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Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R08-90/042
May 1990

EPA

Superfund Record of Decision:

Rocky Mountain Arsenal (Operable Unit 23), CO

[redacted]

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SUPERFUND RECORD OF DECISION
Rocky Mountain Arsenal (Operable Unit 23), CO
Seventh Remedial Action

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 17,000-acre Rocky Mountain Arsenal (RMA) (Operable Unit 23) site is a former U.S. Army chemical warfare and incendiary munitions manufacturing and assembly plant in Adams County, Colorado. From the 1950s to late 1969, the U.S. Army used the RMA facility to produce the nerve agent GB (isopropylmethylphosphonofluoridate). From 1974 to 1982, private industries leased major portions of the plant facilities to manufacture various insecticides and herbicides. Since 1970, the U.S. Army facility operations primarily have involved the destruction of chemical warfare materials. Because final remediation of the RMA site will take many years to complete, thirteen Interim Response Actions (IRAs) were determined to be necessary prior to implementing the final On-Post Record of Decision (ROD). Operable Unit 23 (OU23), the Shell Section 36 Trenches, is one of several areas being addressed as part of the Other Contaminated Sources Interim Remedial Action. Approximately 31 trenches occupy an 8-acre area of Section 36 in the central portion of the RMA. From 1952 to 1965, liquid and solid waste including bulk or drummed process intermediates, off-specification product, laboratory sample filters, and other debris from the manufacture of pesticides was disposed of and buried in the trenches. Investigations by the Army from 1987 through 1989 have identified ground water

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Rocky Mountain Arsenal (Operable Unit 23), CO
Seventh Remedial Action
Contaminated Media: soil, gw
Key Contaminants: VOCs, other organics (pesticides)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 75
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EPA/ROD/R08-90/042
Rocky Mountain Arsenal (Operable Unit 23), CO
eventh Remedial Action

Abstract (Continued)

contamination in a surficial unconsolidated sand aquifer underlying the site. A plume of dense non-aqueous phase liquids (DNAPLs) was also detected, and is believed to have originated from the Shell Section 36 trenches. The primary contaminants of concern affecting the soil and ground water are VOCs and other organics including pesticides.

The selected interim remedial action for this Operable Unit includes constructing a subsurface barrier around the perimeter of the site, such as a grout curtain tied into an impermeable clay layer located beneath the sand aquifer to effectively contain ground water and DNAPLs; covering the trench area with a vegetative soil cover to reduce precipitation infiltration; and investigating further the DNAPL plume, which is located downgradient of the trench area. The estimated present worth cost for this remedial action is $1,500,000. O&M costs were not provided.

PERFORMANCE STANDARDS OR GOALS: Not applicable.

ROD - MAY 3, 1990
ROCKY MTN. ARSENAL, CO
O.U. 23

DRAFT FINAL DECISION DOCUMENT FOR OTHER CONTAMINATION SOURCES INTERIM RESPONSE ACTION SHELL SECTION 36 TRENCHES, RMA

O.U. 23

Prepared by
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Prepared for
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March 1990

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

1.0 INTRODUCTION

The Shell Section 36 Trenches (Shell Trenches) are listed with the "Remediation of Other Contamination Sources" Interim Response Action (IRA) sites under the Final Technical Program Plan FY88-FY92 and the Federal Facility Agreement. The process and guidelines used to assess alternatives, produce this Proposed Decision Document, and implement this IRA are specified in and conducted in accordance with the Federal Facility Agreement.

As listed in Section 22.8 of the Federal Facility Agreement, the purpose of the Proposed Decision Document for Other Contamination Sources IRAs is to (a) state the objective of the IRA; (b) discuss Interim Response Action alternatives, if any, that were considered; (c) provide the Army's rationale for the alternative selected; (d) present the Army's final ARAR decision; (e) summarize the significant comments received regarding the IRA and the Army's responses to those comments; and (f) establish an IRA Deadline for completion of the IRA, if appropriate.

Each of the above issues is addressed in this document. Comments regarding the Draft Final Alternatives Assessment for Other Contamination Sources Interim Response Action, Shell Section 36 Trenches (Shell 1989a) were addressed in written responses included in the Final Alternatives Assessment for Other Contamination Sources Interim Response Action, Shell Section 36 Trenches (Shell 1990) and are substantively incorporated into this document, where appropriate.

Strategies and system alternatives were evaluated based on their ability to meet the objective of the IRA and achieve the criteria of protection of human health and the environment, reasonableness of cost, cost-effectiveness, attainment of ARARs to the maximum extent practicable, timeliness, and consistency with and

contribution to the Final Response Action. The preferred alternative is a physical barrier (e.g., slurry wall or sheet piling) that encircles the trenches and a soil and vegetative cover to effectively eliminate recharge and the consequential need to extract groundwater.

2.0 SITE DESCRIPTION

2.1 LOCATION AND SITE HISTORY

The Shell Trenches are located in the south-central portion of Section 36 of the RMA (Figure 2-1). They were used from 1952 to 1965 for land disposal of liquid and solid wastes generated from the manufacture of pesticides in the South Plants. Although no definitive records exist, the site of the trenches may also have been used for disposal by the Army prior to 1952 (Shell 1982).

Approximately thirty-one trenches, located in eighteen east-west trending rows, were excavated, partially filled with laboratory and plant wastes, and covered with excavated soils (Figure 2-2). The trenches were excavated from 5 to 10 feet below the surface of the ground. They are between 10 and 20 feet wide and are separated by 3 to 23 feet of undisturbed soil (HLA 1986). The trenches and surrounding berms cover approximately 8 acres.

A variety of organic and inorganic compounds contained in bulk or drummed process intermediates, off-specification product, and laboratory sample filters -- as well as rags, plastic and metal cans, glass jars, piping, pipe fittings, and insulation -- were disposed in the trenches. The exact composition and quantities of the assorted wastes disposed in the trenches are not known.

2.2 HYDROGEOLOGY

The trenches are underlain by 8 to 17 feet of moderately well-sorted, fine-grained, unconsolidated sand interpreted to be eolian in origin (Figure 2-3). This eolian sand unit is underlain by 6 to 11 feet of silty clay interpreted to be eluvial in origin. The eluvial clay unit forms a layer of low

permeability that inhibits the vertical migration of contaminants from the trenches.

Two hydrogeologic units, corresponding to the eolian and eluvial units, have been identified in the trench area. The water table beneath the trenches occurs in the eolian sand unit approximately 6 to 12 feet beneath ground surface (Figure 2-4). Groundwater in this unit flows from the south to the north-northwest. The estimated hydraulic conductivity is 1×10^{-3} to 5×10^{-3} cm/sec.

The eluvial clay unit forms a layer of low permeability underlying the saturated eolian sand unit. In core samples, it appears moist but may not be saturated. Assuming saturation, the estimated vertical hydraulic conductivity is 1×10^{-6} cm/sec or less.

Local recharge to the eolian sand unit is believed to occur within the trench area. Based on estimates of flow and recharge, local recharge may account for a significant portion (i.e., up to 100 percent) of groundwater flow through the trenches.

2.3 NATURE AND EXTENT OF CONTAMINATION

The Shell Trenches have been shown to be a source of soil and groundwater contamination for numerous volatile and semi-volatile compounds (Ebasco 1987 and 1988; Shell 1989a and 1989b). In addition, a dense non-aqueous phase liquid (DNAPL) was found in one well approximately 100 feet north of the northernmost trench. The DNAPL has a specific gravity of 1.324 and a kinematic viscosity of 17.30 centistokes (i.e., one and one-third times denser and twenty times more viscous than water). It consists of organochlorine pesticides, volatile halogenated organic compounds, and semi-volatile halogenated organic compounds. Based on the composition of the DNAPL and its proximity to the

site, the DNAPL is believed to have originated from the Shell Trenches.

