



Explanation of Significant Differences for the Lime Basins Dense Non-aqueous Phase Liquid Remediation Project

Fact Sheet

INTRODUCTION

This Explanation of Significant Differences (ESD) documents a significant change in a portion of the remedy for the Section 36 Lime Settling Basins (Lime Basins) Remediation of the Rocky Mountain Arsenal (RMA) Federal Facility Site. This ESD also documents a change in the Containment System Remediation Goals (CSRGs), or groundwater standards, for the Basin A Neck System for treatment of groundwater extracted from the Lime Basins dewatering wells. The Lime Basins Remediation Project area is located in the central portion of the site.

From 1942 to 1974, the former Lime Basins were used to treat and discharge to Basin A liquid waste and storm runoff from Army and Shell chemical manufacturing operations. From 1955 to 1974, the Lime Basins were also used to store lime slurry generated as a by-product of acetylene production by Shell Oil Co. Although these were common industrial and waste disposal practices of the time, they resulted in contamination of surface soils and groundwater.

To address the contamination and mitigate the potential for releases, an

Interim Response Action (IRA) was conducted prior to the Record of Decision (ROD). The IRA included relocating sludge material from outside the basins to within the basin area, constructing a vegetative cap over the basins area, and constructing a storm sewer line to shed water and route drainage around the former basins to outfall northeast of the Lime Basins.

The original remedy decision for the Lime Basins site included excavation of contaminated soil with disposal in the on-site Enhanced Hazardous Waste Landfill (ELF). In October 2005, an Amendment to the ROD was approved for the alternate remedy at the Lime Basins site. The selected alternate remedy for the Lime Basins relied on containment in place beneath a RCRA-equivalent cover. A vertical groundwater barrier wall and dewatering wells were included to provide effective overall containment.

In 2009, Dense Non-aqueous Phase Liquid (DNAPL) was discovered in two of the six dewatering wells. Two significant changes to the original remedy were then required to address DNAPL at the Lime Basins and



treatment of groundwater extracted from the Lime Basins dewatering wells at the BANS, resulting in the need for an Explanation of Significant Differences (ESD).

EXPLANATION OF SIGNIFICANT DIFFERENCES

This ESD summarizes modifications to the Lime Basins Remediation Project that resulted from new information developed by the Army since the ROD was signed. The ROD outlines the RMA's overall cleanup program. Significant changes include the addition of remedy components to address DNAPL at the Lime Basins and changes to the BANS CSRGs based on treatment of groundwater extracted from the Lime Basins dewatering wells.

In August 2009, field monitoring of the Lime Basins dewatering wells indicated the potential presence, which was later confirmed, of DNAPL in two of the six dewatering wells. Because DNAPL was identified as previously unreported contamination that could constitute a principal threat, the discovery triggered a Remedial Investigation/Feasibility Study (RI/FS) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

Following completion of the RI, the FS was conducted to develop and evaluate remedial action alternatives to address the DNAPL contamination at the Lime Basins. The FS component of the project was a focused FS that followed EPA Guidance on presumptive remedies. The objective of the presumptive remedies initiative is to use past experience and performance assessments to streamline site investigations and expedite selection of cleanup actions.

The change to the Lime Basins Remediation Project is consistent with the presumptive remedy outlined in EPA

Guidance, which consists of DNAPL source containment and DNAPL removal to the extent possible. Those objectives are met through the addition of monitoring wells, increased water level and water quality monitoring and removal and disposal of recoverable DNAPL from the dewatering and monitoring wells where appropriate.

There are no changes to the existing components of the Lime Basins remedy (i.e., slurry wall, dewatering wells, and RCRA-equivalent cover) implemented in accordance with the ROD Amendment.

Groundwater extracted from the Lime Basins dewatering wells will be treated at the BANS. However, the existing CSRG list provided in the ROD was based on compounds identified upgradient of the system and did not include all the DNAPL compounds. Therefore, the CSRG list for BANS is being revised to include the following DNAPL compounds:

- 1,2-Dichlorobenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene

The changes to the remedy and CSRGs for the BANS, while resulting in the need for an ESD, do not alter the overall hazardous waste management remedy that was selected in the ROD, nor are the implementation costs to address DNAPL expected to result in a significant increase for the overall Lime Basins remedy.

