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:

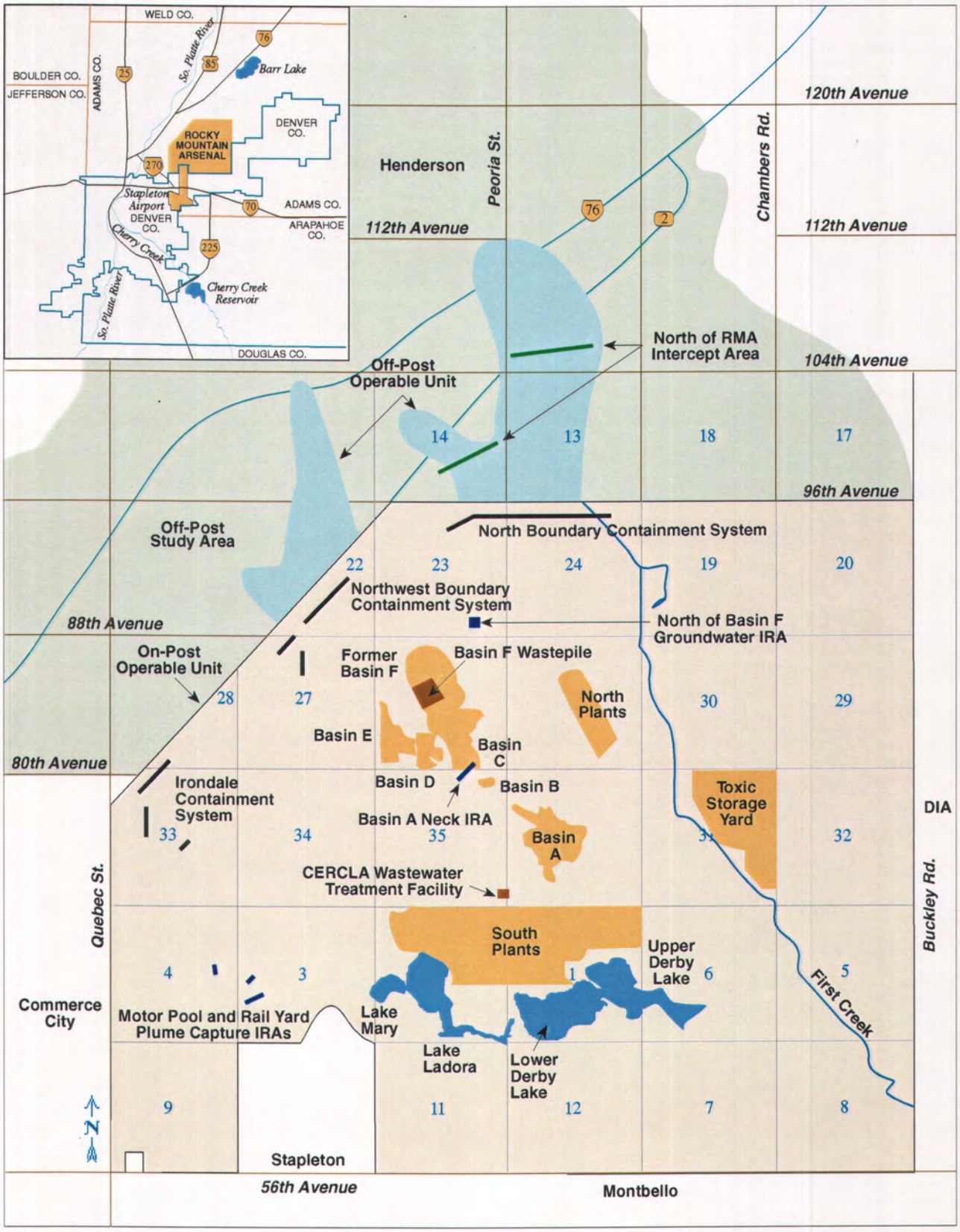
- Continued operation of the Off-Post Groundwater Intercept and Treatment System.
- Natural attenuation of inorganic chloride and sulfate concentrations to meet remediation goals for groundwater in a manner consistent with the on-post remedial action.
- Continued operation of the NWBCS, NBCS, and ICS 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 D-1
RMA Operable Units

Rocky Mountain Arsenal
Prepared by Foster Wheeler Environmental Corporation

RMA ROD 6.96 jb

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

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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

