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THE FOLLOWING OBJECTIVES WERE DELINEATED TO MEET THE NEEDS OF THIS IRA:
- ASSESS THE GROUNDWATER CAPTURE PORTION OF THE NWBS AND EVALUATE THE POTENTIAL FOR CONTAMINATED GROUNDWATER WITHIN THE UNCONFINED AQUIFER TO BYPASS THE NWBS.
- ASSESS THE QUALITY AND QUANTITY OF CONTAMINATED GROUNDWATER APPROACHING THE NWBS AND CHARACTERIZE THE MIGRATORY PATHWAY OF PLUMES.
- ASSESS THE TREATMENT SYSTEM OF THE NWBS THROUGH AN EVALUATION INVOLVING EFFECTIVENESS, IMPLEMENTABILITY, AND COST. ALTERNATIVE WILL BE SELECTED, AS NECESSARY FOR THE CAPTURE AND TREATMENT OF CONTAMINATED GROUNDWATER APPROACHING OR BYPASSING THE SYSTEM THROUGH THE UNCONFINED AQUIFER.

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NORTHWEST BOUNDARY SYSTEM
ROCKY MOUNTAIN ARSENAL
LONG-TERM IMPROVEMENTS
INTERIM RESPONSE ACTION
OCTOBER 1991
CONTRACT NO. DAAA15-88-D-0022
VERSION 1.0**

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 ROCKY MOUNTAIN ARSENAL
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Prepared by:

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Prepared for:

PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL

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INTRODUCTION

This Interim Response Action (IRA) Decision Document addresses the Northwest Boundary System (NWBS) Long-Term Improvements IRA B(ii), which evaluated the present groundwater capture and treatment system and the remediation requirements of the system. The Federal Facility Agreement (FFA), effective February 17, 1989, calls for the assessment, selection, and implementation of any appropriate improvements to the NWBS, as necessary.

Alternatives have been reviewed based on criteria outlined in the EPA guidance for conducting Remedial Investigations and Feasibility Studies under CERCLA. The evaluation criteria included short-term risk, effectiveness, operational complexity, timeliness, present value cost, ability to meet ARARs, long-term effectiveness, and protectiveness.

HISTORY OF THE NORTHWEST BOUNDARY SYSTEM

Rocky Mountain Arsenal (RMA), located 10 miles northeast of Denver in Adams County, Colorado, (Figure 2-1) was established in the spring of 1942 as a chemical warfare agent manufacturing facility. During the years following the war, the Arsenal neutralized and demilitarized chemical warfare agents.

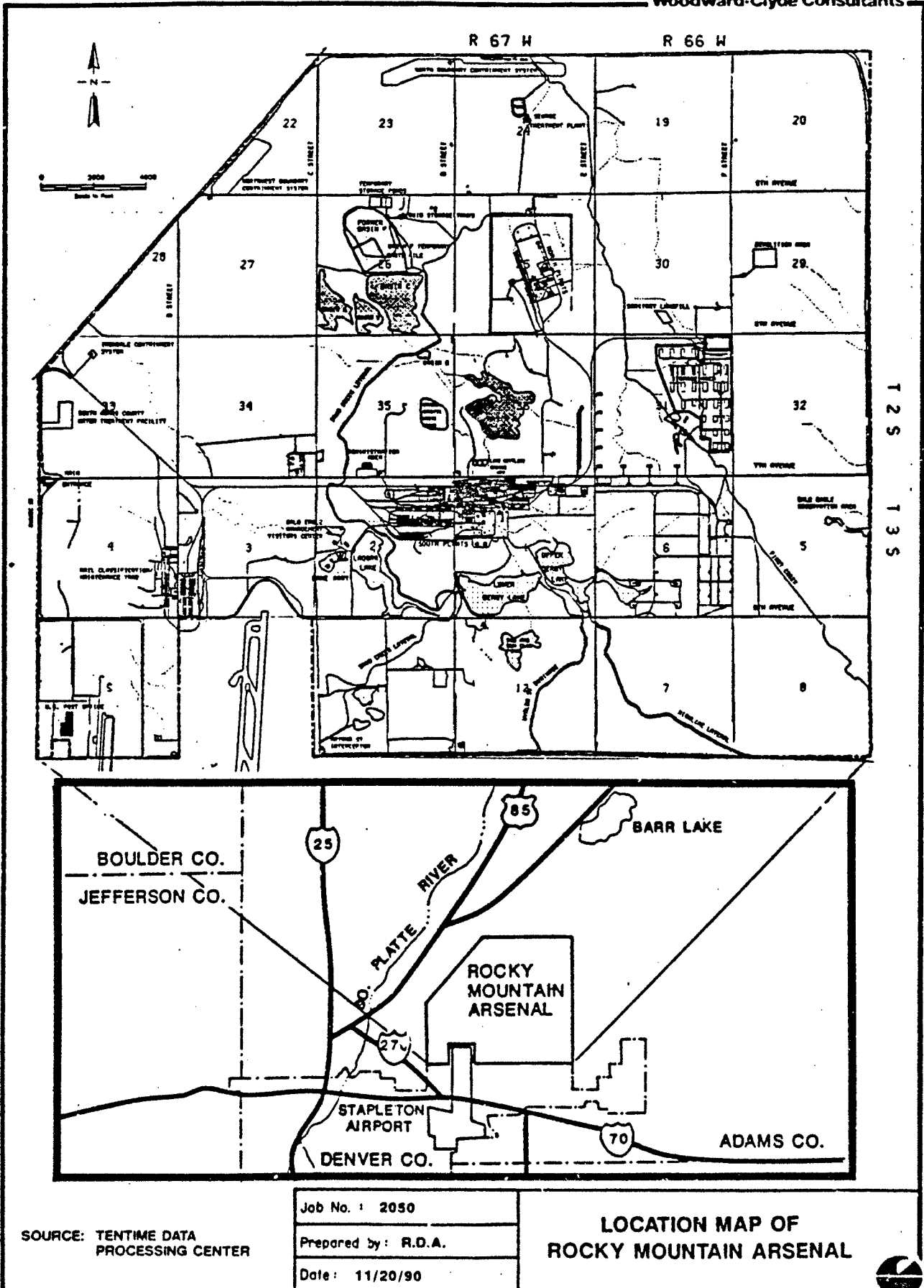
In 1947, the Julius Hyman Company leased part of the South Plants facility for the production of pesticides. The Shell Oil Company took over the operation of the pesticide manufacturing facilities in 1952. During the years the facility was operated by Shell, chlorinated organic and organophosphorus pesticides were manufactured.

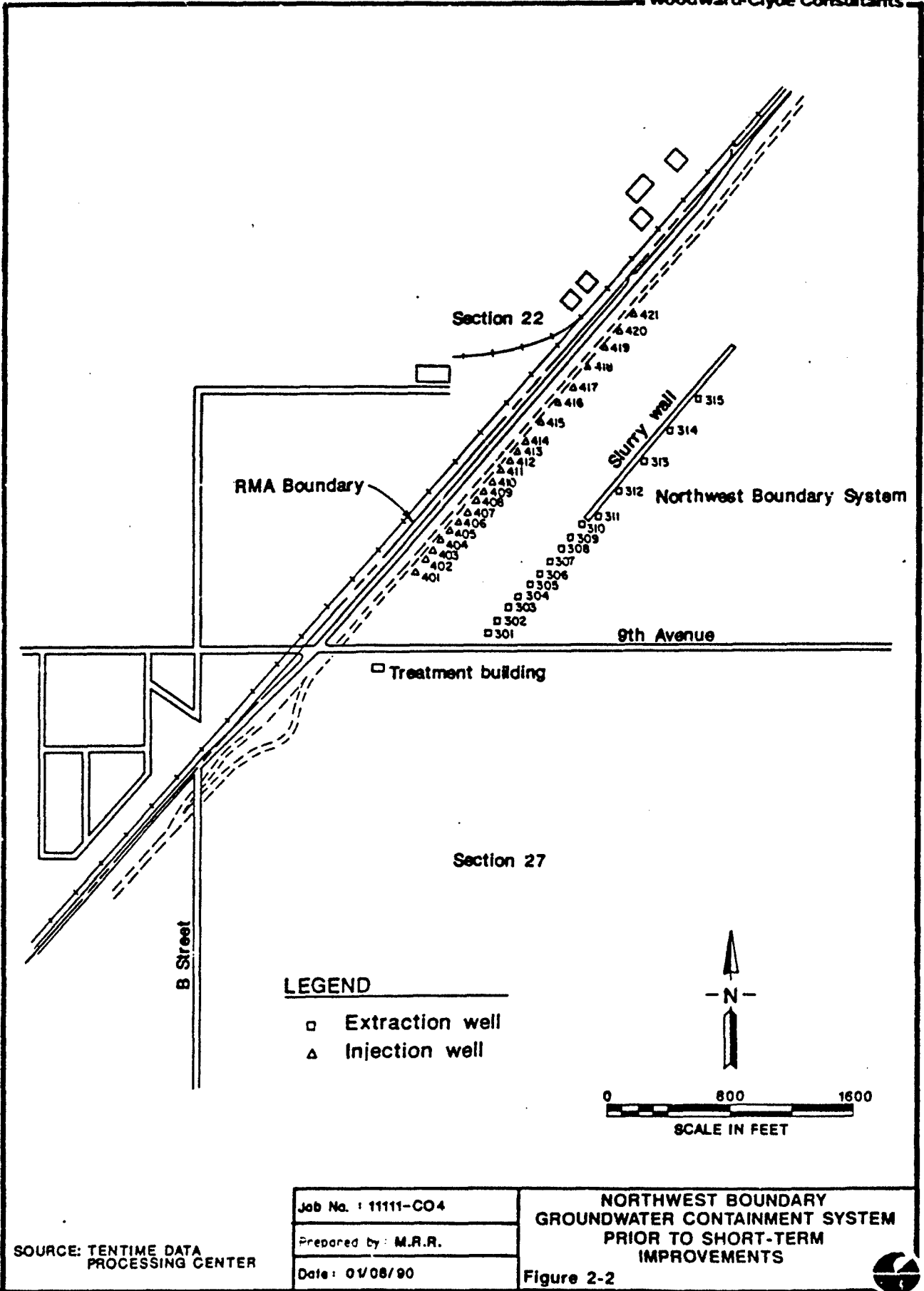
Construction of the North Plants manufacturing facility was completed in 1953. This facility was responsible for the manufacture of GB nerve agent until 1957 and for munitions filling operations until 1970. From 1970 to 1982, RMA was engaged in the disposal of chemical warfare materials.