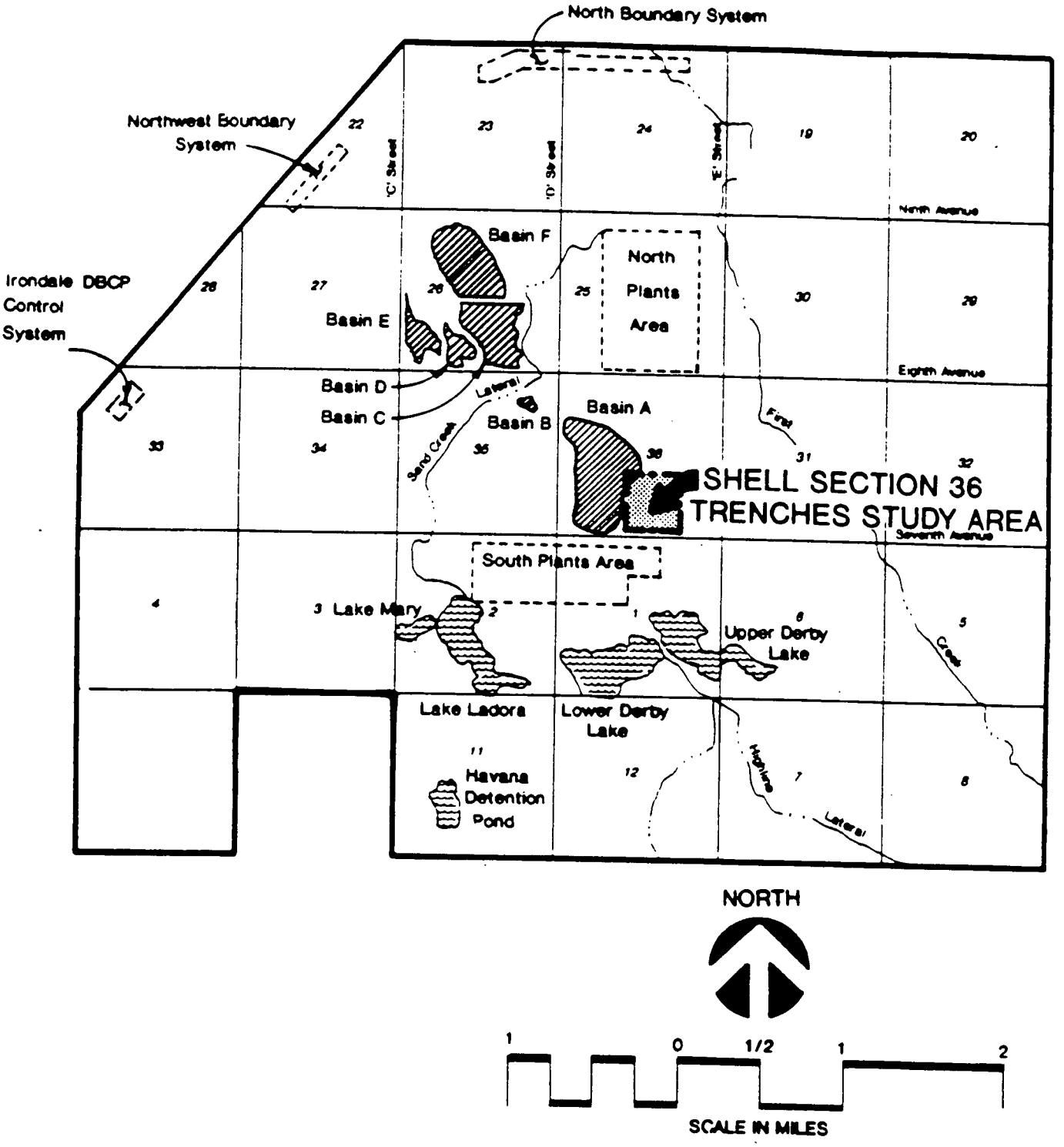

Figure: 2-1

Location Map of Shell Section 36 Trenches

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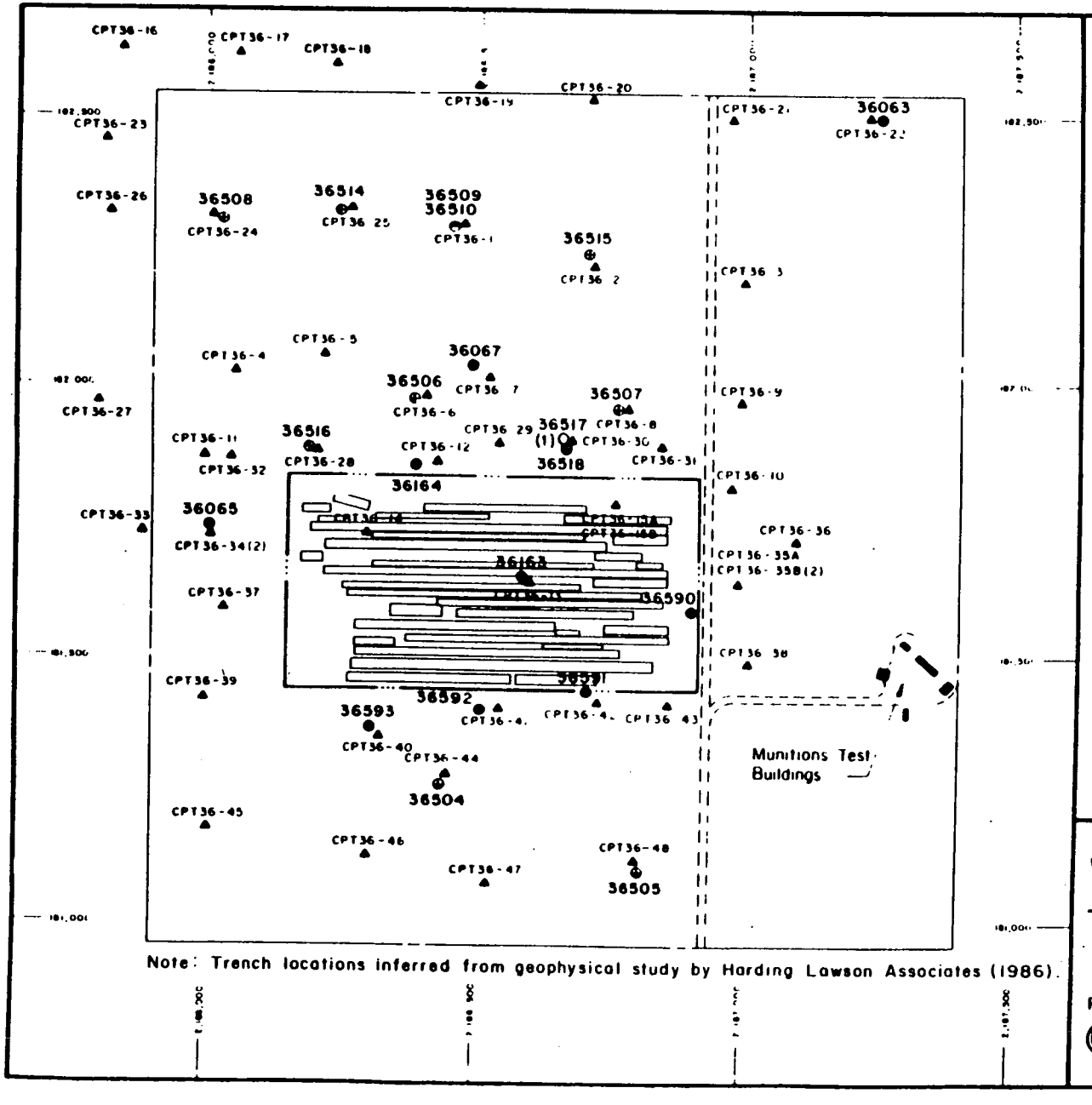
MK-ENVIRONMENTAL SERVICES
A DIVISION OF MK-FERGUSON

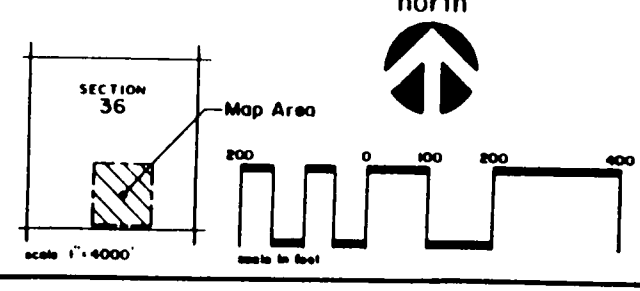


Legend

- Previously Existing Alluvial Monitoring Well
- Newly Installed Alluvial Monitoring Well
- Newly Installed Alluvial Cluster Well
- Newly Completed Cone Penetrometer Test Hole
- Approximate Maximum Extent of Trench Area
- Dirt Road
- CPT 36-1 — Cone Penetrometer Test Hole Identification
- 36508 — Well Identification
- 36517 — Abandoned Alluvial Monitoring Well

Notes: (1) Well 36517
- a Completed 9-21-89
- b Sampled for DNAPL 9-27-89
- c Abandoned 9-29-89

(2) CPT hole twinned with a core boring



Well and Cone Penetrometer Test Hole Location Map

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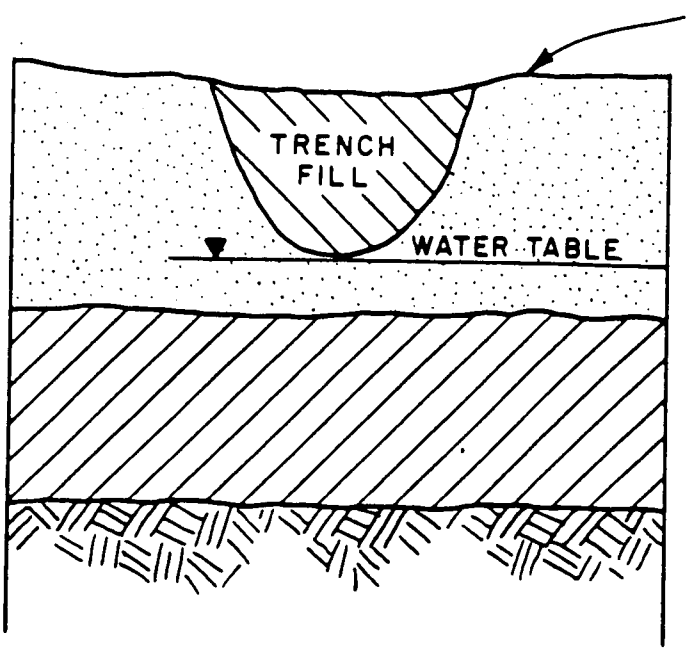
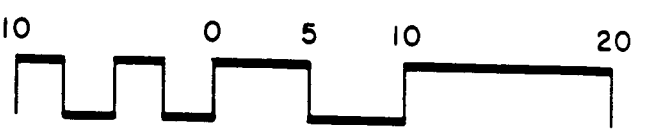
Figure: 2-2



EOLIAN SAND UNIT:
Predominantly Sand; brown fine-grained, moderately well-sorted. Some Silt and Clay present in thin beds or lenses

ELUVIAL CLAY UNIT
Predominantly Silt and Clay; brown, poorly sorted, mottled, moist. Minor fine-grained Sand.

DENVER FORMATION:
Saprolite, Claystone, Siltstone; black, brown, and gray, very weathered, moist to wet.