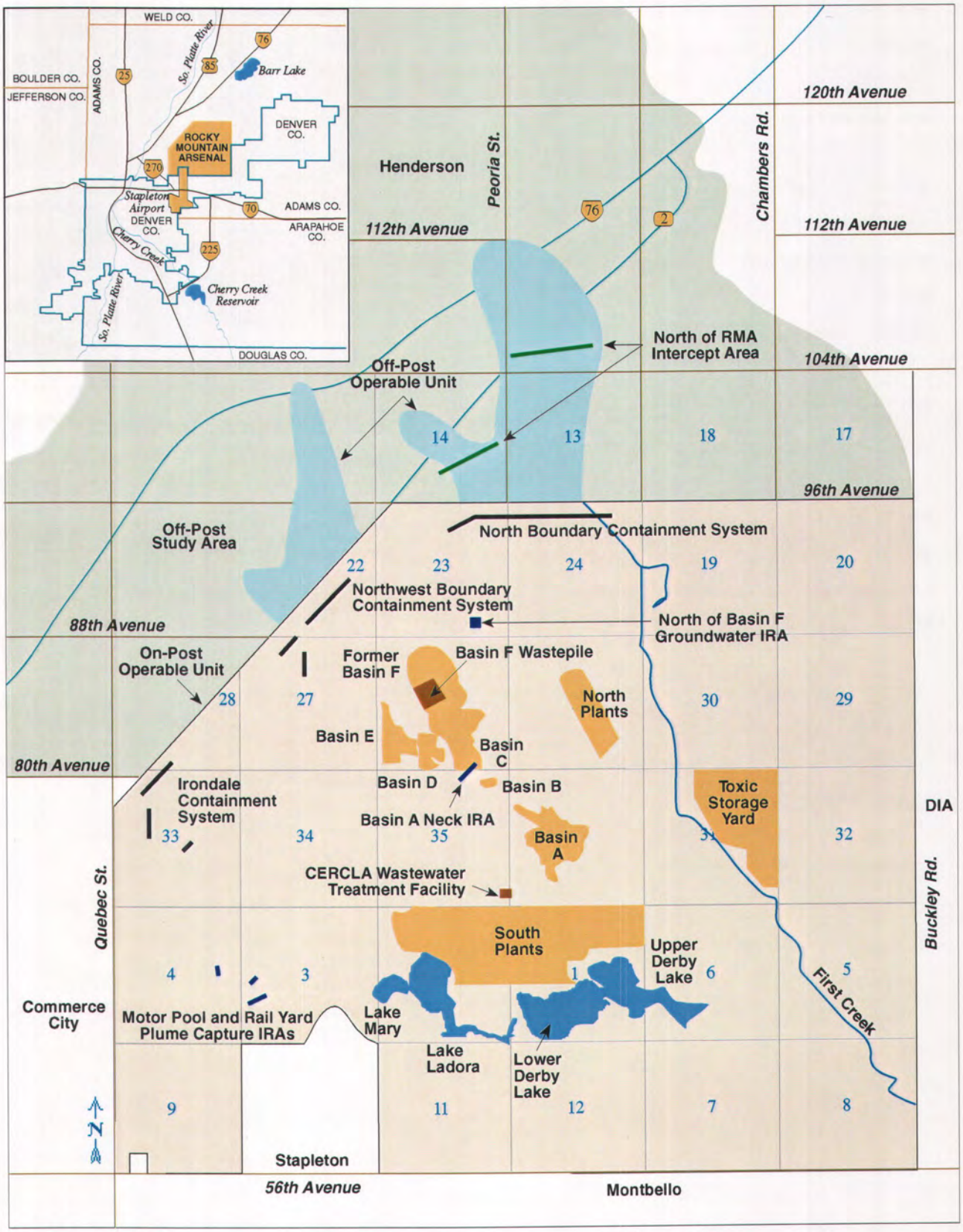
RMA is situated within a temperate grassland region and is part of a broad transition zone between mountain and plains habitats. Tall-grass species are common in moist areas and short-grass species prevail in dry areas. On-post human activity has resulted in vegetation dominated by weedy species and 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.

Regional wildlife is 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 1.0-1
RMA Site Map

Rocky Mountain Arsenal
Prepared by Foster Wheeler Environmental Corporation

RMA ROD 6.96 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.

