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### The Rocky Mountain Arsenal: Groundwater Contamination and Clean-Up Activities

Connally E. Mears

Elaine H. Heise

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**THE ROCKY MOUNTAIN ARSENAL: GROUNDWATER  
CONTAMINATION AND CLEAN-UP ACTIVITIES**

**Connally E. Mears  
EPA Coordinator for the  
Cleanup of Rocky Mountain Arsenal**

**and**

**Elaine H. Heise  
EPA Community Relations Specialist  
Denver, Colorado**

**UNCOVERING THE HIDDEN RESOURCE:  
GROUNDWATER LAW, HYDROLOGY AND POLICY LAW  
IN THE 1990s**

**Natural Resources Law Center  
University of Colorado  
School of Law  
Boulder, Colorado**

**June 15-17, 1992**

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**THE ROCKY MOUNTAIN ARSENAL: GROUNDWATER  
CONTAMINATION AND CLEAN-UP ACTIVITIES**

by  
Connally E. Mears, EPA, Coordinator for the Cleanup of RMA  
and Elaine H. Heise, EPA, Community Relations Specialist

**I. INTRODUCTORY REMARKS**

This presentation will be generally limited to groundwater contamination and remediation at both the Rocky Mountain Arsenal and the "off-post" area which is north and northwest.

**II. HISTORY OF INDUSTRIAL ACTIVITIES AND WASTE DISPOSAL AT THE  
ROCKY MOUNTAIN ARSENAL.**

The Rocky Mountain Arsenal was established in 1942 on what was then a farm area 10 miles from downtown Denver. Until 1950, it was used by the Army to support World War II by manufacturing and assembling chemical and incendiary munitions. Also, the Arsenal served during this period as a place to dispose of Levinstein mustard gas and several million rounds of mustard-filled shells, to test-fire mortar rounds filled with smoke and high explosives, and to destroy many different types of obsolete World War II weapons by detonation or burning.

For four years in the 1950s, the Army produced GB nerve agent. Munition-filling operations continued until 1969. For the next 13 years - until 1982 - the Arsenal was primarily involved with the disposal of chemical warfare materials, including the incineration of TX anti-crop agent, mustard agent, explosive components, and the destruction of GB agent and related munitions casings by caustic neutralization and incineration.

Shell Oil Company manufactured pesticides and herbicides at the Arsenal from 1952 to 1982. Shell's operations were preceded by two private companies who manufactured chlorinated benzenes and DDT.

As a result of the Army's chemical warfare operations, and industry's (mainly Shell) pesticide and herbicide manufacture, hazardous wastes exist on most of the 27-square miles occupied by the Arsenal. In accordance with waste disposal practices commonly used several decades ago, contaminants were discharged into unlined evaporation basins or buried. "Basin F" was lined.

The toxic substances are mostly found in deeper soil areas on at least 178 sites or about 10 percent of the Arsenal, and in the groundwater. This includes what the Army has called "the most contaminated square mile on earth," the infamous "Basin A." Contamination was also spread by the wind across the surface of the Arsenal.

All manufacturing activities, and storage and disposal of chemicals and weapons ended 10 years ago.

### III. WHERE IS THE CONTAMINATION?

- \* In buildings, surficial soils, deeper soils, groundwater, surface water and sediments.
- \* Much of the contamination is not apparent on the surface, although there are some areas where vegetation cannot grow.
- \* Most of the deeper soil contamination is in the central area associated with former toxic chemical production facilities and waste basins. Other areas with deeper soil contamination are scattered around the outer portions of the Arsenal.
- \* Extensive groundwater "plumes," generally extending north and northwest from the central area, have varying degrees of contamination. These plumes are found in the 25 square mile off-post area and reach to the South Platte River, although in concentrations that do not present a health threat.

#### IV. WHAT ARE TYPICAL CONTAMINANTS FOUND IN THE GROUNDWATER AT THE ARSENAL?

\* **volatile organic chemicals**, such as benzene, di bromochloropropane (DBCP), chloroform, toluene and trichloroethylene (TCE); **pesticides** and other semivolatile chemicals, such as aldrin, atrazine, chlordane, dieldrin, diisopropylmethyl phosphonate (DIMP), and endrin; and **heavy metals**, including arsenic, cadmium, chromium, lead, and mercury.

\* More than 750 chemicals were generated or handled at the Arsenal from 1942-82, including 60 organic compounds, salts, and heavy metals.

#### V. WHAT IS BEING DONE TO CLEAN UP THE CONTAMINATION?

The U.S. Army has the lead role in the cleanup. Shell Oil Company, Colorado Department of Health, U.S. Fish and Wildlife Service, U.S. Department of Justice, and the Agency for Toxic Substances and Disease Registry are also involved in the cleanup. The U.S. Environmental Protection Agency (EPA) has the oversight role and is the final authority for the clean-up decisions at the Arsenal. Its mission is to ensure that clean-up activities are protective of human health and the environment.

Considerable progress has been made. Under the Superfund law, the Army and Shell have spent \$111 million in interim projects cleaning up contaminated groundwater and toxic wastes. Another \$151 million of interim clean-up activities will be completed within the next two years.

The final remedies for the cleanup will be selected in the off-post Record of Decision in the Fall of 1993 and the on-post Record of Decision in the Spring of 1994.

#### VI HOW IS THE GROUNDWATER CLEANUP BEING DONE?

The many different kinds of contaminants may require many different kinds of clean-up activities.

Clean-up activities include construction and improvements to seven groundwater intercept and treatment systems - cleaning one billion gallons of water a year, closure of a well more than two

miles deep, windblown dust control, removal of 76,000 drums of hazardous salts, closure of more than 350 abandoned wells, and removal and containment of 10.5 million gallons of liquids and 564,000 cubic yards of soils and sludges - all highly contaminated - from "Basin F."

Groundwater intercept and treatment systems are being used to clean up the groundwater contamination. These systems capture the contaminated water at eight different locations, pump it out of the ground, remove the contaminants with granular activated carbon, and inject the clean, treated water on the other side to continue to flow off the Arsenal. The systems are cleaning one billion gallons a year to drinking water levels at the point of reinjection. Contamination in the groundwater leaving the RMA has diminished.