Scale in feet

Figure: 2-3

Schematic Cross Section in Trench Area

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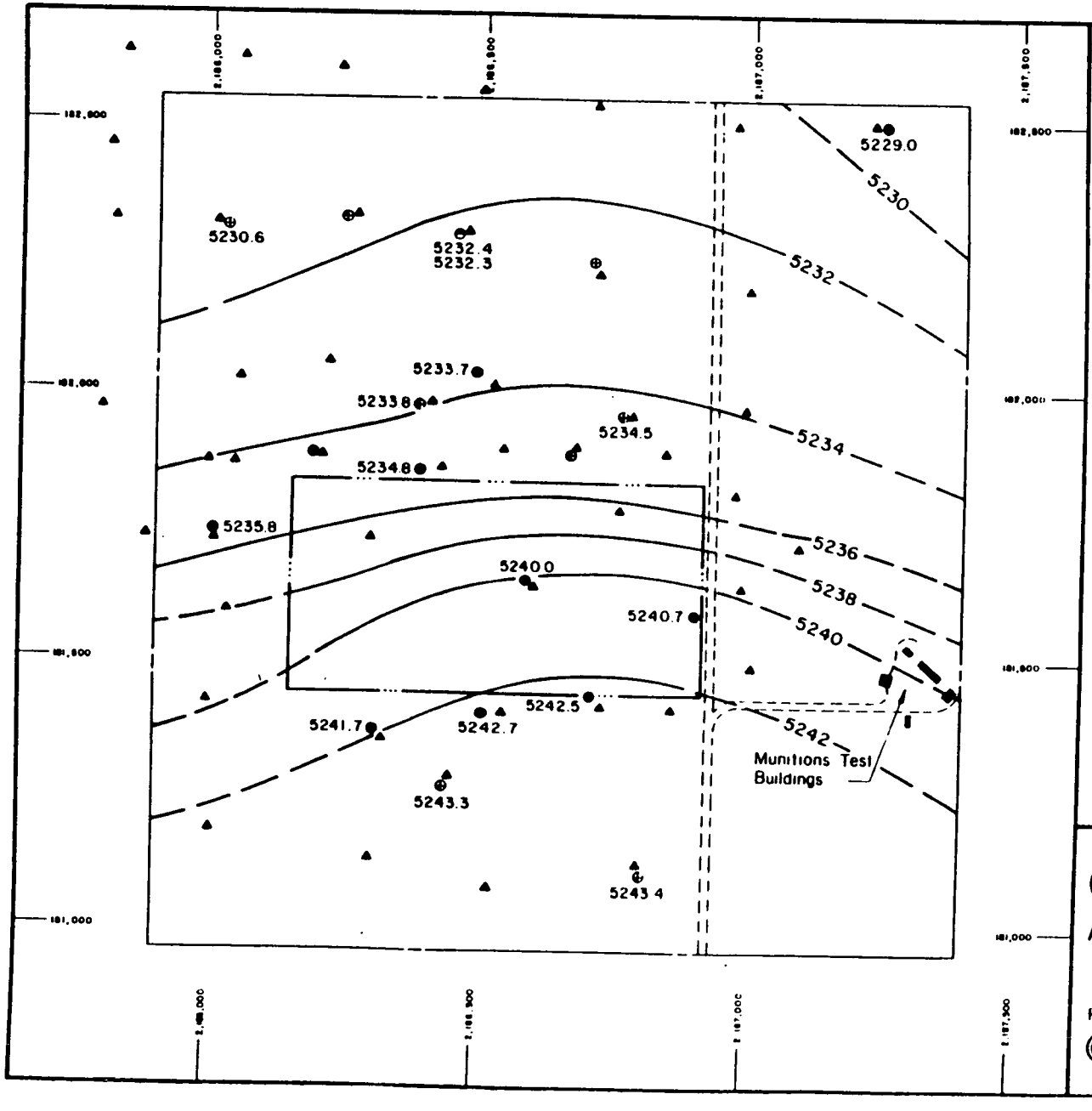
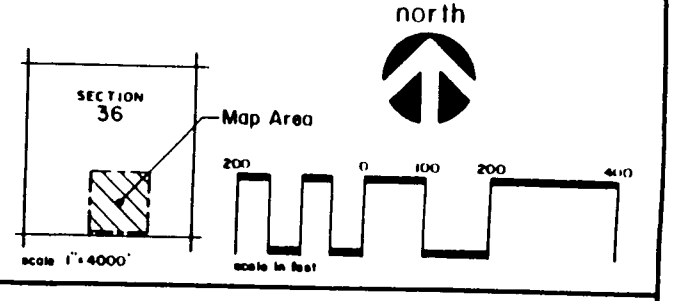


Legend

- Previously Existing Alluvial Monitoring Well
- Newly Installed Alluvial Monitoring Well
- Newly Installed Alluvial Cluster Well
- Newly Completed Cone Penetrometer Test Hole
- Approximate Maximum Extent of Trench Area
- Dirt Road
- 52337 Elevation of Water Level in Feet Above Mean Sea Level
- 5240 Contour Showing Water Level Surface Elevation in Feet Above Mean Sea Level; Dashed Where Inferred



Contour of Water Table

August 1989

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ure. 2-4

3.0 INTERIM RESPONSE ACTION OBJECTIVE

The objective of this IRA is to reduce the lateral migration of dissolved and separate-phase (i.e., DNAPL) contaminants emanating from the Shell Trenches. The vertical migration of contaminants is inhibited by the eluvial clay unit described in Section 2.0.

4.0 INTERIM RESPONSE ACTION ALTERNATIVES

The preferred alternative for this IRA was selected by (a) evaluating alternative strategies (i.e., general interim response actions) against criteria listed in the Federal Facility Agreement, (b) selecting a preferred strategy, (c) developing technologies appropriate for the preferred strategy, (d) combining appropriate technologies into system alternatives, (e) evaluating the system alternatives based on the same criteria, and (f) selecting a preferred system alternative based on its ability to meet the IRA criteria.

The criteria used to assess strategy and system alternatives are specified in the Federal Facility Agreement and include:

(1) Protection of human health and the environment;

(2) Reasonableness of cost;

(3) Cost-effectiveness;

(4) Attainment of Applicable or Relevant and Appropriate Requirements (ARARs), to the maximum extent practicable;

(5) Timeliness; and

(6) Consistency with and Contribution to the efficient performance of the Final Response Actions, to the maximum extent practicable.

4.1 ALTERNATIVE STRATEGIES

The strategies that were considered for this IRA are:

(1) No Action;

(2) Monitoring/Maintenance;

(3) Excavation;

(4) In-Situ Remediation; and

(5) Containment.

Each strategy was evaluated based on its ability to meet the IRA criteria. However, if a strategy did not meet the objective of the IRA -- which is to reduce the lateral migration of contaminants emanating from the Shell Trenches -- it was eliminated without discussion of its ability to meet any of the IRA criteria.

4.1.1 No Action

The No Action alternative was eliminated as a strategy for this IRA because it does not meet the objective of the IRA, which is to reduce the lateral migration of contaminants emanating from the Shell Trenches.

4.1.2 Monitoring/Maintenance

A Monitoring/Maintenance strategy consists of (1) monitoring groundwater and air at sufficient frequencies to ensure knowledge of any change in the extent of contamination until implementation of the Final Remedy, and (2) implementing institutional controls to prevent or reduce human and non-human biotic access to the area of contamination. Similar to the No Action strategy, the Monitoring/Maintenance strategy was eliminated because it did not meet the objective of the IRA.

4.1.3 Excavation

An excavation strategy consists of removal of the contents of the trenches and contaminated soils, followed by temporary storage of the removed material and/or treatment and disposal of these

materials. Although an excavation strategy meets the IRA objective of reducing the lateral migration of contaminants emanating from the Shell trenches, it does not meet the IRA criteria of timeliness, reasonableness of cost, or cost-effectiveness.

Excavation, waste characterization, and evaluation and implementation of treatment technologies or construction of an interim waste storage facility would require significant periods of time (four to five years) and be very costly (potentially $100 million or more). The large time periods and costs estimated for this strategy result from the heterogeneity, complexity, and character of the materials in the trenches.

In comparison to containment (which meets the objective of the IRA and attains all the IRA criteria), excavation and waste characterization is not timely, reasonable in cost, or cost-effective. For these reasons, it was eliminated as a viable strategy for this IRA.

4.1.4 In-Situ Remediation

In-situ remediation comprises treatment technologies that are conducted in place (i.e., without excavating or extracting any materials). These technologies include vitrification and vacuum venting. Vacuum venting was eliminated because it was not appropriate for the large concentrations of contaminants in the Shell Trenches. Vitrification was eliminated because of the unpredictable reactions that might occur in the presence of metal drums containing organic liquids.

4.1.5 Containment

A containment strategy consists of a physical barrier, recovery trench, or groundwater interception system that inhibits the lateral migration of contaminants away from the Shell Trenches. It meets the objective of the IRA as well as all the IRA criteria. A containment strategy protects human health and the environment by inhibiting contaminant migration; it is reasonable in cost and cost-effective (i.e., less than $3 million); it can be expected to meet ARARs to the maximum extent practicable and can be implemented in a timely manner (two years or less); and it can reasonably be assumed to be consistent with and contribute to the efficient performance of the Final Response Action by reducing the spread of contamination during the IRA.

In summary, a containment strategy fulfills all the assessment criteria required for Interim Response Actions under the Federal Facility Agreement, while the other strategies do not. For these reasons, containment is selected as the preferred strategy for the Shell Trenches IRA.

4.2 SYSTEM ALTERNATIVES

Three system alternatives that achieve the strategy of containment were developed and evaluated using the IRA criteria listed in the beginning of this chapter. They are:

(1) Constructing and Operating a Recovery Trench Downdip and Downgradient of the Shell Trenches and Extracting Groundwater and DNAPLs;

(2) Encircling the Shell Trenches with a Physical Barrier and Extracting Groundwater; and

(3) Encircling the Shell Trenches with a Physical Barrier and Constructing a Soil and Vegetative Cover.

All of the above system alternatives meet the objective of the IRA, are protective of human health and the environment, capable of achieving ARARs to the maximum extent practicable, timely, reasonable in cost, and consistent with the Final Response Actions to the maximum extent practicable. Therefore, they were primarily evaluated on cost-effectiveness and functional advantages or disadvantages.

4.2.1 Constructing and Operating a Recovery Trench Downdip and Downgradient and Extracting Groundwater and DNAPLs

The first alternative consists of constructing a recovery trench downdip and downgradient of the Shell Trenches. The recovery trench would be keyed into the eluvial clay. Groundwater and DNAPLs would be collected in and extracted from the recovery trench. Extracted groundwater would be treated in the CERCLA wastewater facility; DNAPLs would be placed in an onsite temporary storage facility.

The potential advantage of this alternative is that it actively removes contaminants from the Shell Trenches site. However, the total amount of contaminants that would be removed from the site during the IRA is insignificant relative to the total amount of contaminants that exist at the site because of the high viscosity (i.e., twenty times that of water) and consequently low flowrates of DNAPL.

The present value of this alternative is estimated to be approximately $2,900,000. This cost is nearly double in cost to the third alternative (Section 4.2.3) and is not justified by a commensurately higher level of containment than the third

alternative. For these reasons, it is not believed to be cost-effective and is eliminated as a viable alternative for this IRA.

4.2.2 Encircling Shell Trenches with a Physical Barrier and Extracting Groundwater

The second alternative consists of encircling the trenches with a physical barrier and regulating water levels within the enclosure by extracting groundwater. The physical barrier would be keyed into the eluvial clay. Extracted groundwater would be treated in the CERCLA wastewater facility. DNAPLs would not be extracted.

This alternative has the potential advantage of maintaining a reverse gradient across the physical barrier. However, because the saturated thickness of eolian sediments is so small and the life of the IRA so short, a reverse gradient is not necessary to effectively contain contaminants during this IRA.

The present value of this alternative is estimated to be approximately $2,900,000. Similar to the first alternative, this alternative is nearly twice as expensive as the third alternative without a commensurately higher level of containment. Therefore, it is not cost-effective and is eliminated as a viable alternative for this IRA.

4.2.3 Encircling Shell Trenches with a Physical Barrier and Constructing a Soil and Vegetative Cover

The third alternative consists of encircling the Shell Trenches with a physical barrier and providing a soil and vegetative cover to inhibit recharge. The physical barrier would be keyed into the eluvial clay. The soil and vegetative cover would effectively eliminate recharge and, therefore, eliminate the need to extract groundwater from within the enclosure.