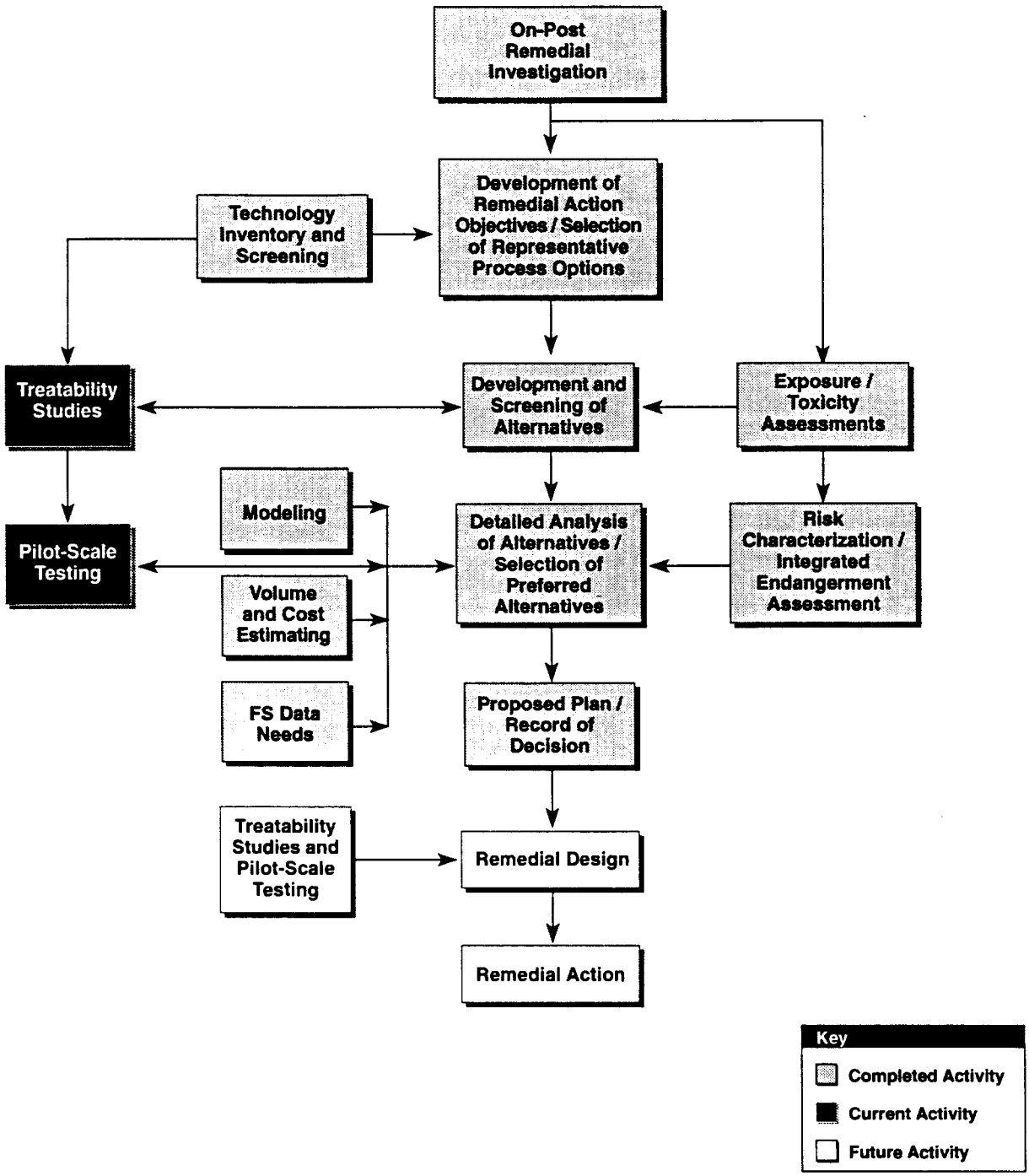
