the remedies.

10. **Off-Post Operable Unit**

The 160 acres of soil off-post that you refer to were tilled to a depth of approximately 12 inches and were revegetated. A final inspection of the site will be conducted in late 1996.

11. **Montbello**

The Army and Shell will fund ATSDR to conduct an RMA Medical Monitoring Program in coordination with CDPHE. The program's nature and scope will include baseline health assessments and be determined by the on-post monitoring of remedial activities to identify possible exposure pathways to off-post communities, including Montbello.

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. .DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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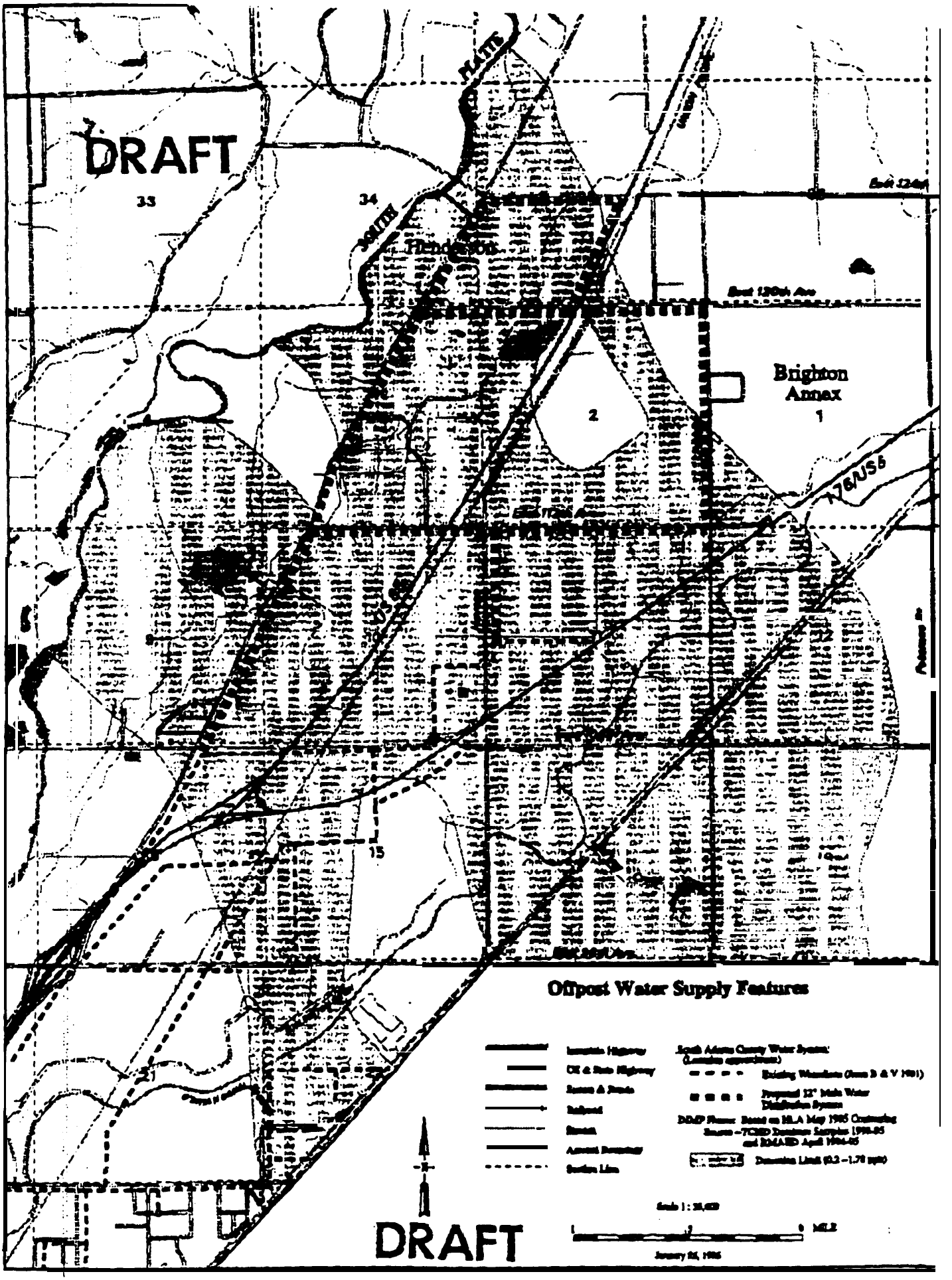
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Public Meeting Transcript

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ROCKY MOUNTAIN ARSENAL PUBLIC MEETING

ON THE PROPOSED PLAN FOR FINAL CLEANUP

November 18, 1995

Held at the Rocky Mountain Arsenal, Building 111-A, commencing at 9:10 a.m., November 18, 1995, before Melanie L. Humphrey-Watkins, Registered Diplomate Reporter and a Notary Public of the State of Colorado.

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P R O C E E D I N G S

(Meeting proceedings convened 9:10 a.m., November 18, 1995.)

MR. ZEIK SAIDMAN: Let me introduce myself. My name is Zeik Saidman. I've been asked to facilitate this meeting today, this public meeting. I work for the University of Colorado-Denver at the graduate school of public affairs. And I'll explain a little bit more my role in a couple minutes.

I want to turn it over to Patricio, who is the interpreter, and he has a few minutes.

(Discussion in Spanish off the record.)

MR. ZEIK SAIDMAN: Thanks, Patricio.

The participants felt that it was -- the -- that it was important to have a translator here, and we appreciate Patricio coming by.

I'm going to go over a proposed agenda and desired outcomes for today's meeting and talk, also, about the ground rules about how to conduct a successful meeting.

And this is a -- the desired outcomes and proposed agenda I'm going to go over. And we have -- before we do that, we want to have a welcome from Colonel Bishop.

COLONEL BISHOP: Good morning, ladies and

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gentlemen.

In spite of the government shutdown, we felt that this meeting was important enough to make special funding arrangements for my people to be able to come out here and interact with you all on the proposed plan. And we were able to do that, thanks to some special financial arrangements that we do have and a special fund.

We feel that your input is critical and has been. This is not the first time we have gone into the public arena seeking your input and comments on the final remedy of the Rocky Mountain Arsenal. And that's really what we're here to address today. Your input is important to us and has been over the past two years that we've been in the public forum.

This is the official public meeting for the Rocky Mountain Arsenal proposed plan under the CERCLA process. And we would like to welcome you here this morning. We hope you have an enjoyable experience.

Let's see. I guess about two years ago I took you out and showed you my incinerator. I can't do that today, folks. It's gone. I promised you I'd start it up and operate it safely and shut it down, and I'd tear it down. And it's torn down. So one less thing on the landscape for you to see.

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And usually, these prairie critters generally put on a pretty good show, in spite of the rest of it.

So please enjoy your day, give us your comments. Thank you for coming out.

Zeik, it's all yours.

MR. ZEIK SAIDMAN: Thank you, Colonel.

Again, let me go through the desired outcomes for today's meeting, make sure you're in the right meeting and what we are planning to do today.

Desired outcomes for today's meeting is to present to the community a proposed plan to remedy the situation, answer questions about the proposed plan, and listen to and officially record community comments about the proposed plan. And we have a court reporter over here.

How does that sound? And I need some kind of feedback from you. Does that sound like the desired outcomes for today's meetings? Is that your expectations for today? Give me a few nods out there if that's okay.

Okay.

All right. To get to that -- we're starting a few minutes late. We'll go -- I think we started about five, seven minutes late. We'll honor

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1 that and go on the other side of the time. But we're
2 going through the agenda right now. We had the
3 interpreter's comment, welcome from Colonel Bishop.
4 I will explain my role, going through the proposed
5 agenda, desired outcome.
6 We have ground rules for successful
7 meetings. I want to share with -- that with you in
8 a minute, an introduction of the panel. They'll
9 introduce themselves in a few minutes. We think
10 that will take about 15 minutes or so. Then
11 Charlie Scharmann has a video that maybe a few of you
12 have seen but probably many of you haven't, and that
13 runs about 15 minutes.
14 Then Charlie will go over the highlights of
15 preferred alternatives around water, structures,
16 soil, clarification period. We look at that lasting
17 about a half an hour.
18 Then we have a break, and I saw the
19 wonderful cookies and everything on the other side,
20 so we will take about a ten-minute break. And then
21 we have an hour for formal public comment period.
22 And if we need to take longer, we're willing to take
23 longer. But we've talked to people, and they like
24 the time agenda. They like to know that there's an
25 ending time for this. But again, the panel and the

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1 court reporter are willing to stay here till
2 everybody has a chance to be heard.
3 Okay? How does that agenda look? Does
4 that make sense to people?
5 Okay. All right. Let me talk about my
6 role a little bit.
7 I was asked to come in. Again, I work with
8 UCD, the graduate school of public affairs at the
9 university. And I'm a neutral. I don't have any
10 interest in the substantive matters of this -- of
11 these issues.
12 My job is to make the meeting run smoothly
13 and keep everything on track and focused. And if
14 it's okay with you, I'll act as a timekeeper so we
15 have a sense of how we're moving along. Is that
16 okay, that I be the timekeeper for today's meeting?
17 Again, your job is to say, "Okay. That
18 makes sense to me." Okay. All right.
19 AUDIENCE SPEAKER: What if we say no?
20 MR. ZEIK SAIDMAN: No? Do you have a
21 problem with that?
22 AUDIENCE SPEAKER: No. I say, what if we
23 say no?
24 MR. ZEIK SAIDMAN: Just say no. Just say
25 no and I'll ask you why.

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1 Thank you. Yeah, you can say no or say, "I
2 have a problem with that."
3 AUDIENCE SPEAKER: Because you've got a
4 watch.
5 MR. ZEIK SAIDMAN: I have a watch. And
6 I'm -- my job is to help enforce ground rules about
7 this meeting. And simply, our experience is that
8 certain meetings run better than others if people
9 follow these rules. And let me share them with you.
10 This is a graphic representation.
11 Respect each other's time. We want
12 everybody to have a chance to be heard. And maybe
13 you've been at or viewed a meeting where people will
14 go on and on and on, and other people that want to be
15 heard don't have a chance. When we have the formal
16 comment time, my suggestion is we run about
17 three minutes apiece. And if people have to speak
18 longer, they can come back around again.
19 But I think we can make -- everybody can
20 make cogent comments in three minutes. And of
21 course, there's public comment cards here -- are
22 they over there, Cathy?
23 MS. CATHY COFFEY-WEBER: Yes.
24 MR. ZEIK SAIDMAN: Public comments cards.
25 You can send in -- if you have something written out,

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1 you can send that in until December 15th, I believe.
2 So there's opportunities. And we would
3 just suggest that you highlight your comments in
4 those three minutes. Does that make sense to
5 people --
6 AUDIENCE SPEAKER: Yes.
7 AUDIENCE SPEAKER: Yes.
8 MR. ZEIK SAIDMAN: -- in terms of time?
9 Okay. Because I know that -- again, we
10 will stay here as long as we need to, but there are
11 some bus tours scheduled and those kind of things.
12 No shaggy dog stories. And that simply --
13 that doesn't mean that you couldn't bring your pet;
14 that just means that we're trying to stay on the
15 topic. We're trying to stay on the topic, which is
16 the proposed final plan. And I will occasionally
17 intervene if we feel that you're off on some other
18 topic that we can put in what we call a bin, we can
19 get to come back to that. And some people may want
20 to talk to you; I'm sure some of the panelists
21 would. But this is on the proposed final plan. I
22 would definitely come back.
23 This is a cowboy with a gun. And
24 basically, it's hard on the issues, easy on the
25 people. These are complicated problems. They're

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1 not -- there's not very -- there's not a lot of
2 easy answers to this thing. So hard on the issues,
3 easy on the people. You know, personal attacks, I
4 will try to intervene on those kind of things.
5 The colonel -- I didn't think it was
6 proper for me to interrupt the colonel, but we're
7 trying -- at least probably for the facilitator.
8 When we use acronyms and jargon -- help me out, too.
9 I might miss them but we'll try to have people
10 explain to us. Especially when you're in the
11 culture, you start using them, and people don't
12 know -- the public doesn't know what you're talking
13 about sometimes.
14 Keep side conversations to a minimum. It's
15 distracting to your neighbors and people up front if
16 you're talking and having long conversations.
17 Listen -- this is an ear. Can you see
18 that now? I want to put this up a little higher.
19 Listen for understanding. Listen, panelists,
20 audience. Listen for understanding.
21 In our society we tend to think about
22 reloading versus listening. Okay. Well, let's try
23 to listen to each other.
24 And take care of your personal needs. We
25 rent coffee so you don't need a hall pass from me or

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1 anything like that.
2 Okay. So does that make sense in terms of
3 running a successful meeting? Is there anything else
4 that we should add? Does everybody agree with that?
5 Again, nods. Let me ask you this: Whose
6 responsibility is it to enforce these ground rules?
7 AUDIENCE SPEAKER: You.
8 AUDIENCE SPEAKER: Yours.
9 MR. ZEIK SAIDMAN: And everyone. It's all
10 of our responsibility. So if that's okay with
11 everybody, let's try to honor those.
12 MR. RICK WARNER: Could I make a request?
13 MR. ZEIK SAIDMAN: Yeah.
14 MR. RICK WARNER: Those ground rules are
15 fine with me if you allow this meeting to go on for
16 as long as it takes, even if that's several days.
17 MR. ZEIK SAIDMAN: Did you come in late?
18 MR. RICK WARNER: Yes.
19 MR. ZEIK SAIDMAN: Because I mentioned that
20 several times, that anybody --
21 MR. RICK WARNER: Okay.
22 MR. ZEIK SAIDMAN: -- who needs to be heard
23 and feels they didn't have the chance to be heard, we
24 are going to take that opportunity. The panel is
25 willing to stay here, and so is the court reporter.

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1 But we are asking people to limit their
2 comments up front to about three minutes apiece, and
3 then the next person can speak so everybody has an
4 opportunity to speak. And that person can come back
5 and speak again and speak as long as they want.
6 Is that okay with everybody?
7 Okay. All right. And I think -- let's
8 see. Now we're at the point right now where I
9 introduce the panel, and the panel will give their
10 name and organizations. And when you speak, also
11 just give your name, too, and if you're with an
12 organization.
13 Charlie?
14 MR. CHARLES SCHARMANN: I'm Charlie
15 Scharmann. I'm the technical director out here for
16 the Army. I coordinate the technical aspects of the
17 cleanup program for Colonel Bishop, and I'll be
18 taking about some of those things this morning.
19 MR. ZEIK SAIDMAN: Okay. Barbara.
20 MS. BARBARA NABORS: Good morning. I'm
21 Barbara Nabors. I'm an engineer with the State, and
22 I serve as the coordinator for our staff at the
23 Colorado Department of Public Health and
24 Environment. I'm really pleased to see a lot of new
25 faces out here than we have had at some of the

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1 previous meetings. This meeting represents kind of a
2 culmination of years of work between all of the
3 parties, and so it's really important that you take
4 this opportunity to give us your comments, either
5 verbally today or later, through the mail.
6 The world at stake here at the Arsenal is
7 one of watchdog. We have to make sure that the broad
8 spectrum of environmental laws of the State are
9 followed and represent the citizens of Colorado.
10 MR. ZEIK SAIDMAN: Thank you, Barbara.
11 Can everybody hear the panelists?
12 AUDIENCE SPEAKER: Yes. Yes.
13 MR. ZEIK SAIDMAN: We had a -- Murphy's
14 law. We had a little technical difficulty with the
15 mics this morning. And so just put your hand up if
16 you have trouble hearing any of the people speaking.
17 Laura?
18 MS. LAURA WILLIAMS: Good morning. I'm
19 Laura Williams. I'm the team leader for the
20 Environmental Protection Agency here at the Arsenal.
21 And I first would like to personally acknowledge the
22 commitment and energy that each one of you
23 demonstrates just by being here this morning. I know
24 it takes time and effort to actually come out to one
25 of these meetings.

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1 Public involvement and comment process for
2 EPA – I'm sorry, that's Environmental Protection
3 Agency -- is very important to me, as well as the
4 Agency, and so I strongly encourage each and every
5 one of you to make use of this time and to provide
6 your comments to us.
7 In fact, I know it's not fashionable to
8 support the government, but if you actually like the
9 remedy, it's all right to say so here, as well, and
10 none of us will hold it against you. So please feel
11 free.
12 The remedy that results from this proposed
13 plan that we're discussing today is a commitment that
14 the parties you see up here today are making to clean
15 up the Arsenal. But I want you to know that it
16 doesn't end the public comment process. You're
17 welcome to provide more input as the designs continue
18 and as cleanup continues. And in fact, we would
19 welcome that partnership with the community.
20 Thank you.
21 MR. ZEIK SAIDMAN: Thank you, Laura.
22 Ray?
23 MR. RAY RAUCH: My name's Ray Rauch. I'm
24 the project leader for the Fish and Wildlife Service
25 out here at the Arsenal. I do like to thank you for

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1 coming out on this very nice day. I think we'd all
2 like to be outside somewhere. But this is very
3 important. It's kind of a milestone here. And I'd
4 also like to tell you why the Service is involved
5 out here.
6 We have two concerns out here. One, we're
7 a co-trustee for natural resources here at the
8 Arsenal. And secondly, with the refuge act passed
9 in '92, this will be a national wildlife refuge, and
10 the Service has been charged with managing as if it
11 was a national wildlife refuge now, subject to the
12 cleanup.
13 Again, thank [illegible] for coming out.
14 MR. ZEIK SAIDMAN: Thank you, Ray.
15 Michael?
16 MR. MICHAEL ANDERSON: Good morning. My
17 name is Mike Anderson. I'm the project manager with
18 Shell Oil Company. Shell has been active in the
19 actions that have taken place out here at the Arsenal
20 over the last ten years or so. And we are committed
21 to follow through on the safe and effective cleanup
22 of the Arsenal.
23 We have very much appreciated the
24 participation by stakeholders in participating in
25 giving us your thoughts on where the remedy for the

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1 Rocky Mountain Arsenal ought to be, and we appreciate
2 you all coming out this morning so we can hear any
3 additional concerns that will help us move forward
4 with the remediation.
5 MR. ZEIK SAIDMAN: Thank you, panel.
6 I think now we're about on time for showing
7 the video. How many -- just curious. How many of
8 you have seen the video?
9 Oh. Okay. About a third of the room.
10 Well, Charlie, I'm going to turn it over to
11 you for your presentation.
12 MR. CHARLES SCHARMANN: Okay.
13 MR. ZEIK SAIDMAN: We have to hand off the
14 mic here.
15 MR. CHARLES SCHARMANN: Okay.
16 Good morning again and welcome. I see some
17 familiar faces. I'm glad to see you back out here.
18 I see some new faces. I welcome you and hope you
19 continue to stay interested in the Arsenal program.
20 We have monthly meetings with what we call
21 our Restoration Advisory Board the first Thursday of
22 every month, and that's another opportunity for folks
23 to come out and just check on the status of things.
24 But this is a big milestone for us here at the
25 Arsenal for the cleanup program and, again,

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1 appreciate your time this morning.
2 One of the things that we're trying to do
3 today is make sure that everyone understands what
4 we're proposing to do at the Arsenal. And we're
5 going to do a couple things, try not to spend too
6 much time. I know some of you have seen the video
7 before, but I want to go over it, and I'll spend some
8 time hitting the highlights of it. And we're just
9 trying to do our best to make sure that you
10 understand the details -- or the proposal that we
11 have so that you can make informed comment, either
12 today or in writing by December 15th.
13 So again, to reemphasize, the goal is to
14 try to make sure that you do understand, you know,
15 what we're proposing.
16 In addition to myself, we have the other
17 parties here to answer questions, clarify what we're
18 proposing. We also have various technical experts
19 from the different agencies and the Army who prepared
20 the documentation that supports this decision or this
21 proposal.
22 I point out that a lot of the technical
23 work behind it -- an example of that is the report
24 sitting over on this table. I know many of you would
25 say you don't want anything to do with that level of

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1 paperwork, so we prepared a proposed plan, and it is
2 a summary of all the studies that have been done --
3 done out here.
4 So what we're going to do -- let me just
5 spend a minute on where we've been and kind of where
6 we're going as a form of introduction to the video.
7 This lays out the steps of how we get toward a
8 decision and where we move once we make a decision.
9 Some of you may have seen the poster out
10 front here that's entitled "The Road to the Record of
11 Decision." And this is the same steps are shown here
12 on this slide.
13 What we have, basically, up in this area
14 here, are the -- is the study phase. We do studies
15 to find out where contamination is, we do a risk
16 assessment to see what effect the chemicals may have
17 on people or on the environment, and then we do a
18 feasibility study to look at different options.
19 And this is where we are right now. We're
20 at the proposed plan, where we have a recommended
21 preferred alternative. And if we stay on schedule,
22 we will have a final record of decision by June of
23 next year. So that kind of gives you an idea of
24 where we are in the program.
25 During -- and while we've been doing

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1 studies, we've also been doing some interim response
2 actions, as we refer to them, and these are cleanup
3 actions that everyone has decided needs to happen
4 before a final remedy.
5 After June of next year we would move into
6 design and cleanup. And then where we go from there,
7 in, hopefully, about ten years, we have the
8 Rocky Mountain Arsenal National Wildlife Refuge. So
9 that's kind of long term. That is our goal. I
10 apologize for the handwriting.
11 There we go.
12 AUDIENCE SPEAKER: Charlie, would you mind
13 slipping that up a little bit on the screen?
14 MR. CHARLES SCHARMANN: Sure. And you can
15 see I'm not a . . .
16 So that is our long-term goal. And we keep
17 that in mind, that once we're finished with the
18 cleanup program out here, we will have, hopefully, an
19 asset for the community, one that the local community
20 can enjoy and, hopefully, will be of national pride,
21 as well.
22 With that as a form of introduction, some
23 of this will be covered in the video probably a
24 little more clearly, and after that I'll take some
25 time to just go through some of the highlights of the

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1 proposed plan, and we'll give you an opportunity to
2 ask questions to clarify and make sure we all
3 understand what the proposed plan is.
4 So with that, Steve, we can . . .
5 (Following is the text of the
6 videotape shown.)
7 FEMALE COMMENTATOR: There are many
8 chapters in the past, present, and future of the
9 Rocky Mountain Arsenal, from native prairie to ranch
10 and farmland, to manufacturing site of chemical
11 weapons and pesticides, to Superfund sites, to the
12 national wildlife refuge. The Arsenal is now
13 returning to its roots. This video focuses on an
14 important milestone, the Army's proposed plan for the
15 Arsenal's cleanup and the key role you play in the
16 Arsenal's future.
17 Following years of study, litigation, and
18 months of meetings, the Army, Shell Oil Company, the
19 State of Colorado, the U.S. Environmental Protection
20 Agency, and the U.S. Fish and Wildlife Service have
21 finalized and support an agreement for the preferred
22 remedy for the Arsenal.
23 Extensive public involvement helped shape
24 this agreement by making the parties aware of key
25 community issues. Public input ensured, among other

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1 things, that there will be no incineration of soil;
2 that there will be development of a medical
3 monitoring program to ensure that community health is
4 not affected by cleanup; that water would be supplied
5 to the South Adams County Water and Sanitation
6 District; and that people whose wells are affected by
7 the chemical DIMP have access to a new drinking water
8 supply.
9 Also, to avoid excavating dangerous waste,
10 trenches used by the Army for hazardous waste
11 disposal will be covered with concrete and capped.
12 This agreement serves as the basis for the Army's
13 on-post proposed plan for cleanup of the Arsenal.
14 You'll see how this critical juncture was
15 reached through a brief history of the Arsenal and
16 its role in our community and a recap of cleanup
17 activities that have been completed or are ongoing.
18 The Arsenal is a 27-square-mile site
19 located 10 miles northeast of downtown Denver and
20 adjacent to Commerce City and Denver's Montbello
21 community. Buffalo herds and native Americans once
22 shared its wild prairie. Settlers and farmers moved
23 in and worked the soil until the U.S. Government
24 acquired the land so the Army could produce chemical
25 weapons during World War II.

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1 Following the war private industry leased
2 Arsenal facilities. The largest of these, Shell
3 Chemical Company, produced pesticides from 1952 to
4 1982 at the Arsenal.
5 Waste generated by military and industrial
6 manufacturing were disposed of by commonly used
7 practices of the time. This led to contamination of
8 ground and surface water and soil from the burying of
9 toxic waste and the use of open basins, A through F,
10 for the evaporation of liquid waste. Contamination
11 also occurred from wind dispersion, sewer line leaks,
12 and accidental spills.
13 The first sign of contamination was
14 discovered north of the Arsenal in the mid-1950s,
15 when groundwater caused crop damage on nearby farms.
16 Since the 1970s the Army and Shell have
17 systematically investigated the contamination sources
18 and have dealt with areas of major concern. Today
19 there are no chemicals or weapons produced at the
20 Arsenal, and the final cleanup plan is now proposed.
21 The Army has the lead role and is
22 responsible for the safe, effective cleanup of the
23 Arsenal. Shell assists the Army in a variety of
24 studies and projects and shares remediation costs.
25 The State of Colorado and EPA ensure that

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1 State and Federal regulations are met and that public
2 health and the environment are protected. EPA makes
3 the final decision if there is a dispute.
4 The Fish and Wildlife Service manages the
5 more than 300 species of animals living at the
6 Arsenal, which will become a national wildlife
7 refuge, as mandated by Congress, when cleanup is
8 complete.
9 What is the status of the Arsenal today?
10 COLONEL BISHOP (on video): Today all the
11 parties are working together to try to finalize the
12 final remedy selection for Rocky Mountain Arsenal. I
13 would like to point out that a significant amount of
14 reduction of risk to both wildlife and people has
15 already occurred through the outstanding success of
16 our interim response action program.
17 FEMALE COMMENTATOR: Interim response
18 actions have been used to contain or eliminate some
19 of the contamination problems while the final cleanup
20 solutions were being determined. Examples are the
21 excavation of the waste disposal basin, Basin F, and
22 destruction of its liquid waste through the submerged
23 incinerator.
24 Sludge from the basin was excavated and
25 stored in a fully enclosed waste pile, which will be

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1 dealt with as part of the final remedial actions.
2 The more contaminated soil remaining in Basin F will
3 be solidified in place and capped.
4 In June 1995, after two years of operation,
5 the incinerator completed the destruction of more
6 than 11 million gallons of hazardous liquid drained
7 from Basin F. The incinerator has been sold and is
8 in the process of being cleaned and dismantled.
9 Other interim response actions at the
10 Arsenal include improvement of the groundwater
11 treatment systems, the closure of the hydrazine
12 rocket fuel facility, dust control, asbestos removal,
13 wastewater treatment, covering and revegetation of
14 disposal areas, and the removal of chemical- and
15 weapons-manufacturing equipment.
16 The groundwater treatment facilities
17 continue to treat contaminated groundwater before it
18 leaves the Arsenal. More than 1 billion gallons of
19 water are treated each year. These systems will
20 continue to be an important part of treating
21 contamination at the Arsenal in the proposed plan.
22 To understand the cleanup process, it's
23 important to look at the systematic investigation
24 that the Army has undertaken.
25 The first questions the Army had to answer

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1 about contamination at the Arsenal were, "What and
2 where is it?"
3 More than 50,000 samples were taken in
4 ground and surface water, air, soil, and structures
5 on the Arsenal. The findings have been summarized in
6 more than 230 reports. The air quality is
7 continually monitored on the Arsenal. Today test
8 results show air quality is superior to that of
9 nearby urban areas.
10 Contaminants are found in water,
11 structures, and soil. More than 320 locations of
12 suspected contamination were examined, and of those,
13 178 sites containing measurable levels of
14 contamination were identified. Most of the sites are
15 in the central sections of the Arsenal, in and around
16 manufacturing complexes and in solid and liquid waste
17 disposal areas, basins, and sewer lines. The
18 contaminants of greatest concern at the Arsenal
19 include pesticides, chemical munitions by-products,
20 heavy metals, and solvents.
21 Samples taken at the Arsenal indicate that
22 some wildlife also were affected by contamination in
23 the water and soil. The current and future cleanup
24 will eliminate ways people and wildlife can be
25 exposed to contamination.

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1 MR. RAY RAUCH (on video): The overall
2 health of most wildlife at the Arsenal is very good.
3 The best thing now for the refuge and the wildlife is
4 to move forward with the cleanup.
5 FEMALE COMMENTATOR: What will be done
6 about the contamination of water, structures, and
7 soil at the Arsenal?
8 Army experts have explored many possible
9 alternatives, which are discussed in the Army's
10 detailed analysis of alternatives. Their proposed
11 plan summarizes the Army's findings and reflects the
12 agreement of the parties on the preferred method of
13 cleaning up the Arsenal.
14 Each alternative is evaluated by these
15 criteria: Will it protect human health and the
16 environment? Does it comply with laws and
17 regulations? Will it be effective long term? Will
18 it reduce contamination? Will workers, the
19 community, and the environment be affected during
20 implementation? How reliable and doable is the
21 alternative? Is it cost-effective? How is the
22 cleanup recommendation accepted by regulatory
23 agencies and the public?
24 EPA takes its oversight responsibilities
25 very seriously. These criteria ensure that a

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1 cost-effective yet protective remedy is located.
2 Different areas will need different cleanup
3 approaches, and some might be a combination of
4 methods. Here is a brief overview of the way the
5 proposed plan deals with water, structures, and
6 soil:
7 For water the proposed plan recommends
8 continued operation of the boundary and other
9 groundwater treatment systems well into the future,
10 installation of a new groundwater system for a
11 contamination plume northeast of the Army disposal
12 trenches near Basin A.
13 The Army and Shell will provide or arrange
14 for 4,000 acre-feet of water for the South Adams
15 County Water and Sanitation District. The off-post
16 DIMP chemical plume will continue to be monitored.
17 And, in addition to those who were provided
18 new drinking water initially, well owners who in the
19 future detect concentrations exceeding the State
20 standard will be provided an alternative water
21 supply.
22 Continued operation of the off-post
23 groundwater treatment system and maintaining high
24 lake levels on-post to keep contamination from moving
25 into them.

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1 MS. BARBARA NABORS (on video): Water
2 issues have been a very important part of these
3 cleanup decisions, and this remedy addresses
4 citizens' concerns for a safe drinking water supply.
5 FEMALE COMMENTATOR: In the proposed plan
6 the term "structures" includes buildings,
7 foundations, basements, tanks, pipelines, and other
8 man-made items.
9 Almost all of the structures will be
10 demolished. All structures contaminated with warfare
11 chemicals and significant levels of other
12 contamination will be demolished and placed in the
13 on-site hazardous waste landfill.
14 Other structures will be demolished and
15 used in Basin A as part of the fill needed to
16 construct a large cap over the basin. This cap
17 consists of multiple layers, topped by a grassy
18 cover.
19 Caps over more contaminated materials will
20 be further enhanced, and if buildings are found to be
21 contaminated with certain levels of warfare
22 chemicals, they will undergo a special caustic
23 washing treatment before being placed in the new
24 on-site hazardous waste landfill.
25 The major task facing the Army and Shell is

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1 the soil remediation. The proposed plan recommends
2 building a state-of-the-art hazardous waste landfill
3 for soil and debris that will meet or exceed Federal
4 and State regulations.
5 The landfill, which will accept material
6 only from the Arsenal, will include a double-liner
7 system, liquid leak detection and collection systems,
8 and a permanent groundwater monitoring program. In
9 addition, specially constructed triple-lined cells
10 will be included to hold the most contaminated soil.
11 The landfill will have a protective cover that meets
12 regulations.
13 Dirt from the Basin F waste pile and highly
14 contaminated soil from the lime basins will be placed
15 in triple-lined landfill cells. Some of the dirt in
16 the waste pile is wet and will need to be dried
17 before placement in the landfill.
18 Contaminated soil from such areas as the
19 weapon and pesticide manufacturing areas, chemical
20 sewers, and other landfills will be excavated and
21 placed in the landfill.
22 Soil from the waste disposal basin known as
23 the M-1 basin will be treated, then placed in the
24 landfill. Treatment for the Hex pits has yet to be
25 determined. The excavated areas will be covered with

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1 soil varying in thickness.
2 The Shell and Army disposal trenches will
3 have underground walls built around them and will
4 have a cap or cover meeting or exceeding Federal and
5 State regulations.
6 Areas where concentrations of contaminants
7 in soil may not present much of a threat to animals,
8 such as in the secondary basins and surficial soil,
9 along with debris from former sanitary landfills,
10 will be placed in Basin A as fill.
11 Munitions debris will be excavated and
12 placed in the hazardous waste landfill. If munitions
13 containing explosives are found and can be moved
14 safely, they will be shipped off-site for
15 detonation. If not, they will be detonated on-site
16 by Army specialists. The basin will then be covered
17 with concrete and a soil cap to protect wildlife.
18 The cost of the proposed cleanup, including
19 money spent to date by the Army and Shell, is
20 approximately $2 billion. Cleanup could take ten
21 years or more, depending on the manner in which
22 Congress allocates funds to the Army. Final cleanup
23 will ensure a healthy future for the Rocky Mountain
24 Arsenal.
25 In 1992 Congress directed the U.S. Fish and

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1 Wildlife Service to manage the Arsenal as a national
2 wildlife refuge.
3 The Rocky Mountain Arsenal National
4 Wildlife Refuge provides important habitats -- food,
5 water, and shelter -- for a diversity of wildlife,
6 including threatened species. It also presents
7 educational and recreational opportunities for refuge
8 visitors.
9 The public plays an important role in the
10 ongoing cleanup process. Public meetings,
11 discussions with individuals, and tours of the
12 Arsenal all provide information for the public and
13 allow them to take part in the ongoing public comment
14 process.
15 The Army, Shell, EPA, the State, and
16 Fish and Wildlife Service would like your comments on
17 the proposed plan and encourage you to take an active
18 role in the cleanup activities at the Rocky Mountain
19 Arsenal.
20 A series of informational meetings and
21 workshops will continue to allow public involvement
22 as we move toward the final record of decision, which
23 is expected in mid-1996.
24 Decisions made in the coming days will help
25 shape the future of the Arsenal and its neighbors for

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1 years to come. A safe, successful cleanup will
2 provide yet another chapter in the long history of
3 the Arsenal. This next chapter will allow the
4 Arsenal to return to its roots as a place where
5 wildlife finds safe water, while affording neighbors
6 an opportunity to discover the joys of wildlife and
7 nature.
8 (Conclusion of videotape.)
9 MR. ZEIK SAIDMAN: Several -- where's
10 Bill? Several thousand of those videos have gone out
11 and are available.
12 MS. CATHY COFFEY-WEBER: One thousand.
13 MR. ZEIK SAIDMAN: One thousand. Okay.
14 And there's a -- are videos available for people.
15 MS. CATHY COFFEY-WEBER: Videos are
16 available at local grocery stores and video stores in
17 Commerce City and those stores close to the Montbello
18 community and they're free. Just ask at the video
19 counters, and they'll be made available to you.
20 MR. ZEIK SAIDMAN: And I want to point out
21 that people appearing in the film have not received
22 any royalties for their parts in the video.
23 Okay. Charlie's going to talk a little bit
24 more about preferred alternatives, water, structure,
25 and soil, and then we'll have a time period for

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1 clarifying questions about what he said or anything
2 on the video.
3 Charlie?
4 MR. CHARLES SCHARMANN: Okay. Actually,
5 I'd just like to take a couple minutes and go over
6 with you some of the thinking behind the preferred
7 alternatives. Some of the discussions that have gone
8 on over the past couple years with the parties and
9 the community, I think, are fairly important, and I'd
10 like to take a chance to just go through, for each of
11 the water, structures, and soil, just recap it
12 quickly and give you an idea of what some of the
13 discussions and thinking behind the cleanup
14 options is.
15 I would ask you, if you -- something just
16 doesn't make sense, you need to clarify it, please
17 raise your hand. I'm going to stop after each
18 segment and see if there are any questions.
19 If you have comments, you don't like
20 something, you do like something, you have a concern,
21 I would ask that those type of comments be delayed
22 until the next section after the break; we'll have a
23 period of time just to go through comments.
24 So that -- I'm going to start with
25 water -- and I know this overhead is not the

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1 best -- and just point out to you where you are.
2 This is 56th Avenue down here, 96th Avenue
3 to the north, Buckley Road to the east, Quebec Street,
4 and Highway 2. You either came in the Arsenal on
5 Havana, down here, or 72d Avenue, here. And we are
6 roughly right here.
7 So the idea for groundwater is to build,
8 basically, layers of protection. We have several
9 groundwater treatment systems already operating, both
10 on the Arsenal and off the Arsenal, and the idea is
11 to get layers of redundancy, if you will.
12 Most of the source areas are in the center
13 of the Arsenal, and we have a series of groundwater
14 treatment systems already in place. Basin A neck is
15 located here. Northwest boundary, north boundary,
16 and our Irondale water treatment system. We also
17 have a well that pumps water north of the Basin F --
18 this is Basin F. We have a well that pumps water
19 back to the Basin A neck area.
20 So the idea there is to go back and treat
21 groundwater, in some cases, very close to the sources
22 but, at a minimum, keep contaminated groundwater from
23 leaving the Arsenal. Our boundary systems have been
24 doing that for several years. And again, we treat
25 over a billion gallons of groundwater each year.

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1 In addition to what we have on-site -- I
2 should mention, in addition to what systems we
3 already have installed, we are planning to install
4 another one in this location, and that's by our Army
5 trenches area. And that's an additional system
6 that's part of this final remedy.
7 In addition to what we have on-site, many
8 of you may have seen our groundwater treatment system
9 off-site. It's located north of the Arsenal about a
10 half a mile, on Peoria, and it was installed in
11 1991. And its objective is to treat groundwater that
12 went off the Arsenal prior to our boundary systems
13 being installed.
14 So what we have, again, are layers of
15 protection there, as far as groundwater and
16 contaminated groundwater migration. If -- we want to
17 capture it before it gets out into the community.
18 The video mentioned -- and a very important
19 aspect of it -- was the provision of a water supply
20 to South Adams County. Many of you are aware of
21 this, making arrangements for provision of
22 4,000 acre-feet to South Adams County, and South
23 Adams County, the Army, and Shell are in detailed
24 discussions right now. They will be ongoing over the
25 next several months and beyond to work out the

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1 solution as to what supply may be available to
2 provide that 4,000 acre-feet to South Adams County.
3 There are South Adams County
4 representatives here this morning, I believe, so if
5 you have questions, you not only get the Army's
6 perspective or Shell's perspective; South Adams
7 County, I believe, will be available to talk about
8 that, as well.
9 The other aspect of the water remedy deals
10 with the hookup or the provision of an alternate
11 supply to folks in an area that is defined by where
12 the chemical DIMP has migrated off the Arsenal
13 historically.
14 And I put up this map. This is the general
15 area. What we have -- again, this is Highway 2.
16 This is 96th Avenue, 104th, 112th, 120th. Hopefully,
17 that gives you an idea as to where the area is.
18 We will be doing additional sampling out in
19 this area to better define the geographic limitations
20 as to where we are going to provide an alternate
21 supply. But this is a -- gives you a general idea
22 of where it is that we're looking at. And the idea
23 there is, because this area has DIMP in it -- and
24 you may be aware that the State of Colorado and the
25 Army have had disagreements over the years as to what

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1 a cleanup level would be for DIMP.
2 Because of some of that, we have made
3 arrangements to make an alternative water supply
4 available to the folks in that area. And it may
5 consist of a hookup to a municipality, whether it be
6 South Adams County or Brighton -- they both service
7 that -- those areas -- or the installation of a new
8 drinking water well. Again, that would be a safe
9 supply for folks out in that area.
10 So that --
11 MR. ZEIK SAIDMAN: Charlie, would you say
12 what DIMP was again.
13 MR. CHARLES SCHARMANN: DIMP is an Army --
14 the by-product of Army chemical production. It's
15 diisopropyl methylaphosphonape, if that means anything
16 to you. Doesn't mean anything to me. But it is not
17 a chemical agent. It is a by-product of those -- of
18 the production, operation of that, by the Army.
19 And we've had probably some meetings with
20 many of you on that particular issue.
21 MR. ZEIK SAIDMAN: Okay.
22 MR. CHARLES SCHARMANN: That covers the
23 water. Are there any questions of clarification on
24 what we're proposing for water?
25 MS. CHERYL SHIMICH: My name is

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1 Cheryl Shimich. I'm from Thornton. And on page 2 of
2 that --
3 THE COURT REPORTER: I can't hear you.
4 MS. CHERYL SHIMICH: Yes. I was just
5 wondering if you'd help me understand something.
6 On page 2 of the proposal that you handed
7 out and in your video you mentioned like a billion
8 gallons of water a year is treated on those -- the
9 boundary.
10 Could you help put that in perspective for
11 me? Is that billion gallons a percentage of total
12 contaminated groundwater that you're dealing with?
13 Or do you deal with 100 percent of the contaminated
14 groundwater? Could you give me some percentages,
15 please.
16 MR. CHARLES SCHARMANN: Sure. I'll give it
17 a shot.
18 Again, what we have -- that's not only our
19 boundary systems, which included Irondale, northwest,
20 and north, but it also includes our off-post system,
21 which is not on this map. But again, it's about a
22 half mile north of the Arsenal, is our treatment
23 system.
24 What we have is, starting at the source
25 areas on the Arsenal, we have groundwater plumes with

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1 contamination flowing to the -- toward the Arsenal
2 boundaries. And these boundary systems are located
3 in areas to make sure they capture all the
4 contamination before it leaves the Arsenal. So we do
5 have effective capture. We don't have groundwater
6 contamination moving off the Arsenal.
7 So that -- as far as 100 percent, those
8 systems were designed and improved over time to make
9 sure that we don't have additional groundwater
10 contamination moving off the Arsenal.
11 Our off-post system is located in an area
12 where we are again capturing groundwater
13 contamination. It does not capture every portion of
14 the off-post area. They're located in a significant
15 area where we have contamination above health
16 standards, and we want to make sure that the
17 contamination in groundwater that is above health
18 standards doesn't move any further than where it is
19 right now.
20 So as far as on the Arsenal, what we have,
21 we have a couple of systems -- I failed to mention
22 it. We have another system down in this area where
23 we have a historical source, and we have our Basin A
24 neck system, which is in the vicinity of -- of
25 Basin A, and our South Plants areas here.

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1 Those systems -- the purpose of those is
2 to go back closer to the sources. What you have is a
3 lower amount of groundwater at that location. So
4 instead of having several hundred gallons a minute,
5 you have 10 to 20 gallons a minute, and that amount
6 of water is more highly concentrated. So you can
7 treat a more highly concentrated water in a lower
8 amount, and it's a lot more effective to do that, to
9 go back toward the sources.
10 Okay? But as it moves toward the boundary,
11 it may become more dilute. You have an additional
12 volume of water to deal with, and it's a little less
13 efficient, but at the same time, it's very important
14 that we have those boundary systems operate to make
15 sure contamination doesn't move off the Arsenal.
16 And the nature of the groundwater cleanup
17 is that it doesn't happen very quickly. And many of
18 these systems will be operating tens -- if not a
19 hundred years or more -- before we actually could
20 clean the groundwater.
21 MR. ZEIK SAIDMAN: Okay. Does that answer
22 your question?
23 MS. CHERYL SHIMICH: Yes, thanks.
24 MR. ZEIK SAIDMAN: Any other
25 clarifying questions to Charlie? This is the

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1 clarifying-questions period. Over here.
2 AUDIENCE SPEAKER: Charlie --
3 MR. ZEIK SAIDMAN: Can you use the mic.
4 AUDIENCE SPEAKER: Well, just a quick
5 question.
6 Charlie, I've got a two-page comment that
7 I'm formally going to read and some other stuff. Do
8 you want me to wait till the formal -- joke.
9 MR. ZEIK SAIDMAN: Yeah.
10 AUDIENCE SPEAKER: As opposed to -- and
11 this addresses the Henderson area that I feel has
12 been totally let out of the negotiations.
13 MR. CHARLES SCHARMANN: Yes. And I know
14 there's some strong feelings out there as to the
15 various aspects of the -- of the remedy. And if you
16 could bring that up during the comment period, that
17 would be good.
18 AUDIENCE SPEAKER: Do you pump that water
19 back into the ground? What do you do? You treat it
20 and pump it back?
21 AUDIENCE SPEAKER: Yes.
22 MR. ZEIK SAIDMAN: Can everybody hear the
23 question?
24 MR. CHARLES SCHARMANN: I'll repeat it.
25 MR. ZEIK SAIDMAN: Repeat the question.

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1 MR. CHARLES SCHARMANN: The question was,
2 do we put the water back into the ground after we're
3 finished treating it.
4 AUDIENCE SPEAKER: Is that how you did when
5 you created the earthquakes in the '60s?
6 MR. CHARLES SCHARMANN: And the follow-on
7 was, is it like when we created the earthquakes back
8 in the '60s. Let me address that.
9 As far as -- after treatment of the
10 groundwater, we put the clean water back in the
11 ground so it then continues to flow off-post.
12 AUDIENCE SPEAKER: Pumped underground, high
13 pressure or --
14 MR. CHARLES SCHARMANN: It is put in the
15 ground in a very shallow -- to very shallow depths,
16 less than a hundred feet.
17 The deep disposal well that was used back
18 in the '60s was 12,000 feet deep. So it's really a
19 totally different situation. That was injected way
20 below any useful water supply.
21 AUDIENCE SPEAKER: Are you retrieving that
22 contamination?
23 MR. CHARLES SCHARMANN: No, we are not.
24 That well was closed in 1985, following EPA
25 procedures. We basically pulled up much of the

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1 casing and grouted the well up with a
2 cement-bentonite grout.
3 MR. ZEIK SAIDMAN: Over there. And then
4 over here and then there. Go ahead.
5 AUDIENCE SPEAKER: My question deals with
6 the article that was in the newspaper this week about
7 bringing the water from Fitzsimons over here, that
8 they need so much more water over to this area for
9 the cleanup process.
10 And they said -- they weren't clear about
11 how that water was going to get over here. I was
12 wondering if they're going to use a high canal
13 lateral coming across 56th Avenue there at Chambers.
14 And if they do do that, could it be reopened like it
15 is in the Denver area, access for people in the
16 Montbello area?
17 MR. ZEIK SAIDMAN: Can everybody hear that
18 question?
19 Okay. Charlie, maybe repeat it.
20 MR. CHARLES SCHARMANN: I guess that
21 question is very specific to the additional needs for
22 water in the future, not only the needs that Rocky
23 Mountain Arsenal has. We need to keep water in our
24 lakes; we need water for irrigating areas that we
25 were revegetating. That's already in the -- in the

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1 future.
2 We also are evaluating options to provide
3 the 4,000 acre-feet to South Adams County. There are
4 a lot of different sources of water being evaluated,
5 and we have asked questions as to what water rights
6 are available.
7 Fitzsimons may be one of those that --
8 that -- it's possible but I wouldn't really want to
9 get into the specifics as to, if that happens, how
10 would it be implemented. That -- that whole
11 evaluation process is in the very early stages. It
12 could be that that is not even used as an option to
13 provide water for either the Arsenal or South Adams
14 County. So . . .
15 AUDIENCE SPEAKER: Thank you.
16 MR. ZEIK SAIDMAN: More?
17 AUDIENCE SPEAKER: At this point has any
18 kind of determination been made whether there's going
19 to be a Stapleton contamination factor involved in
20 the cleanup on the Arsenal?
21 MR. ZEIK SAIDMAN: Norm, stand up and why
22 don't you use the microphone. People in the back
23 can't hear you.
24 AUDIENCE SPEAKER: At this point has any
25 determination been made whether or not there will be

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1 a Stapleton factor involved in the cleanup of the
2 Arsenal, whether there's anything coming off of
3 Stapleton or whatever that could affect the cleanup?
4 MR. CHARLES SCHARMANN: Good point.
5 What Norm's talking about is some of you
6 may be familiar that this is -- again, 56th Avenue --
7 going to be extended, is in the process of being
8 extended across this area.
9 But we have some contamination in
10 groundwater moving onto the Arsenal along the western
11 side of the Arsenal, and we have had discussions and
12 continue discussions with EPA, with various sources
13 south of the Arsenal, including Stapleton, including
14 some other industrial sites. In some cases EPA and
15 the Army have recovered some money from some of those
16 Superfund sites down there.
17 We will continue to do that, continue those
18 discussions to try to find out where sources there
19 are and try to recover any resources that we've
20 expended on that contamination.
21 I can tell you that South Adams County also
22 is getting active -- or is actively talking to folks
23 down in that area and doing some tests of their own
24 to determine who, in fact, may be contributing to
25 that plume that flows in that area.

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1 MR. ZEIK SAIDMAN: Okay. Any other
2 questions, clarifying questions? Over here. Stand
3 up so we can see if we can hear you back there.
4 THE COURT REPORTER: I can't hear anything.
5 MR. ZEIK SAIDMAN: Sorry for the audio
6 problem here.
7 MS. CATHY COFFEY-WEBER: Excuse me. The
8 reporter can't hear questions from the floor. We
9 need people to come forward.
10 MR. ZEIK SAIDMAN: Do you have a clarifying
11 question?
12 AUDIENCE SPEAKER: Yeah. I was just
13 wondering if, in the proposed plan of choice,
14 approximately how many of the sources of the
15 groundwater contamination is going to be cleaned up,
16 percentage-wise.
17 MR. CHARLES SCHARMANN: Did everybody hear
18 the question?
19 Okay. Anyway, how many sources will be
20 cleaned up. I'm going to be covering that under the
21 soils portion of the remedy. So if I could, I'd like
22 to defer that to that portion. If I don't answer the
23 question sufficiently, let me know and we'll address
24 it again.
25 Because the cleanup remedies between soils,

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1 structures, and water are very much interrelated, and
2 it's important to understand those connections. So
3 I'll try to address that when I talk about the soils,
4 which are the primary sources of contamination out
5 here.
6 MR. ZEIK SAIDMAN: Any other water
7 questions? Maybe that's the way to do it, if -- any
8 other related to water?
9 MR. ROLAND RUSSELL: Is there agreement
10 that the 4,000 feet is adequate?
11 MR. CHARLES SCHARMANN: Thanks, Roland.
12 MR. ROLAND RUSSELL: I'm sorry, I had to go
13 on record.
14 MR. ZEIK SAIDMAN: Did everybody hear the
15 question?
16 MR. CHARLES SCHARMANN: Is there agreement
17 that the 4,000 acre-feet for South Adams County is
18 adequate?
19 You know, there isn't, as far as between
20 South Adams County and the parties. The role of that
21 whole issue in the discussions on remedy was very
22 important. That figure was arrived at throughout the
23 discussions. Whether it was sufficient for all
24 parties, I can tell you probably that's -- that's
25 not the case. There's disagreement on that.

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1 But at this -- at this day we're moving
2 forward to acquire the -- evaluate options for
3 4,000 acre-feet. And I guess I'd open that up to
4 South Adams County to give their view as to, you
5 know, whether that's sufficient or not.
6 But clearly, I think it's -- it's not in
7 their view. So . . .
8 MR. ZEIK SAIDMAN: Any other water
9 questions? Okay.
10 Your next piece is on soil?
11 MR. CHARLES SCHARMANN: On structures real
12 quickly.
13 Just to let you know the major areas on the
14 Arsenal where we have structures, this area here is
15 the South Plants. This area here is our North
16 Plants. And that's where the major industrial
17 activities took place over time.
18 They also have what we call our rail yard
19 area, where we had materials coming in the Arsenal
20 and materials being shipped off the Arsenal, and we
21 have various warehouses over in this area.
22 That's kind of where most of the buildings are
23 located, out here.
24 And what we're planning to do is, in these
25 areas, there's a mixture of fairly clean buildings,

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1 those that were used for administrative purposes,
2 didn't have a lot of contamination history, and those
3 structures will go into Basin A. We need a lot of
4 material that -- to fill up Basin A before it is
5 eventually capped so the -- that's where those
6 administrative or clean buildings will go.
7 The other categories that we have, we have
8 some buildings that were used that had a pesticide
9 history. And then there are some that the Army
10 used in its chemical agent production. In those
11 two categories -- both buildings from those
12 two categories will go into our landfill, which is
13 located roughly -- will be located roughly in this
14 area here.
15 So fairly straightforward. There will be a
16 few buildings left out here. But by and large, the
17 plan is to take down most of the structures and put
18 them either into Basin A or into our new hazardous
19 waste landfill.
20 MR. ZEIK SAIDMAN: Okay. Any questions
21 about structures?
22 MR. CHARLES SCHARMANN: Any questions on
23 structures?
24 Yes, sir.
25 MR. ZEIK SAIDMAN: You've got to get up to

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1 the -- I'm sorry. You and then you. You've got to
2 come to the mic so the court reporter can hear you.
3 Let me suggest this in terms of time:
4 We -- a lot more clarifying questions than we
5 expected. Let's go to 10:30, check in with you then,
6 and then take a break at 10:30, and then give us a
7 full hour for public comments, and I think we can
8 delay the bus for half an hour or so.
9 Is that okay with everybody? So we'll go
10 to 10:30, then we'll check in, see if everybody got
11 their clarifying questions.
12 Okay. This is on structure.
13 AUDIENCE SPEAKER: Just a quick question
14 for you, Charlie. In your proposal that you have
15 that you passed out, you described structural
16 disposal of asbestos and other contaminants as
17 ongoing. What is presently happening to that
18 material now?
19 MR. CHARLES SCHARMANN: Okay. We are --
20 as part of our interim response action program, we
21 are taking down tanks and piping and, also, removing
22 asbestos from buildings and along pipelines. All
23 that material is going -- currently going off-site
24 to a -- an approved landfill. And I believe
25 currently we are using CSI's -- I think that's the

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1 Conservation Services, Incorporated -- landfill east
2 of here. And -- for that asbestos material.
3 The metal from tanks and piping and things
4 such as that is being recycled. That which can be
5 recycled is being recycled. That which cannot is
6 being -- it's either being held here on-site or
7 being taken to a hazardous waste landfill, and we use
8 Highway 36.
9 MR. ZEIK SAIDMAN: Does that answer your
10 question?
11 AUDIENCE SPEAKER: Yes, it does.
12 MR. ZEIK SAIDMAN: This gentleman over
13 here. Did you have a question?
14 AUDIENCE SPEAKER: Well, I think he
15 answered part of it.
16 MR. ZEIK SAIDMAN: Okay. Try him on the
17 part you don't think he answered.
18 AUDIENCE SPEAKER: I will.
19 MR. ZEIK SAIDMAN: Clarifying question on
20 structure.
21 AUDIENCE SPEAKER: You mentioned how
22 some of the metals are being hauled away to the
23 landfill and other metals are being recycled. What
24 percentage is being recycled and what percentage is
25 being hauled away?

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1 MR. CHARLES SCHARMANN: The majority is
2 being recycled. It's only that metal piping and
3 tanks that cannot be decontaminated that is being
4 disposed of. Everything that can be decontaminated
5 is being -- and can be recycled -- is being taken
6 to a smelter for recycling.
7 I think -- Gary Anderson, do you have an
8 idea of what percentage -- I mean, 90-some percent
9 probably is being recycled.
10 MR. GARY ANDERSON: I'd guess approximately
11 95 percent of the metal materials are being recycled,
12 and the other 5 percent would be composed of pumps
13 and motors and things that, as you said, can be
14 decontaminated in the internal working parts.
15 MR. CHARLES SCHARMANN: This is
16 Gary Anderson, one of the project engineers that --
17 senior engineer.
18 You're here managing the various interim
19 cleanup actions that are ongoing.
20 AUDIENCE SPEAKER: Okay. Another
21 question. You said they are being recycled. How are
22 you recycling it? Are you generating additional
23 waste as you are cleaning it up and deconning it?
24 MR. CHARLES SCHARMANN: Do you want to go
25 ahead?

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1 MR. GARY ANDERSON: Do I have to come to
2 the mic?
3 MR. ZEIK SAIDMAN: Yeah, come on up here.
4 AUDIENCE SPEAKER: I'm staying. I might
5 think of another question.
6 MR. ZEIK SAIDMAN: Okay.
7 MR. GARY ANDERSON: The materials that
8 we're recycling here would be going through a defense
9 utilization marketing contract, the DRMO. The defense
10 reutilization marketing office is the military's
11 utilization office for recycling and, also, for the
12 disposal of hazardous materials and other kinds of
13 materials.
14 They have a contract in turn with Duwald
15 and Gahagen, and we send our scrap metal to them.
16 They in turn send it to a smelter. And I believe
17 they're using one of the foundries down in Pueblo.
18 AUDIENCE SPEAKER: The other part of the
19 question was, that percentage of the metal --
20 MR. ZEIK SAIDMAN: You've got to come up.
21 I'm sorry.
22 AUDIENCE SPEAKER: -- that is being
23 deconned or cleaned up, which is about 95 percent,
24 how are you cleaning it? Are you using solvents?
25 Are you using -- what?

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1 MR. GARY ANDERSON: The -- our decon
2 efforts are a little bit dependent on what kind of
3 processes the tanks were used for. In some instances
4 we're using a hot water wash with a detergent to
5 decontaminate the surfaces.
6 We're -- after we decontaminated it, we do
7 a visual inspection, according to the regulations, and
8 look for any kind of gross contamination that might
9 be left behind. Once the -- it's -- we also use a
10 triple rinse so the surface is washed three times.
11 Once it passes a visual inspection, it's
12 sent off for recycling. We make sure that we're
13 complying with the EPA - the Federal laws, as well
14 as the State laws, for the contamination process.
15 AUDIENCE SPEAKER: Okay.
16 MR. GARY ANDERSON: The extra material that
17 we generate is the wash waters that we generate from
18 this --
19 AUDIENCE SPEAKER: Secondary waste.
20 MR. GARY ANDERSON: Correct. And those
21 wash waters are treated here on post at a wastewater
22 treatment plant that we have on post, operated by the
23 Army and its contractors.
24 So we don't really generate any additional
25 waste treating except for some suspended solids that

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1 we would get out of the wash water or metals that we
2 might generate after we've done the treatment of that
3 wash water.
4 AUDIENCE SPEAKER: Okay.
5 MR ZEIK SAIDMAN: Thank you.
6 Okay. Any other structural questions?
7 Any other structural questions?
8 Okay, Charlie. Now your soil.
9 MR. CHARLES SCHARMANN: Okay. The last
10 piece to talk about here is our soil remedy, and it's
11 certainly the most complex. I don't want to spend a
12 lot of time on it, but if you have questions, you
13 know, please do ask.
14 In general, the thinking behind our soil
15 remedy is to, basically, shrink the area that is
16 going to be managed long term by the Army and,
17 basically, move waste in outlying areas into either a
18 new state-of-the-art landfill or into Basin A or some
19 of the surrounding areas.
20 What we have, the high-level material is
21 shown in red on this map. And that material would be
22 excavated and put into our new hazardous waste
23 landfill.
24 What's shown on green on this map is -- is
25 generally low-level soil contamination that we will

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1 be, in some cases, pushing into the excavation that
2 has occurred of the high-level material in each
3 area. So this -- let's take, for example, the South
4 Plants. We excavate this red area. We then push in
5 the area around it that is low-level material into
6 the excavation, and then that area will be capped.
7 And the same type of thing will occur in Basin A and
8 around the Basin F area.
9 When we're done, what we'll end up having
10 is a few areas -- and I'll show you on another
11 map -- where we will have a cap, which, in some --
12 will be different designs in different areas but may
13 consist of concrete, may consist of clay, soil, other
14 materials that -- basically, the intent of that is
15 to keep water from moving through that material and
16 taking contamination and moving it in groundwater.
17 And that's what we're trying to prevent.
18 So we're trying to consolidate things into
19 the middle of the Arsenal, shrink the area that will
20 be managed long term as a containment area, and open
21 as much area to be used as the refuge -- open up as
22 much area as possible.
23 In addition to just excavating and moving
24 soil into containment facilities, we will be doing
25 some treatment of soil in a couple key areas. One is

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1 the former Basin F area, which is shown in brown
2 here. We also have a couple sites down in the South
3 Plants area where we will either be doing treatment
4 in place or excavation and treatment of some of that
5 material.
6 The treatment at former Basin F will be
7 done in place, and that will be in-place
8 solidification, where we will drill into that area
9 and inject cement, grout, a solidifying agent to make
10 sure contaminants are bound up and not moving away
11 from that site.
12 And that -- I should mention again that
13 Basin F site will have a cap over it when we're
14 done.
15 To address the question about source
16 areas -- so we have a mixture. I mean, we have some
17 where we're improving the containment at the site to
18 make sure that contaminants don't move away from that
19 site or we reduce the potential for that to occur.
20 In other cases we are doing some active treatment
21 either, in some cases, to destroy the chemical or to
22 tie it up and solidify it, make sure it doesn't move
23 away from the site itself.
24 Does that address the question about source
25 areas? We are taking actions -- to let you know

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1 that -- how contamination occurred in the past is
2 that you had liquid, in many cases, in disposal
3 basins that leaked down into the groundwater and then
4 moved. Okay. What's left behind on soils in many
5 cases are contaminants on the soil, and you want to
6 keep water from moving through that to take
7 contaminants into the groundwater and move them out.
8 So actions are being taken to address the source
9 areas and make sure they don't impact the groundwater
10 long term.
11 I can tell you, since the time that we have
12 no longer had actual liquid in the disposal lagoons,
13 we have seen a drop-off in the amount of
14 contamination getting into the groundwater, even
15 without taking actions on any sites.
16 Certainly, by taking additional action to
17 contain the material there, we hope to see even a
18 further drop-off, as far as the level of
19 contamination in groundwater on the Arsenal itself.
20 MR. ZEIK SAIDMAN: Clarifying questions
21 around soil? And then again, we have the public
22 comment, where we go on the record. But any
23 clarifying questions around soil?
24 Over here and here. Come up.
25 AUDIENCE SPEAKER: Charlie, how much soil

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1 is planned to be excavated and moved? And also, what
2 measures will be taken for dust abatement?
3 MR. ZEIK SAIDMAN: Did everybody hear that?
4 MR. CHARLES SCHARMANN: Exact volume I
5 don't have off the top of my head, Rick.
6 I believe the amount of material to go
7 into our hazardous waste landfill is on the order
8 of 1.5 million to 2 million yards, cubic yards, of
9 material.
10 And we have a more precise figure in --
11 probably in the proposed plan. If not there, then in
12 other reports. We also have some experts here that
13 may have that.
14 And that's what -- that's what goes into
15 the landfill. Other material will be, as I
16 mentioned, excavated and put into either Basin A or
17 into the South Plants area or into the Basin F area.
18 I don't have a figure off the top of my head.
19 It's probably several million yards. I
20 just don't have that figure.
21 But regarding dust abatement, that is a big
22 concern of ours, as well as the community and the
23 parties. Conventional methods would be to wet the
24 material before you do large-scale excavations. We
25 will need to go through a detailed evaluation process

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1 to know exactly what measures we need to take to keep
2 dust from -- from moving away from the site.
3 And not only the dust but, also, potential
4 odors and vapors that may come from an excavation all
5 need to be addressed as part of the design of -- of
6 the remedy. So I can't really get specific as to
7 exactly the measures, but that's certainly going to
8 be a concern of ours as we work through the design.
9 MR. ZEIK SAIDMAN: Roland?
10 MR. ROLAND RUSSELL: To what degree are you
11 going to follow regulations in addition to the
12 Federal? Are you going to comply with State and
13 local?
14 MR. ZEIK SAIDMAN: Did everybody hear that?
15 AUDIENCE SPEAKER: Uh-huh.
16 MR. ZEIK SAIDMAN: Okay. Thank you.
17 MR. CHARLES SCHARMANN: Roland, that is our
18 intent. And we certainly want to work closely with
19 not only the State and Federal regulators but, also,
20 local authorities, as well, to make sure everyone is
21 comfortable with the way we are proceeding with the
22 cleanup. That's very much a priority for us.
23 MR. ZEIK SAIDMAN: A question back
24 there, sir.
25 AUDIENCE SPEAKER: Is there any direct

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1 compensation for the surrounding area, other than to
2 clean up their water and the 4,000 acre-feet, which
3 doesn't seem to be enough? But are there any other
4 compensations that are being considered?
5 MR. CHARLES SCHARMANN: There have been a
6 number of things raised throughout the discussions.
7 I can't say that there's any -- you're asking for
8 monetary --
9 AUDIENCE SPEAKER: Well, that would be
10 one thing.
11 MR. CHARLES SCHARMANN: -- issues? Okay.
12 Well, there aren't any --
13 AUDIENCE SPEAKER: The way it affects the
14 property values and things like that. That's the
15 most affected area.
16 MR. CHARLES SCHARMANN: There are a couple
17 of things that I might want to highlight, also, that
18 are being done to address that concern. It doesn't
19 necessarily result in a monetary payment. But one of
20 the concerns we heard from the community was a -- to
21 have a medical monitoring program during the cleanup
22 activities and make sure that the actions that we're
23 taking don't affect the surrounding communities.
24 And the State is taking the lead on that
25 with the Federal agency, the agency for toxic

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1 substances and disease registry. You may not be
2 familiar with them, but they are basically the
3 Federal entity charged with that area of medical
4 monitoring.
5 So we have ongoing dialogue to talk about
6 what medical monitoring is necessary during the
7 clean --
8 AUDIENCE SPEAKER: Is that for all of
9 the people in the surrounding area, immediately
10 surrounding area?
11 MR. CHARLES SCHARMANN: That's right.
12 That's to address issues of the surrounding
13 communities to the south, to the west.
14 AUDIENCE SPEAKER: I've lived in that area
15 for quite a while, and nobody -- I haven't heard
16 anybody address me about some medical benefits
17 possibly or anything like that.
18 MR. CHARLES SCHARMANN: Let me --
19 AUDIENCE SPEAKER: Then the other thing I
20 want to bring out is I think it impacts that
21 whole -- the whole area, especially in the
22 Commerce City to Quebec Street area and the northern
23 area, towards the schools.
24 But I had -- I had no compensation for
25 those sort of things. And people in all of these

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1 films that I've seen or slides that I've seen, there
2 was always some sort of compensation. And I feel
3 that this hasn't been addressed. And I don't know
4 if this is the right forum to bring this up, but this
5 is the ROD. I think this is the right time to bring
6 it up, myself, personally. So -- I want to throw
7 that out.
8 MR. CHARLES SCHARMANN: It may be good to
9 go ahead and -- and put that on the record during
10 the comment period. That was raised by different
11 entities, and some of them are here this morning, and
12 they can speak about what they raised as issues.
13 But certainly, I think you recognize the
14 difficulty of trying to sort that out and put figures
15 on things and then determine whether impact has
16 occurred and what level of impact and things such
17 as that.
18 But there are some steps built into this
19 remedy to make sure that, during the implementation
20 of it, that we all can stand up and say, "This site
21 is not affecting the community," that actions are
22 being taken safely. And when we're done with the
23 cleanup action, everyone can say, "It's a safe site.
24 It's now an asset to the community."
25 So regarding what happened in the past,

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1 that was a very difficult issue to deal with and
2 it was raised. But it did not result in any type
3 of agreement on a monetary payment or anything
4 like that.
5 But the other thing I wanted to mention
6 that is being explored is the establishment of a
7 trust fund. And this is another difficult issue.
8 But there is a lot of concern by the community that,
9 10 years from now or 15 years from now, there may not
10 be money to deal with the long-term operation of the
11 containment sites and the groundwater treatment
12 systems that we leave behind.
13 And there was an agreement to try to set up
14 a trust fund where the interest and, potentially,
15 principal from that trust fund would be used to
16 continue the long-term operation and maintenance of
17 the facilities.
18 AUDIENCE SPEAKER: Will the cities in the
19 surrounding communities have access to that trust
20 fund to . . . to improve the neighborhood? Or do
21 I -- the health and welfare of the neighborhood?
22 MR. CHARLES SCHARMANN: The intent of that
23 trust fund was solely for the purpose of operation
24 and maintenance of the cleanup of structures or
25 facilities.

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1 AUDIENCE SPEAKER: So in essence, there's
2 no -- nothing for the community, though.
3 MR. CHARLES SCHARMANN: That's right. That
4 wasn't part of that trust fund.
5 AUDIENCE SPEAKER: Thank you.
6 MR. ZEIK SAIDMAN: I would think those kind
7 of comments are part of the public record comments.
8 But let's focus just in on the clarifying questions.
9 But thank you.
10 MS. LAURA WILLIAMS: Zeik, you have a
11 question up front.
12 MR. ZEIK SAIDMAN: I'm sorry, Mark.
13 Thank you.
14 AUDIENCE SPEAKER: Two questions, kind of
15 related both to the water and the soil.
16 Do we have a good estimate on how much
17 acreage will be needed for these managed areas once
18 the cleanup is completed and -- let's stick with that
19 one for now.
20 MR. CHARLES SCHARMANN: Okay. Let me --
21 actually, that leads into the last slide I was
22 planning to use, which is here, to show you the areas
23 or the facilities that will be operated long term.
24 And what we have long term to manage are
25 the areas that are to be capped, the South Plants

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1 area, area called the Shell trenches, area called the
2 Army complex trenches, Basin A, and Basin F. All
3 those areas will have some type of cap over top of
4 them that need to be -- that would need to be
5 maintained long term.
6 In addition to those sites, we'll have a
7 new hazardous waste landfill in this area, which
8 will, again, need to be maintained long term.
9 That's from a soil remedy standpoint. From
10 water, we have our northwest boundary system, our
11 north boundary system, our Basin A neck groundwater
12 system. And the reason some of the groundwater
13 treatment systems have disappeared on this map is
14 that we feel a few of them may be able to be shut
15 down in the next several years because they have
16 accomplished the objective that we constructed them
17 for. And in the case of the Irondale area, we have
18 contamination that is being more rapidly cleaned
19 up -- contamination the Army has contributed to that
20 is being more rapidly cleaned up in that area -- and
21 that is a system we expect to shut down probably in
22 the next four years or so.
23 Does that address your point, Norm, as far
24 as areas?
25 AUDIENCE SPEAKER: So it's maybe

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1 not 1 1/2 square miles or -- if you were to come up
2 with an estimate that way?
3 MR. CHARLES SCHARMANN: Sounds reasonable,
4 you know. Which --
5 MR. ZEIK SAIDMAN: What was the comment,
6 Norm?
7 MR. CHARLES SCHARMANN: -- there are
8 640 acres for a square mile so -- you know, roughly
9 a thousand.
10 MR. ZEIK SAIDMAN: All right. A question
11 here?
12 AUDIENCE SPEAKER: This is a general
13 question.
14 When you worked out your program, were
15 there historical precedents for this? And could you
16 tell us where they were and how successful they were?
17 MR. CHARLES SCHARMANN: As far as, I
18 guess -- any particular aspect of the remedy? The
19 soils portion or the water portion or --
20 AUDIENCE SPEAKER: No, the general problem
21 that you have with a contaminated site. What other
22 geographical sites throughout the world have been
23 faced with this same kind of a problem?
24 MR. CHARLES SCHARMANN: We certainly have
25 some folks that have some more broad-based experience

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1 that you may be able to ask during a break. But I
2 can tell you, in general, that across the country
3 there is a mixture of actions that are being taken.
4 And I can't say that we have found one that is
5 identical or very similar to Rocky Mountain Arsenal.
6 This is a very complex site, a very large site. So
7 trying to apply something that may have been done in
8 another site that is smaller, had different problems,
9 is sometimes difficult.
10 But clearly, across the country there have
11 been many sites that have put containment structures
12 there, caps. Lowry Landfill here locally is an
13 example of that, where they're using a combination of
14 capping, containment, and treatment.
15 And if you look across the country, there
16 will be some sites where, if they had a small amount
17 of material, they have used, you know, aggressive
18 treatment measures to get rid of that completely,
19 where they can.
20 But we really have seen a mixture across
21 the country, as far as doing aggressive treatment and
22 containment measures like landfills and caps.
23 With regard to water, I can tell you that
24 the Rocky Mountain Arsenal is one of the first sites,
25 if not the first site, where we installed a

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1 groundwater treatment system. Our north boundary
2 system was installed as a pilot system in 1979. We
3 expanded it in 1981, and that was one of the first
4 systems of its type in the country. So in many cases
5 Rocky Mountain Arsenal is precedent setting, and
6 we're on the leading edge of cleanup actions.
7 MR. ZEIK SAIDMAN: Let me check in with the
8 group before we take a break.
9 How many people have more clarifying
10 questions before public comment? How many people --
11 one, two -- one, two, three. Let's take those
12 three more questions, and let's try to wrap it up in
13 five to ten minutes, and then we'll take a break.
14 Okay. You and who's next? Who else raised
15 their hand? You. And you over there.
16 Okay. So let's . . .
17 AUDIENCE SPEAKER: My question is, you said
18 that you're going to cap the chemicals and everything
19 in these landfills and everything, and then you say
20 that you're checking on the water and some of the
21 water systems you're closing down because they're
22 okay.
23 Is there an ongoing project that would
24 check this over a period of time to see that the
25 water doesn't leak through the cement or leak through

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1 the clay or anything like that?
2 MR. CHARLES SCHARMANN: Can everybody hear
3 the question?
4 Okay. The question about monitoring. And
5 we have had an aggressive monitoring program, an
6 extensive monitoring program, out here since the
7 mid-'70s. And that's been expanded and approved and
8 in some cases cut back at times.
9 But we look at groundwater; we also do air
10 monitoring. We take a look at -- through the
11 Fish and Wildlife Service -- the animals out here.
12 So a lot of very complex monitoring program ongoing.
13 That will continue in the future. It
14 will -- we will monitor around sites such as our
15 landfill to try to determine whether, in fact,
16 chemicals are -- that are in that facility -- are
17 getting out of that and into groundwater. So that
18 will be a key part of that landfill monitoring
19 program.
20 In addition to that, our groundwater
21 plumes, we are monitoring them extensively to track
22 movement. We have a very good handle on where they
23 are and how they're moving. The interest there is to
24 monitor them long term, to go ahead and document that
25 we are seeing improvements to groundwater quality.

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1 And certainly, we need to do that before we're able
2 to shut a system down like we did out in Irondale.
3 You need to go through a monitoring program to make
4 sure you achieve what you hoped to achieve, you know,
5 before you can shut a system down.
6 So there will be -- and EPA can probably
7 speak more about this -- a compliance monitoring
8 program -- the State can, as well -- with the
9 landfill. There are set programs that will need to
10 take place to monitor the effectiveness of the
11 remedy.
12 MS. LAURA WILLIAMS: In fact, I'd like to
13 add, Charlie, that under Superfund there's -- a
14 containment remedy like this, it's a requirement
15 every five years that all that data that's being
16 collected be reevaluated just to make sure that not
17 only is it protective against the standards that were
18 in effect at the time the remedy took effect but,
19 also, is it still protective, according to new
20 regulations that may have been implemented since.
21 And if it's not, then there could be some additional
22 work that could be done.
23 MR. ZEIK SAIDMAN: Thank you.
24 Barbara?
25 MS. BARBARA NABORS: You covered it very

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1 well, Laura.
2 MR. ZEIK SAIDMAN: All right. And next
3 question?
4 AUDIENCE SPEAKER: I keep wondering, when
5 we hear about this ongoing cost and so forth and --
6 and the cost -- why was an incinerator such as a
7 kiln, cement kiln, that type of thing -- why can't
8 that be used in the cleanup once and for all, and you
9 don't have to keep coming back and monitoring what
10 was -- what is still there?
11 MR. CHARLES SCHARMANN: Regarding where the
12 evaluation of treatment technologies fit in this
13 whole remedy, that was a concern that was raised
14 early on. Many people had that view, that "Let's go
15 ahead and treat it and get it done once and for all."
16 The problem we have at many of the sites
17 out here, the large sites, such as Basin A and the
18 South Plants area, is that you cannot get all the
19 contamination that is there. And in many cases
20 implementing a treatment scenario like incineration
21 of soil is very complex, very complicated, and in
22 some cases, very expensive and would take a lot
23 of time.
24 And we heard throughout the last couple
25 years some concerns about having emissions continue,

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1 too, which potentially would affect the community.
2 In general, I think folks were not interested in
3 having incineration occur out here long term.
4 And regardless of how much treatment you
5 do, you still need to rely on some type of
6 containment portion of your remedy in the form of
7 caps or landfills because you just cannot physically
8 treat all the material that's out here and render
9 it -- this a pristine site. You need to take some
10 of these -- these containment strategies or
11 measures, no matter what you do. And what we ended
12 up with was a mixture. We have some sites where
13 we're doing some treatment, and we -- we're using
14 treatment techniques that seem to be popular or ones
15 that the community and the parties were comfortable
16 with that could -- they could be done safely, and
17 they could be done timely, and they could be done in
18 a cost-effective manner.
19 So to go back to history, that's kind of
20 how it evolved, that -- early on, I think we all
21 looked seriously at whether we could aggressively
22 treat, you know, the whole site. But it --
23 practically speaking, it's not possible.
24 MR. ZEIK SAIDMAN: Next?
25 AUDIENCE SPEAKER: I was just curious if

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1 you could explain how putting the cap on is going to
2 reduce the amount of water contamination since, to
3 me, it seems like it would just redirect it and let
4 the water just go underneath and through
5 horizontally. So --
6 MR. CHARLES SCHARMANN: Did everyone hear
7 that question?
8 Okay. What we have, the cap -- it's a
9 combination of things that address the total
10 contamination, whether it's in the soil or in --
11 already in the groundwater.
12 The intent is to stop water from
13 percolating through the material and continuing to
14 carry chemicals down. Okay. That we can effectively
15 stop with caps. The groundwater that's already there
16 that's contaminated, that is flowing to our
17 groundwater treatment systems, and we will capture
18 and treat that material.
19 In some areas, such as the South Plants and
20 Basin A area, by stopping water from percolating
21 down, you're going to lower the level of groundwater,
22 where that is. So you're going to reduce the amount
23 of migration that is occurring right now. You know,
24 right now there may be a certain amount of
25 groundwater contamination. As you lower the water,

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1 the level of that groundwater, you're drying up
2 another area and, effectively, immobilizing more
3 contamination.
4 So a combination of cap, which cuts water
5 from going through the soil and taking more
6 chemicals, along with the groundwater treatment
7 systems, which treat groundwater that is already
8 mi -- flowing toward them. You know, the
9 combination is what you're using to deal with that
10 total contamination issue.
11 MR. ZEIK SAIDMAN: Let me suggest this:
12 We've gone about 40 -- we've gone 40 minutes past
13 our break. The people that have questions, my
14 suggestion is to come up and ask the panel or Charlie
15 during the break. If you don't feel they've answered
16 your question as well as they could have, make that a
17 part of your public comment. Because I think people
18 have patiently been sitting here.
19 So let's take a break for ten minutes, ask
20 these guys your questions. If they don't answer them
21 satisfactorily, come back and make a public comment.
22 MR. CHARLES SCHARMANN: I would like to
23 mention one more thing. In addition to the panel
24 members and myself, we have some folks on the Army
25 technical staff that have name tags who are experts

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1 in the various areas, so feel free to, you know,
2 address the questions to them, as well.
3 MR. ZEIK SAIDMAN: There are materials
4 around here. So let's take a ten-minute break.
5 (Meeting proceedings recessed
6 10:35 a.m., reconvened 10:50 a.m.)
7 MR. ZEIK SAIDMAN: Everybody get their
8 cookies and coffee?
9 What we say about an agenda, it's a road
10 map to follow. And we'll adjust to go down the blue
11 routes if we have to.
12 But what we're recommending right now is to
13 go to 11:30 for public comments, and then, at 11:30,
14 those people who want to take a tour of the bus -- a
15 bus tour -- because there are some people, I
16 understand, here who are invited out -- who came out
17 to the Arsenal to see the wildlife and be a part of
18 this, but they said they would also want to sit in on
19 the public hearings.
20 So the first bus would be available at
21 11:30, but we will continue public comments -- we
22 have two more buses. So if you miss the first bus,
23 you can take the third -- second or third bus if you
24 want to do it.
25 MR. BILL THOMAS: Zeik, if I may, for those

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1 who have to leave at 11:30, we have public comment
2 cards on this table here and the front table. So
3 their comments will still get recorded, okay, if they
4 want to leave at 11:30 to catch that bus.
5 MR. ZEIK SAIDMAN: Okay.
6 Sir.
7 AUDIENCE SPEAKER: How long, about, will
8 the bus tour last?
9 MR. BILL THOMAS: It's planned
10 approximately 30 to 45 minutes, depending on what
11 kind of questions that may come up on the bus. We'll
12 have some technical folks on the bus that can answer
13 questions that you've heard here this morning. So 30
14 to 45 minutes, approximately.
15 MR. ZEIK SAIDMAN: Okay? So the first bus
16 would be taking off around 11:30.
17 And, Bill, you just want them to go back to
18 the back?
19 MR. BILL THOMAS: Just come right out here,
20 and I'll take care of you.
21 MR. ZEIK SAIDMAN: Thank you.
22 We're now beginning the formal public
23 comment period. As we said in the beginning, we
24 thought, to give everybody an opportunity to speak at
25 least the first time turn around, we would try to

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1 keep it around three minutes. I will time that.
2 Again, those comments can be submitted in
3 writing till December 15th. As Bill mentioned, there
4 is the -- the Arsenal reply card, plus you can send a
5 document in, also, and it's all on the front page of
6 the proposed plan.
7 So is that okay with everybody? So would
8 you come up to the mic --
9 AUDIENCE SPEAKER: Move that mic back.
10 MR. ZEIK SAIDMAN: And there's a suggestion
11 to move it back so you can address both the table and
12 the audience.
13 How's that, about that angle? I'm sorry?
14 Okay. And I just -- I think the floor is
15 open for public comments and let's begin. And I will
16 flag you around three minutes when the time has
17 come.
18 Okay. Who wants to --
19 AUDIENCE SPEAKER: Can I just make a
20 suggestion to speed things up a little bit?
21 At other public meetings I've been to,
22 people have kind of lined up so that each time you
23 don't recognize somebody and then everybody moves
24 away --
25 MR. ZEIK SAIDMAN: Okay. Queue one up.

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1 Queue one up. Okay.
2 (Discussion off the record.)
3 MR. ZEIK SAIDMAN: Thanks, Bill. Please
4 give your name, if you're with an organization, and
5 the city of residence. You don't -- on the sign-up
6 sheet people put addresses but not city of
7 residence. Okay. So name, organization, city of
8 residence.
9 Mayor Busby.
10 MAYOR DAVID BUSBY: What if I said
11 "Brighton"? What would you say?
12 I'm David Busby. I'm the mayor of
13 Commerce City. As far as organizations, I'm a member
14 of the coalition, which is Adams County, Commerce
15 City, School District 14, Citizens Against
16 Contamination, and one other one. R A -- no, the
17 R A B isn't on the coalition.
18 AUDIENCE SPEAKER: Reeser --
19 MAYOR DAVID BUSBY: Jeannie Reeser'
20 office -- Tri-County. That's the other one. And I
21 also am a member of the Restoration Advisory Board,
22 which meets every other month.
23 The comments I have is, first, I want to
24 thank the parties for hosting this meeting,
25 especially since, supposedly, the Federal government

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1 is shut down. I haven't noticed it. Maybe some of
2 you have. But it hasn't had any effect on me. And
3 maybe it saved us some money on our debt, also.
4 I speak not personally but on behalf of the
5 citizens of Commerce City and not necessarily all of
6 them but the majority of them because we've held some
7 public hearings in the city itself with regard to the
8 proposed plan and the eventual record of decision
9 that will be reached, hopefully, in May or June
10 of 1996.
11 We listened very carefully. Initially we
12 had thought that destruction of most of the
13 contaminants out here would be the best way to go.
14 However, a number of the people in our community and
15 Montbello and Green Valley, Brighton, and Henderson
16 area voiced their concern about the emissions from
17 the incineration of the soils and the contaminants
18 within those soils, so we relooked at that with
19 information provided by Tri-County, mostly, since
20 they were somewhat an unbiased group. They had the
21 information available, but they weren't a direct
22 party in the Rocky Mountain Arsenal.
23 With that we came to the conclusion that
24 the proposed plan is a good direction to go in;
25 however, we have some concerns. The concerns are

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1 some of the remedies that have been chosen under the
2 proposed plan, such as Basin A without a liner under
3 it. Hopefully, that the eventual plan will have a
4 slurry wall to bedrock all the way around it. That's
5 just a suggestion. So that we get containment that
6 we can rely on.
7 Also, the Shell trenches, the complex
8 trenches, the Hex pits, similar-type remedies that
9 have been chosen under the proposed plan we have
10 concerns with.
11 One of the others we mentioned was
12 mentioned by Roland Russell regarding the
13 4,000 acre-feet. We have a tremendous amount of
14 concern over that because the South Adams County
15 Water and Sanitation District has approximately
16 13,000 acre-feet adjudicated or have rights to access
17 in the years in the future. So 4,000 we see as a
18 very low amount that was agreed upon without our
19 input.
20 Last statement, we do support the new
21 state-of-the-art, triple-lined landfill that's going
22 to be used. That will give us triple protection
23 versus the present double protection that we have in
24 landfills. And hopefully, this will minimize the
25 cost to us taxpayers -- and that's each and every

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1 one of us -- for the eventual proposed plan, while
2 still protecting us and the habitat here at the
3 communities surrounding the Rocky Mountain Arsenal.
4 And that's all the comments I have. And we
5 will be putting it in writing officially from the
6 City of Commerce City before December 15th.
7 MR. ZEIK SAIDMAN: Thank you, Mayor.
8 Does the panel have any comments to make on
9 anything?
10 Okay.
11 MS. BARBARA NABORS: You might just mention
12 that all of these public comments that are being
13 recorded and that are received in writing will be --
14 appear in the record of decision in a responsiveness
15 summary, and there will be a response from the Army
16 to each and every comment. And that will be
17 available in the libraries.
18 MR. ZEIK SAIDMAN: Okay. Did everyone hear
19 that? A response -- there will be a response in
20 writing to these --
21 AUDIENCE SPEAKER: Time frame?
22 MR. ZEIK SAIDMAN: Time frame, Barb?
23 MS. BARBARA NABORS: Well, let's see. It's
24 this spring. June.
25 MR. ZEIK SAIDMAN: June.

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1 MS. LAURA WILLIAMS: June '96 is the
2 current schedule, but it may drop off a little bit
3 because of the government shutdown. So . . . whether
4 or not we're up in business.
5 MR. ZEIK SAIDMAN: All right. Okay.
6 Thank you.
7 Roland?
8 MR. ROLAND RUSSELL: Once again, thank you
9 very much for holding this meeting on a Saturday when
10 many, many people could come out. It's not always
11 advisable to hold it in the evening, nor on a
12 weekday. I do appreciate everybody coming out.
13 My comments are made in behalf of myself
14 and, also, in behalf of State Representative
15 Jeannie Reeser, who I have represented on the RAB and
16 other committees, such as the Northern Coalition.
17 We were not completely happy with the
18 conceptual agreement. We feel that there are many
19 things that have been left out and that the
20 contamination has occurred over a tremendous period
21 of time since the Arsenal opened in the early 1940s.
22 We feel that the solutions should go beyond Superfund
23 and CERCLA law. I would request that the comments or
24 minutes that were arrived at in the citizen meetings
25 with the principals over the past year, year and a

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1 half also be included in the considerations of
2 reaching the ROD.
3 Thank you.
4 MR. ZEIK SAIDMAN: Did you give -- Roland,
5 did you give your last name, also?
6 MS. CATHY COFFEY-WEBER: Roland Russell.
7 MR. ROLAND RUSSELL: Get it?
8 MR. ZEIK SAIDMAN: Did they get it?
9 Thank you. All right.
10 Any comments from the panel? Okay.
11 Next?
12 Thank you, Roland.
13 MR. JIM ERGER: My name is Jim Erger. I've
14 lived in the Henderson area for a long, long time.
15 I'm a member of the RAB and the SSAB, so the last two
16 years or so I've sat in on lots and lots of
17 meetings.
18 I have a prepared statement that I'm going
19 to read, and then I will make some additional
20 comments afterwards. And this is addressed to
21 Kevin Blose and William J. McKinney with Shell Oil.
22 "Dear sirs: I'm an actual stockholder of
23 the Rocky Mountain Arsenal pollution, having lived in
24 the Henderson area since 1933. Our family farm is
25 located at 112th and Peoria, which is in the heart of

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1 the off-post pollution area of the Rocky Mountain
2 Arsenal.
3 "In my neighborhood in the 1950s I've seen
4 the pollution of our water from our irrigation wells,
5 alluvial aquifer, so bad it contaminated my
6 neighbor's land, killing all growing crops for
7 years. In these same years, in the early-dawn hours,
8 a blue haze could be seen originating from the Rocky
9 Mountain Arsenal, staying close to the ground,
10 drifting from the southeast to the northwest, towards
11 the South Platte Valley. We had to breathe this
12 horrible, smelly, contaminated air.
13 "The Arsenal has not been a good
14 neighbor. It is my opinion that the U.S. Army and
15 Shell Chemical did a first-class job of polluting the
16 Rocky Mountain Arsenal and the surrounding water and
17 lands, and they should be required to do a
18 first-class job of cleaning up their mess. This
19 cleanup must be satisfactory to the majority of the
20 stakeholders.
21 "In farming communities farmers buy a farm
22 to grow crops to make a daily living. As the years
23 go by, they are paying for the farm. When they
24 retire, the farm which they bought and paid for is
25 their retirement program. However, due to the Rocky

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1 Mountain pollution and together with the stigma it
2 has caused for our neighbors, the value of our
3 property -- farm property -- and that of my
4 neighbors has declined drastically.
5 "I am a member of the Site Specific
6 Advisory Board and a member of the RAB. I have been
7 a member since both -- since they've started and
8 have missed very few meetings. During all the
9 negotiations by the parties on the cleanup of the
10 Arsenal, on-post and off-post, at no time was the
11 Henderson area ever represented by anyone. We were
12 completely left out.
13 "We have received all the off-post plume
14 that contains DIMP. There are over 100 citizens
15 receiving bottled water, thanks to the Colorado
16 Health Department, which spares these citizens from
17 drinking the well water that had been polluted with
18 DIMP. This has been a horrible situation for all of
19 us in the Henderson area.
20 "The water, land pollution has gone on
21 for 53 years, from 1942 to 1995. You would think
22 that the U.S. Government, via the U.S. Army, knowing
23 they caused great damage to its own citizens, would
24 lean over backwards to right the wrongs they have
25 caused. Instead, we have to get on our knees, beg

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1 for safe water, hoping they will give us a little
2 something.
3 "As you know, the Shell Oil Chemical did
4 their share of polluting our air. I will give them
5 credit that they bought four to five houses just
6 north of the Arsenal on Peoria Street. I know they
7 paid market prices or above for these properties, as
8 two of these families are lifelong friends of mine
9 and were happy with the sale of them. I am hoping
10 that the Shell Chemical will give the same
11 consideration for the rest of the Henderson area.
12 "Therefore, it seems the solution to
13 correct the problem is to have a totally new supply
14 of water, perhaps from the city of Denver or mountain
15 water, brought to the polluted area. This new water
16 supply, along with the necessary pipelines and
17 distribution lines, should be paid for by the U.S.
18 Army and Shell.
19 "In other areas of the Arsenal of minor
20 pollution, I would agree with the U.S. Army that,
21 were it possible, capping and containment will
22 suffice. I would recommend the smallest amount of
23 soil you have to move the better and the smallest
24 amount of burning and thermal dispersions you do the
25 better.

