

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 03/00/88	3. REPORT TYPE AND DATES COVERED	
4. TITLE AND SUBTITLE PROPOSED DECISION DOCUMENT FOR THE INTERIM RESPONSE ACTION FOR THE CLOSURE OF ABANDONED WELLS AT ROCKY MOUNTAIN ARSENAL		5. FUNDING NUMBERS	
6. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NUMBER 88141R01	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ROCKY MOUNTAIN ARSENAL (CO.). PMRMA COMMERCE CITY, CO		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		11. SUPPLEMENTARY NOTES	
12a. DISTRIBUTION / AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED		12b. DISTRIBUTION CODE	
<div style="text-align: center; border: 2px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="font-size: 2em; margin: 0;">DTIC SELECTED MAY 24 1995 F</p> </div>			
13. ABSTRACT (Maximum 200 words) THE OBJECTIVE OF THE ABANDONED WELL CLOSURE INTERIM RESPONSE ACTION IS TO LOCATE, EXAMINE, AND PROPERLY CLOSE WELLS THAT MAY BE ALLOWING, OR COULD POTENTIALLY ALLOW, MIGRATION OF CONTAMINATION FROM UPPER AQUIFERS (SOME OF WHICH ARE KNOWN TO BE CONTAMINATED) TO DEEPER AQUIFERS. THIS PROPOSED DECISION DOCUMENT PROVIDES SUMMARIES OF: 1. ALTERNATIVES CONSIDERED 2. SIGNIFICANT EVENTS LEADING TO THE AWARD OF THE IRA CONTRACT 3. THE IRA PROJECT 4. THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, STANDARDS, CRITERIA, OR LIMITATIONS (ARAR'S) ASSOCIATED WITH THE PROGRAM.			
14. SUBJECT TERMS TREATMENT, ARARS, CERCLA		15. NUMBER OF PAGES	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED		16. PRICE CODE	
18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	

19950522 114

88141R01 *
NON-DOJ REVIEWED

2ND COPY



U.S. ARMY
MATERIEL COMMAND

— COMMITTED TO PROTECTION OF THE ENVIRONMENT —

**Proposed Decision Document
for the Interim Response Action
for the Closure of Abandoned Wells
at Rocky Mountain Arsenal**

March 1988

Prepared for :

**U.S. Army Program Manager's Office for
Rocky Mountain Arsenal Contamination Cleanup**

FILE COPY

**Rocky Mountain Arsenal
Information Center
Commerce City, Colorado**

**The use of Trade Names in this report does not constitute an official
endorsement or approval of the use of such commercial products.**

The report may not be cited for purposes of advertisement.

**PROPOSED DECISION DOCUMENT
FOR THE INTERIM RESPONSE ACTION FOR
THE CLOSURE OF ABANDONED WELLS AT
ROCKY MOUNTAIN ARSENAL**

MARCH 1988

Prepared for:

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR
ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

THE USE OF TRADE NAMES IN THIS REPORT DOES NOT CONSTITUTE AN
OFFICIAL ENDORSEMENT OR APPROVAL OF THE USE OF SUCH
COMMERCIAL PRODUCTS. THE REPORT MAY NOT BE CITED FOR
PURPOSES OF ADVERTISEMENT.

Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

PROPOSED DECISION DOCUMENT
ABANDONED WELLS CLOSURE

TABLE OF CONTENTS

1.0 INTRODUCTION..... 1

2.0 HISTORY OF RMA WELLS..... 1

3.0 INTERIM RESPONSE ACTION OBJECTIVES..... 2

4.0 INTERIM RESPONSE ACTION ALTERNATIVES..... 3

5.0 CHRONOLOGY OF EVENTS FOR THE ABANDONED WELL IRA..... 7

6.0 SUMMARY OF THE INTERIM RESPONSE ACTION PROJECT..... 9

7.0 IRA PROCESS..... 14

8.0 ARARs..... 15

 8.1 ATTAINMENT OF ARARs..... 15

 8.2 IDENTIFICATION AND SELECTION OF ARARs..... 15

 8.3 SELECTION OF ARARs AND DETERMINATION OF ARAR IMPACT... 15

 8.3.1 Ambient or Chemical-Specific ARARs..... 15

 8.3.2 Location-Specific ARARs..... 15

 8.3.3 Performance, Design, or Other Action-Specific ARARs..... 16

 8.3.3.1 Type of ARARs..... 16

 8.3.3.2 Well Locating and Sampling..... 16

 8.3.3.3 Well Closing..... 16

9.0 SCHEDULE..... 20

10.0 REFERENCES..... 21

**PROPOSED DECISION DOCUMENT
FOR THE INTERIM RESPONSE ACTION FOR
THE CLOSURE OF ABANDONED WELLS AT
ROCKY MOUNTAIN ARSENAL**

1.0 INTRODUCTION

The Interim Response Action (IRA) for the Closure of Abandoned Wells at the Rocky Mountain Arsenal (RMA) is being conducted as part of the IRA Process for RMA in accordance with the June 5, 1987 report to the court in United States v. Shell Oil Co. and the proposed Consent Decree. The IRA project will include a search for all pre-1942 wells and for post-1942 wells for which accurate construction information does not exist or exists and indicates that the wells may not have been properly constructed. Wells identified in the ongoing RI/FS project at RMA as having improper construction techniques and a significant potential for allowing inter-aquifer contamination are also included in the IRA. The program itself involves a search for wells on a priority basis, with subsequent closure of the wells. The IRA is presently being conducted under Task 37 of the RI/FS program, but it is anticipated that a follow-up contract will be required to complete closure of all wells judged important enough to require action.

2.0 HISTORY OF RMA WELLS

RMA was constructed circa 1942 in an area that had been devoted to agricultural and residential use. As many as 250 water wells for irrigation, stock watering, and domestic use were constructed on what is now RMA property. Information on the pre-1942 wells, available from scattered sources, indicates that about one-half of the wells are greater than 30 inches in diameter and were probably hand-dug. The reported well depths range from 15 to 1,000 feet with approximately 40 wells over 100 feet deep. It is also reported that approximately 40 of the pre-1942 wells have been "filled" and an additional unspecified number have been covered. The remainder of the wells were probably left open (Morrison-Knudsen, 1985, RIC 85343R01). It has been estimated that approximately 200 of these 250 wells are not usable for monitoring purposes (ESE, 1986, RIC 87013R01).

In addition, since the establishment of RMA in 1942, hundreds of monitoring wells have been installed on the property. The majority of these wells are in good condition and still in use. It has been determined, however, that approximately 150 to 200 of the post-1942 monitoring wells are no longer usable (ESE, 1986, RIC 87013R01). Information on most of the post-1942 monitoring wells is available from the USATHAMA database. These wells are reportedly two to six inches in diameter and 15 to 140 feet deep.

3.0 INTERIM RESPONSE ACTION OBJECTIVES

The Program Manager's Office for the Rocky Mountain Arsenal Contamination Cleanup (PMO-RMA) is concerned with the potential for contaminant migration between aquifers through unused and undocumented wells on RMA. The objective of the Abandoned Well Closure IRA is to locate, examine, and properly close wells on RMA that may be allowing, or could potentially allow, migration of contamination from upper aquifers, some of which are known to be contaminated, to deeper aquifers.

This proposed decision document provides a summary of the alternatives considered, a chronological listing of the significant events leading to the award of the IRA, a summary of the IRA project, and a summary of the Applicable, or Relevant and Appropriate Requirements, standards, criteria, or limitations (ARARs) associated with the program.

4.0 INTERIM RESPONSE ACTION ALTERNATIVES

In a June 5, 1987, report to the court in United States V. Shell Oil Co., the United States (the Army and EPA), Shell, and the State of Colorado committed to the need for an Abandoned Wells Closure IRA that was described as follows:

The parties agree that all wells on the Arsenal that are not currently part of the ongoing groundwater monitoring program or that are not suitable for inclusion in the future monitoring program will be plugged and closed by the United States. This action will ensure that such wells do not serve as conduits for the flow of contamination from upper to lower ground water aquifers. The parties will meet on June 9, 1987 to reach consensus on which wells are appropriate for sampling and closure and to develop a priority closure list.