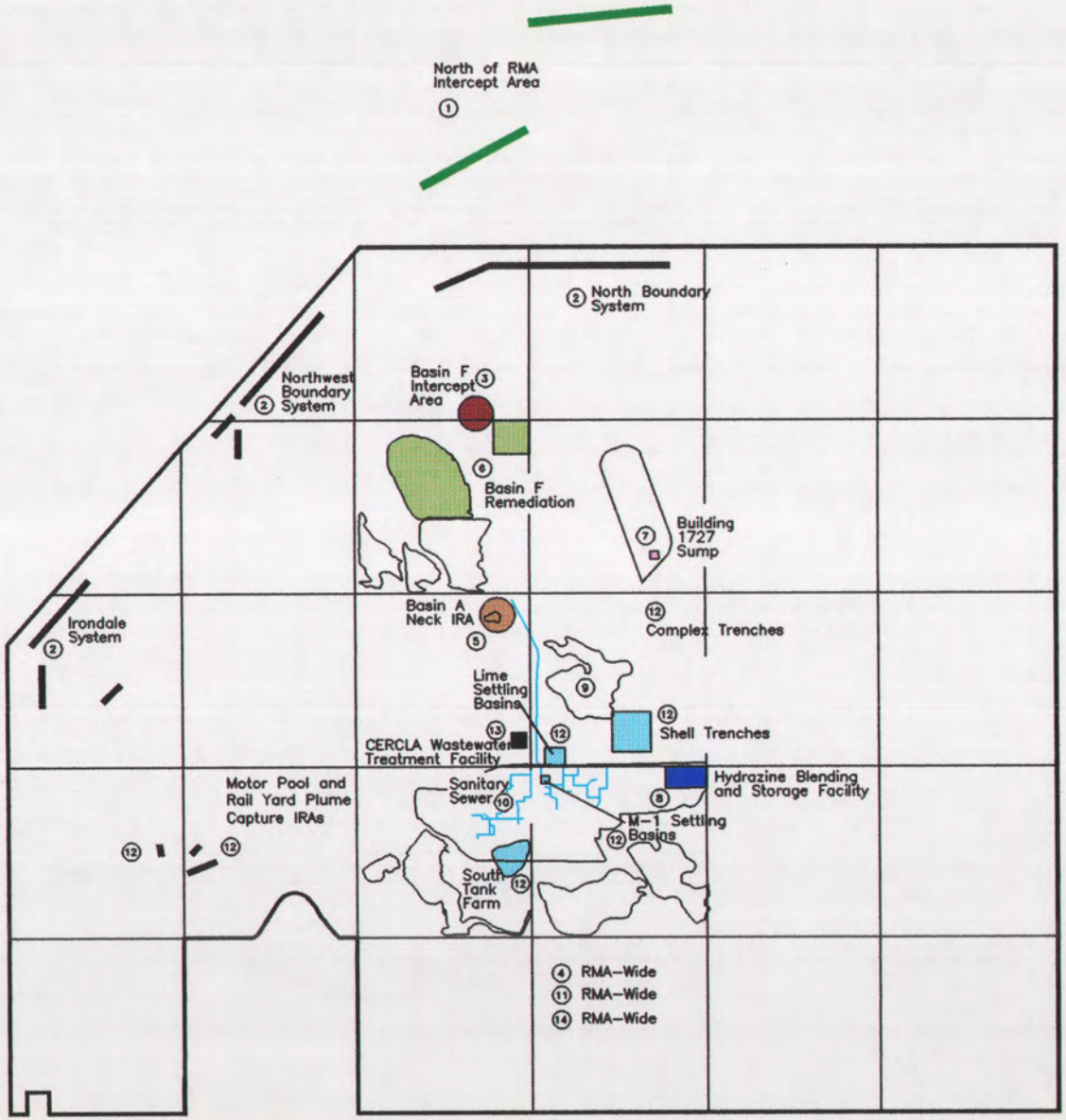