The primary functional advantages of encircling the trenches and eliminating recharge are minimal operation and maintenance. Both groundwater and DNAPLs within the enclosure would be contained, but neither would need to be extracted or treated as part of this IRA. These functional advantages result in lower costs than the other alternatives that recover groundwater and/or DNAPLs for similar effectiveness. The present value of this alternative is estimated to be approximately $1,500,000. This cost is approximately one-half that of the first two alternatives.

This third alternative is protective of human health and the environment, is reasonable in cost, cost-effective, can be expected to achieve ARARs to the maximum extent practicable, can be implemented in a timely manner, and is expected to be consistent with and contribute to the efficient performance of the Final Response Action. For these reasons, it is selected as the preferred alternative for this IRA.

5.0 CHRONOLOGY OF EVENTS

The significant events that lead to the decision to select a containment system with a soil and vegetative cover as the preferred alternative for the Shell Section 36 Trenches IRA are as follows:

Date	Event
June 1987	The State of Colorado, Shell Oil Company, U.S. EPA, and U.S. Army agreed to 13 Interim Response Actions (including the Shell Section 36 Trenches).
June 1987	The U.S. Army completed Final Phase I Contamination Assessment Report, Site 36-3: Insecticide Pit, Version 3.3 (Ebasco 1987).
September 1988	The U.S. Army completed Final Phase II Data Addendum, Site 36-3: Insecticide Pit, Version 3.1.
February 1988	Proposed Consent Decree lodged in the case of U.S. v. Shell Oil Company with the U.S. District Court in Denver, Colorado. The Consent Decree specified 13 Interim Response Actions (including the Shell Section 36 Trenches).
February 1989	The Federal Facility Agreement specified that the Shell Section 36 Trenches site is one of several sites where Interim Response Actions are proposed.
September 1989	Shell Oil Company submitted Draft Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, Shell Section 36 Trenches, RMA (Shell 1989a) to the U.S. Army. The Army issued this report to the Organizations and the State on September 29, 1989 for review and comment. Results of field investigations and proposed alternatives were presented. Containment was recommended as the preferred strategy.

November 1989	Shell Oil Company received comments f om the U.S. EPA, U.S. Army, U.S. DOI, and th State on the Draft Final Alternatives Asse ment for Other Contamination Sources, Int im Response Action, Shell Section 36 T ches, RMA on November 2, 1989.
December 1989	Shell Oil Company submitted Results Field Investigations Conducted August an ptember 1989, Shell Section 36 Trenches, Ro y Mountain Arsenal (Shell 1989b) to the U.S. Army. The Army issued this report to the Organizations and the State on December 21, 1989.

6.0 DESCRIPTION OF THE INTERIM RESPONSE ACTION

The selected strategy for the Shell Trenches IRA is containment. Each of the three system alternatives described in Section 4.2 are viable options that meet the objective of the IRA, are protective of human health and the environment, can attain ARARs to the maximum extent practicable, and can be implemented on a timely basis. On a cost basis, the physical barrier encircling the trenches with a soil and vegetative cover (i.e., passive containment) is the most reasonable and cost-effective.

For these reasons, the preferred Interim Response Action consists of a physical barrier encircling the trenches and a soil and vegetative cover. The physical barrier will be keyed into the eluvial clay. The exact location and northernmost extent of the physical barrier will be based on all available data during engineering design. The soil and vegetative cover will be constructed to prevent recharge and the consequential rise of water levels within the enclosure.

In addition to a passive containment system, a field investigation of DNAPLs that may exist downgradient and downdip of the known location of DNAPLs (i.e., Well 36517) will be conducted. Based on the results of the investigation, an interim response action (if necessary) will be proposed either as a modification of this IRA pursuant to paragraph 22.16 of the Federal Facility Agreement or as a separate, new IRA pursuant to paragraph 22.1(1) of the Federal Facility Agreement.

The major assumptions upon which the selection of this passive containment system alternative is based will be verified during the preparation of the Implementation Document for this IRA. If differences between the assumed and actual conditions are

significant, the selection of this alternative may be re-evaluated.

7.0 IRA PROCESS

The IRA process for the Shell Trenches IRA is as follows:

1. As Lead Party, Shell prepared a Draft Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, Shell Section 36 Trenches, RMA. The report was submitted to the U.S. Army for issuance to the Department of Interior (DOI) and the other Organizations and the State for review and comment. Comments were submitted by the U.S. Army, U.S. DOI, U.S. EPA, and the State.

2. After the issuance of the Draft Final Alternatives Assessment, DNAPLs were discovered in a well at the site. Based on this discovery and on concerns about adequate time for review by the U.S EPA and the State, the dates for issuance of both the Final Alternatives Assessment and the Proposed Decision Document were postponed to January 26, 1990.

3. Shell, DOI, and the other Organizations and State will be afforded the opportunity to participate, at the RMA Committee level, in the identification and selection of ARARs pertinent to this IRA.

4. As Lead Party, Shell submits this Proposed Decision Document for the Shell Section 36 Trenches IRA to the U.S. Army for issuance to the DOI and other Organizations and State. It includes the Army's final ARARs decision. Upon issuance, the Proposed Decision Document is subject to a 30-day public comment period during which the other Organizations and State, the DOI, or any other person may comment on it. Time

permitting, the Army shall hold at least one public meeting during the comment period to inform the community in the vicinity of the Arsenal about this IRA.

5. Promptly after the close of the comment period, Shell will submit the Draft Final Decision Document for the Shell Trenches IRA to the U.S. Army for transmittal to the DOI and other Organizations and State.

6. Within 20 days after issuance of the Draft Final Decision Document for the Shell Trenches IRA, an Organization (including the State if it has agreed to be bound by the Dispute Resolution process, as required by the Federal Facility Agreement, or DOI under circumstances set forth in the Federal Facility Agreement) may invoke Dispute Resolution. Dispute Resolution may concern either the proposed IRA or the Army's ARAR decision.

7. After the close of the period invoking Dispute Resolution (if Dispute Resolution is not invoked) or after the completion of Dispute Resolution (if invoked), Shell shall submit a Final Decision Document for the Shell Trenches IRA to the Army. The Final Decision Document will include comments received on the Proposed Decision Document and responses to those comments. The Army shall then issue a Final Decision Document to the other Organizations, the State, and DOI. If Dispute Resolution has been invoked, the decision may be subject to judicial review in accordance with Section 39.2 of the Federal Facility Agreement.

8. Following issuance of the Final IRA Decision Document, Shell shall be the Lead Party responsible for designing and implementing the IRA in conformance with the Decision Document. Shell shall issue a Draft Implementation Document to the DOI and the other Organizations for review and comment. This Draft Implementation Document shall include final drawings and specifications, final design analyses, a cost estimate, and a schedule for implementation of the IRA.

9. As Lead Party for design and implementation of this IRA, Shell will issue the Final Implementation Document, as described above, and will be responsible for implementing the IRA in accordance with the IRA Implementation Document.

8.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE REMEDIATION OF OTHER CONTAMINATION SOURCES (SECTION 36 TRENCHES) INTERIM RESPONSE ACTION

8.1 INTRODUCTION

These Applicable or Relevant and Appropriate Requirements (ARARs) address a specific area identified for evaluation for remediation prior to the issuance of a Record of Decision (ROD) for the Onpost Operable Unit of the Rocky Mountain Arsenal. The remedial actions selected involve monitoring for the Army trenches and a containment approach involving a physical barrier and cover for the Shell trenches. Some standards are discussed in general terms, to be further defined as more specific remedial actions are identified.

8.2 AMBIENT OR CHEMICAL-SPECIFIC ARARS

Ambient or chemical-specific requirements set concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. Such ARARs either set protective cleanup levels for the chemicals of concern in the designated media or indicate an appropriate level of discharge based on health and risk-based analyses and technological considerations.

The objectives of this IRA are discussed in the Final Assessment Documents. This IRA will be implemented prior to the final remediation to be undertaken in the context of the Onpost Operable Unit ROD. The lists of specific contaminants included in the Final Assessment Documents have been completed based upon the field data concerning these specific sources. The media of concern here are the water and the soils in the trench areas

considered for remediation. However, no ambient or chemical-specific ARARs were identified concerning levels of contaminants for soils. Since the selected approaches for this IRA do not involve the treatment of groundwater from the area of either the Army or Shell trenches, no chemical-specific ARARs concerning water were selected for this IRA.

Air Emissions

The approaches selected by this IRA do not involve the operation of any treatment system which will result in air emissions. The capping in the area of the Shell trenches is expected to substantially reduce any current emissions coming from the soils in their current state. The monitoring to take place in the area of the Army trenches will not affect any emissions that may originate in that area, but air monitoring will identify any potential concerns regarding emissions from this area.

The standards contained at 40 CFR Part 50 were reviewed and determined to be neither applicable nor relevant and appropriate to apply as specific limitations to this IRA. These standards apply to Air Quality Control Regions (AQCR), which are markedly dissimilar from the area within which activity is being conducted pursuant to this IRA. An AQCR is generally a very large area, covering many square miles. The trenches cover an extremely small area, far smaller than an AQCR. These standards are not generally applied to specific emissions sources, such as automobile tailpipes or smokestacks. These considerations lead to the determination that these ambient air standards are neither relevant nor appropriate to apply as specific limitations within the context of this IRA.

Other air standards, such as those contained at 40 CFR Parts 60 and 61 and similar state standards such as those contained at 5

CCR 1001-10, Regulation 8 were not considered as potential ARARs since the IRA will not include a treatment system which causes air emissions.

8.3 LOCATION-SPECIFIC ARARS

Location-specific requirements set restrictions on activities, depending on the characteristics of the site or the immediate environment, and function like action-specific requirements. Alternative remedial actions may be restricted or precluded, depending on the location or characteristic of the site and the requirements that apply to it.

Paragraph 44.2 of the Federal Facility Agreement provides that "wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act (16 U.S.C. 1531 et seq.), migratory birds to the extent required by the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), and bald eagles to the extent required by the Bald Eagle Protection Act, 16 U.S.C. 688 et seq."

While this provision is not an ARAR, the statutory requirements are ARARs and will be complied with for purposes of this IRA. Based on where facilities related to this IRA are likely to be located the Army believes that this IRA will have no adverse impact on any endangered species or migratory birds or on the protection of wildlife habitats. Coordination will be maintained with the U.S. Fish and Wildlife Service to ensure that no such adverse impact arises from implementation of this IRA.