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1 "I know the Rocky Mountain Arsenal can
2 never be returned to the pristine state it was in
3 1942; however, if it is capped and contained areas
4 are fenced away from the public, the remaining 85
5 to 95 percent of the Arsenal will become the Central
6 Park of the Denver-metropolitan area, as Central Park
7 is to New York City."
8 And so that is my formal comments, but the
9 comments that I have that -- I have been totally
10 frustrated the last few days, trying to -- we're
11 going to set up a large meeting in the Henderson
12 area, hopefully at the buildings down there with --
13 the County buildings and stuff. I've got a whole
14 bunch of the ladies involved.
15 We're going to circulate petitions; we're
16 going to -- instead of being sent back, run over --
17 we've taken all the polluted water that has come off
18 of the Rocky Mountain Arsenal, yet no one has come to
19 us and said, "Well, what are you going to get?" I
20 say, what part of that 4,000 acre-foot belongs to
21 Henderson?
22 You know, nobody says nothing. Where are
23 the pipelines going to go? What size? At one time
24 they were talking 3-, 2-inch, 6-inch pipelines.
25 We're saying, "We want 12-inch pipelines out there."

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1 We want a surface supply of water that either comes
2 from -- like over at Rocky Flats, they're getting
3 Carter Lake water. We want either mountain water,
4 Denver water, or, say, Thornton water or Aurora
5 water.
6 We will not accept any more underground
7 water such as they've been trying to propose to bring
8 out of the Prospect Valley -- hell, it's got radon
9 beyond the regular stuff that's in the -- in the
10 water over in this area.
11 So that's my comments.
12 MR. ZEIK SAIDMAN: Thank you.
13 (Applause.)
14 MR. ZEIK SAIDMAN: Next?
15 Try to -- again, try to be conscious of
16 other people having an opportunity to speak, and
17 those will be put into the record.
18 MR. RICK WARNER: My name is Rick Warner.
19 I live in Broomfield. I'm with the Site Specific
20 Advisory Board. If that wasn't mentioned earlier,
21 it's another board that people can come out and
22 become involved in and get information from. It's an
23 informal board. It's held the last Thursday of each
24 month in the Commerce City municipal building, and
25 sometimes we have intervening work group meetings.

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1 It's a -- anyone can come. Anyone can participate.
2 Anyone can sit in if they want.
3 I will probably run over three minutes so
4 please feel free to interrupt me.
5 I'd just like to say, to begin with, that
6 over the course of the last three years, some
7 progress that I would like to say that has been made
8 is meetings of this sort. This meeting I thought
9 went a whole lot better than past presentations;
10 fewer acronyms, less propaganda, less spinning
11 towards one way or the other, a lot of clarity. I
12 think we're on our way.
13 Certainly, in the last year or so,
14 documentation and help from the various parties is a
15 lot better than it ever has been before. There's a
16 lot more openness.
17 So the -- they've agreed that the public
18 needs to be involved. I'm afraid what I worry about
19 is that they still don't embrace the public role.
20 They still don't respect the public. I think you've
21 heard a little bit about that from Jim. This happens
22 in many areas.
23 I'd like to read -- there's a group called
24 the Federal Facilities Environmental Restoration
25 Dialogue Committee. It's a long name. This is a

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1 committee of Federal agencies, environmental groups,
2 industry, local and city governments, health
3 departments that have gotten together and said,
4 "Things aren't working in Federal facilities. How
5 do we make them better?"
6 And what they've come up with is a series
7 of reports which, one, helped contribute to the
8 establishment of things like Site Specific Advisory
9 Boards, administration advisory boards. But recently
10 they've released -- I always forget the name of
11 this; I'll look it up -- Principles for
12 Environmental Cleanup of Federal Facilities.
13 And I -- there's 14 of them. I have no
14 intention of reading all of them, but I would like to
15 read you the first one and the third one, the nature
16 of the obligation. "The Federal government has
17 caused or permitted environmental contamination.
18 They are, in fact, the largest in the country.
19 Therefore, it has not only a legal but an ethical and
20 moral obligation to clean up that contamination in a
21 manner that, at a minimum, protects human health and
22 the environment and minimizes burden on future
23 generations." I think that's an important part right
24 there, future generations.
25 "In many instances the environmental

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1 contamination has contributed to the degradation of
2 human health, the environment, the economic vitality
3 in local communities. The Federal government must
4 not comply with -- must not only comply with the
5 law; it should strive to be a leader in the area of
6 environmental cleanup, including environmental
7 concerns, ecological concerns, and health
8 requirements."
9 I can heartily agree with the statement.
10 That's -- I think that's certainly on track.
11 That's exactly what I would like to see at the
12 Rocky Mountain Arsenal. I don't think we are
13 approaching that.
14 The third item here is an item they call
15 environmental justice. This is a -- not only
16 theirs, but the president of the United States has
17 issued an executive order on environmental dust for
18 all Federal agencies to follow.
19 It says simply here the Federal government
20 has an obligation to make certain efforts to reduce
21 the negative impacts of environmental contamination
22 related to Federal facility activities on affected
23 communities that have historically lacked economic
24 and political power, adequate health services, and
25 other resources.

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1 I mention this because of the sort of
2 things that Jim's talking about here. What has
3 happened out here is, over the course of the last few
4 months, we have seen that the citizens have come and
5 said, "We want this contamination treated. We want a
6 system where it will go away, but we don't want
7 further emissions; we don't want more odors and
8 vapors to come up; we want this site cleaned up. We
9 want to feel good about the area we live in. We want
10 our water to be safe; we want our water to be safe;
11 we want our water to be safe." They say that all the
12 time. I guess for a reason.
13 Instead, what the Federal government and
14 Shell Oil Company have done here is they have used
15 water to extort a lesser cleanup of this site and
16 still have not provided nearly enough water to
17 satisfy the needs of Commerce City and Henderson.
18 And we are now playing games with the distribution
19 system, limiting the amount of water that can be sent
20 out there. We don't really know where the plumes
21 lie, what -- who exactly is going to be covered, who
22 isn't going to be covered.
23 The very reason there's a proposed plan
24 today is because of water out there, because they
25 agreed to water. There are no details to that

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1 agreement. You're agreeing to a pig in a poke if you
2 think this proposed plan has gone far enough along to
3 get what people need out of this.
4 MR. ZEIK SAIDMAN: Rich, how close are you
5 to wrap-up?
6 MR. RICK WARNER: Hours. Is that
7 three minutes?
8 MR. ZEIK SAIDMAN: Can you give us a
9 couple -- yeah, it's more than three minutes. Can
10 you wrap up in a couple minutes, and then other
11 people -- and then you can come back.
12 MR. RICK WARNER: Just simply, I think what
13 you want here is you want a cleanup that's going to
14 be protective now; people are involved with water
15 because the water's bad.
16 You want people -- you want a cleanup
17 that's going to be protective for your children and
18 your grandchildren and my children and my
19 grandchildren. And anybody else's children and
20 grandchildren that come here.
21 This area is developing rapidly. There's
22 going to be more people here in a very short period
23 of time. They need to know the ground they live
24 on is safe, that the winds that blow their way are
25 safe, and that the water that they're going to be

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1 using is safe.
2 (Applause.)
3 MR. ZEIK SAIDMAN: Other comments on the
4 plan?
5 MR. WALDO SMITH: I'd like to make a
6 comment.
7 MR. ZEIK SAIDMAN: Okay. Come up.
8 MR. WALDO SMITH: My name is
9 Waldo G. Smith. I'm a member of the SSAB and the
10 RAB. I'm also an aide to Councilman Dennis Gallager
11 of the First District of the City and County of
12 Denver.
13 MR. ZEIK SAIDMAN: Is that -- does
14 everybody know what SSAB is?
15 MR. WALDO SMITH: What's that?
16 MR. ZEIK SAIDMAN: Do people know what SSAB
17 is and the two things you mentioned? I may be the
18 only person that doesn't.
19 MR. WALDO SMITH: SSAB is the Site Specific
20 Advisory Board to the Rocky Mountain Arsenal.
21 MR. ZEIK SAIDMAN: And the other thing you
22 mentioned was?
23 MR. WALDO SMITH: And the RAB is the
24 Restoration Advisory Board.
25 MR. ZEIK SAIDMAN: Okay. Thank you.

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1 MR. WALDO SMITH: At the beginning of this
2 discussion I didn't feel like I should be saying
3 anything, but as a result of what I've heard, I would
4 like to introduce into the record part of my comments
5 on this cleanup exercise. And it all starts out with
6 a letter from the acting deputy assistant secretary
7 of the Army from Washington. It's addressed to my
8 colleague, Dennis Gallager.
9 "I would like to thank you and Mr. Smith
10 for your letter of August 29th to President Clinton
11 concerning a trust fund provision in the agreement as
12 a conceptual remedy for the cleanup of the Rocky
13 Mountain Arsenal."
14 And I go further in my comments by saying,
15 with specific reference to a possible trust fund, a
16 little research by a naive layman indicates some
17 interesting facets and financial aspects of the Rocky
18 Mountain Arsenal cleanup. And what I've found was
19 that, over the years, our United States Government
20 has misused the term "trust" specifically in
21 connection with Social Security. They have taken the
22 word "trust" to mean "slush." And as a result, we
23 have concern over our trust funds.
24 This is very unfortunate, that we should
25 allow this to continue. And if I have any breath

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1 left in me at the end of this year, I'll continue to
2 pursue this problem.
3 I go on by saying that the trust fund --
4 I'm not going into the details because that's
5 annoying.
6 Please notice that at the beginning of this
7 discussion, under Item 4, I mention escrow. The
8 scheme would not be effective in the present fiscal
9 year. The Army has been assured of its
10 appropriations for this fiscal year. This situation
11 would, hopefully, give a public-private partnership
12 an opportunity to bolster the trust fund with
13 individual or corporate tax-exempt donations. This
14 will give the general public a direct chance to
15 rehabilitate the environment we need to protect for
16 our survival and -- in parentheses -- and
17 politicians. The fiscal control of the trust fund
18 should be overseen by the General Accounting Office
19 as an independent, unbiased government agency.
20 Thank you very much.
21 (Applause.)
22 MR. ZEIK SAIDMAN: Any comments from the
23 panel? Okay.
24 All right. Any other comments?
25 MS. CATHY COFFEY-WEBER: Zeik, right there.

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1 MR. ZEIK SAIDMAN: I'm sorry. Okay.
2 Again, state your name, organization, if
3 you're with one, and your city of residence.
4 MR. SRINADH IYENGAR: My name is
5 Srinadh Iyengar; I come from the Highlands Ranch.
6 Myself and my son were visitors. We just came to see
7 the wildlife but got our program canceled but have
8 sat here listening to what was happening.
9 Just to tell you two bad experiences that
10 we did have -- we're now in the beginning of this
11 process. Just two weeks back I was going through the
12 Merritt Island Wildlife Preserve, and I was very sad
13 to read the story of one songbird that would appear
14 ten years, people watched it diminish in numbers
15 slowly and finally it died. But today we say we're a
16 thriving wildlife national preserve. And I hope
17 that, in years to come, that you will come to see
18 that similar suggestion here but not hear the same
19 sad story.
20 The second thing is I moved from San Diego,
21 from an area called Tierrasannta, where one of the
22 first things we heard when I went there was there
23 were unexploded shells in that area and two children
24 were killed picking up -- picking those up.
25 And even today the discussion is still going on,

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1 after 40 years. And people are still trying to find
2 out how they can get rid of these shells. And I hope
3 that we won't be able to hear or see those problems
4 come back.
5 Thank you.
6 MR. ZEIK SAIDMAN: Thank you.
7 (Applause.)
8 MR. ZEIK SAIDMAN: Any comments?
9 All right. Anybody else?
10 Okay.
11 MS. SANDRA JAQUITH: My name is
12 Sandra Jaquith, and I've been involved in this
13 process for about 12 years. I started off as a
14 member of Citizens Against Contamination, an
15 organization based in Commerce City. We got involved
16 because there was TCE in the water in the Commerce
17 City area, and we started fighting for cleanup of
18 water, and our group continued then into a monitoring
19 process of the cleanup of the Rocky Mountain
20 Arsenal.
21 For the last year and a half I've been a
22 member of the SSAB, which is the Site Specific
23 Advisory Board, and I'm community cochairperson of
24 the RAB, which is the Restoration Advisory Board,
25 for the cleanup of the Rocky Mountain Arsenal. As

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1 many of you already know, we have written comments
2 that are due by December 15th, and I'll be doing
3 detailed written comments at that time.
4 MR. ZEIK SAIDMAN: Sandra, what city of
5 residence did you mention?
6 MS. SANDRA JAQUITH: I'm sorry, Denver --
7 I'm a citizen of Denver, Colorado. Grew up in
8 Commerce City and lived here until -- well, lived
9 here for about 30 years before I moved into Denver,
10 which is how I got involved in this process.
11 There are just a couple of things that I
12 wanted to make a point of this morning on the
13 record.
14 As some of you probably realize, there are
15 many of us here who could probably go on for hours
16 about our comments about the cleanup of the Rocky
17 Mountain Arsenal, and that brings me to the way this
18 whole thing is structured.
19 One of the comments I've made in public in
20 the past I would like to make for the record today is
21 that I'm very much opposed to the way this whole
22 document was structured. For those of you who aren't
23 involved in this process, as you read this document
24 you would think that there are actually
25 five alternatives that are being considered for

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1 treatment or a remediation of the Rocky Mountain
2 Arsenal.
3 And the truth is that what they describe on
4 the second page as the agreement that they reached,
5 the parties reached back in June, really does make a
6 definite agreement about what course they are going
7 to pursue for the remedy as -- at the Rocky Mountain
8 Arsenal.
9 Now, what we've been told is that in the
10 process -- this is a legal process that they have to
11 follow, the meeting they have here today, and they'll
12 listen to all of our comments. But unless there's
13 something that really will derail their agreement,
14 the agreement is also set pretty much in stone. And
15 so the alternatives that you're reviewing and
16 commenting on I think are really a misnomer. I think
17 it's really an illusion about public comment about
18 the cleanup or the remediation of the Rocky Mountain
19 Arsenal.
20 My second comment about this process is the
21 use of the word "cleanup." And I've used it a couple
22 times this morning. And I'm sorry to have that be
23 such an easy phrase to use because there's no cleanup
24 at this site. At this point there's nothing about
25 a -- "cover-up" is the word I use for it. And I

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1 don't mean that just to be sarcastic about it.
2 It's simply a matter of landfilling
3 contamination, some of the contamination, and putting
4 a -- sometimes a very thin soil cap or cement cap
5 over the rest of it.
6 One of the concerns we have is the
7 long-term monitoring and maintenance of those caps.
8 In our processes of discussion about maintenance,
9 they are talking about a 30-year program, and we
10 think this is a -- this is contamination that will
11 last for hundreds -- if not thousands -- of years,
12 and we're very concerned that, if they're not going
13 to clean this up, that there be an adequate process
14 for monitoring and maintaining the remedy that they
15 have in place, which goes back to Waldo's comments
16 about a trust fund.
17 One of the things that was raised earlier
18 today by Roland Russell from Commerce City is the
19 SAPC process that we were involved in. And that was
20 the discussion that we describe on page 2 when they
21 cited their alternatives.
22 The public was -- there were several of us
23 or many of us who were involved in discussion leading
24 up to the decision of their remedy. But when the
25 parties actually decided their remedy, they went

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1 behind closed doors with their own discussions and
2 decided what the remedy would be.
3 One of the things that I would ask is that
4 all of the citizens' comments throughout that period
5 of the SAPC negotiations be included as part of the
6 official record so that those are also considered as
7 comments in the process of the decision of
8 remediation of the Rocky Mountain Arsenal.
9 And last but not least and one of the most
10 important issues today ties into the whole issue of
11 the cleanup or the nonclean-up of the Rocky Mountain
12 Arsenal, and that is that the argument for doing
13 covers, rather than any other kind of treatment --
14 well, there are many, money being one of them.
15 And one of the others is those
16 contaminations aren't reaching anybody. But those
17 contaminants will still be going into groundwater,
18 and we have major groundwater problems out here. And
19 with that in mind, one of the big fights that you
20 heard Jim Erger talk about earlier is how much water
21 will be available for the citizens of the surrounding
22 communities whose water has been affected by these
23 contaminants, contaminants that they didn't put in
24 place and that they had no control over.
25 It's a travesty if Henderson, which lies

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1 directly to the north, northwest of the Rocky
2 Mountain Arsenal, does not have an alternative water
3 supply. We're very concerned about all of the issues
4 of water, including the amount of water that is given
5 to SACWSD -- which is the South Adams County Water
6 and Sanitation District -- how many homes in the
7 plume above the Rocky Mountain Arsenal or north of
8 the Rocky Mountain Arsenal will be hooked up, how big
9 the pipes will be that connect the alternative water
10 supplies with those homes, and whether or not there
11 will be any water available and any process available
12 for expansion by Commerce City or the other
13 communities into the north and northwest area once
14 the remediation has taken place.
15 So as an outline of my major concerns, you
16 can probably see that I'm not very happy with the
17 decisions that they've come to concerning the
18 remedies of the Rocky Mountain Arsenal. I think that
19 they leave a great deal to be desired. They're
20 minimal at best.
21 And I hope that all of you who are here
22 today for the first time, with these kinds of
23 comments in mind, will take some time to reexamine
24 the document they've given you and call some of the
25 agencies on here, particularly including the State

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1 and the EPA. I tend to think of the State as here to
2 protect your interests. And though I have
3 disagreements with them occasionally, I believe that
4 they're here for us.
5 Call somebody from Commerce City or South
6 Adams County Water District or ask to get a hold of
7 me or somebody from SSAB or RAB, and we'll be happy
8 to talk to you about some of our concerns and the
9 processes that we have had or the involvement that we
10 have had in this process.
11 MR. ZEIK SAIDMAN: Thank you.
12 MS. SANDRA JAQUITH: Thank you.
13 (Applause.)
14 MR. ZEIK SAIDMAN: Before the next person
15 makes a comment, I'd promised that the tour group who
16 wanted to take a bus could leave at 11:30. And,
17 Bill, maybe they'd go through that exit down there.
18 MR. BILL THOMAS: If they would, please.
19 Whoever wants to go on the bus tour this
20 time should, for right now, just exit through there.
21 Thank you.
22 MR. ZEIK SAIDMAN: They've been patiently
23 waiting. But we have other business, and we will
24 again continue with the comments that people want
25 to make.

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1 MS. LAURA WILLIAMS: Zeik, I'd like to just
2 respond a little bit to what Sandy said before we
3 start again.
4 MR. ZEIK SAIDMAN: Okay. Can we
5 reconvene.
6 Laura wanted to respond -- Sandra --
7 Sandra, Laura wanted to respond to something in your
8 comments.
9 MS. LAURA WILLIAMS: I just wanted to
10 reiterate again that EPA very much wants to hear
11 public input in the process. We don't consider it
12 just a little process that we go through. We take it
13 very seriously.
14 And I think that to come to a conclusion
15 that somehow there was a cover-up, as it's been
16 discussed, unfairly characterizes what's been going
17 on at the Arsenal. We've had a very contentious
18 nature with all the stakeholders involved, lawsuits
19 between the parties going on, and so it makes sense
20 that we do have to come to some kind of agreement
21 amongst ourselves before we can even come to the
22 public with any kind of a meaningful proposal on how
23 to clean up the site.
24 So I believe very strongly that we have
25 come to that agreement; we have commitment from all

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1 the stakeholders saying, "Yes, we believe this is the
2 right way to go." And this meeting, even though it
3 is part of the formal process, is our way of coming
4 to the community and saying, "Please tell us what you
5 think of this."
6 So at least from the Environmental
7 Protection Agency's viewpoint, this is a very
8 important part of selecting that remedy. It's not
9 just going through the motions of pretending that
10 we're hearing what you have to say and then just
11 coming up with our own decision. And I feel that --
12 I've been involved at a lot of other Superfund sites,
13 and this is a very typical process for all Superfund
14 sites. It is not something just specific to the
15 Arsenal.
16 MR. ZEIK SAIDMAN: Thank you.
17 Comment? For the record. And name --
18 MR. LARRY FORD: Okay. My name is
19 Larry Ford. I'm the manager of the South Adams
20 County Water and Sanitation District in the Commerce
21 City area. I live at 12388 Leevy Circle in
22 Henderson, Colorado.
23 I thought maybe I ought to get up and say a
24 few words so that you do know that the water district
25 is very interested in what's happening. We've worked

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1 with the Army for many, many years, and we've got the
2 Klien treatment plant built at the Army's expense and
3 EPA. They did a very good job, and they worked very
4 closely with us.
5 The problem is is the Klien treatment plant
6 doesn't deal with some of the future contamination
7 that we see coming at us, and that's why we felt that
8 the only way to put this community back is to -- to
9 have a new water supply.
10 It's probably the most critical thing for
11 the Commerce City area and the Henderson area, is
12 that the water supply be replaced. We've -- we've
13 got the rights to -- I believe it's around
14 12,000 acre-feet of water. The Army and Shell are
15 saying, "We'll replace 4 of it, 4,000 acre-feet."
16 But we don't think that's enough, especially with the
17 Henderson area.
18 The main reason is, if you have
19 4,000 acre-feet of very pristine water that you can
20 mix with the Klien treatment plant water, it would
21 probably -- we'd end up with something that would be
22 acceptable to the citizens. But we've got to make
23 sure that it's a -- it's very high-quality water,
24 and we've got to make sure that Henderson is
25 dealt with.

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1 The citizens -- there's a lot of you
2 sitting in this room -- we went forward, we got the
3 coalition formed and several other committees. We
4 got to sit at the table in the negotiations. We feel
5 we were a friend of the Army and EPA -- Army and --
6 and Shell. I think they got by with a lot less than
7 they would have got by with if they -- we hadn't
8 have been at the table.
9 I think the State and EPA wanted much more,
10 as far as the cleanup. But we knew we had to get it
11 done. We couldn't sit here for another ten years
12 before we made a decision. We couldn't end up in
13 court.
14 But I think the main thing was that we
15 expected that we would end up with a water supply for
16 the community that would help put our lives back
17 together, that we would -- that we could see growth,
18 we could see things happening that hasn't happened
19 now Maybe our property values would come back. We
20 live out here, we can't get any development, and it's
21 all because of the water.
22 We're not saying the Army's totally
23 responsible. We know they're not in our present
24 area. So maybe the 4,000 acre-feet doesn't look bad
25 for our area, if it's good water, but -- but what

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1 about Henderson? Henderson's very important because
2 the contamination in Henderson is directly related to
3 the Army and the Rocky Mountain Arsenal.
4 So I guess I play on the Army and Shell's
5 sympathy, that -- you want the citizens behind you,
6 you want to get this thing wrapped up. You know,
7 look at -- look at Henderson, look at some more
8 water, and look at a good quality water so that our
9 community can be put back together.
10 Thank you.
11 MR. ZEIK SAIDMAN: Thanks.
12 (Applause.)
13 MR. ZEIK SAIDMAN: Okay. Additional
14 comments?
15 Okay. Name, organization if you're with
16 one, and the city.
17 MR. DAN MULQUEEN: My name is
18 Dan Mulqueen. I'm a resident of Denver. I'm a
19 member of the Site Specific Advisory Board and the
20 Restoration Advisory Board.
21 And as a result of the -- a lot of people
22 have referred to the fact that some organizations of
23 people were involved in the SAPC steering and policy
24 committee -- subcommittee -- or committee
25 negotiations. And when that came to an end and we

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1 were finally invited out of the negotiations, we
2 did 10 or 15 minutes of a round on the 20 different
3 sites or so, what objections and what concerns we had
4 about those sites.
5 But one issue came up for every one of
6 those sites and one issue only, and that was dioxin,
7 which is a contaminant that citizens have suspected
8 out here for a long time due to the haphazard and
9 uncontrolled burning, and it's a great health
10 concern, worldwide and locally.
11 And we still haven't seen any information
12 or any approach to dioxin as a contaminant. That's
13 something we think might be a serious mistake, due to
14 the fact that this will be a wildlife refuge; the
15 wildlife might be impacted by it if it's here without
16 testing for it anywhere. I think there's a great
17 risk that the wildlife refuge might be
18 nonsustainable, nonsupported, and might become a
19 problem in the future. And I just -- I really think
20 we need an answer to that before we go too much
21 further.
22 We have another problem -- I personally
23 have a real problem with the fact that land disposal
24 restrictions -- which is something that Congress
25 instituted in 1984 in the Reagan administration,

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1 which -- very strong law against burying hazardous
2 waste without treatment. There's no document that
3 containment of waste is, in the public perception,
4 far superior to dispersal through incineration.
5 But I don't think that the matrix goes far
6 enough, in that there are alternatives to just
7 untreated land disposal. I think there's
8 alternatives to incineration. I think those have to
9 be considered at greater length than has been
10 considered here.
11 Right now I think what's being considered
12 for -- as waivers against land ban are things that
13 may or may not be legal, and I think they should be
14 looked at really seriously. I think just an
15 agreement, the conceptual remedy -- agreement on a
16 conceptual remedy made by the parties is kind of an
17 agreement not to sue each other over these things.
18 And I think a Judge ought to look at this
19 and see whether or not RCRA is in -- kind of being
20 sidestepped by what's called the CAMU rule, which is
21 a rule that they're -- it's already been sued under
22 by the Environmental Defense Fund in Washington, and
23 there's some kind of a settlement working on that,
24 where the EPA has agreed to either rewrite or do away
25 with CAMU.

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1 Now, if this whole remedy is built on
2 supposed exemption from the land ban and that
3 exemption goes away before the remedy's even begun to
4 be implemented, where are we then? Well, let's see a
5 contingency for that.
6 Let's see some contingencies for seeing if
7 keeping the lakes full doesn't -- if that
8 doesn't -- it's theoretical. They say, if they find
9 enough water to keep the lakes full, then the plumes
10 won't move around. Well, what if that's not true?
11 I mean, these are the kind of things we're
12 going to find out when they're performed. You know,
13 hopefully, it will be good enough monitoring that
14 we'll know whether or not this is successful. If
15 it's not successful, then what? I think we have the
16 right and the obligation to consider these things,
17 and the public should be able to comment on these
18 things, not just comment on what we've already seen.
19 I think we -- we need to see the
20 contingencies. What happens if these things don't
21 work? What happens if the rules change? What
22 happens if the laws and the exemptions to the laws
23 change or are found illegal? Then what?
24 There's a lot of money here. There should
25 be more money. Poor -- the Federal government

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1 poor-mouth and -- about cleaning up their own mess
2 infuriates me. When they need a B-1 bomber, there's
3 no poor-mouthing. They just go get the damn money.
4 The whole government's supposedly shut down today,
5 nonessentials shut down today. Well, they found a
6 way to put this together. They found a way to carry
7 it out. Shell came up with the money to pay the
8 salaries of the people who came today.
9 Let's -- you know, let's get one way or
10 the other. We either don't have the money or we do
11 have the money, but I think it should be
12 generalized.
13 And the issue of water is -- is critical.
14 I think we should see the water before we see the
15 decision.
16 Thank you.
17 MR. ZEIK SAIDMAN: Thank you.
18 Comments from --
19 MS. BARBARA NABORS: I wanted to respond to
20 part of Dan's comment.
21 In response to the dioxin issues, that's
22 been a concern that's been expressed by Dan and other
23 stakeholders. The State went ahead and embarked on a
24 small-scale study to look at the dioxin in the tissue
25 of animals and soils here at the Arsenal, and I've

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1 been frustrated because that data isn't available
2 yet. And I know that you've been asking me
3 frequently about the whereabouts of it.
4 Part of the reason for the delay is that
5 our wildlife toxicologist, who's performing the
6 study, decided that we needed to expand the scope of
7 the analysis, and that is the reason that we haven't
8 gotten the information out yet. But I can commit to
9 you that, when we get it available, we will make that
10 available to the other -- to the stakeholders.
11 MR. DAN MULQUEEN: Thank you.
12 MS. LAURA WILLIAMS: I also have a small
13 comment --
14 MR. ZEIK SAIDMAN: Laura.
15 MS. LAURA WILLIAMS: -- just in terms of
16 the Superfund process.
17 If there are changes in the remedy that are
18 made, if they're small changes -- such as, "Well,
19 let's move the building over 1 foot" -- that
20 generally does not go out to the public for
21 additional comment. However, if it is a large change
22 which says, "We can no longer landfill" or "The cap
23 is going to be changed so significantly that it's
24 totally revised," that will go out to the public for
25 additional comment, and it will go through this

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1 formal public comment process that you're seeing here
2 for the proposed plan.
3 MR. DAN MULQUEEN: Can you name that
4 process? Is that significant -- the planning a
5 significant difference? Is that what --
6 MS. LAURA WILLIAMS: It's just called
7 post-record of decision changes, and there are
8 two different documents that can be produced as a
9 result of that. One is the explanation of
10 significant differences, and the other one is called
11 a ROD amendment, literally amends the entire remedy.
12 MR. DAN MULQUEEN: And can you tell us
13 which of those are open to public comment?
14 MS. LAURA WILLIAMS: Sure. The ROD
15 amendment 100 percent is. The explanation of
16 significant differences is made available to the
17 public, does not incorporate public comment, quote,
18 unquote, as part of its selection, but it can be
19 developed that way.
20 AUDIENCE SPEAKER: And that's up to
21 the EPA?
22 MS. LAURA WILLIAMS: Up to the parties
23 as -- as things are being developed. I would think
24 it's more a reflection of community involvement and
25 community concern, more than it is does EPA want to

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1 do it.
2 MR. ZEIK SAIDMAN: Okay.
3 MR. RAY RAUCH: Comments, Zeik.
4 MR. ZEIK SAIDMAN: Michael, Ray. Okay.
5 MR. MICHAEL ANDERSON: I'd just like to
6 comment that Shell, as well as the other parties here
7 at the table, except the Colorado Department of
8 Health, are all signatories to a Federal facility
9 agreement in 1979 which had a settlement agreement
10 associated with it on how Shell would help pay for
11 cleanup activities.
12 Shell is not paying the Army while they're
13 on furlough. That is an incorrect statement, Dan. I
14 don't know where you got your information.
15 MR. ZEIK SAIDMAN: Ray, did you have
16 something?
17 MR. RAY RAUCH: Yes. To date the service
18 has found no wildlife that attributes the death to
19 dioxin. We provided specimens to the State to look
20 for dioxin residues there. So to date we don't have
21 any evidence of any wildlife that's been affected.
22 MR. DAN MULQUEEN: But you say that you --
23 you haven't found anything that you've attributed
24 dioxin as a cause of death.
25 MR. RAY RAUCH: Cause of death.

1 AUDIENCE SPEAKER: But have you found
2 wildlife with tissue concentrations of dioxin?
3 MR. RAY RAUCH: No. That's what's provided
4 to the State, to look for those. But we found
5 other -- the contaminants and if it's another
6 wildlife disease or trauma, hit by a car or
7 something.
8 MR. DAN MULQUEEN: Okay. Do you know what
9 the -- what the -- what kind of pathology results
10 from dioxin poisoning?
11 MR. RAY RAUCH: We didn't look for dioxins
12 on those things. We were looking for the chemicals
13 of concern.
14 MR. DAN MULQUEEN: Why are not the --
15 Charlie, why are not the dioxin, PCBs, MDMA, and --
16 one more -- are not in the human health risk
17 characterization? There's -- there are four
18 chemicals that seem to be drivers that aren't listed
19 here. Do you remember what -- when -- what are we
20 going to do about that?
21 MR. CHARLES SCHARMANN: Well, let me first
22 explain how we went about developing that list that's
23 in the proposed plan.
24 The contaminants of concern, that list
25 resulted from an exhaustive review of all the

1 chemicals that were used on Rocky Mountain Arsenal
2 and a database that -- we had to figure out exactly
3 what we expected to find out here. That's a very
4 extensive list of chemicals. Okay.
5 We did some screening analyses as part of
6 our investigations to find out exactly what may be
7 there, and we used that information to tell us how
8 frequently some things were detected and -- in order
9 to get us a smaller list. That's not a list of every
10 single compound that may be at a site, but it's a
11 list of chemicals that would drive you and your
12 decisions of what remedy you pick between a -- to
13 clean a site up.
14 In the case of the animals, a smaller list
15 was developed because those are the chemicals most
16 likely to be found in animals out here. Based on
17 historical analysis, our view was that dioxin, if --
18 we do not have a likelihood that dioxin would be out
19 here in levels that would be of concern. And in
20 fact, much of the remedy that we've already developed
21 for other chemicals also would address dioxin or
22 other chemicals that are in that area.
23 So because there was not a specific program
24 for it, you know, does not mean that it's not being
25 addressed by our remedy. The State is doing some

1 additional work, and based on that, there may be
2 something identified to say, "Hey, maybe you need to
3 do some additional work for dioxin." But our view is
4 that that is not the case, and -- but we're open, as
5 studies go on, to take a look at that.
6 MR. DAN MULQUEEN: Wasn't that -- isn't
7 the part of the beauty of a burying solution, in that
8 it doesn't really matter what's there; you're just
9 burying it anyway?
10 MR. CHARLES SCHARMANN: Well, you certainly
11 have to have a material characterized to the point to
12 know what containment measures to use, and you want
13 to make sure liners -- to the extent that you're
14 using liners -- are compatible with the waste that
15 you're putting in touch with those liners.
16 So certainly, you know, you need to have
17 some level of characterization done. We feel we have
18 extensive soil data to know, you know, what we're
19 putting in our landfill. And yes, in the case of --
20 if dioxin were there, it would be contained by the
21 facilities we're putting in, that's right.
22 MR. ZEIK SAIDMAN: Let me give some
23 other -- thank you.
24 Anybody else? I mean -- opportunity to
25 ask a question.

1 And let me -- Bill was asking me if
2 there's anybody else interested in the tour bus. Is
3 anybody else? Okay.
4 Bill, do we have a bus available? Do you
5 want to go now, or do you want to stay --
6 AUDIENCE SPEAKER: We want to stay.
7 MR. ZEIK SAIDMAN: You want to stay.
8 Okay.
9 MR. BILL THOMAS: So can I get a show of
10 hands how many people are interested in a tour?
11 That's fine. We have plenty of room.
12 Thank you.
13 MR. ZEIK SAIDMAN: Okay. And about a half
14 dozen, Bill, raised their hand.
15 Do you want to stay till the end of the
16 hearing? Okay.
17 All right. Let me just also get a show of
18 people who want to make comments. How many more
19 people want to make -- this gentleman does over
20 here. Anybody else besides this gentleman in terms
21 of comments? Okay.
22 Go ahead.
23 Name and organization, if you would.
24 MR. RON PACE: My name is Ron Pace. I'm a
25 citizen of Commerce City, and I have been for life.

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1 First of all, I want to thank the board for
2 at least coming out. And you have been very
3 informational, and I thank you for that.
4 But to the citizens, I -- I thank you for
5 your concern. As you know -- as you see me, I'm a
6 very young person, and I am very concerned about the
7 water situations and the soil that is here at the
8 Arsenal. I've lived here my whole life, and the
9 biggest complaint that I hear, just from friends that
10 I have over, is "What's this smell? What's the
11 water?" Well, I agree with them. What is the
12 smell? What is the water?
13 And one thing I ask -- and that I want to
14 take part of -- is let's unite, let's get this thing
15 fixed. I want to know the organizations that I can
16 stand behind that is going to watch people like this
17 and say, "Hey, let's get this thing fixed. We can
18 work together, that's fine, but let's get it fixed."
19 I want to thank everybody for their
20 concerns, and I appreciate it from one young person
21 to everybody else.
22 (Applause.)
23 MR. ZEIK SAIDMAN: Okay. Final comments?
24 Rich, you had some more comments?
25 Okay. Does anybody -- has anybody not had

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1 a chance to speak who would want to speak?
2 MR. ROGER BAIN: I think I want to say
3 something.
4 MR. ZEIK SAIDMAN: Do you want to say
5 something?
6 If you don't mind, Richard.
7 MR. RICK WARNER: No.
8 MR. ZEIK SAIDMAN: Anybody else who wants
9 to speak before we repeat again?
10 Okay. You want to speak.
11 Okay. Anybody else?
12 All right. And then we'll go back
13 through people who had a chance to speak already,
14 to be fair.
15 MR. ROGER BAIN: My name's Roger Bain. I
16 live in Henderson.
17 And one of the things -- this whole
18 situation has been frustration to me. Part of
19 it's -- I didn't understand how they came up with
20 the conclusion to not clean up anything off-site. I
21 read the materials at the library, and I did not --
22 was not happy with the fact that they did their
23 tests, were short -- let's see, how do I want to say
24 this? They tested their like unknown pesticides on
25 dogs. They fed them to them for a month to determine

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1 long-term effects over a short-term period. And I
2 don't think that's reasonable.
3 And also, when they did the background
4 tests for what's north of the Arsenal, what
5 contaminants there are there, they didn't do anything
6 from the south. There are no test sites from the
7 south of the Arsenal. All of them were north.
8 There's one east, one west. Where in the hell's the
9 south?
10 That doesn't make any sense, logically, for
11 scientific conclusions.
12 MR. ZEIK SAIDMAN: Panel, do you want to
13 respond to that point?
14 Charlie?
15 MR. CHARLES SCHARMANN: Yeah. I guess I'd
16 like to question whether you're referring to water or
17 soil tests first.
18 MR. ROGER BAIN: Both.
19 MR. CHARLES SCHARMANN: Okay. With regard
20 to the soil tests that were done, we did a lot of
21 soil sampling on the Arsenal. And based on those
22 results, we were able to see where soil possibly had
23 blown off the Arsenal. And the trends, based on wind
24 patterns -- basically, the prominent winds are to the
25 north and to the east. And so that's where surface

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1 soil was blowing, and that's where we concentrated
2 our tests.
3 We did take soil samples on the south edge
4 of the Arsenal, and . . .
5 AUDIENCE SPEAKER: Not off.
6 MR. CHARLES SCHARMANN: Right. Not off
7 because, based on the results that were on the
8 Arsenal, we did not see results that were high enough
9 to say that it would go any further south.
10 I believe EPA, in response to some concerns
11 of some citizens down in the Montbello area, has
12 taken some samples, but that's -- to address the
13 specific concerns of folks in that area.
14 But based on the data we have on-site, I
15 think that the parties are in agreement that we've
16 looked at the areas where there was a chance that our
17 chemicals could have migrated.
18 With regard to groundwater, groundwater
19 flows from the south to the north to the northwest.
20 So that's -- that's the reason why we concentrated
21 our efforts in groundwater, you know, to the north,
22 because those are the areas that could have been
23 impacted by our Arsenal operation.
24 MR. ROGER BAIN: I understand that part but
25 I'm thinking of like a blank. You know, what's not

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1 there is in the south or south -- on the southern
2 side. So anything that you do on the north side, you
3 do have contamination, you have a level that's
4 already there, you're not seeing that -- well, maybe
5 before anything was here to the south -- you're not
6 seeing what wasn't there.
7 Does that make any sense?
8 MR. CHARLES SCHARMANN: As a -- like a
9 background sample? Is that --
10 MR. ROGER BAIN: Yeah. I mean like
11 blank --
12 MR. CHARLES SCHARMANN: Okay. We did test
13 some areas totally removed from Rocky Mountain
14 Arsenal. And in some cases we went north and east of
15 Brighton, you know, areas that would not be impacted
16 by, say, wind transport of soils and things such as
17 that. And we took some samples to try to establish
18 what the ground ought to be, and in an agricultural
19 community you do have some pesticides in your
20 background samples.
21 MR. ROGER BAIN: I understand that.
22 MR. CHARLIE SCHARMANN: And we used that
23 information to see whether the Arsenal has impacted
24 the areas above what we would call background
25 levels.

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1 So we did try to address that. Taking
2 samples south of the Arsenal, you know, wouldn't
3 necessarily be background, necessarily. You know,
4 north of the Arsenal it's highly agricultural so we
5 went into areas like -- again, I said north and east
6 of Brighton where -- that are similar but unaffected
7 by the Arsenal. So we did try to address that very
8 issue.
9 MS. BARBARA NABORS: You might also mention
10 that the State was concerned with the soil off of
11 those, as well. And as part of the conceptual remedy
12 and the off-post RAB, there's going to be 160 acres
13 of surficial soil tilled to try and remove it from
14 the surface in the off-post area.
15 And I'm thinking that perhaps your comments
16 about short-term versus long-term tests had to do
17 with DIMP and water and the mink studies and that
18 sort of thing. That -- you probably know that that
19 was a major, major concern of the State.
20 And the Army is using our State groundwater
21 standard of 8 parts per billion so we are -- feel
22 comfortable that that issue has been resolved.
23 MR. CHARLES SCHARMANN: I guess one further
24 thing, address your concern and then Jim's comment
25 regarding being left out. And I apologize. You

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1 know, we try to make ourselves available to address
2 questions. Some folks have been involved in
3 discussions over the past year, year and a half. We
4 always can do a better job of that.
5 And you know, we'll be committed to work
6 with you, whatever meetings that you want to attend
7 where we talk about the water supply issue, who gets
8 hooked up, who doesn't, you know, where pipelines go
9 and things like that.
10 A lot of that has not been even discussed
11 yet. The commitment is there to address that area.
12 How we go about doing that in terms of where the
13 waterlines are -- is it South Adams County? Is it
14 Brighton? There are new wells that need to be
15 installed, things such as that. Those discussions
16 need to take place.
17 We've been working with Tri-County to try
18 to survey the area to see what some of the concerns
19 are that people want to know. There's -- we've heard
20 there were some concerns of some folks who saw that
21 survey.
22 So I guess we'd like to work with whoever's
23 interested in that, but we need to get out in that
24 area and hear some of the concerns, and that was the
25 purpose of this survey that was developed by

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1 Tri-County, was to use that as a vehicle to get out
2 there and find out, you know, what the people had on
3 their mind, what they want. Do they want to be
4 hooked up to a municipal water supply? You know, do
5 they want a monthly water bill? Things like that.
6 I mean, we don't want to force something on
7 somebody, so we need to definitely get in touch with
8 the community.
9 And, Jim, we'd like to work with you and
10 anybody else, really, who wants to get involved in
11 that. We need help on it.
12 MR. ROGER BAIN: Okay. I don't have other
13 questions.
14 MR. ZEIK SAIDMAN: Okay. Back there, this
15 gentleman. Comment on the proposed plan, name, and
16 organization.
17 MR. MIKE WALTENBURG: My name is
18 Mike Waltenburg. I live in Commerce City. I've been
19 a 30-year resident of the area. I was stationed at
20 the Arsenal for 4 1/2 years, and I have several
21 questions about carcinogenics.
22 The thing that I had some questions about
23 is, right now I've asked several questions, and I
24 have not received any direct answer on any of them.
25 I've had disturbing questions. For one, I have --

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1 right now I don't believe any of the people on the
2 board can sit there and give -- have a list of all
3 the names of the people that worked on the Arsenal,
4 what happened to -- up to this time -- on health
5 issues.
6 MS. LAURA WILLIAMS: I think EPA can.
7 MR. MIKE WALTENBURG: Do you have it
8 with you?
9 MS. LAURA WILLIAMS: I don't have it
10 with me.
11 MR. MIKE WALTENBURG: How long would it
12 take you to give me this information?
13 MS. LAURA WILLIAMS: I don't know. I'd
14 have to check.
15 MR. MIKE WALTENBURG: The other one -- the
16 other thing is the carcinogenics that the Arsenal had
17 at the time, from the inception until now, that --
18 the waterborne, the movement of the water. What
19 happened to all the little particles of dust every
20 time the wind blew out here and it picked up and went
21 to the south, went to the north, went into Commerce
22 City, and even went down into Denver?
23 And I -- you know, I don't hear any --
24 anyone saying that we have a medical program or --
25 or even an organization or even a -- something to

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1 fall back on for skin cancers, for any of the number
2 of things that can come up with these carcinogenics.
3 I don't think anybody really thinks about,
4 you know, this stuff could have happened -- you
5 could have driven by the Arsenal in a dust storm in
6 the '60s and die tomorrow from it.
7 And this stuff is continuing to go on.
8 Right now they're talking about putting caps on
9 them. What happened to the caps right now? Are
10 there exposed areas right now? They're talking about
11 surface. I asked a question here about a year ago
12 about -- I watched them killing off the prairie dogs
13 out here. They said that they were doing that
14 because they were getting rid of the prairie dogs
15 because there was ground pollution. Excuse me. They
16 were within 200 yards of the edge of the Arsenal. If
17 there was ground pollution there, why weren't they on
18 the other side of the road?
19 A prairie dog, to me, does not burrow more
20 than about 18 to 20-some inches. Maybe I'm wrong.
21 That means that he is in the top area where I live.
22 The dust that is what he breathes I breathe.
23 You know, how far are they going to go with
24 the -- with this extermination thing? It's us that
25 are being exterminated. Very slowly. They send

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1 millions of dollars overseas every year, but we live
2 in this area. I think some of this money that's
3 being spent ought to be spent at home. What we're
4 doing right now is killing ourselves talking
5 about it.
6 That's all I have to say. I -- my family
7 is what I'm interested in.
8 MR. ZEIK SAIDMAN: Comments from the
9 panel?
10 MR. RAY RAUCH: On -- the prairie dogs I'd
11 like to address.
12 We didn't kill them off on the south. We
13 sprayed for fleas; we killed the fleas. Prairie dogs
14 were dying from the plague. That's why you saw it.
15 And we was outside the fence so . . . excuse me.
16 MR. MIKE WALTENBURG: Well, I was in the
17 program at the Arsenal back in the '60s when the
18 plague was in, and we trapped some of the animals
19 that were here then. And I don't ever remember
20 putting flea powder on the hole and then closing it
21 with my foot.
22 MR. RAY RAUCH: In the '60s the Service
23 wasn't here. So I'm talking about now, what we've
24 done.
25 MR. MIKE WALTENBURG: Yes. I watched the

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1 individuals. That's fine. This is not going
2 anywhere.
3 But I watched them putting powder upon the
4 ground -- no, they weren't spreading it around; they
5 weren't putting it tracking to kill the fleas. They
6 were putting it in the holes and closing it. When --
7 usually when you're going to take and destroy a
8 burrowing animal, that's how you do it.
9 And I noticed shortly after that there
10 wasn't hardly -- back on Highway 2, there isn't that
11 many prairie dogs left. Two or three years ago we
12 had thousands up through there. Now, perhaps maybe
13 something has come through there.
14 But if you want to get rid of the base food
15 for the -- for the eagles and stuff, I think the
16 prairie dogs are right where you want to start. I'm
17 possibly mistaken on it.
18 MR. RAY RAUCH: No. Prairie dogs is one of
19 the main prey species. '50s, '60s, I can't address
20 that, but I can address what the Fish and Wildlife
21 has done since the middle '80s out here, and it has
22 been spraying for fleas. So -- and we are losing
23 prairie dogs. We lost 98 percent of the prairie dogs
24 to plague this year.
25 MR. MIKE WALTENBURG: All right.

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1 MR. ZEIK SAIDMAN: Michael, do you have
2 something you want to comment?
3 MR. MICHAEL ANDERSON: I'd just like to
4 comment there have been a number of health studies
5 done by ATSDR, by the Colorado Department of Health,
6 and most of those studies are available to indicate
7 whether or not there have been issues in terms of
8 health impacts by contaminants at the Arsenal.
9 I'd be glad to talk with you after the
10 meeting and make some of those studies available to
11 you; we can work that out through the Army. You'll
12 have a chance to look at some of these studies.
13 In addition, Shell has done some studies
14 over time in terms of looking at workers at
15 pesticides plants, both in Europe and here in the
16 United States, and results of those studies are also
17 available. We'd be glad to make those results
18 available to you if you haven't seen them before.
19 MR. MIKE WALTENBURG: No, I haven't. But I
20 do have a comment to make about the pesticide and
21 the -- the -- what is it in Europe and whatever. I
22 understand -- we ought to have a base with that.
23 But what happened to the study right here? I -- the
24 reason I -- I don't want to --
25 MR. MICHAEL ANDERSON: There's information

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1 available.
2 MR. MIKE WALTENBURG: One of the questions
3 I do have is how much of the stuff that was on the
4 Arsenal that was -- how do I want to say this? --
5 that was classified information -- how much of this
6 has been unclassified now, up to this date?
7 The reason I ask is because I was stationed
8 here, and I used to mow the grass around the F lake.
9 I used to work over here in the GB -- or in the GB
10 area -- make sure I point my finger in the right
11 direction -- up here in the mustard area. I had
12 access to all of that.
13 And that's why I was -- I was wondering.
14 Because I know what was spilt. I know what was
15 shoveled off to the side and everything. And you
16 know -- and almost all of that material was
17 carcinogenic.
18 MR. CHARLES SCHARMANN: Well --
19 MR. MICHAEL ANDERSON: That needs to be
20 brought up.
21 MR. CHARLES SCHARMANN: I can address the
22 classification issue.
23 Much of what was classified on here -- and
24 I can't tell you exactly what information is
25 available and what's not. But much of that had to do

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1 with the amount of chemical agents that we produced,
2 stored, et cetera. And for -- again, as part of
3 national security, that information was not made
4 available to the general public.
5 Regarding the chemicals handled, where they
6 were spilled, how much was disposed of, all that
7 information I think you may be referring to as the
8 way we handled wastes out here. All that was opened
9 and reresearched as part of our studies to find out
10 exactly where, in fact, we could have chemicals here
11 on-site.
12 So -- but with regard to much of the
13 chemical agent production and storage information, I
14 just don't know off -- off the top of my head. We
15 could find that information out for you, if there is
16 still some information classified.
17 But I wanted to address your issue with
18 regard to ongoing, say, blowing of contamination,
19 things like that. And we do have an active
20 monitoring program now to try to measure exactly what
21 is going on now. And we will continue that in the
22 future to make sure that our actions don't adversely
23 affect the community.
24 Historically, if you go back years, you
25 know, it was a totally different climate or

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1 environment at that time. And maybe the records
2 aren't as good.
3 But Mike mentioned some of the studies, the
4 health studies or epidemiological studies, that were
5 done to try to determine -- make a determination on
6 whether there's been a high incidence of cancer or
7 what type of cancer, things like that, in this
8 community. And again, I believe their conclusions
9 were that they could not find that where there has
10 been high incidences of cancer above what they would
11 expect background to be.
12 In the future it's something we can do
13 something about. Unfortunately, we can't go
14 back 30 years and have the records. But in the
15 future we are not only monitoring the air, we will be
16 monitoring the workers, and that was the whole intent
17 of the medical monitoring program, is to use the
18 information contained on-site, as well as deal with
19 some off-site issues with the local community, to
20 make sure that we can make statements to you,
21 hopefully, that you're not being affected by the
22 actions being taken at Rocky Mountain Arsenal in the
23 future.
24 So that's something we can do something
25 about. In the past I -- unfortunately, you know,

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1 recordkeeping, monitoring was not as good as it is
2 today so . . .
3 MR. ZEIK SAIDMAN: Okay.
4 MS. BARBARA NABORS: I have a summary, a
5 citizen summary, of two of the studies that the
6 Colorado Department of Public Health was involved in.
7 And if you'd like to take this, you can have it. And
8 I believe there's a couple comments, people that you
9 could call at the health department if you have
10 questions, Mike Wilson.
11 MR. ZEIK SAIDMAN: Barb, are there more
12 copies of that?
13 MS. BARBARA NABORS: That is the only one I
14 brought, but we could probably have copies made
15 if . . .
16 MR. ZEIK SAIDMAN: Do you want to -- how
17 do you want to have that get out to people?
18 Norm, do you want a copy?
19 AUDIENCE SPEAKER: Yes.
20 MR. ZEIK SAIDMAN: Can you get their --
21 can you go up to --
22 MS. BARBARA NABORS: I can send one to
23 Norm. I'd be happy to do that.
24 MR. ZEIK SAIDMAN: If you want to get
25 additional copies, you can keep that -- you can

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1 contact Barb and get those copies.
2 AUDIENCE SPEAKER: Fax it to me.
3 MR. ZEIK SAIDMAN: Can you do that, fax it
4 to him?
5 All right. Thank you.
6 Anybody again who hasn't had a chance to
7 make a first comment? And again, trying to focus on
8 the proposed plan for the final cleanup, as much as
9 anything, in terms of discussion. That's what the
10 hearing's about. Anybody else who hasn't had a
11 chance to speak?
12 Okay. So Rich, did you -- do you want to
13 make another comment?
14 THE COURT REPORTER: Excuse me.
15 (Discussion off the record.)
16 MR. ZEIK SAIDMAN: The court reporter's
17 ready. Rich, do you . . .
18 Okay. Again, let's try to focus on the
19 proposed plan.
20 MR. RICK WARNER: Okay. First I'd like to
21 say that -- and it hasn't even been mentioned here.
22 I suppose if this was one of the largest bomb
23 manufacturers in America, it would be mentioned, but
24 this is the largest military Superfund site in
25 America. It is -- it -- there's none bigger.

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1 And what we have here is over here on this
2 table you see seven volumes of dated alternative
3 analysis that you can use to judge from. And if you
4 go through that, you'll see that that references
5 about -- I don't know -- 50 or 60 other volumes.
6 Some of them meant multiple volumes. It's a lot of
7 paper to go through.
8 This just came out. What they did here is
9 they took 181 sites, and they consolidated them
10 into 25 median groups, and all of that got
11 consolidated into one large operable unit. And it's
12 incredible that -- the reason, I guess, for that is
13 so people can't look at it too close. I don't know.
14 Anyway, for that reason I would like to
15 request that the public comment period be
16 extended 180 days so that those not well-versed in
17 this would have a reasonable chance of making
18 pertinent comments and having pertinent input into
19 this.
20 It has been explained to members of the
21 board that they really don't expect the public --
22 any sort of public comment to affect the decision
23 one way or another, but it does go on the
24 administrative record, and it's only fair that people
25 get pertinent and real comments on the administrative

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1 record.
2 Next point I'd like to make is that this
3 couple to the south -- last time I talked to you
4 about Commerce City and Henderson; this time I'd like
5 to talk about Montbello and Green Valley Ranch and
6 Aurora and -- and Park Hill.
7 These are not part of the off-post study
8 areas. They are not a consideration of anything that
9 happens out here. If you lived out here -- as you
10 have, probably, for years and years -- you know that
11 the tumbleweeds don't pile up on your north fence;
12 they pile up on your south fence. The wind blows
13 that way.
14 If you take a tour here, if you just drive
15 around, you'll see many, many smokestacks out here.
16 That smoke and the debris that came out of these
17 stacks and the contaminants and pollution went to the
18 south, went to the southwest. If you were watching
19 the SQI while it was burning on almost any given day,
20 you could see that plume glow all the way around, all
21 the way around.
22 It's true of living in the Front Range. We
23 kind of live in a vortex here, a -- of circulating
24 winds. Not enough has been looked at in the off-post
25 area. It's for that reason -- the off-post came to

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1 comment two or three years ago. We still don't have
2 a record of decision out. I've requested copies of
3 it. I still have not seen the record of decision.
4 But it should have addressed things like
5 this. There were a lot of comments that were not
6 supportive of it. I think that there should not be
7 an on-post decision until the off-post decision has
8 been decided. The reason for that is because, in the
9 off-post, people live. People's issues need to be
10 addressed first, rather than the blank prairie.
11 But that's that.
12 MR. ZEIK SAIDMAN: Any additional comments
13 you want to make? Just . . .
14 MR. RICK WARNER: I do have one other --
15 MR. ZEIK SAIDMAN: Okay.
16 MR. RICK WARNER: -- at this particular
17 three-minute stance.
18 The trust fund was mentioned. The reason
19 the trust fund was mentioned is because this cleanup
20 does not end in nine or ten years. This is a
21 thousand-year treatment. These chemicals are going
22 to be toxic and in that ground for a thousand years.
23 If you happen to know of a landfill anywhere in the
24 history of mankind that has been good for a
25 thousand years -- 500 years, a hundred years --

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1 please let me know. I'd be -- I'd love to have that
2 information. I don't think that one exists.
3 The history is not something we deal with
4 here. We deal with fantasy science, which we call
5 risk analysis and modeling. In that particular
6 instance along the south, one of our own members
7 looked at their modeling data, went outside, got
8 other information, and believes he has
9 incontrovertible evidence -- that's probably not a
10 real good word in science anyway -- that the waters
11 did flow to the south. He is in the process of
12 preparing that report now. And hopefully, it will be
13 available to the parties as soon as he is done.
14 But definite groundwaters and -- and
15 contamination, vertical contamination, of the
16 aquifers in the south, too.
17 So that's it for now. Thanks.
18 MR. ZEIK SAIDMAN: Thank you.
19 Comments from the panel?
20 MR. CHARLES SCHARMANN: Just -- I would
21 like to address the issue as far as the off-post RAB.
22 Rick's right. That originally came out in
23 1994 as a draft final or proposed final. It has
24 taken us this time to work out the issues and prepare
25 a final. We have prepared one that went to the

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1 parties for review. We also made it available to
2 some individuals on the Restoration Advisory Board.
3 If we have not gotten that to the Site Specific
4 Advisory Board, anyone who would like a copy -- we
5 can get you a copy of, Rick, in a minute.
6 MR. RICK WARNER: Great.
7 MR. CHARLES SCHARMANN: Our hope is that
8 that will be finalized and signed in the next month
9 or so. And we were scheduled to have a signing on
10 November 29th for that document, but due to the
11 furloughs and whatnot, that will be delayed.
12 MR. RICK WARNER: There is no additional
13 public comment on that document; is that right?
14 MR. CHARLES SCHARMANN: That's right. We
15 went through a public review process on that, and we
16 received a fair amount of public comment, and I think
17 some of those comments we received were -- were
18 incorporated, obviously, or else we explained why
19 they could not be incorporated.
20 But we've gone through the public process
21 on that particular record of decision.
22 MR. RICK WARNER: That was about
23 three years -- two years ago?
24 MR. CHARLES SCHARMANN: The proposed final
25 came out in December of -- of 1993, actually. I'm

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1 sorry. Is that right, Tim?
2 MR. TIM KILAGANNON: Yeah.
3 MR. CHARLES SCHARMANN: 1993. So the
4 public process on that -- you're stretching my memory
5 here, but I think it was in the spring of '93 that we
6 had our public meeting on that.
7 MR. TIM KILAGANNON: April of '93.
8 MR. CHARLES SCHARMANN: April of '93 is
9 when we had our public meeting. And we have had, I
10 believe, either a 60- or 90-day public review period
11 for that document.
12 MR. RICK WARNER: So about 2 1/2 years.
13 MR. CHARLES SCHARMANN: Yes.
14 MR. RICK WARNER: Okay.
15 MR. CHARLES SCHARMANN: I stated correctly
16 before.
17 With regard to the study area -- and a lot
18 of the rationale for why it was set up the way it was
19 is presented in that off-post documentation. But
20 again, I was not saying that the wind does not blow
21 to the south. And I apologize if I inferred that.
22 But the data that we have on-site of where
23 soil has blown, where it -- chemicals may be found in
24 surface soils, is mostly to the north and to the
25 east, the higher levels. There was some detected to

1 the south. But again, it's a lower level, and it was
2 below health standards on-site so no further study
3 was done off-site.
4 Again, that supports the -- why we set the
5 study area up the way we did.
6 MR. RICK WARNER: In the 30 or 40 years
7 that this was here, were those soils to the south
8 ever tilled, moved around, replanted, revegetated?
9 Was there any sort of activity that changed -- could
10 have changed the depth of those contaminations, could
11 have moved them to other site places on the Rocky
12 Mountain Arsenal? I understand from people who
13 worked here that that did happen quite often down
14 there on flooding.
15 MR. CHARLIE SCHARMANN: Those activities
16 occurred across the Arsenal, not just to the south.
17 You know, I don't have -- our facilities folks may
18 have a better feel for exactly where those activities
19 occurred. But again, we did not target any one part
20 of the Arsenal that I'm aware of. And certainly, the
21 areas to the south I don't believe that -- were
22 targeted any more for those kinds of activities.
23 MR. RICK WARNER: Nor, also, the areas east
24 of First Creek where all the new hotels and houses
25 are being built or where those oil wells have been

1 dug -- or new developments have been planned to be
2 built. Nothing that be done there, either, right?
3 MR. CHARLES SCHARMANN: Not that I'm aware
4 of, Rich.
5 MR. ZEIK SAIDMAN: Okay. Other comments
6 from the panel?
7 Okay. Any other comments from people in
8 terms of the proposed plan?
9 Any -- I'll ask it again. Any other
10 comments from people for the proposed plan?
11 Those who want to take a bus tour --
12 another bus tour, out by the exit sign. And we thank
13 you for your public comments.
14 This meeting is adjourned.
15 (Meeting proceedings concluded
16 12:17 p.m., November 18, 1995.)
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1 CERTIFICATE
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3 I, MELANIE L. HUMPHREY-WATKINS, a
4 Registered Diplomate Reporter and Certified Realtime
5 Reporter, do hereby certify that I reported by
6 machine shorthand the proceedings contained herein
7 and that the foregoing 146 pages constitute a full,
8 true and correct transcript.
9 Dated this 10th day of December, 1995.
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12 MELANIE L. HUMPHREY-WATKINS
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RESPONSES TO COMMENTS MADE AT THE PUBLIC MEETING ON THE ROCKY MOUNTAIN ARSENAL ON-POST PROPOSED PLAN NOVEMBER 18, 1995

The transcript from the public meeting on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan is included in the Responsiveness Summary in its entirety. Individual comments from the transcript of the public meeting are summarized in brief below, with responses immediately following each comment. The appropriate page and line number of the transcript are indicated for reference, as is the commentor's name. Comments that were answered during the public meeting, where the transcript reflects a response, are not repeated here.

Comment 1 (page 80, line 2), Mayor David Busby: Suggests that, because Basin A has no liner under it, a slurry wall to bedrock be installed all the way around Basin A for containment.

Response: Computer modeling of the groundwater flow in the Basin A area revealed that installation of a slurry wall would not significantly enhance the control that can be achieved by covering the soil and other material placed in the Basin A Consolidation Area and by extracting and treating groundwater at the Basin A Neck system. Slurry walls have been selected for the Shell Trenches and Complex Trenches as part of the remedy, and treatment is planned for the Hex Pit. A new groundwater extraction system for the Section 36 Bedrock Ridge Plume will be installed to prevent migration of contaminants into the First Creek alluvial aquifer.

Comment 2 (page 80, line 13), Mayor David Busby: States that the 4,000 acre-feet agreed upon in the Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal (Conceptual Remedy) is not sufficient for South Adams County Water and Sanitation District (SACWSD)

Response: The Army and Shell have reached an Agreement in Principle with SACWSD that includes payment of $48.8 million by the Army and Shell to SACWSD and requires SACWSD to supply water to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume by January 1999. In addition, the Agreement in Principle requires SACWSD to provide the 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon at RMA at 303- 289-0259.

Comment 3 (page 80, line 20), Mayor David Busby: Commerce City supports the new state-of-the-art, triple-lined landfill

Response: Comment noted.

Comment 4 (page 82, line 17), Mr. Roland Russell: On behalf of Mr. Russell and State Representative Jeannie Reeser, states that many things were left out of the Conceptual Remedy. Requests that comments or minutes from citizen meetings with the Parties be included in the remedy selection.

Response: The Army believes the public has provided significant input to the Conceptual Remedy and the remediation process at RMA. Prior to the Conceptual Remedy, the Parties were at a standstill and heading into litigation over the major differences seen as a basis for RMA remediation. The Conceptual Remedy, with the help of the Colorado Lieutenant Governor and a seasoned mediator, helped the Parties base an agreement on compromise without affecting the protectiveness of the selected remedy. The Conceptual Remedy does not contain specifics about the remediation process that will soon begin. The Parties are working hard to resolve the many questions that remain, and the public has an important role in that process. In addition, the Army has included more public participation in the selection process (more than 20 workshops and public meetings) than what is required under the Comprehensive Environmental Response, Conservation and Liability Act (CERCLA) by encouraging everyone to participate in the review and selection process over the past years. Again, the Army emphasizes that the Conceptual Remedy was not the product of one party dictating its agenda to the other parties. The Conceptual Remedy was a compromise for all parties involved in order to provide a safe, cost-effective, and implementable remedy. Many comments were reviewed and considered during the process. While no one will agree on every aspect of the Conceptual Remedy, the Army believes that the selected remedy will be fully protective of human health and the environment.

Comment 5 (page 86, line 12), Mr. Jim Erger: The solution to correct the problems caused by the Army and Shell is to have a totally new supply of water, along with pipelines and distribution lines, paid for by the Army and Shell.

Response: With regard to compensating homeowners and providing a new water supply, please see the response to **Comment 2**, above.

Comment 6 (page 86, line 19), Mr. Jim Erger: In areas of the Arsenal with minor pollution, capping and containment will suffice. The smallest amount of soil you have to move, the better, and the smallest amount of burning and thermal treatment, the better.

Response: Comment noted.

Comment 7 (page 87, line 19), Mr. Jim Erger: What part of the 4,000 acre-feet of water belongs to Henderson? Where are the pipelines going to go? What size? We want 12-inch pipelines. We want a surface supply of water, not underground water.

Response: With regard to water for the Henderson area, please see the response to **Comment 2**, above. SACWSD will be responsible for placing and designing the pipelines.

Comment 8 (page 91, line 9), Mr. Rick Warner: The federal government must not only comply with law but should strive to be a leader in the area of environmental cleanup.

Response: The Army is committed to seeing that RMA is a leader in environmental remediation. Lessons learned at RMA will be shared throughout the United States; this leadership image reflects not just on the success of the remediation but especially on the public involvement process.

Comment 9 (page 92, line 25), Mr. Rick Warner: There are no details regarding the water supply.

Response: Please see the response to **Comment 2**, above, regarding the water supply. Further information will be provided as it becomes available.

Comment 10 (page 95, line 14), Mr. Waldo Smith: The public wants a Trust Fund as provided in the Conceptual Remedy.

Response: During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operation and maintenance of the remedy. The Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the On-Post Record of Decision (ROD). Principal and interest from the Trust Fund would be used to cover the costs of long-term operations and maintenance throughout the lifetime of the remedial program. These costs are estimated to be approximately $5 million per year (in 1995 dollars).

It is the intent of the Parties that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund. The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remedial sites. The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the actions federal agencies can take with respect to such legislation. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representative of the Parties (subject to restrictions on federal agency participation), local governments, affected communities and other interested stakeholders and will be convened with in 90 days of the signing of the ROD. According to the U.S. Government Manual, "The General Accounting Office [GAO] is charged with examining all matters relating to

the receipt and disbursement of public funds. The existence of a trust fund containing government funds and the use of such a fund is subject to GAO audit. Fiscal control of such a such is not considered within GAO's delegated authority.

Comment 11 (page 97, line 16), Mr. Srinadh Iyengar: Hopes that stories of wildlife extinction and children being hurt or killed will not happen at RMA.

Response: The Army is firmly committed to ensuring the safety of people and wildlife during remediation activities at RMA.

Comment 12 (page 99, line 19), Ms. Sandra Jaquith: Questions whether five alternatives were really considered in the Feasibility Study (FS) as presented in the Proposed Plan. Also questions the public involvement in selecting the remedy.

Response: The purpose of the FS was to generate a number of possible remediation alternatives from the universe of alternatives and then narrow those down to select the one that could best address the site based on the proscribed FS selection criteria. In the Detailed Analysis of Alternatives (DAA), a component of the FS, five primary alternatives were developed, compared to each other, and compared to the selection criteria prescribed by CERCLA. The selected alternative was the one agreed upon in the Conceptual Remedy and described in the On-Post Proposed Plan. Please see also the response to **Comment 4**, above.

Comment 13 (page 100, line 20), Ms. Sandra Jaquith: Questions the use of the word "cleanup." Expresses concern about long-term monitoring and maintenance of the caps.

Response: Please see the response by Ms. Laura Williams, EPA, on page 105, line 9, of the public meeting transcript, regarding public input and the use of the term "cleanup." Regarding long-term monitoring, a 30-year monitoring program for the caps is mentioned in the Proposed Plan and the Record of Decision (ROD) because it follows U.S. Environmental Protection Agency (EPA) cost-estimating guidelines. However, the Army and Shell are committed to maintaining the integrity of the remedy in perpetuity and will conduct monitoring to ensure the protectiveness of the caps and landfills as long as necessary.

Comment 14 (page 102, line 3), Ms. Sandra Jaquith: Requests that all citizens' comments throughout the period of Steering and Policy Committee negotiations, leading up to the Conceptual Remedy, be included as part of the official record.

Response: The Responsiveness Summary of the ROD follows EPA guidance and includes only the written comments and oral comments from the public meeting. All comments were reviewed and considered in the selection of the remedy. In addition, written minutes from meetings during the settlement process are part of the On-Post Administrative Record and can be found at the Joint Administrative Record Document Facility.

Comment 15 (page 102, line 25), Ms. Sandra Jaquith: Questions the amount of water to be provided to SACWSD, how many homes will be connected to SACWSD, how large the pipelines will be, and whether there will be water available for community expansion to the north and northwest of RMA after remediation.

Response: Please see the response to **Comment 2**, above.

Comment 16 (page 107, line 5), Mr. Larry Ford: States that the Klein treatment plant does not deal with some of the contamination expected to reach the plant in the future. States need for water supply to be replaced. Asks what about Henderson?

Response: Please see the response to **Comment 2**, above.

Comment 17 (page 110, line 5), Mr. Dan Mulqueen: Requests an answer to whether dioxin is present and what will be done if it is found.

Response: Dioxin and furan sampling was undertaken by the Colorado Department of Public Health and Environment, and these results are currently being evaluated by the Biological Advisory Subcommittee. Please see also the response in the public meeting transcript by Mr. Ray Rauch, U.S. Fish and Wildlife Service (USFWS), beginning on page 116, line 17.

Comment 18 (page 110, line 22), Mr. Dan Mulqueen: Questions the selection of landfilling soil without treatment.

Response: Many alternatives to land disposal were considered in the DAA, including innovative and conventional treatment technologies. However, because of the large volume of contaminated soil and the wide variety of contaminants, a combination of containment and limited treatment was selected as a remedy because it ensured protection of human health and the environment, as well as being implementable and cost-effective. EPA's goal in establishing the Corrective Action Management Unit (CAMU) Rule, which was adopted by the State of Colorado in the Colorado Hazardous Waste Management Act (CHWMA), was to "provide remedial decision makers with an added measure of flexibility in order to expedite and improve remedial decisions" while "existing closure regulations and requirements for [Resource Conservation and Recovery Act] RCRA-regulated units, which require closure to occur in a manner that is protective of human health and the environment, remain in effect." Purpose and Context of the CAMU Rule, 58 Fed. Reg. 8659 (1993) (to be codified at 40 C.F.R. Parts 260, 264, 265, 268, 270 and 271). The onsite landfill that is central to the CAMU will meet applicable CHWMA requirements. Also, when the ROD is signed and final, the CAMU will be in place and its application to the RMA remediation would only be revised subject to court ruling or if it were found not to be protective of human health and the environment.

Comment 19 (page 112, line 6), Mr. Dan Mulqueen: Questions what will happen if the plan for keeping the lakes full is not successful.

Response: Monitoring is ongoing to address the potential need for additional action in the lakes area. If necessary, the remedial design will address the required actions.

Comment 20 (page 113, line 13), Mr. Dan Mulqueen: States that the issue of water is critical.

Response: Please see the response to **Comment 2**, above.

Comment 21 (page 121, line 4), Mr. Ron Pace: States concern about water and soil. Questions "What is the smell?" and "What is the water?"

Response: Some odors were generated during previous RMA operations and during the Basin F Interim Response Action, but the Army is not aware of any odors being generated onsite at this time. Air monitoring at RMA does not indicate the presence of contaminants that could migrate off-post. The off-post groundwater has been and will continue to be monitored, and those results are available to the public. Please see also the response to **Comment 2**, above.

Comment 22 (page 129, line 23), Mr. Mike Waltenburg: Questions whether there is a medical program or organization looking at cancer in people living near RMA.

Response: Studies on human health have been completed by the Agency for Toxic Substances and Disease Registry (ATSDR) independently and in conjunction with CDPHE. The studies showed no conclusive health impact on the communities surrounding RMA. Also, the final Public Health Assessment, produced by ATSDR, will be complete in the summer of 1996. A Medical Monitoring Program has been established to monitor any off-post impact on human health due to the RMA remediation. This Program will continue until the soil remediation is completed. A Medical Monitoring Advisory Group has been established to evaluate specific issues covered by the Medical Monitoring Program. The Group is composed of representatives of the Army, Shell Oil Company, EPA, Colorado Department of Public Health and Environment (CDPHE), Tri-County Health Department, ATSDR, USFWS, Denver Health and Hospitals, and the Site-Specific Advisory Board. The Group also includes representatives from the communities of Montbello, Commerce City, Henderson, and Denver. If you would like more information on the Medical Monitoring Program or wish to participate as part of the Medical Monitoring Advisory Group, please call Ms. Mary Seawell of CDPHE at 303-692-3327. Please see also the responses in the public meeting transcript by Mr. Michael Anderson, Shell, beginning on page 133, line 3, and Ms. Barbara Nabors, CDPHE, beginning on page 137, line 4, regarding medical monitoring.

Comment 23 (page 139, line 14), Mr. Rick Warner: Requests that the public comment period be extended 180 days.

Response: The comment period for the On-Post Proposed Plan was extended by 30 days to balance the concerns of those who wanted more time to comment and those who wanted no more delays to the ROD.

Comment 24 (page 139, line 20), Mr. Rick Warner: States that public comment will not affect the decision one way or another.

Response: The Army is interested in public comments and concerns and has made substantial effort to hear those concerns through the Restoration Advisory Board, the Site-Specific Advisory Board, stakeholder meetings, and avenues of public comment such as the comments on the On-Post Proposed Plan. The Army has included more public participation than what is required by under the CERCLA, such as conducting more than 20 open houses and public meetings to enable those interested to voice their concerns. The Army believes the public has provided valuable input to the remediation process at RMA and all comments were reviewed and considered in the selection of the remedy.

Comment 25 (page 141, line 1), Mr. Rick Warner: States that there is no final Off-Post ROD.

Response: The Off-Post ROD was signed and became final on December 19, 1995.

Comment 26 (page 141, line 18), Mr. Rick Warner: Reiterates the earlier comment regarding a Trust Fund

Response: Please see the response to **Comment 10**, above

Comment 27 (page 142, line 10), Mr. Rick Warner: Believes that groundwater does flow to the south from RMA.

Response: For a more detailed response regarding groundwater flow patterns at RMA, please see the Army letter responding to Mr. John Yelenick's written comments. In summary, no such groundwater plume has been identified by the extensive groundwater monitoring programs the Army conducts annually. Groundwater flows generally downgradient from the southeast corner of RMA toward the South Platte River. Superimposed on the regional gradient is a groundwater mound in the RMA South Plants. The mound is created by leaking pipes, increased recharge from unlined ditches and ponded areas, and may also be the result of natural variations in the permeability of the alluvium and the bedrock in the area. Groundwater in the area of the mound flows radially out from the mound in all directions. A groundwater divide occurs at the confluence of the regional flow system and the mound. As a result, groundwater entering RMA from the southeast is forced to turn either east or west around the South Plants area. Water flowing south from the mound area is forced to change direction and join the regional flow system. The groundwater flow direction in the confined Denver Formation is also from southeast to northwest. It is physically impossible for groundwater or contamination from RMA to flow southward from the RMA boundary.

12–8

Responses to Citizen Comments

Rocky Mountain Arsenal
Reply Card

Proposed Plan Comment

Please add my name to the Army's mailing list of upcoming public meetings:

Name Bob + Kathy Bailey.

Address 8681 E. 104th Ave

City Henderson State CO Zip 80640

Phone 303/288-4132

Please list any questions and/or comments you have.

The water supply for Henderson needs to be part of the Cleanup.

k You

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DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr Bob and Ms. Kathy Bailey
8681 E 104th Avenue
Henderson, Colorado 80640

Dear Mr. and Ms. Bailey:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

In response to your comment about a water supply for Henderson, the Army and Shell Oil Company (Shell) have reached an Agreement in Principle, enclosed with this letter, with South Adams County Water and Sanitation District (SACWSD) that includes payment of $48.8 million by the Army and Shell and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume by January 1999 In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004 The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr Tim Kilgannon of this office at 303-289-0259 or Mr Larry Ford of SACWSD at 303-288-2646

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

version 10 - 26/01/96

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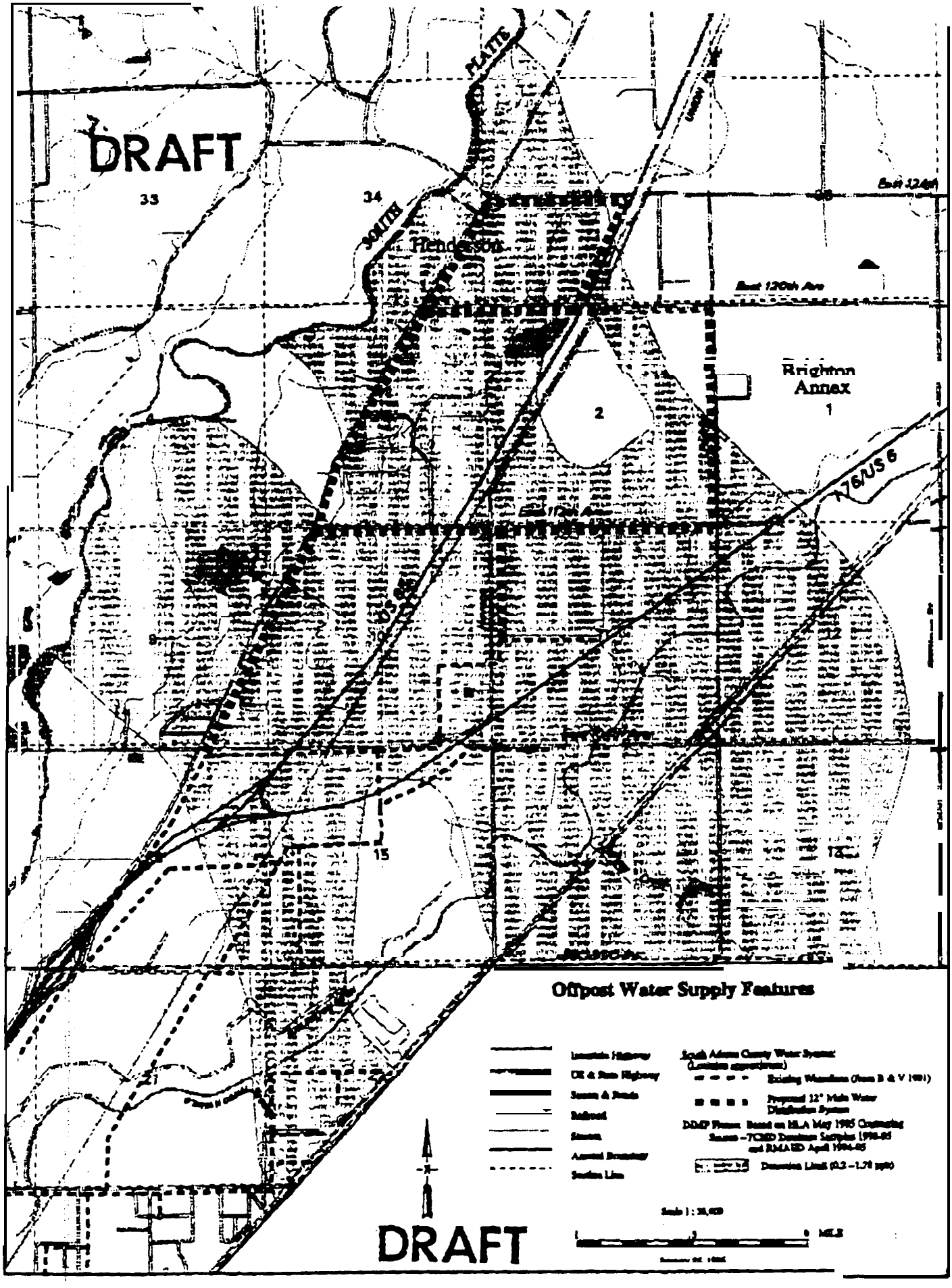
DRAFT
33
34
SOUTH
PLATTE
Henderson
East 124th
East 120th Ave
Brighton
Annex
1
2
176/US 6
15
Offpost Water Supply Features
Interstate Highway
US & State Highway
Streets & Roads
Railroad
Streets
Arsenal Boundary
Section Line
South Adams County Water System
Existing Waterlines (from B & V 1991)
Proposed 12" Main Water Distribution System
DDMP Plumes Based on HLA May 1995 Contouring
Source – TCMD Database Samples 1990-95
and RMAED April 1994-95
Detection Limit (0.2 – 1.78 ppb)
Scale 1 : 25,000
MILE
DRAFT

TOTAL P. 02

JAN 19 1996

The panel's (The EPA, CDPHE, U.S. Army, Shell Oil Co., and USF&WS) pro posed Record of Decision (ROD) is not an effective solution. The proposed ROD (The great cover up) does not provide elimination of contaminates in Basins A and F. Covering Basins A and F make them a landfill! Is land filling hazardous material without a liner legal? Do federal regulations (CERCLA?) prohibit this type of action? The soils in Basins A and F must be treated and appropriately land filled. Full LDRs must be followed throughout RMA. Basins A and F must be decontaminated as much as possible! Not taking any treatment action for Basins A and F is unacceptable.

According to the DAA (4-15) regarding option IV, " ... high short-term risks are posed to workers and the community during excavation, transportation, and treatment or land filling." Treatment of the soils in Basins A and F cannot be ruled out, since there are high short-term risks for any soil excavation! On Nov. 18, 1995 Mr. Anderson of Shell Oil Company mentioned water was going to be used to control release of vapors during excavations. Why isn't a foam agent designed to capture vapors during excavation being used? The foam is safer than water. Option V is reasonable because the long-term results are the most effective at maintaining cleaner groundwater. Option V should be modified; so soils can be treated by thermal desorption and not be incinerated.

The water treatment system at the boundaries is not doing a satisfactory job. Toluene is still crossing the RMA boundary. This is unacceptable. What other chemical agents are crossing the RMA boundary in treated water? Another activated carbon filter or better form of water treatment should be installed. Clean water is essential for a healthy life style.

Clean water is priceless! The extra cost for the added treatment of soil and water is worth it. Remember Basin A is considered the most contaminated square mile in the U.S.A. We must

pay the price for 53 years of neglect to insure safe drinking water for wildlife, and communities surrounding RMA.

SINCERELY

ROGER BAIN
DEBRA BAIN
8300 E 104th WAY
HENDERSON CO 80640

JAN 19 1995

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. Roger and Ms. Debra Bain
8300 E. 104th Way
Henderson, Colorado 80640

Dear Mr and Ms. Bain:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

Hazardous materials from the Basin F wastepile will be properly disposed in the on-post hazardous waste landfill. Highly contaminated materials from the Former Basin F will be treated by in situ solidification A Resource Conservation and Recovery Act-equivalent cap will then be placed over this site. Capping is a form of waste containment, and is a remedy different from landfilling. A cap is designed to limit rainfall infiltration and to minimize contaminant migration from the site Capping is not a viable solution for containment in all remediation situations, but, for the remaining wastes in Former Basin F, capping will safely and cost-effectively contain the waste materials. The remediation technology planned for Basin A is a cover that provides containment of waste and minimizes rainfall infiltration In Basin A, a soil cover consisting of 6 inches of concrete and 4 feet of soil will protect people and the environment. The cap/cover technology minimizes the short-term risks of exposure to workers and the community because soil-borne contaminants are left in place and not excavated and exposed to the environment. The landfill and the cap/cover designs for Basins A and F comply with federal, state, and local regulations (including the Comprehensive Environmental Response, Compensation, and Liability Act) Concerns about the short-term impacts of excavation and treatment were evaluated against the potential long-term effects of containing the waste in place, and the Army believes that a protective remedy was selected.

Water spraying is a common method used to control the spread of dust during excavation operations In addition, odor and vapor suppression methods such as foams or enclosures are planned for use at those sites where odors and/or vapors may be released. Furthermore, air monitoring will be conducted during remediation activities, and, if necessary, the excavation plan will be modified to ensure worker and community safety

Clean water for the public is one of the Army's primary goals that will be met by continued operation of groundwater treatment/containment systems and by providing a supplemental water supply to meet community needs. The Army believes that the continued treatment of groundwater at RMA is an important part of the remediation The RMA groundwater treatment

systems currently treat about one billion gallons of water per year to meet all state and federal standards. Toluene has not been found in RMA groundwater at levels of concern and is not detected in the treated water from the North, Northwest, or Irondale boundary containment systems.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U. S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

Commerce City Business & Professional Association, Inc.

P.O. Box 303 • Commerce City, CO 80037-0303

"Bringing Business Together"

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Wes Wilson	288-4857
L. Harlow Leeper	829-2121
[illegible]	288-6600

RECEIVED
JAN 16 1996

January 12, 1996

Charles Scharmann
Office of the Program Manager
Attn: AMXRM-RP/C. Scharmann
Rocky Mountain Arsenal
Commerce City, Colorado 80022

Dear Mr. Scharmann:

The Commerce City Business and Professional Association supports the Henderson Coalition in its efforts to force the U.S. Army and Shell Oil Company to replace their contaminated ground water supply. The blight of contamination has affected our community and that of our neighbor, Henderson. It is inconceivable that this community must fight so hard to right the wrongs committed by the Army and Shell.

Through attending various meetings it would seem that the Army and Shell would gladly replace the water supply in the amounts requested for Henderson and Commerce City, since no other financial concessions for the real damages done to our businesses, schools, and residents have been or will be made. That does not take into account the very negative public image we suffer from and the very real damages done. That does not take into account the numbers of people who have been supplied bottled drinking water by the Colorado Department of Public Health and Environment for the last several years.

It would seem that, as a very small part of the overall cleanup agreement, replacement of the contaminated supply would include a safe, permanent, good quality water supply for Henderson and Commerce City and would not be questioned. Instead, we have banded together to fight for what has been taken from us and from the generations to come.

We will continue to work to improve the image of our community, the image so badly damaged by our "neighbors" at the Rocky Mountain Arsenal. We will continue to plan for future growth, though our resources have been destroyed.

9601608-1/1

For successful consideration of the Record of Decision by our communities and our leaders, our future growth supply which was determined to be enough for 100,000 people for 100 years must be provided. Without a supply for the future, our growth will continue to be stifled and our businesses and residents will continue to suffer.

We implore you to restore our poisoned future water supply. We demand nothing more and will accept nothing less than replacement in the quantities and under the terms determined by our community leaders. It would seem that this is the very least, yet most important, course of action that our "neighbors" at the Rocky Mountain Arsenal can take.

Sincerely,

Lois Litsey, President

F.D. Chambers, Vice President

Cathy Russell, Secretary

M. Sue Kygar, Treasurer

Wes Wilson, Director

Dr. Jerome Cheney, Director

L. Harlow Leeper, Director

Joe Reilly, Director

/clr

Commerce City Business & Professional Association, Inc.