For example, the amount of DIMP (diisopropyl methyl phosphonate) in an off-post monitoring well was 138 ppb in 1985, 105 in 1987, 14 in 1988, and 6.7 in 1989. Another monitoring well registered 640 ppb in 1987 and 55 in 1989. "EPA believes that the reduction of the contamination is due to the effectiveness of the groundwater intercept and treatment systems."

Groundwater intercept and treatment systems have been operating at the north boundary of RMA since 1979, at Irondale since 1981, and at the northwest boundary since 1984. Improvements have been made to these on-post systems. Four other intercept locations were built, and another one, now under construction in the off-post area, should begin operating in 1993, making a total of eight systems in operation.

Here are some details on the Interim Response Actions dealing with groundwater:

| <u>Costs</u>  | <u>Project and Completion Dates</u>                                  |
|---------------|--|
| (in millions) |  |
| \$4.3         | North boundary groundwater treatment system<br>(two stages, 1979-82) |
| 1.1           | Irondale groundwater treatment system<br>(by Shell) (1981)           |



- 5.5 Northwest boundary groundwater treatment system (1984)
- 2.75 Improvements to North Boundary System (1990) and treatment plant modifications (1991)
- 3.7 Closure of 353 abandoned wells on-post (1990)
- 0.7 Basin F groundwater intercept system
- 3.1 Basin A neck groundwater treatment system (1990)
- 1.4 Northwest Boundary System Improvement (1991)
- 3.0 Rail Classification Yard and Motor Pool Groundwater (implementation of groundwater intercept and treatment system) (1991)
- 0.5 South Tank Farm Plume (monitoring ongoing) (1991)
- 8.7 Groundwater treatment system to the north (construction going on in 1992; operational in 1993)

All interim response actions must be consistent with final remedies.

In late 1989, the largest water treatment plant of its kind in the nation - the Klein Water Treatment Facility - began operation and secured safe drinking water for the 30,000 men, women and children who live west of the Arsenal. A total of \$23.1 million was spent for treatment of TCE in the public water supply plus about 400 private well connections in south Adams County. This figure includes \$8.2 million from EPA, and \$14.9 million from the Army.

#### VII. LEGAL FRAMEWORK FOR THE CLEANUP

In spite of numerous lawsuits about federal and state jurisdiction, clean-up activities at RMA have steadily progressed. Several law suits are pending.

A Federal Facility Agreement (FFA) became effective in 1989 and was signed by the Army, U.S. Department of Interior, U. S. Agency for Toxic Substances and Disease Registry, Department of Justice, U.S. Environmental Protection Agency, and Shell Oil Company. The State of Colorado has not signed the FFA.

The FFA describes the clean-up work to be done at RMA and identifies "Interim Response Actions" (IRAs) as priority items expediting clean-up activities before a final remedial decision.

The FFA also decrees that no groundwater consumption on the Arsenal will ever be allowed.

The Arsenal became a Superfund site and was put on the National Priorities List in 1987, except for Basin F. Basin F was listed in 1989.

#### VIII. WHAT IS THE FUTURE OF THE ROCKY MOUNTAIN ARSENAL?

Clean-up goals must be protective of human health and the environment and consistent with all possible uses of the Arsenal, including a wildlife refuge and potential commercial or industrial activities. Residential or agricultural use is precluded by the FFA.

The decision about land use should be made by the appropriate Federal agencies or Congress and take into account the concerns of the public, but the cleanup should not be limited in any way.

#### IX. WHERE TO GET MORE INFORMATION ABOUT GW CONTAMINATION AND REMEDIATION:

Here is how to reach:

|                                      |          |
|--------------------------------------|----------|
| U.S. Army                            | 289-0143 |
| U.S. Fish & Wildlife Service         | 289-0232 |
| U.S. Environmental Protection Agency | 294-1140 |
| Shell Oil Company                    | 298-1818 |
| Colorado Department of Health        | 331-4855 |

For all documents pertaining to the cleanup:

Joint Administrative Record Document Facility 289-0362

15 May, 1992



# Fact Sheet

May 1992

Elaine Heise 294-1140  
EPA, Community Relations

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## GROUNDWATER INTERCEPT AND TREATMENT SYSTEMS

### AT THE ROCKY MOUNTAIN ARSENAL (RMA)

Groundwater intercept and treatment systems are being used to clean up the groundwater contamination at the Rocky Mountain Arsenal. These systems capture the contaminated water at eight different locations, pump it out of the ground, remove the contaminants with granular activated carbon, and inject the clean, treated water on the other side to continue to flow off the Arsenal.

The systems are now cleaning **one billion gallons** a year to drinking water levels at the point of reinjection. Contamination in the groundwater leaving the RMA has diminished.