In 1975, the Army initiated water quality monitoring programs to evaluate the nature and extent of contamination and to develop response actions to control contaminant migration. In 1980, a groundwater surveillance program identified a contaminant plume in the alluvial groundwater leaving RMA to the northwest in Section 22, T2S R67W.

Construction of the NWBS (Figure 2-2) containment system began in March 1983, and the system became operational in 1984. The NWBS was designed to intercept and remove dibromochloropropane (DBCP) as well as other organic compounds, from the alluvial groundwater.

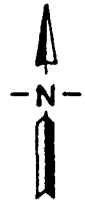
The NWBS is located in the south half of Section 22 along the northwest boundary of RMA. The groundwater extraction system consists of a partial slurry wall, a row of 15 groundwater extraction wells, and a parallel row of 21 groundwater injection wells. Current operations rely





LEGEND

- Extraction well
- △ Injection well



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SCALE IN FEET

SOURCE: TENTIME DATA PROCESSING CENTER

Job No. : 11111-CO4
Prepared by : M.R.R.
Date: 01/08/90

**NORTHWEST BOUNDARY
GROUNDWATER CONTAINMENT SYSTEM
PRIOR TO SHORT-TERM
IMPROVEMENTS**

Figure 2-2



on the creation of a reverse hydraulic gradient (from a northwest to a southeast gradient) in the vicinity of the NWBS to enhance the capture of contaminants by the extraction wells. A slurry wall (approximately 1,425 feet long prior to the recent 665-foot extension to the northeast) was constructed between the two rows of wells at the northeast end of the system to provide additional control of groundwater movement. Along the southwest end of the system, where a paleochannel has been identified, the capture of contaminants is based entirely on hydrodynamic control (a hydraulic barrier) created by the use of extraction and injection wells.

Recent investigations (Stollar 1989) indicated that low concentrations of organic contaminants within the alluvial groundwater may be bypassing the system and migrating offpost. Additionally, other contaminants are present in the NWBS area but are not completely treated by the current treatment system.

As part of the Short-Term Improvements IRA, Shell investigated contaminant bypass of the NWBS, and responded in June 1990 with a plan to extend the boundary system 665 feet to the northeast. This system extension was completed in October 1990.

Shell's Short-Term Improvements IRA assessment (MKE 1990 and MKE 1991) also identified dieldrin as the most widely distributed contaminant bypassing the system to the southwest. The objective of the Short-Term Improvements IRA is the implementation of any appropriate improvements to rectify bypass of the dieldrin plume to the southwest of the NWBS.

INTERIM RESPONSE ACTION OBJECTIVES

The Comprehensive Monitoring Program (CMP) Annual Groundwater Report for 1988 (Stollar 1989) identified some groundwater contaminants present within the Northwest Corridor of Rocky Mountain Arsenal (RMA) that apparently were not being captured completely and/or treated completely by the NWBS. This IRA investigation conducted by the Army evaluated the system's ability to meet remediation needs for the next five years and to treat the intercepted groundwater to existing ARARs. The following objectives were delineated to meet the needs of this IRA:

- Assess the groundwater capture portion of the NWBS and evaluate the potential for contaminated groundwater within the unconfined aquifer to bypass the NWBS.
- Assess the quality and quantity of contaminated groundwater approaching the NWBS and characterize the migratory pathways of plumes.
- Assess the treatment system of the NWBS through an evaluation involving effectiveness, implementability, and cost. Alternatives will be selected, as necessary, for the capture and treatment of contaminated groundwater approaching or bypassing the system through the unconfined aquifer.

INTERIM RESPONSE ACTION ALTERNATIVES

This investigation emphasized the potential for contaminants within the unconfined aquifer to bypass the system and assessed the upgradient flow (contaminant types, concentrations, and volumes) approaching the system over the next five years. Remedial alternatives that were identified and evaluated within this assessment included:

- **Capture System Modification**
 - No Action
 - Hydraulic barrier (extraction and injection wells)
 - Physical barrier (slurry wall) plus hydraulic barrier

- **Treatment**
 - No action
 - Enlarging the system
 - Adding new technology to the current system
 - Replacing the old system with a newly designed system

4.1 CAPTURE SYSTEM MODIFICATION

In June 1990, the Final Decision Document (MKE 1990b) and Final Implementation Document (MKE 1991a) for Shell's Short-Term Improvements IRA were submitted to the Army. These documents addressed a 665-foot extension of the NWBS to the northeast. Construction of the extension was completed in October 1990, and bypass of the system to the northeast was halted at that time.

Since completion of the NWBS northeast extension, the Long-Term Improvements IRA capture system alternatives only address bypass of the system to the southwest.

A combination of barrier (physical and hydraulic) and extraction technologies for capturing contaminated groundwater were evaluated. The various capture scenarios presented were developed using a calibrated numerical groundwater model. The capture systems were evaluated with respect to potential lateral bypass of contaminants around the NWBS.

An assessment of the distribution of the RMA target contaminants identified dieldrin, DIMP, and chloroform as the primary target contaminants for the NWBS. The assessment indicated that the dieldrin plume is the most widespread of the known target chemicals in the vicinity of the NWBS. Therefore, the capture systems were evaluated based on capture of the entire known dieldrin plume, assuming that other chemicals of concern existing within the dieldrin plume will be captured also.

An extraction and barrier (slurry wall) system are already in place at the NWBS, and a groundwater treatment plant has been in place and operating since 1984. Therefore, the application of the remedy selection process was adapted to account for these existing facilities.

Four capture system alternatives were evaluated. They include:

- Alternative I (No Action): Modification of the system as presented in the Final Addendum to Implementation Document For Northwest Boundary System STI IRA for Southwest Extension (MKE 1991).
- Alternative I(a): Modification of the system as presented in the Final Addendum to Implementation Document For Northwest Boundary System STI IRA for Southwest Extension with performance and groundwater quality monitoring.
- Alternative II: Modification of the current system by extending the hydraulic barrier southwest 2,400 feet (adding 6 extraction and 8 recharge wells), and increasing the total extraction rate from 550 gpm to 850 gpm.
- Alternative III: Modification of the current system by extending the hydraulic barrier southwest 2,400 feet, (adding 7 extraction and 8 recharge wells) extending the slurry wall to the full length of the extraction and recharge system and increasing the total extraction rate from 550 gpm to 610 gpm.

Three capture system alternatives (I(a), II and III) were retained for further consideration with treatment alternatives. The No Action Alternative (I) was dropped from further consideration.

4.2 TREATMENT ALTERNATIVES

A granular activated carbon (GAC) adsorption treatment system is currently in operation at the NWBS. Therefore, a "no action" treatment alternative would result in the current system being retained. The second treatment alternative considered under the Long-Term Improvements assessment, enlarging the current system, would be required if the selected capture system alternative resulted in an increase of the extraction rate above the current plant capacity (1000 gpm). Since none of the capture system alternatives would exceed 1000 gpm, enlarging the treatment system will not be necessary.

The third and fourth treatment alternatives considered, adding new technology and replacing the current system, would be required if the current treatment system did not meet ARARs or if an alternative technology would better meet a set of treatment criteria.

The current ARARs for dieldrin, DIMP, and chloroform (the primary target contaminants for the NWBS) are 0.002 µg/l, 600 µg/l, and 100 µg/l (as part of total trihalomethanes), respectively. Chloroform was the only trihalomethane detected in groundwater in the vicinity of the NWBS. Chloroform is found in the extracted groundwater at approximately 16 µg/l. Since the levels of chloroform are well below the current ARAR, additional treatment for chloroform is not required. The measured concentrations of the remaining contaminants within the extracted groundwater were found to be low enough that the existing system is sufficient to reduce contaminants to levels at or below current ARARs.