P.O. Box 303• Commerce City, CO. 80037-0303

"Bringing Business Together"

80th Avenue Liquors 288-8566
88th Drive-In Theatre 288-5624
A B & T Shoppe, Inc 288-6103
A &R Industrial Service Company 287-5885
A-1 Auto Electric Co., Inc 287-3347
A-J Sales & Service Co 287-0223
Absolute Value Sales&Marketing 427-9484
Access Housing, Inc 289-7078
Ace Jewelry, Inc 288-4857
Acme Tree Service, Inc 288-8821
Adams City Liquor Store 287-8620
Adams County Library System 287-2515
Adams County School District 14 289-3941
Adams County School District 14 289-3940
ALCO Discount Store #73 287-3309
Allied Insulation Co. Of Colo, Inc 289-3326
Allstate Rent-A-Fence, Inc 287-7200
Aspen Mortuary 287-0495
B & B Auction 289-7253
Bee Bee Que ,Inc 287-2856
BFI of Colorado, Inc 287-8043
Big 'E' Concrete 288-8428
Big Ed's Tavern 288-9965
Blanchard, Thomas J., MD 288-2615
Challenge Sport & Spine Center 287-0393
Chambers & Son's Towing 288-3154
Charlotte's Web Restaurant 287-7544
City of Commerce City Parks Div 289-3713
City of Commerce City 289-3612
Clearview Motel & Apts 286-0386
Colographic, Inc 288-4796
Color Decorating 289-2880
Colorado Asphalt Services, Inc 292-3434
Colorado Auto Auction, Inc 287-8077
Colorado National Bank Northeast 399-0655
Colorado Brake & Supply, Inc 399-2934
Colorado Charter Lines, Inc 287-0239
Colorado Computer Products 289-6213
Colorado Denver Express 289-5577
Colorado Down & Feather, Inc 287-2831
Commerce City Dental Center 288-6877
Commerce City Express 288-7987
Commerce City Floral, Inc 288-6859
Commerce City: Mission Possible! 289-4497
Commerce City Post Office 288-2100
Commerce City Tire & Auto 289-5662
Community Health Services 289-1086
Cordova's Tire Repair, Inc 288-3238
Cummins Rocky Mountain, Inc 287-0201
Dairy Queen #33 289-1650
Del's Liquors 659-7439
Denver Pet Cemetery, Inc 288-0177
Denver Windustrial Co 287-2884
Derby Bicycle Shop & Screen Printing 288-4100
Derby Lanes 288-2225
Derby Tire Service, Inc 287-1808
Digital Solutions Group, Inc 740-8776
Direct Flooring Brokers 287-2233
Dollar General Store 289-3192
Donner Diesel, Inc 287-3481

Dr. Jerome F. Cheney, DO 286-8600
Drive Line Service of Denver, Inc 287-5538
DSP Builders, Inc 289-0666
Dychem International, Inc 288-1972
Earl F. Douglass Roofing Co 288-2635
Electric Power Equipment Co 288-0751
Elite Auto Glass 287-5000
Empire Tarps 288-4704
Ethanol Management Company 286-9408
First Federal Savings:Bank 289-2931
Foothills Mill & Supply, Inc 287-2069
Fraternal Order of Eagles #3461 288-0861
Frontier Truck Eqpt & Parts Co 289-4311
G & B Truck Leasing, Inc 287-4302
Gahagen Iron & Metal Co 288-6867
Gala Gardens 288-3383
Gehler & Merrigan 287-2563
General Air Service & Supply 892-7003
Grif-Fab Corp 287-2552
Ground Engineering Consultants, Inc 289-1989
H & H Tire Sales & Service 289-2856
H & H Transformer, Inc 289-2802
H_2O Power Equipment, Inc 287-7561
Hast Lumber Company 288-1515
Hi Lo Market 288-1747
Holiday Inn DIA 371-9494
Honnen Equipment Company 287-7506
Intermountain Lift Trucks, Inc 289-2201
Interstate Trailer Sales & Service 287-0375
Ivy K Barber Stylists 287-5383
J & J Mailing Service, Inc 296-4842
JR's Hair Company, Inc 287-7118
Jayhawk Trailers 286-7923
Jean's Realty, Inc 289-4801
Jergensen Insurance Agency 288-6000
Joyce's Submarine Sandwiches 289-1101
K & K Surplus, Inc 287-7195
Katie's Restaurant 289-3253
Ken's Commerce City Drug, Inc 288-3784
Key Bank Commerce City North 287-7411
Key Bank Commerce City South 289-1178
L & B Produce Trucking 295-7084
La Casa Del Rey 287-7480
Larry's Lounge, Inc 288-9292
Latorin's, Inc 288-8888
Leeper & Co 289-5555
Manpower Temporary Services 457-3400
Manpower Temporary Services 758-2700
Marvin A. Pugh, CPA 451-5878
Max Air Trailer Sales 289-3264
McCoy Sales Corp. DBA Parker Store 762-8012
McDonalds Restaurant #5562 288-9418
Mid America Wrecker Sales, Inc 289-2836
Mile Hi Auto Repair, Inc 288-9000
Mile Hi Travel, Inc 288-8100
Mile High Greyhound Park 288-1591
Mile High Roofing & Exterior Supply, Inc 289-4586
Mountain States Industrial Svc, Inc 289-4511
Mountain States Crane Service, Inc 289-4511

Mr. Bill's Auto Service 289-73-
Nativity Lutheran Church ELCA 289-22
Norm's Printing/C C Beacon 288-47
Northeast Assistance Center 287-11
One Stop Automotive 287-13
Our Lady Mother of the Church 289-64
Pawnbank, Incorporated 288-89
People's Choice Transportation, Inc 289-22
Perez Imports 287-49
Phillips 66 Propane Company 293-87
Poplar Grove Care Center 289-71
Professional Repair Service 288-94
R-Place 287-66
RAC Transport Co., Inc 289-55
Rainbo Bread Company 288-26
Rent-A-Heap Cheap 393-00
Riggi Oil Co., Inc 288-57
Rocky Mountain Fire & Safety 287-3
Rose Terrace Care Center 289-18
Roybal's Barber Shop ..... No Phon
Rusty's Cafe 288-81
Ruth Ann's Bookkeeping 252-146
S A C Fire Dept 288-08
S A C Water & Sanitation District 288-26
Sand Creek Optimist Club 287-01
School District 14 Credit Union 287-802
Schroeder Auto Carriers, Inc 288-388
Security Key & Lock 286-130
Shady Lane Mobile Home Park 288-366
Shell Oil Company 861-70
Sheraton Inn Denver Airport 333-771
Shorty's Tree Service 659-73-
Sir Speedy Printing Center, Inc 289-730
Stand By Power Service Co., Inc 289-58
Steven R. Gibson, P.C 980-011
Stewart & Stevenson Power, Inc 287-744
Stockyards Ranch Supply, Inc 287-80
Surplus Supply Co./Ace Hardware 288-66
Taxsavers 289-591
The Bank of Cherry Creek 394-550
The Greater Rocky Mountain Group 399-874
The Sewer & Plumbing Works, Inc 288-193
Timpte, Inc 289-624
Travel Time 286-373
Triple "J" Appliance Repair 288-660
True Vintage Sales 287-712
United Asphalt, Inc 287-543
United Parcel Service 430-380
United Power, Inc 659-055
Valley Glass Co., Inc 287-014
VFW Post #4444 Currie-Toles 286-865
Vi's Printing 288-30
W J Whatley, Inc 287-80
Waste Management of Colorado 289-23
Watersaver Company, Inc 289-181
Weaver Electric Co 288-074
Werthwhile Inn 289-646
Westurf Distributors, Inc 289-195
Younger Brothers Lumber 288-261

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Commerce City Business and Professional Association, Inc.
P.O. Box 303
Commerce City, Colorado 80037-0303

Dear Officers and Board of Directors:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

The Army believes that the Agreement in Principle that the Army and Shell Oil Company have reached with South Adams County Water and Sanitation District (SACWSD) ensures an adequate, safe, and permanent water supply for the community. The Agreement in Principle, enclosed with this letter, includes payment of $48.8 million to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume by January 1999. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply for Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr Tim Kilgannon of this office at 303-289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646

The Army understands that there is a perception among the public that RMA contamination has had a negative effect on the image of the surrounding communities. However, the ongoing remediation and the future transition to a National Wildlife Refuge will continue to have a positive influence on that image. In addition, RMA has contributed to the communities in several other ways The Army and the U S Fish and Wildlife Service provide educational opportunities through remediation or wildlife tours, and the Army has recently received accreditation for its environmental education program through the Colorado School of Mines and the Denver Public Schools. Economic contributions include hiring of local contractors and labor and providing used computer equipment to the public schools The Army is committed to seeing that RMA is a leader in environmental remediation Lessons learned at RMA will be shared throughout the United States; this leadership image reflects not just on the success of the remediation but especially on the public involvement process

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U. S. Department of Justice, 999- 18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

01/26/96 FRI 13:54 FAX 703 6962940 US ARMY ENVIR LAW DIV →→ RMA COUNSEL 002

WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

01/26/96 FRI 13:55 FAX 703 6962940 US ARMY ENVIR LAW DIV →→ RMA COUNSEL 003

G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

01/26/96 FRI 13:56 FAX 703 6962940 US ARMY ENVIR LAW DIV →→→ RMA COUNSEL 004

AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

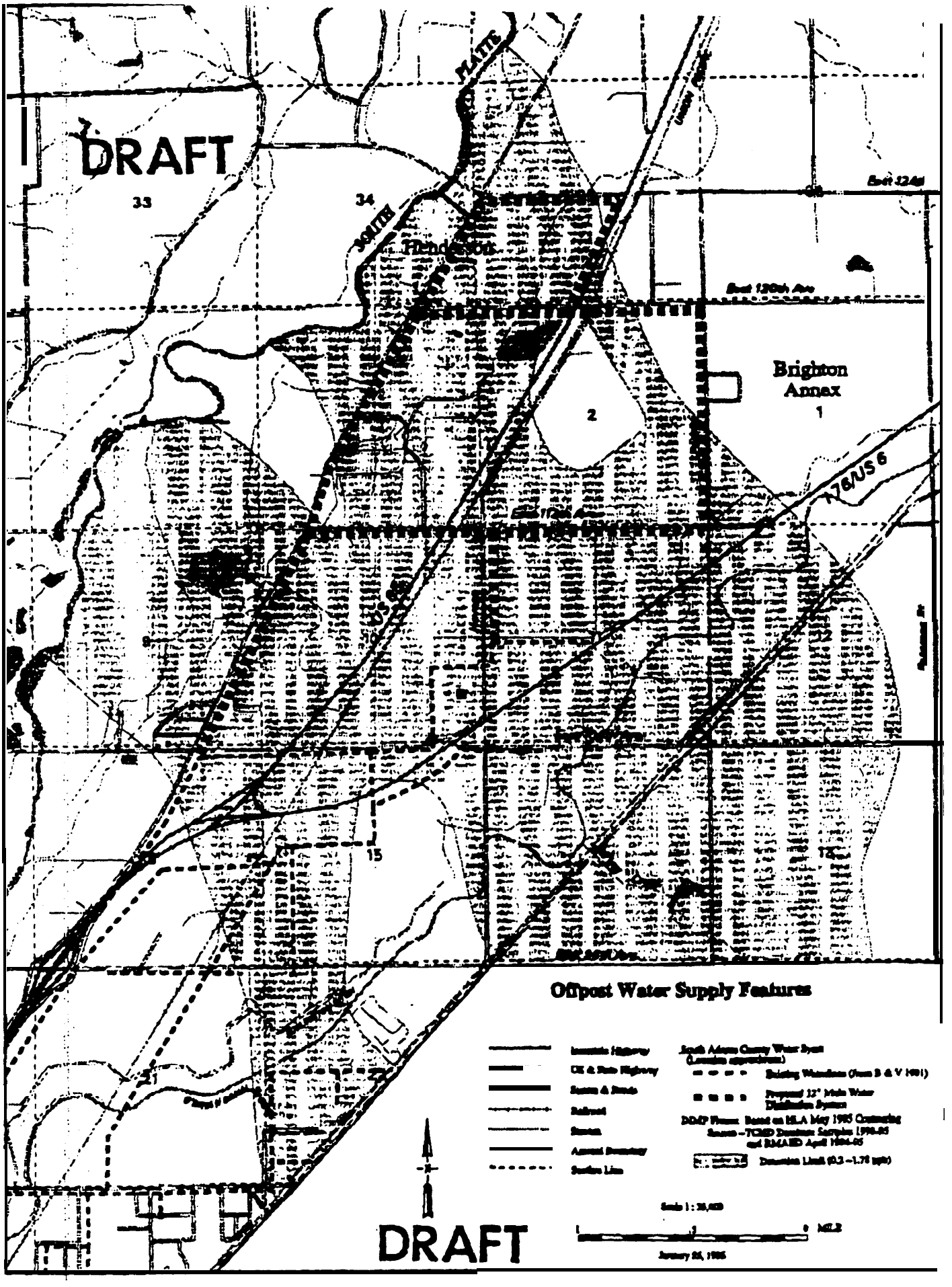
P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

version 10 - 26/01/96

01/26/96 FRI 13:56 FAX 703 6862940 US ARMY ENVIR LAW DIV → RMA COUNSEL 005


DRAFT
33
34
SOUTH
PLATTE
Henderson
East 124th
East 120th Ave
Brighton
Annex
1
2
176/US 6
15
Offpost Water Supply Features
Interstate Highway
UK & State Highway
Railroad
Stream
Arsenal Boundary
Section Line
Existing Waterlines (from B & V 1991)
Proposed 12" Main Water Distribution System
Detection Limit (0.2 – 1.78 ppb)
DRAFT

TOTAL P. 02

rec'd 18 Jan 96

January 14, 1996

On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Att: AMCPM-PM/
Col. Eugene Bishop
Building 111-RMA
Commerce City, Colorado 80022-1748

Dear Col. Bishop:

Thank you for giving us the opportunity for making comments to the Rocky Mountain Arsenal On-Post Closure Plan.

This comment is from a concerned citizen and should be considered as my comments alone , eventhough, I am active in the Site Specific Advisory Board and Restoration Advisory Board for the Rocky Mountain Arsenal.

After rereading the past comments written by the public regarding the remediation plans, I am very disappointed that the Parties have not taken much consideration for what the public wants done at the Arsenal for clean up and remediation. The public has asked for remediated land and clean water. The public has asked that the contaminated soil and leachate remain on site and treated. The Parties are not going to remediate any portion, except the Hex Pits, maybe. The majority is being capped, some landfilled and other actually removed from the site taken elsewhere.

Burying the problem just leaves it for others to contend with later.

I wanted and was lead to believe that the Arsenal was going to be cleaned up--not just covered up.

My opinion on the Parties solution:

1. Capping:
   A. dumping dirt on top of explosives, nerve gases, mustard gases, pesticides, etc., then promoting public access is totally unacceptable.

   B. natural phenomina is not addressed such as: earthquakes, floods, ground water contamination

2. Landfill:
   A properly built and managed landfill seems to be a necessity coupled with reasearch to provide adequate solutions.

   A. site: should be near Basin A or F not near any earthquake fault and well above the water table.

   B. construction: the liners should be tested for the chemicals it is containing. Individual areas should be set aside for different chemicals and not all mixed together. Must be built to last. Also, must be built so that easy access for monitoring, as well as, removal when new technology exists for proper neutralization.

   C. monitoring: proper regulations maintained with the highest skill and technology for today and for the future generations.

3. Solidification:
   A. a medium that will not break down with age.
   B. a medium that the toxins will not leach.

My solution is to neutralize the chemicals that can be treated with todays technology, properly stored and managed. What is not known; reaserch at Rocky Mountain Arsenal for the answers to the currently unknown so that they can be correctly and harmlessly processed. Fence off Sections 1,26,25,31,36,2 from the public access with signs clearly labelling the hazardous conditions that are weather-worthy for hundreds of years. Specific research for Rocky Mountain Arsenal chemicals and conditions must be provided for on site immediately to reduce the cost of remediation and make the cleanup more effective and safer.

Lonna Fischer

Lonna Fischer
SSAB/RAB

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms. Lonna Fischer
4070 E 129 Way
Thornton, Colorado 80241

Dear Ms. Fischer:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

The Army realizes that there are remaining issues regarding the selected remedy for RMA However, public concerns were definitely considered in the development of the alternatives. The concerns about the short-term risks and effects of excavation and treatment were weighed against the potential long-term effects of containing the waste in place. The public has also been concerned about thermal processes such as incineration because of potential emissions. The Army's selected remedy minimizes short-term risks of exposure to workers and the community because soil-borne contaminants are left in place. The landfill and cap/cover designs will comply with federal, state, and local regulations.

A common public concern during the selection process was the availability of a safe water supply Clean water for the public is one of the Army's primary goals that will be met by continued boundary system operation and by providing a supplemental water supply. The Army believes that continued treatment of water at the RMA boundary is an important part of the remediation The RMA boundary treatment systems currently treat about one billion gallons of water per year to meet all state and federal standards.

Responses to your specific comments are provided below.

1 Capping:

The capping process is significantly more complex than your comment suggests. Multiple protective layers (Resource Conservation and Recovery Act [RCRA] caps or RCRA-equivalent caps that meet all federal, state, and local regulations) will be constructed over the more contaminated sites, and soil covers of 1 foot or more of clean soil will be constructed over the less contaminated sites The cap/cover structures will be designed to minimize rainfall infiltration and the potential for human or animal exposure. All caps/covers will be maintained regularly and repaired if necessary. Public access to capped

areas will be very limited. Natural phenomena, such as earthquakes and floods, and introduced phenomena such as contamination, must be and are considered in siting, design, construction, and operation of hazardous waste containment and treatment systems.

2. Landfill:

The hazardous waste landfill will be a state-of-the-art landfill that complies with or exceeds all federal and state siting, design, construction, operation, and closure requirements. Measures will be taken to ensure safe disposal, and all operations will be under the oversight of the Colorado Department of Public Health and Environment

Siting studies have been conducted to identify the best possible location for the landfill, with regard to both geology (soil type and whether it is near a fault) and proximity to the water table.

The appropriate testing will be conducted for the liners. Several separate "cells" are planned so that waste can be segregated. The landfill design will satisfy all applicable siting and monitoring requirements.

The landfill is included in the periodic overall review of the remedy as required by the U S Environmental Protection Agency (EPA) Also, extensive monitoring in and around the landfill itself will take place as part of the long-term landfill operation.

3. Solidification:

There has been significant technological development in the area of solidification/stabilization chemicals as well as in test methods over the past decade, much under EPA sponsorship. The Army agrees that tests must be conducted to ensure that stabilization chemicals used are compatible with the waste, that the products are stable, and that treatability goals can be met.

The Army believes that the capping/covering of much of the central portion of RMA (e. g ,Basins A and F, South Plants) is protective of human health and the environment. In addition, the RMA National Wildlife Refuge planning efforts are considering which areas the public may access during and after the remediation

Extensive testing and research already has been conducted for most of the RMA chemicals, and monitoring, feasibility studies, and treatability studies have been conducted during the past several years as part of the On-Post Remedial Investigation/Feasibility Study process leading up to the Record of Decision.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Copies Furnished

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U S Department of Justice, 999- 18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

rec'd 11 Dec 95

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Fuller East Partnership
Fuller 45 Partnership
Buffalo Estates Partnership
General Partnerships
John J. Vandemoer
John B. Villano
Managing and General Partners
8791 Circle Drive
Westminster, CO 80030
Ph. 427-7641, Fax 427-5167
Pager 687-1212

December 7, 1995

Program Manager for the Rocky Mountain Arsenal
Rocky Mountain Arsenal
Commerce City, Colorado 80022

Dear Program Manager for the Rocky Mountain Arsenal:

We are the General Managers of three general partnershipin the Henderson vicinity. The partnerships total 146 acres which have been subdivided into 2 to 2.5 acre home sites. We have the powers of attorney to sign for the General Partners in these partnerships. They all concure with us that the following statement is their wish.

We the undersigned, being property owners of the area known as Henderson, Colorado, Directly North of the Rocky Mountain Arsenal, request that the United States Army and Shell Oil CO pay for and install a water system to provide water to the existing homes and future and water needs due to the contamination of our water supply. The water provided to the area must replace the 2500 acre feet of contaminated water and be of excellent quality and quality and sufficient quantity to repair the damage to our area. Since 1942 the United States Army and Shell Oil Co. have been contaminating our land and water and must be held accountable for their actions.

Sincerely,

John J. Vandemoer
John B. Villano

Enclosures: *[Three General Partnership Lists of General Partners]*

9534503-1/1

EXHIBIT B

FUL23 **Fuller East Estates %JBV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
George M. Beime 6065 S. Chester Way Denver CO 80111	Work #:	(303) 291-8450			R	4.9
G. David Brown 9443 Jennings Rd. Morrison CO 80465	Work #:	(303)697-1339			R	4.9
Walter T. & E. Jean Bryson 1499 Kellogg Rd. Springfield OR 94777	Work #:				R	4.9
Trena Dale P.O. Box 38802 Colorado Springs CO 80937	Work #:	(501)855-0819			R	4.9
DeCola Partnership 780 Washington #1401 Denver CO 80203	Work #:	(303) 298-0202			R	4.9
Charles Hanaven Jr. 16500 Co.Rd.45, P.O.B.85 Cheyenne Wells CO 80810	Work #:				R	4.9
Mary Ann Hohs 6243 E. Peakview Ave. Englewood CO 80111	Work #:	(303) 982-7968			R	2.45
Scott Klune 3798 S. Ceylon Way Aurora CO 80013	Work #:	(303)693-9107			R	4.9
Beverly J. Mather- Makala, Trstee P.O. Box 295297 Louisville AR 75029-5297	Work #:	(303)924-0180			R	4.9
Linda J. McAninch 673 Blake Ct. Carol Stream IL 60188	Work #:	(321)701-4495			R	2.45
James R. & Teresa B. Peay P.O. Box 1673 Denver CO 80201	Work #:	(303)893-0214			R	4.9

EXHIBIT B

FUL23 **Fuller East Estates %JBV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
James K. & Shirley F. Pelton 18544 County Road #46 Cheyenne Wells CO 80810	Work #:				R	4.9
Richard E. Pelletier 14217 Downing St. Brighton CO 80601	Work #:	(303)450-2222			R	9.8
Paul E. Raybin 673 Blake Ct. Carol Stream IL 60188	Work #:	(312)701-4495			R	2.45
Red Ink % Max E. Carlson 104 W. 6th St. Julesburg CO 80737	Work #:	(303)474-3331			R	4.9
Richard K. Riman 720 Harrington Rd. Rockville MD 20852-1029	Work #:	(301) 838-9698			R	4.9
Richard K. Riman 12351 N. Pine Vista Tr. Parker CO 80134-8219	Work #:	(303)733-9428			R	0
Thomas C. & Martha A. Roddam 3514 Edolin Drive Finksburg MD 21048	Work #:	(410) 356-3600			R	4.9
David D. Sparks 7976 S. Gaylord Way Littleton CO 80122	Work #:	(303) 446-7273			R	4.9
John J. Vandemoer 8791 Circle Drive Westminster CO 80030	Work #:	(303)687-1212			Option %	1
John J. Vandemoer III, Trustee Irrevocable Trust 2195 Egbert St. #123 Brighton CO 80218	Work #:	(303)427-7641			R	4.9
John B. Villano 2701 E. 112th Ave. Thornton CO 80233	Work #:	(303)280-0056			Option %	1

EXHIBIT B

FUL23 **Fuller East Estates %JBV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
Ralph Villano Jr. 13215 W.C. Road 8 Fort Lupton CO 80621	Work #:	(303)983-5252			R	2.45
Robert Lee Villano 1675 W. 113th Ave. Westminster CO 80234	Work #:	(303)893-5252			R	2.45
Robert P. Villano 1675 W. 113th Ave. Westminster CO 80234	Work #:	(303)893-5252			R	2.45
						100

EXHIBIT B

FUL22 **Fuller-45 Estates %JJV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
Randy Bussing & Kim Harrold 7975 W. 44th Ave. Wheat Ridge CO 80033	Work #:	(303)423-7142			R	4.9
Trena Dale P.O. Box 38602 Colorado Springs CO 80937	Work #:	(501)855-0819			R	4.9
M.C. DeCola Irrvcbl Trst for/Chldrn 790 Washington #1401 Denver CO 80203	Work #:	(303)759-2221			R	4.9
Phillip & Susan Evans & M. Erb 3443 S. Boston Ct. Denver CO 80231	Work #:				R	4.9
Edward L. & Carlyne K. Gerstner 12209 Briar St. Overland Park KS 66211	Work #:				R	4.9
Cecil J. Hallinan P.O. Box 2800 Corona CA 91720	Work #:	(909)277-1010			R	4.9
Mary Ann Hohs 6243 E. Peakview Ave. Englewood CO 80111	Work #:	(303) 962-7968			R	2.45
Loretta G. Iacovetta 221 S. Garfield #211 Denver CO 80209	Work #:	(303)322-4180			R	4.9
Eileen J. Ito 2570 Newland St. Denver CO 80214	Work #:				R	24.5
Scott Klune 3798 S. Ceylon Way Aurora CO 80013	Work #:	(303)693-9107			R	4.9
Truman C. Leuthouser 7208 S. Sundown Circle Littleton CO 80120	Work #:	(303)690-5467			R	4.9

EXHIBIT B

FUL22 **Fuller-45 Estates %JJV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
Susie Russell 1317 Strike Jumper Court Las Vegas NV 89119	Work #:	(702)255-6500			R	4.9
Cesare E. Morganti Jr. 1147 Peakview Drive Castle Rock CO 80104	Work #:	(303) 781-3520			R	4.9
John William Pascal 1244 Mariposa St. Denver CO 80204	Work #:	(303)623-5300			R	1.225
James K. & Shirley F. Pelton 19544 County Road #46 Cheyenne Wells CO 80810	Work #:				R	4.9
Robert V. & Lisa K. Perry 16622 W. 56th Drive Golden CO 80403	Work #:	(303)420-4132			R	1.225
Paula Romero Schmitt 4989 Rocky Rd. El Sobrante CA 94803	Work #:	(510)934-3956			R	2.45
Dorothy L. Romero 1469 Treat Blvd. #1436 Walnut Creek CA 94596	Work #:	(303)455-2208			R	2.45
John J. Vandemoer 6791 Circle Drive Westminster CO 80030	Work #:	(303)687-1212			Option %	1
John B. Villano 2701 E. 112th Ave. Thornton CO 80233	Work #:	(303)280-0056			Option %	1
Dennis E. Wenzel 929 Washington St. Denver CO 80203	Work #:				R	4.9
						100

EXHIBIT B

BUF22 **Buffalo Estates %JJV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
Bald Eagle Resources, T. Galloway 154 Blue Spruce Drive Evergreen CO 80439	Work #:	(303)989-3191			R	3.75
Bald Eagle Resources, S. Smith c/o Scott Smith 2025 S. Owens Ct. Lakewood CO 80227	Work #:	(303) 830-0100			R	0
Rudolph A. Baronne 8918 Winona Ct. Westminster CO 80030	Work #:	(303)373-7244			R	5
Vito & Appalonia Binetti 1846 E. Euclid Avenue Littleton CO 80121	Work #:	(303)797-2014			R	5
Don J. Binetti 3991 S. Helena Street Aurora CO 80013	Work #:				R	5
Laura Blackman 29 Via Barcelona Moraga CA 94556	Work #:	(510) 631-9629			R	2.5
Brian Boyanovsky % Chuck Mason 707 Newell Street Walla Walla WA 99362	Work #:	(509)525-1700				0
Brian Boyanovsky 22014 490th Street Albert City IO 50510	Work #:	238-8980			R	5
Nancy A. Brenton 6040 W. 39th. Ave. Wheatridge CO 80033	Work #:	(303)458-8418			R	0.5
Theresa Tadonini Celeste 22 Longview Rd. Sparta NJ 07871	Work #:				R	0.5
Jeff & Sharon Haber 751 Detroit Street Denver CO 80206	Work #:	(303)321-2277			R	5

EXHIBIT B

BUF22 **Buffalo Estates %JJV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
Eileen J. Ito 2870 Newland St. Denver CO 80214	Work #:				R	10
Rita Colleen Kennedy 4355 Everett Wheatridge CO 80033	Work #:				R	2.5
Richard Rasmusson 4355 Everett St. Wheatridge CO 80033	Work #:	(303)388-5603			R	2.5
Scott Klune 3798 S. Ceylon Way Aurora CO 80013	Work #:	(303)693-9107			R	2.5
Joseph R. Klune 740 Everett St. Lakewood CO 80215	Work #:	(303)936-7291			R	2.5
Charles W. & Gail M. Mason 707 Newell St. Walla Walla WA 99362	Work #:	(509)525-9561			R	5
Linda J. McAninch 673 Blake Ct. Carol Stream IL 60188	Work #:	(321)701-4495			R	2.5
Mary V. McCracken 11947 Lafayette Northglenn CO 80233	Work #:	(303)538-2935			R	2.5
Cesare E. Morganti Jr. 1147 Peakview Drive Castle Rock CO 80104	Work #:	(303) 781-3520			R	5
Susan M. Neill 20800 Bartlett Drove Brookfield WI 53045	Work #:				R	5
Paul E. Raybin 673 Blake Ct. Carol Stream IL 60188	Work #:	(312)701-4495			R	2.5

EXHIBIT B

BUF22 **Buffalo Estates %JJV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
Richard K. Riman 720 Harrington Rd. Rockville MD 20852-1029	Work #:	(301) 838-9896			R	5
Richard K. Riman 12351 N. Pine Vista Tr. Parker CO 80134-8219	Work #:	(303)733-9428			R	0
Mark Saltzman 1906 Flournoy Rd. Manhattan Beach CA 90266	Work #:	(310) 546-2995			R	2.5
Mary Pauline Tadolini 742 S. Youngfield Ct. Lakewood CO 80228	Work #:	(303)571-3857			R	0
Stephen C. Tadolini 428 DeFrance Drive Golden CO 80401	Work #:	(303)236-0751			R	0.5
Deborah K. Tadolini 3354 S. Flower Street Unit #55 Lakewood CO 80227	Work #:				R	0.5
Antoinette M. Tadolini & J. Norland 2220 Cedar Croft Road Acton CA 93510	Work #:				R	0.5
Junn-Kuo & Cecilia C. Teng 7858 S. Harrison Circle Littleton CO 80122	Work #:	(303)977-5080			R	5
Donald H. & Marie Tierman 11 Welcome Rd. Saddlebrook NJ 07662	Work #:				R	0
Don Tierman 1371 Kahaulani Drive Kailua HA 96734	Work #:	(808)262-5142			R	5
John J. Vandemoer 8791 Circle Drive Westminster CO 80030	Work #:	(303)687-1212			R	0.625

EXHIBIT B

BUF22 **Buffalo Estates %JJV**

CLIENT			FIRST TAX ID	OTHER TAX ID	TYPE	AMOUNT
John B. Villano 2701 E. 112th Ave. Thornton CO 80233	Work #:	(303)280-0056			Regular %	0.625
Chih Ted Yang & Eveline Liu Yang 571 Sunrise Drive Golden CO 80401	Work #:				R	5
						100

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Fuller East Partnership
Fuller 45 Partnership
Buffalo Estates Partnership
General Partnerships
Mr. John J. Vandemoer
Mr. John B. Villano
Managing and General Partners
8791 Circle Drive
Westminster, Colorado 80030

Dear Mr Vandemoer and Mr. Villano:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

In response to your comment about an alternative water supply, the Army and Shell Oil Company have reached an Agreement in Principle, enclosed with this letter, with South Adams County Water and Sanitation District (SACWSD) that includes the payment of $48.8 million to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999 In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon of this office at 303-289-0259 or Mr Larry Ford of SACWSD at 303-288-2646.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U. S Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

01/26/96 FRI 13:54 FAX 703 6962940 US ARMY ENVIR LAW DIV →→ RMA COUNSEL 002

WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

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I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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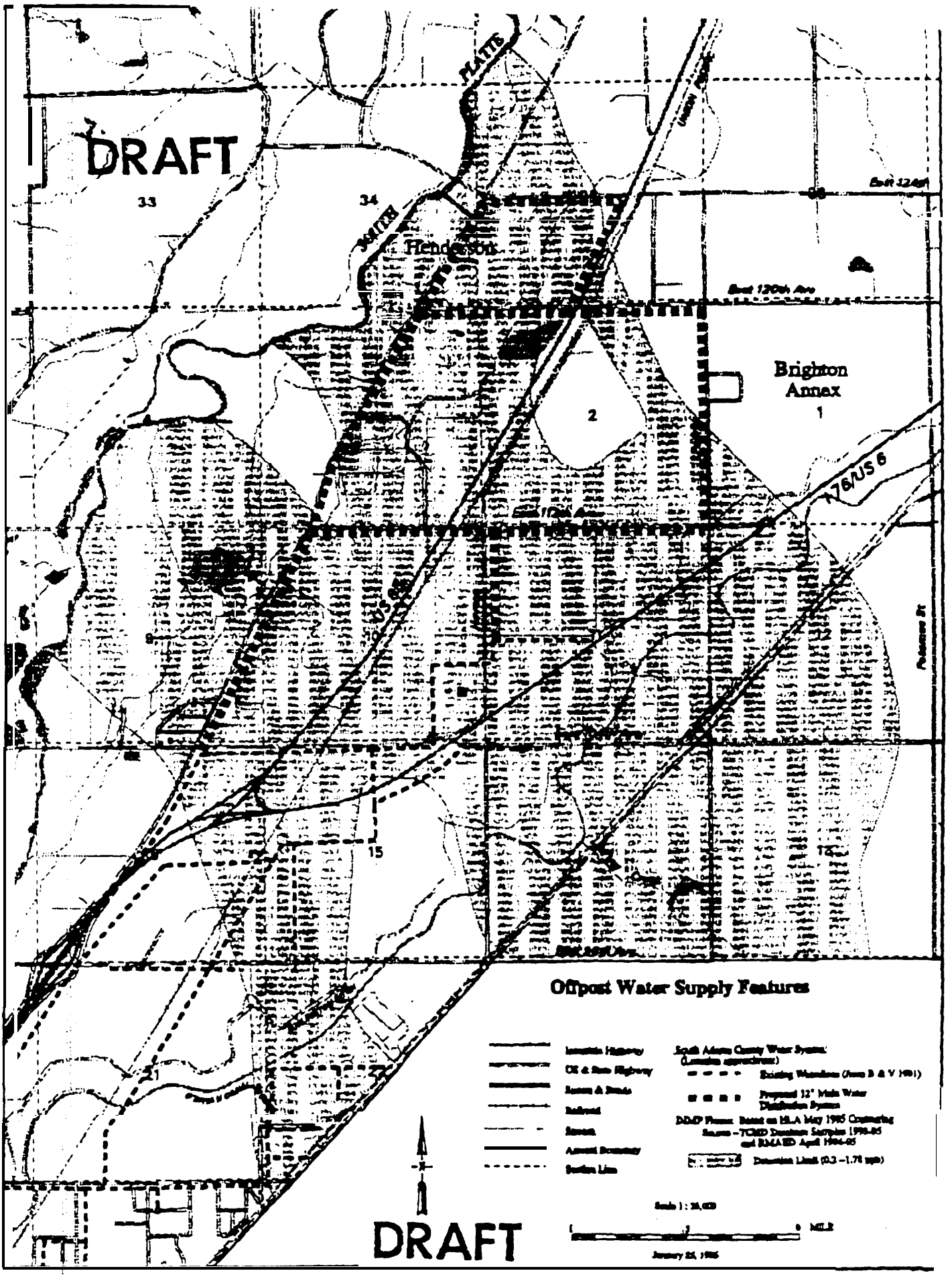
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DOD

OSD INITIATIVE

DEAR MR PRESIDENT

I AM WRITING TO YOU ABOUT THE GRAVE MISJUSTICE DONE TO THE PEOPLE OF MY COMMUNITY BY THE DEPT. OF THE ARMY AND SHELL OIL CO. WE HAVE BEEN INUNDATED WITH TOXINS OUR AIR,WATER AND SOILS FOR ALMOST 53 YEARS.ONLY IN 1988 DID THE ARMY OFFICIALLY DECLARE THEIR MISDEEDS.WHERE ELSE COULD BY PRODUCTS OF NERVE GAS HAVE COME FROM? NOW THEY WANT TO FINALLY PUT THIS TO REST. BUT THE FINAL REMEDY AS THEY CALL IT WILL NT GIVE US ANY CLEAN WATER. HOW CAN A COUNTRY SUCH AS OURS THE GREATEST IN THE WORLD HELP BOPAHL, CHERNOBLE,GRENADA,MEXICO, SHOULD I GO ON? NOT HELP THEIR OWN PEACE LOVING TAX PAYING FLAG WAVING CITIZENS? WE DO NOT SEEK MUCH, BUT WATER PURE AND SIMPLE! WE DESIRE A SUPPLY OF 2500 ACRE FEET PER YEAR TO SUSTAIN US UNTIL THE MISDEEDS OF THE ARMY ARE NO MORE. THIS IS ESTIMATED AT FORTY YEARS. THIS WE ASK IN YOUR NAME FOR THE PEOPLE OF HENDERSON ,CO. I UNDERSTAND WHERE ALL YOUR ENERGIES MUST GO FOR THE MOMENT. BUT IF YOU COULD LOOK INTO THIS MATTER BEFORE THE ARMY FINALIZES THIS IN MARCH OF 1996 WE WOULD BE GREATLY APPRECIATIVE. PLEASE HAVE A SAFE AND HAPPY HOLIDAY SEASON, YOU AND YOUR FAMILY.

THANK YOU
BOB HANSON
11001 E. 120 AVE.
HENDERSON CO 80640

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Henderson Coalition
Jim Enger
16521 East 121st Circle
Brighton, Colorado 80601

December 4, 1995

Dear Resident:

In May of 1995 the United States Army (Army), Shell Oil Company (Shell), Colorado Department of Public Health and Environment (CDPHE), United States Environmental Protection Agency (EPA), and the United States Fish & Wildlife Service (USF&WS), agreed upon a Conceptual Remedy to be used in the cleanup of the Rocky Mountain Arsenal. The Conceptual Agreement means the five parties have agreed in principal how to cleanup the Arsenal. The final decision, called the Record of Decision (ROD), is to be issued in the spring of 1996.

However, the Conceptual Agreement does not address the issue of contamination of off-post water. The Stakeholders, which include Commerce City and Henderson have asked for 7500 acre feet of good quality water to replace the contaminated supply. The Conceptual Agreement states that the Army and Shell will provide a replacement supply of only 4000 acre feet, which is not intended to serve Henderson. In the past it was estimated that there was 2500 acre feet of ground water which could be served to the Henderson area. We think it is important that the 2500 acre feet of water be provided to Henderson in addition to the 4000 acre feet identified in the Conceptual Agreement.

It is imperative that residents and property owners in Henderson make their wishes for a clean, safe, reliable water supply known immediately.

Statements may be mailed to:

Program Manager for the Rocky Mountain Arsenal
Rocky Mountain Arsenal
Commerce City, Colorado 80022

In an effort to secure a clean, safe, reliable water supply, the Henderson Coalition was formed. The Coalition is sponsoring a meeting for residents to voice their opinions. The Army, Shell, EPA, CDPHE, and USF&WS have been invited to the Tuesday, December 12 meeting. The meeting will be held at 7:30 p.m. at the Adams County Regional Park, 9755 Henderson Road. A flier with the details is enclosed. The Coalition is also circulating petitions which can be signed at the December 12 meeting.

We need to show the policy makers that we are united in our efforts to get a clean, safe, reliable water supply to replace our poisoned, contaminated supply.

Following is the language used in the petition:

WE, THE UNDERSIGNED, BEING RESIDENTS AND/OR PROPERTY OWNERS OF THE AREA KNOWN AS HENDERSON, COLORADO, DIRECTLY NORTH OF THE ROCKY MOUNTAIN ARSENAL, DEMAND THAT THE UNITED STATES ARMY AND SHELL OIL COMPANY PAY FOR AND INSTALL A WATER SYSTEM TO PROVIDE WATER TO THE EXISTING HOMES AND FUTURE WATER NEEDS DUE TO THE CONTAMINATION OF OUR WATER SUPPLY. THE WATER PROVIDED TO THE AREA MUST REPLACE THE 2500 ACRE FEET OF CONTAMINATED WATER AND BE OF EXCELLENT QUALITY AND SUFFICIENT QUANTITY TO REPAIR THE DAMAGE TO OUR AREA. SINCE 1942 THE UNITED STATES ARMY AND SHELL OIL COMPANY HAVE BEEN CONTAMINATING OUR LAND AND WATER AND MUST BE HELD ACCOUNTABLE FOR THEIR ACTIONS.

Remember, the Army and Shell have polluted and poisoned our water for 53 years. At no time have they agreed with the Stakeholders that our supply should be replaced. CDPHE has provided bottled water to members of our community for years.

If this issue is not resolved before the ROD is signed, there will be no recourse.

It is up to us to secure the future of our community. Write a statement to the Program Manager of the Rocky Mountain Arsenal, sign the petition, and attend the meeting on December 12. Encourage your neighbors to participate. This could be the last opportunity to recover some of the damages to our community.

Sincerely,

James L. Erger

James L. Erger
Henderson Coalition

Encl.

VERY IMPORTANT MEETING

HENDERSON AREA RESIDENTS
DIMP MEETING

Rocky Mountain Arsenal Pollutant and Contaminant Meeting: Tuesday, December 12, 1995 at 7:30 PM
Place: Adams County Regional Park
9755 Henderson Road, Brighton, CO

Does your well have DIMP?

Why haven't the US Army or Shell Oil replaced the water they have poisoned since 1942 (53 years)?

R.O.D. as proposed has not included any high quality replacement water for the Henderson Area or the necessary pipelines.

Sponsored by the Henderson Coalition.
Agencies Invited: US Army, Shell Oil, Tri-County Health, Colorado Department of Health, South Adams County Water and Sanitation, Adams County Commissioners and EPA.

Henderson Coalition - Jim Erger, Chairman, 659-0549 (home), 659-9288 (work).

TO PROGRAM MANAGER
ROCKY MOUNTAIN ARSENAL

I BELIEVE THAT YOUR FINAL DECISION CANNOT BE MADE WITHOUT A COMPLETE OVERHAUL OF THE HENDERSON RESIDENTS WATER SUPPLY IF WE ARE TO ONLY GET LIP SERVICE THEN WE WILL NEVER ACCEPT ANY FINAL REMEDY. WE DEMAND WATER THAT YOU HAVE TAKEN FROM US.

IF WE HAVE 2500 ACRE FEET IN OUR AQUIFER THAT HAS BEEN DESTROYED BY THE ARMY AND SHELL THEN NO AGREEMENT WILL BE ACCEPTED AS FINAL WITHOUT THAT SPECIFIC NUMBER WRITIN IN STONE.THE TOTAL COST OF THIS REMEDY SHOULD NO LONGER FALL UPON US. AS WE HAVE BORE THE PAIN AND UNDUE MONETARY HARDSHIP YOU HAVE PLACED UNTO ,US SINCE 1942.

THE YEARS OF LIES THAT YOU HAVE PERPETRATED UPON US HAVE BEEN EXPOSED. BUT WHAT GOOD DOES THAT DO US TO KNOW THE TRUTH IF WE ARE TOLD THAT IS DOES NOT MATTER? THAT WHAT MATTERS IS THAT THE GOVERNMENT CAN DO TO US WHAT IT WANTS AND ANYONE UNDER CONTRACT WITH SAME IS EXEMPT.WE REQUIRE, WE DEMAND JUST COMPENSATION! THIS WILL BE DONE BEFORE YOU REACH THE END OF YOUR ASSOCIATION WITH THE PEOPLE OF ADAMS COUNTY. ONLY THEN CAN WE ALL LIVE IN PEACE AND HARMONY WITH ONE ANOTHER AND OUR GOVERNMENT.

THANK YOU
ROBERT S. HANSON
11001 E. 120 AVE.
HENDERSON CO. 80640

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. Robert S. Hanson
11001 E. 120 Avenue
Henderson, Colorado 80640

Dear Mr. Hanson:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

The Army believes that the Agreement in Principle that the Army and Shell Oil Company have reached with South Adams County Water and Sanitation District (SACWSD) ensures a safe and adequate water supply for the community. The Agreement in Principle, enclosed with this letter, includes the payment of $48.8 million to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume by January 1999. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004 The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr Tim Kilgannon of this office at 303-289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U S. Army
Program Manager

Enclosure

Readiness is our Profession

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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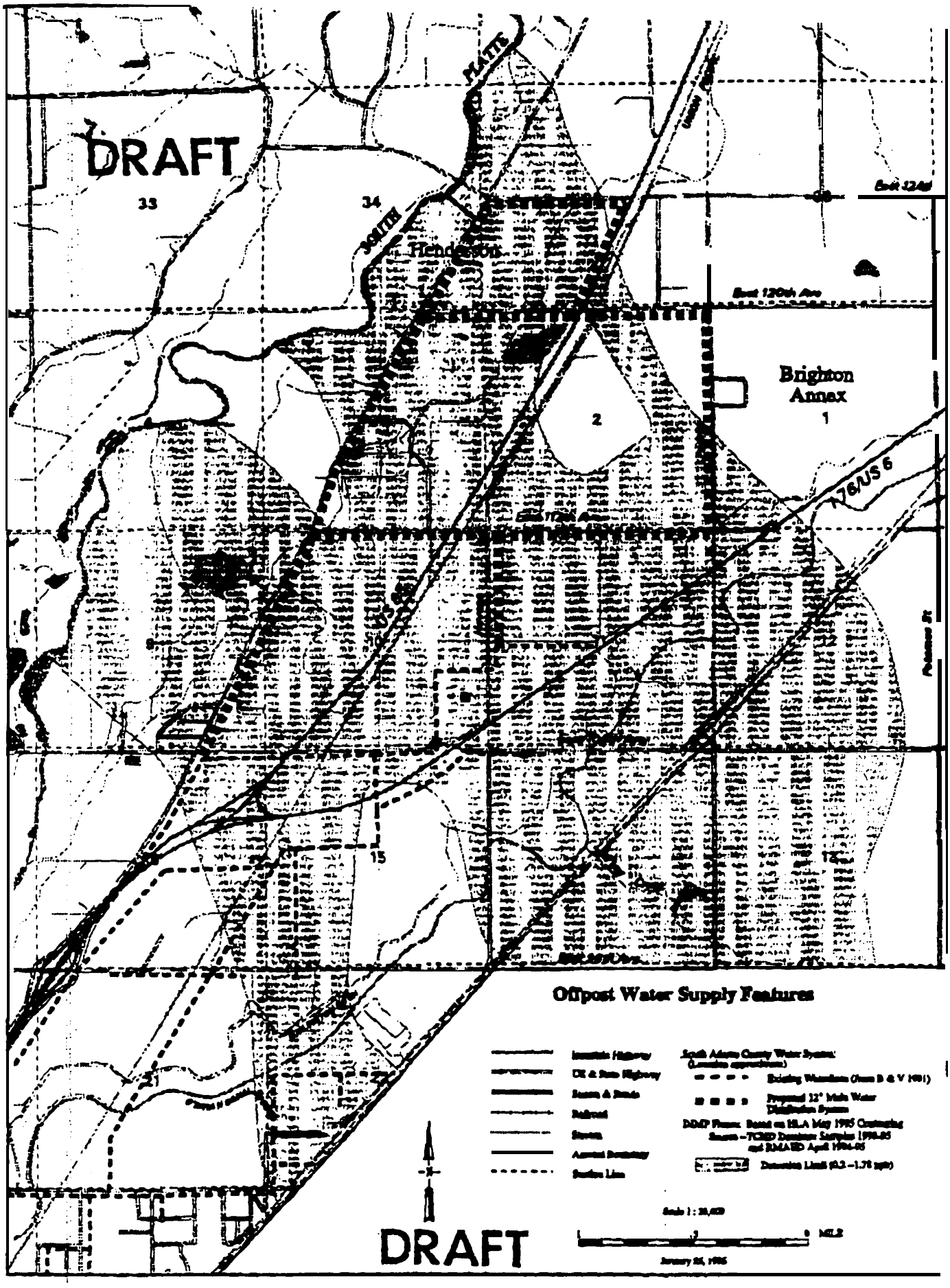
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Offpost Water Supply Features
DRAFT

TOTAL P.02

9390 W. 1st Ave.
Lakewood, CO 80226
232-1242 (FAX or phone)

Ruth ~~Metham~~ MECHAM
Public Affairs Office
Rocky Mountain Arsenal

FAX 289-0582

December 15 is the stated end of the comment period for the Proposed Plan. Technically the comment period could have ended in November, so the period has already been extended once.

Since my main interest is the safe and effective cleanup of Rocky Mountain Arsenal in the shortest practical time period, I am opposed to any extension of the comment period for the Proposed Plan.

In no way do I wish to imply lack of support for on-going evaluation of all studies of health or environmental effects of past and/or future actions. Results of studies should be made public and should be expected to impact the decision-making process when it comes to specific technologies. However, the Proposed Plan leaves room for such adjustments.

Thank you,

Clara Jan Humphrey

Clara Jan Humphrey

9534604-1/1

rec'd 18 Jan

9390 W. 1st Ave, Lakewood, CO 80226

On-Post Proposed Plan Comments
Program Manager, Rocky Mountain Arsenal
Attn: AMCPM-PM/Col. Eugene H. Bishop

Colonel Bishop:

As I have stated in the past, I believe the goal of remediation at Rocky Mountain Arsenal must be protection of human health and the environment. Generally, I think the Proposed Plan points in the right direction. However, there are some things which should be spelled out in the final Record of Decision.

1. Folks in the Henderson area which have wells contaminated by DIMP or other materials from RMA should be provided safe water and the needed delivery system. The cost should be included as one of the costs of remediation and given high priority for completion within the next year or two.

2. Environmental Monitoring should be combined with Health monitoring in order to assure stakeholders that remediation is indeed meeting the stated goal.

3. I'm concerned about the adequacy of the five year review process as outlined at the Restoration Advisory Board meeting last fall. In order to fully understand the effectiveness of the remediation program it is imperative that the official review include data on all work, monitoring data, public comments or complaints, and proposed scheduling. The first review should take place during 2001 with total review taking place each five years after that. Good public relations suggest an ongoing public review of progress, problems, and proposals such as take place at RAB meetings.

4. The HEX pits seem to pose a special problem at this time. If an acceptable solution can not be reached before the R.O.D. deadlines, I recommend that they be pulled out of the On-Post R.O.D. and become a separate operable unit!

5. A Trust Fund has been sold as a back-up guarantee for stakeholder concerns, but is still tentative. The Trust Fund must be guaranteed as part of the remediation! It must be available for emergency use or for use in case Congress refuses to fund Operation and Maintenance at a future time. I want remediation to be complete as soon as possible, but not at the expense of long-term health risks.

6. Public involvement should go beyond what is required, including open houses, progress reports, and other means which will answer questions and concerns of stakeholders. Failure to keep the public involved in the past has led to suspicion and opposition, neither of which will facilitate community acceptance.

Charles Lane Humphrey

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms Clara Lou Humphrey
9390 W 1st Avenue
Lakewood, Colorado 80226

Dear Ms. Humphrey:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

Your first letter was emphatic in that the period for comments on the On-Post Proposed Plan should not be extended for any reason. Although the Army agrees with the spirit of the letter to the effect that the remediation process should move fluidly and unimpeded by needless delays, several parties required more time to research the document adequately and to assess its contents In order to allow additional time for comment without excessively delaying the Record of Decision (ROD), the comment period was extended by 30 days.

Your second letter contained additional comments, and responses are provided below, numbered consistent with your comments.

1 The Army and Shell have reached an Agreement in Principle with South Adams County Water and Sanitation District (SACWSD) The Army and Shell have committed to connecting Henderson area well owners to the SACWSD or alternative system if their wells are located within the detectable area of the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint north of RMA, which is currently being evaluated. The Agreement in Principle, enclosed with this letter, includes payment of $48.8 million to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the DIMP plume footprint by January 1999. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to the Commerce City and Henderson area by 2004. The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon of this office at 303-289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646.

2 The primary goal of the Medical Monitoring Program is to monitor any off-post impact on human health due to the RMA remediation. Elements of the Program could include medical monitoring, environmental monitoring (including water, soil, and air monitoring), or health/community education. This Program will continue until the on-post soil remediation is completed. A Medical Monitoring Advisory Group has been established to evaluate specific issues covered by the Medical Monitoring Program.

3. The extensive, site-wide monitoring program that is planned will provide early detection of any problems with either soil or groundwater remediation. Additionally, the required periodic five-year review of the remedy will evaluate whether the remedy remains protective of human health and the environment. The Army agrees that the review should be comprehensive, and intends to continue the dialogue with the public in a forum like the Restoration Advisory Board, as you suggest.

4. Subject to the results of treatability testing and technology evaluation, approximately 1,000 bank cubic yards (BCY) of principal threat material from the Hex Pit will be treated by an innovative thermal technology. Solidification will become the selected remedy if evaluation criteria for the innovative technology are not met. The remaining 2,300 BCY of material will be excavated and disposed in the on-post hazardous waste landfill.

5 During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operation and maintenance of the remedy The Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the On-Post ROD. Principal and interest from the Trust Fund would be used to cover the costs of long-term operations and maintenance throughout the lifetime of the remedial program. These costs are estimated to be approximately $5 million per year (in 1995 dollars).

It is the intent of the Parties that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund. The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remedial sites. The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the actions federal agencies can take with respect to such legislation Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders and will be convened within 90 days of the signing of the ROD.

6. As stated in the response to your Comment Number 3 above, the Army intends to continue the dialogue with the public throughout the remediation process at RMA.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Copies Furnished

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U. S Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

01/26/96 FRI 13:54 FAX 703 6962940 US ARMY ENVIR LAW DIV →→ RMA COUNSEL 002

WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

version 10 - 26/01/96

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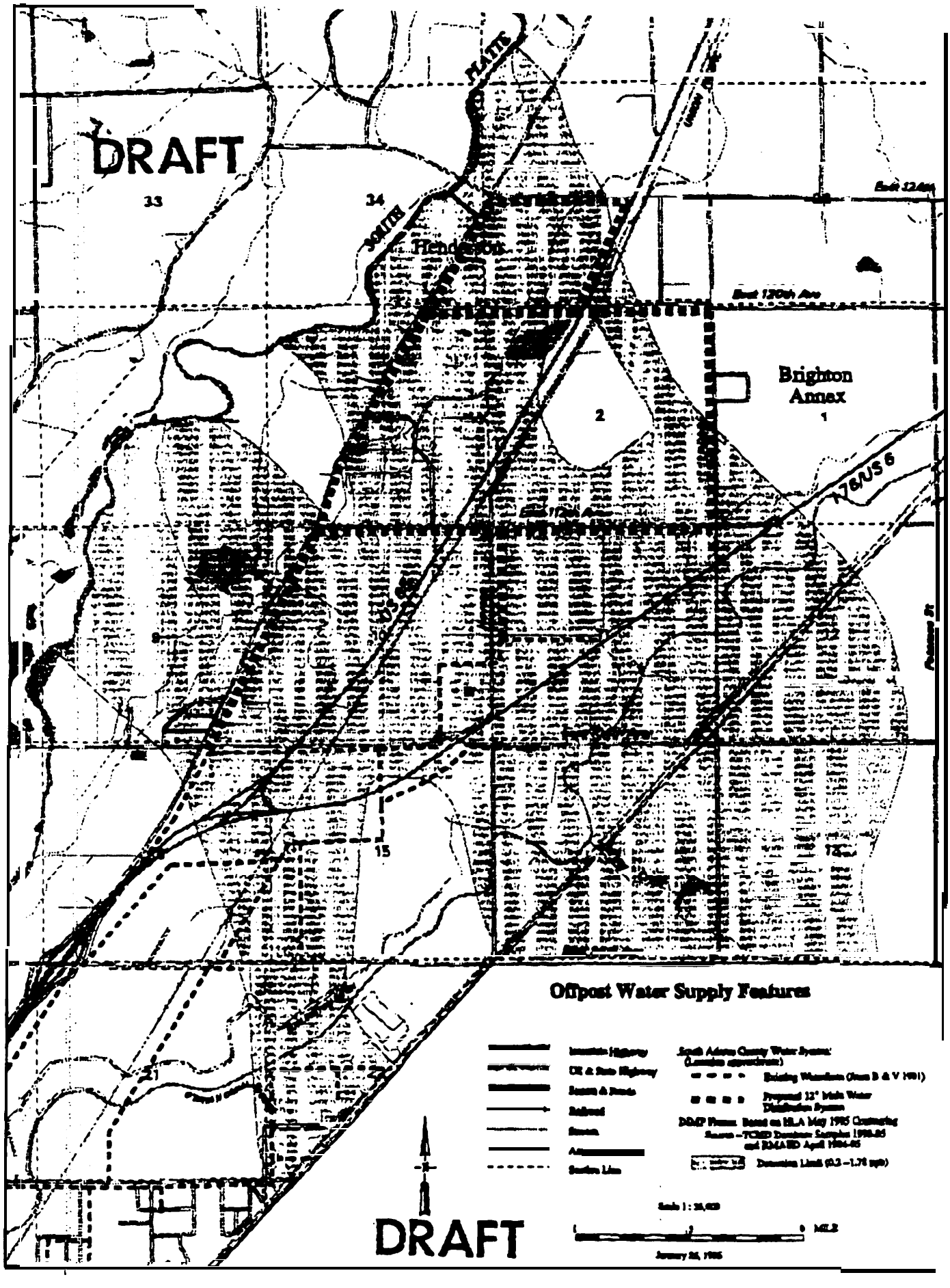

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ROYAL FAMILY

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May the meaning of the Season be deeper,
it's friendships stronger, and its hopes brighter
as Christmas comes to you this year.

To Whom it may concern -
We respectfully request that the US Army and Shell Oil Co. pay for and install a water system for the homes in Henderson, Colorado. John & Humphreys

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr John Humphreys
11690 Peoria St.
Henderson, Colorado 80640

Dear Mr Humphreys:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

The Army believes that the water supply issue for Henderson has been successfully resolved through the Agreement in Principle that the Army and Shell Oil Company have reached with the South Adams County Water and Sanitation District (SACWSD). The Agreement in Principle, enclosed with this letter, includes the payment of $48.8 million to SACWSD and requires that SACWSD supply water to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999 In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004 The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact Mr Tim Kilgannon of this office at 303-289-0259 or Mr Larry Ford of SACWSD at 303-288-2646

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248 Thank you again for your comments

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Readiness is our Profession

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
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F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

01/26/96 FRI 13:55 FAX 703 6962940 US ARMY ENVIR LAW DIV ---> RMA COUNSEL 003

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J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

01/26/96 FRI 13:56 FAX 703 6962940 US ARMY ENVIR LAW DIV --- RMA COUNSEL 004

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K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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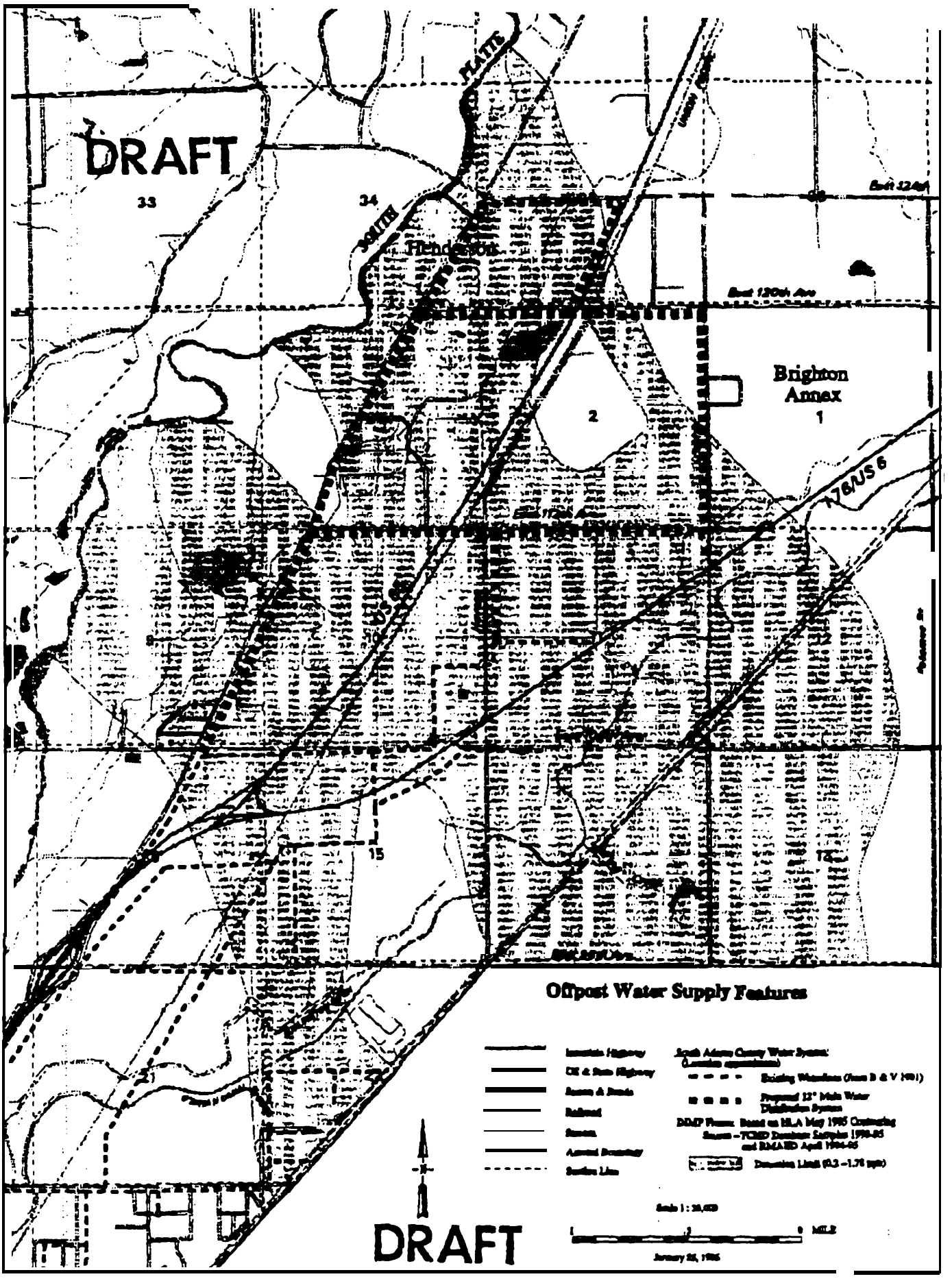
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• BARBARA S. BANKS
• EDWARD IMATANI

• SUITE 1310 •
ONE TABOR CENTER

1200• 17th STREET
DENVER• CO• 80202

PHONE• 303-446-2717
FAX• 303-446-2716

December 13, 1995

Program Manager for the Rocky
Mountain Arsenal
Rocky Mountain Arsenal
Commerce City, Colorado 80022

The undersigned represents James H. Imatani and Sumi Imatani, who own a residence in Henderson, Colorado. It is our belief that the United States Army and Shell Oil Company have caused contamination and irreparable damage to the water system that feeds the wells from which they obtain water for subsistence. The current plan set forth in the Conceptual Agreement fails to provide a substitute source of water. We hereby demand that an alternative source of water be provided in the plan for residents of the Henderson area. Otherwise, Mr. and Mrs. Imatani will effectively lose their residence.

Your consideration is most appreciated.

Very truly yours,

BANKS & IMATANI, P.C.

By: Edward Imatani
Edward Imatani

EI:bds

cc: Mr. and Mrs. Imatani
Henderson Coalition, c/o Jim Erger

Banks & Imatani, P.C.
ATTORNEYS AT LAW

9534803-1/1

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. Edward Imatani
Banks & Imatani, P.C.
One Tabor Center, Suite 1310
1200 17th Street
Denver, Colorado 80202

Dear Mr Imatani:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan. Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

The Army and Shell Oil Company have reached an Agreement in Principle, enclosed with this letter, with South Adams County Water and Sanitation District (SACWSD) that includes the payment of $48.8 million to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999 In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004 The Parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs If you have any further questions regarding the water supply, please contact Mr Tim Kilgannon of this office at 303-289-0259 or Mr Larry Ford of SACWSD at 303-288-2646

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosure

Readiness is our Profession

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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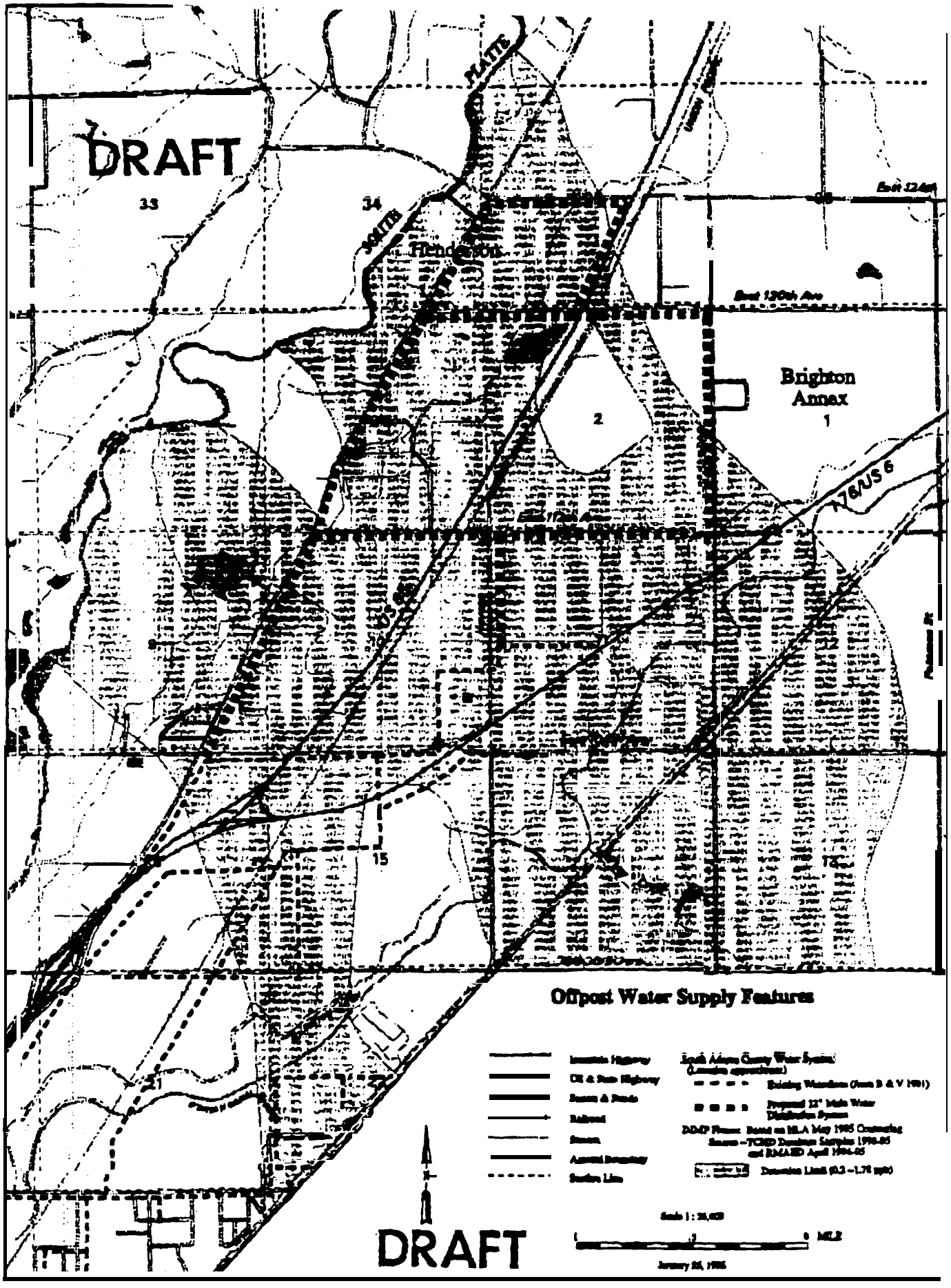
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SANDRA JAQUITH

Attorney at Law

844 Downing Street
Denver, CO 80218

303-832-3707
FAX 303-832-3708

January ~~19~~ 23, 1996

On-Post Proposed Plan Comments
Kevin Blose, Program Manager
Rocky Mountain Arsenal
Attn: AMCPM-PM/Col.Eugene H.Bishop
Building 111--RMA
Commerce City, CO 80022-1748

Re: My AMENDED COMMENTS ON THE PROPOSED PLAN FOR THE ROCKY MOUNTAIN ARSENAL ON-POST OPERABLE UNIT

Dear Mr. Blose:

After submitting my Comments on the Porposed Plan for the Rocky Mountain Arsenal On-Post Operable Unit, on January 19, 1996, I found six typographical errors in my text. Please find below a corrected and amended set of my comments. I want my Comments, as corrected and amended, to be included in the RMA On-Post Record of Decision. If you have any questions concerning this request, please contact me at the phone number set forth above.

INTRODUCTION:

I am submitting the following comments as an individual. However, throughout the comments, I do make reference to a collective "we." The comments asserted under my collective "we" are derived from my participation in and/or my facilitation of the many public meetings held in relation to the subjects addressed in these comments. Although I do not claim to speak for the public, I would assert that I have been in direct communication with the many citizens affected by the Arsenal clean-up and I am in a position to pass on their concerns and comments.

GENERAL COMMENTS:

This public comment process is a fraud. This plan offers for public comment five alternatives for remediation and a proposed plan, which represents what is commonly called the preferred alternative in this phase of the CERCLA process. Unlike most preferred alternatives, this one has been accepted and agreed to by all five of the parties to this remediation as a negotiated compromise. (See paragraph 'A' of Conceptual Agreement.) I believe that this pre-selected remedy is contrary to §117 of CERCLA .

The effect of presenting a pre-selected plan instead of a preferred alternative is to make a sham of this public comment process. Since this proposed plan has been accepted by written agreement as the plan for remediation, it is not really a ***proposed plan, it is the final agreement of the five parties.*** Since each party agrees to support the Conceptual Agreement and Proposed Plan, how could a modification based on public comment be made? It has been presented by the Army, the lead agency, but it will receive little or no critical analysis from the other parties. We have already seen the effects in public meetings. No one seems willing to critize the plan. We, as citizens, have been told publicly and privately that none of the key elements (meaning those set forth in the written agreement) will be changed unless thiere is a "train wreck". It was explained at the November, 1995 RAB meeting by the parties that since it is a ***negotiated settlement***, if one element is changed then the whole agreement fails.

My understanding of the role of ***public comment*** on a preferred alternative is to give the public an opportunity to review all alternatives and to comment on why or why not the preferred alternative is acceptable or preferrable or appropriate. This gives the public and the other parties an opportunity to effect changes in determining the final remedy. Since there will be no real changes between the proposed plan and the final remedy, we must conclude that public comment is irrelevant and constitutes an onerous and futile burden on the public.

We will only believe that this public comment constitutes ***meaningful*** public participation if significant changes are made to this proposed plan.

. I am unhappy that there is essentially no clean-up, no de-toxification of the primary contaminants, in the proposed plan (the only possible de-toxification would come from the promise to ***treat*** the HEX Pits with an alternative technology.) The proposed plan offers a little solidification, some landfilling, but most of the contaminants will be capped with soil and/or concrete. This is ***not a clean-up***, it is ***a cover-up.***

The Rocky Mountain Arsenal ("RMA") has been described as containing the most contaminated square mile on the planet and, by this proposed plan, the contamination will be left in place.

I do not believe that this is protective of human health, wildlife, or the environment.

This remediation decision is being made without knowing what effect the contamination has had on the surrounding communities or the wildlife. Inadequate studies have been done in the surrounding communities regarding how to determine whether human health has been affected, and the studies on the effects of the contaminants on the wildlife have not been finished (most of them were only begun in the past five years even though the Army has been involved in the remediation process for at least twenty years.) It is my belief that the parties did not, and do not, want to know how the contaminants have affected human health and the wildlife.

Shell Oil Company has claimed throughout this process that the contaminants do not need to be treated or de-toxified. They have adamantly and continuously supported the cover-up of the contamination, even though there are no long-term proven technologies on landfills and caps. Not suprisingly, Shell has been instrumental in thwarting the studies of the health effects of these contaminants on wildlife. Shell has refused to support pilot projects on innovative treatment technologies. In doing so I believe that they have controlled and defined the final remedy at the Rocky Mountain Arsenal, to the detriment of all people of Colorado. It is not right that the polluters were allowed to decide not to clean up their mess. I am ashamed and appalled that the State of Colorado, through the Governor's office, pushed for and supported a remedy that does not clean-up the contamination at RMA.

The only possible explanation for this absurdity is that Shell Oil Company *refuses* to allow contaminants to be treated and de-toxified. And if Shell refuses, it is not done, since this proposed plan is based on unanimous agreement of the parties.

When, and by what authority, was a preferred alternative proposed *only upon unanimous agreement* of the polluters? In the original DAA, the Army recommended extensive de-toxification of the contaminants. The EPA and the State of Colorado supported extensive de-toxification of the contaminants. It was *only* Shell Oil Company that opposed de-toxification of contaminants. The proposed plan contains *no* detoxification. Shell Oil Company determined the remedy at RMA, a minimal and non-protective remedy. A remedy that will require diligent monitoring and maintainance if it is to be at all effective. And there is presently no mechanism to create a trust fund to ensure that such funds will be available for this purpose in the future.

1. ***ONE OPERABLE UNIT ("OU") IS NOT SUFFICIENT:***

This on-post operable unit consists of 179 or 181 separate contamination sites (depending on how you define and count). There is no technical reason for heaping everything into one unit and it is likely illegal to not break it up. Certainly, such a

classification is burdensome on those citizens who seek to review, analylize and comment upon it.

The on-post operable unit should have been divided into smaller, related units so that the contamination problems could be reviewed, analyzed, and remediated in some sane and reasonable manner. Citizens, the EPA and even the State of Colorado have requested this hundreds of times.

One on-post operable unit is not effectively manageable. Even the site characterizations were inadequate due to the sheer size of the site and volume of the contaminants. And more importantly, it is virtually impossible to provide effective, complete, and meaningful public participation when the problem is as enormous as the RMA.

It seems that the many problems created by the overwhelming size and complexity of the on-post operable unit at RMA were purposely designed. It was Shell Oil Company that specifically refused to allow the on-post operable unit to be broken into smaller operable units. The sheer size ensured that it could not be analogized to other sites, whereas smaller units might have been so analogized. By maintaining one operable unit, every aspect of the remediation had to be simplified and minimalized in order to make it even minimally manageable.

The State of Colorado did NOT have enough staff to effectively review and address all issues. Nor did the EPA have enough staff to effectively review and address all issues. Only the polluters, Shell Oil Company and the Army could afford enough staff to effectively manage and address all issues. And, not surprisingly, this Proposed Plan substantially resembles Shell's original proposal for remediation.

This site is so huge and complex, and the corresponding Proposed Plan is so vague and simplified, that any meaningful comment is precluded. All details of actual remediation plans and processes, and changes thereto, should require meaningful public comment.

2. ***BASIN F WASTEPILE:***

When Basin F Wastepile was placed in its present location, the public was told that it provided a temporary storage of the highly saturated and toxic soils. The liner was designed to last five years, and we were told that it was stored pending treatment (which I understood would be de-toxification of the contaminants).

The Proposed Plan recommends moving the soils of the Basin F wastepile to the landfill, in the process, the soils will be heated to remove excess moisture. This is ironic since one of the primary, proven technologies for removing pesticides from the soils is to heat them, though at a higher temperature than is necessary for simply removing the moisture. It is ridiculous to heat the soil to remove the moisture and *not* heat it enough to

remove the contaminants for treatment. I want the contaminants removed from the soils of the Basin F wastepile and de-toxified.

3. ***GROUNDWATER:***

The groundwater and aquifer have been contaminated and Proposed Plan offers some treatment of the water but, for all intents and purposes, the water that flows under the RMA is too contaminated to be used. This has severely impacted the drinking water of the surrounding communities and their future growth.

Since at least 1980, the surrounding communities and their local governmental institutions have demanded a full clean-up of the RMA. Replacement drinking water was needed and demanded. Then, about a year-and-a half ago, it was made clear that the Army believed that replacement drinking water was not legally required as part of the remedy at RMA and that the remedy would not include replacement drinking water *and* de-toxification of contaminants. Those same governmental institutions that had once *demanded clean-up* suddenly supported minimal treatment including a cover-up of the contaminants. Compare Northern Coalition's October and December SAPC positions. Replacement drinking water was being held hostage and the surrounding communities seemed to choose replacement water, to protect their health, their community reputations and property values, and future growth. In short, they chose their survival and will pay the price of living next to the largest hazardous waste site in America.

Every citizen or member of the public with whom I have spoken is *unhappy* with the Proposed Plan but many Commerce City residents have accepted it in order to receive replacement water. Unfortunately, the replacement water offered in the Proposed Plan is less than that requested and is inadequate for the needs of the surrounding communities, including South Adams County Water and Sanitation District (SACWSD) and the Henderson area, where the water still contains excessive levels of DIMP.

More water should be supplied, including the 7,500 acre feet requested by SACWSD and additional water for the people of Henderson for drinking and agriculture, where appropriate. The water should be of the highest quality available.

4. ***BOUNDARY SYSTEMS:***

The boundary water treatment systems are not effective enough, and the Colorado Basic Standards for Groundwater (CBSG) are not being met for inorganics (chloride and sulphate) at north boundary and chloroform at northwest boundary. Where possible, all contaminants, including DIMP, should be treated at the source as well as at the boundary.

No remedy is proposed for treating NDMA, the western plume, or arsenic, especially at Basin A Neck and the M-1 ponds. Proposed remedies are necessary, including meaningful public comment.

5. *PUBLIC ATTENDANCE AT MEETINGS*:

Members of the public should be allowed to attend or observe meetings of the parties on technical issues and other day-to day decisions concerning the RMA remediation. The parties have refused the many requests by members of the public to attend such meetings. Why are the parties so dedicated to hiding their deliberations and decision making from the public?

6. *SOIL TREATMENT LIMITS*:

The decisions to excavate soil to only 10 feet (5 feet at South Plants) and to limit "cap" the volume of soil to be remediated were arbitrary and capricious and, therefore, illegal. They were also never open to public comment. Soil excavation and de-toxification should go as deep, and include as much, as is necessary and practicable to detoxify them.

7. *DIOXIN:*

The proposed Plan is not a protective remedy because it does not address dioxin. Given the types of chemical production that occurred at RMA since the 1940s, there is every reason to believe that there are high levels of dioxins at RMA. To determine the extent of dioxin levels there should be full and extensive sampling, testing, analysis, and risk assessments subject to full and meaningful public review and comment.

8. *HEX PITS:*

The Proposed Plan provides no specific remedy but innovative treatment and detoxification have been promised by the parties. This remedy needs extensive analysis and public discussion before a remedy is chosen, open to public review and comment. In my opinion, and the opinion of many other stakeholders, the remedy should be treatment of the contaminants using an innovative technology including a closed system thermal treatment, preferrably ECOLOGIC. This is the only site at which innovative technology and detoxification were promised in response to citizen concerns and demands. We fully expect the parties to honor this promise.

9. *EMERGENCY PLAN:*

The Proposed Plan provides no emergency plan, excavation plan, transportation plan, or traffic plan. All are necessary and should be designed with full and meaningful public participation.

10. *SOUTH PLANTS:*

The South Plants Tank Farn Light Non-aqueous Phase Liquid (LNAPL) plume is not specifically mentioned in the Conceptual AGreement and the present DAA recommends no action. The July,

1993 version of the DAA porposed to extract and treat the LNAPL and, as late as January, 1995, Shell supported the proposed treatment. This issue was dropped without explanation or comment. The LNAPL constitutes principal threat waste and should be treated to reduce contaminants.

The Conceptual Remedy provides that high levels of water will be maintained in the lakes to prevent the South Plants Plume from migrating into the lakes. There is evidence that the lake water levels are not achieving hydraulic containment. The plan is flawed and not in compliance with the Conceptual Agreement.

The South Tank Farms Plume (STFP) needs a pump and treat system rather than relying on elevated lake levels. It is a ridiculous waste of water rights to attempt to use a hydraulic pressure system that is already ineffective - and it is sure to fail completely during periods of drought. This proposed remedy is not protective.

It is proposed that the South Plants soils be excavated to 5 feet but they should be excavated as deep as is necessary to remove principal threat contamination. Soils will also be excavated from the M-1 Pits and solidified, so why aren't the excavated soils from the Lime Basins not also treated? At least solidify them, especially since they are loaded with lime - a key ingredient for the D.C.R. solidification process.

ALL of the groundwater from South Plants should be pumped and treated to provide some source control of groundwater. Why allow contaminated water to flow downstream causing contaminants to spread to clean water or to seep into lower aquafers? This was previously recommended in the DAA and proposed during the SAPC negotiations, but was dropped without comment or explanation.

12. *FORMER BASIN F:*

The Proposed Plan recommends in-situ solidification which is an unproven technology. There is no basis for this treatment in the record and thus it is arbitrary and capricious. Performance standards have not been developed. Performance standards need to be developed, along with a contingency plan if this remedy fails. This needs to be re-evaluated and a proper record made to support the remedy, and should be open to full and meaningful public review and comment.

13. *LAND DISPOSAL RESTRICTIONS (LDRS):*

I have grave concerns about the application of the Corrective Action Management Unit (CAMU) rule and the Area of Contamination (AOC) concept to avoid complying with Land Disposal Restrictions (LDRs). The application of the AOC concept at RMA goes well beyond the definition of AOC in the NCP preamble. The CAMU rule is currently being challenged and is obviously illegal. It is wrong to use these machinations to avoid federal regulation and LDRs.

14. *BIOTA :*

There is no selected remedy, only a selected process. A remedy needs to be chosen, with full and meaningful public participation and comment.

This should be made a separate Operable Unit. Short tern destruction of biota would be justified to attain long-term habitat improvement by detoxification of contaminants.

15. *TRENCHES :*

The Shell Trenches are extremely toxic and must be treated and detoxified. It is a relatively small site but constitutes some of the worst contamination. The proposed cap and slurry are inadequate to remedy this site and the remedy is not protective.

It is proposed that the Army Trenches be capped with concrete. This is absolutely inadequate. The Army Trenches contain Unexploded Ordinances (UXO) and it is *ridiculous* to leave UXO next to an international airport. A feasibility study needs to be done to remove the UXO and the soils on this site must be treated by detoxification of the high levels of contaminants.

16. *LAKE SEDIMENTS:*

There is no proposed remedy for lake sediments. This site needs to be made a separate Operable Unit for evaluation and development of a remedy with full and meaningful public review and comment.

In conclusion I hereby and formally request that all stakeholder comments and documents from the SAPC negotiations as well as all public comments from the public meeting held on the Proposed Plan at the Rocky Mountain Arsenal on November 18, 1995, by incorporated in written form, and in their entirety, into these public comments.

Sincerely,

Sandra Jaquith

Sandra Jaquith
Community CO-Chairperson
Remedial Advisory Board (RAB), Rocky Mountain Arsenal

Member of RMA, Site Specific Advisory Board (SSAB)

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms Sandra Jaquith
Attorney at Law
844 Downing Street
Denver, Colorado 80218

Dear Ms Jaquith:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

Enclosed are responses to your comments in the order they appeared in your letter

If you have additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248 Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Enclosures

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U S Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

Readiness is our Profession

U.S. ARMY RESPONSES TO COMMENTS FROM MS. SANDRA JAQUITH ON THE ROCKY MOUNTAIN ARSENAL ON-POST PROPOSED PLAN

General Comments
(Pages 1-3 of the letter)

The Army believes the public comment process for the On-Post Proposed Plan is a useful tool that can help shape and define the terms to which the parties agreed in the Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal (Conceptual Remedy). As you may recall, previous to the Conceptual Remedy, the parties were at a standstill and heading into litigation over the major differences seen as a basis for RMA remediation. The Conceptual Remedy, with the help of the Lieutenant Governor and an experienced mediator, helped the parties reach a conceptual agreement based on compromise without affecting the protectiveness of the selected remedy.

The Army also believes that the public has provided valuable input to the remediation process at RMA As you are aware, the Conceptual Remedy does not contain specifics about the remediation that will soon begin The parties are working hard to resolve the questions that remain, and the public input is important to that process. In addition, the Army has included more public participation in the selection process than what is required under the Comprehensive Environmental Response, Conservation and Liability Act (CERCLA) by encouraging any interested party to participate in the review and selection process during the past years Many comments were reviewed and considered during the process. While no one will agree on every aspect of the Record of Decision (ROD), the Army believes that, with the help of the Parties and public, the selected remedy will be fully protective of human health and the environment

The remediation process has been ongoing for more than 15 years and has included substantial reductions in toxicity, especially in groundwater The Basin F Interim Response Action (IRA) treated more than 10 million gallons of highly contaminated liquids In addition, the sludges and soils in contact with the contaminated liquid have been contained in the Basin F wastepile, which will be moved as part of the final remedy to an on-post, state-of-the-art, triple-lined cell(s) of the hazardous waste landfill While landfills do not detoxify contaminants, they do protect people and the environment by cutting off exposure pathways.

The health effects on people and wildlife by many of the compounds produced at RMA have been studied for many years, and this information is available at the Joint Administrative Record Document Facility (JARDF) Studies have been completed by the Agency for Toxic Substances and Disease Registry (ATSDR) independently and in conjunction with the Colorado Department of Public Health and Environment (CDPHE). These studies showed no conclusive health impact on the communities surrounding RMA Also, the final Public Health Assessment, produced by ATSDR, should be complete in the summer of 1996 The U.S. Fish and Wildlife Service (USFWS) has stated in numerous meetings that although adverse impacts have been identified in

wildlife within highly contaminated areas, the general population of wildlife is healthy based on the studies completed thus far. Other studies are continuing at RMA to more fully assess potential health impacts on wildlife.

A Medical Monitoring Program for the surrounding communities has been identified as part of the On-Post ROD to measure health effects, if any, during the remediation process.

Shell has consistently supported the remediation process in many ways. They have participated in many innovative studies (e.g., thermal desorption, enhanced soil vapor extraction, and air sparging) and have been instrumental in providing data that would support or dismiss various remediation technologies. Again, the Army reemphasizes that the Conceptual Remedy was not the product of one party dictating its agenda to the other parties. The Conceptual Remedy was a compromise for all parties involved in order to provide a fully protective, cost-effective, and implementable remedy.

During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operation and maintenance of the remedy. The Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the ROD Principal and interest from the Trust Fund would be used to cover the costs of long-term operation and maintenance throughout the lifetime of the remedial program. These costs are estimated to be approximately $5 million per year (in 1995 dollars).

The Parties intend that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund. The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remediation sites. The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the actions federal agencies can take with respect to such legislation Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated

A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders and will be convened with 90 days of the signing of the ROD

Specific Comments

1. One Operable Unit (OU)

The Army considers the definition of one On-Post OU the best approach to manage waste from different sites at RMA and to use alternatives that are more efficiently implemented on a large scale. There is no legal requirement to subdivide this site into more than one OU. The Army has, however, treated some individual contaminated sites in the IRA program.

The Army has long recognized that successful environmental restoration projects require input of interested community residents and has conducted more than 20 open houses and public meetings to enable those interested to voice their concerns.

2. Basin F Wastepile

The Army has consistently tested the wastepile liner systems and found them to be in excellent condition. The Army believes that the Basin F wastepile, in its present state, will be in good operating condition at least until such time that it is moved to the new landfill. Although the wastepile liner itself cannot be tested without potentially disturbing its integrity, an identical liner system under Pond A, which was in constant contact with Basin F liquid for seven years, was tested during its closure and was found to be in excellent condition. These data provide a strong indication that the liner system will fully contain the waste as long as it is needed

The temperature and process for drying, which is water evaporation, is very different from the temperature required for destruction or desorption of pesticides. As has been explained in the public meetings, thermal desorption or incineration processes operated at high temperatures would be needed to vaporize and destroy the pesticides Additionally, pesticides have low vapor pressure, very low water solubility, and are immobile; they consequently pose a low risk with regard to migration and are good candidates for containment technologies.

3. Groundwater

In response to your comment about an alternative water supply, the Proposed Plan states that the Army and Shell are committed to providing an additional 4,000 acre-feet of water to South Adams County Water and Saitation District (SACWSD) The Army and Shell have reached an Agreement in Principle, enclosed with these responses, with SACWSD that includes payment of $48.8 million to SACWSD and requires that SACWSD water be supplied to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999 In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson Area by 2004 The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and

Henderson's water needs. If you have any questions regarding the water supply, please contact Mr Tim Kilgannon of this office at 303-289-0259 or Mr. Larry Ford of SACWSD at 303-288-2646.

4. Boundary Systems

The boundary systems are effective with respect to all currently identified contaminants. DIMP and chloroform are treated at the RMA boundaries to levels below their respective standards Remediation goals have been established for chloride and sulfate in concert with CDPHE and the U.S. Environmental Protection Agency (EPA). N-nitrosodimethylamine (NDMA) is currently being monitored; if this program identifies an NDMA problem, potential modifications required to achieve the remediation goals will be included in the remedial design.

5. Public Attendance at Meetings

The Army believes that it is not practical for members of the public to attend all technical and day-to-day operations meetings regarding the RMA remediation. The Army has found that smaller meetings can be more focused, where decisions and progress can be made more efficiently. However, the relevant information generated in meetings between the Parties is shared with the public in Restoration Advisory Board and Site-Specific Advisory Board meetings and via newsletters and other means (e. g., the Internet).

6. Soil Treatment Limits

The excavation depths of 10 feet (5 feet in South Plants) and the excavation volumes discussed in the Proposed Plan and incorporated into the ROD are based on the Remedial Investigation (contaminant types and concentrations in soil), the Risk Assessment (exposure pathways and risk-based contaminant limits), and the Feasibility Study (remediation criteria and selection of remedial alternatives) The Army believes these depths and volumes are appropriate in light of the extensive sampling that has been performed and the identified vertical distribution of contaminants

7. Dioxin

Dioxin and furan sampling was undertaken by CDPHE, and the analytical results are presently being evaluated by the Biological Advisory Subcommittee (BAS). Although The Army believes that the currently identified contaminants of concern include all contaminants representing the greatest potential for risk, other contaminants may become a concern in the future (e g , dioxin). In such an instance, the contaminant will be evaluated with respect to the remedy selected, designed, or implemented to ensure that the remedy remains protective of human health and the environment.

8. Hex Pit

Subject to the results of treatability testing and technology evaluation, an innovative thermal technology will be used to treat approximately 1,000 bank cubic yards (BCY) of principal threat material from the Hex Pits. Solidification will become the selected remedy if evaluation criteria for the innovative technology are not met. The remaining 2,300 BCY will be excavated and disposed in the on-post hazardous waste landfill.

9. Emergency Plan

Emergency plans are typically part of the post-ROD remedial design activities. The Parties and the public will be kept informed of contingency plans as they are written.

10. South Plants

The reason for the elimination of light, nonaqueous-phase liquid (LNAPL) treatment is that the extractable volume of the plume was determined to be much less than had been expected Shell performed a pilot-scale study for removal of LNAPL over a 6-month period and was able to remove only about 50 gallons of LNAPL They concluded that the volume of extractable LNAPL was much less than previously estimated and that efficient removal and treatment could not be achieved at that extraction rate It appears that a significant fraction of the LNAPL is contained in the soil pores and is not mobile Because the LNAPL is not highly mobile, it would not be classified as a "principal threat." Because the LNAPL cannot be efficiently reversed, the preferred remedy is to allow the ongoing natural attenuation to continue and to monitor the plume. The remedy, accumulation of extractable volume, and potential extraction will be reevaluated as part of the 5-year site review

Water levels at Lake Ladora and Lower Derby Lake will be maintained to support aquatic ecosystems The biological health of the ecosystems will continue to be monitored. Lake-level maintenance or use of other means of hydraulic contaminant or plume control will be used to prevent South Plants plumes from migrating into the lakes at concentrations exceeding Colorado Basic Standards for Groundwater at the point of discharge Groundwater monitoring will be used to demonstrate compliance

There is no evidence of significant migration beyond the South Tank Farm Plume boundary at this time Migration of contaminants in this area is very slow due to the hydrogeological conditions. and contaminants appear to be attenuated by natural processes, such as biodegradation, at the edge of the plume Samples from the deeper aquifer show no evidence of contamination. Plume movement will be further reduced through construction of soil covers over South Plants, which will result in continued lowering of the water table and reducing hydraulic gradients.

The comparative analysis for the Lime Basins indicates that the landfill alternative is more cost-effective than a solidification alternative. Disposal in the enhanced landfill is protective of human health and the environment.

11. Letter had omitted #1 1.

12. Former Basin F

In situ solidification was identified as a representative process option for Former Basin F during the Development and Screening of Alternatives. During the Detailed Analysis of Alternatives (DAA), solidification formed part of a remedial alternative for that site and was retained for further evaluation. During the early stages of the DAA, in situ thermal treatment (RF heating) appeared promising as an in situ technology and was tested in pilot scale at the Former Basin F site. The pilot-scale test could not demonstrate effective treatment of pesticides, so that technology was removed from further consideration and was replaced by in situ solidification. Solidification/stabilization is not considered an emerging or unproven technology by EPA. As of the end of fiscal year 1993, both in situ and ex situ solidification had been selected in numerous RODs nationwide, although solidification is not frequently used to treat organic contaminants. Necessary testing will be performed prior to implementation of the in situ solidification treatment technology to ensure that stabilization chemicals are compatible with the waste, that the products are stable, and that treatability goals can be met. If the selected process is ineffective, an alternative technology may be adopted through the ROD amendment process. In addition, during the remedial design/remedial action process, contingency plans and public involvement will be important.

13. Land Disposal Restrictions (LDR)

While it is true the Corrective Action Management Unit (CAMU) rule is currently being challenged, the EPA supports the concept, and the State of Colorado in the Colorado Hazardous Waste Management Act (CHWMA) has adopted it. EPA's goal in establishing the CAMU Rule was to "provide remedial decision makers with an added measure of flexibility in order to expedite and improve remedial decisions" while "existing closure regulations and requirements for [Resource Conservation and Recovery Act] RCRA-regulated units, which require closure to occur in a manner that is protective of human health and the environment, remain in effect." Purpose and Context of the CAMU Rule, 58 Fed. Reg. 8654 (1993) (to be codified at 40 C.F.R. Parts 260, 264, 265, 268, 270, and 271). The on-site landfill that is central to the CAMU will meet applicable CHWMA requirements.

The area of contamination (AOC) is a CERCLA concept that is used to determine whether RCRA land disposal restrictions are applicable to CERCLA response actions. The use of the AOC concept at RMA is appropriate based on applicable laws, regulations and site conditions.

14. Biota

In addition to the human health exceedance sites that will be remediated (in which biota sites will be remediated as well), large areas of low contamination level surficial soil were identified for remediation, as shown in Figure 9.3-1 of the ROD. Additional areas of surficial soil contamination known as the "Area of Dispute" (see Figure 6.2-6) are currently being monitored to evaluate whether unacceptable levels of exposure (i. e., risk) exist for the "Area of Dispute" shown on that figure. The monitoring and evaluation process detailed in the ROD will continue ongoing efforts by the BAS to identify areas that may pose risk to biota and to refine the areas to be remediated. The public will be kept informed about the Parties' findings.

15. Trenches

The selected remedies for the Shell and Army Trenches were based on a combination of criteria described in the DAA, including short-term risks during remediation and implementability. The combination of RCRA-equivalent caps and slurry walls selected for these sites will effectively interrupt exposure pathways and minimize infiltration of precipitation through remaining contaminated material. The Army believes that these remedies will prevent exposure to or migration of contamination and that they are protective of human health and the environment over the short and long term.

16. Lake Sediments

Approximately 38,000 BCYof lake sediments will be removed and placed in either the on-post hazardous waste landfill or Basin A Consolidation Area as part of the selected remedy. This action addresses the potential human health and biota risks identified to date. The USFWS will continue monitoring the lakes to evaluate the need for additional action.