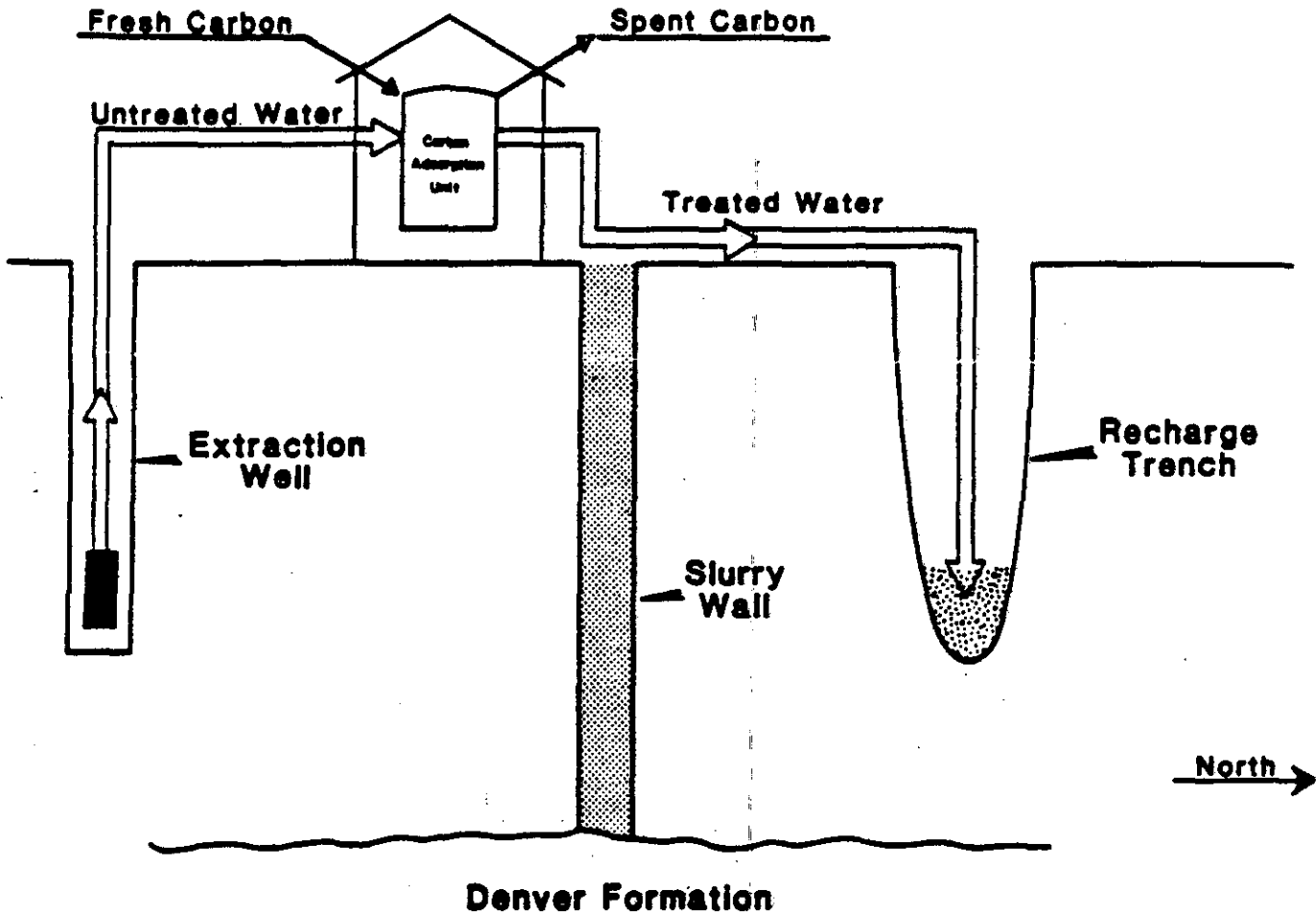
For example, the amount of DIMP (diisopropyl methyl phosphonate) in an off-post monitoring well was 138 ppb in 1985, 105 in 1987, 14 in 1988, and 6.7 in 1989. Another monitoring well registered 640 ppb in 1987 and 55 in 1989. EPA believes that the reduction of the contamination is due to the effectiveness of the groundwater intercept and treatment systems.

Groundwater intercept and treatment systems have been operating at the north boundary of RMA since 1979, at Irondale since 1981, and at the northwest boundary since 1984. Improvements have been made to these on-post systems. Four other intercept locations were built, and another one, now under construction in the off-post area, should begin operating in 1993, making a total of eight systems in operation.

EPA has oversight of these Army projects. Further, EPA encouraged the Army and Shell to expedite all the new systems, including the work on the groundwater intercept and treatment system north of the Arsenal.

If you have any questions, please call Elaine Heise, EPA Community Relations Coordinator, at 294-1140.

(please see reverse)



**Schematic Diagram of  
North Boundary Treatment System**

(PLEASE SEE REVERSE)



# Fact Sheet

ROCKY MOUNTAIN ARSENAL (RMA)

January 1992

## WHO'S DOING WHAT: MAJOR PARTICIPANTS

Several government agencies and private interests are involved in the studies relating to the cleanup of the Rocky Mountain Arsenal. The role of each is described below:

o The U.S. Environmental Protection Agency (EPA) has overall responsibility for the cleanup of the contamination problems at the arsenal. EPA conducts some studies and oversees others. Specifically, EPA has conducted investigations for the SACWSD water contamination problems and for four Superfund sites in the Commerce City area. EPA also oversees the Army investigations on and off the arsenal.

CONTACT: Connally E. Mears - 293-1528 - RMA Coordinator, or  
Elaine H. Heise - 294-1140 - Community Relations  
294-7559 (fax for Mears) 294-7665 (fax for Heise)

EPA, Region 8, Suite 500, 999 18th St., Denver, CO 80202

o U.S. Army is responsible for cleaning up any contamination it created on or off post. The Army is conducting several studies and cleanup actions.

CONTACT: Bill Thomas - 289-0143 - Chief, Public Affairs  
- 289-0582 (fax)

Rocky Mountain Arsenal, Commerce City, CO 80022-2180

o Colorado Department of Health (CDE) administers the state's environmental and public health laws which provide for safe public drinking water, clean air, and effective solid and hazardous waste management.

CONTACT: Jeff Edson - 331-4851 - RMA Project Manager -  
Hazardous Materials and Waste Management  
Division (HM & WMD)

Marion Galant - 331-4855 - Community Relations  
(HM & WMD) 331-4401 (fax)

CDH, 4210 E. 11th Ave., Denver, CO 80220

o Tri-County Health Department (TCHD) oversees local health issues in Adams, Arapahoe, and Douglas Counties, distributes chemical analyses, samples water, and performs a liaison function with area residents. It has performed some air monitoring and a well water survey.

CONTACT: Ken Conright - 288-6816 - Environmental Health Supervisor - 220-9208 (fax)

TCH, 4301 E. 72nd, Commerce City, CO 80022

o South Adams County Water and Sanitation District (SACWSD) provides drinking water to the 30,000 residents of south Adams County. SACWSD, using Army and EPA funds, opened the Klein Water Treatment Plant in November 1989, adjacent to the arsenal. The \$10 million state-of-the-art facility is the largest drinking water treatment plant in the U.S. using a granular activated carbon treatment system.