The proposed changes are detailed in the "Explanation of Significant Differences for the Lime Basins Dense Non-aqueous Phase Liquid Remediation Project" dated October 28, 2011. Design documents are available for public review and comment (see bottom of fact sheet for locations).

WHAT ARE THE SIGNIFICANT CHANGES TO THE REMEDIATION PROJECT?

Addition of Remedy Components to the Lime Basins Remediation Project

The change to the Lime Basins Remediation Project is the addition of remedy components to address the DNAPL present at the site.

The revised remedy includes installation of four new monitoring well pairs along the east and west segments of the existing slurry wall to facilitate water-level measurement, DNAPL detection, and analyses of DNAPL compounds. Enhanced water level and water quality monitoring is included for the existing monitoring and dewatering wells and the eight new wells to allow for the evaluation of slurry wall performance and further refinement of the delineation of DNAPL source zones at these locations. Recoverable quantities of DNAPL are removed from the dewatering wells and monitoring wells where appropriate.

A summary of project remediation changes is included in Table 1 on the following page.

The ROD-specified BANS CSRGs included compounds that were present upgradient of the system and current or likely exceedances of applicable standards. Because the expected sources of groundwater for treatment at BANS did not include some of the DNAPL compounds, the ROD-identified CSRG list did not identify standards for all the DNAPL compounds.

Therefore, the BANS CSRGs have been revised to include chemical-specific CSRGs pertinent to treatment of Lime Basins groundwater. For the chlorinated benzene compounds, the CSRGs represent the Colorado Basic Standards for Groundwater.

The revised chemical-specific CSRGs for the BANS are listed in Table 2 on page 6.

Previous Changes to the Lime Basins ROD Remedy

The original remedy decision for the Lime Basins site included excavation of contaminated soil with disposal in the on-site ELF. The excavated area was then to be backfilled with clean borrow, and the IRA soil cover was to be restored/replaced over the Lime Basins area. A change in the ROD-selected remedy for the Lime Basins was necessary due to significant increases in contaminated material volume to be placed in the ELF and short-term risks associated with the excavation identified during remedial design.

In October 2005, an Amendment to the ROD was approved for the alternate remedy at the Lime Basins site. The selected alternate remedy for the Lime Basins relies on containment in place beneath a RCRA-equivalent cover. A vertical groundwater barrier wall and dewatering within the barrier wall are included to provide effective overall containment.

Table 1: Changes to Lime Basins Remediation Project

ROD-Prescribed Remedy	Modification
Construct vertical groundwater barrier around the three Lime Basins.	No Change. Barrier wall was constructed as designed. Construction was completed in 2009. Potential impact of the DNAPL on the performance of the barrier wall will be evaluated under the Lime Basins DNAPL Remediation Project.
Install dewatering system.	No Change. Dewatering wells and monitoring wells were installed as designed. Construction was completed in 2009.
Construct RCRA-equivalent cover over the Lime Basins.	No Change. RCRA-equivalent cover was constructed as designed. Construction was completed in 2010.
Treat extracted groundwater at BANS to meet CSRGs	Change. Add CSRGs for DNAPL compounds to the BANS CSRG list.
Revegetation standards consistent with ROD requirements for cover systems.	No Change. Vegetation standards required for RCRA-Equivalent covers were included in the ICS Cover design.
Institutional controls consistent with ROD requirements for cover systems (e.g., delineation and access control) as modified by the ROD Amendment for the Section 36 Lime Basins Remediation and Basin F Principal Threat Soil Remediation.	No Change. Engineering controls were constructed during the ICS project. Institutional controls are included in the Land Use Control Plan (under development).
Long-term Operations and Maintenance.	Enhancement. Remove recoverable quantities of DNAPL from dewatering and monitoring wells. Operations and maintenance of the dewatering wells and the RCRA-equivalent cover remain unchanged.
Long-term groundwater monitoring.	Enhancement. Install 4 additional monitoring well pairs (8 wells total) along the east and west segments of the slurry wall. Enhanced water level, DNAPL, and water quality monitoring for new and existing monitoring wells.

The required remedy, including changes from the ROD Amendment, included the following:

- Construct a vertical groundwater barrier to fully encompass the three Lime Basins to prevent migration of groundwater through the buried waste.
- Install dewatering wells inside the barrier wall and extract groundwater to maintain a positive gradient from the outside to the inside of the barrier wall and maintain groundwater level

below the level of the Lime Basins waste for as long as the surrounding local groundwater table is in the alluvium.