The provisions of 40 CFR 6.302(a) and (b) regarding construc. n that would have an adverse impact on wetlands or be within a floodplain are considered relevant and appropriate to apply in the context of this IRA. The Army will comply with these

regulations to the maximum extent practicable to avoid construction conducted pursuant to this IRA in a manner the would have an adverse impact on wetlands or be within a flood plain.

The regulations at 40 CFR 230 were reviewed and determined not to be applicable within the context of this IRA because no discharge of dredged or fill material into waters of the United States is contemplated. Because these regulations address only the disposal of such materials into the waters of the United States, which is not contemplated, they are not considered to be relevant and appropriate to apply in the context of this IRA.

The regulations at 33 CFR 320-330 were reviewed and determined to be neither applicable nor relevant and appropriate because they address actions affecting the waters of the United States. No such actions are contemplated within the context of this IRA.

8.4 ACTION-SPECIFIC ARARS

Description

Performance, design, or other action-specific requirements set controls or restrictions on activities related to the management of hazardous substances, pollutants, or contaminants. These action-specific requirements may specify particular performance levels, actions, or technologies as well as specific levels (or a methodology for setting specific levels) for discharged or residual chemicals.

Construction Occurring Incident to the IRA

Air Emissions

On the remote possibility that there may be air emissions during the course of the construction associated with this IRA, the Army has reviewed all potential ambient or chemical-specific air emission requirements. As a result of this review, the Army found that there are, at present, no National or State ambient air quality standards currently applicable or relevant and appropriate to any of the volatile or semivolatiles chemicals in the ground water found in the area in which construction is contemplated.

In the context of this IRA, there is only a very remote chance of any release of volatiles or semivolatiles and, even if such a release did occur, it would only be intermittent and of very brief duration (because the activity that produced the release would be stopped and modified appropriately if a significant air emission, based upon specific standards contained in the Health and Safety Plan, was detected by the contractor's air monitoring specialist). The Army has significant experience with the construction of extraction and reinjection wells and has not experienced any problems from air emissions during construction of such facilities. Since minimal excavation of saturated material is anticipated, it is not believed that air emissions are likely to occur, as they might if large amounts of saturated material were excavated and necessitated drying. The site-specific Health and Safety Plan will adequately address these concerns. This plan to be developed for use in the IRA will detail operational modifications to be implemented in the event monitoring detects specific levels of such emissions.

The National Emissions Standards for Hazardous Air Pollutants (NESHAPS) were evaluated to determined whether they were applicable or relevant and appropriate to apply in the context of construction of this IRA. These standards were not considered applicable because they apply to stationary sources of these pollutants, not to construction activity. These standards were not considered relevant and appropriate because they were developed for manufacturing processes, which are significantly dissimilar to the short-term construction activity contemplated by this IRA.

The provisions of 40 CFR 50.6 will be considered relevant and appropriate. This standard is not applicable because it addresses Air Quality Control Regions, which are areas significantly larger than and different from the area of concern in this IRA. Pursuant to this regulation, there will be no particulate matter transported by air from the site beyond the installation boundary that is in excess of 50 micrograms per cubic meter (annual geometric mean) and the standard of 150 micrograms per cubic meter as a maximum 24-hour concentration will not be exceeded more than once per year.

The provisions of Colorado Air Pollution Control Regulation No. 2, concerning odor emissions is considered relevant and appropriate to apply at the installation boundary.

Worker Protection

The provisions of 29 CFR 1901.120 are applicable to workers at the site because these provisions specifically address hazardous substance response operations under CERCLA. It should be noted that these activities are presently governed by the interim rule found at 29 CFR 1910.120 but that by the time IRA activity commences at the site, the final rule found at 54 FR 9294 (March

6, 1989) will be operative. The final rule became effective on March 6, 1990.

General Construction Activities

The following performance, design, or other action-spe fic State ARARs have been identified by the Army as applicable:

Colorado Air Pollution Control Commission Regulation No. 1, 5 CCR 1001-3, Part III(D)(2)(b), Construction Activities:

a. Applicability - Attainment and Nonattainment Areas

b. General Requirement

Any owner or operator engaged in clearing or leveling of land or owner or operator of land that has been cleared of greater than one (1) acre in nonattainment areas for which fugitive particulate emissions will be emitted shall be required to use all available and practical methods which are technologically feasible and economically reasonable in order to minimize such emissions, in accordance with the requirements of Section III.D. of this regulation.

c. Applicable Emission Limitation Guideline

Both the 20% opacity and the no off-property ansport emission limitation guidelines shall apply to construction activities; except that with resp to sources or activities associated with construct n for which there are separate requi.ements set forth n this regulation, the emission limitation guidelines t ere specified as applicable to such sources and activities

shall be evaluated for compliance with the requirements of Section III.D. of this regulation. (Cross Reference: Subsections e. and f. of Section III.D.2 of this regulation).

d. Control Measures and Operating Procedures

Control Measures or operational procedures to be employed may include but are not necessarily limited to planting vegetation cover, providing synthetic cover, watering, chemical stabilization, furrows, compacting, minimizing disturbed area in the winter, wind breaks, and other methods or techniques.

Colorado Ambient Air Quality Standards, 5 CCR 1001-14, Air Quality Regulation A, Diesel-Powered Vehicle Emission Standards for Visible Pollutants:

a. No person shall emit or cause to be emitted into the atmosphere from any diesel-powered vehicle any air contaminant, for a period greater than 10 consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity, with the exception of Subpart B below.

b. No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated diesel-powered vehicle of over 8,500 lbs gross vehicle weight rating operated above 7,000 feet (mean sea level), any air contaminant for a period of 10 consecutive seconds, which is of a shade or density as to obscure an observer's vision to a degree in excess of 50% opacity.

c. Diesel-powered vehicles exceeding these requirements shall be exempt for a period of 10 minutes, if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position.

d. This standard shall apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways.

Colorado Noise Abatement Statute, C.R.S. Section 25-12-103:

a. Each activity to which this article is applicable shall be conducted in a manner so that any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Sound levels of noise radiating from a property line at a distance of twenty-five feet or more there from in excess of the db(A) established for the following time periods and zones shall constitute prima facie evidence that such noise is a public nuisance:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in subsection (1) of this section may be increased by ten db(A) for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five db(A) less than those listed in Subpart (a) of this section.

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements.

In substantive fulfillment of Colorado Air Pollution Control Commission Regulation No. 1, this IRA will employ the specified methods for minimizing emission from fuel burning equipment and construction activities. In substantive fulfillment of Colorado's Diesel-Powered Vehicle Emission Standards, no diesel motor vehicles associated with the construction shall be operated in manner that will produce emissions in excess of those specified in these standards.

The noise levels pertinent for construction activity provided in C.R.S. Section 25-12-103 will be attained in accordance with this applicable Colorado statute.

Wetlands Implications

Through estimation of the general area where any construction would occur or facilities be located, the Army does not believe that any wetlands could be adversely affected. However, until a final design is selected, it cannot be definitively determined that no impact on wetlands will occur. If the final site selection and/or design results in an impact on wetlands, the Army will review the regulatory provisions concerning wetlands impact, generally identified as relevant and appropriate in the discussion of location-specific ARARs above, and other appropriate guidance, and will proceed in a manner consistent with those provisions. Coordination will be maintained with the U.S. Fish and Wildlife Service concerning any potential impacts on wetlands.

Construction of Physical Barrier and Cover for Shell Trenches

The substantive standards contained in 40 CFR §264.310, specifically those requirements contained in subsections a(2)-(4) and b(1) and (4), which describe the necessary standards and actions concerning landfill covers, are considered relevant and appropriate to apply to the construction and continued operation of this cover.

Land Disposal Restrictions and Removal of Soil

There are no action-specific ARARs that pertain to the excavation of soil during the construction associated with this IRA.

EPA is currently developing guidance concerning the Land Disposal Restrictions (LDR). While guidance is limited, the Army has not, at this time, made a determination that any waste subject to LDR will be present in the soil removed by this IRA. Further EPA guidance concerning the applicability of LDRs to CERCLA actions is likely to be issued prior to the implementation of this IRA and the Army will review such guidance as it is released. If it is determined that a waste subject to LDR is present, the Army will act in a manner consistent with EPA guidance then in effect for the management of such within the context of CERCLA actions.

Although removal of soil from the area where construction activity will take place is a TBC, not an ARAR, it will be performed in accordance with the procedures set forth in the Task No. 32 Technical Plan, Sampling Waste Handling (November 1987), and EPA's July 12, 1985, memorandum regarding "EPA Region VIII Procedure for Handling of Materials from Drilling, Trench Excavation and Decontamination during CERCLA RI/FS Operations at the Rocky Mountain Arsenal." Soils, not included for further treatment, generated by excavation during the course of this IRA, either at surface or subsurface, may be returned to the location from which they originated (i.e., last out, first in). Any materials remaining after completion of backfilling that are suspected of being contaminated (based on field screening techniques) will be properly stored, sampled, analyzed, and ultimately disposed as CERCLA hazardous wastes, as appropriate.

For material determined to be hazardous waste resulting from construction activities, substantive RCRA provisions are applicable to their management. These substantive provisions include but are not limited to: 40 CFR Part 262 (Subpart C, Pre-Transport Requirements), 40 CFR part 263 (Transporter Standards), and 40 CFR Part 264 (Subpart I, Container Storage and Subpart L, Waste Piles). The specific substantive standards applied will be

determined by the factual circumstances of the accumulation, storage or disposal techniques actually applied to any such material.

Soil Treatment and Disposal

These proposed remedial actions do not include any significant possibility of on-site or off-site disposal of soils or contaminated material excavated pursuant to this IRA. The selected alternative of monitoring for the Army trenches only involves minimal excavation and should result in only small amounts of excavated soil remaining to be handled as discussed above. The containment structures contemplated in connection with the Shell trenches will result in some excavation of soil. However it is intended that the excavated soil be retained in the area of the trenches, covered by the containment structures which are to be built pursuant to this IRA. In the event that some material is later considered for disposal, ARARs for such activities have been generally identified, with more specific analysis to follow after any specific disposal determination is made. On-site disposal of material is not contemplated. For off-site disposal of hazardous material the administrative and substantive provisions of 40 CFR Part 262, Subparts A,B,C and D, and any substantive provisions of 6 CCR 1007-3, Part 262, Subparts A,B,C and D which are more stringent than the corresponding federal regulations, are considered relevant and appropriate.

8.5 COMPLIANCE WITH THE OTHER ENVIRONMENTAL LAWS

As is evident from the various portions of this document this IRA was prepared in substantive compliance with 40 CFR 15 2.16 (the regulations implementing the National Environmental olicy Act of 1969).