To determine if an alternative technology would better meet a set of treatment criteria, five alternative treatment technologies were evaluated against a set of feasibility and implementability criteria that addressed the objective of implementing the NWBS Long-Term Improvements IRA B(ii) over the next five years. The five treatment technologies evaluated were:

- GAC Adsorption (current system)
- Air Stripping
- Ultraviolet-Enhanced Chemical Oxidation
- Rotating Biological Contractor
- Fixed-bed Biological Contractor

One technology for treatment of the extracted groundwater was retained following the initial evaluation process. The treatment technology selected that best met the criteria is adsorption from the liquid phase onto GAC using the treatment system that is already in operation at the site.

The current treatment system is sufficient to treat the primary target contaminants to levels at or below ARARs, has the capacity to handle flow from any of the capture system alternatives, and best met the feasibility and implementability criteria. Therefore, the current technology was retained and the "no action" treatment alternative was selected.

The selected treatment alternative was then combined with the three retained capture system technologies (Alternatives I(a), II and III) resulting in three remedial alternatives.

A simple comparative evaluation and ranking procedure was used to evaluate the three remedial alternative systems and select a preferred alternative. The evaluation procedure examined each alternative against the following eight criteria, which are in substantive compliance with the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA). The evaluation was based generally on the procedures and technical criteria for remedy selection set forth in Environmental Protection Agency (EPA) guidance, primarily, "Guidance for Remedial Investigations and Feasibility Studies under CERCLA" (U.S. Environmental Protection Agency 1988a).

- Short-term Risk. Short-term risk is the public health and environmental risk due to operation of the process.
- Effectiveness. Effectiveness is defined as the percent permanent destruction of toxic compounds, the decreased mobility of these compounds, and/or reduction in the volume of contaminants.
- Operational Complexity. Operational complexity is the ease of operation and maintenance requirements for periodic routine maintenance, and the proclivity of the system to break down (as a maintenance issue, not as a reliability issue).
- Timeliness. Schedule impact is the likelihood that the groundwater treatment system will be modified and operating by June of 1992.

- Present Value. This criterion is the differential present value cost, considering both capital cost of the treatment plan (in 1990 dollars) and differential annual operating cost (i.e., the amount of present value of an alternative that exceeds the lowest present value alternative).
- Ability to Meet ARARs. Treatment alternatives are required to meet all ARARs.
- Long-term Effectiveness. This criterion concerns whether or not a treatment alternative would leave residual wastes on site at the NWBS.
- Protectiveness. This criterion measures long-term reductions of risk, onsite or offsite. The long-term risk is defined to be related to contaminants in groundwater.

Each of the three remedial alternatives considered for the treatment of groundwater from the NWBS groundwater remediation program will meet target treatment levels. However, the alternatives differ in timeliness and cost. Based on the criteria of timeliness and cost, the preferred alternative is I(a) (Modification of the system as presented in the Final Addendum to Implementation Document For Northwest Boundary System STI IRA for Southwest Extension with performance and groundwater quality monitoring) with no alteration of the current treatment system.

CHRONOLOGY OF EVENTS

The significant events leading to the decision to adopt the action described in Section 6.0 of this report for the Long-Term Improvements IRA are presented below.

<u>DATE</u>	<u>EVENT</u>
February 17, 1989	The EPA, the Department of the Army, the Department of Interior, the Department of Health and Human Services, and the Department of Justice (Organizations) enter into Federal Facility Agreement, which delineates 13 Interim Response Actions.
September 1989	Northwest Boundary Improvements Interim Response Action is awarded to Woodward-Clyde by the Army.
March 1990	Field investigation begins.
April 1990	Shell submits report of Field Investigations, Assessment, and Proposed Decision Document for the NWBS Short-Term Improvements IRA (MKE 1990a) to organizations for review and comment.
May 1990	Task Plan is presented to EPA, Shell, and the Colorado Department of Health (CDH) for comment.
June 1990	Army responds to comments on the Task Plan made by EPA, CDH, and Shell.

June 1990

Shell submits Report of Field Investigations, Assessment, and Final Decision Document for the NWBS Short-Term Improvements IRA.

August 1990

Field investigation completed.

January 1991

Shell submits Draft Addendum to Final for the Implementation Document for Northwest Boundary System Short-Term Improvements IRA for Southwest Extension.

February 1991

Draft Final of Northwest Boundary System Long-Term Improvements IRA Assessment Document (WCC 1991a) submitted to Organizations and State for review and comment.

April 1991

Army submits Addendum to Final for the Implementation Document for NWBS Short-Term Improvements IRA to the Organizations and State.

June 1991

Final Assessment Document for Northwest Boundary System Long-Term Improvements IRA including responses to comments from Army issued to Organizations and State.

June 1991

Proposed Decision Document for NWBS Long-Term Improvements issued to Organizations and State.

June 1991

Field Data Report placed in Joint Administrative Record and Document Facility.

INTERIM RESPONSE ACTION DECISION

The evaluation of the alternatives investigated indicated that the most suitable technology for hydraulic control is the installation and operation of a hydraulic barrier as an extension to the southwest portion of the NWBS with no extension of the slurry wall. The best judgement weighing system used in evaluating treatment system criteria suggested that no modification of the current treatment system is required.

Alternative I(a), extending the existing NWBS capture system to the southwest by the addition of three extraction wells and four hydraulically upgradient recharge wells, with groundwater quality monitoring, water level monitoring, and a performance evaluation program, is the preferred alternative.

With the implementation of Shell's Short-Term Improvements alternative, the Army's decision for long-term improvements will consist of the following:

- Construct additional groundwater monitoring wells
- Perform groundwater quality sampling
- Perform water level measurements
- Evaluate groundwater flow in the vicinity of the entire NWBS, including the Short-Term Improvements southwest capture system and northeast extension
- Evaluate entire system performance

The monitoring well locations identified in the Short-Term Improvements phase of this IRA and the additional wells listed below will be assessed to determine if they are adequate to fully characterize the dieldrin distribution. If any of the existing or proposed monitoring wells are within the radius of influence of the Short-Term Improvements extraction well field, additional monitoring wells, located downgradient and outside of the extraction system's radius of influence, will be required.

Monitoring Wells NWMW2, NWMW6, NWMW7, NWMW8, and NWMW9 (identified under the short-term improvements) and wells 28004, 28003, 28002, 27505, 27085, 27502, 27005, 27086, 27503, /27504, 22501, and 22507 will be sampled. These wells fall within the line parallel to the RMA boundary, downgradient of the Short-Term Improvements system. Groundwater samples from these wells will be used to assess the movement of the dieldrin plume.

A one year performance evaluation of the NWBS and the Short-Term Improvements system will assess the effects of the extraction and recharge system on the hydrogeologic system and recharge in the vicinity of the NWBS. The evaluation will include an assessment of the extraction and recharge well fields' influence on the water table at the monitoring wells discussed above as well as at approximately 150 additional wells in the vicinity of the NWBS.

If the results from the groundwater quality sampling indicates bypass of the captured system, then operational changes to the system, such as adjusting/increasing the pumping rates of the extraction wells or the installation of additional pumping wells, will be assessed and implemented as appropriate. Likewise, if the hydrogeologic assessment indicates the potential for undesirable changes to the groundwater flow regime, then operational changes and/or relocation of extraction or recharge wells will be assessed and implemented as appropriate.

INTERIM RESPONSE ACTION PROCESS

With respect to the IRA for the improvement of the NWBS at RMA, the IRA process is as follows:

1. The scope of the IRA is described in the June 5, 1987 report to the Court of the United States (the Army and EPA), Shell, and the State in United States v. Shell Oil Co. A similar description is included in the proposed Consent Decree, paragraph 9.1 (l), and the FFA, paragraph 22.1 (l).
2. The Organizations and Department of Interior (DOI) shall have the opportunity to participate, at the RMA Committee level, in the identification and selection of ARARs that may be applicable to IRAs.
3. The Army issues the Proposed Decision Document for the IRA for the NWBS Long-Term Improvements for a 30-day public comment period. During comment period, the Army will hold one public meeting addressing the IRA decision. The Proposed Decision Document is supported by an administrative record.
4. Promptly after the close of the comment period, the Army shall transmit to the other Organizations, DOI, and the State, the Draft Final IRA Decision Document for the NWBS Long-Term Improvements.
5. Within 20 days after the issuance of the Draft Final IRA Decision Document for the NWBS Long-Term Improvements, an Organization (including the State if it has agreed to be bound by the Dispute Resolution process, as required by the FFA or DOI under the provisions set forth in the FFA) may invoke Dispute Resolution.
6. After the close of the period for invoking Dispute Resolution, if Dispute Resolution is not invoked, or after the completion of Dispute Resolution, if invoked, the Army shall issue the Final IRA Decision Document to the other Organizations, DOI, and the State. The Army shall also notify the public of the availability of the Final IRA Decision Document with the supporting administrative record. Only preliminary design work for the IRA may be conducted prior to the issuance of the Final IRA Decision Document.