Figure 2.3-1

Remedial Investigation / Endangerment Assessment / Feasibility Study Flow Diagram

Rocky Mountain Arsenal
Prepared by Foster Wheeler Environmental Corporation

RMA ROD 6.96 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

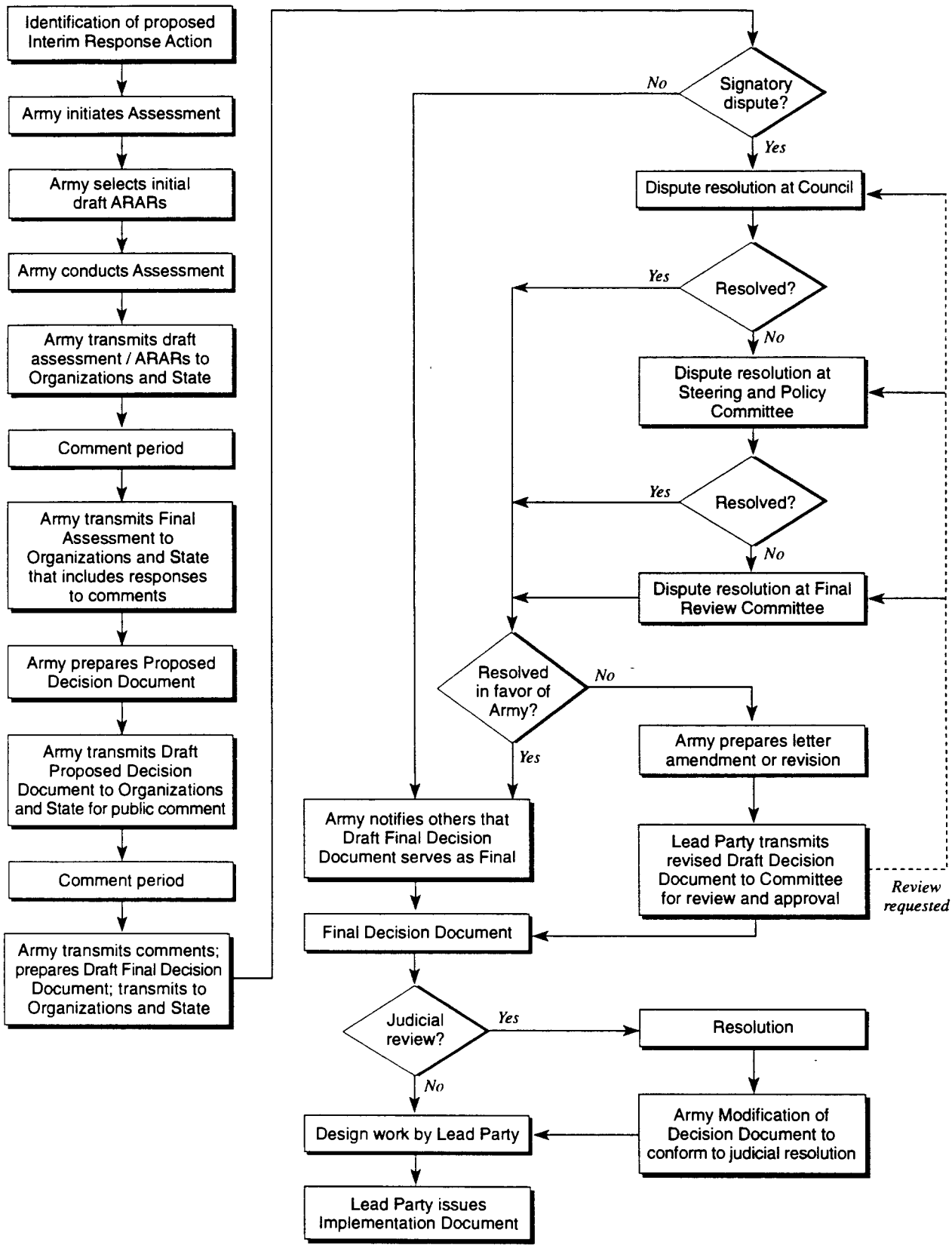
Prepared for:
Office of the Program Manager
for Rocky Mountain Arsenal
June 1996

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 6/06/96
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

RMA ROD 6.96 jb

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.

Table 2.4-1 Summary of Past and Ongoing Response Actions

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 with experts available to answer questions from the public. 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 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 ambient air contamination related 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 groundwater flow direction at RMA is northwest toward the South Platte River. High groundwater flow volumes and velocities at RMA are associated with thick, permeable sand and gravel deposits of the Platte River Valley, which occur along the Western Tier (e.g., Sections 4, 9, and 33) of RMA, and with similar deposits along First Creek. The saturated portion of these alluvial sediments is generally thicker and coarser grained than alluvial sediments in the central portion of RMA. Groundwater flow velocities and volume in the central portion of RMA are one or more orders of magnitude less than in the Western Tier or First Creek areas because groundwater in the central portion flows through predominantly thin, fine-grained alluvium and low-permeability bedrock. Superimposed on the regional groundwater flow system is a large groundwater mound centered over a bedrock topographic high beneath the South Plants. Groundwater in this area flows radially away from the South Plants mound and eventually flows towards the Western Tier or the northern boundary.