9.0 SCHEDULE

Consistent with the Federal Facility Agreement and the Final Technical Program Plan FY88-FY92, the milestone for completing the Draft Implementation Document for the Shell Trenches IRA is December 19, 1990. The Deadline for completing the IRA will be established in the Implementation Document, but is presently expected to be January 24, 1993.

10.0 CONSISTENCY WITH FINAL RESPONSE ACTION

Although the Final Response Action has not yet been se ɔted, it is believed that this IRA will be consistent with and ɲtribute to the efficient performance of the Final Response Act ɔn by reducing the spread of contaminants in groundwater and separate-phase liquids emanating from the Shell Trenches.

11.0 REFERENCES

Ebasco Services, Inc., (Ebasco) 1987. Final Phase I Contamination Assessment Report, Site 36-3: Insecticide Pit, Version 3.3.

Ebasco Services, Inc., (Ebasco) 1988. Final Phase II Data Addendum, Site 36-3: Insecticide Pit, Version 3.1.

Harding Lawson Associates (HLA), 1986. Geophysical Investigation of Contaminant Sources 36-3, 36-10, 36-17.

Shell, 1982. Letter Technical Report dated May 7, 1980; re: Contamination of Groundwater -- Section 36 of the Rocky Mountain Arsenal, from Group Leader, Office Engineering to: CF: 804-4.

Shell, 1989a. Draft Final Alternatives Assessment for Other Contamination Sources Interim Response Action, Shell Section 36 Trenches, RMA.

Shell, 1989b. Results of Field Investigations Conducted August and September 1989, Shell Section 36 Trenches, Rocky Mountain Arsenal.

Shell, 1990. Final Alternatives Assessment for Other Contamination Sources Interim Response Action, Shell Section 36 Trenches, RMA.

APPENDIX A

COMMENTS AND RESPONSES ON THE DRAFT ARARS

RESPONSES TO STATE COMMENTS ON
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOR THE REMEDIATION OF OTHER CONTAMINATION SOURCES
(SHELL TRENCHES) INTERIM RESPONSE ACTION

1. Page 22, paragraph 3: The section on air emissions states that the standards of 40 C.F.R. Part 50, the National Primary and Secondary Ambient Air Quality Standards, are considered neither applicable nor relevant and appropriate to the IRA. The State has previously commented on the inappropriateness of not considering the standards as ARARs. These standards are clearly ARARs because the area affected by the IRA is within an Air Quality Control Region. In addition, the provisions of 40 CFR 50.6 are considered relevant and appropriate later in the ARARs analysis (p.26) making the above-specified paragraph inconsistent with the Army's later analysis. The document should be revised to include the National Primary and Secondary Ambient Air Quality Standards as ARARs.

RESPONSE: The Draft Final Decision Document has been revised to reflect that the specific limitations contained in 40 CFR Part 50 are neither applicable nor relevant and appropriate to apply to a specific emissions source. The provisions of 40 CFR § 50.6 are not applied to a specific source.

2. Page 25, paragraph 2: The paragraph provides that the Army has concluded that there are no federal or State ambient air quality ARARs involving construction of the IRA system. However, Colorado Regulation No. 7, pertaining to Volatile Organic Compounds should be identified as an ARAR. Regulation 7, part V requires that reasonably available Control Technology (RACT) be used for disposal of VOCs.

RESPONSE: The Army has reviewed the cited regulation and concluded that it is neither applicable nor relevant and appropriate to apply to construction activity such as that contemplated by this IRA. It is noted that the VOC emission levels cited in this regulation far exceed any reasonably anticipated emissions which could result during construction activities.

3. Page 26, paragraph 2: The paragraph states that the provisions of 40 C.F.R. Section 50.6 are considered relevant and appropriate. However, Shell should also consider Colorado Ambient Air Standards for Total Suspended Particulates (TSP), which are stricter than the federal standards. The State has not yet adopted the federal PM10 standard, but rather invokes the TSP standards. Therefore, both the federal and State standards apply as ARARs. Colorado's TSP standard is 150 ug/m3 (24-maximum concentration) and 60 ug/m3 (annual geometric mean). This standard is applicable at the property boundary and includes background concentrations as well as source impacts.

RESPONSE: The Draft Final Decision Document was revised in response to this comment. It is noted that the Army, not Shell, is responsible for the identification of ARARs.

4. Page 26, paragraph 4: In the section on general construction activities ARARS, Colorado regulation No. 2, pertaining to odorous emissions, should be included. For a predominantly residential or commercial area, the standard requires that odors must not be detected after the emissions have been diluted with seven or more volumes of odor-free a .

RESPONSE: The Draft Final Decision Document was revised in response to this comment.

03/22/90

5. Page 33, paragraph 2: The document provides that for off-site disposal of hazardous material, the substantive provisions of 40 CFR 262 and stricter corresponding State regulations found at 6 CCR 1007-3, part 262, are considered relevant and appropriate. However, for any off-site disposal of hazardous wastes, Shell must comply with all pertinent Colorado Hazardous Waste Management Act regulations, both procedural and substantive, including 6 CCR 1007-3, part 262.

RESPONSE: The Draft Final Decision Document was revised in response to this comment. See also response to comment 3.

RESPONSES TO SHELL'S COMMENTS ON THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE COMPLEX DISPOSAL TRENCHES IRA AND SHELL TRENCHES IRA

With respect to the above-referenced documents, Shell Oil Company reserves the right to comment on how any substantive RCRA standards, including land disposal restrictions, may apply to the IRAs.

RESPONSE: Shell's comment is noted. As Shell is aware, the IRA process provides for further opportunity for review and comment.

APPENDIX B

COMMENTS AND RESPONSES

SHELL'S RESPONSES TO EPA COMMENTS ON PROPOSED DECISION DOCUMENT FOR OTHER CONTAMINATION SOURCES IRA SHELL SECTION 36 TRENCHES

1. COMMENT:

Justification for not including the Denver Formation in this IRA is needed.

RESPONSE:

As described in the Proposed Decision Document, the Shell Trenches are located in unconsolidated fine-grained eolian sand. Underlying the eolian sand is a 6 to 17 feet thick eluvial clay unit that consists of massive brown to gray clay with minor interbeds of silt and silty clay. The Denver Formation underlies the clay unit and, in this study area, consists of silty claystones and clayey siltstones.

Average hydraulic conductivities for fine-grained sand range from 10^{-2} cm/sec to aproximately 10^{-4} cm/sec, while clays range from 10^{-6} cm/sec to 10^{-9} cm/sec. The vertical hydraulic conductivity of clays like those underlying the Shell Trenches approach those required for hazardous waste landfills (i.e., 10^{-7} cm/sec). Therefore, for the life of the IRA, the eluvial clay effectively inhibits the vertical migration of both DNAPLs and contaminants dissolved in groundwater.

2. COMMENT:

The relationship between the trenches, the eolian sand, the alluvial [sic] clay, and the uppermost Denver Formation sand unit should be presented so that a clear picture of the potential for contamination of the Denver Formation can be developed.

RESPONSE:

The relationship between the trenches, eolian sand, eluvial clay, and the uppermost Denver Formation is shown in Figure 2-3 of the Proposed and Draft Final Decision Documents. The Denver Formation immediately underlying the eluvial clay consists of claystones and siltstones and therefore is not a "Denver Formation sand unit". Any sand units that may occur beneath the trenches are at least 30 to 40 feet beneath the bottom of the trenches.

3. COMMENT:

The difference in hydraulic head between the eolian sand and the uppermost Denver sand should also be presented.

RESPONSE:

The precise difference in hydraulic head between the eolian sand and the uppermost Denver sand unit is not known because the wells proximal to the Shell Trenches that are screened in the Denver Formation are screened over large intervals, not over a particular sand unit. However, the determination of the precise vertical hydraulic gradient is unnecessary for this IRA, because the low hydraulic conductivity of the eluvial clay and the claystones of the uppermost Denver Formation effectively prevents the vertical migration of both DNAPLs and contaminants dissolved in groundwater.

4. COMMENT:

A brief discussion of what type of field investigation is envisioned for determining the extent of the DNAPL plume should be presented. Tracking a narrow, sinuous DNAPL plume is going to be a very challenging undertaking.

RESPONSE:

Shell is currently investigating and evaluating several different types of investigative methods that could be utilized to investigate DNAPL that may exist north of the proposed wall. Shell did not include descriptions of these potential techniques because the exact details of an investigative study are engineering details that are most appropriately provided in the Preliminary Engineering Package and Draft Implementation Document.

5. COMMENT:

Since the report implies that the DNAPLs will be completely contained under this IRA or another IRA, the EPA would like to develop some understanding and a level of confidence that the DNAPLs will be contained. We request a concise statement in the Draft Final Decision Document that the DNAPL plume will be adequately characterized and contained.

RESPONSE:

Section 6.0 of the Proposed Decision Document already describes the preferred alternative and states that (1) a field investigation of DNAPLs that may exist downgradient and downdip of the trenches will be conducted, and (2) based on the results of the field investigation an interim response action may be proposed to address DNAPLs that may be found to exist.

The objective of the "hotspot" IRAs is to "mitigate the threat of release" of contaminants. As stated in the Final Alternatives Assessment and Proposed Decision Documents for this IRA, the preferred alternative will accomplish that objective. Nowhere in either of the documents is it stated that contamination will be "completely" contained. However,

to the extent that current containment wall technology and location allows, the DNAPLs will be contained.

6. COMMENT:

Since it may not be obvious to most readers that the selected response action is consistent with the final remedy, a discussion describing how the selected response action is consistent with and contributes to the Final Response Actions needs to be included in the Decision Document.

RESPONSE:

A brief description of how this selected alternative is consistent with potential Final Response Actions is provided in the Proposed Decision Document and will be included in the Draft Final and Final Decision Documents.

SHELL'S RESPONSES TO THE STATE'S COMMENTS ON THE PROPOSED DECISION DOCUMENT FOR OTHER CONTAMINATION SOURCES IRA SHELL SECTION 36 TRENCHES

GENERAL COMMENTS:

1. COMMENT:

The State does not oppose the selection of containment as the preferred strategy for this IRA. However, we are concerned about possible vertical migration of the contaminants into the eluvial clay unit. The IRA alternative proposed by Shell for the Section 36 trenches consists of a cap and a physical barrier (slurry wall or sheet piling) keyed into the eluvial unit (Section 4.2.3). Shell bases its decision to key the wall into the eluvium versus the Denver Formation on the following two assumptions: 1) a three-orders of magnitude difference in hydraulic conductivity values exists between the eolian and eluvial units; and 2) the eluvial unit inhibits vertical migration of contaminants below the trenches (Proposed Decision Document, pages 4 and 6).