In early February, 1988, the parties lodged a proposed Consent Decree with the court in United States v. Shell Oil Co. that contains a similar provision.

Accordingly, with respect to this IRA, the typical alternatives analysis that is usually performed pursuant to CERCLA has been supplanted by these documents. The following discussion of alternatives is therefore an abbreviated one in recognition of the advanced stage of the project and the fact that the fundamental decisions with respect to the need for and nature of the Abandoned Wells Closure IRA are the product of a consensus reached months ago.

The overall IRA alternatives considered by the U.S. Army for the RMA Abandoned Wells are as follows:

1. No action;
2. Further study of the potential for inter-aquifer contamination;
3. Incorporation of the wells into existing or future monitoring programs;
and
4. Closure of the wells in accordance with standardized practices in use by water well contractors and in compliance with the ARARs that pertain to well sealing.

The alternatives assessment for this IRA was relatively straightforward. The no-action alternative was quickly ruled out as unacceptable. There is known contamination in the upper aquifers at RMA. There are some data available to indicate that there is a net upward component to the inter-aquifer flow on some portions of RMA, but there are insufficient data available to guarantee that there is no downward flow component from these upper aquifers to lower, uncontaminated aquifers at other locations on-post. These deeper aquifers represent a valuable resource for the Denver metropolitan area, and are worthy of protection from RMA-based contamination. The no-action alternative would have allowed any inter-aquifer contamination that may be occurring at present to continue and would have

done nothing to stop the potential for future contaminant migration.

Further study of the hydraulic gradients between the various aquifers underlying RMA is an ongoing process and will be continued whether or not the well closure program is undertaken. In consideration of the time required to complete the hydrologic assessment to ensure, with a high degree of confidence, that the downward flow component is not important in terms of contaminant migration, further study was judged not to be an acceptable alternative for remediating the potential problem.

The use of the wells for existing or future monitoring programs was deemed unacceptable because the construction information on these wells either demonstrated that proper construction techniques were not employed, or that insufficient information exists to determine whether the construction methods would be acceptable. Particularly for water quality, well construction methods play an important role in determining the integrity of the samples collected from the well. Unless the sample integrity can be proven acceptable, use of the well for monitoring is not considered a viable alternative. Similarly, for wells that could potentially be screened across more than one aquifer, even water level measurements would be suspect and therefore unacceptable. Further use of these wells for monitoring was judged not to be an acceptable alternative for remediating the potential problem.

The final alternative considered was closure of the wells. This alternative was selected because it would ensure complete cessation of any inter-aquifer contamination occurring along or through well casings. In addition, some of the abandoned wells pose physical hazards to workers and other site visitors due to the potential for falls into the open wells. Closure of the wells would eliminate these physical hazards.

Within this overall closure scenario, there were a number of approaches that could be used to evaluate and, ultimately, close individual wells. Much of the evaluation work has already been performed under Tasks 4 and 44, the groundwater screening and monitoring programs. Further evaluations have been conducted under the preliminary stages of Task 37, the Well Abandonment Program. During the development of the Task 4 Technical Plan (ESE, 1986, RIC 87013R01), a data sheet for each well was prepared. This sheet contained information on the construction characteristics of the wells, their locations, date of installation, screened intervals, etc. Based on the information obtained, the 1,568 known wells on RMA were separated into three general categories. Three hundred fifty-five wells were judged suitable for groundwater sampling and water level measurements. An additional 490 wells were judged to be suitable for water level measurements only. Of the remaining 720 wells, it was determined that 181 were unacceptable for either sampling or water level measurement, 96 were previously closed, and 443 had insufficient data to determine their suitability for further use. Nearly all of the pre-1942 wells were in the category of insufficient data.