7. The Final IRA Decision Document for the NWBS Long-Term Improvements will be subject to judicial review in accordance with Section XXXIX of the FFA except where such review is barred by Sections 113 and 121 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. Sections 6913 and 9621.
8. Following issuance of the Final IRA Decision Document, the Army shall be the lead party responsible for designing and implementing the IRA in conformance with the Decision Document. The Army shall issue the draft IRA Implementation Document to the DOI, the State, and the other Organizations for review and comment. The Draft IRA Implementation Document shall include final drawings and specifications, final design analysis, a cost estimate, and deadlines for implementation of the IRA.
9. If any of the Organizations (including the State) or the DOI believes that the IRA is being designed or implemented in a manner that will not meet the objectives for the IRA set forth in the Final IRA Decision Document or is otherwise not being properly implemented, it may so advise the others and shall recommend how the IRA should be properly designed or implemented. Any organization (including the State, if it has agreed to be bound by the process of Dispute Resolution, as required by the FFA, or the DOI under the circumstances defined in the FFA) may invoke Dispute Resolution to resolve the disagreement.
10. As Lead Party for the design and implementation of this IRA, the Army will issue the Final IRA Implementation Document, as described above, and will be responsible for implementing the IRA in accordance with the Final IRA Implementation Document.

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOR THE NORTHWEST BOUNDARY SYSTEM INTERIM RESPONSE ACTION**

8.1 INTRODUCTION

These ARARs address a specific area identified for interim remediation prior to the issuance of a Record of Decision (ROD) for the Onpost Operable Unit of RMA. The installation of monitoring wells and subsequent groundwater sampling and chemical analysis will be performed as part of this IRA. Further remedial action will be addressed in the ROD for the Onpost Operable Unit of RMA.

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 technological considerations.

The objectives of this IRA are discussed in the Final Assessment Document and in Section 3.0 of this document. This IRA will be implemented prior to the final remediation to be undertaken in the context of the Onpost Operable Unit ROD.

Chemical-specific ARARs have been identified for the following target contaminants at the indicated levels:

<u>Compound</u>	<u>ARAR Level</u>	<u>Source</u>
Arsenic	50 µg/l	MCL
Benzene	5 µg/l	MCL
Chloroform	100 µg/l	MCL*
Dieldrin	0.002 µg/l (0.1 µg/l)**	CBSG
Endrin	0.2 µg/l	MCL
Trichloroethylene	5 µg/l	MCL

Chemical-specific ARARs were not identified for DBCP and DIMP, but "To Be Considered" (TBC) levels were identified, consistent with the National Contingency Plan. In the absence of identified ARARs, the following TBCs will be utilized as operating criteria for the NWBS:

<u>Compound</u>	<u>Operating Criteria</u>	<u>Source</u>
DBCP	0.2 µg/l	PMCL
DIMP	600 µg/l	EPA HA

MCL - Maximum Contaminant Level established under the Safe Drinking Water Act.

CBSG - Colorado Basic Standards for Groundwater

PMCL - Proposed MCL

EPA HA - Environmental Protection Agency Health Advisory

* The MCL identified for Chloroform is for total trihalomethanes. Chloroform is the only trihalomethane identified as a target contaminant at the NWBS.

** Parenthetical values are Colorado Department of Health detection levels that are used as the performance standards for the CBSG level when that level is lower than detection limits.

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 statutes reflected in it are ARARs, applicable to this interim action, and must be complied with. Based on where monitoring wells are 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 Army considers relevant and appropriate and will comply with 40 CFR 6.302(a) and (b) concerning the location of monitoring wells, avoiding the construction of wells in a manner that would have an adverse impact on wetlands or be within a flood plain, where possible.

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 included in this IRA. 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

8.4.1 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.

8.4.2 Well Construction

8.4.2.1 Air Emissions

On the limited possibility that there may be air emissions during the course of monitoring well construction, the Army has reviewed all potential ambient or chemical-specific air emission requirements. Although the State Air Pollution Control Division (APCD) does not currently have Ambient Air Quality Standards (AAQS) for volatile or semi-volatile organic compounds, the state does have particulate standards (5 CCR 1001-14) which must be addressed in the construction phase of the remedial action. The Colorado APCD also enforces an odor standard (5 CCR 1001-4) pertinent to odorous emissions from the operation of treatment systems and for construction.

In the context of this IRA, there is only a limited 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 was detected by the contractor's air monitoring specialist. The Army has significant experience with the construction of monitoring wells and has not experienced any problems from air emissions during construction of such facilities. The site-specific Health and Safety Plan will adequately address these concerns. This plan, developed for use in the IRA, details operational modifications to be implemented in the event monitoring detects specific levels of such emissions.

The National Emissions Standards for Hazardous Air Pollutants (NESHAPS) was evaluated to determine whether it was applicable or relevant and appropriate to 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 C.F.R. 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 that is in excess of 50 micrograms per cubic meter (annual geometric mean) and 150 micrograms per cubic meter (maximum 24-hour concentration) will not be exceeded more than once per year.

8.4.2.2 Worker Protection

The provisions of 29 CFR 1910.120 are applicable to workers at the site because these provisions specifically address hazardous substance response operations under CERCLA. The final rule regarding these activities is found in 54 FR 9294 (March 6, 1989). The final rule became effective on March 6, 1990.

8.4.2.3 General Construction Activities

The following performance, design, or other action-specific state ARARs have been preliminarily identified by the Army as applicable to this portion of the IRA and more stringent than any applicable or relevant and appropriate federal standard, requirement, criterion, or limitation:

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

1. 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:

<u>Zone</u>	<u>7:00 a.m. to next 7:00 p.m.</u>	<u>7:00 p.m. to next 7:00 a.m.</u>
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)

2. 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.

3. 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.
5. 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.
8. 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.
9. 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.

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

- i. Applicability - Attainment and Nonattainment Areas
- ii. Applicable Emission Limitation Guideline -- Both the 20 percent opacity and the no off-property transport emission limitation guidelines shall apply to construction activities, except that with respect to sources or activities associated with construction for which there are separate requirements set forth in this regulation, the emission limitation guidelines there specified as applicable to such sources and activities shall apply. Abatement and control plans submitted for construction activities shall be evaluated for compliance with the requirements of Section III.D. of this regulation.

The following regulation regarding diesel powered vehicles is an ARAR only for equipment that runs on the highway. The regulation does not apply to non-highway equipment such as drill rigs.

- Colorado Air Quality Control Commission Regulation No. 12, 5 CCR 1001-15, Part C, Standards of Visible Pollutants from Diesel Engine Powered Vehicles.
 - A. No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40 percent opacity, with the exception of Subpart "B".
 - B. No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non turbo-charged) diesel-powered motor 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 five (5) consecutive seconds, which is of a shade or density as to obscure an observer's vision to a degree in excess of 50 percent opacity.
 - C. Any diesel-powered motor vehicle 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. These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment and/or cargo over roads, streets, and highways.

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 a 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. Only excerpts from this statute have been cited in this section.

8.4.2.4 Wetlands Implications

Through estimation of the area where the monitoring wells will be located, the Army does not believe that any wetlands could be adversely affected. However, until well locations are made final, it cannot be definitively determined that no impact on wetlands will occur. If final well locations result in an impact on wetlands, the Army will review the regulatory provisions concerning wetlands impact 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.

8.5 COMPLIANCE WITH THE OTHER ENVIRONMENTAL LAWS

This IRA was prepared in substantive compliance with 40 CFR 1502.16 (the regulations implementing the National Environmental Policy Act of 1969).

3.0
SCHEDULE

The implementation of the Short-Term Improvements IRA is scheduled for the summer of 1991.

To allow for evaluation of the operation of the Short-Term Improvements for approximately 2 months, and in accordance with the Federal Facility Agreement, the Draft Implementation Document is scheduled for issuance on November 15, 1991.

CONSISTENCY WITH THE FINAL REMEDIAL ACTION

The Federal Facility Agreement states that all Interim Response Actions (IRAs) shall "to the maximum extent practicable, be consistent with and contribute to the efficient performance of Final Response Actions" (paragraph 22.5).

The alternative assessment criteria used to evaluate the interim response action alternatives for the NWBS Long-Term Improvements IRA were developed in the Final Assessment Document (WCC June 1991).

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- Morrison-Knudsen Environmental Services (MKE). 1990a. Report of Field Investigations, Assessment, and Proposed Decision Document for the Northwest Boundary System Short-Term Improvements Interim Response Action, RMA. April, 1990
- Morrison-Knudsen Environmental Services (MKE). 1990b. Report of Field Investigations, Assessment, and Final Decision Document for the Northwest Boundary System Short-Term Improvements Interim Response Action, RMA.
- Morrison-Knudsen Environmental Services (MKE). 1991a. Implementation Document for Northwest Boundary System Short-Term Improvements Interim Response Action, Southwest Extension. February 1991.
- Morrison-Knudsen Environmental Services (MKE). 1991b. Implementation Document for Northwest Boundary System Short-Term Improvements Interim Response Action Southwest Extension. Draft Addendum to Final. February 1991.
- Stollar, R. L. & Associates, Inc., Harding Lawson Associates, Ebasco Services, Inc., DataChem, Inc., ENSECO-Cal Lab, Midwest Research Institute. 1989. (Stollar 1989) Comprehensive Monitoring Program, Contract No. DAAA15-87-0095, Annual Groundwater Report of 1988. Final Report, Volume I.
- United States Environmental Protection Agency (EPA) Region VIII. 1989. Federal Facility Agreement Pursuant to CERCLA Section 120. Docket No. CERCLA VIII-89-13.
- Woodward-Clyde Consultants. 1991a. Northwest Boundary System Long-Term Improvements Interim Response Action B(ii) Final Assessment Document. Version 3.2.
- Woodward-Clyde Consultants. 1991b. Field Data Report for the Northwest Boundary System Long-Term Improvements IRA.