CONTACT: Larry L. Ford - 288-2646 - Manager  
- 288-9531 (fax)

SACWSD, P.O. Box 597, Commerce City, CO 80037-0597

o Shell Oil Company produced pesticides on the arsenal from 1952-82. The company is assisting the Army with investigations on the arsenal and funding of the cleanup efforts.

CONTACT: Bill McKinney - 861-7000 - Manager, Denver Site Project - 866-0200 (fax)

John Wright - Shell Public Affairs, Houston  
(713) 241-0277 (713) 241-2909 (fax)

Mike Gaughan, Public Affairs, Denver  
(303) 298-1818 (303) 297-3526 (fax)

Shell Oil Co., 1700 Lincoln St., Suite 4100, Denver CO 80203

o Agency for Toxic Substances and Disease Registry (ATSDR) carries out the health-related responsibilities of Superfund. Agency officials consult with EPA and other agencies regarding the health information conveyed to them and help interpret the information on a site-specific basis.

CONTACT: Dr. Glenn Tucker - 294-1063 - Sr Regional Representative ATSDR - Region 8  
- 294-7559 (fax)

ATSDR, Suite 500, 999 18th St., Denver, CO 80202

o The U.S. Fish and Wildlife Service (USFWS) has trust responsibilities for natural resources at the arsenal and provides technical assistance to the Army in conserving wildlife populations and mitigating habitat impacts that might result from cleanup activities.

**CONTACT:** Dr. Pete Gober - 289-0232 - Coordinator  
- 289-0579 (fax)

Lisa Langelier - Community Relations, 289-0232

RMA Field Office, Bldg. 111, Commerce City, CO 80022-2180

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Citizens Against Contamination (CAC) is an independent community activist group representing citizens' interests and involvement with the RMA cleanup. EPA has awarded CAC a \$50,000 Technical Assistant Grant (TAG) for independent citizen oversight of cleanup activities at the arsenal.

**CONTACT:** Beth Gallegos - 892-1158 or 287-9242 - Chairman  
893-8562 (fax)  
after 3 p.m. (fax) 287-3983

Sandra Jaquith - 832-8147 - Co-Chairman

CAC, 6821 E. 61st Place, Commerce City, CO 80022

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How to Obtain Documents Concerning the RMA Cleanup

JARDF (Joint Administrative Record Document Facility)  
Rm 14, Arsenal Security Building  
72nd & Quebec Streets  
Commerce City, CO 80022

Monday, Wednesday, Friday - 12 Noon to 4:30 p.m.  
Tuesday and Thursday - 5:00 p.m. to 9:00 p.m.  
Saturday - 10 a.m. to 4 p.m.

For information about this facility, please call  
Isabel Vargas at 289-0362

Some documents are also available at public libraries in Commerce City, Brighton and downtown Denver, and at the EPA library, 2nd floor, 999 18th St., Denver, CO 80202

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# Fact Sheet

January 1992

**SUBJECT:** THE ROCKY MOUNTAIN ARSENAL (RMA)

**LOCATION:** Ten miles northeast of Denver, Colorado in south Adams County

**NOTE:** This issue is related to the south Adams County (sAC) issue. Review of the sAC Fact Sheet is recommended.

## SUMMARY

Hazardous wastes exist on most of the Rocky Mountain Arsenal (RMA), in both a thin layer of topsoil and in deeper areas on at least 178 sites. These 178 sites total 1,750 acres, or about 10 percent of the 27 square miles occupied by the Arsenal. More than 750 different chemicals were handled or generated at the Arsenal; of these, 63 were used as target (indicator) chemicals for analyses during the remedial investigation. The contamination is dispersed in buildings, surficial soils, deeper soils, groundwater, surface water and sediments. The volume of contaminated soils is estimated at 8 to 13 million cubic yards.

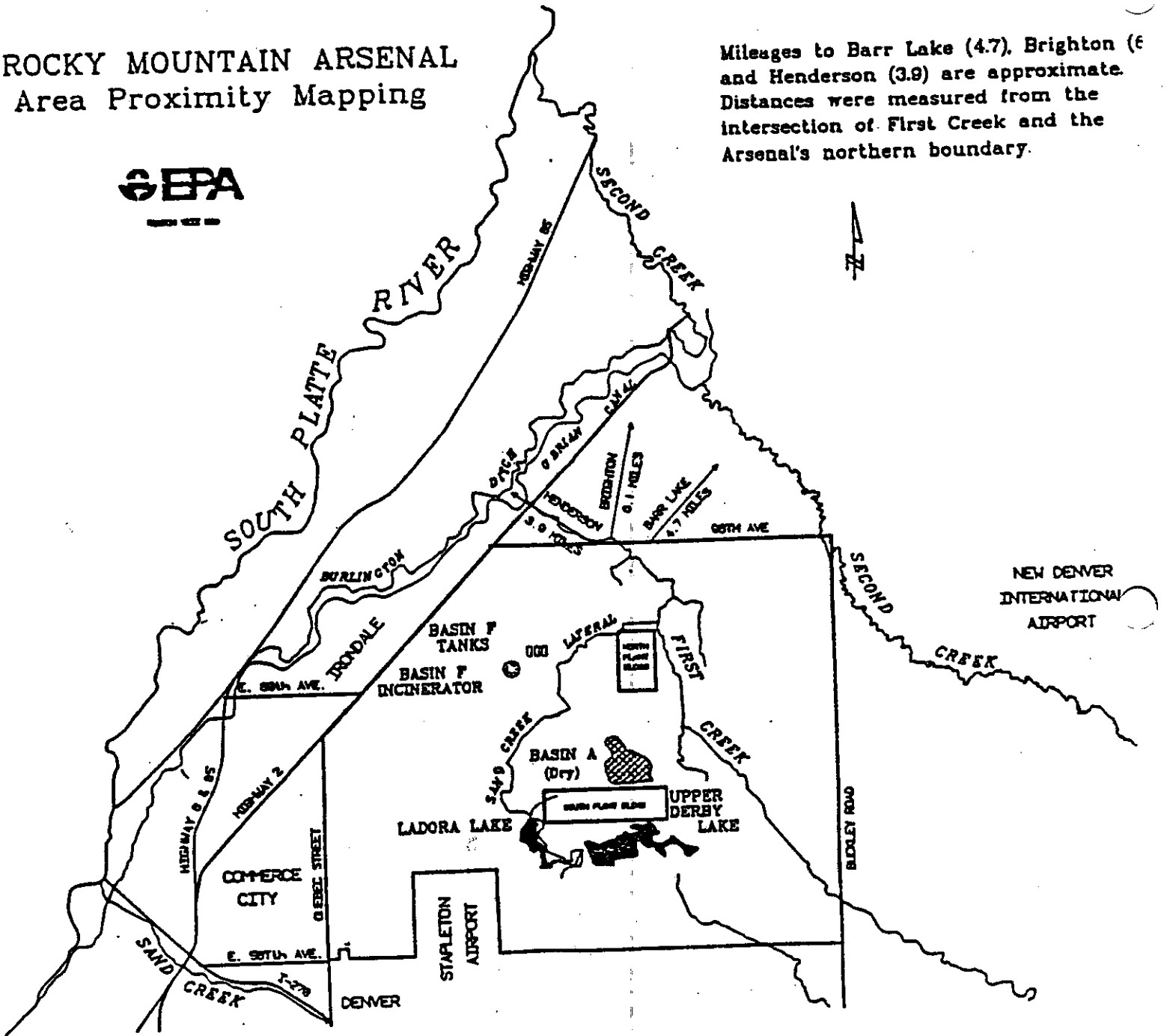
Hazardous waste effluents generated at RMA were routinely discharged to unlined evaporation basins prior to 1956. After 1956, Basin F, which had an asphalt liner, was used for disposal. Solid wastes were buried at selected locations. Spills of raw materials, intermediate and final products occurred within the manufacturing complexes at RMA. Contaminants from many of these sites have entered the groundwater, surface water, air and wildlife and have been transported or migrated off RMA. Plumes of contaminated groundwater move north and northwest from the Arsenal and eventually reach the South Platte River, albeit with levels of contamination which do not pose a health threat.