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 characteristics 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

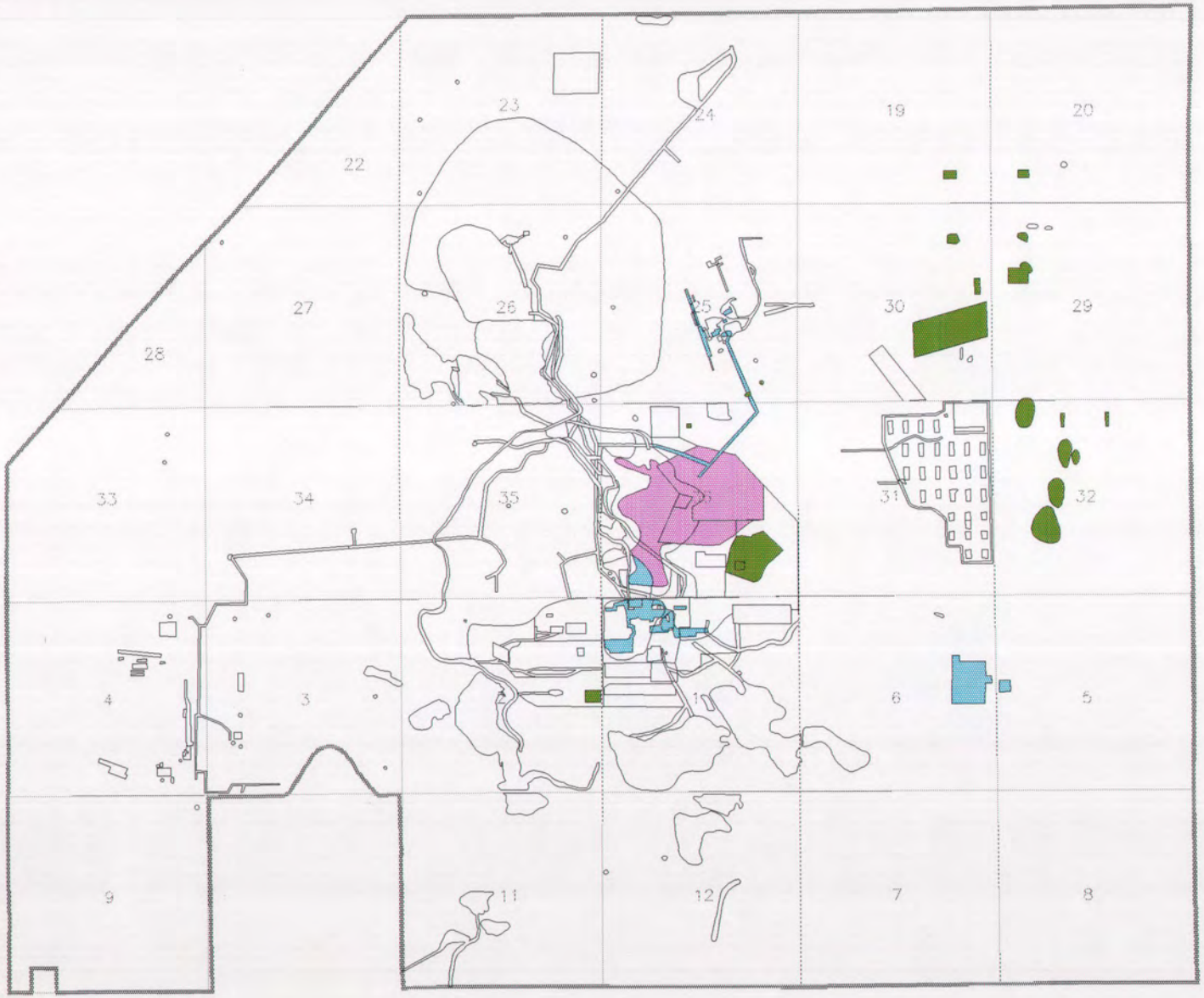
Prepared for: U.S. Army Program Manager for Rocky Mountain Arsenal

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
- 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 5.4-2

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.

