

**ROCKY MOUNTAIN ARSENAL  
SUMMARY SHEET**

1. STATUS: NPL site with Federal Facility Agreement (HRS=58)

2. TOTAL NUMBER OF DESERTS SITES: 209  
RESPONSE COMPLETE: 81

3. DIFFERENT SITE TYPES:

- 5 groundwater plume groups (19 DESERTS sites)
- 4 structures medium groups (983 structures - 12 DESERTS sites)
- 27 soil medium groups (178 DESERTS sites)

4. MOST WIDESPREAD CONTAMINANTS OF CONCERN:

Organochlorine pesticides, Arsenic, Mercury, Copper, Asbestos, Volatile Halogenated Organics, Volatile Aromatic Organics, Volatile Hydrocarbons, Semivolatile Halogenated, Dibromochloropropane, Organics, Organophosphorus compounds, Organosulfur compounds, and Nitrosamines.

5. MEDIA OF CONCERN: Soil, Groundwater, Structures

6. COMPLETED REM/IRA/RA:

Source Control Actions (1975-84) Total Cost \$ 77,925K  
Interim Response Actions (FY85-FY95) Total Cost \$354,711K

7. CURRENT IRP PHASE:

Off-Post operable unit (OU) - Final Record of Decision (Dec 95)  
On-Post operable unit (OU) - Final Record of Decision (June 96)

8. PROJECTED IRP PHASE:

Off-Post OU - ROD implementation in FY97  
On-Post OU - ROD implementation in FY97

9. IDENTIFIED FUTURE POSSIBLE REM/IRA/RA:

10. FUNDING:

PRIOR YEAR FUNDS	\$ 858,797.0 K
FY96 FUNDS	\$ 73,000.0 K
FUTURE REQUIREMENTS	\$1,973,000K
(FY97 - FY37) Note: O & M cost will continue to be incurred beyond 2037	
TOTAL	\$2,904,797.3K

11. DURATION:

YEAR OF IRP Inception	1984
YEAR OF IRP Completion (excluding LTMing)	2015

DATE: March 11, 1997

INSTALLATION ACTION PLAN  
FOR  
ROCKY MOUNTAIN ARSENAL (RMA)

1. INSTALLATION INFORMATION

LOCALE

RMA, a 27 square mile (17,000 acres) installation, is located in southern Adams County, Colorado, approximately 9 miles northeast of downtown Denver. Areas bordering RMA include primarily agricultural land to the north and east, Denver International Airport adjacent to the eastern boundary of RMA, the Denver residential community of Montbello and industrial and commercial activities and the old Stapleton International Airport to the south, and Commerce City and residential, commercial, and light industrial land use to the west.

COMMAND ORGANIZATION

- Major Command: Army Materiel Command
- Subcommand: Chemical & Biological Defense Command
- Installation: Program Manager for Rocky Mountain Arsenal Remediation (PMRMAR)

INSTALLATION RESTORATION PROGRAM (IRP) EXECUTING AGENCY

- Investigating Phase Executing Agency: PMRMAR
- Remedial Design/Action Phase Executing Agency: PMRMAR

REGULATOR PARTICIPATION

- Federal: U.S. Environmental Protection Agency, Region VIII; U.S. Fish & Wildlife Service - RMA National Wildlife Area; U.S. Agency For Toxic Substances & Disease Registry
- State: Colorado Department of Public Health & Environment

REGULATORY STATUS

- Designated an NPL Site in 1987 with 2 operable units (On-Post and Off-Post)
- Federal Facility Agreement (FFA) signed in Feb 1989
- State has regulatory authority over Basin F facilities
- Restoration Advisory Board active (started June 1994)
- Removal from the NPL 2037

SIGNIFICANT CHANGES TO IRP FROM THE PREVIOUS YEAR (FY95)

- Off-Post ROD implementation for FY97.
- On-Post Record of Decision signed June 1996.

## 2. INSTALLATION DESCRIPTION

Rocky Mountain Arsenal (RMA) was established in 1942 by the U.S. Army for the production of chemical and incendiary munitions. The installation was placed on inactive status in 1988. The WWII era manufacturing site is known as the South Plants today. Major war chemicals produced were mustard gas, Lewisite, and chlorine gas (blister agents). Additionally, over 100,000 tons of incendiary munitions were produced by the end of WWII. In the 1950s, as the Cold War heated up, an additional manufacturing site known as the North Plants was constructed to manufacture GB (Sarin) nerve agent. Demilitarization operations of chemical and incendiary ordnance were conducted through the 1970s. Unused portions of the South Plants area were leased to several private chemical producers, most notably Shell Oil Company, to produce industrial and agricultural chemicals, mainly pesticides and herbicides, from the late 1940s until 1982.

Liquid waste streams from the production processes in the 1940s and early 1950s were discharged into a natural unlined evaporation pond, later to be known as Basin A in Section 36. As waste stream production exceeded the Basin A capacity, additional unlined evaporation basins B, C, D, and E were utilized for waste discharge in adjacent sections. In 1956, Basin F, a state-of-the-art asphalt lined evaporation basin, was constructed to collect and store the liquid waste streams from the various processes. Solid wastes, from both industrial and military chemical production, were primarily disposed through burial and burning in Section 36, although some other on-post disposal sites were also used.