- Treat extracted groundwater at an on-site treatment facility.
- Install groundwater monitoring wells inside and outside the barrier wall and monitor to ensure that the dewatering goals are met.
- Construct a RCRA-equivalent cover over the entire Lime Basins area.

- Revegetate consistent with ROD requirements for covers.
- Provide institutional controls consistent with ROD requirements for covers.
- Provide long-term maintenance of the soil cover.
- Provide long-term groundwater monitoring.

SITE HISTORY

RMA is located in Adams County, Colorado, approximately 10 miles northeast of downtown Denver.

The RMA On-Post Operating Unit currently encompasses 1.7 square miles (1,084 acres) and is on the EPA's National Priorities List (NPL) for environmental cleanup as a result of contamination released during previous RMA operations. Groundwater underlying the central and northwestern portions of the site, approximately 15.5 square miles (9,920 acres), remains on the NPL. The On-Post ROD, which describes the site-wide remedy for the RMA, was signed by the U.S. Army, EPA, and the State of Colorado, with concurrence from Shell Oil Co. and the U.S. Fish and Wildlife Service, on June 11, 1996. The selected remedy includes 31 different cleanup plans for soils, structures and the treatment of groundwater contaminants.

The RMA was established in 1942 by the U.S. Army to manufacture chemical warfare agents and incendiary munitions for use as a deterrent in World War II. Following the war and through the early 1980s, the facilities continued to be used by the U.S. Army.

Beginning in 1946, some facilities were leased to private companies to

manufacture industrial and agricultural chemicals. Shell, the principal lessee, manufactured pesticides from 1952 to 1982. Common industrial and waste disposal practices used during these years resulted in contamination of structures, soil, surface water and groundwater.

All fieldwork related to the 31 environmental cleanup projects outlined in the ROD has been successfully completed, within budget and a year ahead of schedule. Documentation related to program completion will conclude in 2011. Groundwater treatment will continue until all water leaving the site meets federal and state standards.

With the environmental cleanup concluding, the transformation of the Rocky Mountain Arsenal into a premier urban national wildlife refuge is nearly complete.

The Rocky Mountain Arsenal National Wildlife Refuge was officially established in 2004, when approximately 5,000 acres of RMA land was transferred from the Army to the U.S. Fish and Wildlife Service (Service) after the land was removed from EPA's NPL. In 2006, a second land transfer expanded the Refuge to 12,000 acres. In September 2010, the Army transferred another 2,500 acres to the Service, bringing the Refuge to its final size of roughly 15,000 acres. The 1,084 remaining acres, which contain the landfills, soil cover areas and groundwater treatment plants, will be permanently retained by the Army to ensure the remedy performs as designed and remains protective of human health and the environment.

Table 2: Chemical-Specific CSRGs for BANS

Chemical Group/Compound	ROD Containment System Remediation Goals (µg/l)	Revised Containment System Remediation Goals (µg/l)
<i>VHOs (Volatile Halogenated Organics)</i>		
1,2-Dichloroethane	0.4 ¹	0.4 ¹
1,1,1-Trichloroethane	200 ^{1,2}	200 ^{1,2}
1,1-Dichloroethylene	7 ^{1,2}	7 ^{1,2}
1,2-Dichlorobenzene	--	600 ^{5,2}
1,3- Dichlorobenzene	--	94 ⁵
1,4- Dichlorobenzene	--	75 ⁵
Carbon tetrachloride	0.3 ¹	0.3 ¹
Chlorobenzene	100 ^{1,2}	100 ^{1,2}
Chloroform	6 ¹	6 ¹
Tetrachloroethylene	5 ^{1,2}	5 ^{1,2}
Trichloroethylene	5 ^{1,2}	5 ^{1,2}
<i>VHCs (Volatile Hydrocarbon Compounds)</i>		
Dicyclopentadiene	46 ³	46 ³
<i>VAOs (Volatile Aromatic Organics)</i>		
Benzene	5 ^{1,2}	5 ^{1,2}
<i>OPHPs (Organophosphorus Compounds; Pesticide Related)</i>		
Atrazine	3 ^{1,2}	3 ^{1,2}
<i>SHOs (Semivolatile Halogenated Organics)</i>		
Hexachlorocyclopentadiene	50 ^{1,2}	50 ^{1,2}
<i>OCPs (Organochlorine Pesticides)</i>		
DDT (Dichlorodiphenyltrichloroethane)	0.1 ¹	0.1 ¹
Dieldrin	0.002 ^{1,4}	0.002 ^{1,4}
Endrin	0.2 ¹	2 ^{1,6}
<i>OSCHs (Organosulfur Compounds; Herbicide Related)</i>		
Chlorophenylmethylsulfide	30 ³	30 ³
Chlorophenylmethylsulfone	36 ³	36 ³
Chlorophenylmethylsulfoxide	36 ³	36 ³
<i>OSCMs (Organosulfur Compounds; Mustard Agent Related)</i>		
1,4-Oxathiane	160 ³	160 ³
Dithiane	18 ³	18 ³
Arsenic	50 ^{1,2}	50 ^{1,2}
Mercury	2 ^{1,2}	2 ^{1,2}