The Task 37 Technical Plan describes alternative strategies for field searches, well assessments, possible sampling, and well closure procedures. In summary, first and

second level field searches were established. Each well considered in the Task 37 program was screened for inclusion into a first level search based upon well characteristics such as proximity to known contamination plumes, depth, or penetration of two or more aquifers. If the well could not be found in the first level search using visual observation and conventional geophysics, it was again screened for inclusion into a more elaborate second level search. Procedures for determining whether or not to sample a particular well were also developed, based upon well condition, proximity to existing monitoring wells and edges of contamination plumes, and aquifer penetration. Proposed well closure procedures are also described in the Technical Plan.

5.0 CHRONOLOGY OF EVENTS FOR THE ABANDONED WELL IRA

The significant events leading up to and including the award of the contract for the prioritization, search, sampling (limited), and closure of abandoned wells are presented below.

- Oct 3, 1986 PMO-RMA issues Proposed Delivery Order to Ebasco Services Incorporated under Contract Number DAAK11-84-D-0017 to "Review existing information and formulate an adequate methodology through geophysical and other techniques, as appropriate, in order to (a) physically locate, record current condition, and survey exact positions, (b) sample and chemically analyze for contaminants and, (c) plug the wells using proper techniques...to mitigate any downward contaminant flow from one aquifer to another by way of the abandoned wells."
- Apr 17, 1987 PMO-RMA issues Order for Services to Ebasco Services Incorporated to carry out the first phase of the well closure program at RMA. The amount of the contract is \$1,246,148. It is awarded as Task Order Number 37.
- May 11, 1987 PMO-RMA holds kick-off meeting for Task 37 with Ebasco Services Incorporated and their intended subcontractor for the well closure program, Geraghty & Miller, Inc. Ebasco/Geraghty & Miller is directed to prepare an approach for carrying out the Task and to develop a Management Plan for it.
- Jun 9, 1987 PMO-RMA holds a meeting with Shell Oil Company, the State of Colorado, and the EPA, along with their contractors, to discuss the technical approach to be used for the well closure program.
- Jul 1, 1987 PMO-RMA submits draft Technical Plan to MOA parties for review and comment.
- Aug 17, 1987 First level field search initiated.
- Jul 29, 1987 Comments received from Shell Oil Company on Task 37 Technical Plan.
- Sep 28, 1987 Comments received from US EPA on Task 37 Technical Plan.
- Oct 30, 1987 PMO-RMA directs Ebasco to halt work on Task 37 until Decision Document can be prepared.
- Jan 7, 1988 Comments received from the State of Colorado on the Task 37 Technical Plan.

Feb 22, 1988

Comments received from the US Department of the Interior (DOI)
on the Task 37 Technical Plan.

6.0 SUMMARY OF THE INTERIM RESPONSE ACTION PROJECT

The IRA for Abandoned Well Closure under Task 37 consists of ten major work components as described below:

1. An historical literature review will be performed to identify information on the location, water quality, and condition of the pre-1942 wells and to identify the post-1942 monitoring wells that are no longer in use or considered unusable for further water quality sampling or water level measurement.
2. The estimated 200 unusable pre-1942 wells and the estimated 150 unusable post-1942 monitoring wells will be prioritized by their potential for adverse impact and the need to locate these wells to institute a first level field search.
3. The first level field search will be conducted to confirm the approximate locations of wells with a high field search priority. The first level search will consist of a site visit with such equipment as a metal detector or magnetometer. If the well is located, it will be labeled and staked for land surveying.
4. Wells that are not found during the first level field search will be prioritized by the need to locate these wells and the applicability of additional location techniques.
5. A second level field search will be initiated for wells with a high second level field search priority. The second level search will employ specialized geophysical search techniques in a final attempt to locate a well. The exact methodology used to locate the well will be chosen based on the applicability of each technique.
6. Once a well is located, it will be examined to establish its physical condition and the need for, or suitability of, properly closing it. The procedures will vary with the condition, type, construction, diameter, and depth of each well.
7. Wells located in the field searches will be evaluated for the need to sample the well before properly closing it. Evaluation criteria will include the location of the well, the aquifer penetrated by the well, and the location and water quality of nearby wells.
8. A water sampling program will be conducted on wells that meet the sampling criteria prior to the closure of the wells. The samples will be analyzed for volatile halogenated organics, organochlorine pesticides, phosphonates, arsenic, mercury, and dibromochloropropane.
9. Wells will be properly closed in the order of their associated first

level field search priority. This will ensure that the deeper wells in existing contaminant plumes will be properly closed first. Wells that are sampled will be closed after sampling. Each well will be examined separately, and the closure procedure will be designed to eliminate the vertical movement of water within the annular space and within the well bore, prevent intermingling of water from different aquifers, eliminate physical hazards, and prevent groundwater contamination from surface or near-surface sources.