APPENDIX A
COMMENTS AND RESPONSES

STATE COMMENTS ON PROPOSED DECISION DOCUMENT, NORTHWEST
BOUNDARY SYSTEM, ROCKY MOUNTAIN ARSENAL
LONG-TERM IMPROVEMENTS, INTERIM RESPONSE ACTION,
JUNE 1991

General Comments:

1. The alternative chosen in the Proposed Decision Document and the IRA Objectives, as stated on page 3-1 of this document are not consistent with the objectives specified in the Federal Facility Agreement (FFA) or the Long Term Improvements (LTI) Final Assessment. Section 22.1(b) (ii) of the FFA states that this IRA shall consist of "assessment of the other two boundary systems (Irondale and Northwest) on the Arsenal and assessment, selection and implementation of any appropriate improvements to these systems as necessary" (emphasis added). At this time the Army has concluded that they do not have sufficient information for the "selection and implementation of any appropriate improvements." Thus, the appropriate action for the Army is to request a delay in the IRA schedule until the required information is available, and then issue a new Decision Document. At that time, the parties would be given the opportunity to comment on the selected alternative. The Army's current approach, in which the actual selection of improvements to the Northwest Boundary System (NWBS) is delayed until next year, means that the "Decision Document" represents only a delay in decision making, and the actual selection of an alternative will be made next year without the appropriate formal comment period.

Nor will the alternative selected in the Proposed Decision Document meet the IRA objectives as stated in the NWBS LTI Final Assessment. On page 4-1 of the Final Assessment document, the Army states the objectives are to assess the present system and select and implement appropriate improvements and to "intercept, treat, and recharge groundwater approaching the NWBS, within five years, that contains any of the target contaminants listed in Subsection 3.3.2 at levels above their respective action level." In the same document, on page 4-5, the Army states that according to the model of the hydraulic control implemented by the short-term improvements, (the proposed remedial alternative), "dieldrin plumes would be captured for a flow simulation period of approximately one year. Long-term (five years) simulation results indicate that the potential exists for dieldrin to bypass the modified system to the southwest." Thus, it is apparent that this alternative does not fulfill the objectives of this IRA and the decision must be postponed until an adequate control system can be designed.

Response:

The NWBS LTI IRA addressed only the Northwest Boundary System. The Irondale System is being addressed separately by Shell. The Army feels that the improvements selected and implemented by Shell under the Short-Term Improvements (STI) are appropriate and adequate. In order to be more conservative in the protection of human health, the Army did not choose alternative I, the No Action Alternative. Instead, the Army chose Alternative I (a): Modification of the system as presented in the Final Addendum to Implementation Document for Northwest Boundary System Short-Term Improvements IRA for Southwest Extension with performance and groundwater quality monitoring. The performance and groundwater quality monitoring program will evaluate the new extraction and recharge system ability to capture the known dieldrin plume and optimize operation of the system. The decision document clearly selects the alternative and does not delay the decision.

The proposed decision does meet the IRA objectives. The groundwater flow model indicated the potential to bypass the modified northwest boundary capture system to the southwest within the accuracy limits of the model. However, there is an advantage to actual monitoring data compared to long-term modeling predictions. The selected alternative recognizes the "potential bypass" in its performance and groundwater quality monitoring program. Currently, since start up of the short-term improvements in early August 1991, bypass has been prevented and the Army believes it will continue in the future. A comprehensive quarterly monitoring program is being developed by Shell for the entire Northwest Boundary System. This quarterly program will include evaluation of the existing system and both extensions that were installed under the Short-Term Improvements IRA. The one-year performance evaluation for the Long-Term Improvements IRA will be of similar scope and will be coordinated with the quarterly monitoring program so as to not duplicate effort. Components of the proposed quarterly monitoring plan for the entire Northwest Boundary System are preliminary and may be revised slightly during the approval process. The quarterly monitoring program is intended to be flexible in order to respond to changing conditions as the IRA modifications become effective. Therefore, the number of wells measured or sampled each quarter may change as is appropriate.

2. According to the Army's response to Shell Comment #22 in the NWBS LTI Final Assessment Document, the selection of Alternative Ia in the Proposed Decision Document is based on Shell's interpretation of the groundwater data, *i.e.*, that there is a dieldrin

plume that is separate from the primary contaminant plume. This interpretation is not supported with adequate data. Because this interpretation of the dieldrin plume has a profound effect on this IRA, it must be evaluated carefully.

There is very little evidence to support the existence of an uncontaminated zone between two plumes as shown in Figure 1 of the Implementation Document for Short-Term Improvements, Southwest Extension. All but one of the monitoring wells not containing dieldrin exist in a small area immediately southwest of the hydraulic barrier; yet, a clean zone extending all the way to Section 34 is hypothesized. The ground water elevations and flow in this area must be better defined. Additional ground water elevation data may reveal the reason why these are clean monitoring wells. The rest of the projected extensive uncontaminated zone, as identified by Shell, can be verified with the installation and sampling of additional monitoring wells. The State has previously requested in its March 7, 1991 letter, and continues to request that a subcommittee meeting be held prior to implementation of the IRA to discuss this issue.

Response:

The historical analytical data from wells within the clean zone and wells bordering this zone indicate that the two dieldrin plumes may be merging. The southern extent of the clean zone is defined by Well 27053, which has been sampled and analyzed for dieldrin 11 times over a ten-year period. No concentrations were reported above the certified reporting limit (CRL). Wells bordering the clean zone (e.g., 27003 and 27072) have had reported dieldrin detections above the CRL only since 1987 (prior analyses were below the CRL). The recharge well field, located as shown in Shell's Implementation Document for the Short-Term Improvements, should prevent the two plumes from merging as well as migrating northward.

3. The source of the "separate dieldrin plume" has not been identified. In the NWBS LTI Final Assessment, Shell's Comment 27 states that this dieldrin plume "may originate from the Sand Creek Lateral in Section 35 and is shown ending in either Section 27 or 34." On Plate NSCA 3.3-12 in the Proposed Final Remedial Investigation Report, Volume XI, North Central Study Area, dated June 1989, this plume described by Shell is apparent. However, Plate NCSA 3.3-11 of the same document shows that the total organic analyte concentrations in this area exceed the concentrations of dieldrin by an order of magnitude. How can this area, which contains a large percentage of contaminants other than dieldrin,

be the source of a plume that contains only dieldrin which has perhaps the largest retardation factor of any of the compounds. This discrepancy must be explained.

Response:

To date, the source of the separate dieldrin plume has not been identified. A current feasibility study has been designed to evaluate source areas and migratory pathways and assess the need for additional data for the entire RMA. Regardless of the source, a review of new and historical analytical data has indicated that the NWBS target contaminants include chloroform, dieldrin, and DIMP. Chloroform was dropped as a target contaminant during the treatment alternatives assessment, since chloroform levels are well below the current ARAR. No other contaminants are projected to pose a problem in the vicinity of the NWBS over the next five years.

4. In the Proposed Decision Document, the Army states that the proposed monitoring of the Short Term Improvements system will "assess the effects of the extraction and recharge system on the hydrogeologic system in the vicinity of the NWBS." To date, the State has only seen ground water elevation maps of the NWBS area with water level contour intervals of one foot and more. We recommend contour intervals of 0.2 feet or less for evaluating the effects of the extraction and recharge system. Because the hydraulic head difference between the extraction and injection wells of the NWBS is only 0.5 feet, a 0.2 foot or less contour interval will be required to assess the NWBS. Development of an accurate water level contour map with 0.2 foot or less contours will require additional ground water elevation data. Such an accurate ground water level map will allow adequate evaluation of both the NWBS and Shell's Short Term Improvements.

Response:

The Army agrees that an effective assessment of the NWBS and the Short-Term Improvements (STI) requires accurate mapping of the unconfined aquifer water surface. Water levels will be measured in all monitoring wells (150 wells total) in the vicinity of the existing NWBS and the STI systems. All wells within this area have been resurveyed for the STI IRA in order to create an accurate water table map. Top-of-casing elevations and water levels are measured to an accuracy of 0.01 foot. Water level maps are contoured at one foot intervals in order to provide a readable presentation. A water level contour map with 0.2 foot contours on it would be highly unreadable and create more confusion to the

person studying the map. However, water level values are plotted on the map so greater detail can be obtained, if desired.

5. In the Proposed Decision Document, the Army states that, "ground water quality samples from monitoring wells down gradient from [the Short Term Extraction/Injection] system will be used to assess the effectiveness of the system." The effectiveness of the system must also be assessed using additional ground water elevation data. Groundwater flow should be more clearly defined within a radius of 2,500 feet of the Short Term Improvements IRA extraction and recharge systems. We therefore request that the Army hold a meeting to discuss the monitoring program outlined in the Proposed Decision Document.