Stapleton Airport abuts the southwest corner of the site, and the new Denver International Airport, now under construction, is on the east. Residential and commercial properties of Commerce City are located to the west and southwest of the site. Rural residential and agricultural land are located to the north and east of the Arsenal. Residential and light industrial areas are located to the south. Henderson lies four miles northwest, Brighton six miles north, and Barr Lake State Park is about five miles northeast; residents in these communities are concerned about both surface and groundwater contamination from RMA.

# ROCKY MOUNTAIN ARSENAL Area Proximity Mapping



Mileages to Barr Lake (4.7), Brighton (6 and Henderson (3.9) are approximate. Distances were measured from the intersection of First Creek and the Arsenal's northern boundary.



All production operations at RMA ceased in 1982. Significant cleanup has been accomplished during the past several years, as described below.

The U.S. Army's sole mission at RMA is to remediate the contamination, as the lead agency. EPA performs both oversight of the Army efforts and a separate Remedial Investigation and Feasibility Study (RI/FS) in EPA's off-post area.

### CONTAMINANTS OF CONCERN

#### In groundwater

Volatile organic chemicals found at the Arsenal include benzene, di bromochloropropane (DBCP), chloroform, toluene, and trichloroethylene (TCE).

Pesticides and other semivolatile chemicals include aldrin, atrazine, chlordane, dieldrin, diisopropylmethyl phosphonate (DIMP), endrin, and others.

Heavy metals include arsenic, cadmium, chromium, lead, mercury, and others.

#### In sediments

Sediment samples from on-post lakes and drainage areas are contaminated with metals and pesticide residues.

#### In soil

Some surface and near-surface soils are contaminated with heavy metals, such as arsenic, lead, and mercury; pesticides, such as dieldrin and aldrin; and other compounds identified in the groundwater (see above).

### HUMAN HEALTH and ENVIRONMENTAL THREAT

The potential exposure routes to people or animals associated with RMA include ingestion, skin absorption and/or breathing of contaminated dust that may result from windblown soils and cleanup activities, or from exposure to contaminated soils, sediments, surface water and groundwater (off-post).

In spite of contamination in the lakes and soils, the Arsenal is home to more than 130 different kinds of animals, including a wide variety of mammals, birds, fish and amphibians. The size of RMA has been of assistance in protecting wildlife habitat. The U.S. Fish and Wildlife Service actively manages the wildlife on the Arsenal.

## FUTURE LAND USES

Since EPA is not a land use agency, the decision on future land uses will be made by the landowner (the Army) and take into account the wishes of the public. However, EPA insists on clean-up goals which are protective of human health and the environment consistent with the range of ultimate uses of the RMA allowed by the Federal Facility Agreement (see below). By insisting on clean-up levels for all FFA-allowed options, including a wildlife refuge, recreational uses, and potential commercial or industrial activities, EPA will ensure that the cleanup is adequate for those uses.

## BACKGROUND

RMA was constructed in 1942. Until 1950, the Army manufactured and assembled chemical and incendiary munitions, distilled available stocks of Levinstein mustard, demilitarized several million rounds of mustard-filled shells, test-fired mortar rounds filled with smoke and high explosives, and destroyed many different types of obsolete World War II ordnances by detonation or burning.

Between 1953 and 1957, the Army produced GB nerve agent. Munition-filling operations continued until 1969. From 1970 to 1982, RMA was primarily involved with the disposal of chemical warfare material, including the incineration of TX anti-crop agent, mustard agent, explosive components, and the destruction of GB agent and related munitions casings by caustic neutralization and incineration.

In 1947, certain facilities in the "South Plants" area were leased to the Colorado Fuel and Iron Corporation for manufacture of chlorinated benzenes and dichlorodiphenyltrichloroethane (DDT). Julius Hyman and Company assumed part of the CF&I lease in 1950 and produced several pesticides. Subsequently, the company was bought by Shell Chemical Company which conducted pesticide and herbicide manufacturing operations from 1952-1982. Both Shell and the Army are responsible for cleanup at RMA.