The Refuge now provides environmental education and interpretive programs, catch-and-release recreational fishing, close to nine miles of trails, wildlife

viewing opportunities and site tours for the public. The Refuge also offers sanctuary to more than 330 species of animals, including wild bison, deer, coyotes, bald eagles and burrowing owls.

OPERABLE UNITS

The On-Post Operable Unit is one of two operable units at RMA. The On-Post Operable Unit addresses contamination within the RMA boundaries. The Off-Post Operable Unit addresses groundwater contamination north and northwest of the RMA.

The overall remedy required by the 1996 ROD for the On-Post Operable Unit (OU) included:

- Interception and treatment of contaminated groundwater at four onsite treatment plants.
- Construction of two on-post RCRA-compliant landfills.
- Demolition of structures with no designated future use and disposal of the debris in either the two landfills or the Basin A consolidation area, depending upon the degree of contamination.
- Containment of contaminated soil in the on-post landfills, under caps/covers, or through treatment, depending upon the type and degree of contamination. Areas that have caps or covers require long-term maintenance and will be retained by the Army. These areas will not be part of the Rocky

Mountain Arsenal National Wildlife Refuge.

- Consolidation of biota risk soil and structural debris from other Arsenal-contaminated areas in the Basin A disposal area. After all waste was received, a wildlife barrier and soil cover was placed over Basin A.

SITE CONTAMINATION

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

The most contaminated areas (those showing the highest concentrations and/or the greatest variety of contaminants) were located in the central manufacturing, transport and waste disposal areas. The highest contaminant concentrations occurred in soil within about five feet of the ground surface, though the higher contamination was also found at greater depths, particularly where burial trenches, disposal basins or manufacturing complexes were located.

The characteristics and locations of the groundwater plumes suggest that the greatest contaminant releases to the groundwater occurred from Basin A and the Lime Basins, the South Plants chemical sewer, the South Plants tank farm and production area, the Complex

(Army) and Shell Trenches in Section 36, and the former Basin F. The Motor Pool/Rail Yard and North Plants areas were other sources of contaminant releases to the groundwater.

PUBLIC PARTICIPATION

A public notice was published beginning Nov. 9, 2011, in the *Denver Post*, *Brighton Blade* and *Gateway News* newspapers announcing the 30-day public comment period for the Explanation of Significant Differences for the Lime Basins Dense Non-aqueous Phase Liquid Remediation Project. The public notice also explained how to provide comments and where the document could be obtained for review.

A presentation explaining the proposed changes will be provided to the Arsenal's Restoration Advisory Board (RAB) in November 2011. The RAB is a community group that meets regularly to receive information and provide input on the cleanup.

The public comment period closes on Dec. 9, 2011. Upon completion of the comment period, the Army, in consultation with the EPA and the State of Colorado, will evaluate each comment and any significant new data received before issuing a final report documenting the project changes.

This ESD and all documents that support the changes and clarifications are part of the Administrative Record and are available at the Joint Administrative Records and Document Facility (JARDF) and the EPA Region 8 Superfund Records Center. The JARDF can be reached at 303-289-0983.

Hours of operation are Monday through Friday 12 p.m. to 4 p.m. or by appointment. EPA's Superfund Record Center can be reached at 303-312-7287. Hours of operation are Monday through Friday from 8 a.m. to 4 p.m.