Conclusion

Public meeting comments on the Steering and Policy Committee documents are available at the JARDF. The only comments included as part of the On-Post ROD are comments made by the Parties and public on the On-Post Proposed Plan. However, many of the concerns raised during public meetings are contained within the Proposed Plan comments and Responsiveness Summary of the ROD.

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

01/26/96 FRI 13:56 FAX 703 6962940 US ARMY ENVIR LAW DIV --- RMA COUNSEL 004

AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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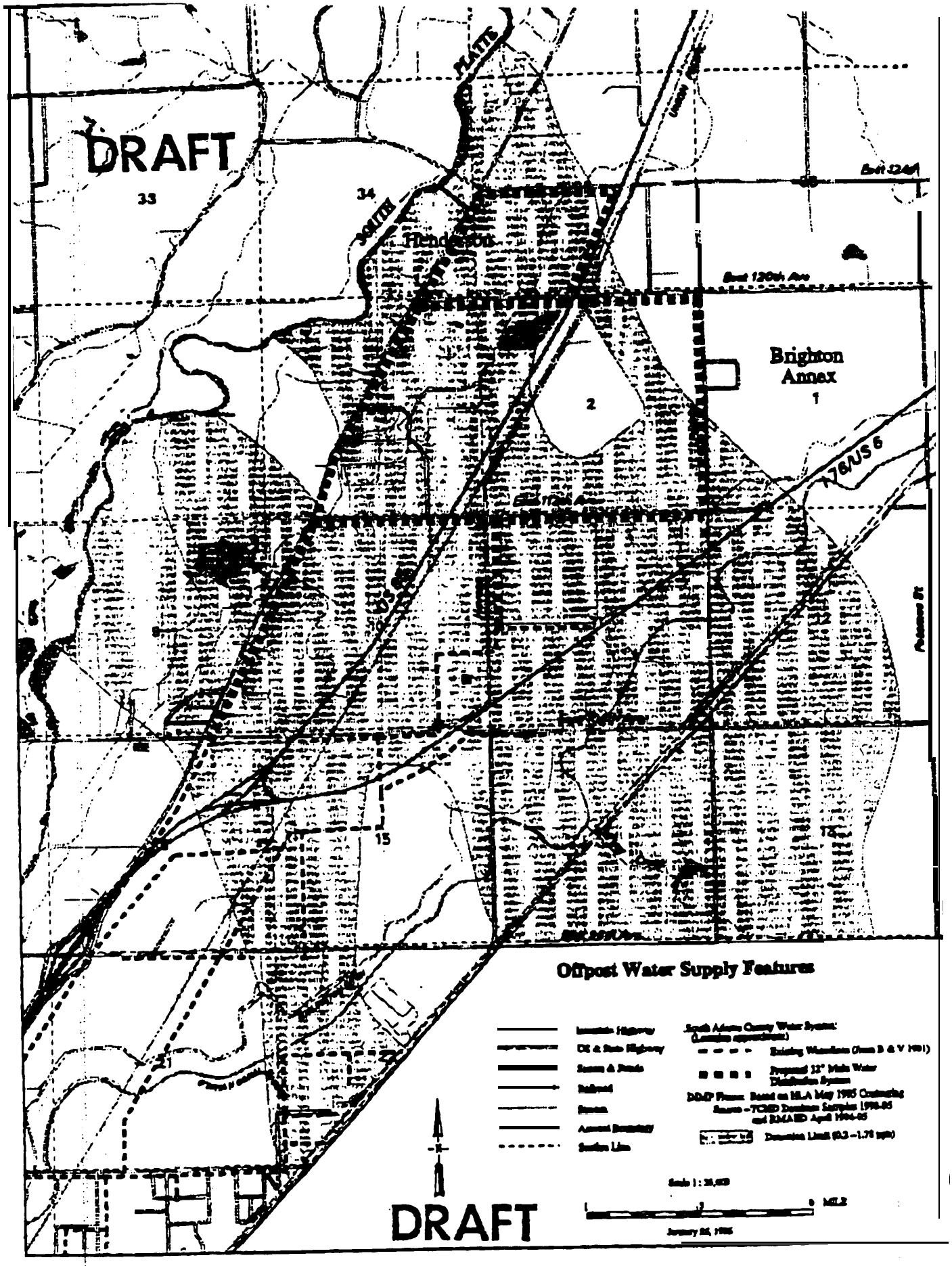
01/26/96 FRI 13:56 FAX 703 6962940 US ARMY ENVIR LAW DIV →→→ RMA COUNSEL 005


DRAFT
33
34
SOUTH
PLATTE
Henderson
East 120th Ave
Brighton
Annex
1
2
I-76/US 6
15
Offpost Water Supply Features
Interstate Highway
US & State Highway
Railroad
Section Line
Existing Waterlines (from B & V 1991)
Proposed 12" Main Water Distribution System
Detection Limit (0.2 – 1.78 ppb)
MILE
DRAFT

TOTAL P.02

Shirley Jentsch
3544 Dyanna Dr.
Thornton, CO 80241
Thornton resident

On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn:AMCPM-PM/Col. Eugene H. Bishop
Building 111 - RMA
Commerce City, CO 80022-1748
Dec. 15, 1995

Gentlemen,

I appreciate the opportunity to provide comment on the proposed remediation of the Arsenal.

I feel the Army and Shell should negotiate with the South Adams County Water and Sanitation District and Henderson residents to resolve replacement water and distribution lines issues. Neither Mr. James Erger of Henderson nor Mr. Larry Ford of the water district appeared satisfied with the Army and Shell's plan at the RMA Public Meeting on Nov. 18th. Peoples whose lives and livelihoods are affected should have a seat at the table where decisions mutually agreeable to all should be negotiated.

I support the establishment of a Medical Monitoring Program and a Medical Monitoring Advisory Group as described on pages 11 and 12 of the Proposed Plan for the RMA On-Post Operable Unit. It should be a timeline priority that this program and group be fully operational and adequately staffed before remedial activities begin. They should have reasonable advance notification of all remedial procedures so they can evaluate possible risks and make recommendations. The public should be allowed to have access to information on issues discussed, recommendations made, and wether or not those recommendations were acted upon. This information should be timely and easily accessible. People have a right to be assured their health is being given top priority in remediation measures.

Because of the complexity and scale of remediation at RMA, I'd prefer a review every three years rather than every five. The cycle should be tied to the announcement of the ROD. Further, every three years the ROD would be reviewed in its entirety. AT the Dec. 7th RAB, I believe it was suggested that as a particular aspect was remediated, its five year review cycle would begin. This kind of piecemeal review cycle would make it extremely difficult for the public to keep updated and involved. I also believe the public's perception of what was meant by a five year review process is that the whole remediation plan is revisited every five years.

For me, confidence in preferred remediation proposals is strongly tied to the standards those proposals chose or were impelled to meet. The higher the standards, the stricter the requirements, the greater the confidence I have in the process. Without the personal technical expertise, I rely on my local government to represent my concerns in these issues. Therefore, I support standards setting and restrictions by state and county governments as those being in my best interests.

Thank you for considering these comments,
Respectfully,

Shirley M. Jentsch

Shirley M. Jentsch

9533404-1/1

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms Shirley M. Jentsch
3544 Dyanna Dr.
Thornton, Colorado 80241

Dear Ms. Jentsch:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

The Army and Shell Oil Company (Shell) successfully negotiated with South Adams County Water and Sanitation District (SACWSD) to arrive at an Agreement in Principle. This agreement, enclosed with this letter, includes payment of $48.8 million to SACWSD and requires that SACWSD provide the water to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999 In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004 The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs If you have any further questions regarding the water supply, please contact Mr. Tim Kilgannon of this office at 303-289-0259 or Mr Larry Ford of SACWSD at 303-288-2646.

The health effects on humans and wildlife to many of the compounds produced at RMA have been studied for many years, and this information is available at the Joint Administrative Record Document Facility (JARDF) Studies have been completed by the Agency for Toxic Substances and Disease Registry (ATSDR) independently and in conjunction with the Colorado Department of Public Health and Environment (CDPHE). These studies showed no conclusive health impact on the communities surrounding RMA. The final Public Health Assessment, produced by ATSDR, will be complete in the summer of 1996. The U.S. Fish and Wildlife Service (USFWS) has stated in numerous meetings that although adverse impacts have been identified in wildlife within highly contaminated areas, the general population of wildlife is healthy based on the studies completed thus far. Also, other studies are continuing at RMA to more fully assess any health potential impacts on wildlife

A Medical Monitoring Program for the surrounding communities has also been identified as part of the Proposed Plan to measure health effects, if any, during the remediation. The primary goals of the Medical Monitoring Program are to monitor any off-post impact on human due to

health the RMA remediation. This Program will continue until the soil remediation is completed A Medical Monitoring Advisory Group has been established to evaluate specific issues covered by the Medical Monitoring Program. The Group is composed of representatives of the Army, Shell, the U. S Environmental Protection Agency (EPA), CDPHE, Tri-County Health Department, ATSDR, the USFWS, Denver Health and Hospitals, and the Site-Specific Advisory Board. The Group also includes community representatives from the cities of Commerce City, Henderson, Denver, Montbello, and Green Valley Ranch. If you would like more information on the Medical Monitoring Program or wish to participate as part of the Medical Monitoring Advisory Group, please call Ms. Mary Seawell of the CDPHE at 303-692-3327.

Five-year site reviews are intended to evaluate whether the response action remains protective of humans and the environment. Statutory five year reviews are required no less often than each five years after the initiation of remedial action. The Army appreciates your comment that a piecemeal review process would be undesirable. The Army intends each periodic review to be performed on the site remedy as a whole.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H Bishop
Colonel, U S Army
Program Manager

Enclosure

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U. S Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT - TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

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I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFO RMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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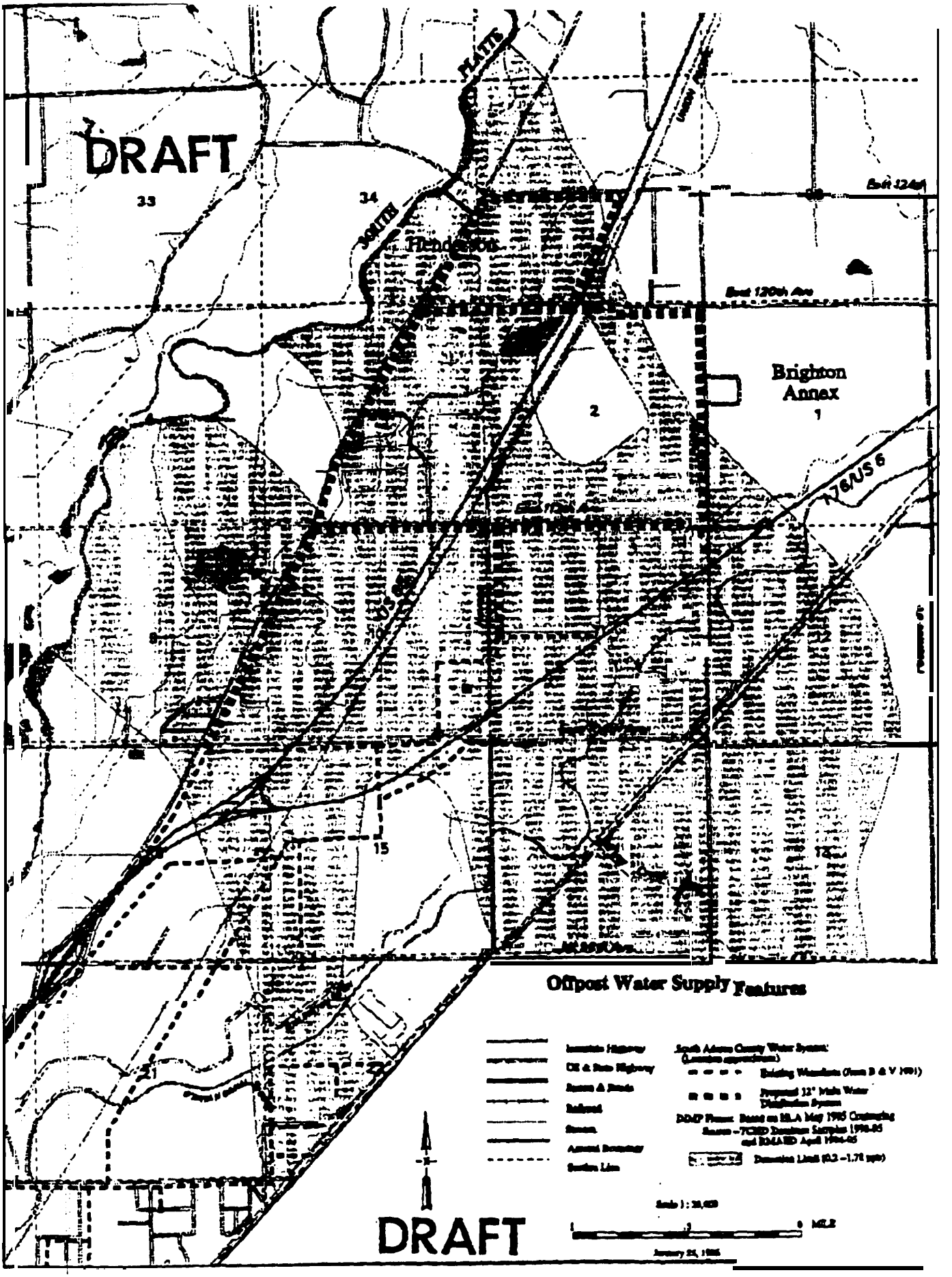
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Offpost Water Supply Features
DRAFT

TOTAL P. 02

rec'd 18 Jan '96

JOAN JOHNSON
State Senator
7951 York #3
Denver, Colorado 80229
Capitol: 866-4865
Home: 288-9237

Senate Chamber
State of Colorado
Denver

COMMITTEES:
Member of:
Agriculture, Natural Resources and Energy
Appropriations
Capital Development
State, Veterans and Military Affairs

January 17, 1995

On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn: AMCPM-PM/
Col. Bishop
Building 111-RMA
Commerce City, CO 80022-1748

Dear Col. Bishop:

The proposed draft Record of Decision for clean-up activities at the Rocky Mountain Arsenal proposes on site disposal of non-hazardous waste, without the normal facility construction requirements, such as liners, etc., for such waste disposal. Additionally, the Record of Decision fails to specifically include a commitment to follow the normal process required for the siting of a non-hazardous waste landfill facility.

While it is understandable that off site disposal of hazardous waste material is probably not feasible for political, cost and practical reasons, why would any non-hazardous waste material be left on site without fully complying with all normal landfill design and construction requirements? As there are reasonable off site alternatives, this material should be disposed off site, if possible.

If non-hazardous waste material is to be disposed of on site, then it should either be placed in the hazardous waste landfill facility that will be constructed on site, or in a separate non-hazardous waste on site facility permitted in accordance with the Solid Waste Act requirements of the State of Colorado.

The requirements of such an on site non-hazardous waste facility should not be less than would be required for all other facilities in Colorado. This includes the required public notice, hearings, etc., by Adams County, the affected local government.

At a minimum, the Record of Decision should include the commitment to study the relative comparative costs and benefits of on site versus off site disposal. This study should include allowing the public to fully participate in the making of the on site versus off site decision and should be completed prior to any decision being made in this area.

Thank you for your consideration.

Sincerely,

Joan M. Johnson

Joan M. Johnson
State Senator

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

The Honorable Joan Johnson
State Senator
7951 York #3
Denver, Colorado 80229

Dear Senator Johnson:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is a important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

Your letter proposes either offsite disposal of nonhazardous materials or construction of an on-site, nonhazardous waste facility in compliance with the Resource Conservation and Recovery Act The Army understands your concern that this material be disposal properly and believes that the approach of placing the material under the Basin A cover will adequately immobilize any contaminants and provide a cost-effective method for disposal of nonhazardous materials In addition, a large volume of fill material will be required to construct the Basin A Consolidation Area, and the RMA nonhazardous material will satisfy that need. Furthermore, by using this nonhazardous material onsite, there will be no negative impact from a very large number of trucks moving through the surrounding community Cost for fill material is also minimized Therefore, the Army chose to keep the nonhazardous material onsite to be used as fill material for the Basin A Consolidation Area

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248. Thank you again for your comments

Sincerely,

Eugene H Bishop
Colonel, U S Army
Program Manager

Readiness is our Profession

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

MetroNorth
Chamber of Commerce
11990 N. Grant Street, Ste. 218
Denver, Colorado 80233-1122
(303) 450-0335
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Susan Sgrignoli
Northglenn Mall Merchants Assoc.

Mark Walker
Community First National Bank

Skeeter Wilson
RE/MAX Northwest, Inc.

Received by
BL
29 Nov 95

ROCKY MOUNTAIN ARSENAL WATER SUPPLY RESOLUTION

BE IT RESOLVED that the Board of Directors of the MetroNorth Chamber of Commerce hereby supports the efforts of the Northern Community Coalition, the South Adams County Water and Sanitation District and the community of Henderson, Colorado, in their efforts to secure adequate water supplies.

The water supplies should not be limited to the 4,000 acre feet identified in the Conceptual Agreement for cleanup of the Rocky Mountain Arsenal. Rather, the supplies should be of high quality, and adequate quantity to address the contamination problems of both the South Adams County Water and Sanitation District and the affected community of Henderson.

The parties and affected communities should agree upon an acceptable amount of water. That agreement should not be delayed but should be resolved and included in the final decision on the Arsenal cleanup.

PASSED and adopted this 22nd day of November, 1995.

Signed Diane J. Schmidt
Diane J. Schmidt, Chair of the Board

9533301

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Ms. Diane J. Schmidt
MetroNorth Chamber of Commerce
11990 N. Grant St., Suite 218
Denver, Colorado 80233-1122

Dear Ms. Schmidt:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan. Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

The Army believes that an adequate amount of high-quality water will be provided to the affected communities The Army and Shell Oil Company have reached an Agreement in Principle, enclosed with this letter, with the South Adams County Water and Sanitation District (SACWSD) that includes payment of $48.8 million to SACWSD and requires SACWSD to supply water to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999 In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004 The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs If you have any further questions regarding the water supply, please contact Mr Tim Kilgannon of this office at 303-289-0259 or Mr Larry Ford of SACWSD at 303-288-2646

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248. Thank you again for your comments

Sincerely,

Eugene H. Bishop
Colonel, U S Army
Program Manager

Enclosure

Readiness is our Profession

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr Robert Foster, U.S. Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFO RMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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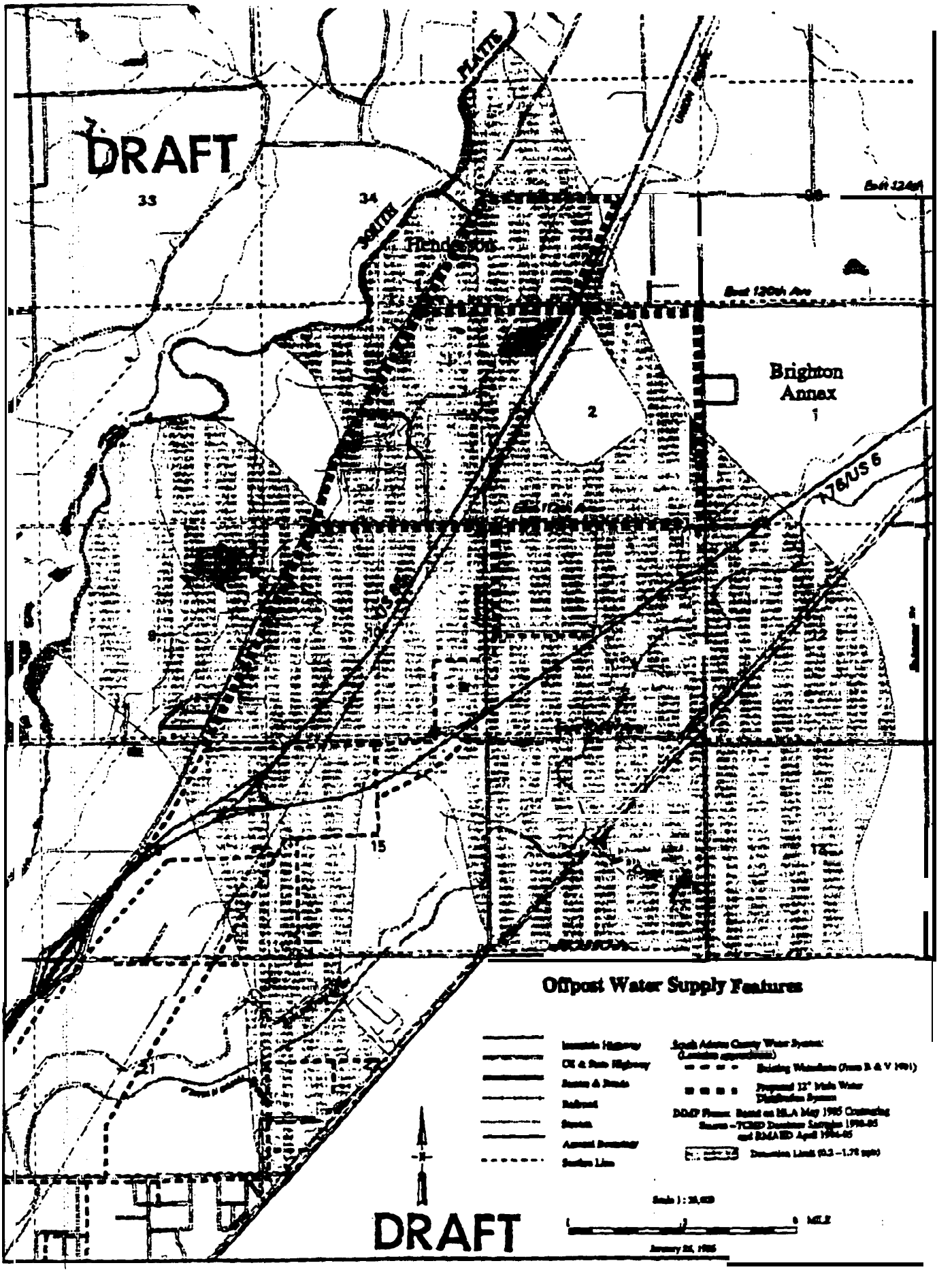
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Offpost Water Supply Features
DRAFT

TOTAL P. 02

rec'd 22

Dan Mulqueen
1422 S. York
Denver CO 80210

January 18, 1996

Proposed Plan Comments
Program Manager for Rocky Mountain Arsenal
Attn: Col. Bishop
Building 111-Rma
Commerce City, CO 80022-2180

Col. Bishop,

Thank you for the opportunity to comment on the Onsite Plan. The amount of time allowed for Public Comment is not adequate to fully express my concerns and questions regarding the Plan as presented, but due to the Army's reluctance to further extend this period, my comments are submitted on this date.

In the interest of conservation and economy, I request that all of your documents be printed on both sides. Recently, the Army distributed the Off-Post ROD in this format, but the majority of information for public review remains one sided and is bulky and wasteful.

I object to the preeminent role of Shell Oil Company in the decision making at the Arsenal. Shell's reputation and continuing world wide activities are well documented, and Army deference to Shell and their position are an embarrassment. The Federal Facilities Agreement was the appropriate venue to protect the taxpayer, when financial liabilities were established, not at the point of clean-up. I object that in many instances this FFA is relied upon to excuse compliance with NCP, CERCLA, and other laws in which the citizens seek protection,

The influence of this 20% payer on issues such as the cost of innovative treatment on a minute area (Hex Pits) has apparently caused the Army to back off on your pledge to the citizens as part of the Agreement on the Conceptual Remedy. I would also like an explanation for why Shell has not signed the Off-Post ROD. I object to the fact that citizens concerned for their communities and the environmental legacy passed to the children, must so often struggle against Shell, their contractors, lobbyists and lawyers, to have our voices heard at the Army's table.

I object to the adherence to the Agreement on the Conceptual Remedy as a Pre-selection of Remedy, proscribed by Congress in 42 USC 9617. As a participant Stakeholder in the SAPC negotiations, I do not believe citizen concerns were included in the Agreement except peripherally, and that the Parties signatory may not make every effort to enforce the components of greatest concern to the citizens, specifically: components 10 D, 17, 18 [Water must be provided, not simply a piping system], 19, 24[to include Dioxins and Furans], 25 [NDMA detection levels are too high, (reporting levels must be below human health exceedence and are known to be commercialy available from Southwest in San Antonio, Texas)] , 27[include Dioxins and Furans especially in the USFWS biomonitoring programs and SFS/risk assessment process], and 28[to add DIMP].

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Citizen concerns expressed prior to but not addressed in this Agreement include: Dioxin and Furan sampling, preference for on-site treatment and applications of innovative and leading edge technologies, the cessation of public tours promoting the Refuge until remediation is complete, in-situ treatment of the South Plans Tank Farm Plume, and an emergency plan for the nearby communities more comprehensive than reliance on the "buffer" zone. Have these concern been documented and where? Will these concerns as presented in the SAPC process be addressed and how?

The Agreement is incomplete in that it does not contain a Inter-Agency Agreement with the State of Colorado. If this Document is to follow, the citizens would request notification as well as the opportunityto provide their concerns and comments during the formation of such an agreement. We understand that this is a vital tool for keeping the project on track as well as maintaining accountabilityand generating public trust.

While all citizens support the provision of replacement water to residents affected by Arsenal contamination, I strongly object to the fact that citizen demands for treatment of wastes has been traded for this water. I refer specifically to statements contained in the transcript of the Public Meeting, Nov. 18, 1995, by Larry Ford and others, that less clean-up was accepted in exchange for an immediate source of pristine water. Based on this, if the replacement water is not acceptable to the community does the decision on remediation become reopened? These issues should be addressed in terms of Federal policies and guidances pertaining to Environmental Justice, and Certification of Adherence to these principals should be provided by each Federal Party.

I object to the use of the State CAMU authorization to sidestep RCRA Land Disposal Restrictions. We know that the EPA is now in the process of ending that Regulation effective early in 1997, and that the state CAMU will be less stringent and thus inappropriate then. To the public this seems to be the single driving force behind the insistence to sign the ROD during the summer of this year.

I object to the designation of the entire contaminated area of the Arsenal as a single AOC for purposes of application of LDRs. It is a stretch of the imagination that the area described is "contiguous " or "discreet", when there is endless variety in contaminants, their sources, and large areas of non- contaminated soil between them. Your designation ignores EPA guidance contained in the Superfund LDR Guide 5, as well as OSWER Directive 9347.3-08FS, which states that landfill siting must be protective of groundwater. The Basin A area, in which you plan to heap principal threat wastes, has a depth to groundwater of 0 feet in places.

While the De-Watering scheme may work here, it is speculative and requires a contingency plan to be included due to the unproven nature of this action as a permanent remedy. A contingency plan must also be developed in regards to the Hydraulic Containment of the South Plant Plumes [keeping the lakes full]. This proposal is unproved and speculative and should not go forward as a stand alone permanent remedy alternative to treatment. In this case both extraction and bioremidiation have been proposed in past plans for the South Plant Plumes, and been determined feasible. The ROD should contain these contingencies.

Is it the Army's intent to use the CAMU and/or AOC designations to avoid sampling and characterization of wastes prior to moving soils and structures? If this is the case, conflicts seem to occur with Worker Safety ARARS {29 CFR 1910. 120[b] to [j], and others}, as well as with Land Use/Deed Restrictions(40 CFR 264.119 and 6CCR 1007-3, section 264.119} which requires exactly these types of characterizations. Although we may have traded off treatment of wastes at the Arsenal, it was never intended that sampling would not occur, It was our understanding that this sampling would be complete and comprehensive, including quantification and characterization of all detected compounds and elements ,whether on the COC list, or not. This action is very important to the future generations who will assume the burden we will have left buried, as clearly stated in the Principals for Environmental Cleanup of Federal Facilities [EPA].

The Structures Volume VI Report shows that not all buildings have been sampled and that often sampling was not complete for all contaminates. This report does not depict the levels of specific contaminates found, sampled for, methods, or detection levels. This makes the information incomplete and mostly unusable as the basis for comment.

The selection of sites and tests appears haphazard, for example, administration and infirmary areas were sampled relatively extensively while some process areas, warehouses and loading areas show no sampling whatsoever. Please explain this and the fact that the structures inventory does not agree at all times with the structures figures and maps provided in this volume. For example, structure 311, does not appear on maps. Further this building served as a storage area for Shell and has been rumored to have held "secret" projects and drums of 2.4.D. The sampling of this structure revealed contamination which lends credence to these stories, but there seems to be no follow through.

Again sampling and screening must be for <u>all analytes</u> not just for those targeted, because of the gaps in the historical record and the high likelihood of the existence of previously unknown and/or unexpected contaminants. Complete sampling should enhance the design parameters, thus increase confidence in the permanence of the remedy.

All no-action sites which were characterized using detection limits higher than action level need to be re-characterized using appropriatdetection limits before these sites or buildings are excluded from clean up. This is particularly in regard to: Dioxins and Furans, NDMA, Dieldren[.002ppb] and elemental and agent compounds. Given the history of Clorine Plant wastes introduced into First Creek, via the Sand Creek Lateral, and it being widely accepted that this activity spawn Dioxins when graphite electrodes are used, soils and sediments associated with SCL and First Creek must be sampled for these compounds and appropriate remediation instituted.

Over the past several years many citizens have requested information about ,and sampling for, Dioxins and Furans on the Arsenal. These requests have been rebuffed until this summer when the State agreed to send some archival soil and animal tissues for testing. The results are positive and confirm citizen concern regarding the presence of these dangerous chemicals on the Arsenal. A separate Operable Unit must be performed to include these and other missed or inadequately characterized contaminants.

I object to the use of Land Use Restriction to close pathways of exposure on the Arsenal. This is contrary to mandate in the NCP which states that institutional controls shall not substitute for active response measures as the sole remedy, unless such active measures are determined to be not practicable. Under the Plan , unlined Basin A will receive additional quantities of principal threat and the ground water impacted is considered for some pump and treat , but pathway abatement is accomplished with a prohibition on the use of this water for potable uses. This will not [illegible] exposure by inhalation of vapors, or biota exposure from [illegible]

Also the NCP [illegible] the use of 10-6 as the point of departure [illegible] EPA guidance has [illegible] this requirement based on land uses as a wildlife refuge. The point of departure now is functionally 10-4. If this questionable interpretation is challenged or overturned subsequently[as the CAMU regulation is being now] the entire arsenal will have to be remidiated.

The danger of miserly characterization and discounting generally held standards is that in time the ultimate costs will far outweigh the short term savings. Levels of remediation are lessened due to the Refuge designation, If cleanup is not adequate to support wildlife at very low cost, the Refuge fails and that land use becomes defunct. Under the law, non-productive Refuges may be transferred for development, and development pressure for this area is certainly going to be great. At that point a future generation will grapple with the decision to complete the cleanup or to assume the risks. The polluter's only hedge in this scenario is to hope for the highest degree of natural a ttenuation. This is an unacceptable position for the Army given the public trust and your announced commitment to "Cleanup" the Rocky Mountain Arsenal. Further there will be little attenuation of elemental contaminants such as mercury, arsenic, or asbestos, and any degradation of the significant quantity of organics will be at least matched by the recombination into other dangerous and exotic compounds.

I object to the Army's failure to include the following Colorado Laws as ARARS: The State Wildlife Act, C.R.S.33-1-101 to 33-1-121; Wildlife Enforcement and Penalties Provisions, C.R.S. 33-6-101 to 33-6-130; and Wildlife Commission Regulations, 2 CCR 406-0 & 406-8. Because some Army decisions and actions may result in the killing or wounding of Colorado game and non-game animals, the Army should be accountable and adhere to the laws and penalties of the State willingly.

I finally must object to the plan for three areas which bring the magnitude of the problems into brutal focus. These are; The Shell Trenches, The Complex Trenches, and The Central Processing Unit. All three areas contain extremely dangerous contamination that may or may not be fully characterized, and which will remain in place and untreated forever, under this plan. Even assuming there will be no further spread into the environment and no exposure results, it is very discouraging that this is the best solution we might achieve here. I would hope that the Army and other parties will reflect on the explanation to be offered to future generations as to why this was the very best we could do here. I know that no justification for this legacy has been presented for future generations but I feel strongly that this should be clearly and prominently presented within the Final ROD.

Sincerely,

Don Mulquen

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. Daniel Mulqueen
1422 S. York
Denver, Colorado 80210

Dear Mr. Mulqueen:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the Army and the public.

Responses to your specific comments are provided in the enclosure

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248. Thank you again for your comments

Sincerely,

Eugene H. Bishop
Colonel, U S Army
Program Manager

Enclosures

Copies Furnished

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City. Colorado 80022-1748
Mr Robert Foster, U.S. Department of Justice, 999- 18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

Readiness is our Profession

RESPONSES TO COMMENTS BY MR. DANIEL MULQUEEN ON THE ROCKY MOUNTAIN ARSENAL ON-POST PROPOSED PLAN

For ease of comparing this response to your letter, the following responses reference the applicable page and paragraph number of your letter.

Page 1, first paragraph: The Army extended the public comment period by 30 days in an attempt to balance the concerns of those who wanted more time to comment and those who wanted no more delays to the Record of Decision (ROD).

Page 1, second paragraph: As you noted with the two-sided page format of the Off-Post ROD, the Army is also interested in conservation and economy and will publish the On-Post ROD in the same format.

Page 1, third paragraph: Shell Oil Company's (Shell) role in the RMA remediation, technically and financially, has been determined through the Army/Shell Settlement Agreement as well as the RMA Federal Facility Agreement (FFA), which are both binding legal agreements and which are both consistent with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Shell has consistently supported the remediation process in many ways. They have participated in many innovative studies (e.g., thermal desorption, enhanced soil vapor extraction, air sparging) and have been instrumental in providing data that would support or dismiss a particular remediation technology The Army believes that Shell's technical expertise has been a valuable asset to the On-Post Remedial Investigation/Feasibility Study (RI/FS) process.

Page 1, fourth paragraph, first sentence The Army is committed to the remedy outlined in the Agreement for a Conceptual Remedy for the Cleanup of the Rocky Mountain Arsenal (Conceptual Agreement) Subject to the results of treatability testing and technology evaluation, the Parties have agreed that 1,000 bank cubic yards (BCY) of principal threat material from the Hex Pit will be treated by an innovative thermal technology The remaining 2,300 BCY of principal threat material will be excavated and disposed in the on-post hazardous waste landfill Solidification will become the selected remedy if evaluation criteria for the innovative thermal technology are not met.

Page 1, fourth paragraph, second sentence Shell has not signed the Off-Post ROD for two reasons First, the Army is the lead agency and has the responsibility to carry out the remedy agreed upon in the ROD. It is not necessary for Shell to sign the ROD as a responsible party to the remediation Second, Shell is bound by the Army/ Shell Settlement Agreement and the FFA, as described above, and those legal documents provide the requirements Shell must meet.

Page 1, last paragraph: The Army is interested in public comments and concerns and has made substantial effort to hear those concerns through the Restoration Advisory Board, the Site-

Specific Advisory Board, and stakeholder meetings, and also through avenues of public comment such as the comments on the On-Post Proposed Plan. The Army has conducted more than 20 open houses and public meetings to enable those interested to voice their concerns. The public expressed concerns about many innovative technologies during the public process. Many participants preferred proven technologies and minimal disturbance of the site; however, some participants indicated preference for innovative technologies.

In response to your comment about an alternative water supply, the Army and Shell have reached an Agreement in Principle, enclosed with these responses, with South Adams County Water and Sanitation District (SACWSD) that requires that SACWSD supply water to consenting drinking water well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004. The Army hopes that the community will work with SACWSD in obtaining an acceptable water supply. The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs If you have any further questions regarding the water supply, please contact Mr Tim Kilgannon of this office at 303-289-0259 or Mr Larry Ford of SACWSD at 303-288-2646.

N-nitrosodimethy lamine (NDMA) studies are underway, and lowering the analytical detection limit is required by the Conceptual Agreement, which was signed June 13, 1995. The Army continues to work with its laboratory on the NDMA issue. Dioxin and furan sampling was undertaken by the Colorado Department of Public Health and Environment (CDPHE), and these results are currently being evaluated by the Biological Advisory Subcommittee (BAS).

Page 2, first paragraph: Please see the response to **Page 1, last paragraph** regarding dioxin and furan sampling Public concerns were definitely considered in the development of alternatives The concerns about the short-term impacts of excavation and treatment were evaluated against the potential long-term effects of containing the waste in place There also was significant public concern about thermal processes such as incineration because of potential emissions The Army believes the most protective remedy is one that minimizes the short-term risks of exposure to workers and the community because soil-borne contaminants are left in place and not excavated and exposed to the environment

RMA tours will continue during the cleanup process, but will not be conducted in affected areas The safety of visitors will be ensured through limited access and monitoring.

The Army assumes your comment regarding in situ treatment of the South Tank Farm Plume is a request for treatment. There is no evidence of significant migration of the South Tank Farm Plume beyond its plume boundaries Migration of contaminants in this area is extremely slow due to the hydrogeological conditions, and contaminants appear to be attenuated by natural processes including biodegradation, at the edge of the plume Samples from the deeper aquifer show no evidence of contamination. Plume movement will be reduced further by covering the South Plant's

area, which will result in lowering of the water table and reducing hydraulic gradients. Continued plume monitoring will provide design refinement/design characterization support for the final remedy

An emergency plan is typically part of the post-ROD remedial activities. The Parties and the public will be kept informed of contingency plans as they are written.

Page 2, second paragraph: The Army believes the public comment process for the On-Post Proposed Plan is a useful tool that can help shape and define the details of the Conceptual Agreement. As you may recall, prior to signing the Conceptual Agreement, the Parties were at a standstill and heading toward litigation over the major differences seen as a basis for remediation of RMA. The Conceptual Agreement, with the help of the Colorado Lieutenant Governor and an experienced mediator, helped the Parties reach an agreement based on compromise without affecting the protectiveness of the selected remedy. An interagency agreement was not necessary because the state was a signatory to the Conceptual Agreement.

The Army also believes that the public has provided valuable input to the selection of a remedy for RMA. As you are aware, the Conceptual Agreement does not contain specifics about the remediation that will soon begin. The Parties are working hard to resolve the many questions that remain, and the public has an important role in that process. In addition, the Army has included more public participation in the selection process than what is required under CERCLA by encouraging everyone to participate in the review and selection process during the past years. Many public comments were reviewed and considered during the process. While no one will agree on every aspect of the Conceptual Agreement, the Army believes that, with the help of the Parties and the public, the remedy will be fully protective of human health and the environment

Page 2, third paragraph: The Army believes the supplemental water supply will be an extra layer of protection to people north of RMA in the unlikely event that all the caps, liners, and multiple groundwater treatment systems were to fail. In addition, many citizens were opposed to the treatment technologies that were proven to treat the multi-faceted wastes in some areas on RMA The Army believes the selected remedy is fully protective of human health and the environment. The Army believes the selected remedy, including the provision of a water source, is consistent with the policies and guidelines pertaining to environmental justice.

Page 2, fourth paragraph U.S Environmental Protection Agency (EPA) goal in establishing the Corrective Action Management Unit (CAMU) Rule, which was adopted by the State of Colorado in the Colorado Hazardous Waste Management Act (CHWMA), was to "provide remedial decision makers with an added measure of flexibility in order to expedite and improve remedial decisions" while "existing closure regulations and requirements for [Resource Conservation and Recovery Act] RCRA-regulated units, which require closure to occur in a manner that is protective of human health and the environment, remain in effect. " Purpose and Context of the CAMU Rule, 58 Fed. Reg. 8659 (1993) (to be codified at 40 C F.R. Parts 260, 264, 265, 268, 270, and 271). The onsite landfill that is central to the CAMU will meet applicable CHWMA

landfill siting, construction, monitoring and closure requirements. The area of contamination (AOC) is a CERCLA concept that is used to determine whether RCRA land disposal restrictions (LDR) are applicable to a CERCLA response action.

Page 2, fifth paragraph: The extent of the AOC at RMA was based on the boundary of the area within which EPA estimated there might be some risk to biota, primarily due to the presence of dieldrin in surface soils in a contiguous area. The on-post hazardous waste landfill was sited according to CHWMA criteria, as described in the CAMU Designation Document and its appendices. Basin A will not receive soil defined as principal threat soil or human health exceedance soil; it will only receive soil with contaminant levels below human health criteria and structural demolition debris to be used as fill.

Page 2, last paragraph: The Army assumes that your comment about dewatering refers to the passive dewatering of the South Plants Central Processing Area and Basin A after soil covers are constructed at those locations. Groundwater monitoring will continue in order to evaluate the effectiveness of the selected remedy, including the capping and passive dewatering. Studies are currently ongoing to address potential needs for additional action in the lakes area. It should be noted that contaminants in the two areas are different. Please see also the response to your comment on **Page 2, first paragraph**.

Page 3, first paragraph: The soil, water, structures, air, and biota have been extensively sampled at RMA during the course of the RI/FS and have been sufficiently characterized to implement the selected remedy. Additional contingency sampling is part of the selected remedy and will be used if needed.

Page 3, second and third paragraphs Representative structures were selected for sampling and analysis to represent the worst case conditions. Section 2.4 of the Structures Volume of the Detailed Analysis of Alternatives (DAA) provides a summary of structure material sampling and references other documents for further detail. Historical data on structure use is sufficient to classify individual structures according to past use and potential future use. Analytical results from structure material sampling indicate low concentrations of contaminants and support the conclusion that structure contamination does not pose a hazard to human health or the environment. Major and minor structures are represented on the DAA plates, including Building 311, which appears on Plate 1.2-1 in Section 2 of the South Plants insert. Building 311 began service as a cafeteria, and was later used for storage of soil cores. Samples taken in and around the structure do not indicate the presence of significant levels of contamination. The preferred alternative for this structure is demolition and disposal in the Basin A Consolidation Area.

Page 3, fourth through sixth paragraphs: The current list of structures analytes is derived from the Remedial Investigation/Feasibility Study (RI/FS), which included a much longer list of analytes. The fact that detection limits change during a program as extensive as RMA's is unavoidable. The Army recognizes that some of the risk-based remediation goals are below analytical detection limits. This fact is not unique to RMA, and that is why the term Practical

Quantitation Limit (PQL) has been established. A PQL is used as the remediation goal until the risk-based standard can be achieved by a laboratory. As stated in the response to your comment at **Page 1, last paragraph**, programs are ongoing to evaluate NDMA, dioxin, and furan at RMA In the event other contaminants not included as contaminants of concern are identified as a concern (e. g., dioxin) during or after design or implementation, an evaluation will be conducted as required by CERCLA guidance (OSWER Directive 9355.3-02) to ensure that the remedial action is protective of human health and the environment. At a minimum, evaluations will be part of the 5-year site review. There is no scientific support for your claim that dioxins were generated by the processes at the Chlorine Plant and subsequently introduced into the Sand Creek Lateral and First Creek.

Page 4, first paragraph: Institutional controls will not be used as a sole remedy at RMA. The use of institutional controls, such as deed restrictions and land use restrictions to supplement engineering controls for long-term management, is consistent with the NCP, the FFA, and the RMA National Wildlife Refuge Act of 1992. As stated in the response to your comment on **Page 2, fifth paragraph**, Basin A will not receive soil or structural material for fill that exceeds principal threat or human health exceedance criteria. The Basin A cover will reduce infiltration and naturally lower the water table, thereby reducing contaminant leaching from the area.

Consumption of groundwater or surface water on-post will be restricted by institutional controls in accordance with the FFA. The Integrated Endangerment Assessment/Risk Characterization (IEA/RC) considered both human inhalation of vapors and biota exposure from use of nonpotable water To assess vapor inhalation, groundwater was considered as a potential source (in addition to soil) because it may have contributed to the concentration of vapors in the soil column. The ecological risk characterization assessed risk to biota from exposure to surface water from the lakes (exposure to groundwater is not anticipated).

Page 4, second paragraph: Following EPA guidance, 10^{-4} is the action criterion below which media do not generally need to be treated at any site, regardless of future use. Once treatment was required due to risk, 10^{-6} was used as the point of departure for evaluating the effectiveness of the treatment technologies The Army believes the selected remedy will be protective of human health and the environment; this protectiveness includes the wildlife residing or foraging at the Refuge

Page 4, third paragraph Please see the response to your comment at **Page 4, second paragraph,** regarding protection of wildlife Regarding mercury, arsenic, and asbestos, all three were considered in the DAA and in the IEA/RC All human health and biota exposures to mercury and arsenic are addressed through landfilling or containment. Asbestos abatement is ongoing

Page 4, fourth paragraph: The Parties disagree on whether the substantive portions of the Colorado Wildlife Enforcement and Penalties Provisions (C.R. S. 33-1-101 et seq. And C.R. S 33-6-101 et seq.) and Wildlife Commission Regulations (2 CCR 406-8) are applicable or relevant

and appropriate requirements (ARARs). The U.S. Fish and Wildlife Service in cooperation with the Colorado Department of Natural Resources has agreed to advise the Army, as the lead agency, with respect to the substance of state wildlife laws and regulations, to ensure that, where indicated, such state laws and regulations are taken into account in connection with the implementation of the selected remedy to the extent they are not inconsistent with federal laws and regulations. The Parties each reserve all rights with respect to their respective legal and jurisdictional arguments relating to whether the above-cited state laws and regulations relative to wildlife should be treated ARARs. The On-Post Location-specific ARARs include the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd et. seq.) that prohibits the taking or possessing of any animal or nest or egg within a National Wildlife Refuge, as well as the use of a Refuge for that purpose, except by people authorized to manage the site or unless the activities are allowed at the site. While not considered to be ARARs, the provisions of the Endangered Species Act, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act apply to RMA. As additional protection, Section 44.2(b) of the FFA specifically prohibits the use of RMA groundwater or surface water for potable use, and Section 44.2(c) specifically prohibits consumption of all fish and game taken at RMA. The RMA National Wildlife Refuge Act of 1992 also contains these restrictions. FFA Section 44.4 gives the United States the additional authority to impose and enforce additional restrictions as necessary for the protection of human health and the environment.

Page 4, last paragraph The Army believes that the Complex Trenches, Shell Trenches, and the South Plants Central Processing Area have been adequately characterized in the RI. The areas do have high levels of contamination, and the Army considered this fact in selecting the appropriate remedy for those areas. The Army believes that the selected remedy will be protective of humans and the environment

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

version 10 - 26/01/96

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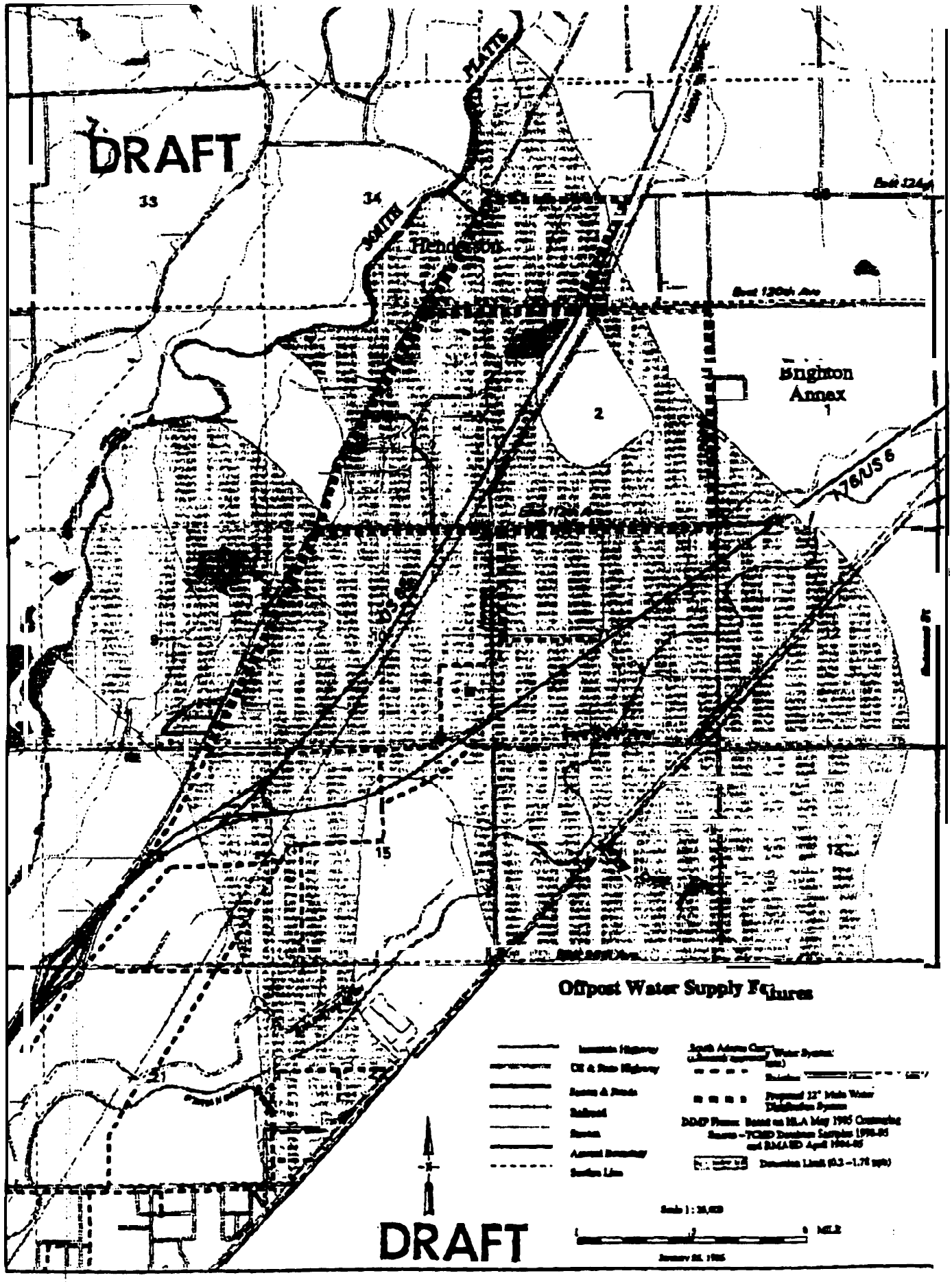
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Offpost Water Supply Features
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TOTAL P. 02

State Representative
ALICE NICHOL
891 East 71st Avenue
Denver, Colorado 80229
Home: (303) 287-7742
Capitol: (303) 866-2931

COLORADO
HOUSE OF REPRESENTATIVES
STATE CAPITOL
DENVER
80203

rec'd 18 Jan 96

Member:
Local Government Committee
Transportation and Energy Committee

January 15, 1996

On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn: AMCPM-PM
Col. Eugene Bishop
Building 111-RMA
Commerce City, CO 80022-1748

Dear Col. Bishop:

The Proposed Plan and Conceptual Agreement on clean-up activities appears to envision disposing of most, if not all, of the non-hazardous waste on the Rocky Mountain Arsenal without the normal landfill liner requirements for such waste disposal. If non-hazardous waste material is to be disposed of on site, then the appropriate approval process, as well as siting and design standards as would be required of any private company for a non-hazardous landfill facility, should be followed. The same rules that would apply to any private company in landfill siting and construction, should also apply to the Army.

In fact, it is preferable that the Army dispose of all non-hazardous waste material from the Rocky Mountain Arsenal in a properly permitted, designed, and constructed off-site non-hazardous waste landfill. The amount of waste material left on site of the Rocky Mountain Arsenal after clean up activities are completed should be minimized. especially if it can be shown that an off site landfill alternative is more cost efficient than siting, permitting, constructing, and operating an on-site properly designed and constructed non-hazardous landfill. Given the tremendous overhead expenses that would be associated with any on site facility, it is hard to see how any off site facility wouldn't be more cost effective.

In summary, on site disposal of non-hazardous waste from clean-up activities at the Rocky Mountain Arsenal should only be allowed if it is cost effective, and if shown to be cost affective, only if the disposal facility on site is properly sited, permitted, designed and constructed in accordance with all applicable laws and other requirements. The alternative of utilizing of an off site non-hazardous waste landfill should be seriously considered, and at the very least, the

proposed Record of Decision should incorporate a commitment to perform a study of comparative costs and benefits of on site versus off site disposal alternatives, before any final decision is made in this regard.

Sincerely,

Alice Nichol

Alice Nichol
State Representative

AN/jw

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF:
Office of the Program Manager

The Honorable Alice Nichol
State Representative
891 E. 71st Avenue
Denver, Colorado 80229

Dear Representative Nichol:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

Your letter proposes either off-site disposal of nonhazardous materials or construction of an onsite, nonhazardous waste facility in compliance with the Resource Conservation and Recovery Act The Army understands your concern that this material be disposed properly and believes that the approach of placing the material under the Basin A cover will adequately immobilize any contaminants and provide a cost-effective method for disposal of nonhazardous materials In addition, a large volume of fill material will be required to construct the Basin A Consolidation Area, and the RMA nonhazardous material will satisfy that need Furthermore, by consolidating nonhazardous material onsite, there will be no negative impact from a large number of trucks moving through the surrounding community Cost for fill material is also minimized Therefore, the Army chose to keep the nonhazardous material onsite to be used as fill material for the Basin A Consolidation Area

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr Brian Anderson of this office at 303-289-0248. Thank you again for your comments

Sincerely,

Eugene H. Bishop
Colonel, U S Army
Program Manager

Readiness is our Profession

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U. S Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

November 14, 1995

On Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Atten: AMCPM-PM
Col. Eugene H. Bishop
Building 111 - RMA
Commerce City, Colorado 80022-1748

Critique on PPRMA On Post Operable Unit

1. The PPRMA should be published in two distinct parts: Part A, Historical Record retained in the libraries as listed on page 4 (Park Hill Library also has the only final detailed analysis of Alternatives report on file as of this date) and Part 2, a portable record coordinated with the historical record.

Part 1 would be the official document which would eventually become the Record of Decision (ROD). Part 2 would be a series of base maps at 1:24000 scale which would be visual displays of the problems areas (soils, structures and water) coordinated with Part 1 in every decision. These maps would be portable for exhibit and discussion at all public or parties meetings.

2. It is strongly suggested that the discussion under Range of Developed Alternatives, Incorporation of the Conceptual Remedy on Pages 11 and 12 of the Plan and the summary on Page 17 should be carefully heeded by the parties.

3. The implementation of items 1 and 2 would suggest a joint meeting with the parties and other interested groups or persons to emphasis the need to arrive at the best public understanding of the plan.

4. With specific reference to a possible trust fund (see enclosed correspondence), a little research (by a naive layman) indicates some interesting facets of the financial aspects of the RMA cleanup. The trust fund would be supported by an original appropriation of 250 Million dollars held in escrow for 10 years at 6% producing $197,750 million. Two years hence the next

appropriation of $125 million would be made at 6% for 10 years et cetera. This sch at the end of 9 years would appear as follows:

Years	*Capital (appropriation)*	*Int. @ 6%/10/years*	*End of 10 year period*
1	*250,000,000*	*197,750,000*	*2006*
3	*125,000,000*	*98,875,000*	*2009*
5	*125,000,000*	*98,875,000*	*2011*
7	*125,000,000*	*98,875,000*	*2013*
9	*125,000,000*	*98,875,000*	*2015*
Capital	*750,000,000*	*593,250,000*	
Int. Through 2015	*593,250,000*		
Money Avail.	*1,343,250,000*	*at the end of 2015*	
Already spent	*750,000,000*		
	2,093,250,000		

Please notice that at the beginning of discussion under item 4 I mentioned escrow. The scheme would not be effective in the present fiscal year. The Army has been assured of its appropriations for this fiscal year. This situation would hopefully give a public private partnership an opportunity to bolster the trust fund with individual or corporate tax exempt donations. This would give the general public a direct chanc rehabilitate the environment we need to protect for our survival (and politicians). comment plan item 4.1-3.

The fiscal control of trust fund should be overseen by General Accounting Office as an independent unbiased government agency.

5. Will this opportunity affect the time schedule for the ROD adversely?

Sincerely,

Waldo G. Smith, P.E.
SSAB, RAB
Enclosures

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
INSTALLATIONS LOGISTICS AND ENVIRONMENT
110 ARMY PENTAGON
WASHINGTON DC 20310-0110

October 18, 1995

ITEM 4.1

Mr. Dennis Gallagher
Councilman, District One
Room 451, City and County Building
Denver, Colorado 80202

Dear Councilman Gallagher:

I would like to thank you and Mr. Smith for your letter of August 29, 1995, to President Clinton concerning the trust fund provision in the Agreement for A Conceptual Remedy for the Cleanup of Rocky Mountain Arsenal.

The Army is very proud of the Agreement reached on the cleanup of Rocky Mountain Arsenal and we appreciate your interest in the matter. As you know, the trust fund is one part of a multi-part agreement representing the cooperative efforts of many parties, public and private alike.

Pursuant to the Agreement, the Army will commit its good faith, best effort towards the establishment of the trust fund. As indicated in the Agreement, establishment of the fund will require special Congressional legislation and the Army is subject to certain restrictions with respect to legislative proposals. The Army is committed to fulfilling its responsibility under the Agreement in accordance with those restrictions.

Thank you again for the letter. Your enthusiasm for the trust fund and the cleanup agreement is appreciated. I welcome your continued participation in the process to clean up the Rocky Mountain Arsenal.

Sincerely,

Raymond J. Fatz
Acting Deputy Assistant Secretary of the Army
(Environment, Safety and Occupational Health)
OASA(I,L&E)

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Comments Plan
Item 4.2

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- The primary goals of the Medical Monitoring Plan are to monitor any off-post impact on human health due to the remediation and provide mechanisms for evaluation of health status on an individual and community basis, until such time as the soil remedy is completed.

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- The Parties commit to good faith best efforts to establish a trust fund for the operations and maintenance of the remedy, including habitat and surficial soils. The Parties recognize, however, that establishment of such a trust fund requires special legislation and there are restrictions on the actions federal agencies can take with respect to proposing legislation and supporting proposed legislation. The funding amount will be determined in the Final DAA and would be funded by the U.S. Army and Shell Oil Company.

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21. Criteria for Shutting Down Internal Containment Systems (ICS)

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August 25, 1995

CONCEPT PLAN
ITEM 43

North Denver Community Center
3627 W. 32nd Avenue
Denver, CO 8021 1

Honorable William Jefferson Clinton
President of the United States
Washington, D.C. 20500

Dear Mr. President:

The attached letter of August 4, 1995 is indeed encouraging. Just maybe, we are witnessing democracy in action.

With reference to change, the accommodation to an innovative trust fund for the RMA cleanup would assuredl y have interesting political repercussions. This action could serve as a demonstration of public private partnership all the way through government to the grass roots.

Specifically I visualize at least three important advantages of this concept:

1. The elimination or at least a reasonable reduction in the yearly political hassle over appropriations for this purpose.

2. The process should be designed in such a manner so as to accommodate to an eventual rollover into O and M for the ultimate project: National Wildlife Refuge.

3. The development of a public private concern for the environment necessary to our economic security.

Item 3 above suggests that a simple short understandable platform for politicians could be: "We stand for a public private partnership to sustain the national security, the national economy and the national environment with liberty, life and happiness for the good of the U. S. A." (Paraphrase of the Declaration of Independence).

Sincerely,

Dennis J Gallagher
Dennis J Galallagher
Councilman 1st District
Denver County

Wado G. Smith
Wado G. Smith
Aide to Councilman Gallagher

Enclosures

✓cc: Raymond J. Fatz, Acting Deputy Asst. Sec. Army

9532402-1/1-C

DENVER AND THE WEST

ITEM 5

Arsenal seeks water supply

By Renato Robey
Denver Post Staff Writer

AURORA — The Rocky Mountain Arsenal wants to take over Fitzsimons Army Medical Center's water rights when the post closes due to defense cuts.

The a rrangement won't cover drinking water for post residents or the hospital but would pertain to water from the High Line Canal that is now being used to irrigate about 50 a cres of farmland near Fitzsimons' East Colfax Avenue gate. The land is planted in a lfalfa.

Arsenal officials wants to use the water to help clean up contamination a t the site where Shell Oil Co. once manufactured pesticides a nd the U.S. Army made chemical weapons.

Arsenal officials have a sked the Army for its rights to 525 a cre feet of water. An a cre foot provides enough water to supply a family of four for a year, or more than 325,000 gallons.

Officials to bid on Fitzsimons' rights to help cleanup toxic land

Fitzsimons gets its drinking water from the Denver Water Board. Although the post is entirely within the boundaries of Aurora, when it opened in 1918 the city didn't have enough water to supply the post. As Fitzsimons is redeveloped for civilian use, the new users will rely on Aurora's municipal water supply.

The arsenal is one of three federal agencies interested in taking over parts of Fitzsimons. Federal agencies get priority when deciding what to do with surplus property.

The Air Force has asked the Army for about 125 a cres of land at the 577-acre post, including military housing and other buildings. The Department of Veterans Affairs has asked the Army for the main hospital and other related buildings. All three agencies have until the end of November to detail their plans for the site. Then the Army must decide who gets the site and the water rights.

The arsenal would use the water to replant some areas with prairie grasses a fter contaminated soil is dug up and removed.

There are also several lakes at the arsenal which need to be kept full as part of the cleanup efforts, and the Fitzsimons water would help do that. Maj. Garry Brewer, chief counsel for the arsenal, said it will need about 3,000 acre feet of water and doesn't have nearly that much.

The arsenal wouldn't have to pay for Fitzsimons' water rights, Brewer said. The a rsenal would simply take water from a different point in the canal than Fitzsimons does.

But farmer Raymond Hanson's a lfalfa fields would pay the price. Hanson has farmed the a rea for hay for his livestock for 15 years. The practice is common on military bases with vacant sections that can be farmed or grazed.

Hanson, an Aurora rancher, has been farming surplus military land for decades. He started farming at the former Lowry Air Force Base in 1973. Since that base has closed, and Fitzsimons is on the way out, his future is in question. Hanson also lost another 1,500-acre chunk of hay-producing land because of development around Denver International Airport.

"It's a big disappointment," said Hanson. "Living this close to the city, it's a way of life."

9532402-1/1-D

COMMENT PLAN
PR 4, 11, 12, 17

PROGRAM MANAGER
ROCKY MOUNTAIN ARSENAL

U.S. ARMY
MATERIEL COMMAND

—COMMITTED TO PROTECTION OF THE ENVIRONMENT—

Proposed Plan *for the* Rocky Mountain Arsenal On-Post Operable Unit

Citizen's Summary

What is the purpose of this report?

The purpose of this Proposed Plan is to identify the U.S. Department of the Army's (Army's) preferred **remedial alternatives**[1] for contaminated water, structures, and soil at Rocky Mountain Arsenal so that the public can participate in the alternative selection process. The Arsenal is located in southern Adams County, Colorado, north of Denver.

The Army is submitting this Proposed Plan to the public in recognition of the importance of public involvement in the environmental restoration of the Arsenal. Its submittal is consistent with Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)** and with the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**. Both CERCLA and the NCP require the investigation and remediation of contamination that poses a potential threat to human health and the environment. Documents that detail such investigations at the Arsenal are listed on pages 3 and 4.

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Mark Your Calendar: Opportunities for Public Involvement

Public Meeting
Saturday
November 18, 1995

Location
Rocky Mountain Arsenal
Building 111-A
Commerce City, CO 80022

Time
9:00 a.m.

Administrative Record Location
Rocky Mountain Arsenal
Building 135, Room 16
72nd Avenue and Quebec Street
Commerce City, CO 80022

Hours
Monday, Wednesday, and Friday
Noon to 4:30 p.m.
Tuesday and Thursday
5 p.m. to 9 p.m.
Saturday
10 a.m. to 4 p.m.

Telephone
Phone: (303) 289-0136
(800) 862-0754

Public Comment Period
October 16 through
December 15, 1995

Send Comments to
On-Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Attn.: AMCPM-PM/
Col. Eugene H. Bishop
Building 111—RMA
Commerce City, CO 80022-1748

[1] Items shown in bold print are included in the glossary on page 29.

9532402-1/1-E

complete than the others. In addition, most of the highly contaminated soil is excavated and moved, which involves a higher short-term risk to workers and the surrounding community.

Sitewide Alternative 4 is preferred because it is more effective in the long term than Sitewide Alternatives 1, 2, or 3 in reducing, through treatment, the toxicity and mobility of some of the most contaminated soil, and is more cost effective and implementable than Sitewide Alternative 5. In this instance, the short-term risks of excavation and transport are balanced by the long-term effectiveness and the moderate cost of the alternative. This results in an overall effectiveness that is greater than that of the other alternatives. In addition, this alternative remediates risks to wildlife in the central sections of the Arsenal. The Supplemental Field Study and USFWS biomonitoring program address potential risks to wildlife outside this area. The preferred soil alternative is highlighted on Table 10 (page 25) and shown on Figure 4 (page 27).

Summary

The preferred alternatives rank highest with respect to the criteria used to evaluate the alternatives and they are consistent with the NCP and the statutory requirements of CERCLA. In addition, the preferred alternatives are required to be reviewed every 5 years with regard to their protectiveness of human health and the environment and compliance with applicable regulations and continued on-post monitoring programs. Areas requiring long-term operation and maintenance (see page 11, Range of Developed Alternatives) consistent with the preferred alternatives are shown in Figure 5 (page 28). On the basis of the available information, the Army concludes that the preferred alternatives would (1) address the threats to human health and the environment by using a combination of treatment and containment as principal elements to permanently reduce the toxicity, mobility, and volume of contaminants in structures, soil, and groundwater; (2) comply with ARARs; and (3) be cost effective.

Monitoring!

Recd 18 Dec 95

December 14, 1995

Waldo G. Smith, P.E.
3627 W. 32nd Avenue
Denver, Colorado 80211

On Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal
Atten: AMCPM-PM
Col. Eugene H. Bishop
Building 111 - RMA
Commerce City, Colorado 80022- 1748

Critique on PPRMA On Post Operable Unit

1. The PPRMA should be published in two distinct parts: Part I, Historical Record retained in the libraries as listed on page 4 (Park Hill Library also has the only final detailed analysis of Alternatives report on file as of this date) and Part 2, a portable record coordinated with the historical record.

Part 1 would be the official document which would eventually become the Record of Decision (ROD). Part 2 would be a series of base maps at 1:24000 scale which would be visual displays of the problems areas (soils, structures and water) coordinated with Part 1 in every decision. These maps would be portable for exhibit and discussion at all public or parties meetings.

2. It is strongly suggested that the discussion under Range of Developed Alternatives, Incorporation of the Conceptual Remedy on Pages 11 and 12 of the Plan and the summary on Page 17 should be care fully heeded by the parties.

3. The implementation of items 1 and 2 would suggest a joint meeting with the parties and other interested groups or persons to emphasis the need to arrive at the best public understanding of the plan.

4. Discussion of a trust fund to support the financial funding for the RMA clean-up brings up complications which invite closer investigation by the Treasury Department and the General Accounting Office in cooperation with the parties and other groups. Frankly, there could develop a situation which demanded a new accounting system to accommodate to the trust fund as ordinarily conceived as well as the present pay as you go shaky appropriations

system.

Any scheme would not be effective in the present fiscal year. The Army has been given appropriations for fiscal year 1995-96 (so I understand) in this situation would hopefully give public private partnership an opportunity to develop a trust with corporate or individual tax exempt donations. To avoid conflicting methods of disbursement of funds, the appropriations would continue to support O & M operations within the RMA clean-up; the revenue generated by trust fund (interest only) would only meet unforseen contingencies which could stall the clean-up final completion in yr. 2008.

This accommodation to appropriations and trust fund should guarantee (provided political maneuvering is not condoned) that the O & M operations of the RMA clean-up will meet the deadline of 2008 A.D.

The fiscal control of the trust fund should be overseen by the GAO as an independent on bias government agency.

5. Does this opportunity (R2B 11/15/95 attached) affect the time schedule for ROD adversely?

Sincerely,

Waldo G. Smith, P.E.
SSAB, RAB
Enclosures

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
INSTALLATIONS LOGISTICS AND ENVIRONMENT
110 ARMY PENTAGON
WASHINGTON DC 20310-0110

October 18, 1995

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Comments Plan
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August 25, 1995

Comment Plan
ITEM 4.3

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3627 W. 32nd Avenue
Denver, CO 80211

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Washington, D.C. 20500

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Denver County

Waldo G. Smith
Aide to Councilman Gallagher

Enclosures

cc: Raymond J. Fatz, Acting Deputy Asst. Sec. Army

9532402-1/1-C

DENVER AND THE WEST

ITEM 5

Arsenal seeks water supply

Officials to bid on Fitzsimons' rights to help cleanup toxic land

By Renate Robey
Denver Post Staff Writer

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9532402-1/1-D

GENERAL ACCOUNTING OFFICE

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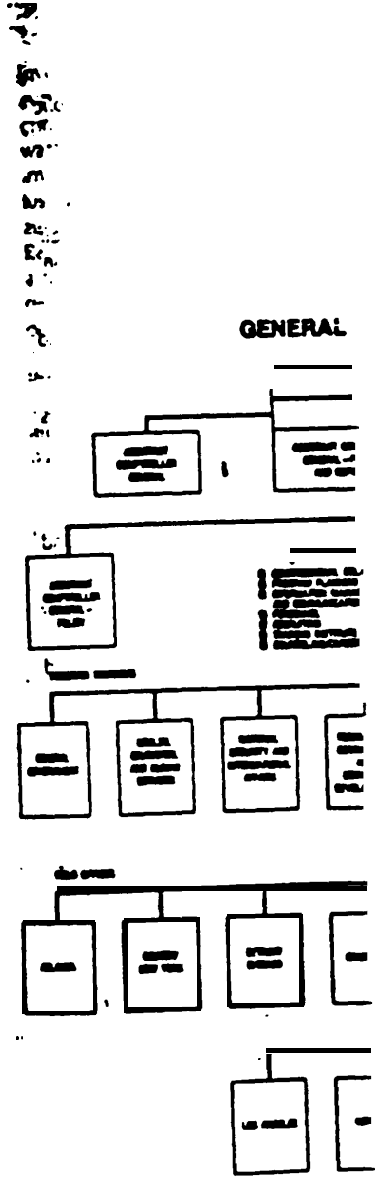

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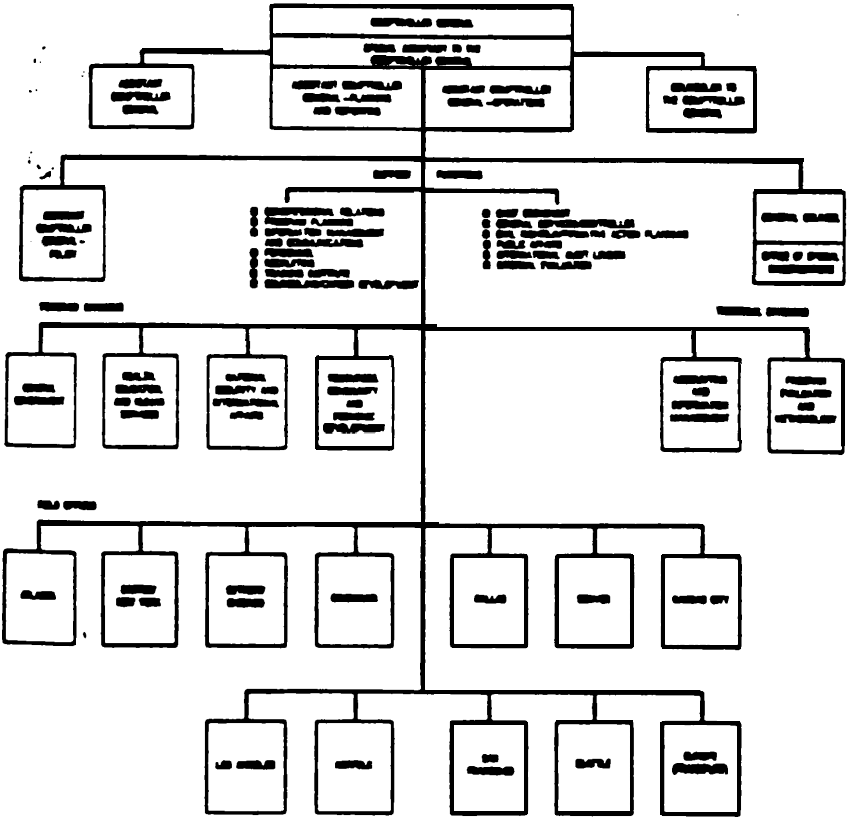

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The ability to review practically any Government function requires a multidisciplined staff able to conduct assignments wherever needed. GAO's staff has expertise in a variety of disciplines—accounting, law, public and business administration, economics, the social and physical sciences, and others.

The Office is organized so that staff members concentrate on specific subject areas, enabling them to develop a detailed level of knowledge. When an assignment requires specialized experience not available within GAO, outside experts assist the permanent staff. GAO's staff goes wherever necessary on assignments, working onsite to gather data, test transactions, and observe firsthand how Government programs and activities are carried out.

Accounting and Information Management Policy The Office ensures that the Congress has available for its use current, accurate, and complete financial management data. To do this, GAO:

—prescribes accounting principles and standards for the executive branch;

—advises other Federal agencies on fiscal and related policies and procedures; and

—prescribes standards for auditing and evaluating Government programs.

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For further information, contact the Office o Washington, DC 20548. Phone, 202-512-48

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Reporting Authorities The Office offers a range of products to communicate the results of its work. The type of product depends on the assignment's objectives and the needs of the intended user. Product types include testimony, oral briefings, and written reports. Virtually all of GAO's reports are available to the public.

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DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr Waldo Smith
North Denver Community Center
3627 W. 32nd Avenue
Denver, Colorado 80211

Dear Mr. Smith:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation in the process helps maintain the dialogue between the U.S. Army and the public.

In response to your query about dividing the On-Post Plan into two sections, the On-Post Record of Decision (ROD) format follows U.S. Environmental Protection Agency (EPA) guidelines and the format of the Off-Post ROD, and so no changes will be made to the layout of the document

The Army agrees with you that the proposed remediation alternative should be carefully followed and that all parties should communicate effectively to arrive at the best possible public understanding of the plan. The Army is proud of its success in cooperating with the State of Colorado, Shell Oil Company, the EPA, the U.S. Fish and Wildlife Service, and local stakeholders to arrive at a ROD to remediate RMA, and looks forward to working with stakeholders as the remediation process extends into the future.

During the formulation and selection of the remedy, members of the public and some local governmental organizations expressed keen interest in the creation of a Trust Fund, as you do in your comment, to help ensure the long-term operation and maintenance of the remedy The Parties have committed to good-faith best efforts to establish such a Trust Fund, as described in the On-Post ROD. Principal and interest from the Trust Fund would be used to cover the costs of long-term operation and maintenance throughout the lifetime of the remedial program. These costs are estimated to be approximately $5 million per year (in 1995 dollars).

It is the intent of the Parties that if the Trust Fund is created it will include a statement containing the reasons for the creation of the Trust Fund, a time frame for establishing and funding the Trust Fund, and an appropriate means to manage and disburse money from the Trust Fund The Parties are also examining possible options that may be adapted from trust funds involving federal funds that exist at other remedial sites. The Parties recognize that establishing a Trust Fund may require special congressional legislation and that there are restrictions on the

actions federal agencies can take with respect to such legislation. Because of the uncertainty of possible legislative requirements and other options, the precise terms of the Trust Fund cannot now be stated.

A Trust Fund group will be formed to develop a strategy to establish the Trust Fund. The strategy group may include representatives of the Parties (subject to restrictions on federal agency participation), local governments, affected communities, and other interested stakeholders and will be convened within 90 days of the signing of the ROD.

According to the U. S. Government Manual, "The General Accounting Office [GAO] is charged with examining all matters relating to the receipt and disbursement of public funds." The existence of a Trust Fund containing government funds and the use of such a fund is subject to GAO audit Fiscal control of such a fund is not considered to be within GAO's delegated authority.

The Army intends to stay on the current schedule for the ROD so that the RMA remediation can go forward.

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H. Bishop
Colonel, U.S. Army
Program Manager

Copies Furnished:

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Suite 945, North Tower, Denver, Colorado 80202
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Center, Commerce City, Colorado 80022-1748

On Post Proposed Plan Comments
Program manager
Rocky Mountain Arsenal (RMA)
Attn: AMCPM-PM/Col. Eugene H. Bishop
Building 111-RMA
Commerce City, Colorado 80022-1748

December 12, 1995

Re: Proposed Plan for the RMA; On Post Operable Unit

To all to whom this may come to affect or may concern as stakeholders of the Rocky Mountain Arsenal, Denver, Colorado:

In May of 1974, diisopropylmethylphosphonate (DIMP) and dicyclopentadiene (DCPD) were detected in the surface water at the northern boundry of the RMA. Later that year the Colorado Department of Health (CDH) detected DIMP in a well north of the RMA. As a result, the CDH issued a cease and desist order directing the RMA to immediately stop the off-post discharge of DIMP and DCPD in surface and subsurface water.

In 1989, the nvironmental Protection Agency issued a human Health Advisory for DIMP in drinking water of 600 parts per billion (ppb). Pursuant to a CDH request of the COLORADO WATER QUALITY CONTROL COMMISSION (1991), the Commission elected to adopt the CDH proposed DIMP standard of 8 ppb.

Finally, pursuant to the AGREEMENT FOR A CONCEPTUAL REMEDY FOR THE CLEANUP OF THE ROCKY MOUNTAIN ARSENAL, dated June 13, 1995, the parties agreed as follows:

o As of the date of the On Post Record of Decision (ROD), and based on a .392 ppb detection limit, the U.S. Army will use the last available quarterly monitoring results to determine the DIMP plume footprint.

o The U.S. Army and Shell Oil Company will pay for the extension of, and hook-up to the current distribution system for <u>all</u> **existing well owners** <u>within the DIMP plume</u> footprint referenced above.

o Existing <u>domestic</u> **well owners** <u>outside the DIMP plume</u> footprint as of the date of the On Post ROD where it is later determined that levels of DIMP are 8 ppb or greater will be hooked up at the U.S. Army and Shell Oil Company's expense to the South Adams County Water and Sanitation District (SACWSD) distribution system or provided a deep well or other permanent solution.

o The U.S. Army and Shell Oil Company agree to pay for, and provide or arrange for the provision of 4,000 acre feet of water, the details of which will be worked out between the U.S. Army, Shell Oil Company and SACWSD.

On September 7, 1995, I learned that the intention of the U.S. Army and Shell Oil Company, with respect to the referenced agreement provisions above intend as follows:

o The Platt River will be designated as the northern-most perimeter for remediation of groundwater despite the fact that DIMP contamination has crossed north of the Platt River;

o The distribution system hookup for "all existing well owners" within the DIMP plume footprint is actually intended only for domestic well owners. The hookup provision does not consider or restrict other forms of exposure to contaminated groundwater.

Pursuant to the FEDERAL FACILITY AGREEMENT, pg. 12, Groundwater means water in a saturated zone or stratum beneath the surface of land or water (**Note: No differentiation between irrigation and drinking water**). Page 5 paragraph 2.7 also affirms that "Groundwater and surface water flowing beyond the Arsenal boundaries will be of a quality that is protective of human health and the environment".

Given the extensive exposure to DIMP, wherein the quantitative exposure limitations have changed from 600 ppb in 1989 to 0.392 ppb in 1995 for neighboring households, I urge that the language of "hook-up to the current distribution system for **all existing well owners within the DIMP plume footprint** be strictly adhered to -- without limitation to the respective well use permit disclosure.

o The provision of 4,000 acre feet of replacement water will not be enough, in quantity, to mitigate the SACWSD loss of 4,300 acre feet of shallow well water, SACWSD loss of 700 acre feet of deep well water, and supply the anticipated DIMP plume footprint exposure areas with an additional 2,500 acre feet.

Respectfully Submitted,

John J. Yelenick
Denver, Colorado

Member: RMA Restoration Advisory Board
Member: RMA Site Specific Advisory Br

On Post Proposed Plan Comments
Program Manager
Rocky Mountain Arsenal (RMA)
Attn: AMCPM-PM/Col. Eugene H. Bishop
Building 111 -RMA
Commerce City, Colorado 80022-1 748

December 13, 1995

Re: Proposed Plan for the RMA; On-Post Operable Unit.

To all to whom this may come to affect or may concern as stakeholders of the Rocky Mountain Arsenal, Denver, Colorado:

Pursuant to the requirements of the COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION and LIABILITY ACT (CERCLA) Sections 113 (k) (2) (B) (i-v) and 117(a), the NATIONAL OIL and HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN and the RMA FEDERAL FACILITY AGREEMENT, I hereby submit these written comments for inclusion into the Record of Decision; the Official Administrative Record for On & Off Post "Record of Decision".

WHEREAS the remedial action objective for the RMA On-Post Operable Plan is to "Ensure that groundwater reaching the RMA boundary will be of a quality that is protective of human health..."; 1

WHEREAS "Groundwater usage (either domestic and/or a gricultural) is the primary contributor to carcinogenic risk, accounting for 45 to 99 percent of the total risk estimated for each zone. This indicates the major role of the groundwater - related exposure pathways."; 2

WHEREAS the FEDERAL FACILITY AGREEMENT stipulates that "Response Actions will be sufficient to prevent the vertical and horizontal migration of on-post contaminated groundwater and surface water so that off-post surface water and groundwater my be used in areas outside of the Arsenal boundaries,"; 3

WHEREAS "Groundwater means water in a saturated zone or stratum beneath the surface of land or water."; 4

WHEREAS "Alternatives that do not meet the requirements of the FEDERAL FACILITY AGREEMENT will be determined to not be implementable.": 5

I hereby submit for your consideration, data for the RMA indicating that there is a high probability that South Plants contamination is escaping the southern RMA boundary via groundwater migration of which the RMA On-Post Operable Unit preferred water alternative fails to address and mitigate.

For purposes of objectivity in presentation, I attach depictive EXHIBITS which I hereby incorporate into these, my comments, for the Record of Decision. My comments conclude with text by- Mr. James J. Snodgrass - Geophysicist with the UNITED STATES BUREAU of MINES who affirms the southern migration supposition through his independent assessment of this, and other documentation.

Background:

The SOUTH PLANTS CONTAMINATION SURVEY and REMEDIAL ACTION ASSESSMENT investigated seventeen suspected disposal sites (Task 2:1985 - 78 spill events) in the manufacturing complex and conducted a program to samphistorically documented spill sites per the historical data classification by the UNITED STATES ARMY TOXIC and HAZARDOUS MATERIALS AGENCY (USATHAMA). High Priority was given to sites proximate to groundwater and historically documented with records. Low Priority was designated for sites without historical records of groundwater contamination yet still proximate to recorded spills. The designation UNCONTAMINATED SITES/NON-SOURCE AREAS was afforded to sites which may have been contaminated but without historical records to prove contamination; or in the alternative, if no responsible party could be identified as having contaminated the given site. 6

9534704-1/1-A

According to the STRUCTURES SURVEY REPORT, there are 982 structures on the RMA; approxima 53 percent were located on the South Plants sections #1 & 2; however, over half of the buildings and other structures' history documentation was incomplete. Low Priority and "Uncontaminated /Non-Source" designated sites had contamination test bore holes, whose depth reached only the surface of the water table levels under the auspices that "contaminents present below 5 feet, or in the saturated zone, are considered to be related to groundwater contamination by water table fluctuations and possibl. lateral migration." (Source: FINAL Phase I Contamination Assessment Report, July 1988 pg. 143) Literal 'In-Depth' investigations were necessary at all of these 'discounted' areas! Generally speaking, subsequent testing and geotechnical studies focused on the historical source sites rather than contaminent pathways, aka: "Secondary Sources/Non-Source" areas. 6

During the production phases at the RMA, the primary concern was the manufacture of the end items on schedule · · · solid and slurry waste was often disposed of in the most convenient and e xpeditious manner, often without regard to its contamination status. 7

EXHIBIT A, Figure SPSA 2.4-5 demonstrates Volatile Aromatic Organics (VAO's moderate aqueous solubility, high volatility) in the South Plants groundwater(1979 /1983) in magnitudes in excess of Certified Reporting Limits; EXHIBIT B, Figure SPSA 2.4-6 for VAO's (specifically e thylbenzene, xylene, and toluene) in 1988/1989; EXHIBIT C, Figure SPSA 3.3-8 for VAO ' s in the groundwater, 1988; EXHIBIT D, Figure SPSA 3.3-4 demonstrates Volatile Halogenated Organics (VHO's - moderate to high aqueous solubility and volatility) in the groundwater 1988. 8 Per EXHIBIT E, Figure SPSA 3.3-1, we see the southern migration pathway composite for 1979/1983. Per EXHIBIT F, Figure SPSA 3.3-2, the southern migration pathway composite for 1988 is illustrated. 9

My review of available documentation indicates a southern contaminent migration flow through sections #1 and #2. EXHIBIT G, Figure C.3-1 and EXHIBIT H, Plate 1 demonstrate the southern organic analy plums for the unconfined flow system 10. Specifically, EXHIBIT I, Figure SSA 3.5-1 demonstrates the VHO plume (composed specifically of 1,1,1 Trichloroethane, 1,1 dichloroethylene and trichlorcethylene: See 8) in the RMA water bearing zones. 11.

EXHIBIT J, Figure SSA 3.4-21 delineates the total area of potential contaminents in soils based on analytical results, historical information and distribution mechanisms. The southern lakes of Ladora, Derby, and Mary and the 1964 lake setiment/solid waste trenches are encompassed. 12. The FINAL DETAILED ANALYSIS OF ALTERNATIVES/WATER DAA affirmed "The highest concentrations of contaminents are observed in wells located beneath the South Plants Central Processing Area and within the 'A' sand or other stratigraphically equivalent units (See: Pg. 3-7); the 'A' sands of sections 1 & 2 and south sections 11 & 12.

The southern lakes are situated on relatively thick permeable alluvial deposits. The deposits pass directly under portions of the South Plants and e xtend south to Lake Ladora where the deposits act as an important semiconfined aquifer unit. 13

In response to a vian mortality occurring on the lakes (approximately 1,200 ducks) 14, Lower Derby, Upper Derby and Lake Ladora were drained and the clay bottom was e xcavated to remove contaminated sediment (1 964-1965). 15 It is important to note the absence of the clay lake bottom; the a bsence may promote communication between the potentially more permeable alluvial material (deposits of sand and gravel) and the underlying Denver Formation.

Most of the sediment was disposed in section #12, south of Lower Derby Lake amounting to approximately 115,000 cubic yards of soil. 16 The balance, and additional solid waste products from the RMA, were disposed in the trenches south of Lake Ladora. <u>These trenches were not lined</u>.

Inferred volumes of contaminated lake soils include 47,000 cubic yards to only a 3 foot depth in Lake Mary; 120,000 cubic yards to only a 3-4 foot depth in Lake Ladora; 240,000 cubic yards to only a 5 foot depth in Lower Derby Lake; 200,000 cubic yards to only a 3-4 foot depth in Upper and e ast Derby Lakes and 74,000 cubic yards to only a 3 foot depth in Rod & Gun Club Pond. A total of 15 analytes have been detected in the Lake sediments. 17 Pursuant to the FINAL PHASE I CONTAMINATION ASSESSMENT REPORT/SOUTH PLANTS, July 1988, pg. 145: The estimated contaminated soil vertical extent of 12.5 feet (Note: Groundwater level in the South Plants area occurs at an average depth of 5 feet (a range of 2 to 10 feet) amounted to an estimated volume of 3,085,000 cubic yards!

WATER BALANCE CALCULATIONS INDICATE THAT UPPER & LOWER DERBY LAKES HAVE UNACCOUNTABLE LOSSES OF WATER (25 of the 26 months monitored) AND IT APPEARS THESE LAKES RECHARGE TO THE WATER TABLE. 18 Lake Ladora and Lake Mary also recharge to the groundwater per the Comprehensive Monitoring Program 1975-1989, Dec. 1992 pg. -v-.

The alluvial deposits cross-section are graphically offered in two sections:

EXHIBIT K (with a groundwater flow rate of 192,000 gpd) and EXHIBIT K-1 commence at point 02011,12,13 (aka:SS2) to 11006 thence to alluvial well point 02026,27,28 (aka:SS2'). This cross-section is located immediately south of Lake Ladora and north of the 'lake bottom e xcavation trenches', situate on the section #2 south/section #11 north boundary known as Commerce City's 64th Avenue/RMA's 6th Avenue. On the same EXHIBIT K and K-2, point 02561 to point 01586 (aka:SS4) to point 02052 (aka:SS5) to point 01024,25,26 (aka:SSl & SS7). (Note: This cross-section is located between Lake Ladora and Lower Derby situate on the section #2 east/section #1 west boundary known in Denver as Peoria north e xtension) thence from alluvial well point 01024,25,26 to alluvial well point 12008 to point 01051 to point 01021,22,23 to point 01001 (aka:SS6). This second of two segments/cross-sectional planes are located south of Lower Derby and north of the 'lake bottom e xcavation trenches', situate on the section #1 south/section #12 north boundary known as Commerce City's 64th Avenue/RMA's 6th Avenue.

Review of these cross-sectionals confirm ready southern migration pathways of sand and gravel. The extent of the sand subcrop, with variable lateral and vertical hydraulic conductivity 13, runs directly under South Plants manufacturing complex that can be seen in EXHIBIT L, Plate 2 (which also identifies additional cross-sectionals to the immediate north of the southern lakes - groundwater table interpositioned).

EXHIBIT M, Figure SSA 1.4-3 demonstrates the position of the coarse gravel and sand interbeds (See EXHIBIT M, Plate WSA 1.4-4) positioned in Eolian deposits with embedded palecohannels situate from the South Plants/South Lakes running through the southern RMA boundary (deposits of which may run to depths of 130 feet thick 19). The palecohannels are filled with coarse sand and gravel that can act as conduits for contamination flow 20; however, per the Modified Preliminary Assessment Site Investigation Report for Leased and Transferred RMA, Oct. 1994 a t Pg3. 2-5,not all of the flow is restricted to these channels. Groundwater flow occurs over channel divides and through the Denver a quifer as well.

EXHIBIT N, Figure SSA 1.4-2 depicts the southern study area soils configuration showing a southern sandy loam gradient with 1 - 3 percent slopes, south. Testing results indicate that Lower Derby recharges the groundwater and Lake Ladora and Lake Mary receive groundwater in upgradient areas and lose it in downgradient areas. The direction of flow (up or down) is probably a more reliable indicator of groundwater flow conditions than the indicated magnitude of the gradient. Interpretations of the vertical distributions of contaminents is complicated by the heterogeneous nature of the Denver Formation resulting in variable potential for vertical (and horizontal) flow throughout the RMA.21 "The heterogeneous nature . . . makes chacterization of the confined flow system (predominantly occurs in permeable sandstone, siltstone and lignite of the unweathered Denver formation) at the scale of the entire site-difficult. The 1994 reclassification of (59%) the original 522 wells designated-confined . . . is not appropriate for e valuating flow within the confined flow system of RMA and surrounding areas. 19 However, the potentiometric surfaces of a quifer zones in the confined flow system . indicates there is a potential for downward flow between the unconfined and confined flow system 19.