Hydraulic controls are best evaluated with hydraulic data/hydraulic evaluation. As Shell stated in Comment #22 to the NWBSLTI-Draft Document, "contaminants follow the groundwater." To evaluate the Short-Term Improvements, it is more efficient to monitor the path ground water contamination will follow (monitoring ground water flow) than to monitor the path ground water contamination has taken (monitoring water quality). Moreover, since much of the dieldrin data is close to the detection limit, the sampling data often presents a confusing picture. In addition to the proposed water quality monitoring, a more extensive ground water monitoring system oriented toward defining ground water flow, including adequate mapping of the direction of groundwater flow must be implemented. This should include adequate ground water elevation data in the immediate area of all injection and recharge wells.

Response:

We agree that an effective assessment of the STI system should use a combination of water quality and water level data. Changes to existing groundwater flow paths resulting from the STI will be evaluated. Under the STI IRA, after the capture system commences operation, frequent water-level and water-quality monitoring will be conducted to determine that the system is functioning properly. When that has been determined, quarterly monitoring will begin under the monitoring program for the entire NWBS. Water levels will be measured in all monitoring wells (150 total) located within at least a 2,500-foot radius of both the existing NWBS and the STI IRA extraction and recharge system. The area monitored covers approximately 8,000 feet by 5,000 feet. A complete monitoring program will be outlined in the Implementation Document, not the Decision Document.

A total of 44 alluvial monitoring wells (both onpost and offpost) will be sampled quarterly for the analytes pertinent to operation of the NWBS.

6. If recharge to the upgradient recharge well field is to continue, the recharge rate must be optimized to ensure that excessive recharge does not result in undesirable changes in the flow paths near the NWBS. Potentially, excessive recharge could cause the dieldrin plume to move southwest around the NWBS. The State has not been provided any information regarding the impact of the recharge system on the shape of the dieldrin plume. We request that the basis for the selection of the recharge rates, and an evaluation of the impact of these rates on the plume be provided.

Response:

The STI system has been designed to capture the current dieldrin plume while minimizing changes to the current groundwater flow pattern. The flow rate of treated water to the reinjection well field will be equal to the flow rate of raw groundwater from the extraction well field, and will be controlled by an automatic flow control valve. Water table data for the wells in the vicinity of the STI will be evaluated in order to optimize discharge/recharge rates and to determine if relocation of any wells is necessary so that undesirable changes to the flow paths are avoided.

7. The Army stated at the NWBSLTI Subcommittee meeting on July 8, 1991 that it may not be necessary to treat for fluoride, because additional ground water from the Short-Term Improvements extraction system may dilute effluent fluoride concentrations to below ARAR levels. Dilution is not an acceptable treatment method for contaminated ground water. Fluoride or any other inorganic contaminants that reach the NWBS at concentrations above ARARs, including the secondary MCL of 2000, must be addressed with additional treatment. See State Specific Comment 36 on the NWBS Long-Term Improvements IRA B(ii) Draft Final Assessment Document, January 1991, Version 2.0.

Response:

The Army did not state that fluoride treatment may not be necessary due to added dilution water from the STI. It was noted by Shell during the meeting that the STI would result in attenuation of fluoride levels in the water reaching the northwest boundary treatment system. The maximum operating limit (MOL) for fluoride for the NWBS is 4000 ppb. The MOL is based on the primary MCL for fluoride in water. The yearly average for

fluoride in the influent groundwater to the NWBS is below 2000 ppb. As stated in the Army's response to State Specific Comments on the NWBS Long-Term Improvements IRA (Bii) Draft Final Assessment Document, January 1991, Version 2.0, fluoride was not identified as being appropriate to address in this phase of the IRA.

8. The travel times calculated by the Army's model may not be accurate due to the questionable calculation of effective porosity. These travel times were used by the Army to select the alternative presented in the Proposed Decision Document. Our specific concerns with the validity of this test include:
 - a. The results of the tracer test may represent the "average" of a layered formation. An average value would not represent the formation adequately. A study of the well logs for monitoring well 22061 (Borehole P-01) and dewatering well 22301 (Borehole DW-1) is necessary to determine if the test was conducted in a layered formation. These logs were not provided with the test information in the NWBSLTI Field Data Report. Please provide such data with the Final Data Report. Please provide such data with the Final Implementation Document or under separate cover.
 - b. The tracer test was not completed when the well was at a steady state condition. The plot of the pumping test data indicates that delayed drainage was occurring throughout the test. The equation of mass transfer which was used to interpret this data assumes steady state conditions exist. Therefore, the effective porosity calculated from these results would be higher than the true value. This will lead to the overestimation of contaminant travel times.
 - c. The Army stated in its response to State Comment #16 on the NWBSLTI Draft Assessment that the curve fitted to the tracer test data is in the NWBSLTI Field Data Report. However, the curve was not included in the report. Additionally, the full reference to the document concerning the data analysis methodology was omitted. Please provide the requested data and reference.

Response:

The issues raised by the State highlight some of the uncertainties involved in groundwater modeling. It was partially because of modeling uncertainties that monitoring and performance evaluation was selected as the preferred alternative.

With regard to the issues raised, the screened intervals for Wells 22061 and 22301 span approximately the entire saturated thickness. Therefore, parameters estimated from the tracer test data represent average values for the alluvium. Additionally, the groundwater flow model used for the NWBSLTI assessment simulated the alluvium as one hydrostratigraphic layer. The model required average aquifer parameter values for the alluvium.

The tracer test was conducted at nearly steady state conditions. This is typical of pumping tests of similar duration. The value for effective porosity estimated from the test (.35) is comparable to the average value estimated for the alluvium in the vicinity of the Irondale treatment facility (.31) (Mackay and Thorbjarnarson). Therefore, estimated travel times for groundwater are reasonable.

The curve for the Sauty method is included in Appendix A of the NWBS LTI Field Data Report. The full reference for the method was inadvertently omitted in the final Field Data Report. For your information, the reference is as follows:

Sauty, Jean-Pierre. An Analysis of Hydrodispersive Transfer in Aquifers. Water Resources Research, Vol. 16, No. 1, pp. 145-158. February 1980.

9. The Army has not assessed contamination bypassing the NWBS in the confined aquifers beneath the water table aquifer; nor has it developed and selected alternatives to prevent contaminant migration via this pathway. Although the Army has repeatedly stated that this IRA is restricted to the unconfined system, the FFA does not restrict the mandated assessment and implementation of appropriate improvements to any specific aquifer. All aquifers must be evaluated. Such an evaluation was contemplated and agreed upon by council members at meetings held at the Jefferson County Nature Center in the fall of 1989.

Response:

The offpost program has taken samples in the confined Denver Formation at the Northwest Boundary and does not believe any problems exist. A letter from Don Campbell to the Organizations and State on April 13, 1990 stated that the Long-Term Improvements would investigate the alluvial and unconfined aquifers. No other written correspondence has stated otherwise.

10. After the year of monitoring data is made available to the parties, the options for improvement of the system should include modification or relocation of the recharge system that has been installed as part of the NWBS Short Term Improvements, in addition to the options that are in the Proposed Decision Document (i.e., adjusting/increasing the pumping rates of the extraction wells or the installation of additional pumping wells). Modification or relocation of the recharge system may be necessary to mitigate undesirable impacts recharge has on the groundwater flow. The undesirable impacts of incorrect placement of the recharge field or excessive recharge rates could include contaminated groundwater bypassing the NWBS or dilution of the contaminant plumes.

Response:

The extraction/recharge system has been designed to prevent any undesirable impacts. The recharge system is located to prevent the new extraction system from changing the path of groundwater that is presently flowing toward and being intercepted by the existing NWBS. Additionally, as stated in response to General Comment 5, a combination of water quality and water level data will be used to assess the effectiveness of both the extraction and recharge systems. If necessary, modifications to the extraction/recharge system will be made.

11. The specific process, including decision criteria for reopening the Decision Document, must be included in the final document if the Army decides to go forward with one year's monitoring as its preferred alternative. This matter should be the subject of the requested subcommittee meeting. The parties also need to discuss the likelihood that sufficient additional information will be obtained after one year's monitoring to determine the necessity of further action.

Response:

As stated previously in response to the State's General Comment 1, the Army's decision is to Implement Shell's Short-Term Improvements and include performance and groundwater quality monitoring. The Decision Document will not be reopened, however, the parties will discuss whether additional action is required based on the monitoring program results.

12. Contaminated groundwater leaving the RMA through the confined Denver aquifer must be evaluated. Contaminants have been detected in groundwater samples taken from the

confined Denver aquifer in Section 22 at concentrations above their respective ARARs. These contaminants include benzene, dieldrin, aldrin, and endrin. DIMP has also been detected at concentrations exceeding the State's proposed standard (see attached figure). This information on confined Denver aquifer contamination is in the Draft Final Remedial Investigation Summary Report, Appendix B, Vertical Extent of Groundwater Contamination in the Denver Aquifer, Version 2.3, dated May 1991. Some of the Denver formation monitoring wells where the ARARs were exceeded are located near the RMA boundary. It is probable that this contamination extends off site. Therefore, the Army must perform additional investigation of contamination in the confined Denver aquifer.