The 1×10^{-6} cm/sec hydraulic conductivity value estimated for the eluvium was based on only two dissipation tests conducted in the eluvial unit; resultant test values were 1×10^{-3} cm/sec and 6×10^{-6} cm/sec (Results of Field Investigations Conducted August and September 1989, Shell Section 36 Trenches [Shell Field Report] page 19) Shell states that, due to time constraints, the interva[illegible]selected for the tests were biased towards the more permeab[illegible]zones, and therefore estimated an average horizontal hydra[illegible] conductivity of 1×10^{-6} cm/sec for the eluvial unit However, this estimate is lower than either of the tw measured values, which themselves show almost three o[illegible]ers of magnitude difference between them. The variance between the two values indicates that the data are insufficient to

estimate a representative hydraulic conductivity for the eluvium.

Response to first Subpart of State's Comment 1:

Two values for hydraulic conductivity were obtained from the CPT dissipation tests: 1×10^{-3} cm/sec and 6×10^{-6} cm/sec. The first and highest value was taken in a sandy layer within the eluvial clay, while the second, lower value was taken in a clay. The dissipation tests measure horizontal hydraulic conductivity over a small (<1 foot) section. Since the composite lithology of the eluvial clay unit consists of between 90 to 100 percent silt and clay, a value for horizontal hydraulic conductivity that may be approximately representative of the eluvial clay as a whole is closer to the value obtained in the clay (i.e., 6×10^{-6} cm/sec). Since vertical hydraulic conductivities in these types of deposits are normally one to two orders of magnitude smaller than horizontal hydraulic conductivities and will be closest to the lowest conductivity of any subsection of a unit, a reasonable estimate for the vertical hydraulic conductivity of the eluvial clay ranges from 1×10^{-6} cm/sec to 1×10^{-9} cm/sec. Thus, the worst case estimate is 1×10^{-6} cm/sec; the vertical hydraulic conductivity is likely much lower.

Continuation of Comment 1:

The data are also inadequate to support Shell's decision to complete the physical barrier in the eluvial unit. Before the State can support the proposal, Shell must clearly demonstrate that a value of 1×10^{-6} cm/sec is a representative hydraulic conductivity for the eluvial clays. To establish an average hydraulic conductivity, approximately five additional dissipation tests should be conducted in the eluvium across the site (equivalent to the number of tests conducted in the eolian unit in the summer

1989 field program). If field tests fail to determine a representative value of 1×10^{-6} cm/sec or lower, the slurry wall/sheet piling should be keyed into the Denver Formation.

Response to second subpart of Comment 1:

As noted above under the response to the first subpart of Comment 1, the estimate of vertical hydraulic conductivity is based on all available data and is probably conservatively high. Therefore, it is not necessary to collect additional data on hydraulic conductivities.

Continuation of Comment 1:

Shell also states that the eluvial clay inhibits vertical migration of contaminants (Proposed Decision Document, page 6). This assumption appears to be based solely on data collected from one alluvial well cluster (36509/36510), located approximately 400 feet north of the northern boundary of Site 36-3 (Final Alternatives Assessment Other Contamination Sources, IRA Shell Section 36 Trenches [Alternatives Assessment Document], Figure 2.2). Several inconsistencies exist in utilizing this cluster well to demonstrate vertical distribution of contaminants in the alluvial aquifer:

(a) While shallow well 36509 contains higher concentrations of analytes than does deeper well 36510, arsenic and diisopropylmethylphosphonate (DIMP) concentrations are within the same order of magnitude in the two wells, indicating that vertical migration is in fact occurring (Draft Alternatives Assessment for Other Contamination Sources IRA, Shell Section 36 Trenches [Draft Alternatives Assessment Document], Appendix C);

Response 1a:

This comment was addressed in Shell's Response to Specific Comment 5 on the Draft Final Alternatives Assessment. Neither arsenic nor DIMP are exclusive to the Shell Trenches; both could originate from other upgradient sources. Moreover, as stated in the response referenced above, we did not state that vertical migration was not occurring, rather that it is inhibited by the presence of a layer of clay.

Comment 1b:

Shell describes the eluvial unit as being comprised of, "approximately 6 percent sand-sized material and 94 percent silt and clay-sized material" (Shell Field Report, p.14). Based on this definition, data from the geological log for Well 36510 indicates that the eluvial unit is not present in this area (Draft Alternatives Assessment, Appendix B). The screened intervals in the two wells cannot be correlated to the eolian and eluvial units, and therefore the presence or absence of contaminants in Well 36510 is not due to eluvial clays inhibiting vertical migration;

Response 1b:

We disagree that the eluvial unit is not present near Well 36510. The CPT log from 36-1 conducted immediately adjacent to Well 36510 clearly shows a distinctive transition from sand to clay (Appendix A, Shell Field Report). Once calibrated to local conditions, the CPT logs are more accurate depictions of the lithology than descriptions from boreholes because they are a quantitative measure of sediment behavior. Moreover, the cone penetrometer testing was conducted continuously from ground surface to the Denver Formation. The borehole drilled for Well 36510 was logged from 2-foot split spoon samples collected every 5 feet to the bottom of the borehole.

Comment 1c:

Well 36509 is screened from the top of the water table (approximately six feet below land surface) to 14 feet below land surface (Draft Alternatives Assessment Docume , Appendix B). Therefore, water samples from this w ll could represent contaminant concentrations from the top of the water column, contaminants from eight feet below the water table, or a composite measurement from the upper eight feet of the water column; additional data would be necessary to determine the extent of vertical stratification across this interval of the aquifer; and

Response 1c:

See Response to State Specific Comment 1a above and Specific Comment 5, Draft Final Alternatives Assessment.

Comment 1d:

Because Well 36510 is screened from 19 to 24 feet below land surface, the contaminant distribution from 14 to 19 feet in the alluvial aquifer is not known.

Shell has not demonstrated the extent of vertical stratification in the alluvial aquifer, nor correlated contaminant distributions within the eolian and eluvial units. To determine if the eluvium is restricting vertical movement of contaminants, 2-to-3 additional clust wells, screened in the eolian and eluvial units and loca within or adjacent to the site boundaries, are necessary. f field data fails [sic] to substantiate the claim that the uvium restricts vertical contaminant migration (or as Shel. states, "provides a barrier to vertical contaminant migration from the trenches"; Alternatives Assessment Document, page A-40), the physical barrier should be keyed into the Denver Formation.

RESPONSE:

Responses to most of the individual comments presented above by the State have been addressed by Shell in previous responses to the State (above and in Shell Responses to State Comments on the Shell Field Report and Draft Final Alternatives Assessment). The decision to key the barrier wall into the eluvial clay is based on (1) the existence of a clay layer underlying the trenches which inhibits the vertical migration of contaminants, and (2) concern that construction of barrier wall into Denver will increase the potential for providing a migration pathway for contaminants in the sand and trenches through the clay and into the Denver Formation.

The estimate of vertical hydraulic conductivity of the clay was based on data from dissipation tests as discussed above, comparison of these value with ranges of hydraulic conductivity applicable to clay materials similar to those observed in the boreholes (Response to first subpart of Comment 1), and professional knowledge of the ranges of vertical permeabilities that are intrinsic to clay materials. Lithology based on CPT logs indicates that the eluvial clay section consists of 90 to 100 percent silt and clay (Table 3-1, Shell Field Report). Lithology recorded in borehole logs verifies interpretations of stratigraphy based on the CPTs (Appendix A, Shell Field Report). That clay has a very low vertical hydraulic conductivity (and is therefore an inhibitor of the vertical migration of water and contaminants) is well documented in standard hydrogeologic textbooks (Fetter 1980, Freeze and Cherry 1979).

Additionally, the risk of contaminating the Denver Formation by creating a migration pathway (i.e., constructing a barrier wall through the clay and into the Denver Formation)

outweighs the questionable benefit of constructing a containment wall into the Denver Formation.

2. COMMENT:

It is very important that adequate characterization of the waste in the trenches be performed prior to installation of the proposed cap. Shell states on p. A-34 if the Final Alternative Assessment for this IRA that "containment or in-situ remediation technologies may be available and acceptable at the time that the ROD is issued. If so, source removal and subsequent waste characterization would not be necessary and would be inconsistent with the Final Remedy." To properly evaluate in-situ remediation alternatives for the final remedy, core samples or pit samples of the trenches must be collected for treatability studies. Because of the heterogeneity and complexity of the Shell Trenches, numerous sampling locations will be required to adequately characterize the trench contents for treatability purposes. The trenches also must be further characterized as described in General Comment #4 below. This required sampling and characterization should be done prior to the installation of the cap over the trenches.

In addition, all metal drums within the trenches must be located prior to the installation of the cap. Previous magnetometer and electromagnetic (EM) geophysical surveys conducted by Harding Lawson Associates (HLA) in February 1986 at Site 36-3 (Geophysical Investigation of Contaminant Sources 36-3, 36-10, and 36-17, RMA, April 18, 1986 [Geophysical Report]), and the magnetometer and EM surveys conducted during the Phase I program at Site 36-17N (Site 36-17 Phase I CAR, Section 3.2.3), were designed for reconnaissance mapping of disposal trenches; the surveys do not appear to have specifically addressed locations of buried metal drums and unexploded ordnance. Although HLA did not document the locations of the buried metal in the

studies, HLA did determine that the magnetometer and EM methods were efficient in locating buried metal at the two sites (Geophysical Report, pages 29-31). Since it is unlikely that metal drums could be adequately treated with in-situ technologies and might actually interfere with the in-situ treatment processes, the excavation of all metal drums within the trenches should be considered as part of the in-situ treatment options evaluated for the final remedy for the trenches.

RESPONSE:

Further characterization of the trenches is outside the scope of this IRA. Moreover, a sufficient understanding of the trenches exists upon which to base a selection of a final remedy for the ROD. If, however, further evaluation is needed, it can readily be performed in the future, despite the presence of the cover.

In its comment the State refers to unexploded ordnance. Shell never disposed of UXO in the Shell trenches and has no knowledge of any other party ever having done so. Therefore, if the State has evidence of UXO in the Shell trenches, Shell requests that the State immediately make such evidence available to Shell, the Army, and EPA.

3. COMMENT:

The nature of contaminants disposed of in the Shell Trenches indicates that both light and dense nonaqueous phase liquids (LNAPLs and DNAPLs) may be present below the trenches (Alternative Assessment Document, page A-10). LNAPLs must be further monitored as part of the DNAPL field investigation program.