EXHIBIT O, Figure SSA 1.5-6 sets forth the alluvial aquifer saturated thickness for the southern study area. EXHIBIT P, Figure 4.4 demonstrates the general downward vertical gradient south of the South Plants/Southern Lakes toward the southern RMA boundary. EXHIBIT P-1, Plate 5.6-1 is a graphic depiction of the southern and western migration routes. The regional ground-water flow to the northwest is at an average hydraulic gradient of about 20 ft./mile (0.00379 ft./ft.) to 32 ft./mile (0.0061 ft./ft.) per ANNUAL GROUND-WATER REPORT FOR 1990 dated August 1991: version 1.1 pg.37, or 4/10's of 1% to 6/10's of 1%. The bedrock surface elevation under South Plants measures 5,270 feet dropping to 5,140 feet in a mile span to Section 11 demonstrating a gradient of 130 ft./mile (0.02462 ft./ft.)or approximately 2 1/2% The southern gradient pathway is as much as 549.6% greater than the northwest gradient (0.00379 ft./ft. %change 0.02462 ft./ft.).

EXHIBIT Q, Figure 4.16 re-emphasizes this southern wayward geographic characteristic. [See: EXHIBIT K-Supplement where South Plants Average Hydraulic Gradient at 'South Plants Study Area southern perimeter equals 0.01 5].

Southern Boundary Contaminents:

Contaminents were detected in the water and sediments in the southern sections of sections #11 and #12. 22 EXHIBIT R, Figure 4-1 and EXHIBIT R-1, Figure 3-1 portray the groundwater and gas analyte detections. Individual analytes do not occur repeatedly in water entering RMA (from the southern boundary) per the FINAL REMEDIAL INVESTIGATION SUMMARY REPORT, Version 3.2, January 1992 pg. A 3-82.

The topography of sections #11 and #12 contain a dozen wetlands and deep-water habitats of the United States. South and west of RMA sections #11 & #12 is the City of Denver's new residential and industrial 4,700 acre Stapleton development, including a food storage and distribution center at east 56th and Havana streets.

Located immediately south of the RMA sections #11 and #12 lie approximately 2 miles square of the idential community known as Montbello, where recent data indicates "live births of low birth weight infants tend to be clustered in census tracts southwest of the Arsenal where the ratio of black to white females of child-bearing age (15-44 years) is greater than 1.0. As you move away from this area in any direction, the number of live births of low birth weight infants and ratio of black to white females of childbearing age decreased" 23

"The Army arbitrarily and consistently relies on insufficient data to conclude that there is no evidence of contamination or no e vidence of a significant migration pathway. The lack of data collected in the Remedial Investigation (RI) cannot be used as a basis for showing no contamination is present or that a particular pathway does not pose a significant threat" (State of Colorado comments on DRAFT FINAL REMEDIAL INVESTIGATION REPORT, March 1989; tendered May 1, 1989 pg.3.)

My comments are a call for Environmental Justicgiven the high probability that South Plants contamination is escaping the southern RMA boundary via groundwater migration - reviewed and supported by Mr. Snodgrass - Geophysicist with the U.S. Bureau of Mines (Copy of his letter dated October 13, 1995 as EXHIBIT S).

The RMA On-Post Operable Unit preferred water alternative fails to address and mitigate the high probability that South Plants contamination is escaping the southern RMA boundary.

Respectfully Submitted,

John J. Yelenick
Denver, Colorado

Enclosures: EXHIBITS A - S

Member: RMA Restoration Advisory Board
Member: RMA Site Specific Advisory Board
Chairman, South Plants Groundwater Task Force

cc:

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References

1 FINAL DETAILED ANALYSIS OF ALTERNATIVES REPORT, Version 4.0, Executive Summary, August 1995, Pg.1

2 TECHNICAL SUPORT FOR RMA OFF POST OPERABLE UNIT FINAL RECORD OF DECISION, September 19, 1995, pgs. 6-9

3 FEDERAL FACILITY AGREEMENT, effective February 17, 1989, pg. 5 para. 2.7

4 CERCLA, 42 U.S.C. 9601(14) Section 101(14)

5 FINAL DETAILED ANALYSIS OF ALTERNATIVES REPORT, Version 4.0, Executive Summary Pg .52

6 SOUTH PLANTS CONTAMINATION SURVEY AND REMEDIAL ACTION ASSESSMENT, March 1995

7 HISTORY OF POLLUTION SOURCES AND HAZARDS AT THE ROCKY MOUNTAIN ARSENAL; Casinir Kuznear & William L. Trautmann, September 1980, pg. 12

8 FINAL REMEDIAL INVESTIGATION REPORT VOL.VIII dated July 1989, SOUTH PLANTS STUDY AREA, pgs. 2-24, 2-25

9 FINAL REMEDIAL INVESTIGATION REPORT VOL.VIII dated July 1989, SOUTH PLANTS STUDY ARFA, pgs. 2-24, 2-25

10 FINAL DETAILED ANALYSIS OF ALTERNATIVES REPORT, WATER DAA, August 1995

11 FINAL REMEDIAL INVESTIGATION REPORT VOL.VIII

12 FINAL REMEDIAL INVESTIGATION REPORT VOL.VI

13 PROPOSED FINAL SOUTH PLANTS/BASIN A GROUNDWATER FLOW MODEL, Dec. 1994 pg. 4-2,1-6 & 5-4

14 STUDY OF AVIAN MORTALITY ON THREE LAKES AT RMA by George Sciple, Wildlife Research Laboratory May 28, 1952 pg.1

15 COMPREHENSIVE MONITORING PROGRAM, WATER YEAR 1975 to WATER YEAR 1989, Dec. 1992 Pg. 43

16 FINAL REMEDIAL INVESTIGATION REPORT VOL.III. SOUTHERN STUDY AREA, June 1989, Pg. 1-34, 1-21, 3-76, 3-24 and 1-45

17 FINAL REMEDIAL INVESTIGATION REPORT VOL.III. SOUTHERN STUDY AREA, June 1989 Pg. 24

18 FINAL REMEDIAL INVESTIGATION REPORT VOL.III. SOUTHERN STUDY AREA, June 1989 Pg. 1-45

19 GROUNDWATER MONITORING PROGRAM, 1993 pgs. 2-2, 4-7, 4-8, ES-3

20 RECORDS SEARCH LEASED AND TRANSFERRED RMA FACILITIES AND LAND, ATTACHMENT 4, Oct. 1994

21 GROUNDWATER MONITORING PROGRAM, 1993 pg. 4-48 and 4-49

22 FINAL REMEDIAL INVESTIGATION REPORT, SOUTHERN STUDY AREA, June 1989 pg. 3-85

23 REPRODUCTIVE, NEUROBEHAVIORAL AND OTHER DISORDERS IN COMMUNITIES SURROUNDING

SPSA-3

SPSA-1

SPSA-8

SPSA-6

SPSA-10

SPSA-11

SPSA-8b

SPSA-5a

SPSA-6a

SPSA-9b

SPSA-1a

SPSA-1b

SPSA-9a

SPSA-1c

SPSA-9

SPSA-2d

SPSA-2c

SPSA-2a

SPSA-2e

SPSA-2b

SPSA-2

ANALYTE GROUP SAMPLE LOCATION AND CONCENTRATION (ug/l)
OPEN SYMBOL INDICATES BELOW CRL
SIZE OF OPEN SYMBOL INDICATES THE MAGNITUDE OF CRL

- < 1
- 1 - < 10
- 10 - < 100
- 100 - < 1,000
- 1,000 - < 10,000
- 10,000 - < 100,000
- ≥ 100,000

1979 1983
YEAR SAMPLED

CRL - Denotes Certified Reporting Limit

EXHIBIT

Note: The sample is from Water Bearing Zone 1 unless otherwise labeled. Superscripts 2 and 3 indicate sample from Water Bearing Zones 2 and 3, respectively.

SOUTH PLANTS STUDY AREA LOCATION

Prepared for:

Program Manager's Office for Rocky Mountain Arsenal Cleanup

FIGURE SPSA 2.4-3
Volatile Aromatic Organics in Groundwater, 1979/1983

Rocky Mountain Arsenal

A

SECTION 2.0 FIGURES
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TECHNICAL SUPPORT FOR

ROCKY MOUNTAIN ARSENAL

Rocky Mountain Arsenal
Information Center
Commerce City, Colorado

FINAL
REMEDIAL INVESTIGATION REPORT
VOLUME VIII
SOUTH PLANTS STUDY AREA
SECTION 2.0
FIGURES 2.2-1 to 2.7-1
VERSION 3.3

July 1989
Contract No. DAAA15-88-D-0024

Prepared by:

EBASCO SERVICES INCORPORATED
APPLIED ENVIRONMENTAL, INC.
CH2M HILL DATACHEM, INC.
R.L. STOLLAR AND ASSOCIATES

Prepared for:

U.S. ARMY PROGRAM MANAGER'S OFFICE
FOR ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

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FINAL
REMEDIAL INVESTIGATION REPORT
VOLUME VIII
SOUTH PLANTS STUDY AREA
SECTION 2.0
FIGURES 2.2-1 to 2.7-1
VERSION 3.3

July 1989
Contract No. DAAA15-88-D-0024

Prepared by:

EBASCO SERVICES INCORPORATED
APPLIED ENVIRONMENTAL, INC.
CH2M HILL DATACHEM, INC.
R.L. STOLLAR AND ASSOCIATES

Prepared for:

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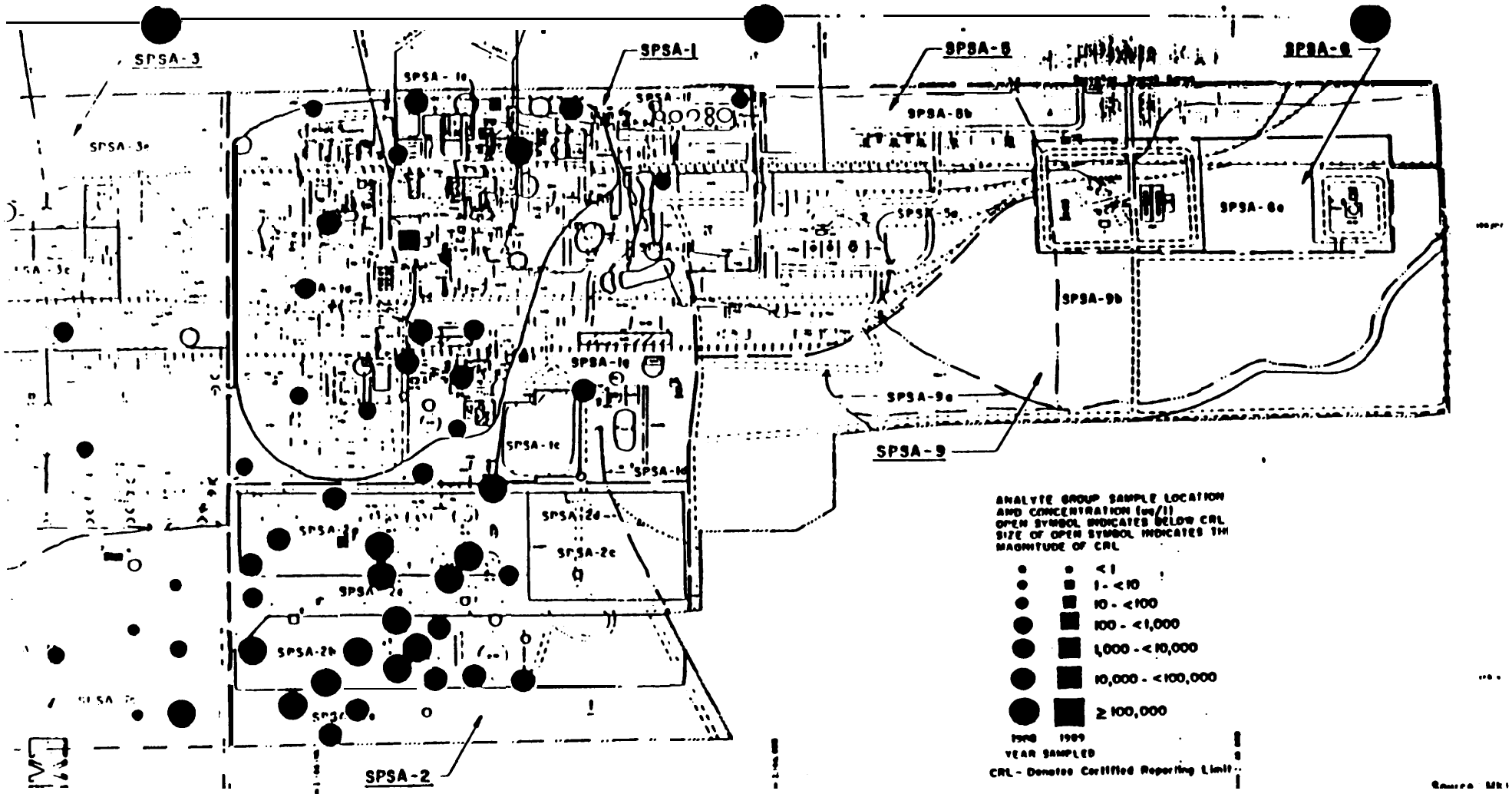


The sample is from Water Bearing Zone 1 unless otherwise labeled. Superscripts 2 and 3 indicate sample from Water Bearing Zones 2 and 3, respectively.

GC/MS Data

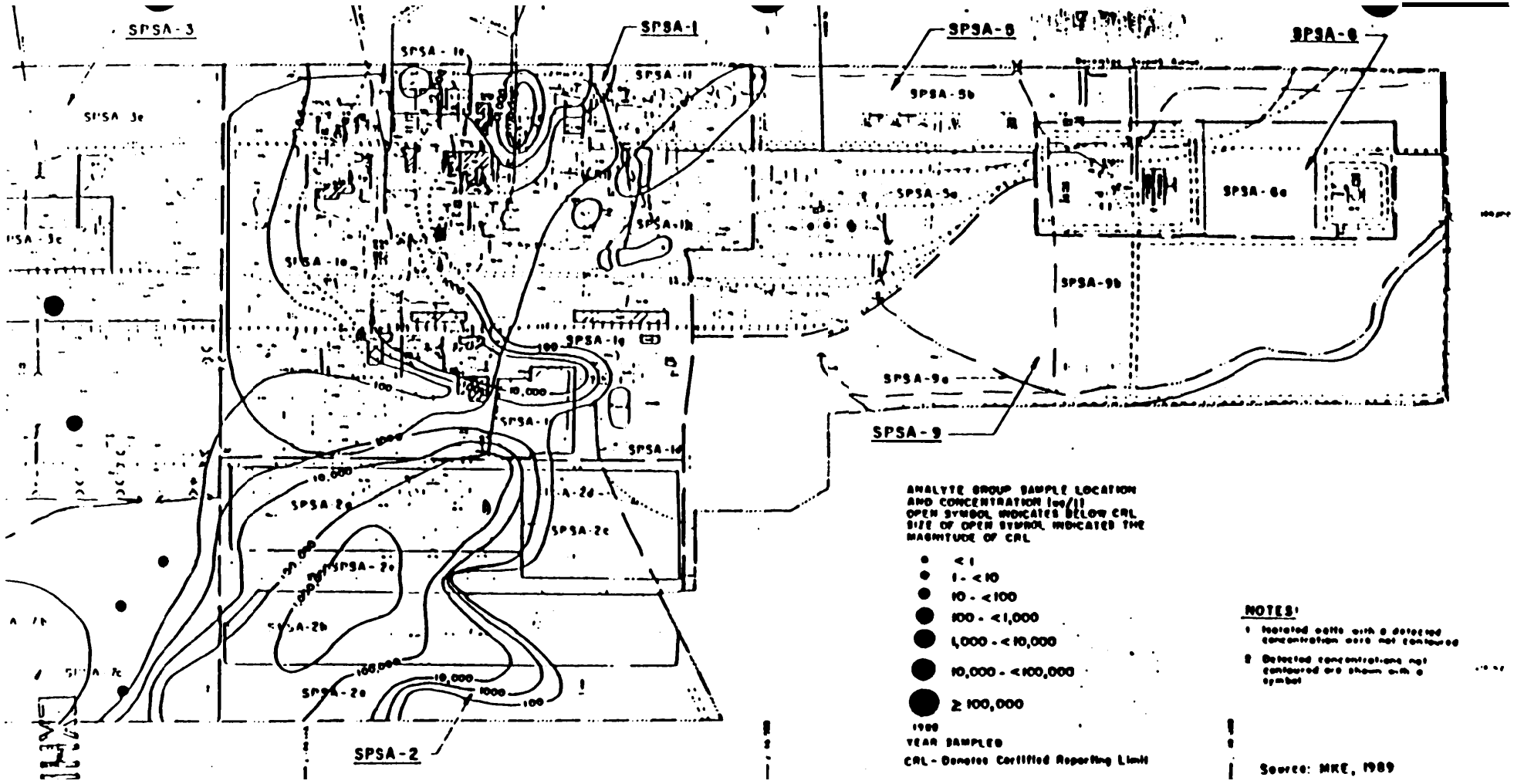
Prepared for:

Program Manager's Office for Rocky Mountain Arsenal Cleanup

Volatile Aromatic Organics in Groundwater, 1988/1989

Rocky Mountain Arsenal

Prepared by Ebasco Services Incorporated



historically associated
lyte group

ate location of historic
associated with analyte group

—1— —10— 1988 Isoconcentration in ug/l
Dashed where inferred,
Queried where questionable
·····10····· Dotted when inferred with 1989 data

SOUTH PLANTS STUDY AREA LOCATION

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE SPSA 3.3-8

Volatile Aromatic Organics
Plume in Groundwater, 1988

Rocky Mountain Arsenal

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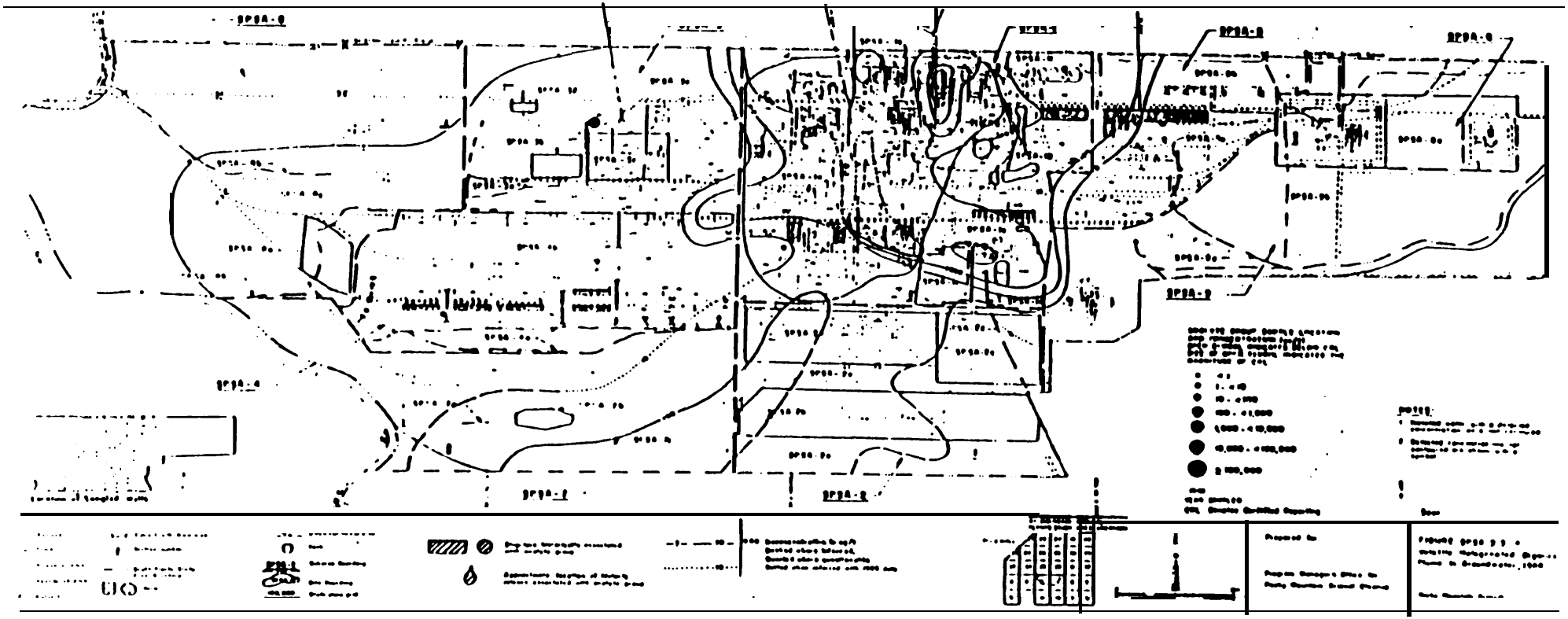

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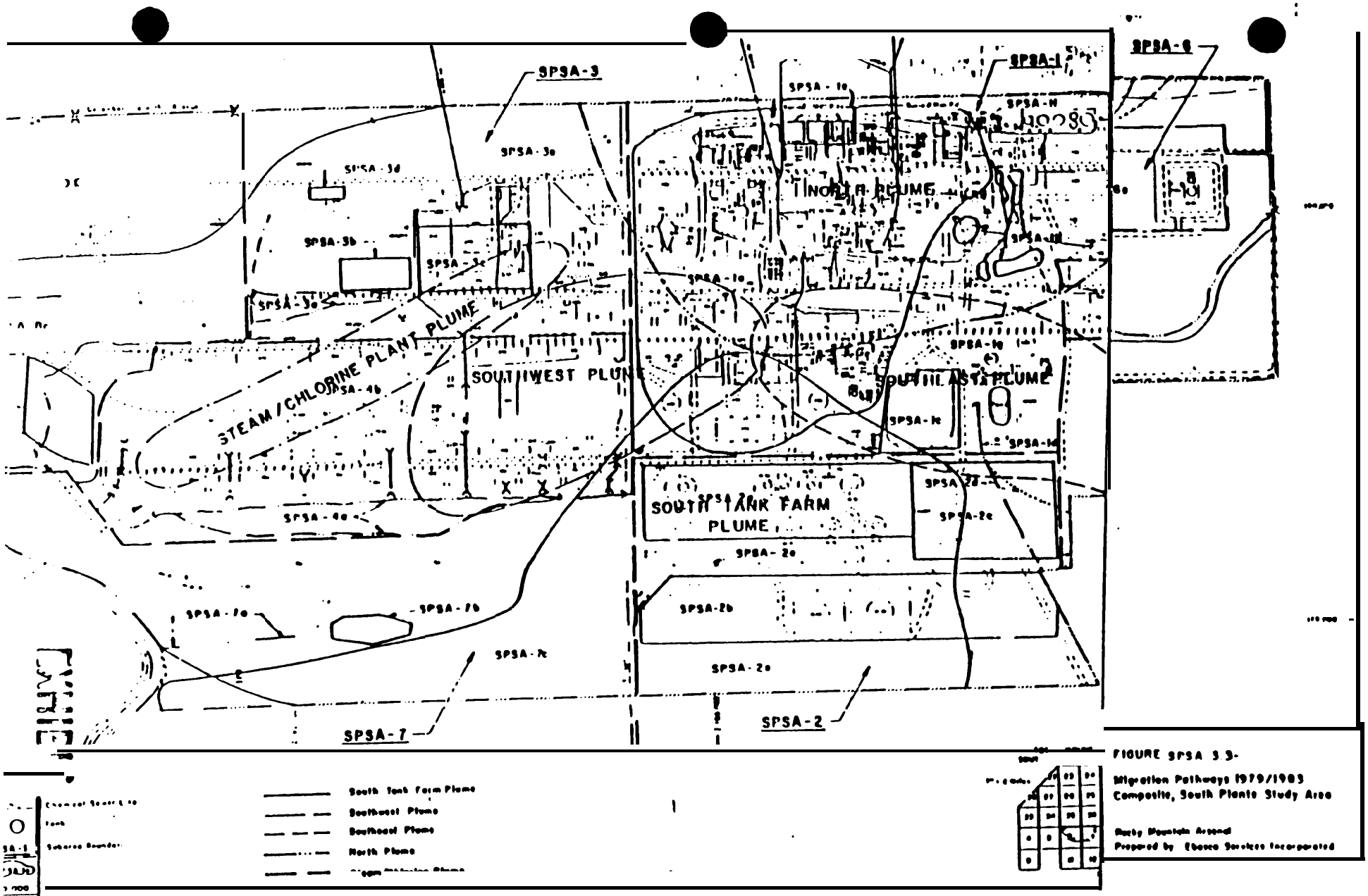

FIGURE SPSA 3.3-

Migration Pathways 1979/1983
Composite, South Plants Study Area

Rocky Mountain Arsenal
Prepared by Ebasco Services Incorporated

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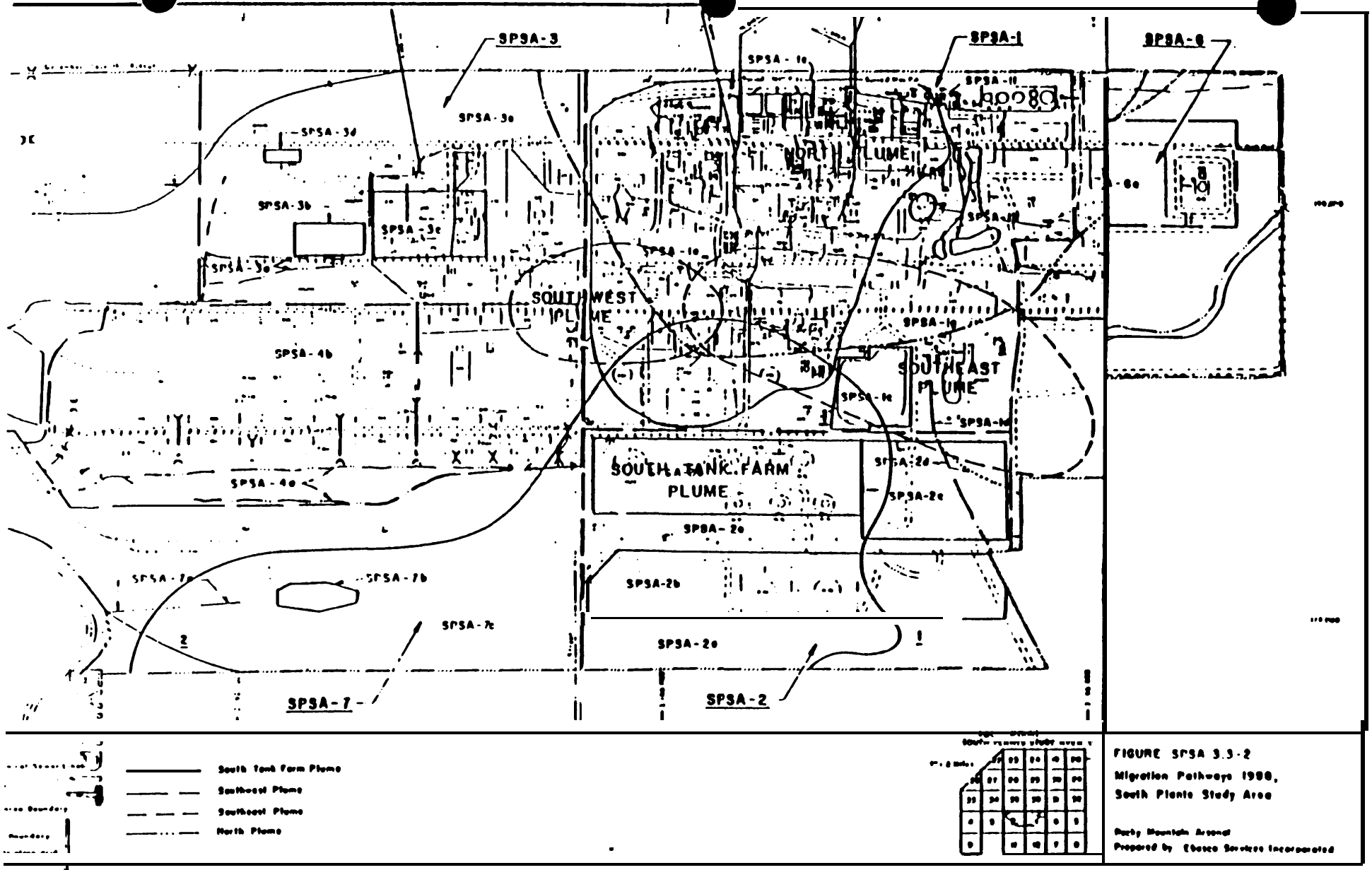

FIGURE SPSA 3.3-2
Migration Pathways 1988,
South Plants Study Area

Rocky Mountain Arsenal
Prepared by Ebasco Services Incorporated

SECTION 3.0
TABLES AND FIGURES

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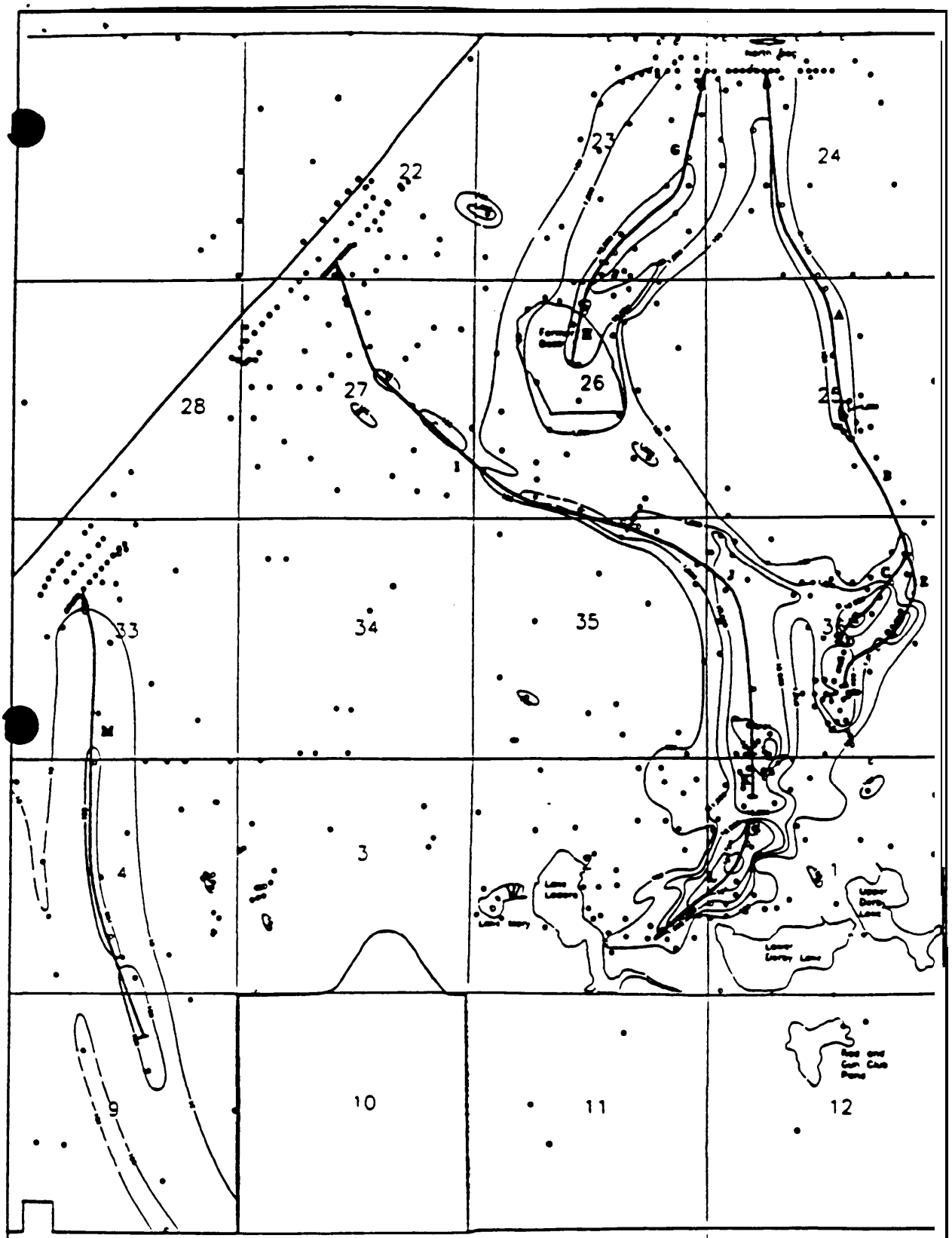

EXHIBIT G

Legend

Monitoring Well

Summed Target Organic Analyte Concentration

Flow Direction

Prepared for
U.S. Army Program Manager
for Rocky Mountain Arsenal

Prepared August 1995

FIGURE C.3-1

Selected Contaminant Migration
Flow Paths

Rocky Mountain Arsenal

TECHNICAL SUPPORT FOR
ROCKY MOUNTAIN ARSENAL

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OF ALTERNATIVES REPORT
VERSION 4.0
WATER DAA
VOLUME V OF VII

AUGUST 1995
CONTRACT NO. DAAA 05-92-D-0002

Prepared by:

FOSTER WHEELER ENVIRONMENTAL CORPORATION
RUST Environment and Infrastructure
Baker Consultants, Inc.

Prepared for:

U.S. Army Program Manager's Office for the
Rocky Mountain Arsenal

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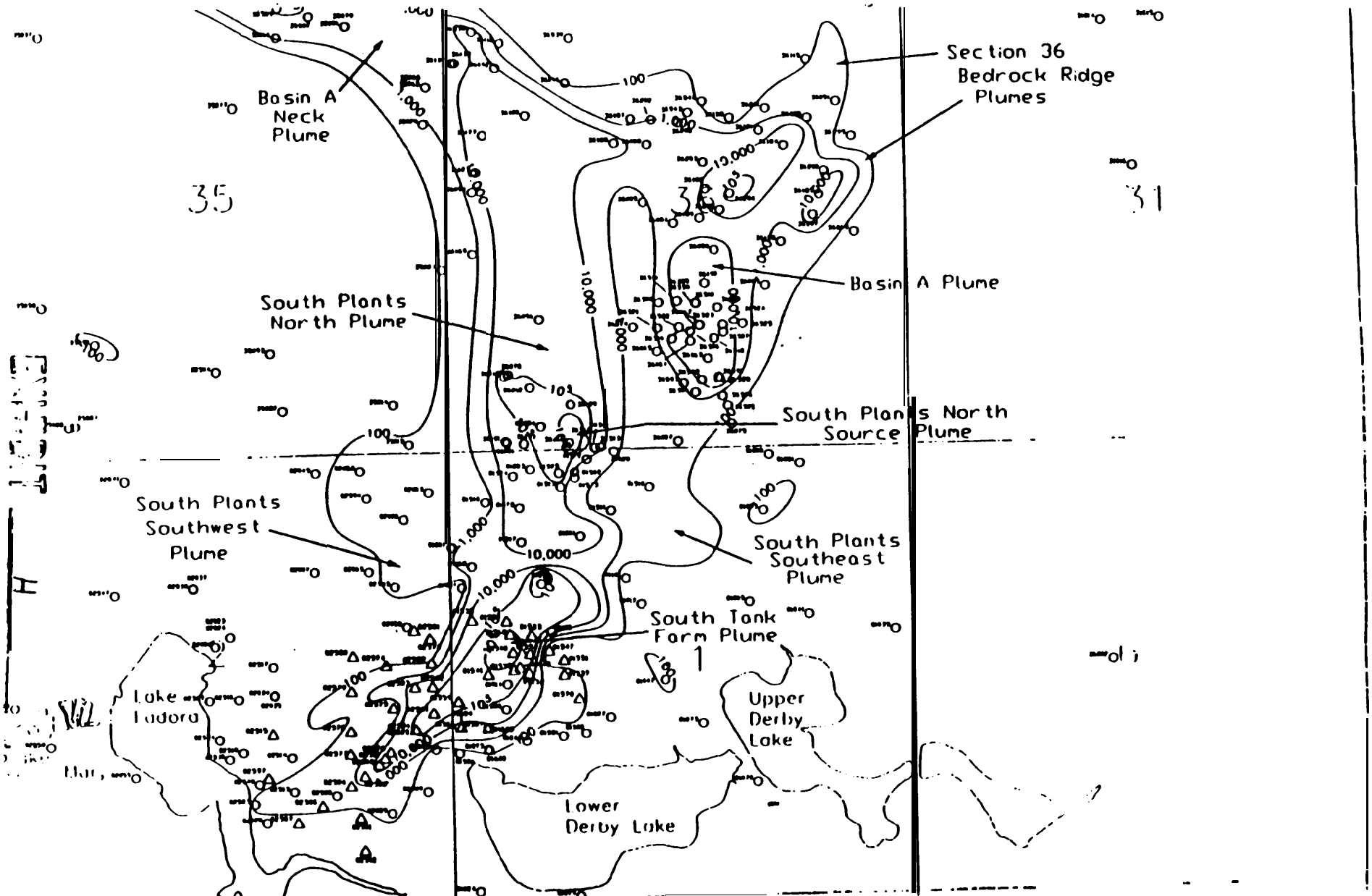

Basin A
Neck
Plume
Section 36
Bedrock Ridge
Plumes
35
36
31
Basin A Plume
South Plants
North Plume
South Plants North
Source Plume
South Plants
Southwest
Plume
South Plants
Southeast
Plume
South Tank
Farm Plume
Lake
Ladora
Upper
Derby
Lake
Lower
Derby Lake
100
1,000
10,000

8

F:\PROJECTS\RMA\OU4\PLUME\PLUME_F.DWG

Prepared for:

U.S. Army Program Manager
for Rocky Mountain Arsenal

Prepared August 1995

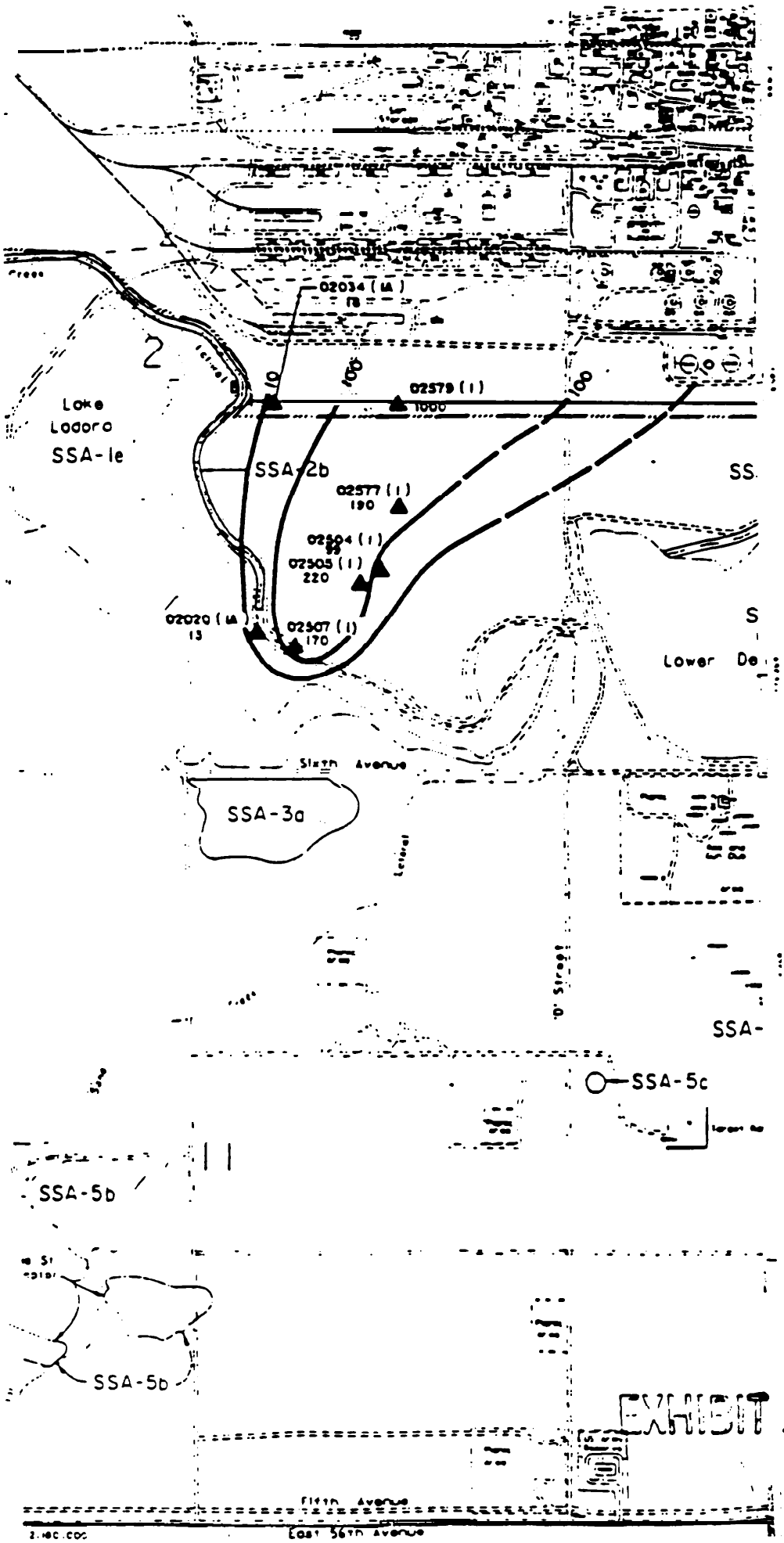
PLATE 1

Summed Target Organic Analyte Plume Map for Unconfined Flow System

Rocky Mountain Arsen al

Prepar ed by: Foster Wheeler Environmen tal Corporation

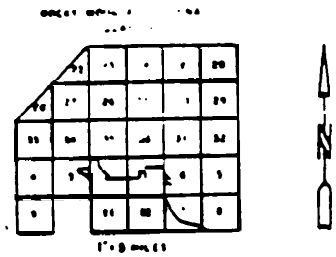
4



LEGEND

- Improved Road
- Unimproved Road
- Railroad Tracks
- Existing Structure
- Former Structure
- Fence
- 6 Section Number
- Stream or Ditch
- Study Area Boundary
- 174,000 State Plane Grid
- 02579(I) 1000 Well (Water Bearing Zone) Detection in micrograms per liter (ug/l)
- 02014(IA) 3.0 Isolated Detection in micrograms per liter (ug/l)
- 10 Equiconcentration Line, Concentration in (ug/l) (Dashed Where Inferred)
- B B' Cross-section Location

Notes:
All data from Morrison Knudsen Engineers, (1988) and Environmental Science and Engineering, (1987)



0 500 1000
SCALE: 1" = 1000'

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

EXHIBIT I

FIGURE: SSA 3.5-1
Volatile Halogenated Organics
Plume in Water Bearing Zones IA & I
Rocky Mountain Arsenal

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VOLUME VI
SOUTHERN STUDY AREA, FIGURES
VERSION 3.3

June 1989
Contract Number DAAA15-88-D-0024

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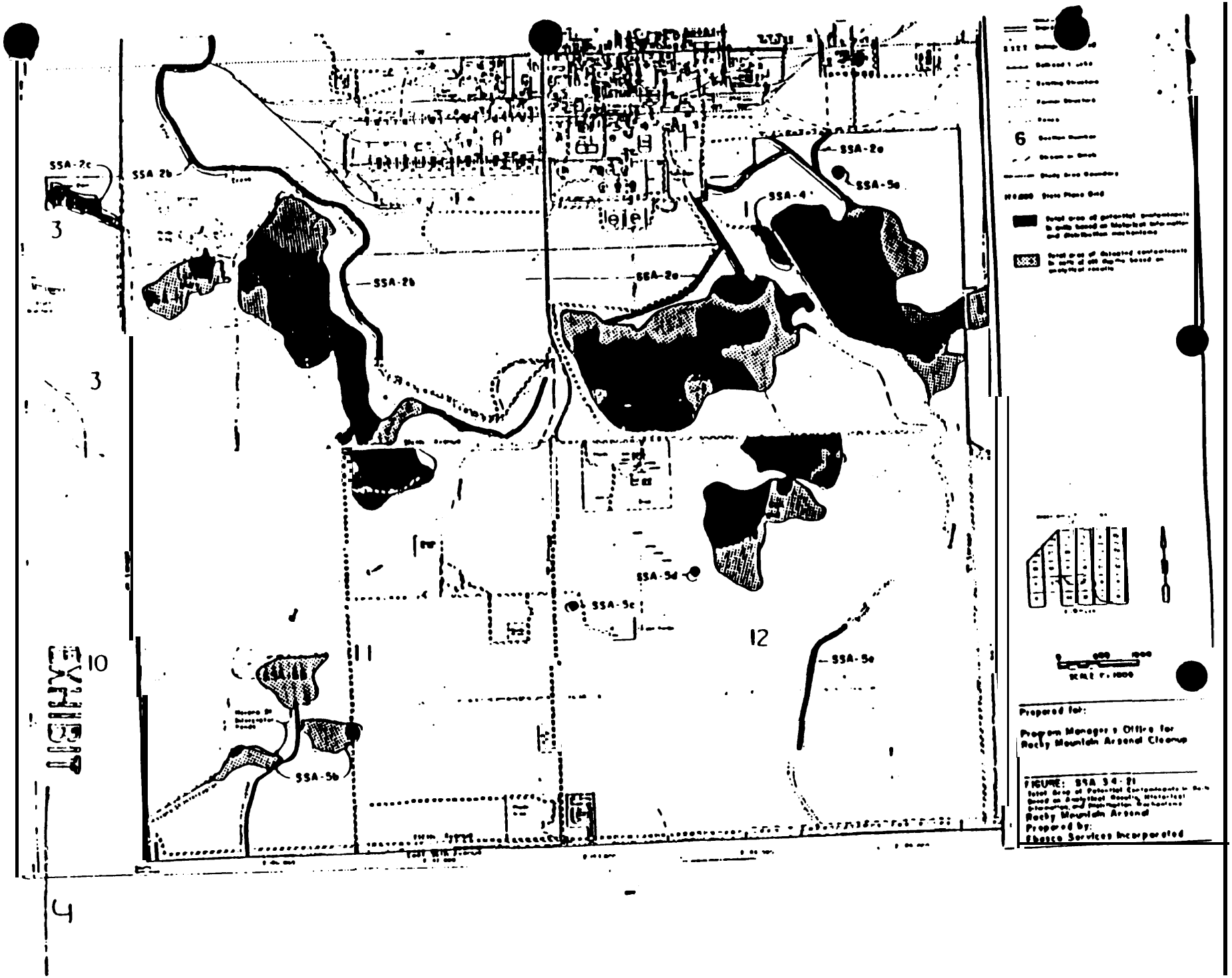
SSA-2c
SSA-2b
SSA-2b
SSA-2a
SSA-5a
SSA-4
SSA-2a
SSA-5d
SSA-5c
SSA-5e
SSA-5b
3
3
10
11
12
6
4
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup
FIGURE: SSA 34-21
Rocky Mountain Arsenal
Prepared by:
Ebasco Services Incorporated

FIGURES
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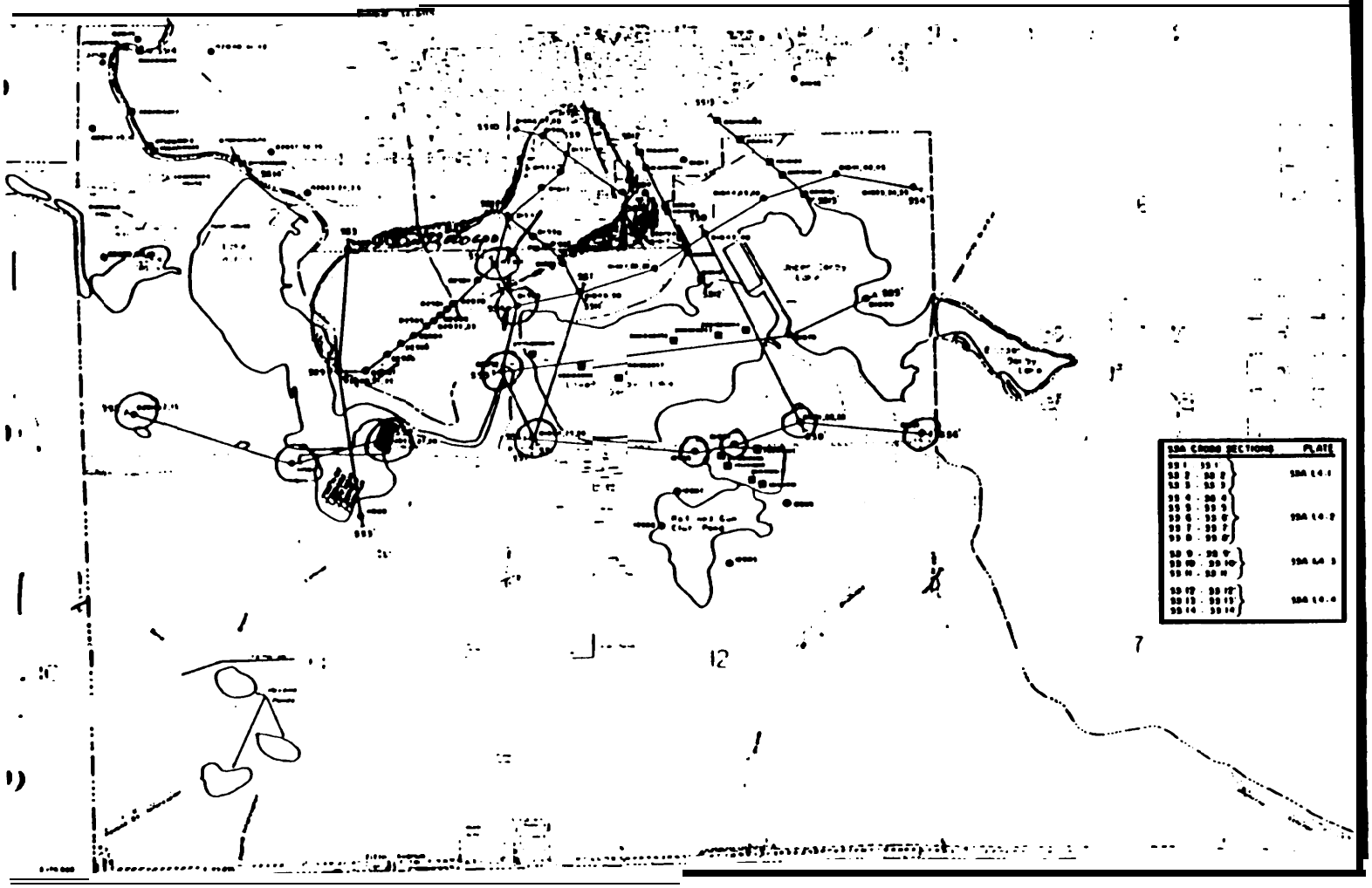

EXHIBIT K

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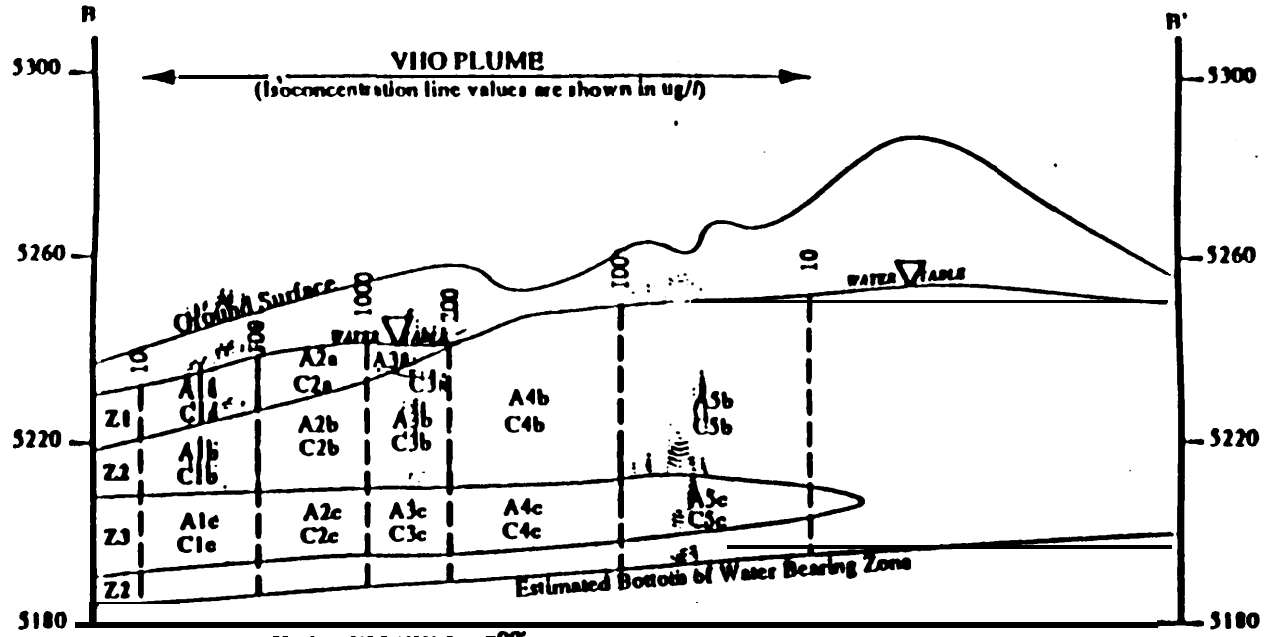
A1a= 5000	sqft	C1a= 59.5	ug/l
A2a= 3980	"	C2a= 340	"
A3a= 880	"	C3a= 740	"
A1b= 8750	"	C1b= 61.4	"
A2b= 12,200	"	C2b= 609	"
A3b= 13,200	"	C3b= 547	"
A4b= 22,000	"	C4b= 148	"
A5b= 35,300	"	C5b= 49.2	"
A1c= 7750	"	C1c= 53.5	"
A2c= 7690	"	C2c= 535	"
A3c= 6160	"	C3c= 600	"
A4c= 8990	"	C4c= 148	"
A5c= 8720	"	C5c= 74.3	"



Horizontal Scale: 1" = 800'
Vertical Scale: 1" = 40'

Z1 = ALLUVIUM
Z2 = DENVER FORMATION CLAYSTONE
Z3 = DENVER FORMATION SANDSTONE

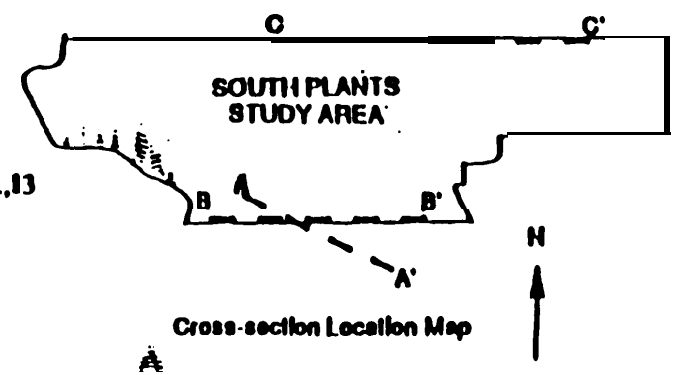
TOTAL PLUME AREA = A_{TOT} = 138,520 sq ft

AVERAGE HYDRAULIC CONDUCTIVITY (Z1) = K_1 = 0.02 cm/sec
AVERAGE HYDRAULIC CONDUCTIVITY (Z2) = K_2 = 0.001 cm/sec
AVERAGE HYDRAULIC CONDUCTIVITY (Z3) = K_3 = 0.008 cm/sec

AVERAGE HYDRAULIC GRADIENT = I = 0.015

GROUNDWATER FLOW RATE = Q_{TOT} = (21,203)(K)(A)(i) = 192,000 gpd

CONTAMINANT MASS FLOW RATE = M_{TOT} = $(3.7854 \times 10^{-6})(Q_{TOT}/A_{TOT})[\sum C_n A_n]$; n = 1,2,...,13
= 183 grams/day



Cross-section Location Map

Conversion Factor (q=21,203; m=3.7854 x 10^{-6})

Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE SPSA 3.5-1
Contaminant Mass Flow Rate Across Section B-B' of Volatile Halogenated Organics Plume

Rocky Mountain Arsenal, RPSS
Prepared by: Ebasco Services Incorporated, May 1989

EXHIBIT K. Supplement

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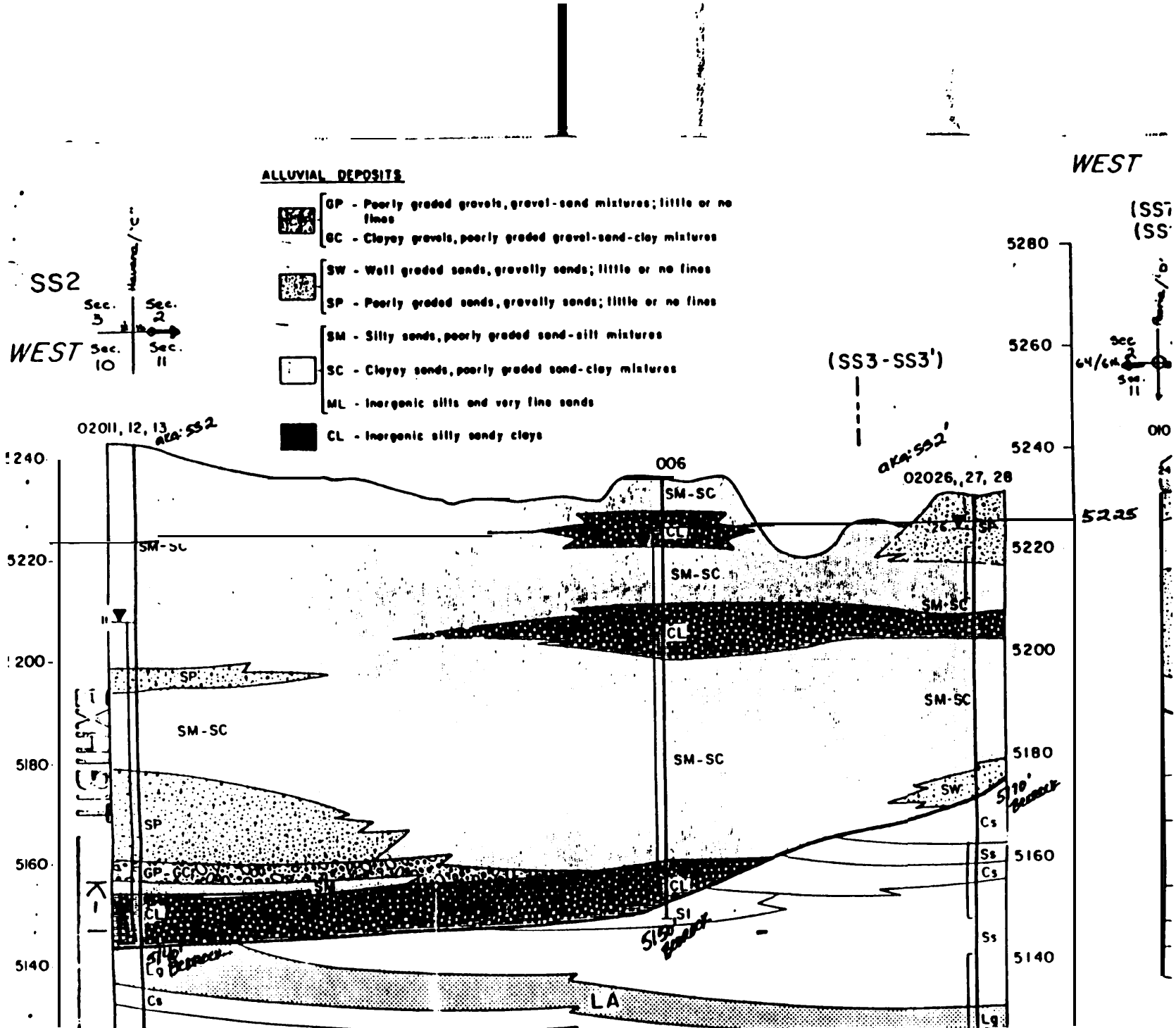
ALLUVIAL DEPOSITS
GP - Poorly graded gravels, gravel-sand mixtures; little or no fines
GC - Clayey gravels, poorly graded gravel-sand-clay mixtures
SW - Well graded sands, gravelly sands; little or no fines
SP - Poorly graded sands, gravelly sands; little or no fines
SM - Silty sands, poorly graded sand-silt mixtures
SC - Clayey sands, poorly graded sand-clay mixtures
ML - Inorganic silts and very fine sands
CL - Inorganic silty sandy clays
SS2
WEST
Sec. 3
Sec. 2
Sec. 10
Sec. 11
WEST
(SS3-SS3')
02011, 12, 13
aka: SS2
006
02026, 27, 28
aka: SS2'
5280
5260
5240
5225
5220
5200
5180
5160
5140
SM-SC
CL
SP
SW
GP-GC
SI
Cs
Ss
Lg
LA

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R. L. STOLLAR AND ASSOCIATES

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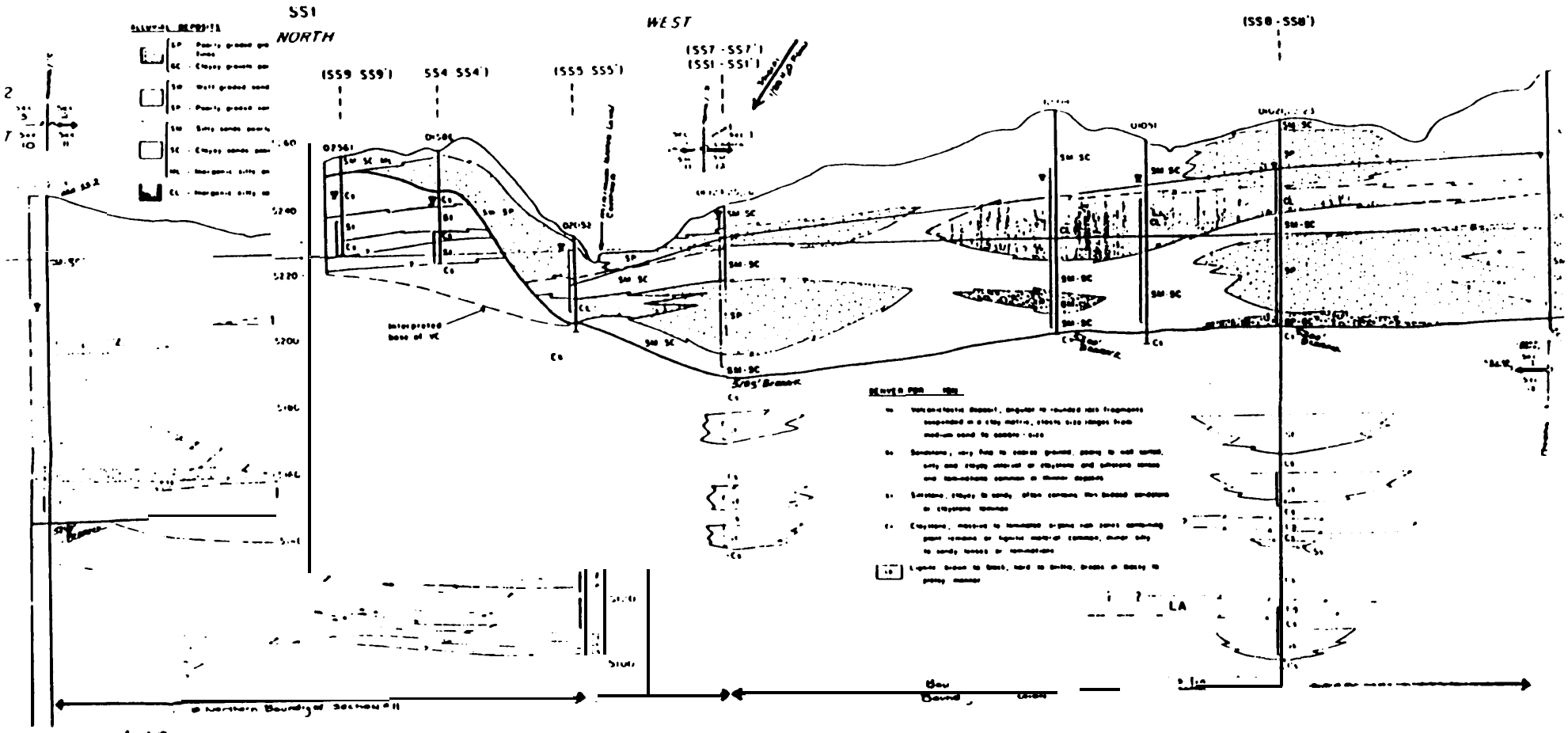

ATTACHMENT A-2

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R.L. STOLLAR AND ASSOCIATES

PREPARED FOR:

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR
ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

THE INFORMATION AND CONCLUSIONS PRESENTED IN THIS REPORT REPRESENT THE OFFICIAL POSITION OF THE DEPARTMENT OF THE ARMY UNLESS EXPRESSLY MODIFIED A SUBSEQUENT DOCUMENT. THIS REPORT CONSTITUTES THE RELEVANT PORTION OF THE ADMINISTRATIVE RECORD FOR THIS CERCLA OP ERABLE UNIT.

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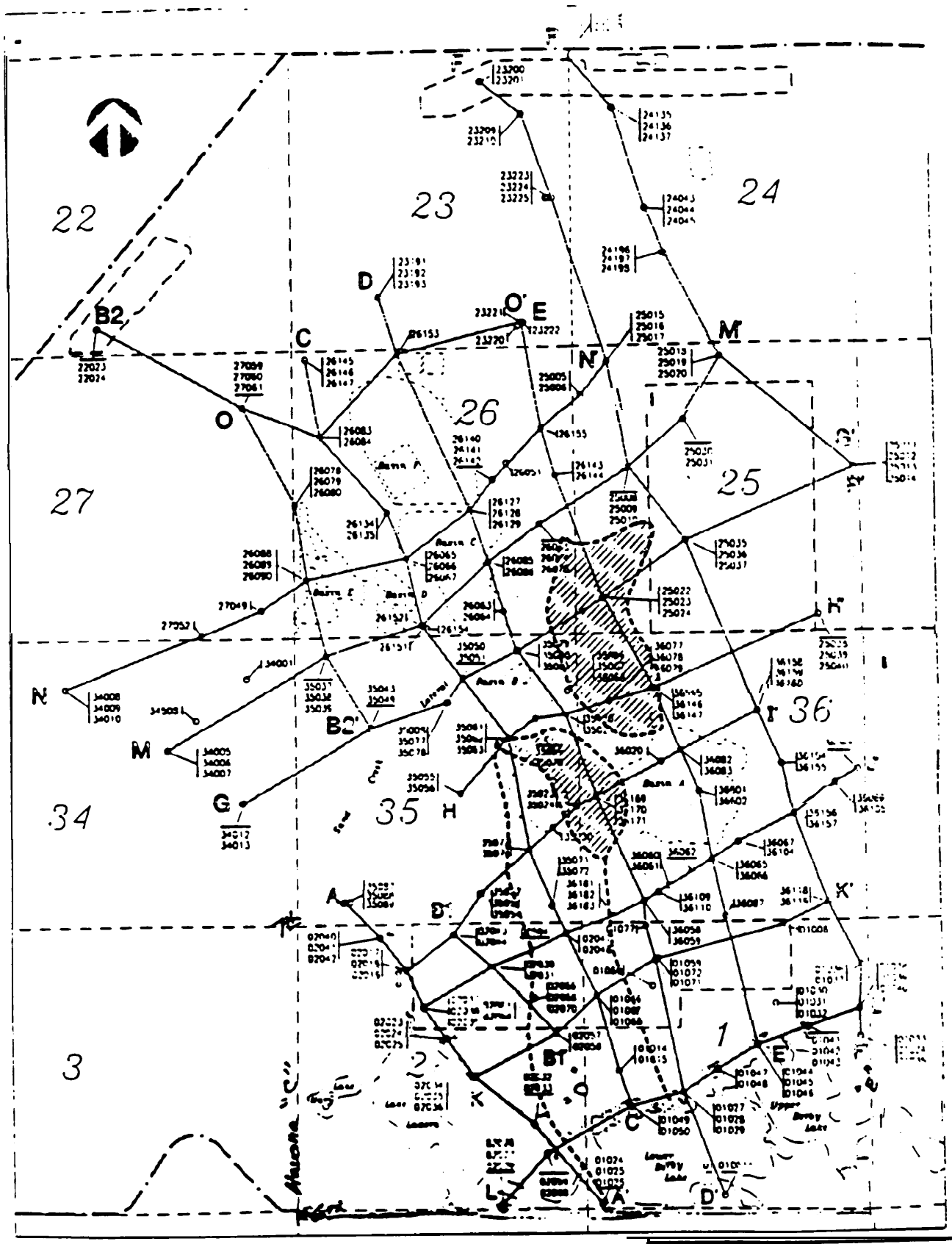


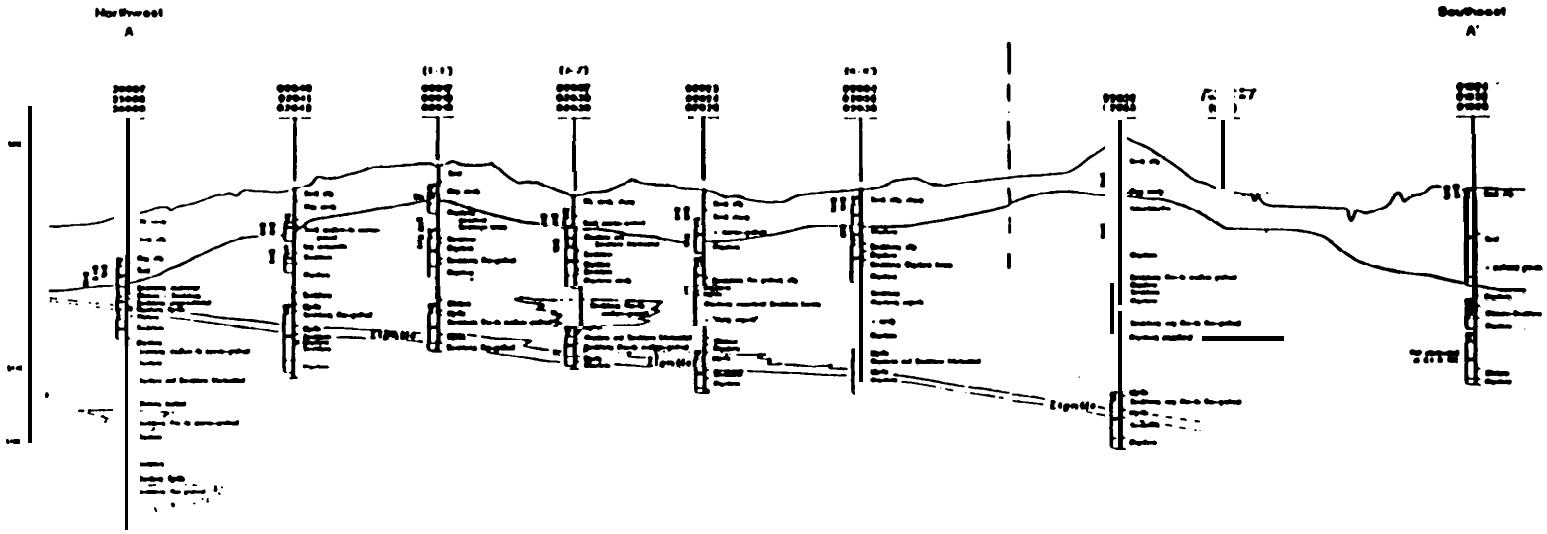
Rocky Mountain Arsenal

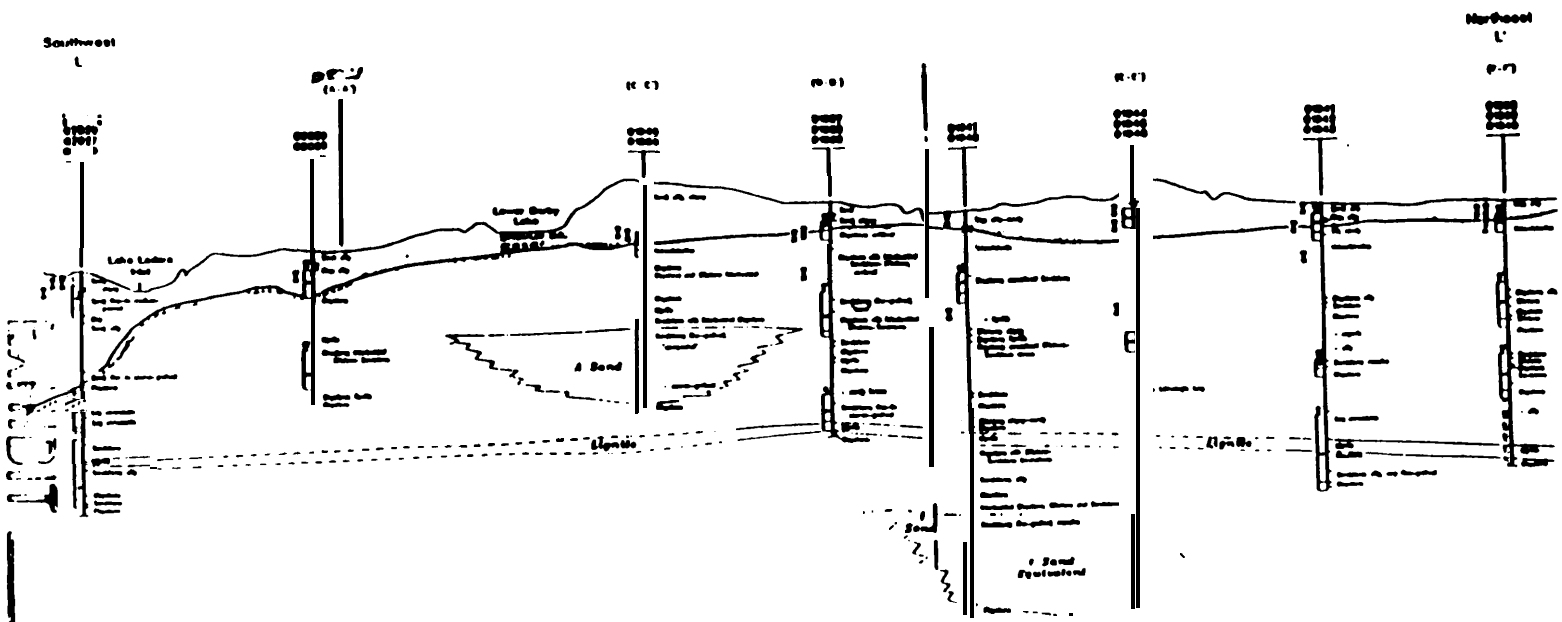
A Sand Extent and Subcrop

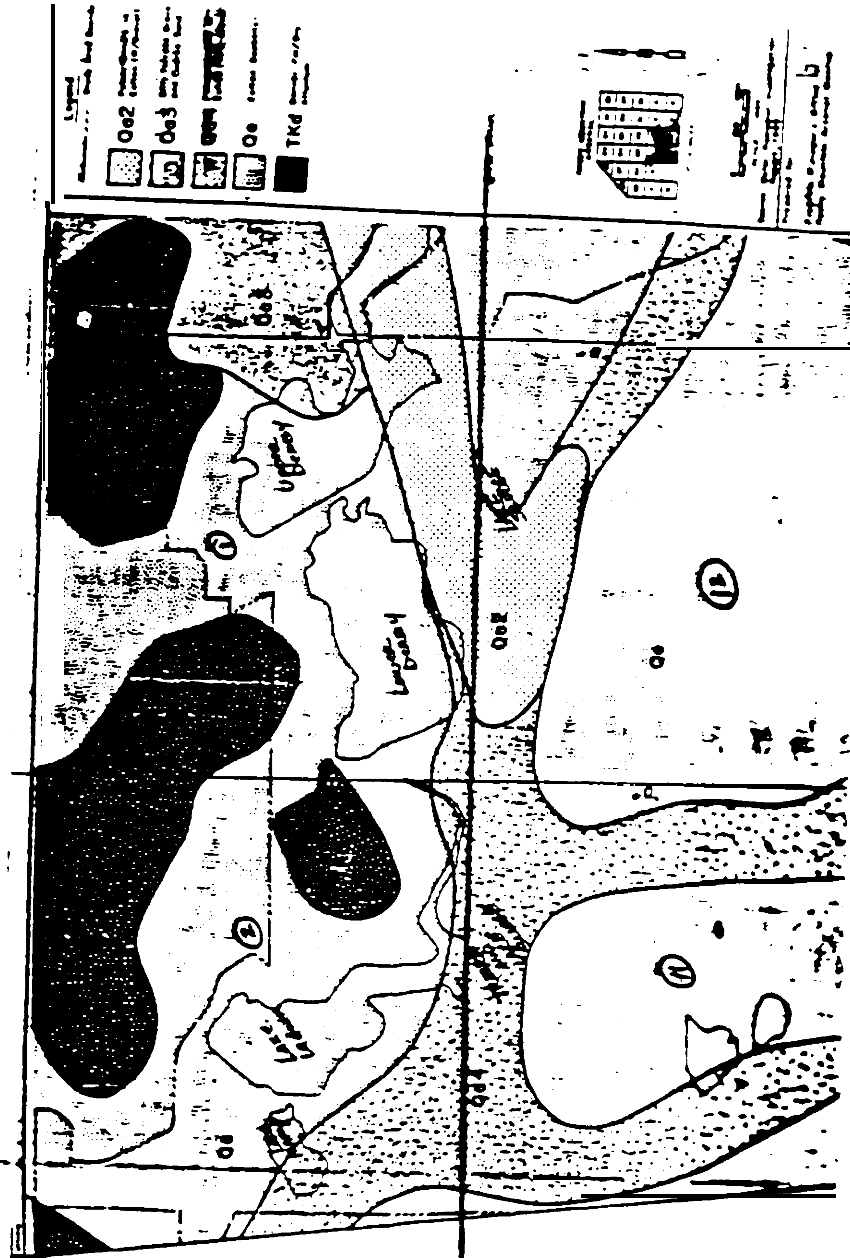
MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

PLATE 2

EXHIBIT


Northwest
A
Southeast
A'


Southwest
L
Northeast
L'



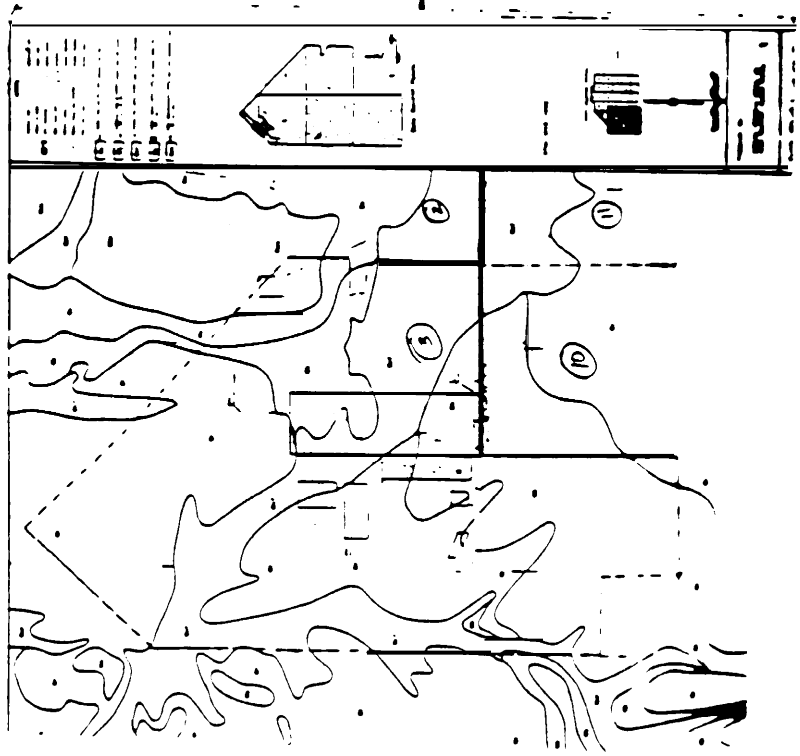


EXHIBIT M

89166R01
FIGURES
2ND COPY

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TECHNICAL SUPPORT FOR

ROCKY MOUNTAIN ARSENAL

Rocky Mountain Arsenal
Information Center
Commerce City, Colorado

FINAL REMEDIAL INVESTIGATION REPORT
VOLUME VI
SOUTHERN STUDY AREA, FIGURES
VERSION 3.3

June 1989
Contract Number DAAA15-88-D-0024

PREPARED BY

EBASCO SERVICES INCORPORATED
APPLIED ENVIRONMENTAL, INC.
CH2M HILL DATACHEM, INC.
R.L. STOLLAR AND ASSOCIATES

PREPARED FOR:

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR
ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

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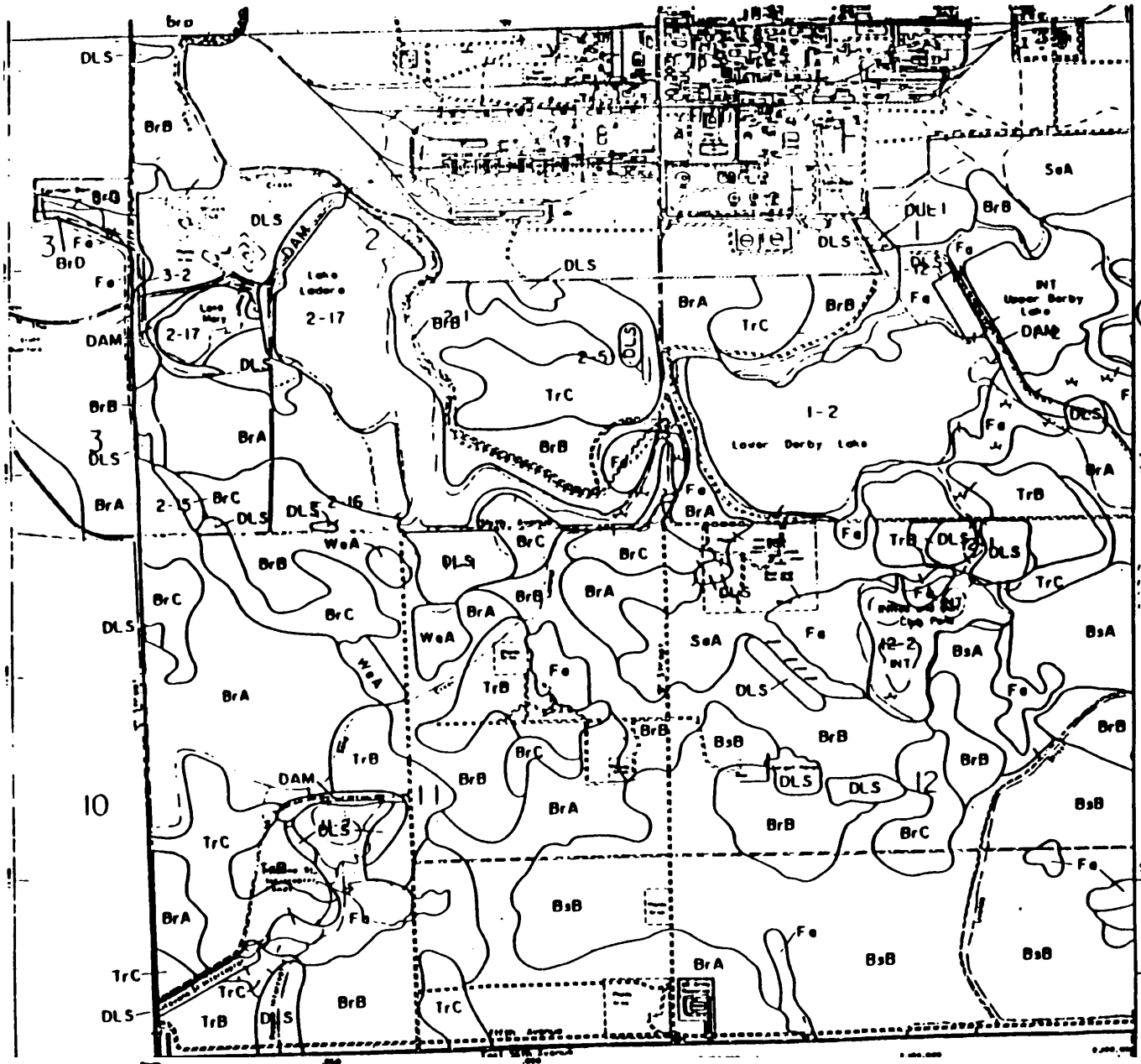

Source JP Walsh & Assoc. Inc., 1988

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup

FIGURE: SSA 1.4-2
Soils Map of the
Southern Study Area
Rocky Mountain Arsenal
Prepared by:
Ebasco Services Incorporated

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FIGURES
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TECHNICAL SUPPORT FOR

ROCKY MOUNTAIN ARSENAL

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Information Center
Commerce City, Colorado

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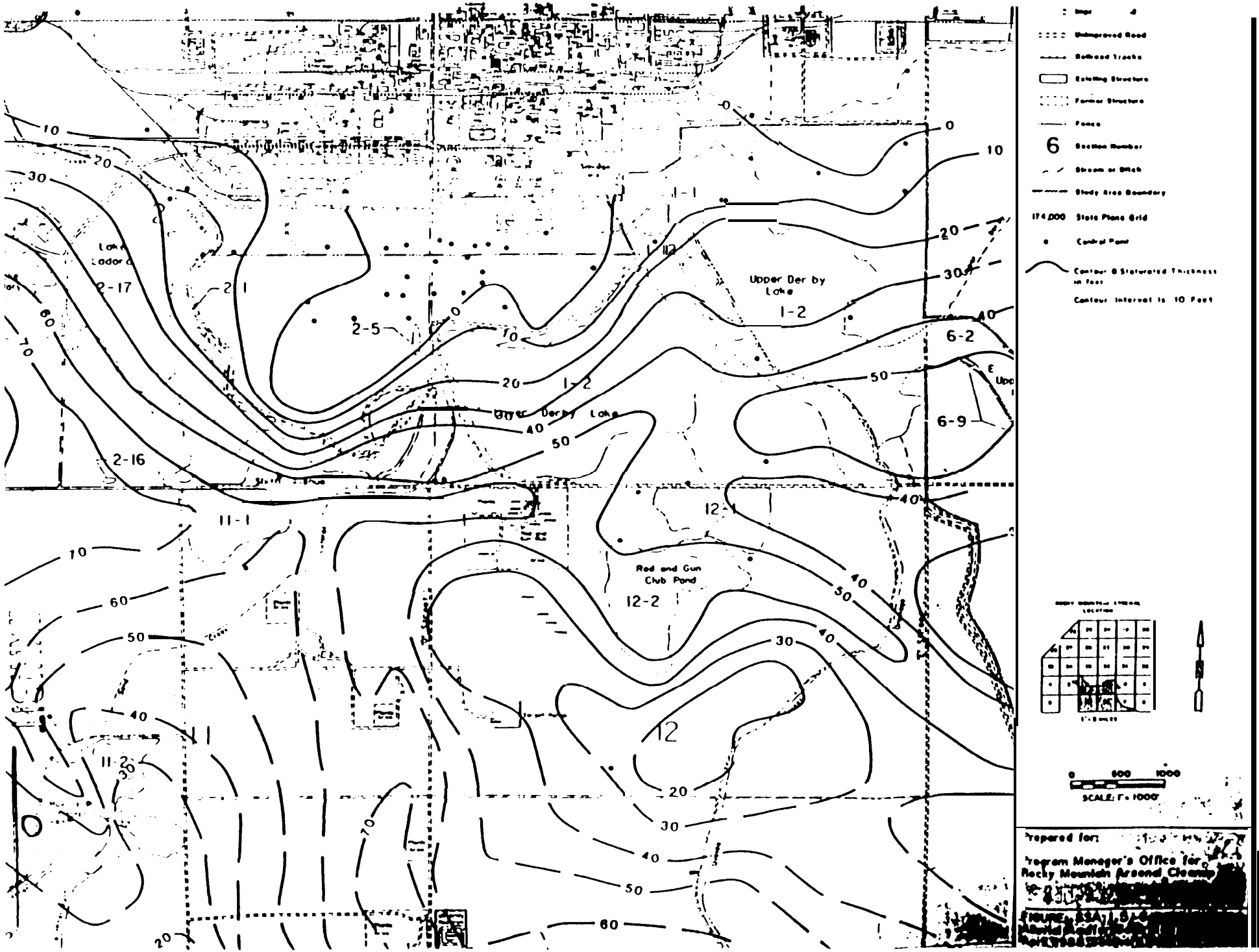
Unimproved Road
Railroad Tracks
Existing Structure
Former Structure
Fence
6 Section Number
Stream or Ditch
Study Area Boundary
174,000 State Plane Grid
Control Point
Contour & Saturated Thickness in Feet
Contour Interval is 10 Feet
Upper Derby Lake
Upper Derby Lake
Rod and Gun Club Pond
Lake Ladora
1-2
2-5
2-17
2-16
6-2
6-9
11-1
11-2
12-1
12-2
12
0
10
20
30
40
50
60
70
0
500
1000
SCALE: 1" = 1000'
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup

89166R01
FIGURES
2ND COPY

FILE COPY

TECHNICAL SUPPORT FOR

ROCKY MOUNTAIN ARSENAL

Rocky Mountain Arsenal
Information Center
Commerce City, Colorado

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REMEDIAL INVESTIGATION REPORT
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EBASCO SERVICES INCORPORATED
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R.L. STOLLAR AND ASSOCIATES

PREPARED FOR:

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR
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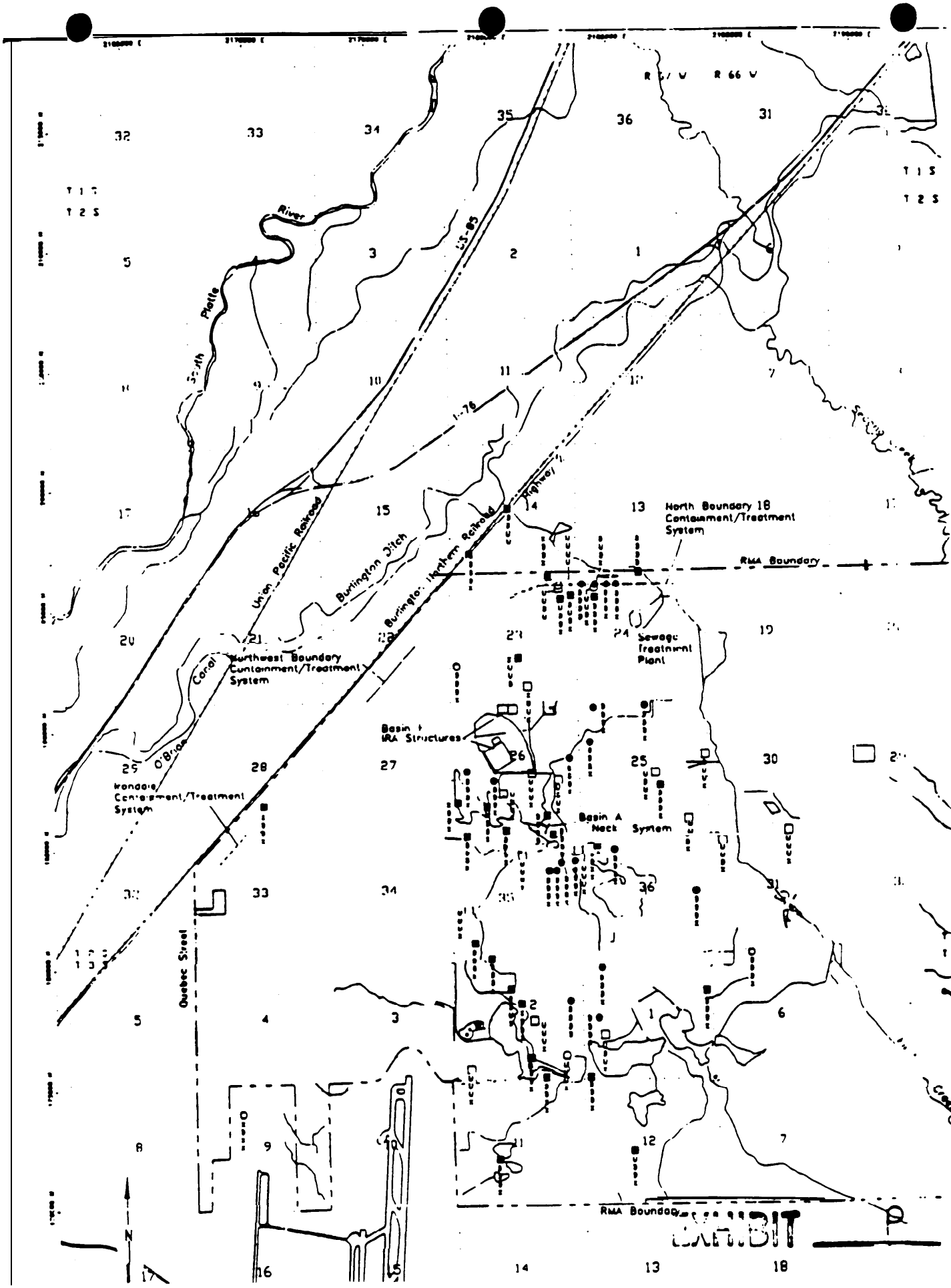
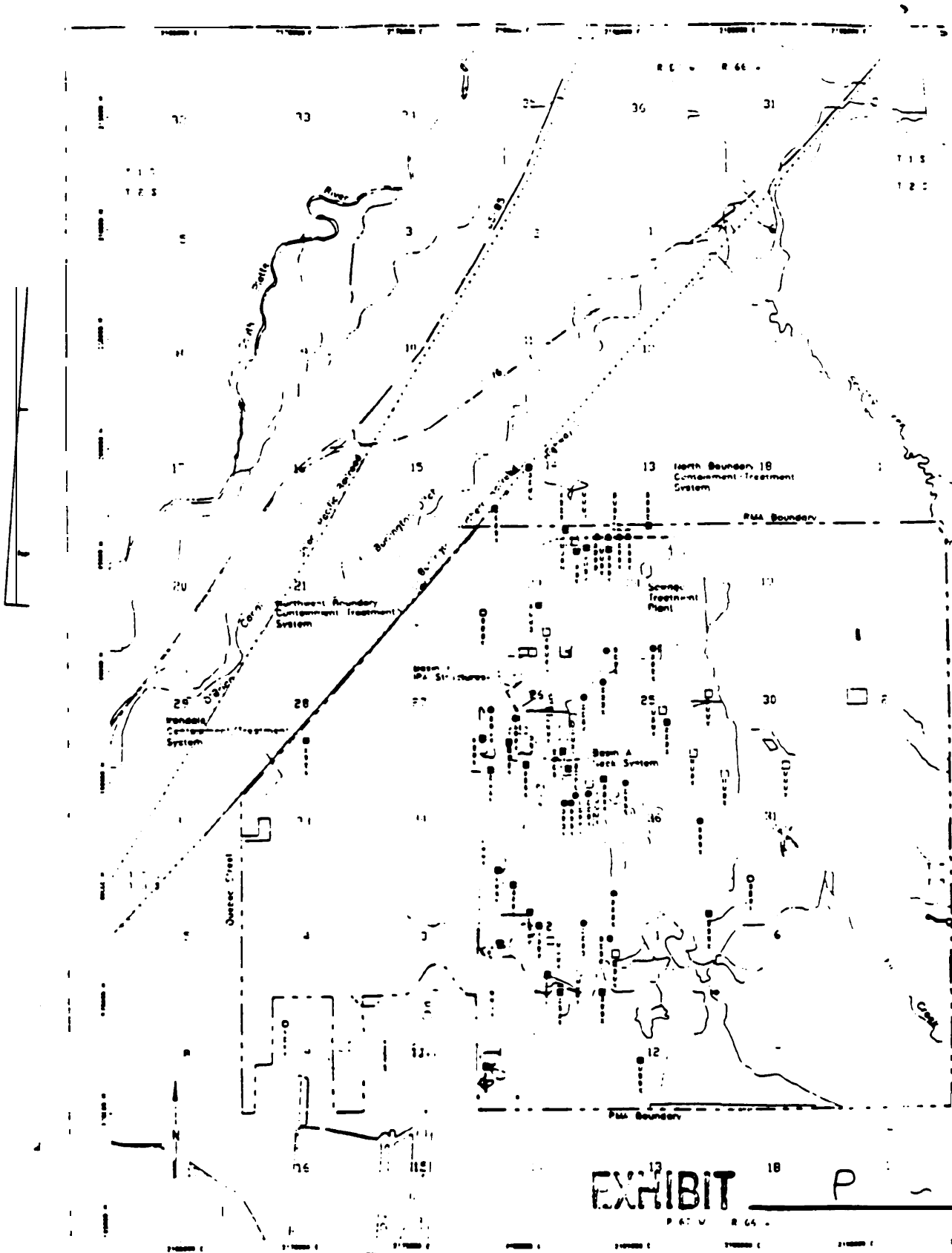
EXHIBIT O



R 66 W
T 1 S
T 2 S
South Platte River
US-85
I-76
Union Pacific Railroad
Burlington Ditch
Burlington Northern Railroad
Highway 2
North Boundary 18
Containment/Treatment
System
RMA Boundary
Sewage
Treatment
Plant
Northwest Boundary
Containment/Treatment
System
Canal
O'Brian
Irondale
Containment/Treatment
System
Basin F
IRA Structures
Basin A
Neck System
Quebec Street
RMA Boundary
N
EXHIBIT



EXPLANATION

Average Annual Upward Vertical Gradient

○ Unconfined Confined Well Cluster

□ Unconfined Alluvial/Unconfined Denver Formation Well Cluster

Average Annual Downward Vertical Gradient

● Unconfined Confined Well Cluster

■ Unconfined Alluvial/Unconfined Denver Formation Well Cluster

Cluster Site ●

First Quarter

Second Quarter

Third Quarter

Fourth Quarter

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

Pacific Western Technologies

Figure 4.4

Approximate Vertical Gradient
Direction at Cluster Sites
October 1, 1991 to
September 30, 1992

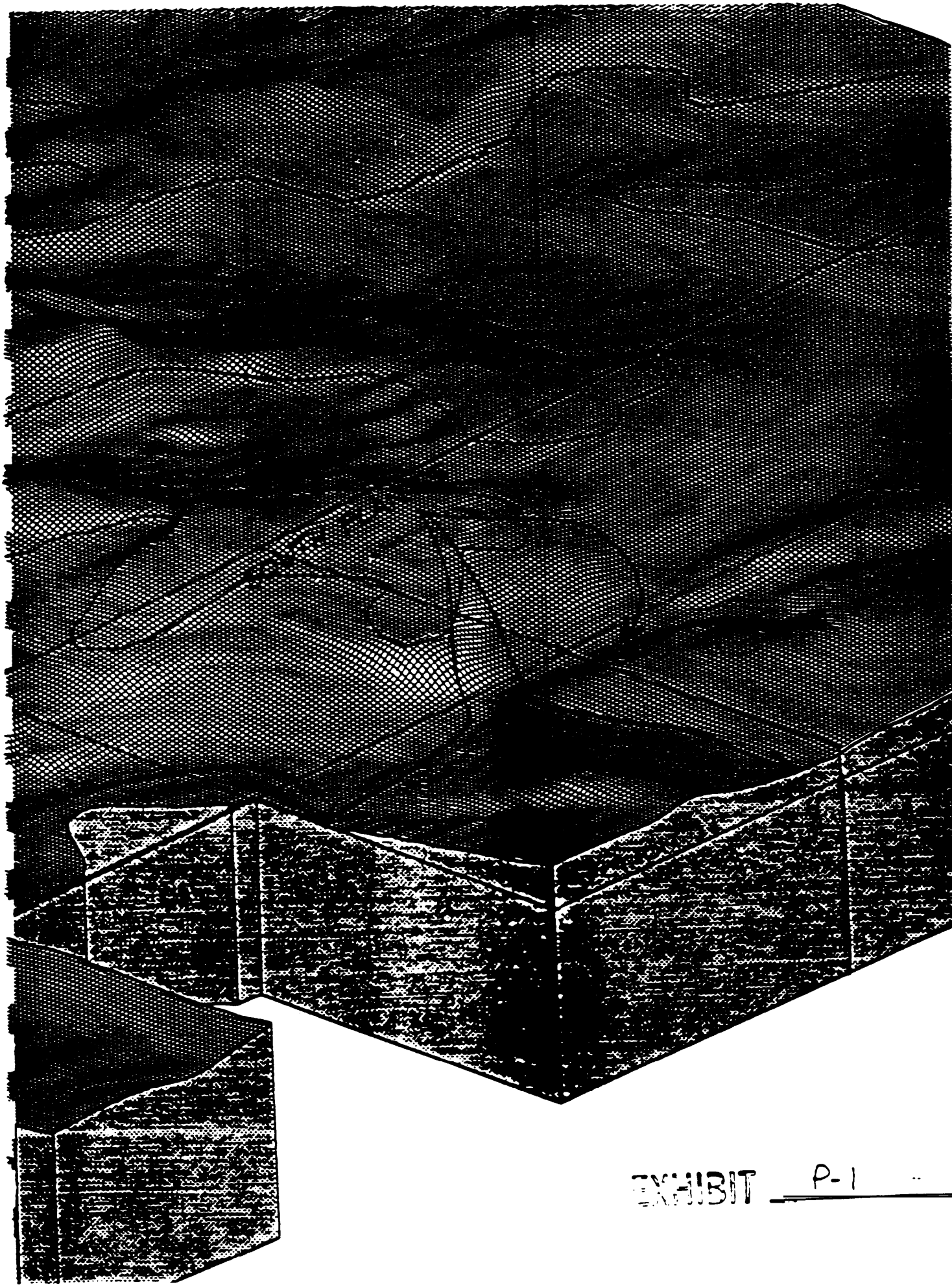
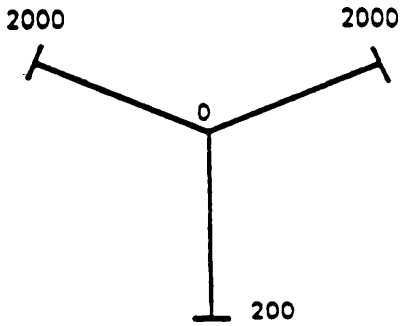


EXHIBIT P-1

150

Scale in Feet



Scale in Feet

Vertical Exaggeration 1 0X

Prepared for:

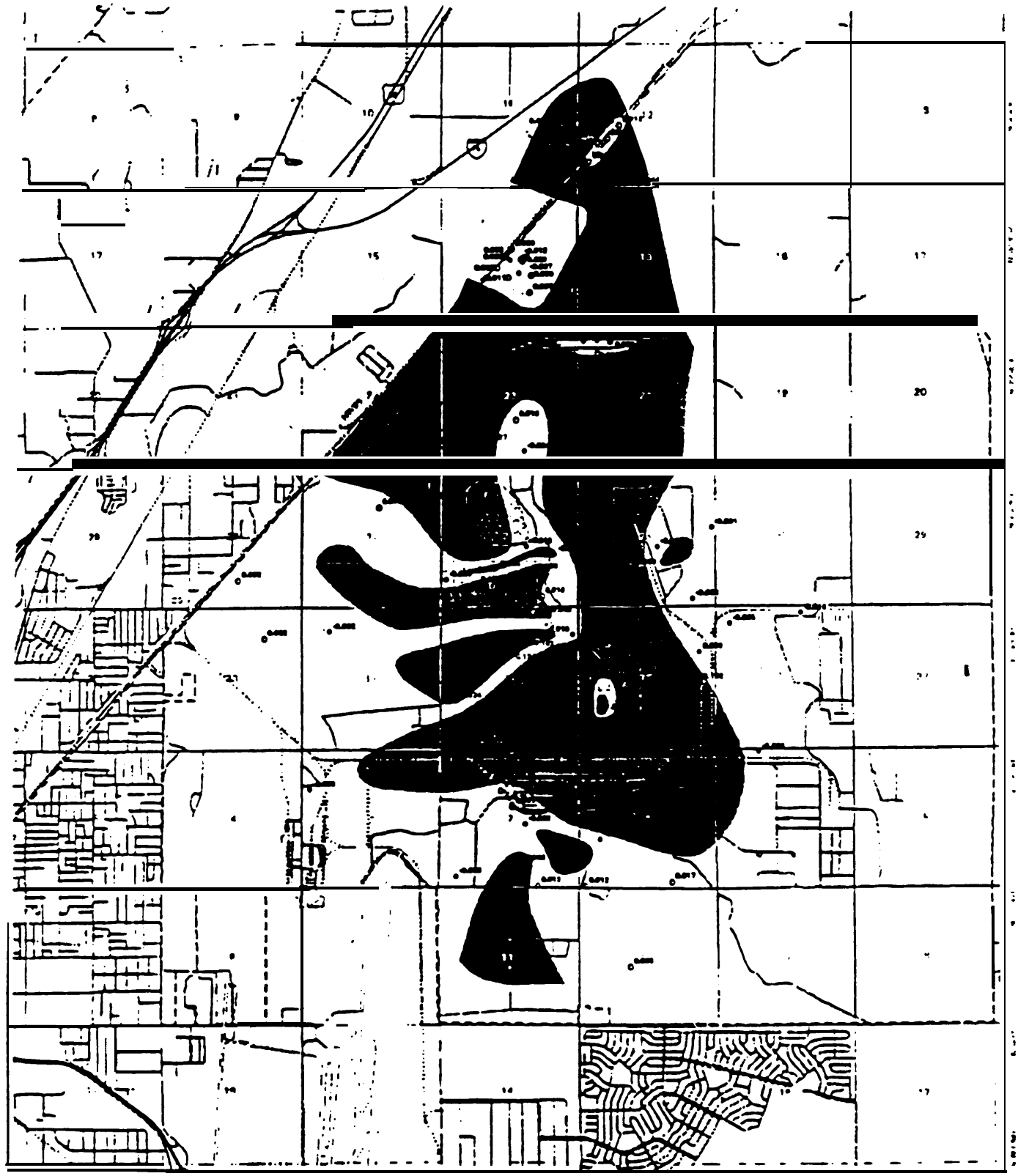
Program Manager for
Rocky Mountain Arsenal
Contamination Cleanup

PLATE 5.6 - 1

Integrated Soil and Groundwater Contaminant Distribution

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated



Explanation

Vertical Gradients

- >0.02 ft/ft down
- 0.02 ft/ft down to 0.02 ft/ft up
- >0.02 ft/ft up
- isogradient line (dashed where inferred)

Vertical gradients are calculated between an unconfined flow system well and the shallowest confined flow system well within 50 feet

- Arsenal boundary
- Section line
- 12 Section number
- Well cluster and gradient, downward gradient
- Well cluster and gradient, upward gradient

Containment system

- Recharge trench / Barrier wall
- Hydraulic barrier / Physical barrier

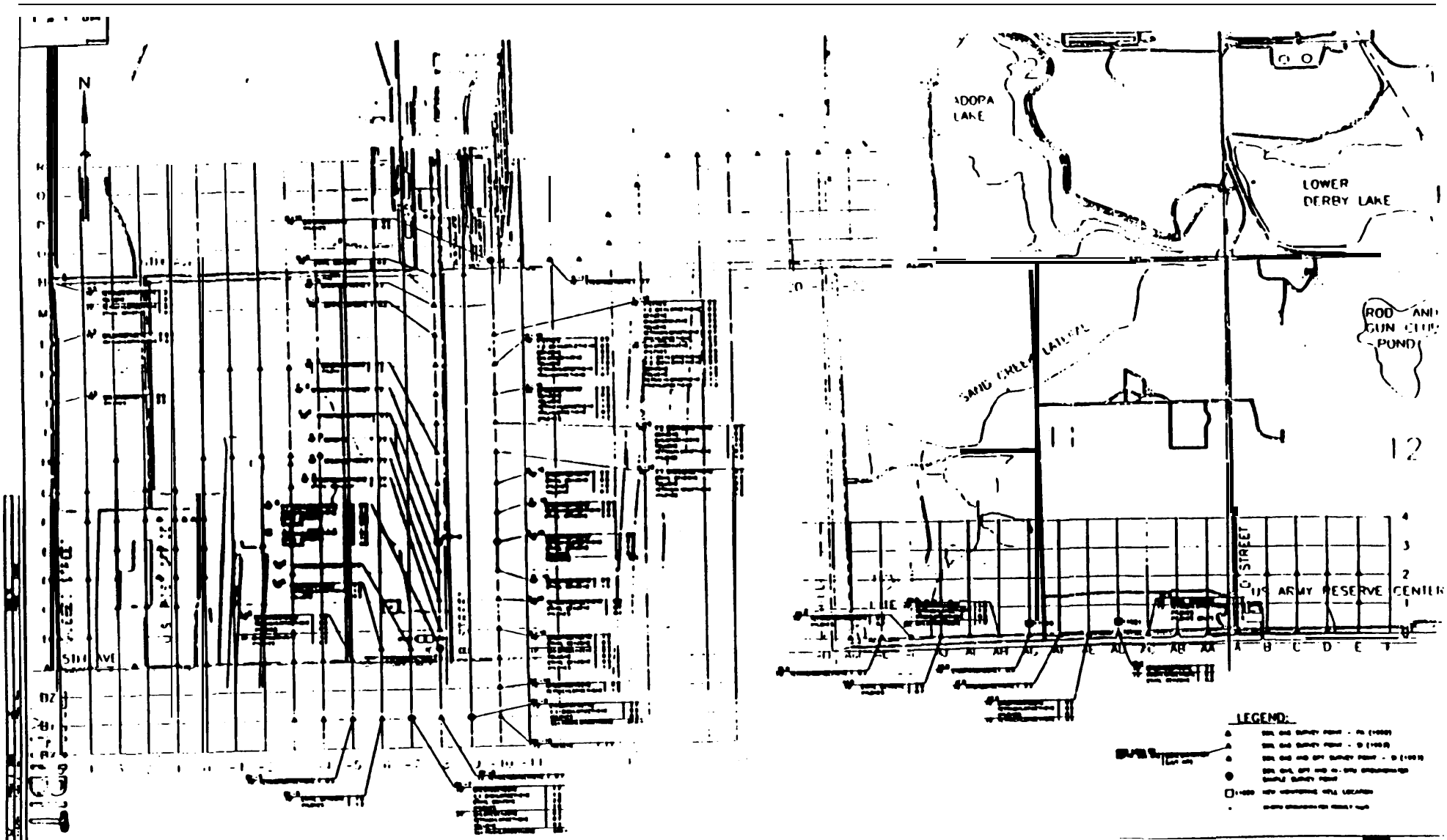
NBS	North Boundary System
NWBS	Northwest Boundary System
ICS	Irondale Containment System
FCPS	First Creek Pathway System
NPS	Northern Pathway System
BAWS	Basin A Neck System

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:
Harding Lawson Associates

Figure 4.16
Generalized Vertical Gradient Contour Map, Water Year 1993

GWAR FY93



Woodward-Clyde Federal Services

ROCKY MOUNTAIN ARSENAL COMMERCE CITY, COLORADO

SI SOIL GAS SURVEY AND IN-SITU GROUNDWATER DETECTED ANALYTE RESULTS FOR RMA LEASED AND TRANSFERRED LANDS

FIG. 4-1

Modified Preliminary Assessment
Site Investig. Report
Leased & Transferred RMA
Facilities & Land

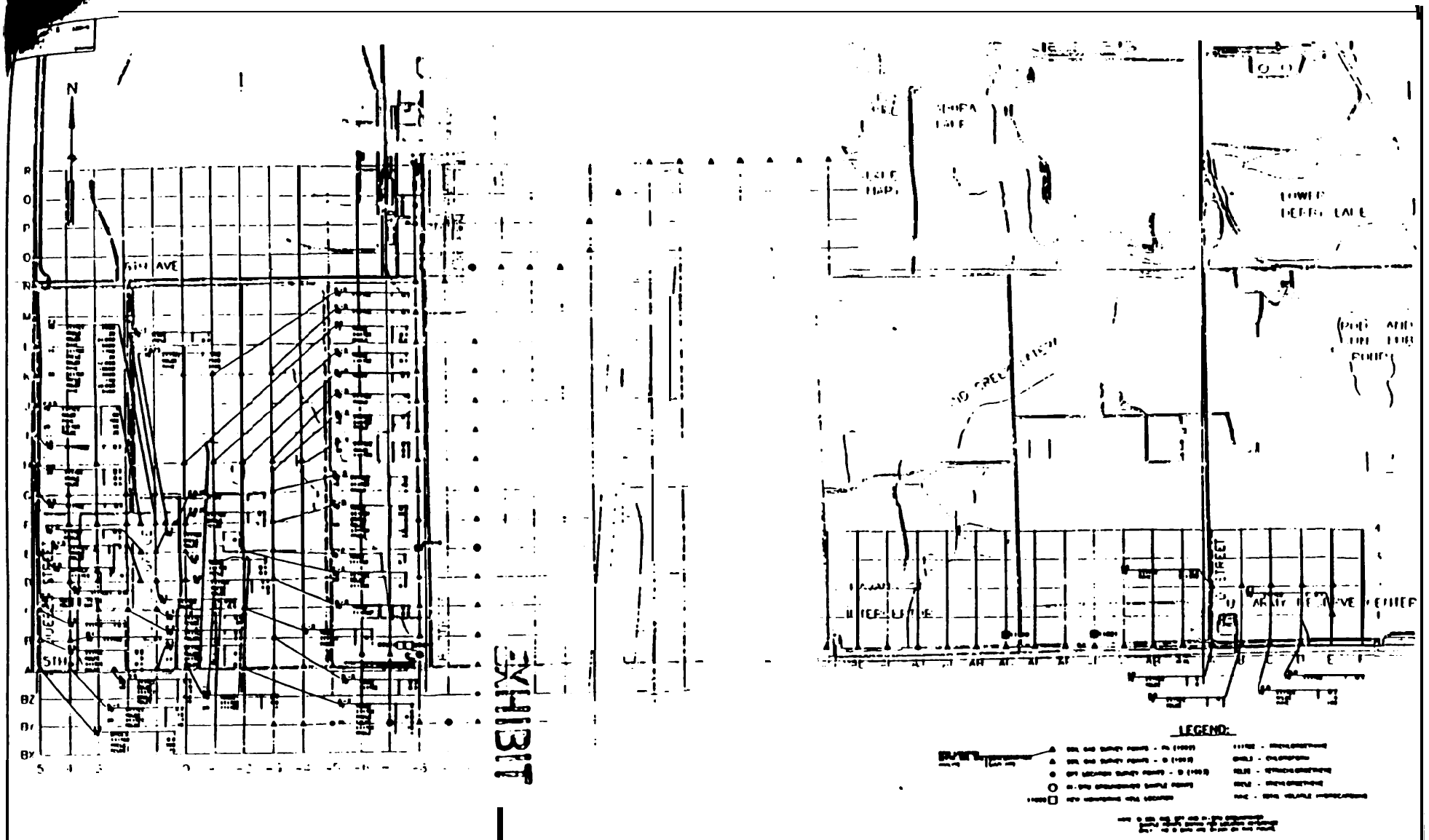
Vol. I

Oct 1994

Final Version

by Woodward-Clyde
Consultants

EXHIBIT R



Woodward-Clyde Federal Services

ROCKY MOUNTAIN ARSENAL COMMERCE CITY COLORADO

PA SOIL GAS SURVEY DETECTED ANALYTE RESULTS FOR RMA LEASED AND TRANSFERRED LANDS

EXHIBIT

R-1

Modified Preliminary Assessm
Site Investig. Report
Leased & Transferred RMA
Facilities & Land

Vol. I

Oct 1994

Final Version

by Woodward-Clyde
Consultants

EXHIBIT R-1

October 13, 1995

Mr. John Yelenick
3650 South Dahlia
Denver, CO 80237-1002

Dear Mr. Yelenick:

Thank you for discussing your project at the Rocky Mountain Arsenal (RMA)with me in July. At the time, I was interested in pursuing a cooperative agreement for the Bureau of Mines to utilize the RMA site for our research in geophysical characterization of contaminated mine and mill sites. A preliminary assessment of the RMA, and review of the data available for the area in sections 11 and 12 south of the South Plant indicated that a fairly complex hydrologic regime exists in the area, and that there is a high probability that contamination is escaping the RMA boundary in a southerly direction. This conclusion is drawn based on the following documented information you provided:

1. Contamination in the area of the South Plant increased significantly from the period 1979-1983 to the period 1988-1989, even though the plant was inactive.

2 Disposal ponds at the South Plant are unlined, resting on permeable alluvium at groundwater level in the unconfined aquifer.

3. Contaminants were detected and theorized into sections 11 and 12 in 1989, and more recently at the southern boundary of the RMA.

4. A plume to the southwest of South Plant is documented, in addition to the groundwater "mound" existing under South Plant which causes radial flow in all directions.

5. While most sampling of soils and groundwater have been in the upper unconfined aquifer, contamination has also been found in the "A" sand beneath the South Plant central processing area.

6. Paleochannels of permeable sand occuring in the area are not well defined, and may be influencing groundwater flow, as well as the connectivity of the upper and lower acquifers The aquitard above the "confined" acquifer may have been scoured allowing communication between the upper and lower aquifers

7. Indications from recent studies (1994) indicate that ground-water flow occurs over channel divides (ridges) and through the lower Denver aquifer as well.

8. As recently as March of this year, the limited well coverage was insufficient to evaluate flow within the confined aquifer.

EXHIBIT S

As I indicated to you in our discussions, my work for the Bureau of Mines has applied non-destructive surface geophysical surveys to map the ground-water channeling at mine waste sites. I have discussed the relevant aspects of the RMA mentioned above with hydrologists and geologists at the Denver Research Center of the Bureau of Mines who concur that there is a high potential for contamination of groundwater off the south boundary of RMA from sources in the South Plant Area. Since the Federal Facility Agreement requires that groundwater quality at the RMA boundary must be protective of off-post receptors, it is recommended that the area south of the South Plant in sections 11 and 12 be evaluated to determine the source of contaminants measured at the southern boundary in the unconfined aquifer. The deeper confined aquifer in the Denver formation should also be sampled to determine if, and to what extent the two aquifers are in communication and whether contaminants are escaping the RMA in the lower ground-water system.

I would recommend an integrated geophysical survey in sections 11 and 12 similar to the work performed by John Nicholl, Jr. and Kathryn Cain (Proceedings, SAGEEP '92, v. 1) in the Northwest Boundary Containment System. Interpretation of such surveys will provide a better model of the subsurface geohydrologic regime and determine the best locations for monitoring wells to intercept possible ground-water migratory pathways.

You may not be aware that my agency has been abolished and is scheduled for closure within 90 days from October 1. This is unfortunate since I feel that we had some unique resources to use in a geophysical characterization project such as yours; however, a cooperative effort is not feasible with the Bureau of Mines at this time. I would be happy to discuss or elaborate on my recommendations for additional characterization of migratory ground-water pathways at RMA.

Please feel free to call me at 236-0777 x691.

Sincerely,

James J. Snodgrass
Geophysicist
11671 W. Asbury Pl.
Lakewood, CO 80228

EXHIBIT S

James J. Snodgrass
Environmental Geophysicist

11671 W. Asbury Place
Lakewood, CO 80228
Daytime: (303) 236-0777 x691 Evening: (303) 986-1868

Objective

Position as Geophysicist or Consultant in an organization responsible for environmental site characterization and remediation planning.

Career Summary

My most recent efforts for the US Bureau of Mines developed near-surface geophysical methods to characterize abandoned mine wastes for remediation planning. I completed the required OSHA training for hazardous waste workers; consequently, my specific area of interest and expertise is the interpretation of hydrologic and geologic conditions at contaminated sites. Prior experience with the US Bureau of Mines entailed management of projects to develop and apply geophysical methods for mineral exploration, and for remote detection of geologic hazards. After graduation and command service in the Corp of Engineers, I entered private industry as a geophysicist with a seismic exploration contractor, attaining the position of Assistant Party Chief on a seismic crew, and enhancing my qualifications to conduct theoretical and applied research.

Experience

Geophysicist- June, 1974 to Present
US Bureau of Mines, Denver Research Center

- Principle Investigator for the project "Geophysical Methods to Characterize Minerals-Related Hazardous Waste Sites."
- Conceived, planned, and conducted research and applications for development of geophysical methods to characterize mine wastes.
- Interpreted geologic and hydrologic parameters for successful long-term remediation projects.
- Developed and demonstrated integrated geophysical approach to effect cost-efficient drilling and sampling programs.

- Developed theoretical and physical models to interpret guided wave propagation in coal seams.
- Developed a mine-transportable digital data acquisition system to implement seismic surveys in underground coal mines.
- Developed and demonstrated use of shear-wave sources and detectors for coal mine

EXHIBIT S

seismic surveys.

- Established feasibility of in-seam seismic methods at operating underground coal mines.
- Developed and demonstrated a borehole radar probe to remotely locate faults.
- Developed a cross-borehole seismic system for application to coal exploration.
- Planned and coordinated field studies to demonstrate mining applications of borehole geophysical techniques.

Geophysicist- October, 1970 to June, 1974
US Bureau of Mines, Twin Cities Research Center

- Designed and implemented studies to determine seismic effects of underground mine blasting.
- Recorded ground vibrations from underground blasting; reduced and analysed data to correlate blasting parameters with experimental results.

Temporary Assistant- June, 1970 to October, 1970
US Bureau of Mines, Intermountain Field Operations Center

- Conducted mineral investigations in wilderness and primitive areas, including mapping, sampling, and records search and documentation.

Assistant Party Chief- January, 1967 to May, 1970
Geophysical Service, Inc.

- Established data quality assurance, determined processing parameters, and interpreted seismic surveys for oil exploration.

Combat Engineer Small Unit Commander- October, 1963 to October, 1966

- Platoon Leader and Company Commander of units responsible for engineering construction and support.

Education

Colorado School of Mines — B.S.- Geophysical Engineer

Other Qualifications

1990- OSHA-required 40-hour training for hazardous waste workers

EXHIBIT S

Publications

1. Snodgrass, J.J. and C.M. Lepper, 1993, Geophysical Characterization of Mineral Waste Sites. Proc. 15th Ann. Mtg. Assoc. of Abandoned Mine Lands Programs, Jackson, WY.

2. Snodgrass, J.J., and D.L. Boreck, 1993, Rock Mass Characterization using Geophysics for Stope Leaching. Proc. SAGEEP, San Diego, CA.

3. Snodgrass, J.J., 1989, Sonic Full-Waveform Applications to Stress Evaluation in Coal Mines. Proc. 3d Int. Symp. on Borehole Geophysics, Las Vegas, NV.

4. Snodgrass, J.J. and Newman, D. A., 1985, An In Situ Technique for the Assessment of Failure in Coal Pillars. Proc. 26th US Symp. on Rock Mech., Rapid City, SD.

5. Snodgrass, J.J., 1985, In-Seam Seismic Surveys Using Controlled-Waveform Source Transducers. Mining Engineering, SME-AIME, April.

6. _____, 1984, In-Seam Seismic Surveys Using Controlled-Waveform Source Transducers. SME-AIME Preprint No. 84-420.

7. Leckenby, R.J., and J.J. Snodgrass, 1984, In-Seam Geophysical Techniques for Coal Mine Hazard Detection. In Mine Ground Control, Bureau of Mines Information Circular 8973.

8. Snodgrass, J.J., and S.A. Suhler, 1983, In Situ Electromagnetic Probing of Coal Seams. SME-AIME Preprint No. 83-356.

9. Snodgrass, J.J., 1982, A New Sonic Velocity Logging Technique and Results in Near-Surface Sediments of Northeastern New Mexico. Bureau of Mines Technical Progress Report 117.

10. Snodgrass J.J., 1981, Dry Sonic Probe for Logging Coal and Roof Properties. Bureau of Mines Technology News No. 114.

11. Snodgrass J.J., 1981, Development of an Engineering Model Borehole Radar System for Void and Fault Detection. Proc. Symp. on Tunnel Detection, Colorado School of Mines, Golden CO.

12. Snodgrass, J.J., 1976, Calibration Models for Geophysical Borehole Logging. Bureau of Mines Report of Investigations 8148.

13. Snodgrass, J.J., and D.E. Siskind, 1974, Vibrations from Underground Blasting. Bureau of Mines Report of Investigations 7937.

14. Snodgrass, J.J., and D. E. Siskind, 1974, Bureau of Mines Research on Vibrations from Underground Blasting. Proc. 2d Rapid Excavation and Tunneling Conference, San Francisco, CA.

EXHIBIT S

15. Condon, J.L., and J.J. Snodgrass, 1974 Effects of Primer Type and Borehole Diameter on AN-FO Detonation Velocities. Mining Congress Journal.

16. Siskind, D.E., J.J. Snodgrass, R.A. Dick, and J.N. Quiring, 197 Mine Roof Vibrations from Underground Blasts, Pilot Knob, Mo. Bureau of Mines Report of Investigations 7764.

EXHIBIT S

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-1748

June 11, 1996

REPLY TO
ATTENTION OF
Office of the Program Manager

Mr. John J Yelenick
3650 South Dahlia
Denver, Colorado 80237-1002

Dear Mr. Yelenick:

Thank you for your comments on the Rocky Mountain Arsenal (RMA) On-Post Proposed Plan Public input is an important component of the remediation process, and your participation helps maintain the dialogue between the U.S. Army and the public.

In response to your letter of December 12, 1995, regarding an alternative water supply, the Army and Shell Oil Company have reached an Agreement in Principle, enclosed with these responses, with South Adams County Water and Sanitation District (SACWSD) that includes payment of $48.8 million to SACWSD and requires that SACWSD supply water to well owners within the diisopropyl methylphosphonate (DIMP, an RMA byproduct) plume footprint by January 1999 Connection of any future well owners to the SACWSD water supply requires that the DIMP level in their water source be above the state standard. No exposure pathways to DIMP other than drinking water have been identified as a concern to human health. In addition, the Agreement in Principle requires SACWSD to provide 4,000 acre-feet of water to Commerce City and the Henderson area by 2004 The parties involved in the water negotiations believe that the settlement is fair and will permit SACWSD to secure an adequate water supply to satisfy Commerce City's and Henderson's water needs. If you have any further questions regarding the water supply, please contact
Mr Tim Kilgannon of this office at 303-289-0259 or Mr Larry Ford of SACWSD at 303-288-2646

Responses to your comments in your letter of December 13, 1995, are enclosed

If you have any additional questions or concerns regarding the RMA On-Post Proposed Plan, please direct them to Mr. Brian Anderson of this office at 303-289-0248. Thank you again for your comments.

Sincerely,

Eugene H Bis Bishop
Colonel, U.S. Army
Program Manager

Enclosures

Copies Furnished:

Captain Thomas Cook, Litigation Attorney, Rocky Mountain Arsenal
Building 111, Commerce City, Colorado 80022-1748
Mr. Robert Foster, U S Department of Justice, 999-18th Street,
Suite 945, North Tower, Denver, Colorado 80202
Program Manager Rocky Mountain Arsenal, Attn: AMCPM-RMI-D, Document Tracking
Center, Commerce City, Colorado 80022-1748

RESPONSES TO COMMENTS BY MR. JOHN J. YELENICK ON THE ROCKY MOUNTAIN ARSENAL ON-POST PROPOSED PLAN

The Army appreciates your level of interest and effort in commenting on the On-Post Proposed Plan for RMA. The regional flow of groundwater, both in the shallow (unconfined) and deeper (confined) flow systems is from southeast to northwest. The volume of shallow groundwater flow crossing the southern boundary of RMA and flowing on-post is approximately 2,000 gallons per minute (gpm). The central part of RMA, including South Plants, is a topographically and hydrologically high area where all of the shallow groundwater flow is derived from within the central area and feeds into this regional flow. Within the central sections of RMA (i. e., 1, 2, 25, 26, 35, and 36) the total amount of groundwater flow is less than 50 gpm. The South Plants groundwater mound is a result of recharge on the topographic high in the bedrock. Groundwater flow associated with the South Plants mound is only about 10 to 20 gpm. Of this flow, only about 10 gpm flows south within Sections 1 and 2. This southward flow mixes with the much higher regional flow in the vicinity of the South Lakes and then flows toward the west and northwest boundaries.

Many statements made in your comments are correct and have been reported in whole or in part in previous reports prepared by the Army and Shell. However, due to several omissions in your conceptual model for groundwater flow, the final conclusion that groundwater flows off Rocky Mountain Arsenal to the south is incorrect

For ease of comparing this response to your December 13, 1995, letter, the following responses reference the applicable page and paragraph of your letter

Page 1, last paragraph: The comment has misstated the definition of high, low, and uncontaminated site types as discussed in the RMA On-Post Detailed Analysis of Alternatives and the Proposed Plan High priority sites are those that had an established record of groundwater contamination beneath or near the site and that had few records concerning soil contamination In these cases, groundwater had already been contaminated, and additional testing was necessary to learn more about the contamination source. Low priority sites had no records of either soil or groundwater contamination, due to lack of study, but were considered potentially contaminated based on records of spills and/or waste disposal at the site Uncontaminated sites were those that could possibly have been contaminated due to their physical nature but for which preliminary investigation revealed no reason to suspect contamination The uncontaminated designation was not dependent upon whether a responsible party could be identified.

Page 2, first paragraph: As a general rule, soil samples were collected from above the water table regardless of the site type designation. The sampling approach was developed by geologic, chemical and other environmental experts from around the United States. Samples were not generally taken from below the water table because it would be difficult to distinguish between soil and groundwater contamination by using this approach For sites where wastes were disposed below the water table (e g , burial trenches in Section 36), soil samples were collected

from the saturated zone. The relationship between the amount of contaminants present in groundwater, pore water, and aquifer soils was studied in a special investigation. The results of the study were used to assess potential contaminant pathways and transport mechanisms.

All sites were investigated regardless of their site type designation as high, low, or uncontaminated. The designation was used to compute a grid spacing or boring density for each site.

Page 2, third paragraph: The southerly flow of groundwater as shown on your Exhibit F terminates in the vicinity of Lower Derby Lake and Lake Ladora. The reason for this termination is discussed below in the response to **Page 4, first paragraph**.

Page 2, fifth paragraph: Your Exhibit J delineates potentially contaminated soil in the lake areas. It is not clear from your comment how you believe the lake sediment contamination is related to the contaminant levels present in groundwater upgradient in the South Plants Central Processing Area. No groundwater plumes associated with the lakes or excavated lake sediments have been detected. For clarification, the South Plants Central Processing Area is located in the northwest corner of Section 1, and it is beneath this area that elevated concentrations of contaminants occur in the groundwater (as you note in your comment). It is also in this area where groundwater contaminants have been detected in the A sand in the Denver Formation.

Page 2, sixth paragraph: There is no uninterrupted sequence of thick saturated alluvium that forms a pathway between the South Plants and the southern lakes, as you suggest. Saturated portions of the alluvium comprise a portion of the <u>unconfined</u> aquifer in the South Plants area The weathered portion of the Denver Formation is also part of the unconfined aquifer. In some portions of the South Plants, the alluvial cover is very thin or has been removed. In many areas of South Plants, the alluvium is unsaturated; that is, the water table is below the bottom of the alluvium, and the groundwater flows at very slow rates within the Denver Formation.

Page 2, seventh paragraph: As a clarification to your comment, the permeability of the lake bottom affects the interchange between the surface water and the unconfined aquifer rather than the interchange between the unconfined and confined aquifers.

Page 3, first paragraph: The Army agrees that various estimates of the volume of contaminated soils have been computed for all source areas. This has largely been due to using different "depths of contamination" as the basis for the estimates (e. g., 5 feet, 10 feet, 15 feet). Regardless of the contaminant volume estimates for South Plants, however, this area has always been considered a source of groundwater contamination by scientists investigating RMA.

The preferred remedy of landfilling and covering/capping materials in the South Plants addresses all of the contamination of concern in the area. The volume of soil addressed by the remedy can be presented differently depending on the depth used for calculating the volume to be covered/capped.

Page 3, second paragraph: The lakes receive water from irrigation flows, surface runoff as a result of precipitation, and groundwater discharge. The lakes also recharge the unconfined aquifer Some lake water evaporates. Chemical analyses of lake water have shown that the lake water is uncontaminated. Therefore, leakage of water from the lakes contributes clean water to the unconfined aquifer. The lake sediments became contaminated because certain compounds adhered to soil particles in South Plants that were washed into the lakes during rainstorms. Because these compounds adhere to the sediments, it is unlikely that contamination in these sediments will create groundwater plumes.

Page 3, fourth paragraph: The southerly groundwater flow has been well-established in numerous reports prepared by the Army. This pathway stops in the vicinity of the lakes. Please see the response to **Page 4, first paragraph**, below. Your Exhibit L shows the area where the A sand subcrops to the alluvium, which is approximately one-quarter to one-half mile north of the South Plants

Page 3, fifth paragraph: Alluvial deposits with thicknesses of slightly more than 100 feet are present south of the lakes. The 130-foot-thick deposits to which you refer are in the Irondale Channel on the west RMA border The saturated thickness of the alluvial deposits is slightly more than 60 feet in some areas of the southern sections of RMA. It is true that groundwater flow is not always restricted by buried channels, or paleochannels, and that groundwater may flow over channel divides; therefore, the water table elevations give the most accurate picture of groundwater flow direction

Page 3, last paragraph: Groundwater flows from points of higher elevation or hydraulic pressure to points of lower elevation or hydraulic pressure, which is often called hydraulic head The hydraulic gradient is the difference in head (or elevation) between two points, divided by the distance between the two points. As you suggest in your comment, the hydraulic gradient must be evaluated by hydrogeologists as a three-dimensional problem. Long-term monitoring has shown that contamination in the confined Denver Formation is restricted to the major source areas and underlies contaminated unconfined groundwater plumes. Because it is difficult to install a deep well through shallow contaminated zones, some of the contamination in the Denver Formation was introduced when wells were installed. This contamination is low in concentration and very limited in extent There is no evidence of contaminant plumes in the confined flow system Contaminant studies in one of the most permeable Denver Formation units (the A sand) that lies beneath a large source (South Plants) have shown that, even in this unit, contamination is localized and is not widespread

Page 3, last paragraph, last sentence: The exchange of water between the unconfined and confined aquifers has been studied and numerically (computer) modeled numerous times during the past ten years Throughout many areas of RMA, groundwater from the unconfined aquifer recharges the confined aquifer through vertical leakage. There is no evidence of lateral migration of contamination in the confined aquifer Even if this were to occur, the strata of the Denver Formation are slightly dipping to the southeast so that as one travels from the southern portions

of RMA toward the Platte River, older and lower sections of the geologic column are crossed Because the bedrock erosional surface drops toward the Platte River, it cross-cuts the Denver Formation, exposing successively deeper and deeper levels of the Denver Formation to the base of the alluvium. The result is that water in a permeable Denver zone eventually discharges into the alluvium on its way to the Platte River. For example, water in the A sand occurs at a depth of about 80 feet beneath the South Plants. This water discharges to the alluvium in Section 36 in the A sand subcrop area, which is located approximately one-quarter mile north of South Plants (see your Exhibit L).

Page 4, first and second paragraphs: This paragraph describes aquifer thickness, vertical gradients, regional hydraulic gradient, and the slope of the bedrock surface. Although you do not state how these features affect groundwater flow, it appears that this was your intent. Therefore, some of the concepts that pertain to these features are summarized below.

- Aquifer Thickness: A thicker aquifer can transmit more water than a thin aquifer can if the hydraulic gradients and the permeabilities of the thick and thin aquifers are the same Hydraulic gradients are lower in areas where the aquifer is thick and higher where the aquifer is thin. Considering hydraulic gradient as the "driving force" behind groundwater flow, it takes more driving force to push an equal amount of water through a thin aquifer than through a thick aquifer. Variations in the aquifer thickness cause local changes in the groundwater flow directions, but groundwater cannot flow upgradient.

- Vertical Gradient Vertical gradient data indicate whether groundwater is moving upward or downward in addition to its regional flow direction, such as toward the South Platte River. Downward gradients predominate in areas of groundwater recharge, and upward gradients indicate areas of groundwater discharge.

  If a well was installed in the South Platte River, it would show an upward gradient, indicating that groundwater was feeding or recharging the river. It is because of this groundwater discharge that the river can flow even during dry periods with little or no rain

- Regional Hydraulic Gradient The elevation of the water table in the southeast corner of RMA is approximately 5300 feet above mean sea level (ft M.S.L.), and the elevation of the water table at the South Platte River is approximately 5000 ft M.S.L. Therefore, groundwater flows "downhill" from the southeast corner of RMA toward the South Platte River Superimposed on the regional gradient is a groundwater mound in the South Plants The mound is created by leaking pipes and increased recharge from unlined ditches and ponded areas, and may also be the result of natural variations in the permeability of the alluvium and bedrock in the area. Groundwater in the area of the mound flows radially out from the mound in all directions. A groundwater divide has been created at the confluence of the regional flow system and the mound. As a result, groundwater entering RMA from the southeast is forced to turn either east or west around

the South Plants area. Water flowing south from the mound area is forced to change direction and join the regional flow system. The groundwater flow direction in the confined Denver Formation is also to the northwest toward the South Platte River.

- Bedrock Slope: The sloping surface of the bedrock forms the bottom of the alluvial aquifer. Groundwater flow directions are determined by the slope of the groundwater table (top of the aquifer) and not by the slope of the base of the aquifer. As stated above, the thickness of the aquifer, which is controlled in some areas by the topography of the bedrock surface, can locally alter the groundwater flow direction. However, variations in the bedrock surface do not turn groundwater around to flow uphill against the regional gradient.

Because of the factors reviewed above, it is clear that groundwater cannot flow upgradient (southward) from the southern boundary of RMA. Groundwater flow southward from RMA is physically impossible.

Page 4, third through fifth paragraphs: The Army understands your concerns about the health of residents in neighboring communities regardless of whether the contamination is ensuing from RMA. The effects on human health of many of the compounds produced at RMA have been studied for many years, and this information is available at the Joint Administrative Record Document Facility (JARDF). Studies have been completed by the Agency for Toxic Substances and Disease Registry (ATSDR) independently and in conjunction with the Colorado Department of Public Health and Environment (CDPHE). These studies showed no conclusive health impact on the surrounding communities from RMA Also, the final Public Health Assessment, produced by ATSDR, should be complete in the summer of 1996.

A Medical Monitoring Program for the communities surrounding RMA has also been identified as part of the On-Post Proposed Plan The primary goals of the Medical Monitoring Program are to monitor any off-post impact on human health due to the RMA remediation This Program will continue until the soil remediation is completed A Medical Monitoring Advisory Group has been established to evaluate specific issues covered by the Medical Monitoring Program. The Group is composed of representatives of the Army, Shell Oil Company, the U.S. Environmental Protection Agency (EPA), CDPHE, Tri-County Health Department, ATSDR, the U S. Fish and Wildlife Service (USFWS), Denver Health and Hospitals, and the Site-Specific Advisory Board The Group also includes community representatives from the communities of Montbello, Commerce City, Henderson, Green Valley Ranch, and Denver If you would like more information on the Medical Monitoring Program or wish to participate as part of the Medical Monitoring Advisory Group, please call Ms. Mary Seawell of CDPHE at 303-692-3327.

Page 4, sixth paragraph: The Army has collected and analyzed thousands of soil, water, air, structure, and biota samples during the past many years and believes it has adequately characterized the nature and extent of contamination at RMA.

Page 4, seventh and eighth paragraphs: The Army believes that the selected remedy is consistent with the policies and guidelines pertaining to environmental justice. The selected remedy is protective of human health and the environment.

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

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WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

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G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

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AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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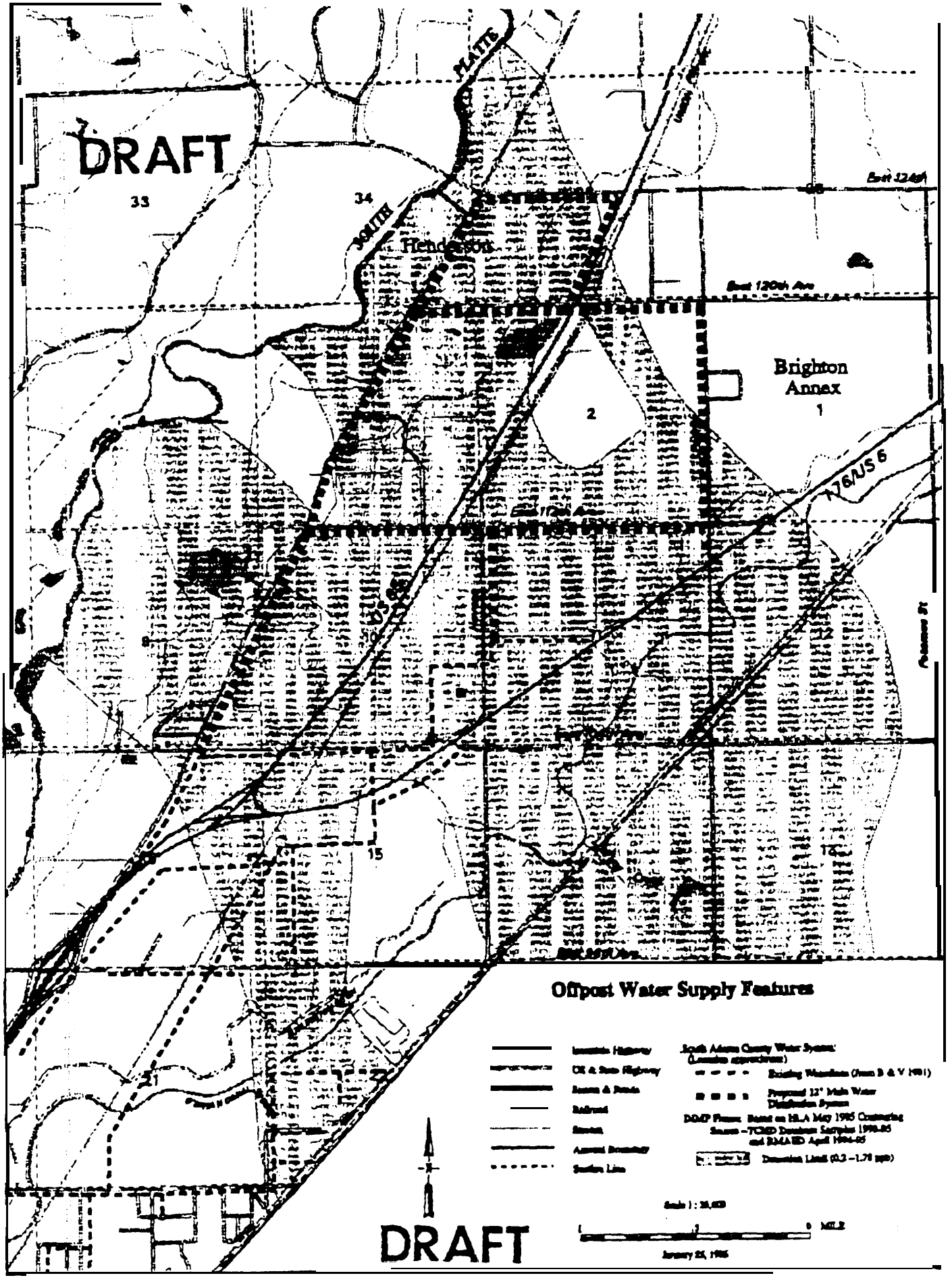

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Appendix A

Applicable or Relevant and Appropriate Requirements and Information To Be Considered

Appendix A

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List of Acronyms and Abbreviations

°F	Degrees Fahrenheit
$\mu g/m^3$	Micrograms Per Cubic Meter
µg/l	Micrograms Per Liter
A	Agent
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos-Containing Material
ACOE	Army Corps of Engineers
AEL	Airborne Exposure Limit
AIR	Automobile Inspection and Readjustment
AOC	Area of Contamination
APEN	Air Pollution Emission Notice
AR	Army Regulations
ARAR	Applicable or Relevant and Appropriate Requirements
Army	U.S. Army
AS	Agent Stabilizer
AWQC	Ambient Water Quality Criteria
BDAT	Best Demonstrated Available Technology
BGEPA	Bald and Golden Eagle Protection Act
CAA	Clean Air Act
$CaCo_3$	Calcium Carbonate
CAMU	Corrective Action Management Unit
CBSG	Colorado Basic Standards for Groundwater
CBSM	Colorado Basic Standards and Methodologies for Surface Water
cc	Cubic Centimeter
CCR	Code of Colorado Regulations
CCWE	Constituent Concentration in Waste Extract
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CG	Phosgene
cm	Centimeter
cm^3	Cubic Centimeter
CN	Cyanide
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COC	Contaminant of Concern
CP	Combustion Product
Cr	Chromium
CRL	Certified Reporting Limit
CRS	Colorado Revised Statute
CSRG	Containment System Remediation Goal
CWA	Clean Water Act
CWC	Draft Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on Their Destruction
DA	Draft Army
DAA	Detailed Analysis of Alternatives
db(A)	Decibel

List of Acronyms and Abbreviations
(Continued)

DBCP	Dibromochloropropane
DCPD	Dicyclopentadiene
DDE	2,2-Bis(para-chlorophenyl)-1,1-dichlorethene
DDT	2,2-Bis(para-chlorophenyl)-1,1,1-trichloroethane
DIMP	Diisopropylmethyl phosphonate
DM	Adamsite
DOD	Department of Defense
DP	Decontamination Product
DSA	Development and Screening of Alternatives
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESSVEP	Enhanced Surface Soil Vacuum Extraction Process
F	Fluoride
FFA	Federal Facilities Agreement
FR	Federal Register
FS	Feasibility Study
ft	Feet
ft^2	Square Feet
FWQC	Federal Water Quality Criteria
GAA	Granular Activated Alumina
GAC	Granular Activated Carbon
GB	Isopropylmethyl Phosphonofluoridate
GC/MS	Gas Chromatograph/Mass Spectrometer
GC	Gas Chromatograph
H	Mustard
HD	Distilled Mustard
Hg	Mercury
HL	Mustard-Lewisite Mixture
HP	Hydrolysis Product
Hr	Hour
HRD	Hardness
ICP	Incomplete Combustion Product
ICP	Inductively Coupled Plasma
ICS	Irondale Containment System
ICt_{50}	Median Incapacitating Dose
IRA	Interim Remedial Action
IRIS	Integrated Risk Information System
kg	Kilogram
kg/mo	Kilograms Per Month
L	Lewisite
LCt_{50}	Median Lethal Dose
LDR	Land Disposal Restriction
MAX	Maximum Peak Above the Ceiling
MBTA	Migratory Bird Treaty Act

List of Acronyms and Abbreviations
(Continued)

MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/l	Milligrams Per Liter
mg/m^3	Milligrams Per Cubic Meter
Mg	Magnesium
mm	Millimeter
MPC	Maximum Peak Concentration
NAAQS	National Ambient Air Quality Standards
naw/gp	Non-Agent Worker/General Population
NBCS	North Boundary Containment System
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NO_2	Nitrogen Dioxide
NPDES	National Pollutant Discharge Elimination System
NWBCS	Northwest Boundary Containment System
OCP	Organochlorine Pesticide
OERR	Office of Emergency Response (EPA)
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OT	One Time Exposure If No Other Measurable Exposure Occurs
PAM	Pamphlet
Pb	Lead
PCB	Polychlorinated Biphenyl
PEL	Permissible Exposure Limit
PM_{10}	Particulate Matter with Diameter Less Than or Equal to 10 Micrometers
ppm	Parts Per Million
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit
rf	Respirable Fraction
RISR	Remedial Investigation Summary Report
RMA	Rocky Mountain Arsenal
ROD	Record of Decision
RTIC	Rocky Mountain Arsenal Technical Information Center
SDP	Stabilizer Decontamination Product
SDWA	Safe Drinking Water Act
SEL	Source Emission Limit
SF	Square Feet
SHO	Semivolatile Halogenated Organic
SO_2	Sulfur Dioxide
STEL	Short-Term Exposure Limit

List of Acronyms and Abbreviations
(Continued)

TBC	To-Be-Considered Criteria
TEGD	Technical Enforcement Guidance Document
TLV	ACGIH Threshold Limit Value
TM	Technical Manual
TSCA	Toxic Substances Control Act
TSP	Total Suspended Solids
TU	Temporary Units
TWA	Time-Weighted Average
UFS	Unconfined Flow System
USAEC	U.S. Atomic Energy Commission
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
UTS	Universal Treatment Standards
UV	Ultraviolet
UW	Unmasked Worker
UXO	Unexploded Ordnance
VAO	Volatile Aromatic Organic
VHO	Volatile Halogenated Organic
VOC	Volatile Organic Compound
VX	Ethyl S-Dimethylaminoethyl Methylphosphonothiolate

Statutory Citations

Citation	Citation Name
16 USC Section 661 et seq.	Fish and Wildlife Coordination Act
16 USC Section 668 et seq.	Bald Eagle Protection Act
16 USC Section 703-711	Migratory Bird Treaty Act
16 USC Section 1531 et seq.	Endangered Species Act
42 USCS Section 7412	Clean Air Act – National Emission Standards for Hazardous Air Pollutants (NESHAPS)
42 USCS Section 7502-7503	Clean Air Act – Nonattainment Plan Provisions/Permit Requirements
CRS Section 25-12-101 to 25-12-108	Colorado Revised Statutes – Noise Abatement
CRS Section 33-2-101 to 33-2-107	Colorado Nongame, Endangered, or Threatened Species Conservation Act
CRS Section 42-4-307(8)	Colorado Revised Statutes – Regulation of Vehicles and Traffic

A.1.0 Introduction

Appendix A is a compilation of chemical-, location-, and action-specific applicable or relevant and appropriate requirements (ARARs) and to-be-considered criteria (TBCs) that are pertinent to potential remediation alternatives at the Rocky Mountain Arsenal (RMA). This Appendix identifies ARARs and TBCs for contaminated water, soil, and structures at RMA.

The ARARs and TBCs identified in this appendix have been compiled to comply with Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Pursuant to this section, an ARAR is defined as "any standard, requirement, criterion, or limitation under any Federal environmental law . . . or ... any promulgated standard, requirement, criterion, or limitation under a State environmental or facility siting law that is more stringent than any Federal standard . . . [that] is legally applicable to the hazardous substance or pollutant or contaminant or is relevant and appropriate under the circumstances of the release or threatened release" at the designated site. Throughout this appendix, since selected remedial actions are presently broad in scope, ARARs citation references are generally broad. Upon entering the design phase of each remedial action and prior to remedial implementation, specific sections within the cited references will be identified and serve as the pertinent ARARs.

ARARs were identified according to the procedures outlined in the most recent U.S. Environmental Protection Agency (EPA) guidance (EPA 1988; Office of Emergency Response-EPA (OERR-EPA) 1988; Office of Solid Waste and Emergency Response (OSWER 1989b) and the National Oil and Hazardous Substances Contingency Plan (NCP) (40 Code of Federal Regulations (CFR 300) (EPA 1990). This Appendix to the Record of Decision (ROD) identifies the ARARs that will be attained by the selected remedies. As there are no specific ARARs that will not be attained (in instances where chemical-specific ARARs standards are below current practical quantification limits [PQLs], and compliance cannot therefore be confirmed, meeting these PQLs will serve as attainment of these ARARs standards), this ROD does not identify any waivers that will be invoked. The PQLs are the Colorado Department of Public Health and Environment's laboratory PQLs.

Federal and state regulations and guidance that were reviewed fall into one of the following three categories: applicable requirements, relevant and appropriate requirements, and other criteria, advisories, or guidance TBC. These requirements are defined in the NCP (40 CFR 300) as follows:

- Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site; they fulfill all jurisdictional prerequisites. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable (40 CFR Section 300.5).

- Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate (40 CFR 300.5).

- In addition to applicable or relevant and appropriate requirements, the lead and support agencies may, as appropriate, identify TBCs for a particular release. The TBC category consists of advisories, criteria, or guidance that were developed by EPA, other federal agencies, or states that may be useful in developing CERCLA remedies [40 CFR 300.400(g)(3)].

The NCP (40 CFR 300) establishes the basic criteria for applicability of a federal or state regulation as specifically addressing the contaminants, actions, or location of a CERCLA site. If a regulation is determined to be applicable or relevant and appropriate, only the substantive portions of the regulation are considered to be applicable. Substantive portions of a requirement refer to those portions of an ARAR that pertain directly to actions or conditions in the environment. They generally involve a quantitative limitation or performance objective. Administrative requirements are those mechanisms that facilitate implementation of the substantive requirements, and they typically include record keeping and reporting, documentation, issuance of permits, and approval of or consultation with administrative bodies. On the other hand, monitoring requirements, including recording of the monitoring results in some form, are generally considered substantive because they are usually necessary to document attainment of cleanup levels and compliance with emission and discharge limitations.

Some regulations are not directly "applicable" to potential remediation alternatives at the RMA, but may be considered "relevant and appropriate." As defined by the EPA in the NCP (40 CFR 300), regulations that are relevant and appropriate must address situations sufficiently similar to those encountered at the CERCLA site such that their usage is well suited to the particular site. Only those "relevant and appropriate" requirements that are determined to be both relevant and appropriate must be complied with. The NCP (40 CFR 300) requires that the following comparisons be made to determine relevance and appropriateness:

- The purpose of the requirement and the purpose of the CERCLA action

- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site

- The substances regulated by the requirement and the substances found at the CERCLA site

- The actions or activities regulated by the requirement and the remedial action contemplated at the CERCLA site

- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site

- The type of place regulated and the type of place affected by the release or CERCLA action

- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action

- Any consideration of use or potential use of the affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site (40 CFR 300.400(g)(2))

Requirements that are judged both relevant and appropriate must be compiled with to the same degree as if they were applicable, unless the ARAR meets the CERCLA criteria for a waiver under Section 121(d)(4) of CERCLA. Other regulations, advisories, or guidance may be useful in developing protectiveness criteria for contaminants for which there are no ARARs. These regulations fall into the TBC category. TBCs are not enforceable, but may be useful in developing remedies. The U.S. Army (Army) will conduct a review of the remedial actions selected for RMA every five years. Requirements that are promulgated or modified after the ROD is signed must be attained (or waived) if determined to be applicable or relevant and appropriate and necessary to ensure that the remedy is protective of human health and the environment (40 CFR 300.430 (f)(1)(ii)(B)).

A.2.0 Chemical-Specific Requirements

Chemical-specific ARARs set concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. Such ARARs either set protective cleanup levels for the contaminants of concern (COCs) in the designated media or indicate an appropriate level of discharge based on health- and risk-based analyses and technological considerations. This section discusses the rationale for chemical-specific requirements for water, soil, and structures media.

A.2.1 Groundwater and Surface Water Requirements

The CERCLA Compliance with Other Laws Manual (OERR-EPA 1988) identifies federal standards developed under the Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act (SDWA), and the Clean Water Act (CWA) as ARARs. These ARARs include the following:

- SDWA Maximum Contaminant Levels (MCLs): 40 CFR 141 Subparts B and G, 40 CFR 143.3

- SDWA Maximum Contaminant Level Goals (MCLGs): 40 CFR 141 Subpart F
- CWA Water Quality Criteria (FWQC): 33 USC Section 1313
- RCRA MCLs: 40 CFR Section 264.94

With respect to state standards, ARARs include the following when these provisions are equivalent to or more stringent than federal requirements:

- Colorado Rules and Regulations Pertaining to Hazardous Waste: 5 Code of Colorado Regulations (CCR) 1007-3
- Colorado Basic Standards for Groundwater (CBSGs): 5CCR 1002-8
- Colorado Primary Drinking Water Regulations: 5CCR 1003-5
- Colorado Basic Standards and Methodologies for Surface Water (CBSM): 5CCR 1002-8

The SDWA establishes standards for public drinking water systems (40 CFR Parts 141 and 143). These standards have been established as part of the National Primary and Secondary Drinking Water Regulations. SDWA MCLs apply to "public water systems," i.e., systems that provide piped water for human consumption to at least 15 service connections or an average of at least 25 persons daily for at least 60 days of the year (40 CFR Section 141.2).

EPA has also promulgated MCLGs in 40 CFR Sections 141.50 through 141.51. Although MCLGs are nonenforceable health goals for public water supply systems and, therefore, not applicable to RMA, Section 121 of CERCLA requires remedial actions to attain at a minimum MCLGs where such goals are relevant and appropriate under the circumstances of the release or threatened release (42 USC Section 962 1(d)(2)(A)). EPA has nonetheless stated that, disregarding special circumstances, "MCLs... are the appropriate standard because they represent the level of quality for the nation's drinking water supplies" (53 FR 51441, December 21, 1988). EPA further states that MCLGs are not relevant at most CERCLA sites because "they would impose a more restrictive requirement than exists for the drinking water consumed by most households in the country." Therefore, EPA (53 FR 51441, December 21, 1988) believes that MCLs are sufficiently protective in achieving the CERCLA goal of protecting human health and the environment. However, according to the NCP (EPA 1990), MCLGs set at levels above zero must be attained by remedial actions for groundwater and surface waters that are current or potential sources of drinking water. Therefore, the Army has determined that non-zero MCLGs are ARARs. Where MCLGs are set at zero, the MCL will generally be the ARAR.

There are no EPA Integrated Risk Information System (IRIS) values per se identified in the database as ARARs. IRIS contains a compilation of health-based values (e.g., unit cancer risks, drinking water health advisories, ambient water quality criteria [AWQC]) that are TBCs. IRIS was consulted for values when other sources of information were not available.

FWQC are nonpromulgated surface water guidelines developed under Section 304 of the CWA that are used by Colorado, in conjunction with designated uses for a stream segment, to establish water quality standards under Section 303 of the CWA (33 United States Code (USC) §1313). Although FWQC are nonenforceable, and thus cannot be applicable, Section 121 of CERCLA states that remedial actions must attain FWQC where they are relevant and appropriate under the circumstances of a release or threatened release (42 USC §962 1(d)(2)(a)).

In determining whether FWQC are relevant, the primary factors to consider are the designated or potential uses of the water, the media affected, and the purposes for which the potential requirements are intended. FWQC have been established for protection of human health and for protection of aquatic life. FWQC for protection of human health address both consumption of water and fish and consumption of fish only. FWQC for protection of aquatic life consider both acute and chronic effects (33 USC §13 13). A review of the site circumstances regarding any release or threatened release indicates that the relevant and appropriate FWQC applicable and protective to this site are the water criteria for the protection of aquatic life. Because Colorado has a promulgated numeric water quality standard, the state standard is relevant and appropriate.

The state and the Army disagree as to whether state surface water quality standards as they relate to agriculture are ARARs at RMA. The issue is not considered to be of significance because the Federal Facility Agreement (FFA) and the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992 prohibit agricultural uses of RMA, including al l farm ing activities such as the raising of livestock, crops, or vegetables. The Parties each preserve their legal positions as to whether state agricultural surface water quality standards are ARARs.

ARARs and TBCs for groundwater and surface water were identified by evaluating the current lists of target contaminants addressed by the groundwater (Table A-1) and surface water (Table A-2) monitoring programs and identifying corresponding standards, regulations, or requirements. Tables A-1 and A-2 provide a comprehensive list of COCs at the site to use as a basis to identify ARARs and TBCs. This list is updated annually to ensure that all COCs are monitored for on a regular basis.

Groundwater standards for RMA as designated in the ROD are referred to as Containment System Remediation Goals (CSRGs). The CSRGs are based on the Preliminary Remediation Goals (PRGs) that were developed as part of the

Detailed Analysis of Alternatives (DAA). Four different sets of PRGs are included in the ROD. These include three sets of CSRGs for the three boundary systems and one for the Basin A Neck IRA system. The compounds listed for each system were selected based on current or likely exceedances of applicable standards.

The CSRGs for the North Boundary Containment System (NBCS) and the Northwest Boundary Containment System (NWBCS) were based on off-post health-based CSRGs for compounds for which these had been developed, CBSGs, and MCLs for compounds for which the other two criteria did not exist.

The CSRGs for Basin A Neck IRA system are different in that health-based criteria were only used for compounds for which there are no CBSGs or MCLs. MCLs were used if CBSGs did not exist.

The existing groundwater standards are still applicable for the Irondale Containment System (ICS).

PQLs and certified reporting limits (CRLs) were included, along with CSRGs, as currently applicable criteria for compounds for which the CSRGs were lower than the PQLs and CRLs.

This is the same approach that was taken to identify constituent ARARs in the ROD. In the ROD, the target contaminant list consisted of parameters monitored for in Task 44 of the remedial investigation; groundwater and surface water analytes monitored as part of the comprehensive monitoring program; other target United States Army Toxic and Hazardous Materials Agency (USATHAMA) compounds; and non-target compounds detected in groundwater that were added to the Chemical Index.

Over the years the target analyte list has changed slightly due to the addition of analytes or to the deletion of analytes that were not detected, detected well below existing standards, detected only one time over a number of years, detected using a gas chromatograph/mass spectrometer (GC/MS) method for quality assurance and quality control, or are of no concern. Accordingly, the current ARARs and TBCs for groundwater and surface water differ from those potential ARARs and TBCs that were identified in the Development and Screening of Alternatives report (Ebasco 1992a).

Tables A-3 through A-7 contain ARARs and TBCs identified for groundwater at each groundwater treatment system. ARARs and TBCs for surface water are identified in Tables A-8 and A-9.

Each requirement was reviewed to determine whether it was applicable or relevant and appropriate in accordance with the CERCLA Compliance with Other Laws Manual (OSWER 1989 b). If more than one ARAR was identified

for a contaminant, the most stringent ARAR was selected. If no ARAR existed for a contaminant, the most stringent TBC appropriate under the circumstances was selected. Finally, if the numerical values of the ARARs or TBCs are a function of the hardness of the surface water or groundwater, the hardness value corresponding to each requirement is given in the "HRD" (hardness) column of the table.

A.2.2 Chemical-Specific Requirements for Soil

The proposed RCRA Corrective Action Rule example action levels (55 FR 30798, July 27, 1990), LDR Universal Treatment Standard (UTS) levels for soil, Toxic Substances Control Act (TSCA) Polychlorinated Biphenyl (PCB) Spill Cleanup Policy (40 CFR Part 761 Subpart G), and EPA's proposed sediment criteria for the protection of benthic organisms for dieldrin and endrin, are TBC values for soil, sediments, and lake sediments at RMA. Land Disposal Restriction (LDR) Best Demonstrated Available Technology (BDAT) levels (40 CFR Part 268, 6CCR 1007-3 Part 268) are ARARs if placement occurs. For on-site disposal, placement occurs when wastes are moved from one Area of Contamination (AOC) (or unit) into another AOC (or unit). Placement does not occur when wastes are left in place or moved within a single AOC. (Section 7.1.1 of the ROD presents a more detailed discussion on placement.)

The proposed RCRA Corrective Action Rule example action levels (55 FR 30798, July 27, 1990) are TBCs for determining cleanup levels for soil and groundwater at RMA. The proposed rule was developed using risk-based information to identify action levels needed at facilities that are contaminated as a result of inadequate management of hazardous waste. Some of the COCs in this proposed rule are also contaminants found at RMA in the soil. The types of cleanup activities contemplated by the proposed rule are similar to some of the types of cleanup activities now being considered for RMA. Table A-10 lists the specific RCRA Corrective Action Rule levels to be considered for soil and sediment remedial actions.

RCRA, TSCA, and laws governing asbestos also set specific values that may be ARARs or TBCs for RMA soil and sediments. EPA proposed soil treatment standards in the UTS rule on September 14, 1993, but deferred action on soil LDRs when that rule was finalized; consequently, UTSs are TBCs with respect to soil at RMA. TSCA establishes guidance on action levels for PCBs in soil that are TBCs.

A.2.3 Chemical-Specific Requirements for Structures

TSCA PCB cleanup levels established for spills occurring after May 4, 1987 in addition to PCB cleanup standards contained in EPA's "Guidance on Remedial Actions for Superfund Sites with PCB Contamination" are TBC values for PCB contaminated structure surfaces and debris. The LDR BDAT levels are ARARs for structural debris if placement occurs (refer to Section 7.1.1 of the ROD for discussion on placement).

A.2.4 Chemical-Specific Requirements for Air

The CERCLA Compliance with Other Laws Manual Part II (EPA 1989) identifies federal standards developed under the Clean Air Act (CAA). These ARARs include the following:

- National Ambient Air Quality Standards (NAAQS): 40 CFR 61
- National Emission Standards for Hazardous Air Pollutants (NESHAPs): 40 CFR 50

State standards that are equivalent or more stringent than federal requirements are also considered ARARs and these include the following:

- Colorado Ambient Air Standards: 5 CCR 1001-5 Regulation 3, 5 CCR 1001-14
- Control of Hazardous Air Pollutants: 5 CCR 1001-8
- Odor Emission Regulations: 5 CCR 1001.4 Regulation 2

A.3.0 Location-Specific Requirements

Remedial actions may be restricted or precluded by location-specific ARARs that are contingent upon the location or characteristics of the site and the requirements that apply to it. These regulations include the Colorado siting requirements for hazardous waste disposal sites (6 CCR 1007-2, Part 2), laws regarding development or other activities in wetlands or floodplains, and laws regarding preservation of historic or cultural sites. The Colorado siting requirements are applicable to the locations, design, and design performance of any hazardous wastes disposal site. With regard to RMA, the siting requirements are applicable to the proposed hazardous waste landfill that is to be part of the designated Corrective Action Management Unit (CAMU). Location-specific ARARs and TBCs are listed in Table A-11.

In determining location-specific ARARs, the following characteristics of RMA must be taken into account:

- Absence of karst topography underlying RMA
- Absence of faults underlying RMA that have had displacement in Holocene time
- Potential presence of areas designated as national historic landmarks or national preservation areas
- Presence of wetlands as shown in the Remedial Investigation Summary Report (RISR) (Ebasco 1992b)
- Presence of 100-year floodplains associated with most drainages at RMA, as shown in the RISR (Ebasco 1992b)

All requirements pertaining to the protection and management of floodplains and wetlands are considered potentially applicable to the remedial activities described in this ROD. Location-specific ARARs pertaining to floodplains are contained in Executive Order 11988 (44 Federal Register (FR) 43239, July 7, 1979; procedures codified in regulations under the National Environmental Policy Act (NEPA), 40 CFR Part 6, and 40 CFR Section 257.3-1(a)). The provisions of 40 CFR Section 257.3-1(a) are applicable only to units regulated under RCRA, but are considered relevant and appropriate requirements concerning the construction of facilities and conduct of remedial actions in floodplain zones. Location-specific ARARs pertaining to wetlands are contained in Executive Order 11990 and 40 CFR Part 6. Excerpts from these requirements are provided below:

Floodplains

- "Evaluate the potential effects of actions . ..[that would be taken] in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain" (40 CFR Section 6.302 (b)).
- "Ensure that . ..(the federal agency's) planning programs and budget requests reflect consideration of flood hazards and floodplain management, including the restoration and preservation of such land areas as natural undeveloped floodplains . .." (40 CFR Part 6, Appendix A, Section 1(a)).
- "Executive Order 11988 . ..requires Federal agencies to . ..prescribe procedures to implement the policies and procedures of [the] Executive Order" (40 CFR Part 6, Appendix A, Section 1(a)).
- "Where there is no practical alternative to locating in a floodplain, minimize the impact of floods on human safety, health and . . . the natural environment" (40 CFR Part 6, Appendix A, Section 3(b)(2)).
- "Restore and preserve natural and beneficial values served by floodplains" (40 CFR Part 6, Appendix A, Section 3(b)(3)).
- "Identify floodplains which require restoration and preservation and recommend management programs necessary to protect these floodplains and to include such considerations as part of on-going planning programs" (40 CFR Part 6, Appendix A, Section 3(b)(5)).
- "Facilities or practices in floodplains shall not restrict the flow of the base flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste, so as to pose a threat to human life, wildlife, or land or water resources" (40 CFR Section 257.3-1(a)).

Wetlands

- "Requires Federal agencies conducting certain activities to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands" (40 CFR Section 6.302(a)).
- "The responsible official shall either avoid adverse impacts or minimize them if no practicable alternative to the action exists" (40 CFR Section 6.302(a)).

Floodplains and Wetlands

- "Before undertaking an Agency action, each program office must determine whether or not the action will be located in or affect a floodplain or wetlands" (40 CFR Part 6, Appendix A, Section 6(a)(1)).
- "The Agency shall utilize maps prepared by the Federal Insurance Administration of the Federal Emergency Management Agency . . . , Fish and Wildlife Service . . . , and other appropriate agencies to determine whether a proposed action is located in or will likely affect a floodplain or wetlands" (40 CFR Part 6, Appendix A, Section 6(a)(1)).
- If an action "is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice procedures" (40 CFR Part 6, Appendix A, Section 6(a)(2)).
- "If the Agency determines a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken . . . [that] shall consist of a description of the proposed action, a discussion of its effect on the floodplain/wetlands, and shall also describe the alternatives considered" (40 CFR Part 6, Appendix A, Section 6(a)(3)).
- "A public notice of the floodplain/wetlands assessment shall be made consistent with the public involvement requirements of the applicable program" (40 CFR Part 6, Appendix A, Section 6(a)(4)).
- "For all Agency actions proposed to be in or affecting a floodplain/wetlands, the Agency shall provide further public notice announcing this decision. This decision shall be accompanied by a Statement of Findings, not to exceed three pages. This statement should include" all items outlined in the statute" (40 CFR Part 6, Appendix A, Section 6(a)(6)).

Requirements adopted as part of RCRA are applicable or relevant and appropriate to remedial actions conducted at CERCLA sites. Location-specific ARARs that may be relevant and appropriate for on-post remediation are contained in 40 CFR Section 257.3-1, which applies directly to floodplain management, and 40 CFR 264 Subpart B, which contains EPA regulations for owners and operators of RCRA-permitted hazardous waste facilities.

The Army is in the process of conducting an archeological, architectural, historical, and prehistorical cultural resource survey. This survey could identify structures that may be protected under the National Historic Preservation Act (36 CFR Part 800) or the Archeological Resources Protection Act (16 USC Section 469a-1). Location-specific ARARs would be triggered if culturally significant structures are identified at RMA.

A.4.0 Action-Specific Requirements

Action-specific ARARs and TBCs are standards that establish restrictions or controls on particular kinds of remedial activities related to management of hazardous substances or pollutants. These requirements are triggered by the particular remedial activities, as opposed to the specific chemicals present or the location of the remediation activity. For example, if a particular remedial action could result in emissions of regulated air pollutants, then certain air

regulations could be ARARs for that particular remedial action. Tables A-12 through A-45 contain ARARs and TBCs for the technologies that are part of any of the alternatives considered in the ROD for water, soil, and structures. Each table contains ARARs and TBCs for a specific technology that may represent only one part of a complete alternative that consists of several technologies. Therefore several ARAR tables will be applied to each alternative. Throughout this appendix, since selected remedial actions are presently broad in scope, ARARs citation references are generally broad. Upon entering the design phase of each remedial action and prior to remedial implementation, specific sections within the cited references will be identified and serve as the pertinent ARARs.

A.5.0 Other Potential Requirements

In addition to the chemical-, location-, and action-specific ARARs and TBCs, there are a number of other requirements and potential requirements that could constrain and direct remedial actions at RMA. These additional requirements are addressed below.

Federal Facility Agreement

Provisions of the FFA regarding use restrictions, federal ownership, and access restrictions are not ARARs or TBCs; however, compliance with these restrictions is required.

Asbestos-Containing Materials

Asbestos-containing materials (ACM) that may be found in structures or soil during remediation will be managed in accordance with potential ARARs identified in the Asbestos Interim Remedial Action (IRA). ACM generated during remedial activities will be disposed in a landfill that is designed and managed in accordance with ARARs specified in the appropriate ARAR tables.

Polychlorinated Biphenyls

The methodology for PCB-contaminated materials is regulated under 40 CFR Part 761 and described EPA guidance (OERR-EPA 1990b). The Army has undertaken several programs to identify, inventory, and dispose of its PCB contamination in structures, equipment, and soil as described below:

- The PCB IRA program identifies and inventories PCB-contaminated materials in nonagent and structures not owned by Shell. Contaminated equipment is disposed in a landfill that meets TSCA requirements. Some large pieces of contaminated equipment, which have proven difficult to remove, are left in place, to be disposed as part of the final structures cleanup. PCB-contaminated structural materials or soil are also left in place for final cleanup under this program. The one exception is a soil removal action at the Building 621 B salvage yard. PCB-contaminated materials that are handled in the final cleanup will be treated and disposed of in landfills that meet TSCA requirements.

- The Chemical Process-Related Activities IRA decontaminates and removes equipment that is potentially agent contaminated. Decontaminated agent equipment that is also PCB-contaminated is currently stored on post, and will be disposed of in a landfill that meets TSCA requirements.

- The electrical substation and transformer maintenance activities have resulted in the removal and proper disposal of all PCB-contaminated equipment.

Equipment, structures, and soil for which the Army has a responsibility will be handled as follows:

- Equipment: PCB fluids will be drained and sent off post for disposal in compliance with applicable TSCA regulations. PCB-contaminated equipment will be disposed in a landfill that meets TSCA requirements. The action levels that will be used to classify a piece of equipment as PCB-contaminated will be taken from 40 CFR Part 761. The equipment will be disposed under one of three possible scenarios:

  - Identified and disposed as part of the ongoing PCB IRA

    Identified under the PCB IRA, but disposed under the final structures cleanup

  - Agent-decontaminated materials that will be disposed under the final structures cleanup

- Structural Materials: The PCB contamination in No Future Use structural materials will be identified in the PCB IRA completion report. Based on a 50-parts per million (ppm) action level, structural materials will be addressed in one of two ways:

  - Structural materials with PCB concentrations of 50 ppm or above that exist above the ground elevation, as well as contaminated parts of ground floor slabs and foundations that will be removed, will be identified prior to demolition, segregated during demolition, and disposed in a landfill that meets TSCA requirements. Similar materials with PCB concentrations below 50 ppm will not require disposal in a TSCA landfill.

  - PCB-contaminated sections of ground floor slabs or foundations that are not required to be demolished as part of the remediation, and that have PCB concentrations of less than 50 ppm, will be left in place. However, if such slab or foundation material has PCB concentrations of 50 ppm or greater, it will be removed during demolition and disposed of in a landfill that meets TSCA design requirements.

- Soil: Act ion on PCB-contaminated soil is dependent on the concentration and location as follows:

  - The three PCB-contaminated soil areas identified by the PCB IRA with concentrations of 250 ppm or greater will be removed. The limits of contamination will be determined based on visual evidence with immunoassay field confirmation sampling (EPA method SW-846).

  - There are five PCB-contaminated soil areas identified by the PCB IRA with concentrations from 50 ppm to below 250 ppm. These areas will receive a minimum 3 feet (ft) of soil cover, and the PCB-contaminated soil there will be left in place. The soil cover will be maintained as part of the wildlife refuge and is subject to the institutional controls of the FFA.

- No remaining areas of PCB-contaminated soil with concentrations above 50 ppm have been identified by the PCB IRA. If necessary, any suspected PCB soil contamination areas will be characterized further during the remedial design. If additional PCB-contaminated soil is found with concentrations of 50 ppm or above, the Army will determine any necessary remedial action in consultation with EPA.

Army Future Use structures have been managed for occupancy under current environmental and worker protection regulations. There is no evidence of PCB contamination in this medium group.

Structures and equipment for which Shell has responsibility will be handled as follows:

- All Shell buildings to be demolished during the final remedy will be inspected for equipment containing fluids potentially contaminated with PCBs prior to demolition. Suspected fluids will be drained and sent off post for disposal in compliance with applicable TSCA regulations. Equipment that contained these fluids as well as all other equipment will be disposed of in a landfill that meets TSCA requirements. Significant Contamination History structures will be demolished and the resulting debris will be placed in a landfill that meets TSCA requirements. Other Contamination History structures will be evaluated by Shell and EPA for any visual evidence of leaks or spills. If observed in areas where potential PCB releases may reasonably have been expected to occur, the affected structural debris will be disposed in a landfill that meets TSCA requirements. Examples of this type of visual evidence would include stains near equipment potentially containing PCB fluids or stains in buildings where there are numerous instances of equipment potentially containing PCB-contaminated fluids. Further details of this work will be addressed at the remedial design stage.

- All fluorescent light ballasts will be disposed at an off-post disposal facility in accordance with applicable TSCA regulations.

Shell does not have responsibility for any structures within the Future Use or Agent History Medium Groups.

Protection of Wildlife

The provisions of the FFA that call for the preservation and management of wildlife at RMA are not ARARs; however, compliance with these provisions is required. Sections 44.2(e) and (f) of the FFA specifically address activities at RMA and provide for the following:

> (e) Wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act, 16 USC Section 1531 et seq., migratory birds to the extent required by the Migratory Bird Treaty Act, 16 USC Section 703 et seq., and bald eagles to the extent required by the Bald and Golden Eagle Protection Act, 16 USC Section 668 et seq.
>
> (f) Other than as may be necessary in connection with a Response Action or as necessary to construct or operate a Response Action Structure, no major alteration shall be permitted in the geophysical characteristics of the Arsenal if such alteration may likely have an adverse effect on the natural drainage of the Arsenal for floodplain management, recharge of groundwater, operation and maintenance of Response Action Structures, and protection of wildlife habitat(s).

The provisions of the Endangered Species Act, (ESA) [16 USC Sections 1531 et seq.; 50 CFR Section 424.02(d)(2); 50 CFR Part 402; 50 CFR Part 17] the Migratory Bird Treaty Act, (MBTA) (16 USC Section 703 et seq.; 50 CFR 10 and 11) and the Bald and Golden Eagle Protection Act (BGEPA) (16 USC Section 668 et seq.) apply to RMA. The Army will establish remediation goals for site contaminants to maintain and enhance healthy populations of the species subject to the ESA, MBTA and BGEPA and their habitats at RMA. Remediation goals for soil and sediment that are consistent with the ESA, MBTA, and BGEPA will be established using a methodology agreed to by the Army, Shell, Colorado, and EPA in consultation with the U.S. Fish and Wildlife Service (USFWS). The Army will also consult with USFWS to determine whether any of the CERCLA activities or remedial alternatives might have a short-term impact on a subject species or its habitat. If a determination is made that the Army's activities or remedial alternatives could impact a subject species or its habitat, the Army will consult with the USFWS to determine whether the activity should proceed and what, if any mitigation measures are necessary, in light of any long-term benefits to protection of populations of the subject species.

The Parties disagree on whether the substantive portions of Colorado Wildlife Enforcement and Penalties Provisions (Colorado Revised Statute (CRS) 33-1-101, et seq. and CRS 33-6-101, et seq.) and Wildlife Commission Regulations (2 CCR 406-8) are ARARs. USFWS, in cooperation with the Colorado Department of Natural Resources, agrees to advise the Army, as the lead agency, with respect to the substance of the above-referenced state wildlife laws and regulations in order to ensure that where indicated, such state laws and regulations are taken into account in connection with the implementation of the selected remedy to the extent they are not inconsistent with federal law and regulations. The Parties each reserve all rights with respect to their respective legal and jurisdictional arguments relating to whether the above-cited state laws and regulations relative to wildlife should be treated as ARARs.

Wastewater from Remedial Actions

Remedial actions at RMA could potentially generate wastewaters from structures and soil. Some of the wastewater generated will be directed to the RMA wastewater treatment plant and treated in accordance with the CERCLA Wastewater Treatment System IRA and the ARARs found therein.

Land Disposal Restrictions

LDRs are applicable requirements for prohibited substances in the event that placement occurs. For subject materials that are managed within a CAMU, or moved from outside to within the CAMU for disposal, as may be established at RMA in the selected remedy, LDRs are not required to be met because placement is not by definition occurring. Similarly, for restricted wastes consolidated (and not otherwise managed) within an AOC, as may be established at RMA in the selected remedy, LDRs are not required to be met because placement is not occurring (refer to Section 7.1.1 of the ROD for discussion on placement). Except for restricted wastes consolidated within, or moved

into a CAMU, and restricted wastes consolidated within an AOC, LDRs are applicable and require, among other things, treatment of listed or characteristic hazardous wastes to BDAT levels prior to placement in land disposal units. The following EPA guidance documents with respect to LDRs are considered TBCs:

- Determining When LDRs are Applicable to CERCLA Response Actions, Superfund LDR Guide 5, OSWER No. 9347.3 -OGFS (July 1989b)

- Determining When LDRs are Relevant and Appropriate to CERCLA Response Actions, Superfund LDR Guide 7, OSWER No. 9347.3 -OBFS (December 1989a)

- EPA Hazardous Waste Land Disposal Restrictions Policy, 55 FR 6640 (February 26, 1990)

Treatment standards for debris contaminated with listed hazardous waste or debris that exhibits hazardous waste characteristics were finalized by EPA on August 18, 1992 and incorporated by reference by the state of Colorado on October 19, 1993. The alternative debris BDAT standards were intended to make land disposal of hazardous debris more feasible. The rule requires that debris contaminated with listed hazardous waste must be handled as if it were hazardous until the listed waste is treated according to BDAT and then the debris can be placed in a nonhazardous waste landfill. Debris that exhibits a characteristic of a hazardous waste must be treated according to BDAT and may be land disposed as nonhazardous once the characteristic is removed. EPA's LDRs for waste debris do not apply to contaminated soil, except for soil mixed with manmade debris (57 FR 958, January 9, 1992.)

LDRs will be considered action-specific ARARs if the soil, sediment, or debris is shown to be RCRA-characteristic waste or to contain RCRA-listed waste, and the remedial alternatives involve "placement" of these RCRA hazardous wastes.

The CAMU regulations allow for exceptions from the LDRs for remediation wastes managed at CAMUs or temporary units The Colorado Hazardous Waste Commission adopted state regulations with the intention that the state regulations be interpreted in a manner consistent with the federal CAMU rule. The CAMU regulations provide flexibility and allow for expeditious implementation of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.

Agent Management and Disposal

Department of Defense (DOD)/Army Regulations addressing unexploded ordnance (UXO) and agent management and disposal are ARARs for any of the possible remedial actions proposed for RMA. These include but are not limited to the following:

- Draft Army (DA) Pamphlet 50-6, Chapter 7 for suspected (or known) chemical munitions. Army Regulation (AR) 50-6-Chemical Surety Program

- AR 75-15 – Emergency Disposal of Munitions (both explosive and chemical munitions) – gives Explosive Ordnance Division (EOD) or Army Technical Escort Unit the authority to explosively dispose of munitions too hazardous to move.

- Draft AR 385-61 – Army Toxic Chemical Agent Safety Program

- Draft AR 385-64 – Ammunition and Explosives

- AR 385-131 – Chemical Agent Safety

State RCRA Authority

The state of Colorado is authorized to administer portions of the hazardous waste management program (e.g., RCRA) to regulate the generation, treatment, storage, and disposal of hazardous waste within Colorado. As such, the Colorado regulations are pertinent to the management of hazardous waste. These regulations, with the exception of LDR requirements for contaminated soil and debris, may also be relevant and appropriate in situations, i.e., where necessary to protect human health and the environment, in which a remediation waste is "sufficiently similar" to a RCRA-listed waste or when the proposed remedial action is similar to a RCRA-regulated activity. According to the "CERCLA Compliance with Other Laws Manual," when evaluating whether Subtitle C requirements are relevant and appropriate, the mere presence of hazardous constituents in a CERCLA waste does not mean the waste is sufficiently similar to a RCRA hazardous waste to trigger Subtitle C as an ARAR. Judgment should be used in assessing whether the waste closely resembles a RCRA hazardous waste, considering the chemical composition form, concentration, and any other information pertinent to the nature of the waste.