Response:

Two of the wells cited (22002 and 22012) are screened within the unconfined aquifer. Well 22002 is screened within the alluvium and Well 22012 is screened within the alluvium/weathered Denver Formation. The other detections cited are sporadic in nature with reported concentrations barely above the CRL for the analytical method used.

For example, Well 22027 has been sampled and analyzed for endrin 30 times from August 1980 through November 1989 with only two reported detections above the CRL. The endrin detection cited occurred in September 1984 with a reported concentration of 0.4 µg/l (the CRL for the analytical method used is 0.2 µg/l).

Also, see response to the State's general comment 9.

Specific Comments:

1. Page 1-1: The Army's list of criteria for the evaluation of alternatives is incomplete. Consideration of short-term effectiveness as well as State and community acceptance must also be included pursuant to 40 C.F.R. § 300.430(e)(9)(iii) of the National Contingency Plan (NCP). In addition, 40 C.F.R. § 300.430(e)(9)(iii) (B) states that:

the alternatives shall be assessed to determine whether they attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility siting laws or provide grounds for invoking one of the waivers under paragraph (f)(1)(ii)(C) of this section.

40 C.F.R. § 300.430(f)(1)(ii) (C)(1) provides that:

an alternative that does not meet an ARAR under federal environmental or state environmental or facility siting laws may be selected ... [where] the alternative is an interim measure and will become part of a total remedial action that will attain the applicable or relevant and appropriate federal or state requirement.

Thus, the language concerning compliance "to the maximum extent practicable" must be deleted from the text. ARARs must either be met or waived pursuant to the above-cited sections.

Response:

The referenced paragraph from the report includes a partial listing of the nine-criteria outline in the EPA document "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA." The criteria actually used in the evaluation were based on the first seven of these nine criteria. As will be noted below, the last two of these criteria are related to the acceptance of alternatives by State agencies and the public and are not to be included in the evaluation prior to issue of the decision document according to the EPA guidance. The general correspondence between the CERCLA criteria and those listed is as follows:

CERCLA Criteria	Assessment Document Criteria
Short-term Effectiveness	Short-term Risk
Reduction in Toxicity, Mobility, Volume	Effectiveness
Implementability	Operational Complexity Timeliness
Cost	Present Value
Compliance with ARARs	Ability to Meet ARARs
Long-term Effectiveness	Long-term Effectiveness
Overall Protection of Human Health and the Environment	Protectiveness
State Acceptance	(Not to be considered in

evaluation at this point)

Community Acceptance

(Not to be considered in
evaluation at this point)

As noted in the document, all alternatives meet ARARs. The text has been changed to clarify this issue. Acceptance of the alternatives selected by the State and the public, based on comments received, has now been considered.

2. Page 3-1: This IRA was to assess the groundwater capture portion of the NWBS and evaluate the potential for contaminated groundwater to bypass the NWBS, regardless of whether it was located in the confined or unconfined aquifer. The first objective, therefore, must be revised accordingly.

Response:

See response to General Comments 9 and 12.

Comment:

The third objective should include all nine NCP criteria for selecting a remedy, pursuant to 40 C.F.R. § 300.430(e)(9)(iii) of the NCP, not just effectiveness, implementability and cost.

Response:

The reference to effectiveness, implementability, and cost in the third objective applies to the screening of alternatives for the treatment portion of the NWBS. Alternatives for the capture and treatment system as a whole were evaluated using the seven criteria based on CERCLA guidance.

3. Page 4-3: The State strenuously disagrees with the Army's decision not to treat chloroform. As explained innumerable times before by both the State and EPA, (see, e.g.):
 - State Comments on Shell Letter Technical Plan on the MCL for total trihalomethanes is not an ARAR for groundwater remediation. To meet the NCP prescribed point of departure of 10^{-4} , the Army must at a minimum treat chloroform to a level of

6 ug/l. This would require the addition of air stripping as originally proposed in Northwest Boundary System Long-Term Improvements IRA B(ii) Draft Final Assessment Document, January 1991, page 5-11.

Response:

The only regulatory standard which applies to chloroform is the MCL for total trihalomethanes of 100µg/l. The Army disagrees that a MOL for chloroform should be established at 6 µg/l and does not believe that the current average levels of chloroform, approximately 25 µg/l, represents any health threat. Chloroform is the only trihalomethane which is of any concern at the NWBS.

4. Page 4-4 -- The text refers to "eight CERCLA criteria" against which each alternative were evaluated. The listed criteria are not enumerated in CERCLA, nor do they accurately reflect the nine criteria prescribed in the NCP. See Specific Comment 2 above.

Response:

The criteria which were used in the evaluation were in general based on the first 7 criteria from CERCLA guidance. See response to comment 1.

5. Page 4-4 -- Why is the Army using the date of June 1992 to judge timeliness of alternatives? Please clarify in the text.

Response:

The text has been changed to clarify timeliness.

6. The chronology of "significant events leading to the decision to adopt the action ..." should include the parties correspondence regarding the objectives, development and implementation of the IRA. (See, for example,):

- Letter from Mears to Campbell, dated 07/27/89.
- Letter from Duprey to Voss, dated 09/29/89.
- Letter from Duprey to Voss, dated 02/16/90.
- Letter from Mears to Campbell, dated 03/12/90.
- Letter from Campbell to Edson, dated 04/13/90.

- Letter from Mears to Blose, dated 05/10/91.

Response:

The section giving the chronology of events leading to the decision to adopt the action is intended as an overview of significant events and is not intended to go into the detail suggested.

7. Page 8-2 -- The operating criteria for DIMP is identified as 600 ug/l. Given the fact that the Water Quality Commission is currently considering the promulgation of a level of 2 ug/l, and may be deciding this issue as early as next month, it is recommended that the Army evaluate its treatment system with this potential standard in mind.

Response:

The current granular activated carbon system readily adsorbs DIMP in the liquid phase. The current ARAR for DIMP is 600 $\mu\text{g/l}$. The current system has the capability to treat DIMP to much lower levels.

8. Page 8-2 -- The Army has identified 50 ug/l as its ARAR for arsenic. As the State has previously pointed out in numerous comment packages, (see e.g., State Comments on the Draft ARARs for Remediation of Other Contamination Sources (Motor Pool Area and M-1 Ponds) IRA, dated October 11, 1989, Specific Comment 3) this standard does not satisfy the 1×10^{-6} point of departure risk required by the National Contingency Plan. Risk Assessments conducted by State Officials indicate that the arsenic Maximum Contaminant Level could result in an individual excess lifetime cancer risk of 2.2×10^{-3} . The State has concluded that .023 ug/l represents a 1×10^{-6} excess cancer risk. See Feasibility Study Report, Draft for Public Comment, Volume I -- Text and Appendices, ASARCO Incorporated and State of Colorado Joint Study Globe Plant Site, Denver, Colorado, dated August 1990; Table 1.4 (previously submitted).

Response:

Only regulatory standards are reviewed when identifying ARARs. The level of 50 $\mu\text{g/l}$ for arsenic is identified as the drinking water standard in both federal and Colorado regulations.

9. Page 8-2 -- As previously noted by the State and EPA, the Maximum Contaminant Level (MCL) of 100 for trihalomethanes is not a relevant or appropriate chloroform standard for a CERCLA remedial action that does not involve chlorination as a method of treatment. Use of this level results in excess cancer risks that exceed that 1×10^{-6} target risk specified by the NCP. The State has previously suggested that .19 ug/l is the appropriate treatment level assuming that individuals may be exposed to chloroform contaminated fish, as well as drinking water. If such is not the case, a level of 6 ug/l would be acceptable.

Response:

The Army disagrees. In the absence of other regulatory standards, the only regulatory standard that applies to chloroform is the MCL for total trihalomethanes of $100 \mu\text{g/l}$. The Army does not feel that the current average levels of chloroform, approximately $25 \mu\text{g/l}$, represents any health threat.

10. Page 8-2 -- The Practical Quantification Limit for dieldrin should be deleted from the text since it is irrelevant to the Army's IRA. Army's current certified reporting limit (to our knowledge) is .05 ug/l. The Army must meet the health-based standard unless impossible from an engineering perspective. Therefore, as previously committed in its Final Decision Document for the Groundwater Intercept and Treatment System North of RMA IRA, dated July 1989 (pp. 37-38), the Army must undergo a concerted effort to lower its detection limit for dieldrin, and then treat to below that limit.

Response:

See the response to the State's comment 3 on Draft ARARs which are located in the Final Assessment Document, page A-4.

11. Page 8-1 -- The MCL for DBCP is no longer proposed at 0.2 ug/l; this is a final number.

Response:

The text has been changed.

12. Page 8-4, 8.4.2.1 -- The following additional State ARARs must be identified in the final document:

- Colorado Ambient Air Quality Standards (5 CCR 1001-14) (State standards for particulates). Construction activities must not result in exceedances of the ambient standards contained in the regulation.
- Colorado Air Regulation No. 2 (5 CCR 1001-4), pertaining to odorous emissions, for operation of the treatment system and for construction.