## MEMORANDUM OF AGREEMENT (MOA)

To promote consultation and cooperation in implementing its CERCLA (Comprehensive Environmental Response, Compensation and Liability Act of 1980, also known as Superfund) responsibilities at RMA, EPA initiated and signed a Memorandum of Agreement (MOA) on December 6, 1982, with the Army, Colorado Department of Health (CDH), and Shell. Under the MOA and a national EPA-DOD Memorandum of Understanding, the Army agreed to provide an initial off-post contamination assessment report based on existing monitoring data, and later, to conduct a RI/FS for on- and off-post.

In addition, EPA agreed to perform a separate off-post RI/FS west of RMA. (See SAC Fact Sheet.) Through the MOA, the parties actively exchanged information and evaluations of issues. (See description of the Federal Facility Agreement (FFA), which replaced the MOA, below.)

#### LEGAL ISSUES; FEDERAL FACILITY AGREEMENT (FFA)

In spite of numerous lawsuits and questions about federal and state jurisdiction, clean-up activities at RMA have steadily progressed.

In December 1983, the United States filed a \$1.8 billion lawsuit against Shell seeking natural resource damages and response costs under CERCLA. At the same time, the State of Colorado filed suit for \$50 million for each release that has occurred, against both the U.S. government and Shell. The State amended its complaint in November 1985, to seek recovery of response costs under CERCLA.

In November 1986, the State sued the Army over Basin F jurisdiction. A hearing on a preliminary injunction over Basin F was held December 11, 1987; the ruling is still pending. However, the Basin F IRA proceeded.

In talks beginning May 8, 1987, the MOA parties entered into intensive litigation negotiations on numerous issues: MOA party participation, dispute resolution, settlement of past and future cleanup costs, an expanded list of interim actions and their funding, and RCRA (Resource Conservation and Recovery Act of 1976) and CERCLA jurisdiction. The parties agreed to a revised technical plan which is described below.

The trial on cleanup and damage claims was scheduled for September 1987, but the Court granted a suspension at the request of all parties. A Shell-U.S. Consent Decree was proposed on February 1, 1988, modified on June 7, 1988, but never approved by the Court. The State's major issues were proposed land use restrictions, RCRA/CERCLA jurisdiction, the State's role, and natural resource damages. Negotiations continued, assisted by a Special Master appointed by the Court on June 30, 1988.

The Army, U.S. Department of Interior, U.S. Agency for Toxic Substances and Disease Registry, Department of Justice, EPA, and Shell signed the FFA, effective February 17, 1989, consistent with Section 120 of the Superfund Amendments and Reauthorization Act of 1986, known as "SARA." The FFA replaced the MOA and established a procedure for the signees to cooperate in the cleanup. The Settlement Agreement, executed the same date, apportioned liability for cleanup between Shell and the Army, and led to resolution of the Army-Shell litigation. The State of Colorado has not signed the FFA, though negotiations continue.

In describing the clean-up work to be done at RMA, the FFA makes a distinction between problems that require short-term solutions to mitigate the spread of contamination, and problems that are not an immediate threat and are best handled by long-term solutions. The FFA identifies "Interim Response Actions" (IRAs) as priority items expediting clean-up activities before a final remedial decision and provides for the identification and performance of approximately 20 clean-up activities to deal with sources of contamination.

The FFA also sets forth specific procedures for finding effective solutions to contamination problems and provides for addressing the comments and concerns of all the agencies and the public. EPA - in its dual role as protector of public health and the environment, and enforcer of proper clean-up activities - has the final authority for clean-up remedies at sites listed on EPA's National Priorities List (NPL).

On September 1, 1989, the United States was served with a Final Amended Compliance Order, a state administrative order issued by the Colorado Department of Health (CDH) under its delegated RCRA authority in the Colorado Hazardous Waste Management Act (CHWMA). The order sought to compel the United States to follow the procedural and substantive requirements of CHWMA, and sought civil penalties for the United States' alleged non-compliance with both the order and CHWMA.

In response, the United States filed an action seeking a court order declaring the Amended Compliance Order unlawful and also argued that it was not subject to such penalties under state law. The court has ruled in favor of the United States in this action, with regard to civil penalties. The remainder of the action is still pending.

In early 1989, a Superior Court jury in California decided that Shell's insurers were not liable for cleanup, contamination control, and natural resource damages arising out of Shell's operations at the RMA. Shell is appealing that decision.

Four private lawsuits have been filed: Land vs. U.S.; Daigle, et al., vs. Shell and U.S.; Adams County Joint Venture vs. Shell; and Maul, et al., vs. U.S. and Shell. The latter two were settled out of court in early 1991.

In July, 1990, CDH asked the federal court for a temporary restraining order to stop the Army from decontamination of nerve gas residue in the North Plants area. Judge Carrigan did not grant the order. While ruling in favor of the Army, he said that CDH was not precluded from bringing actions in the future.

On August 14, 1991, the court issued a ruling in U.S. vs. Colorado granting the U.S. motion for summary judgment. The

Court held that under CERCLA, it had no jurisdiction in the State's Final Amended Compliance Order, in effect, affirming EPA's role as the final authority in selecting the remedies for cleanup at RMA.

#### TECHNICAL PLANS AND IMPLEMENTATION STATUS

EPA advised the Army of the requirements of the National Contingency Plan in the Army's development of an acceptable clean-up plan for the Arsenal. In October 1984, the resulting conceptual plan was released, outlining a \$360 million cleanup over a 15-year period, with all significant contamination to be excavated and treated, when possible, and then deposited in on-post landfills meeting substantive RCRA standards. In the meantime, implementation of interim remedies would take place under RCRA, CERCLA and Underground Injection Control (UIC).

The November 1985 "Kramer Bill" required development of a plan to complete cleanup by September 1993, but none of the resulting four new clean-up plans could meet the deadline.

A mid-course technical review of the RI/FS and Endangerment Assessment (EA) resulted from the May 1987 negotiations described above. The Technical Program Plan (TPP) was issued in March 1988 and established the schedule of clean-up study activities and IRAs. The FFA includes a process for agreeing to changes.