RESPONSE:

Shell investigated the possible presence of LNAPL near the Shell Trenches by measuring all existing wells in August 1989 for LNAPL. Although no LNAPL was detected in any of the wells, LNAPLs will be routinely monitored by visually inspecting all groundwater samples taken during monitoring of the containment system. If LNAPLs are observed in samples, the thickness of LNAPL in the associated well will be measured and the composition analyzed.

4. COMMENT:

Shell states in Response to State Comment 7F (Alternatives Assessment Document, page A-35 through 36) that it does not believe that the trench locations and structures in Site 36-3 are well documented, since "no documentation of the exact location of the trenches, nor exact depths or widths was recorded". Therefore, a trench characterization program is necessary as part of the RI. Such a program will be included in the State's Central Study Area Data Gap Proposal to be presented to the Army under separate cover, and is similar to that proposed by the State for characterization of the Army Section 36 complex trenches. The program consists of trenching, waste-fill sampling, borings completed below the bottoms of trenches, and documentation of trench contents.

RESPONSE:

A trench characterization program is not necessary for the RI since the character of the trenches are sufficiently understood to evaluate alternatives for the FS and ROD.

5. COMMENT:

Some organic compounds are known to interact with bentonitic clays, resulting in an increased permeability in the clay structure. The organic contaminants and DNAPL present in the alluvial aquifer beneath the site 36-3 trenches will be isolated from surrounding groundwater, thereby remaining in contact with the proposed physical barrier. Because of the potential for interaction between the organic contaminants and bentonite slurry and the resultant impacts on barrier wall integrity, compatibility tests should be conducted for the dissolved contaminants and DNAPL relative to the candidate physical barrier materials. Compatibility testing should definitely be included in the Decision Document.

RESPONSE:

Compatibility tests are currently being designed and will be conducted on groundwater and DNAPL samples that can be obtained. The scope of those tests will be described in the Preliminary Engineering Package. For the purposes of this IRA, however, it may not be necessary to conduct compatibility tests because any increase in permeability in soil-bentonite slurry is likely to be insignificant over the 5 year life of the IRA.

SPECIFIC COMMENTS:

1. COMMENT:

Proposed Decision Document, Section 3.0 - The objective should also be to stop the vertical migration of contaminants. In addition, the objectives for this and all other IRA's should include "removal of the source of contamination where feasible."

RESPONSE:

As stated in Section 3.0 of the Proposed Decision Document, the vertical migration of contaminants is inhibited by the presence of an eluvial clay unit.

The objective of this IRA, as set forth on page 3- of the Technical Program Plan, is to "mitigate the threat of release" of contamination, not "stop" the migration of contaminants. Clearly, containing DNAPLs and contaminants within the eolian sand unit will significantly reduce the threat of release of contamination from this site and therefore satisfies the objective of this IRA.

If the State believes that the objective of the Remediation of Other Contamination Sources IRA should have included "removal of the source of contamination where feasible," it should have raised the issue in its comments on the Draft Final Technical Program Plan. To do so at this point is not timely.

2. COMMENT:

Proposed Decision Document, page 4 - Shell states that "[b]ased on estimates of flow and recharge, local recharge may account for a significant portion (i.e., up to 100 percent) of groundwater flow through the trenches."

Does this statement refer to local vertical recharge infiltrating the trenches in Site 36-3, or is Shell stating that the alluvial groundwater component upgradient of the trenches is negligible? Does this imply that Shell's conservative estimate of 2 gallons per minute (gpm) fl w in the eolian unit is derived completely from local recha: ge (Final Alternatives Assessment Document, page 19)? The test [sic] should be modified to clarify this issue.

RESPONSE:

Although the questions are posed as if the answers are mutually exclusive, the answer to all the questions is yes. Groundwater in the saturated eolian unit in the trench area may be derived solely from recharge immediately south and over the trenches; therefore, the alluvial flow from the south toward the trenches may be negligible and the estimated 2 gpm may be completely derived from local recharge.

Figure 2-5 of the Final Alternatives Assessment shows that to the immediate south of the trenches, the eolian unit is unsaturated. If the eluvial clays are unsaturated (which, as the text describes, may be indicated by the moist but not wet appearance of the clay), groundwater in the eolian unit beneath and north of the trenches would be derived from local recharge rather than onflow from the south. This hypothesis is supported by the increase in saturated thickness immediately under the trenches (Figure 2-5), the lack of vegetation and presence of surface cracks over the trenches (which together allow precipitation to infiltrate the surface of the ground rather than runoff or be transpired), and the development of shallow ponds immediately south of the trenches after storm events.

3. COMMENT:

Proposed Decision Document, page 4 - Shell presents an estimated vertical hydraulic conductivity of 1×10^{-6} cm/sec for the eluvial unit. However, this value (1×10^{-6} cm/sec) is given as the estimated horizontal hydraulic conductivity for the unit in the Shell Field Report (page 19); vertical conductivities are assumed to be one-to-two orders of magnitude lower than horizontal conductivities. Please correct this discrepancy.

RESPONSE:

Based on the data available and reasonable estimates of hydraulic conductivities for clays, the vertical estimate of hydraulic conductivity of the eluvial unit is 1 x 10^{-6} cm/sec as specified in the Final Alternatives Assessment and Proposed Decision Document.

4. COMMENT:

Proposed Decision Document, page 9 - Shell estimates that the excavation alternative will cost $100 million and require four-to-five years to complete. The supporting data for these estimates should be provided in the Decision Document, since these estimates are the basis for the rejection of the excavation alternative.

RESPONSE:

The estimates provided are based on costs generated for similar activities at similar sites, adjusted for specific RMA conditions. The supporting data for these estimates can be made available for review at the MK-Environmental Services offices if the State wishes to pursue this matter further.

5. COMMENT:

Proposed Decision Document, Section 6.0 - How will DNAPL and contaminated groundwater encountered during construction of the physical barrier be treated and/or disposed of?

RESPONSE:

The extent to which contaminated groundwater and/or DNAPLs will be encountered, extracted, and therefore handled is dependent on the precise construction technique utilized to

emplace the containment wall. Several techniques that do not required removal of contaminated soils, sediment, groundwater, or DNAPLs are currently being evaluated. The construction technique that is selected and any handling procedures applicable to that technique will be outlined in the Preliminary Engineering Package for this IRA.

6. COMMENT:

Proposed Decision Document, page 19 - The Final Decision Document will include comments received on the Proposed Decision Document, not the Draft Final Decision Document. Please correct the text.

RESPONSE:

The text has been corrected.

7. COMMENT:

Final Alternatives Assessment Document, page 5 - Shell states that the two dissipation tests within the eluvial clay were conducted in sand horizons. Were both tests, with respective hydraulic conductivities of 1×10^{-3} cm/sec and 6×10^{-6} cm/sec, actually conducted in sand intervals? This was not indicated in the Shell Field Report. This information is important to assess Shell estimates of hydraulic conductivity for this unit.

RESPONSE:

Figure 3-10 of the "Shell Field Report" shows the location of all dissipation tests that reached hydrostatic equilibrium. CPT 36-5, 36-9, and 36-10 were conducted in the eluvial section and reached hydrostatic equilibrium. The test conducted in 36-5 was conducted in a clay; the calculated hydraulic conductivity is 6×10^{-6} cm/sec. CPTs

36-9 and 36-10 were conducted in sands; their hydraulic conductivities are approximately 1 x 10^{-3} cm/sec. The textures at specific locations within CPT boreholes can be estimated using Figure 2-2 and the CPT information in Appendix A.

8. COMMENT:

Final Alternatives Assessment Document, page A-28 - The State requested completion of an alluvial well between cluster wells 36509/36510 and Well 36063 to delineate flow patterns north of Site 36-3. Shell states that a well has been installed in this location, and references chemical data from the well. However, no further information is provided. Please provided the well number, location, and referenced chemical data.

RESPONSE:

The well identification number is 36515; it is shown on the CPT and well location map (Figure 2-1) on page 32 of "Results of Field Investigations Conducted in August and September 1989, Shell Section 36 Trenches, Rocky Mountain Arsenal". The chemical data are located in Appendix B of that report.

9. COMMENT:

Final Alternatives Assessment Document, Table 4-3 - This table includes installation of 20 monitoring wells as part of the DNAPL field investigation, however, this is nc specifically described in the Proposed Decision Docume t. Because it appears that the DNAPL field investigation will be conducted concurrently with the Shell trenches IRA, the proposal for the DNAPL field program must be included in the Shell Section 36 Trenches Implementation Document or submitted to the parties for comment prior to any field work

to be conducted prior to distribution of the Implementation Document.

RESPONSE:

A Preliminary Engineering Package will be provided to the Organizations and State prior to completion of engineering design and the issuance of the Draft Final Implementation Plan. The Preliminary Engineering Package will present the conceptual engineering design for all aspects of the Preferred Alternative. This includes such details as the proposed field investigation of DNAPLs that may occur downgradient of the containment wall.

DEPARTMENT OF THE ARMY
PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO 80022-2180

March 29, 1990

REPLY TO
ATTENTION OF:
Interim Response Division

Mr. Connally Mears
U.S. Environmental Protection Agency
Region VIII
One Denver Place
Suite 801
999-18th Street
Denver, Colorado 80202-2405

Dear Mr. Mears:

Enclosed for your review are the Draft Final Decision Documents for the Army Complex Disposal Trenches and Shell Section 36 Trenches Interim Response Actions (IRAs) at Rocky Mountain Arsenal. These documents are being issued in accordance with paragraph 22.9 of the Federal Facility Agreement (FFA).

Following consideration of all comments received during the public comment period from January 27, 1990 through February 26, 1990, the Army has revised the Decision Documents for the Army Complex Disposal Trenches and Shell Section 36 Trenches where appropriate.

In accordance with paragraph 22.10 of the FFA, Organizations with standing to invoke the dispute resolution process should advise me and my counsel in writing within twenty days of issuance of these documents, if they wish to invoke the procedures for dispute resolution.

In accordance with paragraph 22.11 of the FFA, after the close of the period for invoking Dispute Resolution, if Dispute Resolution is not invoked, or after completion of Dispution Resolution, if invoked, the Army shall issue a final IRA Decision Document to the other Organizations and Department of Interior. Unless Dispute Resolution is invoked within the twenty day dispute period, the Army will consider the decisions in the Draft Final Decision Documents the final decision for the Army Complex Disposal Trenches and Shell Section 36 Trenches Interim Response Actions.

If you have any questions or comments, please contact Mr. J.D. Smith at (303) 289-0201.

Sincerely,

Donald L. Campbell
Deputy Program Manager

Enclosure

Copies Furnished:

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