Although the Colorado hazardous waste management regulations are similar to the federal requirements, both federal and state general regulatory citations are provided in the ARARs tables. Only substantive portions of the regulations require compliance with CERCLA on-site activities. It should be noted that "substantive requirements" are those requirements that pertain directly to actions or conditions in the environment. In addition, Table A-12 contains a list of Colorado standards for owners or operators of hazardous waste treatment, storage, and disposal facilities that are more stringent than the equivalent federal regulations. Since selected remedial actions are presently broad in scope, ARARs citations with respect to hazardous waste requirements are also broad. Upon entering the design phase of each remedial action, and prior to remedial implementation, specific sections within the cited references will be identified and serve as the pertinent ARARs.

Worker Protection Standards

Table A-46 presents chemical-specific worker exposure guidelines established by the Occupational Safety and Health Administration (OSHA), the American Conference of Governmental Industrial Hygienists (ACGIH), and the National Institute for Occupational Safety and Health (NIOSH). OSHA does not apply to federal employees; however, DOD employees are covered by OSHA under Executive Order No. 12196, which addresses employee health and safety standards.

The worker protection standards presented in Table A-46 address exposure standards for chemicals detected and potentially associated with water, soil, and structures at RMA. Because ACGIH and NIOSH are not governmental agencies, their threshold limit values (TLVs) and recommended exposure limits (RELs) are presented here as TBCs. OSHA values are presented as ARARs for protection of workers during remediation. OSHA regulations for worker health and safety, which are codified at 29 CFR 1910, are independently applicable to the remedial actions at RMA. Table A-47 presents worker air exposure standards for chemical agent constituents established by the Occupational Safety and Health Administration (OSHA), the American Conference of Governmental Industrial Hygienists (ACGIH), the National Institute for Occupational Safety and Health (NIOSH), and Department of the Army.

Air Emission Standards

Air emission standards that pertain to remedial actions at RMA are identified in Table A-48. The substantive requirements necessary to control particulate and fugitive dust emissions from off-site transport will be addressed in the remedial design phase of the project.

Chemical Weapons Convention

The draft Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on Their Destruction (CWC) provides for a declaration of the possession of any chemical weapons production facilities and the ultimate destruction of such. The CWC was signed by 130 nations, including the United States, in January 1993. Each nation must submit a declaration as to whether it owns or possesses any chemical weapons or whether any chemical weapons are located in its jurisdiction or control. Chemical weapons are defined as toxic chemicals and their precursors, munitions, and devices specifically designed to cause death or harm through the toxic properties of the chemicals, which would be released by employment of munitions or devices.

A.6.0 References

Army (U.S. Army)

1995 (February 1) AR [Army Regulation] 50-6, Nuclear and Chemical Weapons and Material.

1991 (May 17) DA PAM [Department of the Army Pamphlet] 50-6, Chemical Accident or Incident Response Assistance (CAIRA) Operations.

1987 (May 22) AR 385-64, Ammunition and Explosives Safety Standards.

1985 (August 27) AR 385-61, Safety Studies and Reviews of Chemical Agents and Associated Weapon Systems.

1978 (November 1) AR 75-15, Responsibilities and Procedures for Explosive Ordnance Disposal.

AMC (Army Materiel Command)

1987 (October 9) AMC [Army Materiel Command Regulation] 385-131, Safety Regulation for Chemical Agents, H, HD, HT, GB, and VX.

Ebasco (Ebasco Services Incorporated)

1992a (December) Final On-Post Feasibility Study, Development and Screening of Alternatives. Prepared for the Program Manager for Rocky Mountain Arsenal. Version 4.1, 7 v. RTIC 92363R01.

1992b (January) Final Remedial Investigation Summary Report, Version 3.2, RTIC 92017R01.

1989 (July) Water Remedial Investigation Report, Final, Version 3.3; Volume II, Appendix C. RTIC 89186R01.

Ebasco et al.

1988 (May) Rocky Mountain Arsenal Chemical Index; Appendix C. Table C-3, Volumes I-III.

EPA (U.S. Environmental Protection Agency)

1990 (March 8) National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule, 40 CFR Part 300 (Federal Register 55(46): 8666-8865). (NCP).

1989 Integrated Risk Information System (IRIS). (Note: This is an EPA computerized database.)

1988 Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. Interim Final (EPA/540/G-89/004).

1986 TGST Methods for Evaluating Solid Wastes: Physical/Chemical Methods, Third ed.

EPA et al.

1989 (February) Federal Facility Agreement for Rocky Mountain Arsenal. RTIC 89068R01. (FFA)

Harding Lawson Associates

1995 (December) Rocky Mountain Arsenal Offpost Operable Unit Final Record of Decision, Rocky Mountain Arsenal, Commerce City, Colorado. Prepared for the Program Manager for Rocky Mountain Arsenal.

OERR-EPA (Office of Emergency and Remedial Response, U.S. Environmental Protection Agency)

1990a (September) Superfund LDR Guide No. 6A. (2nd ed.) Obtaining a Soil and Debris Treatability Variance for Remedial Actions. Fact Sheet OSWER/9347.3-06FS.

1990b (August) Guidance on Remedial Actions for Superfund Sites with PCB Contamination EPA/540/G-90/007.

1989 (July) Superfund LDR Guide No. 5: Determining When Land Disposal Restrictions (LDRs) Are Applicable to CERCLA Response Actions. (Fact Sheet [Final]). EPA/9347 .3-05/FS.

1988 (August 8) CERCLA Compliance with Other Laws Manual. Part 1. Interim Final (Draft Report) (EPA 540/G-89/006); OSWER/9234.1-01.

OSWER (Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency)

1989a (December) Superfund LDR Guide No. 7. Determining When Land Disposal Restrictions (LDRs) Are Relevant and Appropriate to CERCLA Response Actions (Fact Sheet). OSWER/9347.3-08FS.

1989b (August) CERCLA Compliance with Other Laws Manual, Interim Final OSWER Directive 9234.1-02. EPA/540/G-89/009.

R.L. Stollar & Associates Incorporated

1989a (October) Comprehensive Monitoring Program, Surface Water Final Technical Plan, Version 3.1.1. RTIC 90110R01.

1989b (June) Comprehensive Monitoring Program, Groundwater Final Technical Plan, Version 3.2 RTIC 89213R02.

USATHAMA (U.S. Army Toxic and Hazardous Materials Agency)

1988 (September) U.S. Army Toxic and Hazardous Materials Agency Analyte Summary. Version 4.

A.7.0 Tables

Table A-1 List of Rocky Mountain Arsenal Target Constituents Addressed by the Groundwater Monitoring Program[1]

Group name/constituent	Group name/constituent
Agent degradation products	Volatile aromatic organic compounds
thiodiglycol	benzene
isopropyl methylphosphonic acid	ethylbenzene
	toluene
Metals	m-xylene
cadmium	o- and p-xylene
chromium	
copper	Organophosporous compounds
lead	diisopropyl methylphosphonate
zinc	dimethyl methylphosphonate
Organochlorine pesticides	Organophosphorous pesticides
2,2'bis(p-chlorophenyl)-1,1-dichloroethylene	atrazine
2,2'bis(p-chlorophenyl)-1,1,1-trichloroethane	malathion
aldrin	parathion
chlordane	supona
dieldrin	vapona
endrin	
hexachlorocyclopentadiene	Volatile halogenated organic compounds
isodrin	1,3-dichlorobenzene
	1,1-dichloroethane
Organosulfur compounds	1,2-dichloroethane
1,4-oxathiane	1,1-dichloroethylene
benzothiazole	1,2-dichloroethylene (cis and trans isomers)
p-chlorophenylmethyl sulfide	1,1,1-trichloroethane
p-chlorophenylmethyl sulfone	1,1,2-trichlorethane
p-chlorophenylmethyl sulfoxide	carbon tetrachloride
dimethyl disulfide	chlorobenzene
dithiane	chloroform
	methylene chloride
	tetrachloroethylene
	trichloroethylene

Table A-1 List of Rocky Mountain Arsenal Target Constituents Addressed by the Groundwater Monitoring Program[1]

Group name/constituent	Group name/constituent
Volatile hydrocarbon compounds	Anions
bicyclo[2,2,1]hepta-2,5-diene	chloride
dicyclopentadiene	sulfate
methylisobutyl ketone	fluoride
Arsenic	Cations
Mercury	calcium
Cyanide	magnesium
	sodium
Dibromochloropropane	potassium
Cyanazine	
n-Nitrosodimethylamine	Nitrite/Nitrate

[1] This list does not include the GC/MS analyses that are performed on 10% of the samples for quality assurance/quality control purposes

Table A-2 List of Rocky Mountain Arsenal Target Constituents Addressed by the Surface Water Monitoring Program[1]

Group name/ constituent	Group name/ constituent
Agent degradation products	Volatile aromatic organic compounds
thiodiglycol	benzene
isopropyl methylphosphonic acid	ethylbenzene
	toluene
Metals	m-xylene
cadmium	o- and p-xylene
chromium	
copper	Organophosphorous compounds
lead	diisopropyl methylphosphonate
zinc	dimethyl methylphosphonate
Organochlorine pesticides	Organophosphorous pesticides
2,2'bis(p-chlorophenyl)-1,1-dichloroethylene	atrazine
2,2'bis(p-chlorophenyl)-1,1,1-trichloroethane	malathion
aldrin	parathion
chlordane	supona
dieldrin	vapona
endrin	
hexachlorocyclopentadiene	Volatile halogenated organic compounds
isodrin	1,1-dichloroethane
	1,2-dichloroethane
Organosulfur compounds	1,1-dichloroethylene
1,4-oxathiane	1,2-dichloroethylene (cis and trans isomers)
Benzothiazole	1,1,1-trichloroethane
p-chlorophenylmethyl sulfide	1,1,2-trichlorethane
p-chlorophenylmethyl sulfone	carbon tetrachloride
p-chlorophenylmethyl sulfoxide	chlorobenzene
dimethyl disulfide	chloroform
dithiane	methylene chloride
	tetrachloroethylene
	trichloroethylene

Table A-2 List of Rocky Mountain Arsenal Target Constituents Addressed by the Surface Water Monitoring Program[1]

Group name/constituent	Group name/constituent
Volatile hydrocarbon compounds	Anions
bicyclo[2,2,1]hepta-2,5-diene	chloride
dicyclopentadiene	sulfate
methylisobutyl ketone	fluoride
Arsenic	Cations
Mercury	calcium
Cyanide	magnesium
	sodium
Dibromochloropropane	potassium
n-Nitrosodimethylamine	Nitrite/Nitrate

[1] This list does not include the GC/MS analyses that are performed on 10% of the samples for quality assurance/quality control purposes

Table A-3 ARARs for Groundwater for Northwest Boundary Containment System

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
Arsenic (total)	AsTOT	50*	N	Y	Y	µg/l		40 CFR 141.11, Federal primary MCL
		50*	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Chloroform	CHCL3	6	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Dieldrin	DLDRN	0.002	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
		0.1**	N	Y	Y	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs (referenced in CBSG Table A)
Diisopropylmethyl phosphonate	DIMP	8	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Endrin	ENDRN	2	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		0.2	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Trichloroethylene	TRCLE	5*	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		5*	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard

* The containment system remediation goal for this parameter (identified in Section 9 of the ROD) is more stringent than the ARAR and is listed in Table A-7 as a TBC.
** PQL Detection levels for Gas Chromatography/Mass Spectrometry.
µg/l Indicates micrograms per liter.

Table A-4 ARARs for Groundwater for Irondale Containment System

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
Dibromochloropropane	DBCP	0.2	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		0.2	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Trichloroethylene	TRCLE	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		5	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard

µg/l Indicates micrograms per liter

Table A-5 ARARs for Groundwater for North Boundary of Rocky Mountain Arsenal

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
1,2-Dichloroethane	12DCLE	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		0.4*	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
		1**	N	Y	Y	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs (referenced in CBSG Table A)
1,2-Dichloroethylene	12DCE	70	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		70	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Aldrin	ALDRN	0.002	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
		0.1**	N	Y	Y	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs (referenced in CBSG Table A)
Arsenic (total)	AsTOT	50'	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		50'	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Atrazine	ATZ	3*	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCLG
		3	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Benzene	C6H6	5'	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		5'	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Carbon Tetrachloride	CCL4	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		0.3	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
		1**	N	Y	Y	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs (referenced in CBSG Table A)

' Containment System Remedial Goal for this parameter (identified in Section 9 of the ROD) is more stringent than the ARAR and is listed in Table A-7 as a TBC.
* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.
** PQL Detection levels for Gas Chromatography/Mass Spectrometry.
µg/l Indicates micrograms per liter.

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
Chloride	Cl	250,000	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Chloroform	CHCL3	6	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Dibromochloropropane	DBCP	0.2	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		0.2	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Dieldrin	DLDRN	0.002	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
		0.1**	N	Y	Y	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs (referenced in CBSG Table A)
Diisopropylmethyl phosphonate	DIMP	8	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Endrin	ENDRN	2	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCLG
		0.2	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Fluoride	F	4,000	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCLG
		2,000	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Methylene Chloride	CH2CL2	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		5	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Sulfate	SO4	250,000	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Tetrachloroethylene	TCLEE	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		5	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Trichloroethylene	TRCLE	5'	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL

' Containment System Remedial Goal for this parameter (identified in Section 9 of the ROD) is more stringent than the ARAR and is listed in Table A-7 as a TBC.
* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.
** PQL Detection levels for Gas Chromatography /Mass Spectrometry.
µg/l Indicates micrograms per liter.

Table A-5 ARARs for Groundwater for North Boundary of Rocky Mountain Arsenal

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
		5'	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Toluene	MEC6H5	1,000	N	Y	Y	µg/l		40 CFR 141.50, Federal primary MCLG
		1,000	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Xylenes	XYLEN	10,000'	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard

' Containment System Remedial Goal for this parameter (identified in Section 9 of the ROD) is more stringent than the ARAR and is listed in Table A-7 as a TBC

* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.

** PQL Detection levels for Gas Chromatography/Mass Spectrometry.

µg/l Indicates micrograms per liter.

Table A-6 ARARs for Groundwater at Basin A Neck IRA Treatment System

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
1,2-Dichloroethane	12DCLE	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		0.4*	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
		1**	N	Y	Y	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs (referenced in CBSG Table A)
1,1-Dichloroethylene	11DCE	7	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCLG
		7	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
1,1,1-Trichloroethane	111TCE	200	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCLG
		200	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Arsenic (Total)	AsTOT	50	N	Y	Y	µg/l		40 CFR 141.11, Federal primary MCL
		50	N	Y	Y	µg/l		5 CCR 1003-1, Colorado Groundwater Standard
Atrazine	ATZ	3	N	Y	Y	µg/l		40 CFR 141.50, Federal primary MCLG
		3	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Benzene	C6H6	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		5	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Carbon Tetrachloride	CCL4	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		0.3	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
		1**	N	Y	Y	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs (referenced in CBSG Table A)
Chlorobenzene	CLC6H5	100	N	Y	Y	µg/l		40 CFR 141.50, Federal primary MCLG
		100	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Chloroform	CHCL3	6	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Dichlorodipheny ltrichloroethane	DDT	0.1	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard

* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.
** PQL Detection levels for Gas Chromatography/Mass Spectrometry
µg/l Indicates micrograms per liter.

Table A-6 ARARs for Groundwater at Basin A Neck IRA Treatment System

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
Dieldrin	DLDRN	0 002	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
		0.1**	N	Y	Y	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs (referenced in CBSG Table A)
Endrin	ENDRN	2	N	Y	Y	µg/l		40 CFR 141.50, Federal primary MCLG
		0.2	N	Y	Y	µg/l		5 CCR 002-8, Colorado Groundwater Standard
Hexachlorocyclopentadiene	CL6CP	50	N	Y	Y	µg/l		40 CFR 141.50, Federal primary MCLG
		50	N	Y	Y	µg/l		5 CCR 002-8, Colorado Groundwater Standard
Mercury	Hg	2	N	Y	Y	µg/l		40 CFR 141.51, Federal primary MCLG
		2	N	Y	Y	µg/l		5 CCR 003-1, Colorado primary drinking water standard
Tetrachloroethylene	TCLEE	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		5	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard
Trichloroethylene	TRCLE	5	N	Y	Y	µg/l		40 CFR 141.61, Federal primary MCL
		5	N	Y	Y	µg/l		5 CCR 1002-8, Colorado Groundwater Standard

* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.
** PQL Detection levels for Gas Chromatography/Mass Spectrometry
µg/l Indicates micrograms per liter.

Table A-7 TBCs for Groundwater

Parameter	Abbrev	Conc	Units	Hrd	Source
Arsenic	AsTOT	2.35*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 1995)
Benzene	C6H6	3*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 1995)
Isopropyl Methylphosphonic acid	IMPA	700	µg/l		EPA Lifetime Health Advisory, 1992
N-nitrosodimethylamine	NDMA	0.0007*	µg/l		Risk-based level, Integrated Risk Information System (EPA 1995)
Methyl isobutyl Ketone	MIBK	2000	µg/l		Proposed Corrective Action Rule, 55 FR 30798, Appendix A, July 27, 1990
Parathion	PRTHN	200	µg/l		Proposed Corrective Action Rule, 55 FR 30798, Appendix A, July 27, 1990
Trichloroethylene	TRCLE	3*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 1995)
Isodrin	ISODR	0.06*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 1995)
Dicyclopentadiene	DCPD	46*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 1995)
1,4-Oxathiane	OXAT	160*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 995)
Dithiane	DITH	18*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 995)
Chlorophyenylmethyl su fide	CPMS	30*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 995)
Chlorophyenylmethyl su fone	CPMSO2	36*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 995)
Chlorophyenylmethyl Sulfoxide	CPMSO	36*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 1995)
Malathion	MLTHN	100*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 1995)
Xylenes	XYLEN	1000*	µg/l		Health-based value from off-post ROD (Harding Lawson Associates 1995)

* Containment System Remediation Goals identified Section 9 of the ROD.
µg/l Indicates micrograms per liter.

Table A-8 ARARs for Surface Water

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
1,1,1-Trichloroethane	111TCE	18,400	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
1,1,2-Trichloroethane	112TCE	9,400	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
1,1,2-Trichloroethane	112TCE	18,000	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		9,400	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
1,2-Dichloroethane	12DCLE	20,000	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		20,000	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life
		118,000	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Dichloroethylenes	DCE	11,600	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
Aldrin	ALDRN	3	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		1.5	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Arsenic (V)	AsV	48	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		150	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life
Arsenic (V)	AsV	850	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		360	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Benzene	C6H6	5,300	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		5,300	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Cadmium	Cd	4.3	N	Y	Y	µg/l	550* mg/l	Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		4.3	N	Y	Y	µg/l	550* mg/l	State Surface Water Standard, chronic toxicity to freshwater aquatic life
Carbon Tetrachloride	CCL4	35,200	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		35,200	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Chlordane	CLDAN	1.2	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Chloroform	CHCL3	1,240	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		1,240	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life

* Hardness value based on one-tailed 95% upper tolerance calculation of data in the RMA Environmental Database.

* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.

µg/l Indicates micrograms per liter.

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
Chloroform	CHCL3	28,900	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		28,900	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Chromium (III)	CrIII	836	N	Y	Y	µg/l	550' mg/l	Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		836	N	Y	Y	µg/l	550' mg/l	State Surface Water Standard, chronic toxicity to freshwater aquatic life
Chromium (III)	CrIII	7,015	N	Y	Y	µg/l	550' mg/l	Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		7,015	N	Y	Y	µg/l	550' mg/l	State Surface Water Standard, acute toxicity to freshwater aquatic life
Chromium (VI)	CrVI	11	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		11	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life
Chromium (VI)	CrVI	16	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		16	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Copper	Cu	51	N	Y	Y	µg/l	550' mg/l	Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		51	N	Y	Y	µg/l	550' mg/l	State Surface Water Standard, chronic toxicity to freshwater aquatic life
Copper	Cu	88	N	Y	Y	µg/l	550' mg/l	Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		88	N	Y	Y	µg/l	550' mg/l	State Surface Water Standard, acute toxicity to freshwater aquatic life
Cyanide (Free)	CYNF	5.2	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
Cyanide (Free)	CYFN	22	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		5	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
DDT (Total)	PPDDT	*0.001	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		0.001	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life
		0.1	N	Y	Y	µg/l		State Discharge Permit System PQLs [5 CCR 1002-2: 6.9.2(13) Table 1]
DDT (Total)	PPDDT	*1.1	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		0.55	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life

' Hardness value based on one-tailed 95% upper tolerance calculation of data in the RMA Environmental Database.
* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.
µg/l Indicates micrograms per liter.

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd		Source
DDE	PPDDE	1,050	N	Y	Y	µg/l			Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		1,050	N	Y	Y	µg/l			State Surface Water Standard, acute toxicity to freshwater aquatic life
Dieldrin	DLDRN	*0.0019	N	Y	Y	µg/l			Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		0.0019	N	Y	Y	µg/l			State Surface Water Standard, chronic toxicity to freshwater aquatic life
		0.1	N	Y	Y	µg/l			State Discharge Permit System PQLs [5 CCR 1002-2: 6.9.2(13) Tables]
Dieldrin	DLDRN	*2.5	N	Y	Y	µg/l			Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		1.3	N	Y	Y	µg/l			State Surface Water Standard, acute toxicity to freshwater aquatic life
Endrin	ENDRN	* 0.0023	N	Y	Y	µg/l			Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		0.0023	N	Y	Y	µg/l			State Surface Water Standard, chronic toxicity to freshwater aquatic life
		0.1	N	Y	Y	µg/l			State Discharge Permit System PQLs [5 CCR 1002-2: 6.9.2(13) Tables]
Endrin	ENDRN	*0.18	N	Y	Y	µg/l			Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		0.09	N	Y	Y	µg/l			State Surface Water Standard, acute toxicity to freshwater aquatic life
Ethylbenzene	ETCGH5	32,000	N	Y	Y	µg/l			State Surface Water Standard, acute toxicity to freshwater aquatic life
Fluoride	F	2,000	N	Y	Y	µg/l			State Surface Water Standard, 5 CCR 100, Table 2 Health based stds
Hexachlorocyclopentadiene	CL6CP	*5.2	N	Y	Y	µg/l			Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		5	N	Y	Y	µg/l			State Surface Water Standard, chronic toxicity to freshwater aquatic life
Hexachlorocyclopentadiene	CL6CP	*7	N	Y	Y	µg/l			Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		7	N	Y	Y	µg/l			State Surface Water Standard, acute toxicity to freshwater aquat ic li fe
Lead	Pb	27.9	N	Y	Y	µg/l	550'	mg/l	Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		43.6	N	Y	Y	µg/l	550'	mg/l	State Surface Water Standard, chronic toxicity to freshwater aquatic l ife
Lead	Pb	715	N	Y	Y	µg/l	550'	mg/l	Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		1,504	N	Y	Y	µg/l	550'	mg/l	State Surface Water Standard, acute toxicity to freshwater aquatic life

' Hardness value based on one-tailed 95% upper tolerance calculation of data in the RMA Environmental Database.
* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.
µg/l Indicates micrograms per liter.

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
Malathion	MLTHN	*0.1	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		0.1	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life
		0.2	N	Y	Y	µg/l		State Discharge Permit System PQLs [5 CCR 1002-2: 6.9.2(13) Tables]
Mercury	Hg	0.012	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		0.1	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life
Mercury	Hg	2.4	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		2.4	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Parathion	PRTHN	*0.013	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
Parathion	PRTHN	*0.065	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
Tetrachloroethylene	TCLEE	840	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		840	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life
Tetrachloroethylene	TCLEE	5,280	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		5,280	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Toluene	MEC6H5	17,500	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		17,500	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Trichloroethylene	TRCLE	21,900	N	Y	Y	µg/l		Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		21,900	N	Y	Y	µg/l		State Surface Water Standard, chronic toxicity to freshwater aquatic life
Trichloroethylene	TRCLE	45,000	N	Y	Y	µg/l		Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		45,000	N	Y	Y	µg/l		State Surface Water Standard, acute toxicity to freshwater aquatic life
Zinc	Zn	439	N	Y	Y	µg/l	550' mg/l	Federal Water Quality Criteria, chronic toxicity to freshwater aquatic life
		449	N	Y	Y	µg/l	550' mg/l	State Surface Water Standard, chronic toxicity to freshwater aquatic life
Zinc	Zn	485	N	Y	Y	µg/l	550' mg/l	Federal Water Quality Criteria, acute toxicity to freshwater aquatic life
		496	N	Y	Y	µg/l	550' mg/l	State Surface Water Standard, acute toxicity to freshwater aquat ic life

' Hardness value based on one-tailed 95% upper tolerance calculation of data in the RMA Environmental Database.

* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.

µg/l Indicates micrograms per liter.

Parameter	Abbrev	Conc	App	Rel	Apr	Units	Hrd	Source
Diisopropylmethyl Phosphonate	DIMP	8	N	Y	Y	µg/l		State Surface Water Standard, Human Health Based Water Supply

' Hardness value based on one-tailed 95% upper tolerance calculation of data in the RMA Environmental Database

* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.

µg/l Indicates micrograms per liter.

Table A-9 TBCs for Surface Water

Parameter	Abbrev	Conc	App	Hrd	Source
Ethylbenzene	ETC 6H5	4000	µg/l		Proposed Corrective Action Rule, 55 FR 30798, Appendix A, July 27, 1990
		680	µg/l		EPA Integrated Risk Information System
Methylene chloride	CH2CL2	*5	µg/l		Proposed Corrective Action Rule, 55 FR 30798, Appendix A, July 27, 1990
Methylisobutyl ketone	MIBK	2000	µg/l		Proposed Corrective Action Rule, 55 FR 30798, Appendix A, July 27, 1990
n-Nitrosodimethylamine	NNDMEA	0.007	µg/l		EPA Integrated Risk Information System
		10.0	µg/l		5 CCR 1002-2, State Discharge Permit System PQLs [5 CCR 1002-2 Section 6.9.2(13) Table 1]
Xylenes (Total)	XYLEN	70000	µg/l		Proposed Corrective Action Rule, 55 FR 30798, Appendix A, July 27, 1990

* Asterisk indicates concentration below the lowest USAEC Certified Reporting Limit.
µg/l Indicates micrograms per liter.

Table A-10 TBCs for Soil and Sediments

Chemical Compound	RCRA Proposed Corrective Action Rule Levels (ppm)[2]
VHOs	
1,2-Dichloroethane	8
1,1-Dichloroethylene	10
1,1,2,2-Tetrachloroethane	40
1,1,1-Trichloroethane	7,000
1,1,2-Trichloroethane	100
Carbon tetrachloride	5
Chlorobenzene	2,000
Chloroform	100
Methylene chloride	90
Tetrachloroethylene	10
Trichloroethylene	60
Toluene	20,000
VAO	
Ethylbenzene	8,000
Xylenes	200,000
SHOs	
Hexachlorocyclopentadiene	600
OCPs	
Aldrin	0.04
Chlordane	0.5
DDE	2
DDT	2
Dieldrin	0.04-9.03[3]
Endrin	20–4.03[3]
Parathion	500
Arsenic	80
Mercury	20
PCBs	50*
ICP Metals	
Cadmium	40
Chromium (VI) -	400

[1] The following COCs currently do not have proposed RCRA Corrective Action Rule Levels:
Benzene
Chloroacetic acid
Dibromochloropropane
Dicyclopentadiene
Isodrin
Lead

[2] Source: EPA proposed Corrective Action Rule for solid waste management units (55 FR 30798; July 1990)

[3] Source: EPA proposed Water Quality Criteria for the Protection of Benthic Organisms for Dieldrin and Endrin (these are only applicable to lake sediments and not to soils)

* Based on TSCA regulatory threshold value and not RCRA Subpart 5 standards

ICP Indicates inductively coupled plasma.
OCP Indicates organochlorine pesticide
SHO Indicates semivolatile halogenated organic.
VAO Indicates volatile aromatic organic.
VHO Indicates volatile halogenated organic.

Location	Citation	Requirements
Areas prone to surface movement	40 CFR 264.18(a) 6 CCR 1007-3, 264.18(a)	New treatment facilities, storage facilities, or hazardous waste disposal facilities should not be within 200 ft of a fault. Facilities should not be located in areas prone to earthquakes, floods, fire, or other disasters that could cause a breakdown of the public water system.
Within 100-year floodplain	40 CFR 257.3-1(a) 40 CFR 264.18(b) 6 CCR 1007-3, 264.18(b) Executive Order 11988 40 CFR 6.302 (b) 40 CFR 6, Appendix A, Section 3(a), 3(b)(1), & 3(b)(4) 44 FR 43239 (July 24, 1979)	Facilities should be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood. Floodplain management requirements exist to avoid adverse impacts associated with the occupancy and modification of floodplains.
Wetlands	42 U.S.C. Section 1344 40 CFR Parts 230, Subpart H 33 CFR 320-330 Executive Order 11990 40 CFR 6.302 (a) 40 CFR 6, Appendix A, Section 3(a) & 3(c)	The discharge of dredged or fill material into the waters of the United States is prohibited without a permit. Protection of wetlands is required to avoid adverse impacts associated with the destruction and modification of wetlands.
Area affecting stream or river	16 USC Part 661-663 40 CFR 6.302 (e) and (g) 16 USC 1274 et. seq.	Fish or wildlife resources that may be affected by actions resulting in control or structural modification of any natural stream or body of water should be protected. Federal agencies taking such actions must consult with the U.S. Fish and Wildlife Service. The Wild and Scenic Rivers Act established requirements for water resource projects affecting wild, scenic or recreational rivers in the National Wild and Scenic Rivers system.
Historically or culturally significant properties owned or controlled by a federal agency	16 USC 470 aa et. seq. 36 CFR 800 44 FR 6068	The National Historic Preservation Act identifies procedures for protection of Historically and Culturally Significant Properties, including Colorado's delegated responsibilities under the act.

Location	Citation	Requirements
Prehistoric, historic, or archeological sites owned or controlled by a federal agency	36 CFR 60 36 CFR 63 Proposed 36 CFR 66 36 CFR 296 43 CFR 3 43 CFR 7	Department of Interior regulations for determining site eligibility for the National Register of Historic Places and standards for data recovery should be complied with.
Historical, prehistorical and archeological resources and State Register of Historic Places Act	CRS § 24-80-401 et. seq. CRS §24-80.1-101 et. seq.	Consultation with the Colorado Historic Society, the State Archeologist, and State Register of Historic Places is required before an action is taken.
Cultural resource owned or controlled by a federal agency	35 FR 8921	Executive Order 11593: Any federal agency controlling culturally significant resources is the designated leader in the preservation of those resources. This order ensures that all culturally significant resources located on an agency's property are protected. The federal agencies are responsible for identifying, evaluating, and nominating (where appropriate) to the National Register of Historic Places all culturally significant resources found on their land.
Archeological or historic site owned or controlled by a federal agency	16 USC 469 et. seq.	The Archeological and Historic Preservation Act of 1974 requires that a federal agency notifies the Secretary of Interior of any agency project that will destroy a significant archeological site. The Secretary of the notifying agency may support data recovery programs to preserve the resource.
Historically significant property owned and managed by the U.S. Army	Army Regulation 420 32 CFR 650.181 to 193 Technical Manual 5-801-1 Technical Note 78-17 32 CFR 229	U.S. Department of the Army has procedures and standards for preserving historically significant properties and procedures for implementing the Archeological Resources Protection Act. Department of the Army Regulations 420 prescribe Army policy procedures and responsibilities for compliance with the National Historic Preservation Act of 1966, as amended, for maintaining the preservation of historically significant sites, the hiring of qualified personnel to manage the sites, and the conduct of state-of-the-art standards for preservation, personnel, and projects for accomplishment of the historic preservation program. This regulation also requires that each installation prepare a historic preservation plan or have documentation on file indicating that no resources appropriate for such management planning exist.

Location	Citation	Requirements
Archeological resources on U S Department of the Army installations	16 USC 470 aa et. seq.	The Archeological Resources Protection Act of 1979 establishes criminal and civil penalties for anyone damaging archeological resources. This act also allows the Secretary of the Army to issue excavation permits for archeological resources.
Prehistoric, historic, or archeological sites owned or controlled by the U S. Army	16 USC 470a 36 CFR 800	The National Historic Preservation Act of 1966 requires the Secretary of the Interior to inventory, evaluate, and nominate (where appropriate) significant properties to the National Register of Historic Places.
	43 CFR 3	Preservation of American Antiquities: Provides for the protection of historic or prehistoric remains of any object of any antiquity on federal lands.
	43 CFR 7 36 CFR 296	Protection of Archeological Resources: Provides for the protection of archeological resources located on public lands.
Prehistoric, historic, or archeological sites owned or controlled by the U S Army	Executive Order No 11593, May 13, 1971, 36 FR 8921, Section 2(b)	According to Executive Order No. 11593, each federal agency shall exercise caution to ensure that any such property that might qualify for inclusion is not inadvertently transferred, sold, demolished, substantially altered, or allowed to deteriorate significantly.
	16 USC 470 aa et. seq. 36 CFR 60.6	Based on the historical and field inventory information, the significance of all identified sites should be evaluated following criteria set forth in 36 CFR 60.6 and in accordance with the Preservation Office before conducting any ground-altering activity with guidelines from the Colorado State Historic Preservation Office. The act also requires the Army agency to consult with the Advisory Council on Historic issues that may affect those significant properties. A federal agency should take into account the effect of the project on any National Register-listed or eligible property and is directed to complete an appropriate data recovery program before such a site is damaged or destroyed.
National Historic Landmark Program	36 CFR 65	The National Historic Landmark Program was established to identify and designate National Historic Landmarks and encourage the long range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.

Location	Citation	Requirements
Colorado Requirements for Siting of Hazardous Waste Disposal Site	6 CCR 1007-2, Part 2	State siting requirements control the location, design, and design performance of hazardous waste disposal sites. Such disposal sites must be located and designed in a manner that ensures long-term protection of human health and the environment. Disposal sites must be designed to prevent adverse effects on: • Groundwater • Surface water • Air quality • Public health and the environment
National Wildlife Refuge System Administration Act	16 USC 668dd et. Seq 50 CFR 25	The National Wildlife Refuge Administration Act prohibits the taking or possessing any fish, bird, mammal, or other wild vertebrate or invertebrate animals or part or nest or egg thereof within any such area; or enter, use, or otherwise occupy any such area for any purpose; unless such activities are performed by persons authorized to manage such area or unless such activities are permitted.

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
	29 CFR 1926 Subpart P	29 CFR 1926 Subpart P provides guidelines for workers engaged in activities related to construction and utilization of trenches and ditches.

Action	Citation	Requirements
	AR-385-10 AR 385-64 AMC-R 395-100 DAA Pam 40-8 [TBC] FM 3-21 [TBC] TM 10-277 [TBC] Army Corps of Engineers (ACOE) Guidance on Safety Concepts for UXO [TBC]	If unexploded ordnance (UXO) is encountered during excavation, workers must comply with the substantive requirements of AMCR 385-100, AR 385-10, AR 385-64, as well as guidance provided in DA Pam 40-8, FM 3-21, TM 10-277 and ACOE guidance for UXO regarding health and safety of workers associated with ammunition, explosives, and chemical agents.
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the chemicals listed in Table A-46, excavation at Basin F is expected to encounter ammonia. The ammonia fumes will be neutralized using an acidified scrubber that utilizes hydrochloric acid. Worker exposure standards for these chemicals are as follows: Ammonia: ACGIH-TWA = 25 ppm, 17 mg/m^3; Short-Term Exposure Limit (STEL) = 35 ppm, 24 mg/m^3; NIOSH-REL = 25 ppm, 18 mg/m^3; STEL = 35 ppm, 27 mg/m^3; OSHA-Permissible Exposure Limit (PEL) = 50 ppm, 35 mg/m^3 Hydrogen Chloride: ACGIH-ceiling = 5 ppm, 7.5 mg/m3; NIOSH-ceiling = 5 ppm, 7 mg/m3; OSHA-ceiling = 5 ppm, 7 mg/m3 If chemical agent is encountered during excavation, workers must comply with the chemical-specific exposure guidelines for chemical agents and breakdown products outlined in Table A-28 of this document.

Action	Citation	Requirements
		(OSHA regulations and other health and safety requirements are actually independently applicable requirements, not ARARs and TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emission Control		
Particulate emissions during excavation and backfill	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2, Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. In addition, no off-site transport of particulate matter is allowed. A fugitive dust control measure will be written into the workplan in consultation with the state for the remedial activity. Estimated emissions from the proposed remedial activity per Colorado Air Pollution Emission Notice (APEN) requirements.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Excavation and backfill of soils could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	Volatile organic compound (VOC) regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.

Action	Citation	Requirements
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Air emissions from diesel powered vehicles associated with excavation and backfill operations	5 CCR 1001-15, Regulation 12	Colorado Diesel-Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state as follows: 1) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing 7,500 pounds and less, empty weight, any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 2) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, any air contaminant, for a period greater than (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 35% opacity, with the exception of subpart "C". 3) No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, operated above 7,000 ft (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity.

Action	Citation	Requirements
		4) Any diesel-powered motor vehicle exceeding these requirements shall be exempt for a period of 10 minutes if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position. 5) These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Excavation and backfilling of soils must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the Automobile Inspection and Readjustment (AIR) Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Smoke and opacity	5 CCR 1001-3, Regulation 1, Sect II.A	Excavation and backfilling of soils must be conducted in a manner that will not allow or cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Waste Characterization		
Asbestos waste storage management	6 CCR 1007-2, Part B, Section 5.4	Asbestos waste will be managed according to applicable substantive requirements for asbestos storage.

Action	Citation	Requirements
Asbestos waste handling management	40 CFR 61, Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; deposit asbestos-containing waste as possible at disposal site; mark transport vehicle appropriately during loading and unloading operations.
	5 CCR 10001-10, Regulation Part B, Section 8 B III c 8	Asbestos waste will be managed according to applicable substantive requirements for asbestos handling, transportation, and storage.
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Wastes generated during soil excavation activities must be characterized and evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR 261

Action	Citation	Requirements
		• Determine whether the waste is identified in 40 CFR 261 by testing the waste according to specified test methods or by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes.

Action	Citation	Requirements
		5) "Inert material", which includes solids that are not soluble in water and therefore non-putrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, commercial, and special wastes are expected from soil excavation at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
<u>Waste Management</u>		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	If soil excavation at RMA generates hazardous wastes, the wastes must be treated, stored or disposed in accordance with RCRA regulations, including LDRs-UTS (if placement occurs).
	6 CCR 1007-3 Parts detailed below	Some of the Colorado standards for owners and operators of hazardous waste treatment, storage, and disposal facilities are more stringent than the equivalent federal regulations. The standards that are more stringent are detailed below.
	Part 264.13 6 CCR 1007-3 Sect 264.13	General waste analysis requirements
	Part 264.90 6 CCR 1007-3 Sect 264.90	Groundwater Monitoring Standards

Action	Citation	Requirements
	Part 264.97 (g)(3) 6 CCR 1007-3 Sect 264.97(g)(3)	General groundwater monitoring requirements
	Part 264.98 (c) 6 CCR1007-3 Sect 264.98(c)	Groundwater detection monitoring program
	Part 264.99 (C)(3)(i)(iii) 6 CCR1007-3 Sect 264.99 (C)(3)(i)(iii)	Groundwater compliance monitoring program
	Part 264.100 (e)(2) 6 CCR 1007-3 Sect 264.100(e)(2)	Corrective action program
	Part 264.171-173 6 CCR 1007-3 Sect 264.171-173	Applicability of the requirements of containers
	Part 264.101(c)(1) 6 CCR 1007-3 Sect 264.101(c)(1)	Corrective action for solid waste management units
	Part 264.190 (c) 6 CCR 1007-3 Sect 264.190(c)	Applicability of the requirements for tanks or tank systems
	Part 264.251 (c) & (d) 6 CCR 1007-3 Sect 264.251(c) & (d)	Design and operating requirements for waste piles
	Part 264.273 (c) & (d) 6 CCR 1007-3 Sect 264.273(c) & (d)	Design and operating requirements for land treatment
	Part 264.312 (b) 6 CCR 1007-3 Sect 264.312(b)	Special requirements for ignitable and reactive wastes in landfills
	Part 264.314 (a) 6 CCR 1007-3 Sect 264.314(a)	Special requirements for bulk and containerized liquids in landfills
	Part 264.314(f) 6 CCR 1007-3 Sect 264.314(f)	Liquid waste prohibition

Action	Citation	Requirements
	Part 264.340 (a)(1) & (2) 6 CCR 1007-3 Sect 264.340(a)(1) & (2)	Applicability of incinerator requirements
	Part 264.16 (a)(1) 6 CCR 1007-3 Sect 264.16(a)(1)	Personnel training
	Part 264.31 (a) 6 CCR 1007-3 Sect 264.31(a)	Facility design and operation requirements
	Part 264.51 (a) 6 CCR 1007-3 Sect 264.51(a)	Purpose and implementation of contingency plans
	Part 264.52 (a) 6 CCR 1007-3 Sect 264.52(a)	Content of contingency plans
	Part 264 Subpart cc [TBC] 6 CCR 1007-3 Part 264 Subpart cc	Air emission standards for tanks
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris generated during soil excavation activities must be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris if placement occurs. In certain cases, after treatment the debris may no longer be subject to RCRA Subtitle C regulation.
Management of Remediation Wastes	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.

Action	Citation	Requirements
Temporary Units (TU)	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Groundwater Injection		
Reinjection of treated groundwater	RCRA Section 3020 (b) OSWER Directive 9234.1-06 [TBC] 40 CFR 124, 144, 146, 147 (Subpart G), and 148	Reinjection of treated groundwater must be managed in accordance with the guidelines in OSWER Directive 9234.1-06. Wells must be constructed and installed and managed in compliance with the substantive requirements of 40 CFR 124, 144, 146, 147 (Subpart G), and 148.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Dredged Material Management		
Discharge of Dredged Materials	40 CFR 230 Subpart B	Dredging operations in wetland areas must be managed in accordance with the applicable requirements based on the impacts resulting from specific dredged material discharges associated with sediment removal activities.
Certification of Federal Licenses and Permits (401 Certification)	33 USC Section 1341 Section 401 of Clean Water Act	Provides for state review of facility operations for the purposes of assuring that applicable effluent limitations or other limitations or other applicable water quality requirements will not be violated.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that:

a "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Waste Characterization		
Solid waste determination		Drums, debris, and equipment from structures that stockpiled must be evaluated to determine whether it may be recycled or reused or whether it is a solid waste.
	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 (a) 6 CCR 1007-3 Sect 261.4(a) 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31	A solid waste is any discarded material that is not excluded by 40 CFR 261.4 (a) or that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Solid wastes including drums, debris, and equipment from structures that are temporarily stored in stockpiles must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261

Action	Citation	Requirements
		• Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods or by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes.

Action	Citation	Requirements
		5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes are expected from sstockpiles at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
<u>Waste Management</u>		
Asbestos waste storage management	6 CCR 1007-2, Part B, Section 5.4	Asbestos waste will be managed according to applicable substantive requirements for asbestos storage.
Asbestos waste handling management	40 CFR 61, Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; deposit asbestos-containing waste as possible at disposal site; mark transport vehicle appropriately during loading and unloading operations.
	5 CCR 1001-8, Regulation Part B, Section 8.B.III.c.8	Asbestos waste will be managed according to applicable substantive requirements for asbestos handling, transportation, and storage.

Action	Citation	Requirements
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater) Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements. Containers must be dated when they are placed in storage. All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.
PCB decontamination standards	40 CFR 761.79	PCB containers to be decontaminated by triple rinsing of internal surfaces with solvent containing <50 ppm PCB.
Treatment, storage, or disposal of hazardous wastes in waste piles	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes stored in stockpiles that are determined to be RCRA hazardous wastes must be stored, treated, and disposed in compliance with all substantive requirements of Part 264 as indicated in Exhibit 1-3 of the CERCLA Compliance with Other Laws Manual including 40 CFR Part 264 Subpart 6 and LDRs-UTS if placement occurs.
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris must be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris. In certain cases after treatment, the debris may no longer be subject to RCRA Subtitle C Regulation. [Refer to Table A-20 for citations and requirements relevant to both on-post and off-post solid waste landfills.]
Design and operating requirements for waste piles that contain hazardous wastes	40 CFR 264.251 6 CCR 1007-3 Sect 264.251	Waste piles that contain hazardous wastes must:

Action	Citation	Requirements
		• Have a liner that is designed, constructed, and installed to prevent migration of wastes out of the pile into adjacent soil, groundwater, or surface water. • Be constructed with materials to prevent failure, physical contact with the waste, and that will endure stress of installation and daily operation. • Be placed on a foundation that provides support to prevent failure of the liner. • Be installed to cover all surrounding earth likely to be in contact with the waste or leachate. • Have a leachate collection system. • Have a run-on control system capable of preventing flow onto the active portion of the pile during peak discharge from at least a 25-year storm. • Have a run-off management system to collect and control at least the water volume resulting from a 24-hour, 25-year storm. • Be covered or managed properly if the pile contains any particulate matter which may be subject to wind dispersal.
	6 CCR 1007-3	Colorado regulations are more stringent than federal requirements by requiring that run-on and run-off control systems are designed and operated to collect and control the water volume resulting from a 24-hour, 100-year storm.
Incompatible wastes in waste piles	40 CFR 264.257 6 CCR 1007-3 Sect 264.257 40 CFR 264.17 (b) 6 CCR 1007-3 Sect 264.17(b)	Incompatible wastes must not be placed in the same pile unless 40 CFR 264.17 (b) is complied with. Incompatible wastes must be separated from other materials.
Closure and post-closure care of waste piles	40 CFR 264.258 6 CCR 1007-3 Sect 264.258	At closure, the owner or operator must remove or decontaminate all waste residues and manage them as hazardous wastes.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following:

Action	Citation	Requirements
		• Health and safety program participation required by all on site workers • Site characterization and analysis • Site control • On site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
<u>Stormwater Management</u>		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
<u>Air Emissions</u>		
Standard for asbestos waste disposal	40 CFR 61 Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing waste; deposit asbestos-containing waste as soon as possible at disposal site; mark transport vehicles appropriately during loading and unloading operations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sould levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120(b) to (j)	29 CFR 1910.120(b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under the RCRA and the CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, the ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Demolition		
Air emissions during demolition	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2, Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. In addition, no off-site transport of particulate emissions is allowed. A fugitive dust control measure will be written into the work plan in consultation with the state for the remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Standard for asbestos waste disposal	40 CFR 61 Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; deposit asbestos-containing waste as soon as possible at disposal site; mark transport vehicle appropriately during loading and unloading operations.
Emission control for opacity	5 CCR 1001-3 Regulation 1, Section II	Demolition of structures shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Demolition of structures could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.

Action	Citation	Requirements
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Air emissions from diesel powered vehicles associated with demolition	5 CCR 1001-15, Regulation 12	Colorado Diesel- Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state as follows: 1) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing 7,500 pounds and less, empty weight, any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 2) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, any air contaminant, for a period greater than (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 35% opacity, with the exception of subpart "C". 3) No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, operated above 7,000 ft (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity.

Action	Citation	Requirements
		4) Any diesel-powered motor vehicle exceeding these requirements shall be exempt for a period of 10 minutes if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position. 5) These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Demolition of structures must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
<u>Waste Characterization</u>		
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR 261 6 CCR 1007-3 Part 261	Wastes generated during the demolition of structures must be characterized. Solid wastes must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used

Action	Citation	Requirements
Solid waste determination		Drums, debris, and equipment from structures that stockpiled must be evaluated to determine whether it may be recycled or reused or whether it is a solid waste.
	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 (a) 6 CCR 1007-3 Sect 261.4(a) 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31	A solid waste is any discarded material that is not excluded by 40 CFR 261.4 (a) or that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Solid waste classification	6 CCR 1007-3, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes.

Action	Citation	Requirements
		2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor mounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes are expected from slurry wall installation at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.

Action	Citation	Requirements
Waste Management		
Asbestos waste storage management	6 CCR 1007-2, Part B, Section 5.4	Asbestos waste will be managed according to applicable substantive requirements for asbestos storage.
Asbestos waste handling management	40 CFR 61, Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; deposit asbestos-containing waste as possible at disposal site; mark transport vehicle appropriately during loading and unloading operations.
	5 CCR 1001-10, Regulation Part B, Section 8 B.III.c.8	Asbestos waste will be managed according to applicable substantive requirements for asbestos handling, transportation, and storage.
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater) Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements. Containers must be dated when they are placed in storage. All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.
PCB decontamination standards	40 CFR 761.79	PCB containers to be decontaminated by triple rinsing of internal surfaces with solvent containing <50 ppm PCB.
Treatment, storage, or disposal of hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264	If structure demolition at RMA generates hazardous wastes, the wastes must be treated and stores in accordance with RCRA regulations.

Action	Citation	Requirements
	40 CFR Part 264 Subpart L 6 CCR 1007-3 Subpart L 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes stored in stockpiles that are determined to be RCRA hazardous wastes must be stored, treated, and disposed in compliance with RCRA regulations, including LDRs-UTS if placement occurs.
	40 CFR Part 264 Subpart I 6 CCR 1007-3 Part 264 Subpart I	Applicability of substantive requirements for containers.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed in Appendix A, Table A-12.
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3 Sect 268.45	Hazardous debris encountered during slurry wall installation must be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris. In certain cases after treatment, the debris may no longer be subject to RCRA Subtitle C regulation.
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.

Action	Citation	Requirements
On-post land disposal of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268 EPA/540/G-89/006 [TBC]	Based upon a determination of whether the disposal technique constitutes placement, LDRs-UTS may be applicable. If placement occurs, the on-site disposal facility must comply with the substantive requirements of 40 CFR 264 (6 CCR 1007.3 Part 264) and 40 CFR Part 268 (6 CCR 1007-3 Part 268).
Stormwater Management		
Discharge of stormwater to on-post surface water	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sould levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: Zone / 7:00 a.m. to next 7:00 p.m. / 7:00 p.m. to next 7:00 a.m. Residential / 55 db(A) / 50 db(A) Commercial / 60 db(A) / 55 db(A) Light Industrial / 70 db(A) / 65 db(A) Industrial / 80 db(A) / 75 db(A) b. In the hours between 7:00 a.m. and the next 7:00 p.m , the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

Action	Citation	Requirements
		c Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
	29 CFR 1926 Subpart P	29 CFR 1926 Subpart P provides guidelines for workers engaged in activities related to construction and utilization of trenches and ditches.
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46.

Action	Citation	Requirements
		(OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are presented as guidelines.)
Air Emissions		
Air emissions during trench construction	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2, Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. No off-site transport of particulate matter allowed. A fugitive dust control measure will be written into the work plan in consultation with the state for each remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3 Regulation 1, Section II	Trench construction shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Trench construction could cause volatization of some organic and metal contaminants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements.

Action	Citation	Requirements
		Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use area—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Air emissions from diesel-powered vehicles associated with trench construction	5 CCR 1001-15, Regulation 12	Colorado Diesel-Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state as follows: 1) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing 7,500 pounds and less, empty weight, any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 2) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, any air contaminant, for a period greater than (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 35% opacity, with the exception of subpart "C".

Action	Citation	Requirements
		3) No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, operated above 7,000 ft (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 4) Any diesel-powered motor vehicle exceeding these requirements shall be exempt for a period of 10 minutes if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position. 5) These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Trench construction must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.

Action	Citation	Requirements
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable requirements, not ARARs and TBCs. ACGIH and NIOSH values are presented as guidelines.)

Action	Citation	Requirements
Construction of Caps/Covers		
Design/installation of caps/covers	Final Covers on Hazardous Waste Landfills and Surface Impoundments EPA/530/SW-89/047[TBC]	Caps and covers must be designed and installed to prevent wind dispersal of hazardous wastes. They should be designed, constructed, and installed as specified in EPA/530/SW-89/047.
Air Emission Control		
Particulate emissions during cap/cover installation	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. Excavation and backfilling of soils conducted in a manner that will not allow or cause the emission in excess of 20% opacity. In addition, no off-site transport of particulate matter is allowed. A fugitive dust control measure will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1; Section II	Installation of caps/covers shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. Installation of caps/covers could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.

Action	Citation	Requirements
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Air emissions from diesel powered vehicles associated with installation of caps/covers	5 CCR 1001-15, Regulation 12	Colorado Diesel - Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state as follows: 1) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing 7,500 pounds and less, empty weight, any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 2) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, any air contaminant, for a period greater than (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 35% opacity, with the exception of subpart "C".

Action	Citation	Requirements
		3) No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, operated above 7,000 ft (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 4) Any diesel-powered motor vehicle exceeding these requirements shall be exempt for a period of 10 minutes if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position. 5) These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Installation of caps/covers must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
<u>Stormwater Management</u>		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAM Us may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations land emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
	29 CFR 1926 Subpart P	29 CFR 1926 Subpart P provides guidelines for workers engaged in activities related to construction and utilization of trenches and ditches.
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46.

Action	Citation	Requirements
		In addition to the chemicals listed in Table A-46, workers installing the concrete liners will be exposed to Portland cement dust. Worker exposure standards for Portland cement are the following: Portland cement — ACGIH-TWA = 10 mg/m^3* NIOSH-REL = 10 mg/m^3 (total), 5 mg/m^3 (resp) OSHA-TWA = 15 mg/m^3 (total), 5 mg/m^3 (resp) * value is for total dust containing no asbestos land less than 1% crystalline silica (OSHA regulations and other health and safety requirements are actually independently applicable requirements, not ARARs and TBCs. ACGIH and NIOSH values are presented as guidelines.)
Air Emission Control		
Particulate emissions during installation of concrete liners	5 CCR 1001 -3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. Mixing of concrete material must be conducted in a manner that will not allow or reuse emissions into the atmosphere of any air pollutant in excess of 20% opacity. In addition, no off-site transport of particulate matter is allowed. A fugitive dust control measure will be written in the work plan in consultation with the state for this remediation activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Construction of concrete liners shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.

Action	Citation	Requirements
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. Concrete liner installation could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Concrete liner installation must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
<u>Stormwater Management</u>		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
	29 CFR 1926 Subpart P	29 CFR 1926 Subpart P provides guidelines for workers engaged in activities related to construction and utilization of trenches and ditches.
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46.

Action	Citation	Requirements
		(OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emissions		
Air emissions during slurry wall construction	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2, Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. Slurry wall construction must be conducted in such a manner that will not allow or cause emissions into the atmosphere of any air pollutants in excess of 20% opacity. In addition, no off-site transport of particulate matter is allowed. A fugitive dust control measure will be written in the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Slurry walls shall not cause the emission into the atmosphere of any air pollutant which is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Slurry wall construction could cause volatization of some organic and/or metal contaminants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements.

Action	Citation	Requirements
		Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Air emissions from diesel-powered vehicles associated with slurry wall construction	5 CCR 1001-15, Regulation 12	Colorado Diesel-Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state as follows: 1) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing 7,500 pounds and less, empty weight, any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 2) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, any air contaminant, for a period greater than (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 35% opacity, with the exception of subpart "C".

Action	Citation	Requirements
		3) No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, operated above 7,000 ft (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 4) Any diesel-powered motor vehicle exceeding these requirements shall be exempt for a period of 10 minutes if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position. 5) These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Slurry wall construction must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
<u>Waste Characterization</u>		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities:

Action	Citation	Requirements
	6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	• Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 CCR 1007-3 Part 261	Wastes generated during slurry wall construction must be characterized. Solid wastes must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following:

Action	Citation	Requirements
		1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes are expected from slurry wall installation at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.

Action	Citation	Requirements
Waste Management		
Treatment, storage, or disposal of hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264	If slurry wall construction at RMA generates hazardous wastes, the wastes must be treated and stored in accordance with RCRA regulations.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed in Appendix A, Table A-12.
On-post land disposal of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268 EPA/540/G-89/006 [TBC]	Based upon a determination of whether the disposal technique constitutes placement, LDRs-UTS may be applicable. If placement occurs, the on-site disposal facility must comply with the substantive requirements of 40 CFR 264 (6 CCR 1007-3, Part 264) and 40 CFR 268 (6 CCR 1007-8, Part 268).
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris encountered during slurry wall installation must be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris. In certain cases after treatment, the debris may no longer be subject to RCRA Subtitle C regulation.
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of [illegible] subpart [illegible]

Action	Citation	Requirements
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

Zone	7:00 a.m. to next 7:00 p.m	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable requirements, not ARARs and TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Landfill Design/Operation		
On-post hazardous waste landfill design/operation	40 CFR 264 6 CCR 1007-3 Part 264 40 CFR 268 6 CCR 1007-3 Part 268	On-post hazardous waste landfills shall be designed and operated in compliance with the applicable substantive requirements of 40 CFR 264 (6 CCR 1007-3, Part 264), including Subparts A, B, C, D, F, G, I, J, and N. If the landfill is located outside the AOC from which the hazardous waste was derived or is not in a designated CAMU, placement has occurred and the landfill must comply with LDRs-UTS in 40 CFR 268 (6 CCR 1007-3, Part 268).
Off-post hazardous waste landfill operation	40 CFR 264 6 CCR 1007-3 Part 264 OSWER Directive 9834.11	Off-post hazardous waste landfills shall be RCRA-permitted facilities and shall operate in compliance with all requirements of 40 CFR 264. The facilities shall also be in compliance with OSWER Directive 9834.11 regarding off-site disposal of hazardous waste from CERCLA sites. All RCRA requirements such as manifesting and LDRs-UTS will apply to all off-site shipments of hazardous waste, including any hazardous waste debris.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
TCSA-PCB design standards	40 CFR 761 Subpart D	On-post hazardous waste landfills shall be designed and operated in compliance with applicable substantive requirements of 40 CFR 761 Subpart D.
Waste Management		
Asbestos waste disposal management	6 CCR 007-2, Part B, Section 5.0	On-Post hazardous waste landfill shall be designed and operated in compliance with applicable substantive requirements for asbestos waste disposal sites.
Asbestos waste storage management	6 CCR 007-2, Part B, Section 5.4	Asbestos waste will be managed according to applicable substantive requirements for asbestos storage.

Action	Citation	Requirements
	5 CCR 1000110, Regulation Part B, Section 8 B III c 8	Asbestos waste will be managed according to applicable substantive requirements for asbestos handling, transportation, and storage.
Asbestos waste handling management	40 CFR 61, Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; deposit asbestos-containing waste as possible at disposal site; mark transport vehicle appropriately during loading and unloading operations.
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater) Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements. Containers must be dated when they are placed in storage. All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.
PCB chemical waste landfilling standards	40 CFR 761.75	Landfill must be located in thick, relatively impermeable soil formation or on soil with high clay and silt content, synthetic membranes must be used when these conditions cannot be met. In addition, other structural requirements include avoidance of location in a floodplain; required run-on/run-off structures if below the 100 year floodplain, and ground/surface water monitoring for specified parameters. The landfill must include a leachate monitoring system. PCB wastes must be segregated from wastes not chemically compatible with PCBs.

Action	Citation	Requirements
PCB decontamination standards	40 CFR 761.79	PCB containers to be decontaminated by triple rinsing of internal surfaces with solvent containing <50 ppm PCB.
Treatment, storage, or disposal of hazardous wastes in containers and tanks	40 CFR 264 Subpart I 6 CCR 1007-3 Part 264 Subpart I	Applicability of the substantive requirements for containers.
	40 CFR 264 Subpart J 6 CCR 1007-3 Part 264 Subpart J	Applicability of the substantive requirement for tanks or tank systems.
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.

Action	Citation	Requirements
Air Emission Control		
Emission of particulates	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. No off-site transport of particulate matter is allowed. A fugitive dust control measure will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements will be necessary.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	On-post landfilling shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. On-post landfilling may cause emission of hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO Emissions	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.

Action	Citation	Requirements
Air Emissions		
Standard for asbestos waste disposal	40 CFR 61 Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing waste; deposit asbestos-containing waste as soon as possible at disposal site; mark transport vehicles appropriately during loading and unloading operations.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	On-post landfilling must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.

Action	Citation	Requirements
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Wastewater Treatment/Disposal	40 CFR 262 6 CCR 1007-3, Part 262 40 CFR 264 6 CCR 1007-3, Part 264	Wastewater that is determined to be a hazardous waste must be treated in accordance with the provisions of RCRA.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

Action	Citation	Requirements
		d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b)-(j)	29 CFR 1910.120 (b) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the compounds listed in Table 1, off gases from the rotary kiln incinerators may contain gaseous hydrogen chloride, hydrogen bromide, and hydrogen fluoride. These gases will be removed during further treatment of the off gases, including a caustic quench system using sodium hydroxide. The worker exposure standards for these compounds are as follows:

Action	Citation	Requirements
		Hydrogen bromide: ACGIH-Ceiling = 3 ppm, 9.9 mg/m^3 NIOSH- Ceiling = 3 ppm, 10 mg/m^3 OSHA- PEL = 3 ppm, 10 mg/m^3
		Hydrogen chloride: ACGIH- Ceiling = 5 ppm, 7.5 mg/m^3 NIOSH- Ceiling = 5 ppm, 7 mg/m^3 OSHA- Ceiling = 5 ppm, 7 mg/m^3
		Hydrogen fluoride: ACGIH- Ceiling = 3 ppm, 2.6 mg/m^3 NIOSH-REL = 3 ppm, 2.5 mg/m^3 15-min ceiling = 6 ppm, 5 mg/m^3 OSHA-PEL = 3 ppm
		Sodium hydroxide: ACGIH- Ceiling = 2 mg/m^3 NIOSH- Ceiling = 2 mg/m^3 OSHA-PEL = 2 mg/m^3
		(OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are presented as guidelines.)
Thermal Desorption Unit Operation		
Determination of operational readiness	40 CFR 270.19 6 CCR 1007-3 Sect 270.19 40 CFR 270.62 (b) 6 CCR 1007-3 Sect 270.62(b)	Although permit applications are not necessary for RMA remedial actions, the operational readiness information will be provided in CERCLA documents leading to incineration alternatives.
Operation of thermal desorption unit	40 CFR 264 6 CCR 1007-3 Part 264	The thermal desorption unit shall be operated to comply with substantive requirements of 40 CFR 264, including, but not limited to the following Subpart O requirements: • Stack emission • Monitoring • Inspections

Action	Citation	Requirements
		• Testing of the emergency waste feed cutoff system
	6 CCR 1007-3	Colorado incinerator regulations are broader in scope than the federal regulations. The Colorado regulations include boilers and industrial furnaces as regulated units under Subpart O.
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently waste like
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Thermal desorption of soils will generate salt cake, metal fines, and other solids. These wastes and all others generated must be characterized and evaluated according to the following methods to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261

Action	Citation	Requirements
		• Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Part 1, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain the following five solid waste categories: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation.

Action	Citation	Requirements
		If present, only small quantities of industrial, community, commercial, and special wastes are expected from thermal desorption of soils at RMA.
		No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater)
		Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements.
		Containers must be dated when they are placed in storage.
		All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.
PCB incineration standards	40 CFR 761.70	Incineration requirements for non-liquid PCB apply to PCB concentrations >50 ppm and include specified dwell times; combustion efficiency of 99.9999%; process record/monitoring requirements; automatic shut-off standards; a maximum mass air emission of 0.001 g PCB per kg of PCB entering the incinerator.
PCB decontamination standards	40 CFR 761.79	PCB containers to be decontaminated by triple rinsing of internal surfaces with solvent containing <50 ppm PCB.
Treatment, storage, or disposal of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264	Wastes that are determined to be RCRA hazardous wastes must be stored and treated, in compliance with RCRA regulations.

Action	Citation	Requirements
On-post land disposal of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268 EPA/540/G-89/005 [TBC]	Based upon a determination of whether the disposal technique constitutes placement, LDRs-UTS may be applicable. If placement does occur, the disposal facility must comply with the substantive requirements of 40 CFR Part 264 (6 CCR 1007-3, Part 264) and 40 CFR Part 268 (6 CCR 1007-3, Part 268).
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Air Emissions		
Emission of Particulates	40 CFR 60 Subpart E 5 CCR 1001-8, Regulation 6, Part B (VII)	The thermal desorption unit shall operate in compliance with substantive requirements of 40 CFR 60 Subpart E and the corresponding state requirements. In addition, no off-site transport of particulate matter is allowed.

Action	Citation	Requirements
Performance testing	5 CCR 1001-2 Section II-C	Performance tests shall be conducted and reduced in accordance with applicable reference test materials.
	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control measure will be written into the work plan in consultation with the state for this remedial action. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
	5 CCR 1001-3, Regulation 1, Section III. B	Performance standards regarding particulate matter (<.10 gram of particulate matter per standard cubic foot) and performance testing in accordance with Appendix A of Air Quality Control Commission Regulation 6.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Thermal desorption of soils shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. Thermal desorption will cause volatization of some organic and/or metal contaminants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements.
	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.

Action	Citation	Requirements
		Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO Emissions	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Thermal desorption of soils must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air

Action	Citation	Requirements
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Noise abatement	Colorado Revised Statute, Section 25-12 - 103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

Action	Citation	Requirements
		d Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the compounds listed in Table A-46 will be removed during further treatment of the off gases, including a caustic quench system using sodium hydroxide. The worker exposure standards for these compounds are as follows:

Action	Citation	Requirements
		Hydrogen bromide ACGIH-Ceiling = 3 ppm, 9.9 mg/m^3 NIOSH- Ceiling = 3 ppm, 10 mg/m^3 OSHA-PEL = 3 ppm, 10 mg/m^3 Hydrogen chloride ACGIH- Ceiling = 5 ppm, 7.5 mg/m^3 NIOSH- Ceiling = 5 ppm, 7 mg/m^3 OSHA- Ceiling = 5 ppm, 7 mg/m^3 Hydrogen fluoride ACGIH- Ceiling = 3 ppm, 2.6 mg/m^3 NIOSH-REL = 3 ppm, 2.5 mg/m^3 15-min ceiling = 6 ppm, 5 mg/m^3 OSHA-PEL = 3 ppm Sodium hydroxide ACGIH- Ceiling = 2 mg/m^3 NIOSH- Ceiling = 2 mg/m^3 OSHA-PEL = 2 mg/m^3 If chemical agent is incinerated on post, the agent must be managed to comply with the exposure standards shown in Table A-28 of this document. OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.
<u>Operation of Incinerators</u>		
Determination of operation readiness	40 CFR 270.19] 6 CCR 1007.3 Sect 270.19 40 CFR 270.62 (b) 6 CCR 1007-3 Sect 270.62(b)	Although permit applications are not necessary for RMA remedial actions, operational readiness information will be provided in CERCLA documents leading to incineration alternatives.

Action	Citation	Requirements
Incinerator operations	40 CFR 264 6 CCR 1007-3 Part 264	On-post rotary -kiln incinerators must be operated in compliance with all substantive requirements of Part 264 including, but not limited to the following Subpart O requirements: • Waste-specific performance standards • Stack emission standards • Monitoring Off-post incinerators must be RCRA-permitted and comply with all requirements of 40 CFR 264 Subpart 0.
	6 CCR 1007-3	Colorado incinerator regulations are broader in scope than the federal regulations. The Colorado regulations include boilers and industrial furnaces as regulated units under Subpart 0.
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike

Action	Citation	Requirements
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Incineration/pyrolysis of soils will generate oversize soil, debris, metallic waste, ash, and salt cake. These wastes and all others generated must be characterized and evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain the following five solid waste categories: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes means all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes," which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes.

Action	Citation	Requirements
		5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, commercial, and special wastes are expected from incineration/pyrolysis of soils at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater) Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements. Containers must be dated when they are placed in storage. All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.

Action	Citation	Requirements
PCB incineration standards	40 CFR 761.70	Incineration requirements for non-liquid PCB apply to PCB concentrations >50 ppm and include specified dwell times; combustion efficiency of 99.9999%; process record/monitoring requirements; automatic shut-off standards; a maximum mass air emission of 0.001 g PCB per kg of PCB entering the incinerator.
PCB decontamination standards	40 CFR 761.79	PCB containers to be decontaminated by triple rinsing of internal surfaces with solvent containing <50 ppm PCB.
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268 EPA/540/G-89/006 [TBC]	Wastes that are determined to be RCRA hazardous wastes must be stored, treated, and disposed in compliance with RCRA regulations. If the soil is treated in a central incineration/pyrolysis facility at RMA that is outside the AOC from which the soil came, any waste returned to the AOC after treatment will be subject to LDRs-UTS since placement of the waste will have occurred.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Treatment of UXO containing chemical agent	AMC-R 385-131	UXO shall be incinerated as described in AMC-R 385-131 to a 5X level of decontamination so that it can be released from DOD control.
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris generated during incineration/pyrolysis activities must be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris if placement occurs. In certain cases, after treatment the debris may no longer be subject to RCRA Subtitle C regulation.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Air Emissions		
Emission of particulates	40 CFR 60 Subpart E 5 CCR 1001-8, Regulation 6, Part B (VII)	Incineration/pyrolysis activities must operate in compliance with the particulate emission standards for incinerators in 40 CFR 60 Subpart E and the corresponding state requirements.
	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control measure will be written in the work plan in consultation with the state for the remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Incineration/pyrolysis operations shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.

Action	Citation	Requirements
Performance Testing	5 CCR 1001-2 Section II	Performance tests shall be conducted and reduced in accordance with applicable reference test methods.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs Incineration/py rolysis will cause volatization of some organic and/or metals contaminants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO emissions	42 USC Section 7502-7503 5 CCR 1001-5, Regulation 3	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.

Action	Citation	Requirements
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Incineration /pyrolysis operations must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Emission of particulates	5 CCR 1001-3, Regulation 1, Sect III B	Performance standards regarding particulate matter (<0.1 grams of particulate matter per dry standard cubic foot) and performance testing in accordance with Appendix A or Air Quality Control Commission Regulation No. 6.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that:

a "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements ."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Off-Post Incinerator		
Incinerator facility operations	40 CFR 264 6 CCR 1007-3 Part 264 OSWER Directive 9834.11 [TBC]	The off-post facility must have a RCRA permit to operate under the requirements of 40 CFR 264 including Subpart O. The facility should also be approved under the conditions of OSWER Directive 9834.11 for off-site disposal of hazardous wastes from a CERCLA site.
	6 CCR 1007-3	Colorado incinerator regulations are broader in scope than the federal regulations. The Colorado regulations include boilers and industrial furnaces as regulated units under Subpart 0.
Air Emissions		
Emission of Particulates	5 CCR 1001-3, Regulation 1, Sect III. B	Performance standards regarding particulate matter (<0.1 gram of particulate matter per dry standard cubic foot) and performance testing in accordance with Appendix A of Air Quality Control Commission Regulation No. 6.
Waste Management		
Off-site disposal of hazardous waste	40 CFR Part 268 6 CCR 1007-3 Part 268	All off-site shipments of hazardous waste to approved TSDF must be accompanied by required LDR certifications and analysis.
Off-site shipment of hazardous waste	40 CFR Part 262 6 CCR 1007-3 Part 262	Any shipments of hazardous waste off-site must be in compliance with generator standards such as manifests, packaging/labeling, and placarding requirements.

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46.

Action	Citation	Requirements
		In addition to the chemicals listed in Table A-46, the Enhanced Surface Soil Vacuum Extraction Process (ESSVEP) generates hydrochloric acid vapors in the off gases. Worker exposure standards for hydrogen chloride are as follows: Hydrogen chloride (ceiling) ACGIH-TWA = 5 ppm, 7.5 mg/m^3 NIOSH-REL = 5 ppm, 7 mg/m^3 (ceiling) OSHA-PEL = 5 ppm, 7 mg/m^3 (ceiling) (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
<u>Waste Characterization</u>		
Solid Waste Determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike

Action	Citation	Requirements
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Soil heating will generate wastewater, off gases, and possibly spent carbon. These wastes and all others generated must be characterized and evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes.

Action	Citation	Requirements
		4) "Special wastes," which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes are expected from soil heating operations at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
<u>Waste Management</u>		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes that are determined to be RCRA hazardous wastes must be stored, treated, and disposed in compliance with RCRA regulations, including LDRs-UTS if placement has occurred.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.

Action	Citation	Requirements
Wastewater	40 CFR Part 122 40 CFR Part 125 40 CFR Part 129	Any wastewater generated during soil heating will be routed to the on-post RMA wastewater treatment plant if it is not hazardous waste and will not interrupt the existing treatment system. If wastewater is routed to the on-post treatment plant, it must be treated in accordance with NPDES requirements.
Management of Remediation Wastes		
Corrective action management units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.

Action	Citation	Requirements
Air Emissions		
Emission of particulates	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2, Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control measure will be written into the work plan in consultation with state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado A PEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Soil heating operations shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Soil heating will cause volatization of some organic and/or metal contaminants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air

Action	Citation	Requirements
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO emissions	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Soil heating must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the chemicals listed in Table A-46, ethylene glycol will be used as a coolant in the vitrification process. Worker exposure standards for this chemical are as follows: Ethylene glycol ACGIH-TWA = 50 ppm, 127 mg/m^3 (ceiling)

Action	Citation	Requirements
		(OSHA regulations and other safety and health requirements are actually independently applicable requirements, not ARARs and TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emissions		
Emission of particulates	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control measure will be written into the work plan in consultation with state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	In situ vitrification of soils shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. In-situ vitrification of soils may cause volatilization of some contaminants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.

Action	Citation	Requirements
PM_{10}/CO emissions	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	In situ vitrification must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Air emissions from diesel-powered vehicles associated with in-situ vitrification	5 CCR 1001-15, Regulation 12	Colorado Diesel- Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state as follows: 1) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing 7,500 pounds and less, empty weight, any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity.

Action	Citation	Requirements
		2) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, any air contaminant, for a period greater than (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 35% opacity, with the exception of subpart "C". 3) No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, operated above 7,000 ft (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 4) Any diesel-powered motor vehicle exceeding these requirements shall be exempt for a period of 10 minutes if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position. 5) These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.
<u>Waste Characterization</u>		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated

Action	Citation	Requirements
		• Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike.
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	In situ vitrification will generate grubbed vegetation and debris. These wastes and all others generated must be characterized and evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR 261 • Determine whether the waste is identified in 40 CFR 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys.

Action	Citation	Requirements
		3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, commercial, and special wastes are expected from in situ vitrification at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
<u>Waste Management</u>		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268 EPA/540/G-89/006 [TBC]	Wastes that are determined to be RCRA hazardous wastes must be stored, treated, and disposed in compliance with RCRA regulations, including LDRs-UTS if placement occurs.

Action	Citation	Requirements
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris generated during in situ vitrification activities must be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris. In certain cases after treatment, the debris may no longer be subject to RCRA Subtitle C regulation.
Management of Remediation Wastes		
Corrective action management units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the storm water management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120(b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 CR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike.
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Wastes generated during structure decontamination activities must be characterized. Solid wastes must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR 261 • Determine whether the waste is identified in 40 CFR 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain the following five solid waste categories:

Action	Citation	Requirements
		1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes are expected from hot gas decontamination at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.

Action	Citation	Requirements
Waste Management		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes that are determined to be RCRA hazardous wastes must be stored, treated, and disposed in compliance with RCRA regulations, including LDRs-UTS if placement occurs.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Wastewater	40 CFR Part 122 40 CFR Part 125 40 CFR Part 129	Any wastewater generated during hot gas decontamination of structures will be routed to the on-post RMA wastewater treatment plant if it is not hazardous waste and will not interrupt the existing treatment system. If wastewater is routed to the on-post treatment plant, it must be treated in accordance with NPDES requirements.
Management of Remediation Wastes		
Corrective action management units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAM Us. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.

Action	Citation	Requirements
Air Emission Control		
Particulate emissions	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2, Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control measure will be written into the work plan with state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements will be necessary.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Hot gas decontamination operations shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emissions regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Decontamination of structures could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.

Action	Citation	Requirements
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO emissions	42 USC 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.
Visibility protection	40 CFR 51 300-307 40 CFR 52.26-29	Hot gas decontamination of structures must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
<u>Stormwater Management</u>		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Detonation of UXO Containing High Explosives		
UXO detonation	AR 75-15	High explosives will be detonated in compliance with the substantive requirements of AR 7515 regarding demilitarization of class V materials.
On-post detonation of UXO	40 CFR 264 6 CCR 1007-3 Part 264 40 CFR Part 264 Subpart X 6 CCR 1007-3 Part 264 Subpart X	On-post detonation of UXO must comply with the substantive requirements of Part 264 including the environmental performance standards described in 40 CFR 264.601 (6 CCR 1007-3, Section 264.601) and substantive portions of the monitoring, analysis, reporting, and corrective action requirements of 40 CFR 264.602 (6 CCR 1007-3, Section 264.602).
Off-post detonation of UXO	40 CFR 264 Subpart X 6 CCR 1007-3 Part 264 Subpart X	Off-post facilities used for detonation of UXO must be RCRA-permitted units that have been permitted under 40 CFR 264 Subpart X.
Chemical Agent Decontamination		
Agent decontamination	AR 385-61	Decontamination of chemical agent-contaminated material will comply with the requirements of AR 385-61 and AR 50-6.
Worker Protection		
Health and safety protection	AR 95-15 AR 385-10 AR 385-61 AR 385-64 AMC-R 385-100 DA PAM 385-61 Technical Manual (TM) 10-277 [TBC] AR 50-6	Workers shall comply with the substantive requirements of AMC-R 385-100, AR 385-10, AR 385-61, and AR 385-64.

Action	Citation	Requirements
	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste /materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the chemicals listed in Table A-46, workers involved in the demilitarization of HE- or agent-filled UXO will be exposed to several unique chemicals. Worker exposure standards for explosives are as follows:

Action	Citation	Requirements
		Aluminum (Pyro powder) ACGIH TLV-TWA = 5 mg/m^3 (Pyro-powder) OSHA-PEL = 15 mg/m^3 total, 5 mg/m^3 resp (ASAL) Lead Azide (Colloidal - as Pb)* Nitroglycerin ACGIH TLV-TWA = 0.05 ppm, 0.46 mg/m^3 (skin) NIOSH-REL = 0.1 ppm (skin) OSHA-Ceiling = 0.2 ppm, 2 mg/m^3 (15 min ceiling) * Source: Hazardous Component Safety Data Sheet (ARRADCOM Form 29) Picric Acid ACGIH TLV-TWA = 0.1 mg/m^3 NIOSH-REL = 0.1 mg/m^3, STEL = 0.3 mg/m^3 (skin) OSHA-PEL = 0.1 mg/m^3 (8 hr TWA - skin) RDX (Cyclonite) ACGIH-TWA = 1.5 mg/m^3 (skin) Tetryl ACGIH-TWA = 1.5 mg/m^3 NIOSH-REL = 1.5 mg/m^3 (skin) OSHA - PEL = 1.5 mg/m^3 (8 hr TWA - skin) 2,4,6-Trinitrotoluene (TNT) ACGIH-TWA = 0.5 mg/m^3 (skin) NIOSH-REL = 0.5 mg/m^3 (skin) OSHA-PEL = 1.5 mg/m^3 * Source: Hazardous Component Safety Data Sheet (ARRADCOM Form 29)

Action	Citation	Requirements
		Worker exposure standards for chemical agents and their breakdown products are found in Table A-47 of this document. (OSHA regulations and other health and safety requirements are actually independently applicable requirements, not ARARs and TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emissions		
Emission of particulates	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. UXO demilitarization could potentially cause emission of hazardous air pollutants.
	42 USC Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.

Action	Citation	Requirements
P M_{10}/CO emissions	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.
Visibility protection	40 CFR 51 300-307 40 CFR 52 26-29	Demilitarization of UXO must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the storm water management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the chemicals listed in Table A-46, soil solidification/stabilization will use Portland cement and possibly calcium silicate, calcium hydroxide, and calcium oxide. Worker exposure limits for these compounds are provided below:

Action	Citation	Requirements
		Calcium hydroxide: ACGIH-TWA = 5 mg/m^3; OSHA-TWA = 15 mg/m^3 (total dust), 5 mg/m^3 (resp)
		Calcium oxide: ACGIH-TWA = 2 mg/m^3; NIOSH-REL = 2 mg/m^3; OSHA-PEL = 5 mg/m^3
		Calcium silicate: ACGIH-TWA = 10 mg/m^3*; OSHA-PEL = 15 mg/m^3 (total dust), 5 mg/m^3 (resp)
		Portland cement*: ACGIH-TWA = 10 mg/m^3; NIOSH-REL = 10 mg/m^3 (total), 5 mg/m^3 (resp); OSHA-TWA = 15 mg/m^3 (total), 5 mg/m^3 (resp)

* values are for total dust containing no asbestos and less than 1% crystalline silica

(OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260 30-31 6 CCR 1007-3 Sect 260 30-31 40 CFR 261 2 6 CCR 1007-3 Sect 261 2 40 CFR 261 4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 CCR 1007-3 Part 261	Direct soil solidification/stabilization will generate oversize soil debris and metallic wastes. These wastes and all others generated must be characterized and evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded form regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 26 1 • Determine whether the waste is identified in 40 CFR Part 26 1 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used

Action	Citation	Requirements
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories, which include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, commercial, and special wastes are expected from direct solidification/stabilization at RMA.

Action	Citation	Requirements
		No special testing requirements are specified for solid wastes. The management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
Treatment and storage of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264	Wastes that are determined to be RCRA hazardous wastes must be stored and treated in compliance with RCRA regulations, including the tank requirements in 40 CFR 264 Subpart J.
On-post land disposal of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264 EPA/540/G-89/006 [TBC] 40 CFR Part 268 6 CCR 1007-3 Part 268	Based upon a determination of whether the disposal technique constitutes placement, the LDRs-UTS may be applicable. If placement does occur, the disposal facility must comply with the substantive requirements of 40 CFR Part 264 (6 CCR 1007-3 Part 264) and 40 CFR Part 268 (6 CCR 1007-3 Part 268).
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.

Action	Citation	Requirements
Air Emissions		
Emission of Particulates	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Sec ion II	Direct solidification/stabi lization of soils shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. Direct solidification/stabilization of soils could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Direct soil solidification/stabilization must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.

Action	Citation	Requirements
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of t ime for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements. "

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the chemicals listed in Table A-46, soil solidification/stabilization will use Portland cement and possibly calcium silicate, calcium hydroxide, and calcium oxide. Worker exposure limits for these compounds are provided below:

Action	Citation	Requirements
		Calcium hydroxide: ACGIH-TWA = 5 mg/m^3; OSHA-TWA = 15 mg/m^3 (total dust), 5 mg/m^3 (resp)
		Calcium oxide: ACGIH-TWA = 2 mg/m^3; NIOSH-REL = 2 mg/m^3; OSHA-PEL = 5 mg/m^3
		Calcium silicate*: ACGIH-TWA = 10 mg/m^3; OSHA-PEL = 15 mg/m^3 (total dust), 5 mg/m^3 (resp)
		Portland cement*: ACGIH-TWA = 10 mg/m^3; NIOSH-REL = 10 mg/m^3 (total), 5 mg/m^3 (resp); OSHA-TWA = 15 mg/m^3 (total), 5 mg/m^3 (resp)
		* values are for total dust containing no asbestos and less than 1% crystalline silica
		(OSHA regulations and other health and safety requirements are actually independently applicable requirements, not ARARs and TBCs. ACGIH and NIOSH values are provided as guidelines.)
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated

Action	Citation	Requirements
		• Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of Hazardous Waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Wastes generated during pipe plugging activities must be characterized. Solid wastes must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR 261 • Determine whether the waste is identified in 40 CFR 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
<u>Air Emissions</u>		
Emission Particulates	5 CCR 1001-3, Regulation 1 Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	In situ solidification/stabilization of soils shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.

Action	Citation	Requirements
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. Direct solidification/stabilization of soils could potentially cause emission of hazardous air pollutants.
	42 USC Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	In situ soil solidification/stabilization must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.

Action	Citation	Requirements
Odor emission	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas –odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		(These regulations are commonly considered location-specific ARARs, but may impact the remedial actions taken. They are included in this table for the convenience of the reader.)
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	20 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46.

Action	Citation	Requirements
		(OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emissions		
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirments. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO emissions	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air

Action	Citation	Requirements
		2) For all other land use areas odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Biological reactor treatment of groundwater at RMA will create wastes consisting of spent biomass, iron and manganese precipitates, suspended solids, and recovered dicyclopentadiene (DCPD). These and all other wastes generated in this process must be evaluated according to the following method to determine if the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261

Action	Citation	Requirements
		• Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes.

Action	Citation	Requirements
		5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. Only small quantities of industrial, community, and commercial wastes, along with inert material, are expected to be generated during biological reactor treatment of groundwater at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes from biological reactor treatment of groundwater that are determined to be RCRA hazardous wastes must be treated, stored, and disposed in compliance with RCRA regulations, including LDRs-UTS if placement occurs, and with task requirements in 40 CFR 264 Subpart J.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Reinjection of treated groundwater	RCRA Section 3020 (b) OSWER Directive 9234.1-06 [TBC]	Reinjection of treated groundwater must be managed in accordance with the guidelines in OSWER Directive 9234.1-06. Wells must be constructed and installed and managed according to the requirements of 40 CFR 124, 144, 146, 147 (Subpart G) and 148.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that:

a "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sould levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR Part 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	20 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 29 CFR 1910.1000	Chemical- specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the chemicals in Table A-46, the ultraviolet (UV)/ozone treatment will potentially utilize hydrogen peroxide and ozone. The worker exposure standards for these compounds are given below:

Action	Citation	Requirements
		Hydrogen peroxide ACGIH-TWA = 1 ppm, 1.4 mg/m^3 NIOSH-REL = 1 ppm, 1.4 mg/m^3 OSHA-PEL = 1 ppm, 1.4 mg/m^3 Ozone ACGIH-Ceiling = 0.1 ppm, 0.20 mg/m^3 NIOSH-Ceiling = 0.1 ppm, 0.20 mg/m^3 OSHA-PEL = 0.1 ppm, 0.2 mg/m^3 (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emissions		
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO emissions	42 USC Section 7502-7503 5 CCR 1001-5, Regulation 3	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs.

Action	Citation	Requirements
	42 USC § Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
<u>Waste Characterization</u>		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike

Action	Citation	Requirements
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	UV/ozone treatment of groundwater will create wastes consisting primarily of inorganic sludges. These and all other wastes generated in this process must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes.

Action	Citation	Requirements
		4) "Special wastes," which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. Only small quantities of industrial, community, and commercial wastes, along with inert material, are expected to be generated during UV/ozone treatment of groundwater. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes from UV/ozone treatment that are determined to be RCRA hazardous wastes must be treated, stored, and disposed in compliance with RCRA regulations, including land disposal restrictions LDRs-UTS if placement occurs.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Reinjection of treated groundwater	RCRA Section 3020 (b) OSWER Directive 9234.1-06 [TBC] 40 CCR 124, 144, 146, 147 (Subpart G), and 148	Reinjection of treated groundwater must be managed in accordance with the guidelines in OSWER Directive 9234.1-06. Wells must be constructed and installed and managed according to the substantive requirements of 40 CFR 124, 144, 146, 147 (Subpart G), and 148.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46.
Air Emissions		
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. Solvent extraction could potentially cause emission of hazardous air pollutants.

Action	Citation	Requirements
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO emissions	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.
Visibility protection	40 CFR 51300-307 40 CFR 52.26-29	Solvent extraction must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.

Action	Citation	Requirements
Emission of Particulates	5 CCR 1001-3, Regulation 1, Section III(D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Odor Emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Management of Remediation Wastes		
Waste Management	40 CFR 264 Subpart J 6 CCR 1007-3 Part 164 Subpart J	Applicability of the substantive requirements for tanks.
Correction Action Management Units	40 CFR 264 Subpart S 6 CCR 1007-3 Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAM Us. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.

Action	Citation	Requirements
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
<u>Stormwater Management</u>		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
<u>Wastewater</u>		
Discharge of liquid wastes	40 CFR Part 122 40 CFR Part 125 40 CFR Part 129	Any wastewater generated during solvent extraction will be routed to the on-post RMA wastewater treatment plant if it is not hazardous waste and will not interrupt the existing treatment system. If wastewater is routed to the on-post treatment plant, it must be treated in accordance with NPDES requirements.
	40 CFR Part 262 6 CCR 1007-3 Part 262 40 CFR Part 264 6 CCR 1007-3 Part 264	Wastewater that is determined to be hazardous must be treated in accordance with provisions of the RCRA.
<u>Waste Management</u> Treatment, storage, or disposal of hazardous wastes	40 CFR Part 264, Subpart aa, bb, and cc 6 CCR 1007-3 Part 264, Subpart aa, bb, and cc	Wastes that are determined to be RCRA hazardous wastes must be stored and treated, in compliance with RCRA air emission regulations.
	40 CFR 264, Subpart J 6 CCR 1007-3 Sect 264, Subpart J	Applicability of all substantive requirements for tanks or tank systems.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Air Emissions		
Emissions of particulates	5 CCR 1001-3, Regulation 1, Sect III D 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control measure will be written into the work plan in consultation with the state for the remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use ares—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Emission control for opacity	5 CCR 1001-3, Regulation 1, Sect II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.

Action	Citation	Requirements
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8	Emission of listed hazardous air pollutants is controlled by NESHAPs. Vacuum dusting could potentially cause emission of hazardous air polutants.
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Wastes generated during pipe plugging activities must be characterized. Solid wastes must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR 261

Action	Citation	Requirements
		• Determine whether the waste is identified in 40 CFR 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes.

Action	Citation	Requirements
		5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation.
		If present, only small quantities of industrial, community, special, and commercial wastes are expected from pipe plugging activities at RMA.
		No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	If pipe plugging in structures at RMA generates hazardous wastes, the wastes must be treated, stored or disposed in accordance with RCRA regulations, including LDRs-UTS if placement occurs.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris generated during pipe plugging activities may be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris. In certain cases, after treatment the debris may no longer be subject to RCRA Subtitle C regulation.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sould levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Zone	7:00 a.m to next 7:00 p.m.	7:00 p.m to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120(b) to (j)	29 CFR 1910.120(b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Air Emissions		
Emission of Particulates	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Vacuum dusting shall not cause the emission into the atmosphere of any air pollutant which is in excess of 20% opacity.
Visibility protection	40 CFR 51 300-307 40 CFR 52.26-29	Vacuum dusting must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. Vacuum dusting could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.

Action	Citation	Requirements
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas —odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
<u>Waste Management</u>		
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater) Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements. Containers must be dated when they are placed in storage. All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.

Action	Citation	Requirements
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 160.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 161.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Vacuum dusting of structures at RMA will create wastes consisting of filters with dust particles and debris. These wastes and all other solid wastes generated in this process must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used

Action	Citation	Requirements
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation.

Action	Citation	Requirements
		If present, only small quantities of industrial, community, and commercial wastes are expected from vacuum dusting of structures at RMA.
		No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Vacuum dusting wastes that are determined to be RCRA hazardous wastes must be stored, treated, and disposed in compliance with RCRA regulations, including land disposal restrictions LDRs if placement occurs.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs-UTS and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs-UTS are not triggered.

Action	Citation	Requirements
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

Action	Citation	Requirements
		c Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines)

Action	Citation	Requirements
Air Emissions		
Emission of Particulates	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2, Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Steam cleaning of structures shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulat ion 8 40 CFR 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Steam cleaning may cause volatization of some contaminants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado Odor Emission Regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air

Action	Citation	Requirements
Air emissions from diesel powered vehicles associated with construction or demolition	5 CCR 1001-15, Regulation 12	Colorado Diesel Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state as follows: 1) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing 7,500 pounds and less, empty weight, any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 2) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, any air contaminant, for a period greater than (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 35% opacity, with the exception of subpart "C". 3) No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, operated above 7,000 ft (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 4) Any diesel-powered motor vehicle exceeding these requirements shall be exempt for a period of 10 minutes if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position. 5) These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.