The Army is now conducting a \$115 million RI/FS to evaluate on- and off-post contamination and remedial alternatives, and select remedies. Several interim response actions have been completed, are ongoing, or are in planning. Shell is reviewing and assisting the Army efforts.

EPA also conducted its own \$1.3 million RI/FS off-post study in south Adams County (see SAC Fact Sheet) and performs active oversight of the Army's studies. The combination of these studies will lead to selection of final clean-up remedies for both RMA and SAC.

#### NPL STATUS AND RESPONSIBILITIES

RMA (except Basin F) was proposed for the Superfund National Priorities List (NPL) in October, 1984; it was listed in July, 1987. Basin F, built in 1956, was listed in March, 1989.

Under Section 120 of CERCLA, the Army is the lead agency responsible for determining the extent of contamination and appropriate clean-up measures necessary to protect public health and the environment from releases of hazardous substances, pollutants or contaminants. These Army actions are required to be consistent with the NCP and must be coordinated with EPA. EPA must approve the final remedial decision.

The State has a role, under Sections 120 and 121 of CERCLA, which provide for "substantial and meaningful involvement ... in initiation, development and selection of remedial actions to be undertaken in that State...."

### CURRENT STATUS

The Army's RI is complete, except for surface soil and structures data; the final report is pending. The FS and EA are proceeding; final results are expected in 1993 (off-post) and 1994 (on-post).

In 1989, the Army and EPA constructed a drinking water treatment system for south Adams County. The system began operating in November of that year (see below). EPA's RI/FS for the aquifer and other sources continues under the jurisdiction of the Chemical Sales Co.'s NPL site west of RMA.

Several FFA Interim Response Actions (IRAs) and earlier activities at RMA sites have been completed. (Please see below.)

### Costs      Project and Completion Dates (millions)

#### \*FFA IRAs

\*\* Cleanup activities dealing specifically with groundwater

|       |   |
|-------|---|
| \$4.3 | North boundary groundwater treatment system (two stages, 1979-82)**             |
| 1.1   | Irondale groundwater treatment system, by Shell (1981)**                        |
| 5.5   | Northwest boundary groundwater treatment system (1984)**                        |
| 1.5   | Basin F liquid evaporation and contaminated sewer removal (1982)                |
| 0.09  | Basins A and F windblown dust control   |
| 0.22  | Basins A and F reapplication of windblown dust control for 142 acres (1988-89)* |
| 0.25  | Reapplication of windblown dust control (May, 1991)                             |
| 2.5   | Deep well (12,045 ft.) closure (1986)   |
| 10.5  | Removal of 76,000 drums of waste salts (1986)                                   |



|                           |  |
|---------------------------|--|
| 23.1                      | Treatment for TCE in the public water supply plus about 400 private well connections in south Adams County (1986). Includes \$8.2M by EPA. The Klein Water Treatment Facility supplies safe drinking water to 30,000 south Adams County residents (1989)** |
| 2.75                      | Improvements to North Boundary System (1990)* ** and treatment plant modifications (1991)  |
| 3.7                       | Closure of 353 abandoned wells on-post (1990)* **  |
| 42.0                      | Removal and containment of 10.5M gallons of Basin F liquids and 564,000 cubic yards of sludges (1989)*   |
| 0.7                       | Basin F groundwater treatment system (1990)* **  |
| 3.1                       | "A" neck groundwater containment and treatment (1990) * **   |
| 1.4                       | Northwest Boundary and Water Extraction Systems Improvement (1991)   |
| 3.0                       | Rail Classification Yard and Motor Pool Groundwater (implementation of groundwater intercept and treatment system) (1991)**  |
| 0.5                       | South Tank Farm Plume (action completed; monitoring ongoing)(1991)**   |
| 1.4                       | Army trenches (action completed; monitoring ongoing) (1991)  |
| 3.2                       | Shell trenches (construction completed) (1991)   |
| 0.18                      | Building 1727 sump cleanup (Operations & Maintenance expected through 1993)  |
| <u>\$111.0</u><br>million | Total Completed to Date (not including operation and maintenance costs)  |

**FFA Interim Response Actions for Winter 1991-92 and beyond:**

|       |   |
|-------|---|
| 11.75 | Hydrazine liquid treatment and equipment removal (liquid being transferred to Basin F incinerator, and equipment being removed) (ongoing, through 1992) |
| 8.7   | Groundwater treatment system off-post to the north (1992) (under construction) **   |
| 0.8   | Sanitary sewer closure (ongoing) (1992)   |

- 7.09 Asbestos removal from buildings (ongoing) (1992)
- 14.0 M-1 ponds (ongoing in-situ vitrification design) (1994)
- 0.15 Motor Pool (vapor extraction system implementation) (1992)\*\*
- 1.7 Lime Settling Basins (implementation of containment system) (1992)
- 90.0 Treatment of 10.5 million gallons of Basin F liquids (incinerator construction ongoing) (1992-93)
- 7.25 CERCLA Liquid Waste Treatment (construction begun October, 1991; completion 1992; operational 1993)
- 0.05 Expansion of Abandoned Well Program (1993)
- 4.5 Chemical Process-Related (ongoing through 1993)

Also, proposed Interim Response Actions:

- 0.2 PCBs (1993)
- 5.0 CERCLA Waste Management (1994)

\$151.2 Total (ongoing and proposed)  
million

\$262.2 TOTAL CLEANUP ACTIONS PRIOR TO THE ON-POST RECORD OF  
million DECISION (ROD) (1994)