Response:

5 CCR 1001-14 is neither applicable nor relevant and appropriate because the standards of 50 C.F.R. 50.6 are more stringent. 40 C.F.R. 50.6 is considered relevant and appropriate. See response to Comment 13. Since there is no emission source required by the action to be taken, regulations pertaining to odor emissions are neither applicable or relevant and appropriate.

13. Page 8-5, second full paragraph -- The Army states that the provisions of 40 C.F.R. Section 50.6 are not considered relevant and appropriate, nor applicable to this IRA. However, the Army appears to commit to meet the substantive requirements of 40 C.F.R. Section 50.6. Additionally, we are puzzled by the phrase "there will be no particulate matter transported by air from the site" as it applies to an ambient air standard. We support the inclusion of 40 C.F.R. Section 50.6. as an ARAR, therefore we request clarification of the paragraph as written.

Response:

The text has been amended to reflect that 40 C.F.R. 50.6 is relevant and appropriate.

14. Page 8-3 -- The following typographical and transcription errors for the Colorado Air Pollution Control Commission Regulation No. 1, 5 CCR 1001-3, Part III(D)(2)(b), Construction Activities, must be corrected in the Final Document:
 - "a. Applicability - Attainment and Non-attainment Areas" should be re-labelled "(i) Applicability - Attainment and Nonattainment Areas" [emphasis added] to conform to the regulation as written.
 - The paragraph beginning "b. Applicable Emission Limitation Guideline ..." should be deleted and replaced with the following:

(iii) Applicable Emission Limitation Guideline

Both the 20 percent opacity and the no off-property transport emission limitation guidelines shall apply to construction activities; except that with respect to sources or activities associated with construction for which there are separate requirements set forth in this regulation, the emission limitation guidelines there specified as applicable to such sources and activities shall apply. Abatement and control plans submitted for construction 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.]

Response:

The text has been changed.

15. The correct cite for Diesel-Powered Vehicle Emission Standards for Visible Pollutants is not 5 CCR 1001-14. Rather, the cite is Colorado Air Quality Control Commission Regulation No. 12, 5 CCR 1001-15, Part C, Standards for Visible Pollutants from Diesel Engine Powered Vehicles. Also, the version cited by the Army is out of date. Please replace the text with the following:
 - A. No person shall emit or cause to be emitted into the atmosphere from any diesel-powered motor vehicle any air contaminant, for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40 percent opacity, with the exception of Subpart "B."
 - B. No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated (non-turbocharged) diesel-powered motor vehicle of over 8,500 pounds gross vehicle weight rating operated above 7,000 feet (mean sea level) any air contaminant for a period greater than five (5) consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 50 percent opacity.

- C. Any diesel-powered motor vehicle 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. These standards shall apply to motor vehicles intended, designed, and manufactured primarily for travel or use in transporting persons, property, auxiliary equipment, and/or cargo over roads, streets, and highways.

Response:

The text has been changed.

- 16. Pages 8-7 and 8-8 -- While the State appreciates the Army taking notice of the Colorado Noise Abatement Statute, § 25-12-103, C.R.S., as an ARAR, it should be clearly indicated that the Army only cites excerpts of the statute. Specifically, the Army subheadings a, b, c, d, e, and f corresponds to § 25-12-103(1), (2), (3), (5), (8), and (9), C.R.S., respectively. The document should be amended to more clearly reflect this.

Response:

The text has been changed to reflect that only excerpts of the statute have been cited.

SHELL COMMENTS ON THE PROPOSED DECISION DOCUMENT
FOR THE NORTHWEST BOUNDARY SYSTEM
LONG-TERM IMPROVEMENTS
INTERIM RESPONSE ACTION
JUNE 1991

General Comments:

1. A quarterly monitoring program has been proposed for the Northwest Boundary System (NWBS) that will include evaluation of both the existing system and the southwest extension. The start-up of the southwest extension, which is scheduled for the first week of August 1991, will include near-term monitoring until the hydrogeologic system stabilizes, followed by commencement of the quarterly program in October 1991.

The start-up and quarterly monitoring programs will include wells located in the same areas as those proposed by the Army for sampling in the one-year performance evaluation. Although the frequency of sampling is not mentioned by the Army, the start-up and quarterly programs will accomplish the objectives of the Long-Term Improvements phase of the IRA. The Shell and Army sampling programs will be coordinated so as to not duplicate effort. We suggest that the IRA performance evaluation for the southwest extension be incorporated with the FY 1992 annual performance evaluation for the entire NWBS, which should be issued in early 1993.

Response:

The Army agrees. Coordination with the FY 1992 annual performance evaluation for the entire NWBS will be made during the implementation phase.

Specific Comments:

1. Page 6-1, second paragraph

The four recharge wells are not located hydraulically upgradient of the extraction wells. Instead, they are located in a lateral position to the extraction wells and are designed to prevent the new extraction system from changing the path of the groundwater that is presently migrating toward and being intercepted by the existing system.

Response:

We do not dispute that the STI recharge wells have been designed to prevent change in the path of groundwater in the vicinity of the southwest extension to the NWBS. We do, however, find that the recharge wells are located hydraulically upgradient of the extraction wells, though not directly in the same flow path as the extraction wells as indicated in figure 4-3-2 of the NWBS LTI Final Assessment Document.

2. Page 6-1, last paragraph

We agree with the overall area selected for sampling; however, we have a few suggestions concerning the specific wells selected. Downgradient of the new extraction system, the alluvial aquifer is less than 15 feet thick within the majority of the dieldrin plume. In Shell's Short-Term Improvements investigation, the vertical distribution of dieldrin was found to be relatively uniform. Therefore, sampling both wells in certain adjacent well pairs is not necessary. We agree with the proposed sampling of the paired well clusters located in the paleochannel near the existing extraction system. Specific suggestions on the proposed wells are as follows:

- 1) Sampling of adjacent: Wells 27009 and 27505 is proposed. Both had similar water quality as discussed above. Well 27009 appears to be screened over the uppermost 4 feet of the weathered Denver Formation, instead of in the alluvium as the well log indicates. This conclusion is based on the well's very poor productivity during purging/sampling. Well 27505 would therefore be screened over the full saturated thickness of the alluvium. Thus, depending on the rationale for sampling Well 27009, it may not be necessary to do so.
- 2) Well 27006 is one of the older Army alluvial wells with a partially penetrating, 4-foot screened interval and was selected for sampling. Well 27085 is a fully penetrating alluvial CMP well located adjacent to 27006. They have overlapping screened intervals and similar water quality; therefore, we suggest exchanging Well 27085 for 27006.
- 3) Well "25702" should probably be "27502."

- 4) Wells 27086 and 27011 are adjacent and have overlapping screened intervals and similar water quality. Well 27086 is a fully penetrating CMP well and 27011 is a partially penetrating well; therefore, we suggest deleting Well 27011.

Response:

- 1) We agree that it may not be necessary to sample well 27009.
- 2) Agreed. Well 27085 is a satisfactory substitute for 27006.
- 3) Correct. The well is 27502.
- 4) The fully penetrating well 27086 is sufficient and 27011 has been deleted from the proposed well list.

EPA COMMENTS ON THE PROPOSED DECISION DOCUMENT FOR THE
NORTHWEST BOUNDARY SYSTEM LONG-TERM IMPROVEMENTS IRA
JUNE 1991

General Comments:

The proposed monitoring plan and the commitment to take further action, if necessary, should be described more thoroughly in the Decision Document for this IRA. We recommend that the sampling and analysis schedule, well list, analyte list, and reporting schedule for the results be provided in the Implementation Document.

Response:

The information requested is not appropriate for the Decision Document. Sampling and analysis information and schedules will be included in the LTI Draft Implementation Document.

Comment:

The Proposed Decision Document should be amended to state that the one year performance evaluation will assess the effectiveness of the entire NWBS, including the new slurry wall addition, for the range of contaminants discussed in the Alternatives Assessment, and the addition of further treatment will be added as necessary. This monitoring data should be fed into the Offpost Feasibility Study and the Offpost Record of Decision (ROD). The Decision Document should state the Army's commitment that needed modifications to the NWBS will be added via the mechanism that allows for the most efficient implementation (i.e., the Offpost ROD Remedial Action or an additional phase to this IRA).

Response:

We agree. A comprehensive quarterly monitoring program is being developed by Shell for the entire NWBS. This quarterly program will include evaluation of the existing system and both extensions that were installed under the STI IRA. The one-year performance evaluation for the LTI IRA will be of similar scope and will be coordinated with the quarterly monitoring program so as not to duplicate effort. The text has been changed to reflect the comment.

Specific Comments:

Page 6-1, Section 6.0. In order to support the preferred alternative selected in this Decision Document, please provide in this document a single site vicinity map which clearly depicts the monitoring wells proposed for sampling, the capture and recharge wells, the unconfined water table, and the contaminant plume which this IRA improvement intends to capture.

Response:

This information will be provided in the LTI Draft Implementation Document.

Comment:

Page 6-1, last paragraph, first line. Well 25702 is proposed to be sampled. This appears to be a typographical error as a Section 25 well does not seem appropriate for this IRA. Please correct or explain the use of this well.

Response:

The typographical error has been corrected. The correct well is 27502.