Action	Citation	Requirements
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Steam cleaning must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of Federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements.
	42 USC 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control disposal of VOCs by evaporation or spilling unless reasonably available control technologies are utilized.
<u>Waste Management</u>		
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater) Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements.

Action	Citation	Requirements
		Containers must be dated when they are placed in storage. All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Steam cleaning will generate wastewater from condensate and potential spent filter media. These wastes and all others generated must be characterized. The wastes must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261

Action	Citation	Requirements
		• Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes" which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes.

Action	Citation	Requirements
		5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes, along with inert material are expected from steam cleaning of structures at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Wastewater	40 CFR Part 122 40 CFR Part 125 40 CFR Part 129	Any wastewater generated during steam cleaning will be routed to the on-post RMA wastewater treatment plant if it is not hazardous waste and will not interrupt the existing treatment system. If wastewater is routed to the on-post treatment plant, it must be treated in accordance with NPDES requirements.
	40 CFR Part 262 6 CCR 1007-3 Part 262 40 CFR Part 264 6 CCR 1007-3 Part 264	Wastewater that is determined to be hazardous must be treated in accordance with provisions of the RCRA.
Treatment, storage or disposal of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes that are determined to be RCRA hazardous wastes, such as spent filter media from steam cleaning, must be stored, treated, and disposed in compliance with RCRA regulations, including LDRs if placement occurs.

Action	Citation	Requirements
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Zone	7:00 a.m to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Air Emissions		
Emission of particulates	5 CCR 1001-3, Regulation 1, Section III (D)(2)(j) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Sand blasting shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Sand blasting could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air.

Action	Citation	Requirements
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Sand blasting must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standards for the AIR Program area is a standard visual range of 32 miles. The averaging time is four hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO emissions	42 USC 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate.
<u>Waste Management</u>		
Asbestos waste storage management	6 CCR 1007-2, Part B, Section 5.4	Asbestos waste will be managed according to applicable substantive requirements for asbestos storage.
Asbestos waste handling management	40 CFR 61, Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; deposit asbestos-containing waste as possible at disposal site; mark transport vehicle appropriately during loading and unloading operations.

Action	Citation	Requirements
	5 CCR 1001-10, Regulation Part B, Section 8 B III c 8	Asbestos waste will be managed according to applicable substantive requirements for asbestos handling, transportation, and storage.
PCB storage	40 CFR 761 65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater) Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements. Containers must be dated when they are placed in storage. All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently waste-like

Action	Citation	Requirements
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Sand blasting structures at RMA will create wastes that consist of dust, abrasives such as sand or pellets, debris, and possibly used filters. These wastes and all other solid wastes generated in this process must be evaluated according to the following process to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes.

Action	Citation	Requirements
		4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes are expected from sand blasting of structures at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Treatment, storage, or disposal of hazardous wastes	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 168	Wastes that are determined to be RCRA hazardous wastes, such as spent filter media, abrasives and debris, must be stored, treated, and disposed in compliance with RCRA regulations, including LDRs.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that:

a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Air emissions during salvage	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3 5 CCR 1001-2 Section II	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Salvage of structures shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs. Salvage of structures could potentially cause emission of hazardous air pollutants.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air

Action	Citation	Requirements
Air emissions from diesel powered vehicles associated with salvage	5 CCR 1001-15, Regulation 12	Colorado Diesel Powered Vehicle Emission Standards for Visible Pollutants apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways, and state as follows: 1) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing 7,500 pounds and less, empty weight, any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 2) No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, any air contaminant, for a period greater than (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 35% opacity, with the exception of subpart "C". 3) No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle weighing more than 7,500 pounds, empty weight, operated above 7,000 ft (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity. 4) Any diesel-powered motor vehicle exceeding these requirements shall be exempt for a period of 10 minutes if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position. 5) These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.

Action	Citation	Requirements
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Salvage of structures must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality
PM_{10}/CO emissions	42 USC 7502-7503	

Action	Citation	Requirements
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 107-3 Part 260 40 CFR 260 30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently waste like
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Wastes generated during structure salvage activities must be characterized. Solid wastes must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR 261 • Determine whether the waste is identified in 40 CFR 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used

Action	Citation	Requirements
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation.

Action	Citation	Requirements
		If present, only small quantities of industrial, community, and commercial wastes are expected from structure salvage activities at RMA.
		No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
Asbestos waste storage management	6 CCR 1007-2, Part B, Section 5.4	Asbestos waste will be managed according to applicable substantive requirements for asbestos storage.
Asbestos waste handling management	40 CFR 61, Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; deposit asbestos-containing waste as possible at disposal site; mark transport vehicle appropriately during loading and unloading operations.
	5 CCR 1000 1-10, Regulation Part B, Section 8.B.III.c.8	Asbestos waste will be managed according to applicable substantive requirements for asbestos handling, transportation, and storage.
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater)
		Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements.
		Containers must be dated when they are placed in storage.
		All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.

Action	Citation	Requirements
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	If demolition of structures at RMA generates hazardous wastes, the wastes must be treated, stored, or disposed in accordance with RCRA regulations, including LDRs.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris generated during structure salvage activities must be treated using specific technologies to extract, destroy, or immobilize hazardous constituents on or in the debris. In certain cases, after treatment the debris may no longer be subject to RCRA Subtitle C regulation.
Management of Remediation Wastes		
Corrective action management units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.

Action	Citation	Requ nts
Tanks and Containers		
Residues of hazardous waste in empty containers	40 CFR 261.7 6 CCR 1007-3 Sect 261.7	A container or inner liner removed from a container that has held any hazardous waste is empty if: 1) All wastes have been removed that can be removed using the practices commonly employed to remove materials from that type of container (e.g., pouring, pumping, and aspirating), and 2) No more than one inch of residue remains on the bottom of the container or inner liner, or 3) a) No more than 3% by weight of the total capacity of the container remains in the container or inner liner if the container is less than or equal to 110 gallons in size, or b) No more than 0.3% by weight of the total capacity of the container remains in the container or inner liner if the container is greater than 110 gallons in size. A container that has held a hazardous waste that is a compressed gas is empty when the pressure in the container approaches atmospheric. A container or an inner liner removed from a container that has held an acute hazardous waste listed in 40 CFR 261.31, 261.32, or 261.33(e) is empty if: 1) The container or inner liner has been triple rinsed using a solvent capable of removing the commercial chemical product or manufacturing chemical intermediate, or 2) The container or inner liner has been cleaned by another method that has been shown in the scientific literature, or by tests conducted by the generator, to achieve equivalent removal, or

Action	Citation	Requirements
		3) In the case of a lined container, the inner liner that prevented contact of the commercial chemical product or manufacturing chemical intermediate with the container, has been removed. Any hazardous waste remaining in an empty container or an inner liner removed from an empty container is not considered a hazardous waste and is not subject to the RCRA regulations. Any hazardous waste in a container or inner liner removed from a container that is not empty is subject to RCRA hazardous waste regulations.
Closure of tanks and tank systems	40 CFR 264.197(a) 6 CCR 1007-3 Sect 264.197(a) 40 CFR 261.3(d) 6 CCR 1007-3 Sect 261.3(d) 40 CFR 264.310 6 CCR 1007-3 Sect 264.310	At closure of a tank system, all waste residues, contaminated containment system components, contaminated soils, and structures and equipment contaminated with wastes must be removed, decontaminated, and managed as hazardous wastes unless 40 CFR 261.3(d) applies (i.e., unless residues and contaminated materials are not hazardous wastes). If the owner or operator demonstrates that not all soils can be practically removed or decontaminated as required, then the tank system must be closed in accordance with requirements that apply to landfills.
	40 CFR 264.198(a) 6 CCR 1007-3 Sect 264.198(a) 40 CFR 264.176 6 CCR 1007-3 Sect 264.176	Ignitable or reactive waste should not be placed in tank systems unless the waste is treated, rendered, or mixed before or immediately after placement in the tank system, or unless the waste is stored or treated in such a way that it is protected from any material or condition that may cause the waste to ignite or react.
	40 CFR 264.198(b) 6 CCR 1007-3 Sect 264.198(b) NFPA Flammable and Combustible Liquids Code 1990 [TBC]	Facilities where ignitable or reactive waste is stored or treated in a tank should comply with requirements for the maintenance of protective distances between the waste management area and any public ways, streets, alleys, or an adjoining property line that can be built upon as provided in Tables 2-1 through 2-6 of the 1990 National Fire Protection Association (NFPA) Flammable and Combustible Liquids Code.

Action	Citation	Requirements
	40 CFR 264.199 6 CCR 1007-3 Sect 264.199 40 CFR 264.17 6 CCR 1007-3 Sect 264.17	Incompatible wastes, or incompatible wastes and materials, must not be placed in the same tank system unless 40 CFR 264.17 is complied with. Hazardous waste must not be placed in a tank system that has not been decontaminated and that previously held an incompatible waste or material unless 40 CFR 264.17 is complied with.
	40 CFR 265.201(d) 6 CCR 1007-3 Sect 265.201(d)	Generators that accumulate between 100 and 1,000 kg/mo of hazardous waste in tanks must, upon closure, remove all hazardous wastes from tanks, control equipment, and discharge confinement structures.
	40 CFR 265.201(e)(1) 6 CCR 1007-3 Sect 265.201(e)(1)	Generators of between 100 and 1,000 kg/mo of hazardous waste must not place ignitable or reactive waste in tanks unless the waste is treated before or immediately after placement in a tank or the waste is stored or treated in such a way that it is protected from any material or condition that may cause the waste to ignite or react. Ignitable or reactive waste must not be placed in the tank unless the tank is used solely for emergencies.
	40 CFR 265.201(e)(2) 6 CCR 1007-3 Sect 265.201(e)(2) NFPA Flammable and Combustible Liquids Code 1990 [TBC]	Facilities where ignitable or reactive wastes are treated or stored in covered tanks are required to comply with the buffer zone requirements for tanks contained in Tables 2-1 through 2-6 of the 1990 NFPA Flammable and Combustible Liquids Code.
	40 CFR 264.111(a) and (b) 6 CCR 1007-3 Sect 264.111(a),(b)	A facility must be closed in a manner that minimizes the need for further maintenance and controls, minimizes, or eliminates to the extent necessary to protect human health and the environment post closure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the groundwater or surface waters or to the atmosphere.

Action	Citation	Requirements
	40 CFR 264.197 6 CCR 1007-3 Sect 264.197 40 CFR 264 Subpart G 6 CCR 1007-3 Part 264 Subpart G	The closure plan and closure activities for tank systems must meet all of the substantive requirements provided in 40 CFR 264 Subpart G and 40 CFR 264.197.
Wastewater Treatment/Disposal		
Discharge of wastewater to the treatment plant	40 CFR Part 122 40 CFR Part 125 40 CFR Part 129	Any wastewater generated during cleanup or remedial actions will be directed to the on-post RMA wastewater treatment plant and treated in accordance with NPDES requirements.
	40 CFR Part 262 6 CCR 1007-3 Part 262 40 CFR Part 264 6 CCR 1007-3 Part 264	Wastewater that is determined to be a hazardous waste must be treated in accordance with the provisions of RCRA.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with stormwater management requirements.
Decontamination and Disposal Standards for Chemical Agents	AMC-R 385-131 [TBC]	Army regulations provide standards for decontamination of items exposed to chemical agents. Material, equipment, and clothing that has been decontaminated to the 3X level may be landfilled in a RCRA-approved hazardous waste landfill. Items may not be released from government control until they have been decontaminated to the 5X level.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above).

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Action	Citation	Requirements
		f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	20 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46.

Action	Citation	Requirements
		(OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emissions		
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO Emissions	42 USC Section 7502-7503 5 CCR 1001-5, Regulation 3	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that measured in excess of the following limits:

Action	Citation	Requirements
		1) For residential and commercial areas - odors detected after the odorous air has been diluted with seven more volumes of odor-free air
		2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Air stripper emissions	OSWER Directive 9355.0-28 June 15, 1989 [TBC]	"Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites"
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Air stripping of VOCs from groundwater shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Visibility protection	40 CFR 51 300-307	Air stripping from groundwater must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307 (8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.
<u>Waste Characterization</u>		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities:

Action	Citation	Requirements
	6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	• Abandoned material may be – disposed of – burned or incinerated – accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled materials which is – used in a manner constituting disposal – burned for energy recovery – reclaimed – speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Air stripping of VOCs from groundwater will create wastes consisting of sludges and spent filters. These and all other wastes generated in this process must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories, which include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes.

Action	Citation	Requirements
		2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes, and inert material are expected from air stripping treatment of groundwater at RMA. No special testing requirements are specified for solid wastes. The management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.

Action	Citation	Requirements
Waste Management		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes from air stripping treatment of groundwater that are determined to be RCRA hazardous wastes must be treated, stored, and disposed in compliance with RCRA regulations, including LDRs if placement occurs, and tank requirements in 40 CFR 264 Subpart J.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.

Action	Citation	Requirements
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Storm water runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the storm water management regulations.
Reinjection of treated groundwater	RCRA Section 3020 (b) OSWER Directive 9234.1-06 [TBC] 40 CFR 124, 144, 146, 147 (Subpart G), and 148	Reinjection of treated groundwater must be managed in accordance with the guidelines in OSWER Directive 9234.1-06. Wells must be constructed and installed and managed according to the substantive requirements of 40 CFR 124, 144, 146, 147 (Subpart G), and 148.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period.

Action	Citation	Requirements
		c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	20 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and the NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)

Action	Citation	Requirements
Air Emissions		
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO Emissions	42 USC Section 7502-7503 5 CCR 1001-5, Regulation 3	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air

Action	Citation	Requirements
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be – disposed of – burned or incinerated – accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Abandoned material may be – disposed of – burned or incinerated – accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled materials which is – used in a manner constituting disposal – burned for energy recovery – reclaimed – speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Groundwater treatment at RMA using granular activated carbon (GAC) adsorption will create wastes consisting of spent carbon and carbon fines. These and all other wastes generated in this process must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261

Action	Citation	Requirements
		• Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes, resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids including those that the Colorado Department of Health may identify by regulation.

Action	Citation	Requirements
		If present, only small quantities of industrial, community, and commercial wastes and inert material are expected from GAC treatment of groundwater at RMA. No special testing requirements are specified for solid waste. The management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes from GAC water treatment that are determined to be RCRA hazardous wastes must be treated, stored, and disposed in compliance with RCRA regulations, including LDRs-UTS if placement occurs, and tank requirements in 40 CFR 264 Subpart J.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Management of Remediation Wastes		
Corrective action management units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.

Action	Citation	Requirements
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Storm water runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Reinjection of treated groundwater	RCRA Section 3020 (b) OSWER Directive 9234.1-06 [TBC] 40 CFR 124, 144, 146, 147 (Subpart G), and 148	Reinjection of treated groundwater must be managed in accordance with the guidelines in OSWER Directive 9234.1-06. Wells must be constructed and installed and managed according to the substantive requirements of 40 CFR 124, 144, 146, 147 (Subpart G) and 148.
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a. "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		b In the hours between 7 00 a m and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period c Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour. f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	20 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on- site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and the NIOSH are outlined in Table A-46. Chemical oxidation treatment of groundwater uses ozone and may use hydrogen peroxide to ox idize organic contaminants. The worker exposure standards for these compounds are given below.

Action	Citation	Requirements
		Hydrogen peroxide ACGIH-TWA = 1 ppm, 1.4 mg/m^3 NIOSH-REL = 1 ppm, 1.4 mg/m^3 OSHA-PEL = 1 ppm, 1.4 mg/m^3 Ozone ACGIH-Ceiling = 0.1 ppm , 0.20 mg/m^3 NIOSH-Ceiling = 0.1 ppm , 0.20 mg/m^3 OSHA-PEL = 0.1 ppm, 0.2 mg/m^3 (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emissions		
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO emissions	42 USC Section 7502-7503 5 CCR 1001-5, Regulation 3	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Estimated emissions from the proposed remedial activities per Colorado APEN requirements.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs.

Action	Citation	Requirements
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Chemical oxidation of organic compounds from groundwater shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.
Visibility protection	40 CFR 51 300-307	Chemical oxidation of organic compounds from a groundwater must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307 (8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as applicable). The visibility standard applies only during hours when the hourly average humidity is less than 70%.

Action	Citation	Requirements
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be – disposed of – burned or incinerated – accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled materials which is – used in a manner constituting disposal – burned for energy recovery – reclaimed – speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.4 40 CFR Part 261 6 CCR 1007-3 Part 261	Chemical oxidation of organic compounds will create wastes consisting primarily of sludges. This and all other wastes generated in this process must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used

Action	Citation	Requirements
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories, which include the following: 1) "Industrial wastes," which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes," which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes, and inert material are expected from chemical oxidation treatment of groundwater at RMA.

Action	Citation	Requirements
		No special testing requirements are specified for solid wastes. The management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes from chemical oxidation of organic compounds in groundwater that are determined to be RCRA hazardous wastes must be treated, stored, and disposed in compliance with RCRA regulations, including LDRs if placement occurs, and tank requirements in 40 CFR 264 Subpart J.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.

Action	Citation	Requirements
Stormwater Management		
Discharge of stormwater to on-post, surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Reinjection of treated groundwater	RCRA Section 3020 (b) OSWER Directive 9234.1-06 [TBC] 40 CFR 124, 144, 146, 147 (Subpart G), and 148	Reinjection of treated groundwater must be managed in accordance with the guidelines in OSWER Directive 9234.1-06. Wells must be constructed and installed and managed according to the substantive requirements of 40 CFR 124, 144, 146, 147 (Subpart G) and 148.

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites. A key concern in granular activated alumina (GAA) adsorption treatment of groundwater is the handling of corrosives (acids and caustics) used in GAA treatment and regeneration.
	29 CFR 1910.120 (b) to (j)	20 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. A key concern in GAA treatment is the handling of corrosives used for pH adjustment in GAA treatment and regeneration. The principal corrosives used in GAA process are sulfuric acid and sodium hydroxide. In addition, calcium hydroxide may be used to precipitate iron and hardness prior to treatment. The worker exposure standards for these compounds are given below:

Action	Citation	Requirements
		Sodium hydroxide ACGIH-Ceiling = 2 mg/m^3 NIOSH-Ceiling = 2 mg/m^3 (15-min) OSHA-Ceiling = 2 mg/m^3 = 2 mg/m^3 Sulfuric acid ACGIH-TWA = 1 mg/m^3; STEL = 3 mg/m^3 NIOSH-REL = 1 mg/m^3 OSHA-PEL = 1 mg/m^3 Calcium hydroxide ACGIH-TWA = 5 mg/m^3 OSHA-TWA = 15 mg/m^3 (total dust), 5 mg/m^3 (resp) (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
<u>Air Emissions</u>		
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment for ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.

Action	Citation	Requirements
PM_{10}/CO Emissions	42 USC Section 7502-7503 5 CCR 1001-5, Regulation 3	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of certain hazardous air pollutants is controlled by NESHAPs.
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
<u>Waste Characterization</u>		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be – disposed of – burned or incinerated – accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned or incinerated

Action	Citation	Requirements
		• Recycled materials which is used in a manner constituting disposal - burned for energy recovery - reclaimed – speculatively accumulated • Waste-like material is material that is considered inherently wastelike
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	GAA adsorption will create wastes consisting primarily of regeneration sludge. This and all other wastes generated in this process must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories, which include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys.

Action	Citation	Requirements
		3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes. 5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, and commercial wastes, and inert material are expected from GAA treatment of groundwater at RMA. No special testing requirements are specified for solid wastes. The management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
<u>Waste Management</u>		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	Wastes from GAA adsorption that are determined to be RCRA hazardous wastes must be treated, stored, and disposed in compliance with RCRA regulations, including LDRs-UTS if placement occurs, and tank requirements in 40 CFR 264 Subpart J.

Action	Citation	Requirements
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Reinjection of treated groundwater	RCRA Section 3020 (b) OSWER Directive 9234.1-06 [TBC] 40 CFR 124, 144, 146, 147 (Subpart G), and 148	Reinjection of treated groundwater must be managed in accordance with the guidelines in OSWER Directive 9234.1-06. Wells must be constructed and installed and managed according to the substantive requirements of 40 CFR 124, 144, 146, 147 (Subpart G) and 148.

Action	Citation	Requirements
Transportation of Hazardous Waste		
On-post transportation		All on-post shipments of hazardous waste may be required to meet the provisions of 5 CCR 1001, 40 CFR Parts 52 and 81, and AR 50-6 including, but not limited to the following:
	5 CCR 1001-15, Regulation 12	1) Transportation of wastes in diesel-powered vehicles may be subject to state opacity and visibility standards.
	5 CCR 1001-4, Regulation 2	2) Loading, unloading, or transportation of wastes may cause odors or emissions from contaminants that exceed state odor limitations.
	5 CCR 1001-3, Regulation 1 Section III (D) (2) 5 CCR 1001-5, Regulation 3	3) Transportation on unpaved roadways may be subject to state requirements to reduce particulate emissions resulting from the use of the roadway.
	AR 50-6 Chapter 4 [TBC]	5) This regulation describes procedures to be followed during the transportation of Chemical Surety Materials.
Air Emissions		
Emission of hazardous pollutants	5 CCR 1001-10, Regulation 8	Emission of listed hazardous air pollutants is controlled by NESHAPs. On-Post transportation will cause volatilization of some contaminants.

Action	Citation	Requirements
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
PM_{10}/CO Emissions	42 USC Section 7502-7503 5 CCR 1001-5, Regulation 3	New or modified major stationary sources in nonattainment area are required to comply with the lowest achievable emission rate. Estimated emissions from proposed remedial activity per Colorado APEN requirements. A fugitive dust control measure will be written into the work plan in consultation with the state for the remedial activity.
Waste Management		
Asbestos waste storage management	6 CCR 1007-2, Part B, Section 5.4	Asbestos waste will be managed according to applicable substantive requirements for asbestos storage.
Asbestos waste handling management	40 CFR 61, Subpart M	Prevent discharge of visible emissions during collection, processing, packaging, or transporting any asbestos-containing wastes; deposit asbestos-containing waste as possible at disposal site; mark transport vehicle appropriately during loading and unloading operations.
	5 CCR 1001-10, Regulation Part B, Section 8.B.III.c.8	Asbestos waste will be managed according to applicable substantive requirements for asbestos handling, transportation, and storage.

Action	Citation	Requirements
PCB storage	40 CFR 761.65	Storage facilities must be constructed with adequate roofs, walls; have impervious floors with curbs (no floor drains expansion joints or other openings); be located above 100 year floodplain (applies to PCBs at concentrations of 50 ppm or greater) Temporary storage (<30 days) of PCB containers containing non-liquid PCBs, such as contaminated soil, rags, debris need not comply with above requirements. Containers must be dated when they are placed in storage. All storage areas must be properly marked and stored articles must be checked for leaks every 30 days.
PCB incineration standards	40 CFR 761.70	Incineration requirements for non-liquid PCB apply to PCB concentrations >50 ppm and include specified dwell times; combustion efficiency of 99.9999%; process record/monitoring requirements; automatic shut-off standards; a maximum mass air emission of 0.001 g PCB per kg of PCB entering the incinerator.
PCB chemical waste landfilling standards	40 CFR 761.75	Landfill must be located in thick, relatively impermeable soil formation or on soil with high clay and silt content, synthetic membranes must be used when these conditions cannot be met. In addition, other structural requirements include avoidance of location in a floodplain; required run-on/run-off structures if below the 100 year floodplain, and ground/surface water monitoring for specified parameters. The landfill must include a leachate monitoring system. PCB wastes must be segregated from wastes not chemically compatible with PCBs.
PCB decontamination standards	40 CFR 761.79	PCB containers to be decontaminated by triple rinsing of internal surfaces with solvent containing <50 ppm PCB.

Action	Citation	Requirements
Access Restrictions		
Access controls	40 CFR 264.14 6 CCR 1007-3 Sect 264.14	Access controls will be provided that will prevent unknowing entry and minimize unauthorized entry of persons or livestock onto active portions of RMA. These may include 24-hour surveillance or a barrier (either natural or artificial) and a means of controlling access.
Land Use/Deed Restrictions		
Land use and deed restrictions for former hazardous waste disposal units	40 CFR 264.119 6 CCR 1007-3 Sect 264.119	If RMA ceases to be federal government property, a notation on the deed must indicate that ht eland was previously used to manage hazardous wastes and its use is restricted under 40 CFR 264 Subpart G regulations. A record of the type, location, and quantity of hazardous waste managed at each disposal unit must also be supplied to the local zoning authority or through authority over local land use.
Monitoring		
Groundwater monitoring	40 CFR 264 Subpart F 6 CCR 1007-3 Part 264 Subpart F 2 CCR 402-2, Rule 10RCRA Groundwater Monitoring TEGD [TBC]	Groundwater monitoring will be conducted for the presence of hazardous constituents in the groundwater downgradient from solid water management units. Monitoring wells should be constructed and installed according to the requirements of 2 CCR 402-2, Rule 10 and the guidance in the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD).
	6 CCR 1007-3	Colorado groundwater regulations specify requirements for determining background groundwater quality.

Action	Citation	Requirements
Air Emissions		
Emission of particulates	5 CCR 1001-3, Regulation 1, Sect III(D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. A fugitive dust control program will be written into the work plan in consultation with the state for this remedial activity. Estimated emission from the proposed remedial activity per Colorado APEN Requirements.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air

Action	Citation	Requirements
Monitoring		
Groundwater monitoring	40 CFR 264 Subpart F 6 CCR 1007-3 Part 264 Subpart F 2 CCR 402-2, Rule 10 RCRA Groundwater Monitoring TEGD [TBC]	Groundwater monitoring will be conducted for the presence of hazardous constituents in the groundwater downgradient from solid waste management units Monitoring wells should be constructed and installed according to the requirements of 2 CCR 402-2, Rule 10 and the guidance in the RCRA Groundwater Monitoring TEGD.
	6 CCR 1007-3	Colorado groundwater regulations specify requirements for determining background groundwater quality.
Air Emissions		
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use ares—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Emissions of hazardous air pollutants	5 CCR 1001-10, Regulation 8	Emission of listed hazardous air pollutants is controlled by NESHAPs. Soil flushing will cause volatization of some contaminants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
APEN	5 CCR 1001-5, Regulation 3	Estimated emissions from the proposed remedial activity per Colorado APEN requirements

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b) to (j)	29 CFR 1910.120 (b) through (j) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. In addition to the chemicals listed in Table A-46, peroxide/hypochlorite treatment involves the use of hydrogen peroxide and sodium hypochlorite. Hypochlorite the treatment is neutralized using hydrochloric acid. Worker exposure standards for these chemicals are:

Action	Citation	Requirements
		Hydrogen peroxide ACGIH-TWA = 1 ppm, 1.4 mg/m^3 NIOSH-REL = 1 ppm, 1.4 mg/m^3 OSHA-PEL = 1 ppm 1.4 mg/m^3 Sodium hypochlorite ACGIH-TWA = 0.1 ppm (ceiling), 0.20 mg/m^3 (ceiling) NIOSH-REL = 0.1 ppm (ceiling), 0.20 mg/m^3 (ceiling) OSHA-PEL = 0.1 ppm, 0.2 mg/m^3 STEL = 0.3 ppm, 0.6 mg/m^3 (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are provided as guidelines.)
Air Emissions		
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs. Soil flushing will cause volatization of some contaminants.
	42 USCS Section 7412	National standards for site remediat ion sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.

Action	Citation	Requirements
PM_{10}/CO Emissions	42 USC Section 7502-7503 5 CCR 1001-5, Regulation 3	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Estimated emissions from proposed remedial activities per Colorado APEN requirements.
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado Odor Emission Regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas—odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas—odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
<u>Waste Characterization</u>		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be – disposed of – burned or incinerated – accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled materials which is – used in a manner constituting disposal – burned for energy recovery – reclaimed – speculatively accumulated • Waste-like material is material that is considered inherently wastelike

Action	Citation	Requirements
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Wastes generated during soil excavation activities must be characterized. Solid wastes must be evaluated according to the following method to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR 261 • Determine whether the waste is identified in 40 CFR 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain five solid waste categories. The waste categories include the following: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes.

Action	Citation	Requirements
		5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation.
		If present, only small quantities of industrial, community, commercial, and special wastes are expected from peroxide/hypochlorite treatment of debris at RMA.
		No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
Waste Management		
Treatment, storage, or disposal of RCRA hazardous waste	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268	If peroxide/hypochlorite treatment at RMA generates hazardous wastes, the wastes must be treated, stored, or disposed in accordance with RCRA regulations, including LDRs.
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.
Treatment, storage, or disposal of RCRA hazardous wastes in containers	40 CFR 264, Subpart I, Subpart J 6 CCR 1007-3, Part 264 Subpart I, Subpart J	Applicability of the substantive requirements for containers and tanks.
Treatment and disposal of hazardous debris	40 CFR 268.45 6 CCR 1007-3, Part 268.45	Hazardous debris treated with peroxide or hypochlorite must be treated to extract, destroy, or immobilize hazardous constituents on or in the debris. In certain cases after treatment, the debris may no longer be subject to RCRA Subtitle C regulation.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the stormwater management regulations.
Wastewater Treatment/Disposal		
Discharge of wastewater to the treatment plant	40 CFR 262 6 CCR 1007-3 Part 262 40 CFR 264 6 CCR 1007-3 Part 264	Wastewater that is determined to be a hazardous waste must be treated in accordance with the provisions of RCRA.

Action	Citation	Requirements
Noise abatement	Colorado Revised Statute, Section 25-12-103	The Colorado Noise Abatement Statute provides that: a "Applicable activities shall be conducted in a manner so any noise produced is not objectionable due to intermittence, beat frequency, or shrillness Noise is defined to be a public nuisance if sound levels radiating from a property line at a distance of twenty-five ft or more exceed the sound levels established for the following time periods and zones: b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in Requirement a (above) may be increased by ten decibels for a period of not to exceed fifteen minutes in any one-hour period. c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five decibels less than those listed in Requirement a (above). d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project. e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

Action	Citation	Requirements
		f In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements."

Action	Citation	Requirements
Worker Protection		
Health and safety protection	29 CFR Part 1910	29 CFR 1910 provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA. Requirements provided in 29 CFR 1910.120 apply specifically to the handling of hazardous waste/materials at uncontrolled hazardous waste sites.
	29 CFR 1910.120 (b)-(j)	29 CFR 1910.120 (b) provides guidelines for workers involved in hazardous waste operations and emergency response actions on sites regulated under RCRA and CERCLA. Specific provisions include the following: • Health and safety program participation required by all on-site workers • Site characterization and analysis • Site control • On-site training • Medical surveillance • Engineering controls • Work practices • Personal protective equipment • Emergency response plan • Drum handling • Sanitation • Air monitoring
Worker exposure	ACGIH 1991-1992 [TBC] NIOSH 1990 [TBC] 29 CFR 1910.1000	Chemical-specific worker exposure guidelines established by OSHA, ACGIH, and NIOSH are outlined in Table A-46. (OSHA regulations and other health and safety requirements are actually independently applicable regulatory requirements, not ARARs or TBCs. ACGIH and NIOSH values are presented as guidelines.)

Action	Citation	Requirements
Soil Dryer Unit Operation		
Determination of operational readiness	40 CFR 270.19 6 CCR 1007-3 Sect 270.19 40 CFR 270.62 (b) 6 CCR 1007-3 Sect 270.62(b)	Although permit applications are not necessary for RMA remedial actions, the operational readiness information will be provided in CERCLA documents leading to incineration alternatives.
Operation of Miscellaneous Unit	40 CFR Part 264 6 CCR 1007-3 Part 264 40 CFR 264 Subpart X 6 CCR 1007-3 Part 264 Subpart X	The soil drying unit shall be operated to comply with the substantive requirements of Part 264 including the miscellaneous regulation in 40 CFR 264 Subpart (40 CFR 260.30, Part 264 Subpart X) environmental performance standards.
Waste Characterization		
Solid waste determination	40 CFR 260 6 CCR 1007-3 Part 260 40 CFR 260.30-31 6 CCR 1007-3 Sect 260.30-31 40 CFR 261.2 6 CCR 1007-3 Sect 261.2 40 CFR 261.4 6 CCR 1007-3 Sect 261.4	A solid waste is any discarded material that is not excluded by a variance granted under 40 CFR 260.30 and 260.31. Discarded material includes abandoned, recycled, and waste-like materials. These materials may have any of the following qualities: • Abandoned material may be - disposed of - burned or incinerated - accumulated, stored, or treated before or in lieu of being abandoned by being disposed, burned, or incinerated • Recycled material which is - used in a manner constituting disposal - burned for energy recovery - reclaimed - speculatively accumulated • Waste-like material is material that is considered inherently wastelike

Action	Citation	Requirements
Determination of hazardous waste	40 CFR 262.11 6 CCR 1007-3 Sect 262.11 40 CFR Part 261 6 CCR 1007-3 Part 261	Soil-generated waste must be characterized and evaluated according to the following methods to determine whether the waste is hazardous: • Determine whether the waste is excluded from regulation under 40 CFR 261.4 • Determine whether the waste is listed under 40 CFR Part 261 • Determine whether the waste is identified in 40 CFR Part 261 by testing the waste according to specified test methods and by applying knowledge of the hazardous characteristics of the waste in light of the materials or the process used
Solid waste classification	6 CCR 1007-2, Part 1, Section 1	If a generator of wastes has determined that the wastes do not meet the criteria for hazardous wastes, they are classified as solid wastes. The Colorado solid waste rules contain the following five solid waste categories: 1) "Industrial wastes", which includes all solid wastes resulting from the manufacture of products or goods by mechanical or chemical processes. 2) "Community wastes", which includes all solid wastes generated by the noncommercial and nonindustrial activities of private individuals of the community including solid wastes from streets, sidewalks, and alleys. 3) "Commercial wastes", which includes all solid wastes generated by stores, hotels, markets, offices, restaurants, and other nonmanufacturing activities, with the exclusion of community and industrial wastes. 4) "Special wastes", which includes any solid waste that requires special handling or disposal procedures. Special wastes may include, but are not limited to, asbestos, bulk tires, or other bulk materials, sludges, and biomedical wastes.

Action	Citation	Requirements
		5) "Inert material", which includes solids that are not soluble in water and therefore nonputrescible, together with such minor amounts and types of other materials that do not significantly affect the inert nature of such solids. The term includes, but is not limited to, earth, sand, gravel, rock, concrete that has been in a hardened state for at least 60 days, masonry, asphalt-paving fragments, and other inert solids, including those that the Colorado Department of Health may identify by regulation. If present, only small quantities of industrial, community, commercial, and special wastes are expected from thermal desorption of soils at RMA. No special testing requirements are specified for solid wastes; the management and disposal rules are strictly oriented toward imposing minimum engineering and technology requirements.
<u>Waste Management</u>		
Treatment, storage, or disposal of hazardous wastes	40 CFR Part 264 6 CCR 1 007-3 Part 264	Wastes that are determined to be RCRA hazardous wastes must be stored and treated, in compliance with RCRA regulations.
On-post land disposal of hazardous wastes	40 CFR Part 264 6 CCR 1 007-3 Part 264 40 CFR Part 268 6 CCR 1007-3 Part 268 EPA/540/G-89/005 [TBC]	Based upon a determination of whether the disposal technique constitutes placement, LDRs-UTS may be applicable. If placement does occur, the disposal facility must comply with the substantive requirements of 40 CFR Part 264 (6 CCR 1007-3 Part 264) and 40 CFR Part 268 (6 CCR 1007-3 Part 268).
	6 CCR 1007-3	Some of the Colorado standards for owners and operators of hazardous waste management, storage, and disposal facilities are more stringent than the equivalent federal regulations. These standards are detailed on Appendix A, Table A-12.

Action	Citation	Requirements
Management of Remediation Wastes		
Corrective Action Management Units	40 CFR 264, Subpart S 6 CCR 1007-3, Part 264 Subpart S	The CAMU regulations allow for exceptions from otherwise generally applicable LDRs and minimum technology requirements for remediation wastes managed at CAMUs. These regulations provide flexibility and allow for expedition of remedial decisions in the management of remediation wastes. One or more CAMUs may be designated at a facility. Placement of hazardous remediation wastes into or within the CAMU does not constitute land disposal of hazardous wastes so the LDRs are not triggered.
Temporary Units	6 CCR 1007-3 Sect 264.553 40 CFR 264.553	Design, operating, or closure standards for temporary tanks and container storage areas may be replaced by alternative requirements. The TU must be located within the facility boundary, used only for the treatment/storage of remediation waste, and will be limited to one year of operation with a one year extension upon approval by the regulatory authority.
Air Emissions		
Emission of Particulates	5 CCR 1001-3, Regulation 1, Section III (D) 5 CCR 1001-5, Regulation 3	Colorado air pollution regulations require owners or operators of sources that emit fugitive particulates to minimize emissions through use of all available practical methods to reduce, prevent, and control emissions. In addition no off-site transport of particulate matter is allowed. A fugitive dust control measure will be written in the work plan in consultation with the state for the remedial activity. Estimated emissions from the proposed remedial activity per Colorado APEN requirements.
Emission control for opacity	5 CCR 1001-3, Regulation 1, Section II	Soil drying of soils shall not cause the emission into the atmosphere of any air pollutant that is in excess of 20% opacity.

Action	Citation	Requirements
Emission of hazardous air pollutants	5 CCR 1001-10, Regulation 8 40 CFR Part 61	Emission of listed hazardous air pollutants is controlled by NESHAPs Soil drying will cause volatization of some contaminants
	42 USCS Section 7412	National standards for site remediation sources that emit hazardous air pollutants are scheduled for promulgation by the year 2000. Standards will be developed for 189 listed hazardous air pollutants.
Volatile organic chemical emissions	5 CCR 1001-9, Regulation 7	VOC regulations apply to ozone nonattainment areas. The air quality control area for RMA is currently nonattainment of ozone. Storage and transfer of VOCs and petroleum liquids are controlled by these requirements.
	42 USC Section 7502-7503	New or modified major stationary sources in a nonattainment area are required to comply with the lowest achievable emission rate. Disposal of VOCs is regulated for all areas, including ozone nonattainment. The regulations control the disposal of VOCs by evaporation or spilling unless reasonable available control technologies are utilized.
Visibility protection	40 CFR 51.300-307 40 CFR 52.26-29	Soil drying must be conducted in a manner that does not cause adverse impacts on visibility. Visibility impairment interferes with the management, protection, preservation, or enjoyment of federal Class I areas.
	5 CCR 1001-14 CRS Section 42-4-307(8)	The Colorado Ambient Air Quality Standard for the AIR Program area is a standard visual range of 32 miles. The averaging time is 4 hours. The standard applies during an 8-hour period from 8:00 a.m. to 4:00 p.m. each day (Mountain Standard Time or Mountain Daylight Time, as appropriate). The visibility standard applies only during hours when the hourly average humidity is less than 70%.

Action	Citation	Requirements
Odor emissions	5 CCR 1001-4, Regulation 2	Colorado odor emission regulations require that no person shall allow emission of odorous air contaminants that result in detectable odors that are measured in excess of the following limits: 1) For residential and commercial areas-- odors detected after the odorous air has been diluted with seven more volumes of odor-free air 2) For all other land use areas--odors detected after the odorous air has been diluted with 15 more volumes of odor-free air
Stormwater Management		
Discharge of stormwater to on-post surface waters	40 CFR Parts 122-125	Stormwater runoff, snow melt runoff, and surface runoff and drainage associated with industrial activity (as defined in 40 CFR 122) from RMA remedial actions that disturb 5 acres or more and that discharge to surface waters shall be conducted in compliance with the storm water management regulations.

Chemical Name	Exposure Standards
Aldrin	ACGIH-TWA = 0.25 mg/m3 (skin) NIOSH-REL 0.25 mg/m3 (skin) OSHA-PEL = 0.25 mg/m3 (8 hr TWA) (skin)
Arsenic (organic)	ACGIH-TWA =0.1mg/m3 OSHA-PEL=10.0 :g/m3 (8 hr TWA)
Asbestos	ACGIH-TLV Amosite=0.5 fibers/cm3 Chrysolite=2 fibers/cm3 Crosidolite-0.2 fibers/cm3 Other Forms=2 fibers/cm3 NIOSH-REL=0.1 fibers/cm3 OSHA-REL=0.2 fibers/cm3 (8 hr TWA) OSHA action level=0.1 fibers/cm3
Atrazine	ACGIH-TWA=5 mg/m3
Benzene	ACGIH-TWA=0.1 ppm, 0.3 mg/m3 skin, Suspected human carcinogen NIOSH-REL=0.1 ppm, STEL=1 ppm (15 min) OSHA-PEL=1.0 ppm (8 hr TWA), STEL=5.0 ppm (15 min ceiling).
Cadmium	ACGIH-TWA*=0.01 mg/m3 (total), 0.002 mg/m3 (resp), Suspected human carcinogen NIOSH-REL-Reduce exposure to lowest feasible concentration OSHA-PEL fume=0.1 mg/m3 (8 hr TWA), 0.3 mg/m3 (ceiling) OSHA-PEL dust=0.2 mg/m3 (8 hr TWA), 0.6 mg/m3 (ceiling)
Caprolactam (vapor)	ACGIH-TWA*=5 ppm, 23 mg/m3; STEL=10 ppm, 46 mg/m3
Carbon Tetrachloride	ACGIH-TWA=5 ppm, 31 mg/m3 (skin); STEL=10 ppm, 63 mg/m3, Suspected human carcinogen NIOSH-STEL=2 ppm (60 min), 12.6 mg/m3 OSHA-PEL=10 ppm, 8 hr TWA; 25 ppm (ceiling); 200 ppm (peak concentration, max duration 5 min/in any 4 hrs.)
Chlordane	ACGIH-TWA=0.5 mg/m3 (skin) NIOSH-REL=0.5 mg/m3 (skin) OSHA-PEL=0.5 mg/m3 (8 hr TWA) (skin)

Chemical Name	Exposure Standards
Chlorobenzene	ACGIH-TWA=10 ppm, 46 mg/m3 OSHA-PEL=75 ppm, 350 mg/m3, (8 hr TWA)
Chloroform	ACGIH-TWA=10 ppm, 49 mg/m3, Suspected human carcinogen NIOSH-STEL=2 ppm, 9.78 mg/m3 (60 min) OSHA-Ceiling=50 ppm, 240 mg/m3
Chromium (Cr-metal; compounds)	ACGIH-TWA=0.5 mg/m3 [metal, Cr(II) and Cr (III) compounds] 0.01mg/m3 [CrVI compounds] Insoluble, NOC 0.05 mg/m3 [Cr(VI) compounds], Human carcinogen for water-insoluble compounds NIOSH-REL= 1:g/m3 (10 hr TWA) [carcinogenic Cr(VI) compounds]; 0.5 mg/m3 [metal, Cr(II) and Cr(III) compounds] OSHA-PEL= 1 mg/m3 (8 hr TWA) [metal and insoluble salts]; 0.5 mg/m3 (8 hr TWA) [soluble salts];
Copper	ACGIH-TWA fume=0.2 mg/m3 ACGIH-TWA dust =1 mg/m3 NIOSH-REL fume 0.1 mg/m3 (10 hr TWA) NIOSH-REL dust=1 mg/m3 (10 hr TWA) OSHA-PEL fume=0.1 mg/m3 (8 hr TWA) OSHA-PEL dust =1 mg/m3 (8 hr TWA)
Cyanides (as CN)	ACGIH-Ceiling=5 mg/m3 (skin); TWA=4.7 mg/m3 NIOSH-Ceiling=4.7 ppm, 5 mg/m3 (10 min) OSHA-PEL=5 mg/m3 (8 hr TWA)
Dibutyl Phthalate	ACGIH-TWA=5 mg/m3 NIOSH-REL=5 mg/m3 (10 hr TWA) OSHA-PEL=5 mg/m3 (8 hr TWA)
1, 2-Dibromo-3-chloropropane (DBCP)	OSHA-PEL=1ppb (8 hr TWA)
1,1-Dichloroethane	ACGIH-TWA*= 100 ppm, 405 mg/m3 NIOSH-REL=100 ppm, 400 mg/m3 OSHA-PEL=100 ppm, 400 mg/m3 (8 hr TWA)

Chemical Name	Exposure Standards
1,2-Dichloroethane	ACGIH-TWA=10 ppm, 40 mg/m3 OSHA-PEL=50 ppm (8 hr TWA); 100 ppm (ceiling); 200 ppm (maximum concentration)
1,1-Dichloroethylene	ACGIH-TWA=5 ppm, 20 mg/m3; STEL=20 ppm, 79 mg/m3
1,2-Dichloroethylene (Trans)	ACGIH-TWA=200 ppm, 793 mg/m3 NIOSH-REL=200 ppm, 740 mg/m3 (10 hr TWA) OSHA-PEL=200 ppm, 790 mg/m3 (8 hr TWA)
Dichlorvos (Vapona) DDVP	ACGIH-TWA=0.1 ppm, 0.90 mg/m3 (skin) NIOSH-REL=1 mg/m3 (10 hr TWA) (skin) OSHA-PEL=1 mg/m3 (8 hr TWA) (skin)
DDT	ACGIH-TWA=1 mg/m3 NIOSH-REL=0.5 mg/m3 OSHA-PEL=1 mg/m3 (8 hr TWA) (skin)
Dicyclopentadiene	ACGIH-TWA=5 ppm, 27 mg/m3 OSHA-TWA=5 ppm, 30 mg/m3 (8 hr TWA)
Dieldrin	ACGIH-TWA=0.25 mg/m3 (skin) NIOSH-REL=0.25 mg/m3 OSHA-PEL=0.25 mg/m3 (skin)
Diethyl Phthalate	ACGIH-TWA=5 mg/m3
1,1-Dimethylhydrazine	ACGIH-TWA=0.01 ppm, 0.025 mg/m3(skin)Suspected human carcinogen NIOSH-Ceiling=0.06 ppm, 0.15 mg/m3 (120 min) OSHA-PEL=0.5 ppm, 1 mg/m3
Endrin	ACGIH-TWA=0.1 mg/m3 (skin) NISOH-REL=0.1 mg/m3 (10 hr TWA) (skin) OSHA-PEL=0.1 mg/m3 (8 hr TWA) (skin)

Chemical Name	Exposure Standards
Ethyl Benzene	ACGIH-TWA=100 ppm, 434 mg/m3; STEL=125 ppm, 543 mg/m3 NIOSH-REL=100 ppm, 435 mg/m3 (10 hr TWA); STEL-125 ppm, 545 mg/m3 OSHA-PEL=100 ppm, 435 mg/m3 (8 hr TWA)
Fluoride (as F)	ACGIH-TWA=2.5 mg/m3 NIOSH-REL=2.5 mg/m3 (10 hr TWA) OSHA-PEL=2.5 mg/m3 (8 hr TWA)
Hexachlorobutadiene	ACGIH-TWA=0.02 ppm 0.21 mg/m3, Suspected human carcinogen
Hexachlorocyclopentadiene	ACGIH-TWA=0.01ppm, 0.11mg/m3 OSHA PEL=0.01 ppm, 0.1mg/m3 NIOSH-REL=0.01 ppm, 0.013mg/m3
Hydrazine	ACGIH-TWA*=0.1 ppm, 0.13 mg/m3 (skin), Suspected human carcinogen NIOSH-Ceiling=0.03 ppm, 0.04 mg/m3 (120 min ceiling) OSHA-PEL= 1 ppm, 1.3 mg/m3 (8-hr TWA)
4-Hydroxy-4-methyl-2-pentanone	ACGIH-TWA=50 ppm, 238 mg/m3
Lead (dust & fumes)	ACGIH-TWA=0.05 mg/m3 NIOSH-REL (inorganic) 0.1mg /m3 (10 hr TWA); OSHA-PEL=50 :g/m3
Magnesium (as Mg Oxide fumes)	ACGIH-TWA=10 mg/m3 OSHA-PEL= 15 mg/m3 (8 hr TWA) (resp)
Malathion	ACGIH-TWA=10 mg/m3 (skin) NIOSH-REL=10 mg/m3 (10 hr TWA) OSHA-PEL=15 mg/m3 (8 hr TWA)
Mercury (as Hg) (inorganic)	ACGIH- TWA vapor=0.025 mg/m3 (skin) NIOSH-REL vapor=0.05 mg/m3 (10 hour TWA) (skin) OSHA-Ceiling=0.1mg/m3 (skin)

Chemical Name	Exposure Standards
Methylene Chloride	ACGIH-TWA=50 ppm, 174 mg/m3, Suspected human carcinogen NIOSH-REL=Reduce exposure to lowest feasible limit OSHA-PEL=500 ppm (8 hr TWA); 1000 ppm (ceiling); 2000 ppm, (peak concentration, maximum duration 5 min/2 hr)
Methylisobutyl Ketone (Hexone)	ACGIH-TWA=50 ppm, 205 mg/m3; STEL=75 ppm, 307 mg/m3 NIOSH-REL=50 ppm, 205 mg/m3, (10 hr TWA); STEL=75 ppm, 300 mg/m3 OSHA-PEL=100 ppm, 410 mg/m3 (8 hr TWA)
Parathion	ACGIH-TWA=0.1 mg/m3 (skin) NIOSH-REL=0.05 mg/m3 (10 hr TWA) (skin) OSHA-PEL=0.1 mg/m3 (8 hr TWA) (skin)
PCB (42% chlorine)	ACGIH=1.0 mg/m3 (skin) NIOSH=0.001 mg/m3 OSHA=1 mg/m3 (skin)
PCB (54% chlorine)	ACGIH=0.5 mg/m3 (skin) NIOSH=0.001 mg/m3 OSHA=0.5 mg/m3 (skin)
Pentachlorophenol	ACGIH-TWA=0.5 mg/m3 (skin) NIOSH-REL=0.5 mg/m3 (10 hr TWA) (skin) OSHA-PEL=0.5 mg/m3, (8 hr TWA) (skin)
Phenol	ACGIH-TWA=5 ppm, 19 mg/m3 (skin) NIOSH-REL=5 ppm, 19 mg/m3 (10 hr TWA); Ceiling=15.6 ppm, 60 mg/m3 (15 min) (skin) OSHA-PEL=5 ppm, 19 mg/m3 (8 hr TWA) (skin)
1,1,2,2-Tetrachloroethane	ACGIH-TWA=1 ppm, 6.9 mg/m3 (skin) NIOSH-REL=1 ppm, 7mg/m3 (10 hr TWA) (skin) OSHA-PEL=5 ppm, 35 mg/m3 (8 hr TWA) (skin)

Chemical Name	Exposure Standards
Tetrachloroethylene (Perchloroethylene)	ACGIH-TWA 25 ppm, 170 mg/m3; STEL= 100 ppm, 685 mg/m3 NIOSH-REL Minimize workplace exposure concentrations; limit number of workers exposed OSHA-PEL=100 ppm (8 hr TWA); 200 ppm (ceiling); 300 ppm (peak concentration, maximum duration 5 min/2 hrs)
Toluene	ACGIH-TWA*=50 ppm, 188 mg/m3 NIOSH-REL=100 ppm, 375 mg/m3 (10 hr TWA); STEL=150 ppm, 560 mg/m3 (15 min) OSHA-PEL=200 ppm (8 hr TWA); 300 ppm (ceiling); 500 ppm (peak concentration-for 10 minutes)
1,2,4-Trichlorobenzene	ACGIH-Ceiling=5 ppm, 37 mg/m3
1,1,1-Trichloroethane (Methyl chloroform)	ACGIH-TWA=350 ppm, 1910 mg/m3; STEL=450 ppm, 2460 mg/m3 NISOH-Ceiling-350 ppm, 1900 mg/m3 (15 min ceiling) OSHA-PEL=350 ppm, 1900 mg/m3 (8 hr TWA)
1, 1, 2-Trichloroethane	ACGIH-TWA=10 ppm, 55 mg/m3 (skin) OSHA-PEL=10 ppm, 45 mg/m3 (8 hr TWA) (skin)
Trichloroethylene	ACGIH-TWA=50 ppm, 269 mg/m3; STEL=100 ppm, 537 mg/m3 NIOSH-REL=25 ppm (10 hr TWA) OSHA-PEL=100 ppm (8 hr TWA); 200 (ceiling); 300 ppm (peak concentration, maximum duration 5 min/2 hrs)
Trimethyl Benzene	ACGIH-TWA=25 ppm, 123 mg/m3
Xylene - o,m,p	ACGIH-TWA=100 ppm, 434 mg/m3; STEL=150 ppm, 651 mg/m3 NIOSH-REL=100 ppm, 434 mg/m3 (10 hr TWA); STEL-150 ppm, 655 mg/m3 (15 min ceiling) OSHA-PEL=100 ppm, 435 mg/m3
Xylene - M (","diamine)	ACGIH-Ceiling=0.1 mg/m3 (skin)
Zinc (as zinc oxide)	ACGIH-TWA dust= 10 mg/m3 - containing no asbestos and<1% crystalline silica ACGIH-TWA fume=5 mg/m3; STEL=10 mg/m3 NIOSH-REL fume=5 mg/m3 (10 hr TWA), STEL=10 mg/m3 (15 min ceiling) OSHA-PEL dust=15 mg/m3; 5 mg/m3 (resp) OSHA-PEL fume=5 mg/m3 (8 hr TWA)

Notes:

ACGIH	American Conference of Governmental Industrial gienists
OSHA	Occupational Safety and Health Administration
NIOSH	National Institute for)ccupationa Safety and Iealth NIOSI WA is the time-weighted concentration for a 10-hour day and a 40-hour work week)
STEL	Short Term Exposure I imi
TWA	Time Weighted Av
PEL	Permissible Exposure I imi
MAX	Maximum Peak Above the Ceiling
REL	Recommended Exposure Limit
resp	respirable
hr	hour(s)
min	minute(s)
ppm	parts per million
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
$\mu g/m^3$	micrograms per cubic meter
	proposed change
••	change is proposed, not quantified
•	all forms except alkyl vapor

Chemical Name	Exposure Standards		Source	Associated Agent
Acetic Acid	ACGIH-TWA	= 10 ppm, 25 mg/m^3	SDP	GB
	ACGIH-STEL	= 15 ppm, 37 mg/m^3		
	NIOSH-REL	= 10 ppm, 25 mg/m^3		
	NIOSH-STEL	= 15 ppm, 37 mg/m^3		
	OSHA-PEL	= 10 ppm, 25 mg/m^3 (8 hr TWA)		
Acetylene	ACGIH-TWA	= simple asphyxiant	HP, ICP	L
Acetylene chloride [acetylene monochloride]	Animal toxicity data only[3]		ICP	L
Acetylene Dichloride** [1,2-dichloroethylene]	ACGIH-TWA	= 200 ppm, 793 mg/m^3	ICP	HL, L
	NIOSH-REL	= 200 ppm, 790 mg/m^3		
	OSHA-PEL	= 200 ppm, 790 mg/m^3		
Adamsite (DM) [10chloro-5,10-dihydrophenarsazine]	LCt_{50}[1]	= 11000-44000 mg-min/m^3 (inhal)	A	DM
	ICt_{50}[1]	= 370 mg-min/m^3 (inhal)		
Ammonia	ACGIH-TWA	= 25 ppm, 17 mg/m^3	SDP	GB
	ACGIH-STEL	= 35 ppm, 24 mg/m^3		
	NIOSH-REL	= 25 ppm, 18 mg/m^3		
	NIOSH-STEL	= 35 ppm, 27 mg/m^3		
	OSHA-PEL	= 50 ppm, 35 mg/m^3		
Arsenic (Inorganic Compounds as As - including arsenous oxide, arsenic oxychloride, arsenic trichloride, arsenic trioxide, sodium arsenite)	ACGIH-TWA	= 0.01 mg/m^3	HP, CP, ICP	HL, L
	NIOSH-Ceiling	= 0.002 mg/m^3 (15 min ceiling)		
	OSHA-PEL	= 10 µg/m^3(8 hr TWA)		
Bis(2-chlorovinyl)chloroarsine	Animal toxicity data only[3]		–	L
Calcium Chloride	Animal toxicity data only[3]		DP	HD
Calcium Sulfate	ACGIH-TWA	= 10 mg/m^3***	DP	HD
	OSHA-PEL	= 15 mg/m^3 (8 hr TWA - total dust)		
		= 5 mg/m^3 (8 hrs TWA - rf)		

Chemical Name	Exposure Standards	Source	Associated Agent
Carbon Dioxide	ACGIH-TWA = 5000 ppm, 9000 mg/m^3 ACGIH-STEL = 30000 ppm, 54000 mg/m^3 NIOSH-REL = 5000 ppm, 9000 mg/m^3 NIOSH-STEL = 30000 ppm, 54000 mg/m^3 OSHA-PEL = 5000 ppm, 9000 mg/m^3 (8 hr TWA)	CP, DP	CG, GB, HD, HL
Chlorine	ACGIH-TWA = 0.5 ppm, 1.5 mg/m^3 ACGIH-STEL = 1 ppm, 2.9 mg/m^3 NIOSH-REL = 0.5 ppm, 1.5 mg/m^3 NIOSH-STEL = 1 ppm, 3 mg/m^3 OSHA-Ceiling = 1 ppm, 3 mg/m^3	CP	HL, L
Chloroacetic Acid	Animal toxicity data only[3]	–	HD
Chloroform**	ACGIH-TWA = 10 ppm, 49 mg/m^3 NIOSH-STEL = 2 ppm, 9.78 mg/m^3 (60 min) OSHA-Ceiling = 50 ppm, 240 mg/m^3	DP, ICP, SDP	GB, HD
1,2-Dichloroethane** [ethylene dichloride]	ACGIH-TWA = 10 ppm, 40 mg/m^3 OSHA-PEL = 50 ppm (8 hr TWA); 100 ppm (ceiling); 200 ppm (5 mins/3 hr) NIOSH-REL = 1 ppm, 4 mg/m^3 NIOSH-STEL = 2 ppm, 8 mg/m^3 MPC = 200 ppm	ICP	HD
Diethyldisulfide	Animal toxicity data only[3]	ICP	HD
Diisopropylcarbodiimide (DIPC)	Animal toxicity data only[3]	AS	GB
Distilled Mustard (HD) [2,2-dichloro-diethylsulfide; bis(2-chloro-ethyl) sulfide]	LCt_{50}[1] = 1500 mg-min/m^3 (inhal) = 10000 mg-min/m^3 (s/m-vapor) = 7.0 gm/70 kg man (s/m-liquid) ICt_{50}[1] = 200 mg-min/m^3 (eye injury) = 2000 mg-min/m^3 (s/m @ 70°-80°F)**** MPC = 2 mg-min/m^3 (eye) = 5 mg min/m^3 (s/m)	A	HD

Chemica Name	Exposure Standards		Source	Associated Agent
)is lled Mustard (continued	PEL[2]	= 0 003 mg/m^3 uw (8 hr TWA)		
	Ceiling[2]	= 0 003 mg/m^3 (uw)		
		= 0 003 mg/m^3 (naw/gp)		
	SEL[2]	= 0.003 mg/m^3 (1 hr TWA)		
	AEL[4]	= 0.003 mg/m^3		
Ethanethiol [ethyl mercaptan]	ACGIH-TWA	= 0.5 ppm, 1.3 mg/m^3	ICP	HD
	N OS -Ceiling	= 0.5 ppm, 1.3 mg/m^3 (15 min ceiling)		
	OS IA· Cei ing	= 10 ppm, 25 mg/m^3		
Ethyl Chloride [chloroethane]	ACGIH-TWA	= 1000 ppm, 2640 mg/m^3	ICP	HD
	OSHA-PEL	= 1000 ppm, 2600 mg/m^3 (8 hr TWA)		
Fluoride (Inorganic Compounds - incl ding calcium fluoride and sodium fluoride)	ACGIH-TWA	= 2.5 mg/m^3	DP	GB
	NIOSH-REL	= 2.5 mg/m^3		
	OSHA-PEL	= 2.5 mg/m^3 (8 hr TWA)		
GB	AEL[4]	= 0.0001 mg/m^3 (8hr TWA)		
	AEL[4]	= 0.2 mg/m^3 (any period)		
H	AEL[4]	= 0.003 mg/m^3		
HT	AEL[4]	= 0.003 mg/m^3		
Hydrogen Chloride	ACGIH- Ceiling	= 5 ppm, 7.5 mg/m^3	HP, CP	CG, HD, HL, L
	NIOSH- Ceiling	= 5 ppm, 7 mg/m^3		
	OSHA- Ceiling	= 5 ppm, 7 mg/m^3		
Hydrogen Fluoride	ACGIH- Ceiling	= 3 ppm, 2.6 mg/m^3	CP, HP	GB
	NIOSH-REL	= 3 ppm, 2.5 mg/m^3		
	NIOSH-Ceiling	= 6 ppm, 5 mg/m^3 (15 min)		
	OSHA-PEL	= 3 ppm, (8 hr TWA)		
Hydrogen Sulfide	ACGIH-TWA	= 10 ppm, 14 mg/m^3	ICP	ID
	ACGIH-STEL	= 15 ppm, 21 mg/m^3		
	NIOSH- Ceiling	= 10 ppm, 15 mg/m^3 (0 min)		
	OSHA- Ceiling	= 20 ppm		
	OSHA-MPC	= 50 ppm (10 min OT)		

Chemical Name	Exposure Standards		Source	Associated Agent
Isopropyl Alcohol	ACGIH-TWA	= 400 ppm, 983 mg/m^3	HP	GB
	ACGIH-STEL	= 500 ppm, 1230 mg/m^3		
	NIOSH-REL	= 400 ppm, 980 mg/m^3		
	NIOSH-STEL	= 500 ppm, 1225 mg/m^3		
	OSHA-PEL	= 400 ppm, 980 mg/m^3 (8 hr TWA)		
Lewisite (L) [dichloro(2-chlorovinyl)arsine]	LCt$_{50}$[1]	= 1200-1500 mg-min/m^3 (inhal)	A	HL, L
		= 100000 mg-min/m^3 (s/m)		
	ICt$_{50}$[1]	< 300 mg-min/m^3 (eye injury-vapor)		
		> 1500 mg-min/m^3 (s/m)		
	Ceiling[2]	= 0.0001 mg/m^3 (uw)		
		= 0.0001 mg/m^3 (naw/gp)		
	SEL[2]	= 0.0001 mg/m3 (1 hr TWA)		
Mercury Alkyl Compounds (including dimethyl mercury and methyl mercury salts)	ACGIH-TWA	= 0.01 mg/m^3		HL, L
	ACGIH-STEL	= 0.03 mg/m^3		
	NIOSH-REL	= 0.01 mg/m^3 (skin)		
	NIOSH-STEL	= 0.03 mg/m^3 (skin)		
	OSHA- Ceiling	= 0.01 mg/m^3		
Methyl Chloride [chloromethane]	ACGIH-TWA	= 50 ppm, 103 mg/m^3 (skin)	ICP	
	ACGIH-STEL	= 100 ppm, 207 mg/m^3 (skin)		
	NIOSH-REL	= reduce to lowest feasible concentration		
	OSHA-PEL	= 100 ppm (8 hr TWA)		
	OSHA-Ceiling	= 200 ppm		
	OSHA-MPC	= 300 ppm (5 min/3 hr)		
Methylene Chloride**	ACGIH-TWA	= 50 ppm, 174 mg/m^3	ICP	HD
	NIOSH-REL	= reduce to lowest feasible concentration		
	OSHA-PEL	= 500 ppm, 1765 mg/m^3 (8 hr TWA)		
	OSHA-Ceiling	= 1000 ppm, 3530 mg/m^3		
	OSHA-MPC	= 2000 ppm, 7060 mg/m^3 (5 min/2 hrs)		
Mustard-Lewisite Mixture	LCt$_{50}$[1]	= 1500 mg-min/m^3 (inhal)	A	HL
		> 10000 mg-min/m^3 (s/m)		
	ICt$_{50}$[1]	= 200 mg-min/m^3 (eye injury)		
		= 1500-2000 mg-min/m^3 (s/m)		

Chemical Name	Exposure Standards		Source	Associated Agent
Phosphoric Acid [orthophosphoric acid]	ACGIH-TWA	= 1 mg/m^3	ICP	GB
	ACGIH-STEL	= 3 mg/m^3		
	NIOSH-REL	= 1 mg/m^3		
	NIOSH-STEL	= 3mg/m^3		
	OSHA-PEL	= 1 mg/m^3 (8 hr TWA)		
Phosphorus Pentoxide [POX, phosphoric anhydride]	Animal toxicity data only[3]		CP	GB
Sarin (GB) [isopropyl methylphosphono fluoridate; methyisopropo oxyfluoro-phosph ine oxide]	LCt_{50}[1] (resp)	= 100 mg-min/m^3 (resting)	A	GB
		= 70 mg-min/m^3 (mild activity)		
	ICt_{50}[1] (resp)	= 75 mg-min/m^3 (resting)		
		= 35 mg-min/m^3 (mild activity)		
	TWA[2]	= 0.0001 mg/m^3 (uw - 8 hr TWA)		
		= 0.000003 mg/m^3 (naw/gw - 72 hr TWA)		
	Ceiling[2]	= 0.000 1 mg/m^3 (naw/gw)		
	SEL[2]	= 0.0003 mg/m^3 (1 hr TWA)		
Sulfur	Eye irritation[3]	= 6 ppm	ICP	HD
Sulfur Dioxide	ACGIH-TWA	= 2 ppm, 5.2 mg/m^3	CP	HD
	ACGIH-STEL	= 5 ppm, 13 mg/m^3		
	NIOSH-REL	= 2 ppm, 5 mg/m^3		
	NIOSH-STEL	= 5 ppm, 10 mg/m^3		
	OSHA-PEL	= 5 ppm, 13 mg/m^3 (8 hr TWA)		
1,1,1,2-Tetrachloroethane	Animal toxicity data only[3]		ICP	HD
1,1,2,2-Tetrachloroethane** [acetylene tetrachloride]	ACGIH-TWA	= 1 ppm, 6.9 mg/m^3	ICP	HD
	NIOSH-REL	= 1 ppm, 7 mg/m^3 (skin)		
	OSHA-PEL	= 5 ppm, 35 mg/m^3 (8 hr TWA - skin)		
beta-Thiodiglycol [thiodiethylene glycol]	Animal toxicity data only[3]		DP, HP	HD, HL
Tributylamine (TBA)	Animal toxicity data only[3]		AS	GB

Chemical Name	Exposure Standards	Source	Associated Agent
Distilled Mustard (continued)	PEL[2] = 0.003 mg/m^3 uw (8 hr TWA) Ceiling[2] = 0.003 mg/m^3 (uw) = 0.003 mg/m^3 (naw/gp) SEL[2] = 0.003 mg/m^3 (1 hr TWA) AEL[4] = 0.003 mg/m^3		
Ethanethiol [ethyl mercaptan]	ACGIH-TWA = 0.5 ppm, 1.3 mg/m^3 NIOSH-Ceiling = 0.5 ppm, 1.3 mg/m^3 (15 min ceiling) OSHA- Ceiling = 10 ppm, 25 mg/m^3	ICP	HD
Ethyl Chloride [chloroethane]	ACGIH-TWA = 1000 ppm, 2640 mg/m^3 OSHA-PEL = 1000 ppm, 2600 mg/m^3 (8 hr TWA)	ICP	HD
Fluoride (Inorganic Compounds - including calcium fluoride and sodium fluoride)	ACGIH-TWA = 2.5 mg/m^3 NIOSH-REL = 2.5 mg/m^3 OSHA-PEL = 2.5 mg/m^3 (8 hr TWA)	DP	GB
GB	AEL[4] = 0.0001 mg/m^3 (8hr TWA) AEL[4] = 0.2 mg/m^3 (any period)		
H HT	AEL[4] = 0.003 mg/m^3 AEL[4] = 0.003 mg/m^3		
Hydrogen Chloride	ACGIH- Ceiling = 5 ppm, 7.5 mg/m^3 NIOSH- Ceiling = 5 ppm, 7 mg/m^3 OSHA- Ceiling = 5 ppm, 7 mg/m^3	HP, CP	CG, HD, HL, L
Hydrogen Fluoride	ACGIH- Ceiling = 3 ppm, 2.6 mg/m^3 NIOSH-REL = 3 ppm, 2.5 mg/m^3 NIOSH-Ceiling = 6 ppm, 5 mg/m^3 (15 min) OSHA-PEL = 3 ppm, (8 hr TWA)	CP, HP	GB
Hydrogen Sulfide	ACGIH-TWA = 10 ppm, 14 mg/m^3 ACGIH-STEL = 15 ppm, 21 mg/m^3 NIOSH- Ceiling = 10 ppm, 15 mg/m^3 (10 min) OSHA- Ceiling = 20 ppm OSHA-MPC = 50 ppm (10 min OT)	ICP	HD

VX	Nerve Agent
mg-min/m^3	Milligrams per minute per cubic meter
mg/m^3	Milligrams per cubic meter
min	Minutes
MPC	Maximum peak concentration
naw/gp	Non-agent worker/general population
NIOSH	National Institute for Occupational Safety and Health (NIOSH-TWA is the time-weighted concentration for a 10-hour day and a 40-hour work week)
OSHA	Occupational Safety and Health Administration
OT	One time exposure if no other measurable exposure occurs
PEL	Permissible exposure limit
ppm	Parts per million
REL	Recommended exposure limit
resp	Respirable
rf	Respirable fraction
s/m	Skin exposure/masked worker
SDP	Stabilizer decontamination product
SEL	Source emission limit
STEL	Short-term exposure limit
TBA	Tributylamine
TWA	Time weighted average
uw	Unmasked worker

Parameter	Concentration	Units	Standard	Citation
Asbestos	NA	NA	No visible emissions allowed unless specified alternative waste management procedures followed.	40 CFR 61 Subpart M 5 CCR 1001-10 Regulation 8, Part B
Benzene (Fugitive Emission)	10,000	ppm	Machine reading indicates leak; Readings of less than 500 ppm above background are not considered action events; Colorado Air Pollution Control Regulations; National Emission Standard.	5 CCR 1001 Regulation 8, Section VIII 40 CFR 61.110
Beryllium	10	grams	Over a 24 hour period; National Emission Standard; Colorado Air Pollution Control Regulations	40 CFR 61.32 5 CCR 1001 Regulation 8, Section III
Beryllium	.01	$\mu g/m^3$	30 day average, at least 3 years of data available; National Emission Standard; Colorado Air Pollution Control Regulations	40 CFR 61.32 5 CCR 1001 Regulation 8, Part A
Hydrogen Sulfide	142	$\mu g/m^3$	1 hour average; Colorado Air Pollution Control Regulations.	5 CCR 1001-10 Regulation 8, Part C, Section II
Lead	1.5	$\mu g/m^3$	Average over one month period; Colorado Air Pollution Control Regulations.	5 CCR 1001-10 Regulation 8, Part C, Section I
Mercury (from Sludge Incineration)	1,600	grams/day	Monitor emissions at least once a year by EPA Method 105; Below Federal limit of 3,200 grams/day; Colorado Air Pollution Control Regulations; National Emission Standard.	5 CCR 1001 Regulation 8, Part A 40 CFR 61.52
Odor	7	Volume	Residential commercial areas, dilution with volumes of odor-free air; Colorado Air Pollution Regulations.	5 CCR 1001 Regulation 2
Odor	15	Volume	All other land use areas, dilution with volumes of odor-free air; Colorado Air Pollution Control Regulations.	5 CCR 1001 Regulation 2

Parameter	Concentration	Units	Standard	Citation
Opacity	20%	---	No operation with emissions exceeding 20% opacity; Colorado Air Pollution Control Regulations. Fugitive dust measures will be written into the project work plans in consultation with the state. Nuisance guidelines and "no off-property" transport guidelines apply to certain sources of fugitive particulate matter emissions.	5 CCR 1001 Regulation 1, Section II
Ambient Air Quality Standards	Lead - 1.5	$\mu g/m^3$ (max. arithmetic mean average over a calendar quarter)	Sources cannot cause or contribute to an exceedance of a national or Colorado Ambient Air Quality Standard.	5 CCR 1001-5, Regulation 3 5 CCR 1001-14
	TSP 75 & 260	$\mu g/m^3$ (primary std-annual (geometric mean), 24-hr)	Sources cannot cause or contribute to an exceedance of a national or Colorado Ambient Air Quality Standard.	5 CCR 1001-14
	PM - 150 & 50	$\mu g/m^3$ (24 hr average concentration & annual arithmetic mean, respectively)	Sources cannot cause or contribute to an exceedance of a national or Colorado Ambient Air Quality Standard.	5 CCR 1001-14
	Ozone - 235	$\mu g/m^3$ (1 hr averaging time)	Sources cannot cause or contribute to an exceedance of a national or Colorado Ambient Air Quality Standard.	5 CCR 1001-14

Table A-48 Standards Pertaining to Air Emissions from Potential Remedial Actions

Parameter	Concentration	Units	Standard	Citation
	CO - 10 & 40	mg/m^3 (8 hr and 1 hr averaging time, respectively)	Sources cannot cause or contribute to an exceedance of a national or Colorado Ambient Air Quality Standard.	5 CCR 1001-14
	NO_2 - 100	$\mu g/m^3$ (annual average)	Sources cannot cause or contribute to an exceedance of a national or Colorado Ambient Air Quality Standard.	5 CCR 1001-14
	SO_2 - 700	$\mu g/m^3$ (3 hr max once in any 12 month period)	Sources cannot cause or contribute to an exceedance of a national or Colorado Ambient Air Quality Standard.	5 CCR 1001-14
	--10, 50, and 300	Incremental stds for Category II $\mu g/m^3$ (annual arithmetic mean, 24-hour maximum, and 3-hour maximum)	Sources cannot cause or contribute to an exceedance of a national or Colorado Ambient Air Quality Standard.	5 CCR 1001-14
	-- 80, 365, 1300	$\mu g/m^3$ (annual mean , 24 hr second maximum, and secondary 3 hr second maximum)	Sources cannot cause or contribute to an exceedance of a national secondary ambient air quality standard.	40 CFR 50.4 and 50.5

ppm parts per million
$\mu g/m^3$ micrograms per cubic meter
mg/m^3 milligrams per cubic meter

Appendix B

Agreement in Principle Regarding a Water Supply Between the Army, Shell, and SACWSD

AGREEMENT IN PRINCIPLE REGARDING A WATER SUPPLY BETWEEN SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD), THE ARMY AND SHELL OIL COMPANY

1. PAYMENT BY THE ARMY AND SHELL WILL BE IN THREE ANNUAL INSTALLMENTS, $16 MILLION, $16 MILLION, AND $16.8 MILLION. THE FIRST PAYMENT TO BE MADE WITHIN 90 DAYS OF 1 OCTOBER 1996. SUBJECT TO THE AVAILABILITY OF FUNDS.

2. PAYMENT OF THE ABOVE SUM IS CONDITIONED ON ADHERENCE TO THE FOLLOWING TERMS. OTHER TERMS AND CONDITIONS WILL BE THE SUBJECT OF FURTHER NEGOTIATION.

A. PAYMENTS WILL BE HELD IN TRUST FOR SACWSD. TRUSTEE TO BE CHOSEN BY THE ARMY & SHELL WITH SACWSD CONCURRENCE. ANY INTEREST THAT ACCRUES MUST BE RETURNED TO THE ARMY AND SHELL.

B. SACWSD MUST HOOK UP OWNERS OF DOMESTIC WELLS IN THE DIMP FOOTPRINT WHO CONSENT TO BE INCLUDED IN THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AND WHO CONSENT TO BE HOOKED UP; AND SUCH HOOK UPS WILL BE COMPLETED NOT LATER THAN THE 24TH MONTH AFTER THE DATE OF THE INITIAL PAYMENT FOR THOSE WHO CONSENT BY THE 20TH MONTH AFTER THE INITIAL PAYMENT. THOSE WHO REQUEST TO BE HOOKED UP AFTER THE 20TH MONTH WILL BE HOOKED UP WITHIN A REASONABLE TIME. AS NOTED IN G, BELOW, SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN 130 HOMES. SACWSD ALSO IS NOT RESPONSIBLE FOR EXTENDING THE MAIN WATER DISTRIBUTION SYSTEM BEYOND THE DIMP FOOTPRINT AS FINALLY DETERMINED IN THE ON-POST ROD. THE MAIN WATER DISTRIBUTION SYSTEM FOR THE HENDERSON AREA (12" DIAMETER PIPE SYSTEM) WILL BE COMPLETED BY THE 24TH MONTH AFTER THE INITIAL PAYMENT. SACWSD WILL RECEIVE FROM THE TRUST ACCOUNT $3,950 FOR EACH HOME CONNECTED IN THE NEW SERVICE AREA AND $2,265 FOR EACH HOME CONNECTED IN THE OLD SERVICE AREA, UP TO A TOTAL OF 130 HOMES. ATTACHED IS THE MAP THAT SHOWS THE LATEST DIMP PLUME WHICH IS TO BE UPDATED PRIOR TO THE FINALIZATION OF THE ON-POST ROD.

C. SACWSD MUST CONTRACT FOR WATER RIGHTS OR SUPPLY BY NOT LATER THAN SIX MONTHS AFTER THE DATE OF THE FINAL PAYMENT.

D. PAYMENTS FROM THE TRUST TO SACWSD MUST BE TIED DIRECTLY TO THE ACQUISITION AND DELIVERY OF 4000 ACRE FEET OF

WATER AND THE HOOK UP OF WELL OWNERS IN THE HENDERSON AREA. ALL EXPENDITURES BY SACWSD PAID FROM THE TRUST ACCOUNT WILL BE SUBJECT TO AUDIT BY THE ARMY AND SHELL. UP TO $43 MILLION MAY BE SPENT ACQUIRING AND DELIVERING THE 4000 ACRE FEET OF WATER AND UP TO $4.65 MILLION MAY BE SPENT ON HOOK UPS IN THE HENDERSON AREA. THE REMAINING $1.15 MILLION IS TO OFFSET INFLATION OR CONTINGENCIES. ANY EXPENDITURES CHALLENGED BY THE ARMY, SHELL, OR THE TRUSTEE WILL BE SUBMITTED TO THE ALTERNATIVE DISPUTE RESOLUTION (ADR) METHOD DESCRIBED IN E, BELOW.

E. AN INDEPENDENT QUALIFIED AGENT, WHO IS A SENIOR WATER RESOURCE EXPERT WITH EXPERIENCE IN ACQUIRING AND DELIVERING WATER, WILL BE SELECTED BY SACWSD, WITH THE CONCURRENCE OF THE ARMY AND SHELL, TO DIRECT THE SELECTION, ACQUISITION, AND IMPLEMENTATION OF A WATER SUPPLY ON BEHALF OF SACWSD THAT CAN BE OPERATIONAL BY 1 OCTOBER 2004. THE TERMS OF THE AGENCY WILL BE AGREED UPON SACWSD, THE ARMY AND SHELL. THE ARMY AND SHELL WILL CONCUR WITH THE DESIGN OF AND SUBSEQUENT BID PACKAGES FOR THE WATER DELIVERY SYSTEM. THE CONSTRUCTION FIRM OR FIRMS TO CONSTRUCT THE PROJECT OR PROJECTS WILL BE SELECTED BY COMPETITIVE BID BASED ON A SOLICITATION PROCESS CONCURRED IN BY THE ARMY AND SHELL. THE COSTS ASSOCIATED WITH IMPLEMENTING THIS SECTION WILL BE PAID FROM THE TRUST ACCOUNT. ANY DISAGREEMENT ARISING REGARDING THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO A FORM OF ADR CONSISTING OF SUBMISSION OF THE DISPUTE TO THREE WATER RESOURCE EXPERTS; ONE SELECTED BY THE ARMY AND SHELL; ONE SELECTED BY SACWSD; AND ONE SELECTED BY THE INDEPENDENT AGENT OR BY THE AGREEMENT OF THE TWO SIDES IF THERE IS NO INDEPENDENT AGENT. THE COST OF ADR WILL BE BORNE BY THE PARTIES WITH EACH SIDE PAYING FOR ITS EXPERT AND EACH SIDE PAYING 50% OF THE COST OF THE EXPERT FOR THE INDEPENDENT AGENT.

F. ALL FUNDS REMAINING IN THE TRUST ACCOUNT AT THE COMPLETION OF THE WATER PROJECT OR ON 1 OCTOBER 2004, WHICHEVER OCCURS FIRST, WILL REVERT TO THE ARMY AND SHELL. REVERSION INCLUDES ANY SAVINGS REALIZED BY SACWSD FROM COST SHARING PROJECTS WITH OTHER ENTITIES. REVERSION MAY BE DELAYED WHERE UNKNOWN OR UNEXPECTED CONDITIONS OR CIRCUMSTANCES PREVENT COMPLETION OF THE PROJECT BY 1 OCTOBER 2004. WHETHER, AND FOR HOW LONG, REVERSION SHOULD BE DELAYED WILL BE SUBJECT TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

G. SACWSD AGREES TO SATISFY THE OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 OF THE AGREEMENT ON A CONCEPTUAL REMEDY FOR THE CLEAN UP OF ROCKY MOUNTAIN ARSENAL. THE PAYMENTS TO SACWSD WILL CONSTITUTE COMPLETE SATISFACTION OF THE ARMY AND SHELL'S OBLIGATIONS CONTAINED IN ITEMS 16 AND 17 AND COMPLETE SATISFACTION OF ALL COSTS ASSOCIATED WITH THE TERMS AND CONDITIONS NECESSARY TO EXECUTE THESE OBLIGATIONS. ALL COSTS NECESSARY TO EXECUTE THE REQUIREMENTS OF THIS AGREEMENT, UNLESS OTHERWISE EXPRESSLY STATED, WILL BE PAID OUT OF THE TRUST ACCOUNT. SACWSD WILL NOT BE RESPONSIBLE FOR MONITORING REQUIREMENTS TO BE PERFORMED BY THE ARMY AND SHELL IN ACCORDANCE WITH ITEM 17 AND SACWSD WILL NOT BE RESPONSIBLE FOR HOOKING UP MORE THAN THE FIRST 130 WELL OWNERS. ANY ADDITIONAL HOOK UPS REQUIRED UNDER THE TERMS OF ITEM 17 WILL BE THE RESPONSIBILITY OF THE ARMY AND SHELL.

H. SACWSD WAIVES AND RELEASES THE ARMY AND SHELL FROM ALL RESPONSE COSTS AND CLAIMS FOR DAMAGES FOR ALL RMA CONTAMINANTS AND POLLUTANTS IN THE SACWSD WATER THAT ARE KNOWN OR DETECTED PRIOR TO, OR AT THE TIME OF, THE SIGNING OF THE ON-POST RECORD OF DECISION (ROD). PAYMENT OF RESPONSE COSTS, IF ANY, OWED TO SACWSD AT THE TIME OF THE SIGNING OF THE ON-POST ROD WILL BE DETERMINED BY AGREEMENT OF THE PARTIES PRIOR TO SIGNING THE FINAL AGREEMENT CONTEMPLATED BY THIS AGREEMENT IN PRINCIPLE..

I. ANY REUSABLE RETURN FLOWS ASSOCIATED WITH ANY WATER SOURCE ACQUIRED WILL BE MADE AVAILABLE TO SACWSD FOR REPLACEMENT OF DEPLETIONS UNDER ITS EXISTING AUGMENTATION PLAN FOR THE FIRST THREE YEARS FOLLOWING THE INITIAL DELIVERY OF WATER FROM THE NEW WATER SOURCE IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED, OTHERWISE RETURN FLOWS ASSOCIATED WITH THE NEW WATER SOURCE, AND ANY WATER UNUSED BY SACWSD FROM THE WATER SOURCE ITSELF, SHALL BE MADE AVAILABLE AT ARMY AND SHELL EXPENSE FOR THE REMEDIATION OF RMA FOR NOT LESS THAN 10 YEARS, IN ANNUAL AMOUNTS TO BE DETERMINED ACCORDING TO REASONABLE NEED. THE FINAL PERIOD TO BE AGREED UPON. AFTER REMEDIATION, ALL RETURN FLOWS WILL RETURN TO THE USE OF SACWSD. EACH PARTY WILL BE RESPONSIBLE FOR ANY NECESSARY APPROVALS. DISPUTES ARISING OVER THE IMPLEMENTATION OF THIS SECTION WILL BE SUBMITTED TO ADR AS DESCRIBED IN E, ABOVE.

J. SACWSD WILL WARRANT AND OTHERWISE DEMONSTRATE IT IS AUTHORIZED AND QUALIFIED TO ENTER INTO THIS AGREEMENT, ACQUIRE

AND PROVIDE WATER AND HOOK UP WELL OWNERS, SUBJECT TO THOSE WELL OWNERS' CONSENT TO INCLUSION WITHIN THE DISTRICT. SACWSD WILL BE RESPONSIBLE FOR PERMITTING, ADJUDICATION, AND OTHER REQUIREMENTS OF STATE AND FEDERAL LAW.

K. PARTICIPATION BY THE ARMY AND SHELL, OR BY THEIR REPRESENTATIVES, IN OVERSIGHT IN NO WAY CONSTITUTES AN EXPRESS OR IMPLIED WARRANTY OR REPRESENTATION REGARDING THE ADEQUACY, SUITABILITY, OR LEGALITY OF SACWSD OR THE INDEPENDENT AGENT'S ACTIONS TO OBTAIN OR PROVIDE WATER.

L. ALL PARTIES RESERVE ANY RIGHTS THEY MAY HAVE REGARDING NONPERFORMANCE BY THE OTHER PARTIES.

M. THIS AGREEMENT IS SUBJECT TO COMPLIANCE WITH ALL APPLICABLE LAWS AND WILL BECOME EFFECTIVE AND BINDING WHEN INCORPORATED BY REFERENCE IN THE ON-POST ROD.

N. THE AMOUNT AGREED UPON IS SUBJECT TO APPROPRIATE CREDITS FOR ANY ARMY AND SHELL CONTRIBUTIONS TO WATER OR INFRASTRUCTURE, SUBJECT TO SACWSD APPROVAL. APPROVAL WILL NOT BE WITHHELD UNREASONABLY. DISPUTES WILL BE SUBMITTED TO THE METHOD OF ADR DESCRIBED IN E, ABOVE.

O. ALL PARTIES WILL PUBLICLY SUPPORT THIS AGREEMENT.

P. ALL O&M COSTS ASSOCIATED WITH THE ACQUISITION AND DELIVERY OF WATER AND WITH THE HOOK UP OF WELL OWNERS WILL BE SACWSD'S RESPONSIBILITY. THE ARMY WILL SUPPORT ANY NECESSARY AMENDMENTS TO ALLOW THE KLEIN FUND ALSO TO BE USED FOR O&M COSTS FOR THE NEW WATER SYSTEM.

Q. QUARTERLY PROGRESS REPORTS WILL BE MADE BY SACWSD, OR ITS REPRESENTATIVE, TO THE RMA COUNCIL.

R. THE ARMY OR SHELL WILL PAY, IF NECESSARY, WITHIN 30 DAYS AFTER SIGNATURE OF THE ROD, A SUM NOT TO EXCEED $1 MILLION TO PURCHASE AN OPTION ON WATER AGREED TO BY SACWSD, THE ARMY AND SHELL. THIS SUM WILL BE CREDITED AGAINST THE FIRST ANNUAL PAYMENT UNDER SECTION 1, ABOVE.

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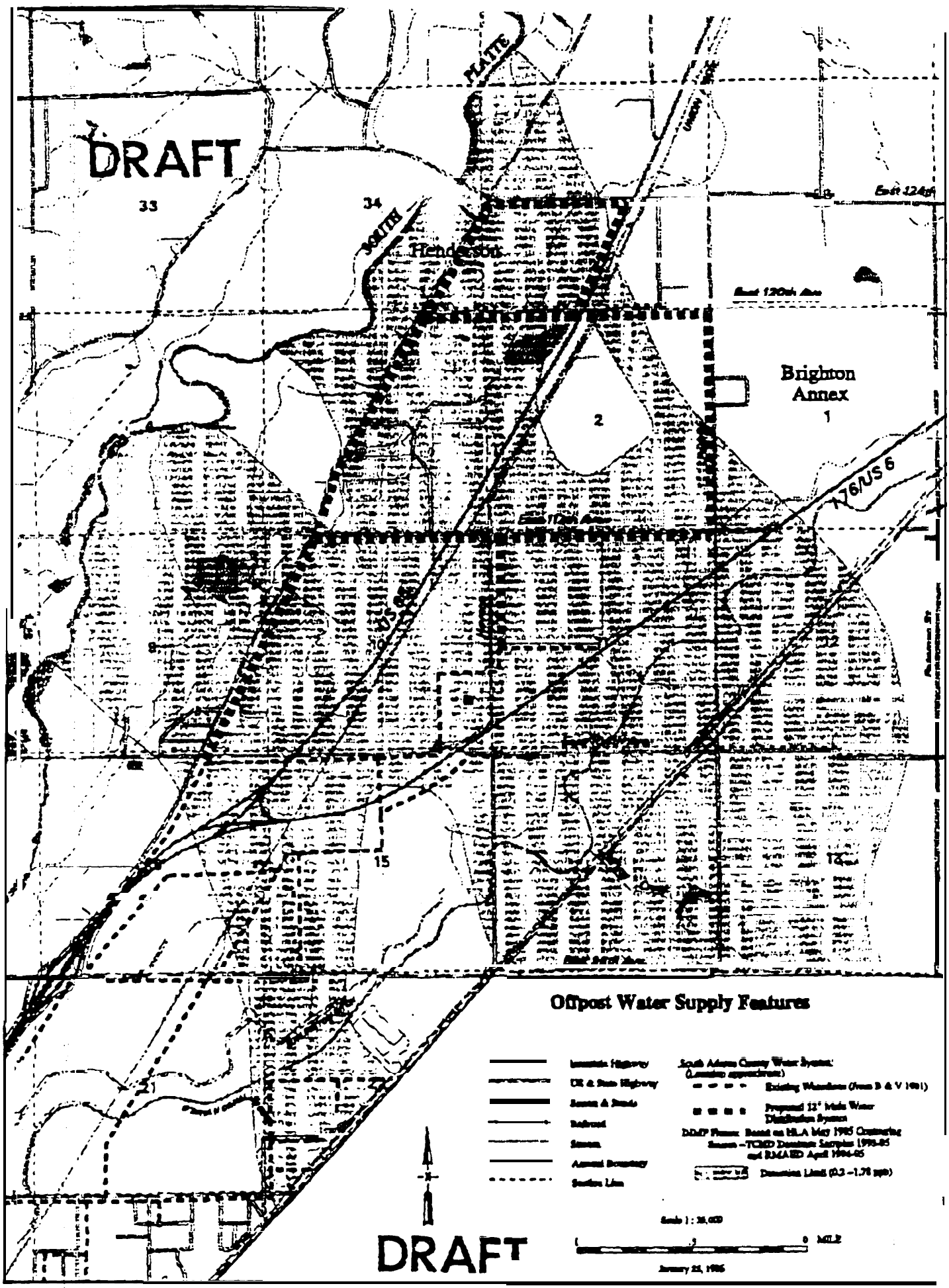
01/26/96 FRI 13:36 FAX 703 6962940 US ARMY ENVIR LAW DIV → RMA COUNSEL 005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Offpost Water Supply Features
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