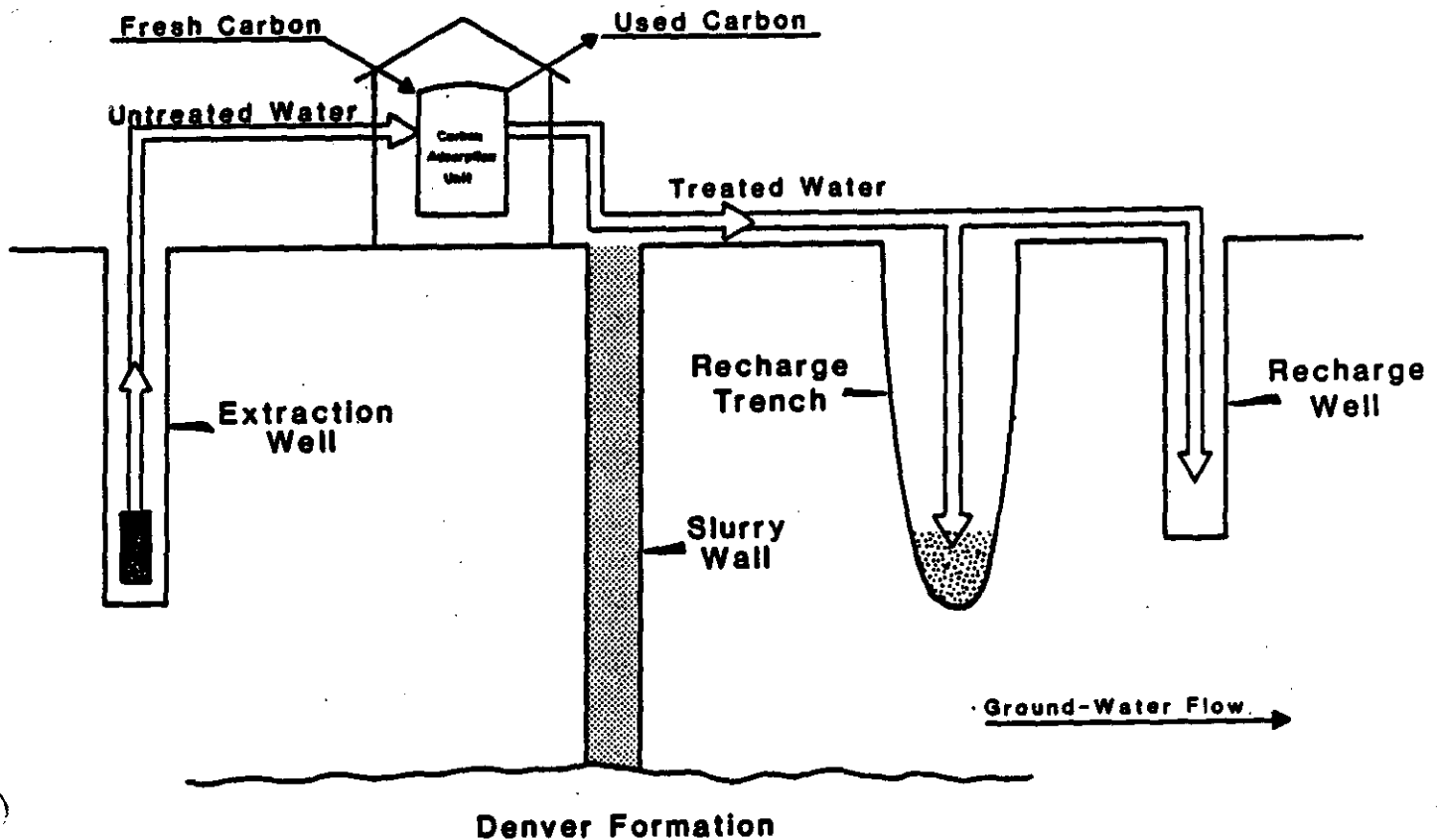
All interim response actions must be consistent with final remedies.

## GROUNDWATER INTERCEPT AND TREATMENT SYSTEMS

Groundwater intercept and treatment systems have been operating at the north boundary of RMA since 1979, at Irondale since 1981, and at the northwest boundary since 1984. Improvements are being made to these systems. Two new similar systems began operating in September 1990 on-post, and two more began operating in 1991. A new one, north of the Arsenal, should be operating in 1992.

These seven operating systems pump the contaminated water from the ground before it leaves RMA, remove contaminants, and inject the treated water on the other side to continue to flow off the Arsenal. The systems are cleaning one billion gallons a year which then flow into the areas north and northwest of RMA. In large measure, the systems are working. Contamination in the groundwater leaving the RMA has diminished.

For example, the amount of DIMP in an off-post monitoring well was 138 ppb in 1985, 105 in 1987, 14 in 1988, and 6.7 in 1989. Another monitoring well registered 640 ppb in 1987 and 55 in 1989.



**Schematic Diagram of  
North Boundary Treatment System**

## CURRENT ISSUES AND ACTIONS

Acceptance by the State of the Federal Facility Agreement is among the highest priorities for the parties involved in the cleanup. The litigation diverts resources from the cleanup efforts and sometimes even complicates sharing of information.

EPA is continuing oversight of the interim response actions, expediting Army and Shell studies and final remedies, working to improve communication among the parties, and encouraging citizen involvement in the Superfund process. The Army's on- and off-post studies are progressing, as are EPA's SAC investigations.

Citizens Against Contamination (CAC), an environmental group composed of citizens of Commerce City, was awarded a \$50,000 Technical Assistant Grant (TAG) by EPA in 1990. The funds are being used to hire independent technical advisors to review data from the ongoing studies and clean-up activities at the Arsenal.

EPA, the Army, Shell, State, and the U.S Fish and Wildlife Service actively participate in the community relations subcommittee for the purpose of involving the community in decisions about clean-up activities as early as possible and coordinating community relations efforts among the five parties.

## DOCUMENTS AVAILABLE TO THE PUBLIC

JARDF (Joint Administrative Record Document Facility)  
Rm 14, Arsenal Security Building  
72nd & Quebec Streets, Commerce City, CO 80022

Monday, Wednesday, Friday - 12 Noon to 4:30 p.m.  
Tuesday and Thursday - 5:00 p.m. to 9:00 p.m.  
Saturday - 10:00 a.m. to 4:00 p.m.

For information about the JARDF, call Isabel Vargas at 289-0362.

Some documents are also available at public libraries in Commerce City, Brighton and downtown Denver, and at the EPA library, 2nd floor, 999 18th Street, Denver, CO 80202.

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