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\F5_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]

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-3T-N of 385			04		Long-Term				
35	SS 0386	Substation-3T-N of 386			04		Long-Term				
36	SS 0387	Substation-3T-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		

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
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						

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
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					

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
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					
160	0605	Flammable Materials Storehouse	2	170	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
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						

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
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	01						
224	0753	Steam Fitter Maintenance/Storage	52	1,000	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
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		

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
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	31						
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						

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
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-3T-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-3T-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						

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
417	SS 0361	Primary Substation-68T-SE of 112			02						
418	SS 0362	Substation-3T-N of 362			02						
419	SS 0363	Substation-3T-N of 362			02						
420	SS 0365	Substation-3T-N of 365			02						
421	SS 0368	Substation-1T-1/4 mi SSE of 351			01						
422	SS 0371A	Substation-1T-S of 372			02		Short-Term				
423	SS 0371B	Substation-1T-N of SS 371			02		Short-Term				
424	SS 0378	Substation-1T-N of 378			03		Short-Term				
425	SS 0379	Substation-1T-SE of 379			03		Short-Term				
426	SS 0383	Substation-3T-E of 383			02		Short-Term				
427	SS 0391	Substation-3T-SE of 391			24						
428	SS 0392	Substation-2T-W of 392			34		Short-Term				
429	SS 0393	Substation-2T-S of 393			34		Short-Term				
430	SS 0411	Substation-3T-NE of 411			01						
431	SS 0422	Substation-3T-W of 422			01						
432	SS 0451	Substation-1T-SE of 413			01						
433	SS 0461	Substation-2T-S of 459			01						
434	SS 0464	Substation-2T-SE of 464			01						
435	SS 0474	Substation-7T-W of 472			01						
436	SS 0510	Substation-3T-SE of 510			01						
437	SS 0512	Substation-3T-NW of 517			01						
438	SS 0514	Substation-3T-200'E of 561			01						
439	SS 0515	Substation-6T-NW of 515			01						
440	SS 0516	Substation-3T-W of 519			01						
441	SS 0517	Substation-2T-NW of 517			01						
442	SS 0517A	Substation-3T-N of 512			01						
443	SS 0517B	Substation-3T-SW corner of 517			01						
444	SS 0521	Substation-3T-SW of 521			01						
445	SS 0523	Substation-3T-S of 803			26						
446	SS 0525A	Substation-1T-SW of 525			01						
447	SS 0527	Substation-1T-S of 527			01						
448	SS 0528	Substation-1T-S of 529			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
449	SS 0529	Substation-3T-S of 540			01						
450	SS 0531	Substation-1T-W of 531			01						
451	SS 0534	Substation-3T-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-3T-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-3T-N of 631			04						
475	SS 0632	Substation-1T-NE of 632			04		Short-Term				
476	SS 0633	Substation-3T-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-3T-S of SS 726			36						
482	SS 0726	Substation-3T-200'S of 725			36						
483	SS 0727	Substation-1T-W side of 727			01						
484	SS 0728	Substation-3T-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-3T-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 T 1505			01						
493	SS 0781	Substation-1T-NE of T 1507			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-3T-S of 809			33						
508	SS 0809A	Substation-3T-300'SW of 809			33						
509	SS 0809B	Substation-3T-200'W of 809			33						
510	SS 0809C	Substation-3T-400'N of 809			33						
511	SS 0809D	Substation-3T-700'NE of 809			33						
512	SS 0809E	Substation-3T-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-3T-0.2 mi S of 809			33						
514	SS 0831	Substation-3T-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-3T-S of 836			24						
518	SS 1402	Substation-3T-150'W of 1601/1701			25						
519	SS 1403	Substation-3T-S of 1701			25						
520	SS 1404	Substation-3T-130'S of 1501			25						
521	SS 1501	Substation-7T-SE of 1501			25						
522	SS 1505	Substation-3T-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-3T-100'NE of 1602			25						
529	SS 1605	Substation-1T-between 1605 & 1608			25						
530	SS 1606-1	Substation-3T-100'E of 1606			25						
531	SS 1606-2	Substation-1T-100'NE of 1606			25						
532	SS 1607	Substation-3T-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-3T-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-3T-E of 1704			25						
542	SS 1704-2	Substation-2T-E of 1704			25						
543	SS 1704-3	Substation-3T-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 T 1512			36						
570	SS FL842	Substation-1T-N of 1618			25						
571	SS GA	Substation-1T-0.1 mi 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						

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
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-1503A/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."