Tight controls on chemical agent production ensured that there were no catastrophic releases during manufacturing and demilitarization operations. However, contamination of soil, surface water, and groundwater on RMA and in groundwater to the northwest of RMA did occur. Contamination came from a number of sources such as liquid waste disposal in the evaporation basins, solid waste burial in trenches, accidental spills of feedstock and product chemicals, leakage from sewer and process water systems, emissions from permitted air stacks, and use of commercial chemical products in normal facility operations.

In the half century since the Arsenal was built, there have been significant advances in our understanding of the effects of industrial and waste disposal practices. As practices once considered appropriate at the Arsenal were found to be unacceptable, they were replaced by better ones, and actions often were taken to remedy adverse effects of the prior practices. For example, a closed-loop industrial cooling water system replaced the use of South Lakes water, and the South Lakes were extensively dredged to remove contaminated sediments. Basin F was constructed in an effort to prevent infiltration of liquid process waste into the groundwater and potentially causing damage to irrigated croplands down-gradient from the Arsenal.

The Army initiated studies to determine sources of contamination and began construction of boundary groundwater control systems and other source control actions in 1975 subsequent to discovery of off-site contamination of groundwater attributed to RMA.

RMA was designated a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priority List (NPL) Site in 1987 with two (2) operable units designated as the On-Post and Off-Post Operable Units.

RMA's Federal Facility Agreement (FFA) was signed in February 1989 by four Federal agencies and one private corporation. Signatories to the FFA were the U.S. Army, Shell Oil Company (Shell), the U.S. Fish and Wildlife Service (Service), the U.S. Environmental Protection Agency (EPA) and the U.S. Agency for Toxic Substances and Disease Registry (ATSDR). The State of Colorado is not a signatory to the FFA.

The Army is a responsible party under CERCLA and the lead agency in the Remedial Investigation, Feasibility Study, Remedial Design and Remedial Action phases for the two operable units. Shell is also a PRP and shares in the cost of cleanup and provides technical expertise and performs some investigations and cleanup actions. The Service manages the flora and fauna of RMA as a National Wildlife Area under the Sikes Act and the Rocky Mountain Arsenal National Wildlife Refuge Act. Once final remediation is completed and certified by EPA, ownership of RMA will be transferred from the Army to the Service. EPA as the lead regulatory agency has oversight authority for the cleanup and final decision authority to resolve disputes among the organizations. ATSDR, part of the U.S. Public Health Service, has responsibility for preparation of public health assessments relative to RMA. The State participates in discussions and meetings concerning most RMA issues which come under provisions of CERCLA and the FFA, but has RCRA authority over the remediation and closure of the Basin F waste facilities, including the Wastepile, tank farm, ponds A & B and the Submerged Quench Incinerator (SQI) which was used to destroy stored Basin F liquids. After incineration of all the liquid was complete, the SQI was dismantled and removed from RMA.

Since 1975, the Army and Shell have undertaken numerous efforts to protect on-post and off-post human health and environment through the implementation of source controls and Interim Response Actions (IRAs). These remedial activities were initiated through agreements with both EPA and the State of Colorado for the immediate implementation of treatment and containment actions. Following initial investigations, contamination sources were identified and initial source control actions were developed. These actions included installing three boundary containment systems (the North Boundary, Northwest Boundary, and Irondale Containment Systems), closure of the on-post deep disposal well, applying fugitive dust emission controls within the waste basins, disposing of 76,000 drums of waste salts, removing portions of the chemical sewer system, upgrading the sanitary sewer system, dredging the South Lakes, and enhanced liquid evaporation from Basin F.

In addition to the source control actions and in accordance with the Federal Facility Agreement, 14 IRAs were established for implementation prior to the Record of Decision. These 14 IRAs were designed to provide immediate containment or treatment of some of the more highly-contaminated areas and thus minimize the potential for exposure to or migration of contamination. These include the closure of many on-post and off-post wells to prevent further contamination of deeper units, application of dust suppressant to bare areas in basins to reduce windblown transport of contamination, improvements to the boundary groundwater systems, addition of

several internal groundwater treatment systems, construction of a groundwater treatment system north of RMA, closure and abandonment in place of the sanitary sewer system, closure and demolition of the hydrazine facility, covering and revegetation of several disposal areas, asbestos removal, and removal of process equipment.

One of the most significant actions taken under the IRA program has been the remediation of Basin F. This IRA included the removal and temporary storage of liquids from the waste pond, the removal and containment of the sludge and underlying soils, and the thermal destruction of 10 million gallons of the temporarily stored liquids. These Basin F actions, initiated in 1988, were completed in 1995. All IRA's were completed with the signing of the ROD in June 1996.

The bulk of the contaminated sites are in the central sections of RMA, in and around manufacturing complexes, solid waste disposal areas, and liquid waste disposal basins. Other contaminated sites include storage areas, maintenance areas, and sewer lines. Infiltration of contaminated water and liquid waste from these source areas transported contaminants into subsurface environments including the unsaturated zone and the unconfined flow system. The resulting contaminant plumes in the groundwater move toward the north and northwest boundaries of RMA where they are now intercepted by boundary containment systems designed to prevent further migration of contaminated groundwater off-post. Other containment systems intercept the plumes near the sources on RMA and in the off-post areas north and northwest of RMA.

These interim response and source control actions, which required significant resources and effort, have resulted in major reductions in the overall environmental impact of manufacturing and disposal practices of the past. The remaining contamination and its potential as a risk to human health or the environment is the focus of the completed On-Post Integrated Endangerment Assessment/Risk Characterization (IEA/RCA), while the On-Post Feasibility Study (FS) identified and selected the remedial alternatives. The Record of Decision was signed in June 1996.