Closure methods will follow standardized procedures in use by water well contractors and in accordance with USATHAMA Quality Assurance/Quality Control procedures. These methods are in compliance with EPA and State of Colorado standards for well sealing (Colorado State Board of Examiners of Water Well and Pump Installation Contractors, 1984). If proper closure necessitates procedures that differ from those described below, the Organizations and the State will be consulted prior to the actual closure.

To properly seal an abandoned water well, the following tasks should be accomplished:

- (a) Elimination of physical hazards;
- (b) Maintenance of hydrostatic head of aquifers;
- (c) Prevention of intermingling of water from different aquifer zones;
- (d) Prevention of groundwater contamination from surface or near-surface sources.

Each well to be plugged will be examined as a separate entity and careful consideration will be given to the original design of the well (if this can be determined) and the geologic environment. The plugging operation will be designed to eliminate the vertical movement of water within the annular space and within the well bore. If artesian conditions exist, the sealing operation will be designed in such a way as to confine the water to the aquifer and prevent either loss of artesian pressure or circulation between two distinct aquifers.

To properly plug a well, all materials that may hinder the sealing operation will be removed to the extent possible, including the screen and casing. If the casing cannot be removed it may have to be cut, torn, or perforated to allow the grout to completely fill the annular space as well as the interior of the casing. This will be accomplished through the use of a perforating tool, a casing knife, or explosives.

The grout will be introduced at the bottom of the well, or at the in-

terval to be sealed (or filled), and placed progressively upward to the top of the well. All sealing materials will be placed by the use of grout pipe, tremie pipe, cement bucket, or dump bailer to avoid segregation or dilution of the sealing materials. To ensure a competent seal between the grout and the borehole, the grout will be pumped until it flows undiluted from the well at ground surface. When conditions permit, the grout placement and casing removal will be conducted at the same time in such a way as to maintain 10 feet of grout within the casing yet to be removed.

Plugging of the wells will proceed after the borehole has been inspected and logged to ascertain casing and hole conditions. Assuming no complications, the cement grout will be placed at the bottom of the hole and the well will be filled to land surface. If the casing appears to be in good condition, an attempt will be made to jack up the casing and remove it while the cement is being placed. If the casing appears to be in poor shape, no attempt will be made to recover it, as this might cause the hole to collapse and prevent a proper cementing job.

The cementing operation for deep wells will be handled in accordance with water well and oil drilling technology. The cementing operation will be planned taking into consideration the borehole diameter, depth, temperature, hole deviation, formation properties, and casing. The cement composition will be determined based upon hole conditions, additives, volume, and setting time desired. Water of drinking water quality will be used for cement mixing. The cement density will be monitored and recorded throughout the cementing operation to ensure that the proper mixing ratio is maintained.

The cement will be placed in the well by means of tubing or drill pipe if the diameter of the well is large enough. The cement slurry will then be pumped through the tubing, which is withdrawn before the cement sets. Should it be necessary to seal the annular space between the casing and hole wall near the land surface, cement will be injected with small diameter tubing around the casing.

Three major types of wells are expected to be closed, each requiring somewhat different closure techniques.

(a) Large Diameter Dug Wells

The dug wells with diameters of 48 to 60 inches and depths of 30 to 50 feet are typically constructed with a 4 inch thick concrete liner. The wells will be filled with commercial grade concrete as it is less expensive than neat cement or grout. If care is taken in the placement of the concrete, preventing

separation of the aggregate and cement, the concrete plug should provide an excellent permanent seal. Some of the dug wells may have been deepened by drilling, and closure procedures for these wells are discussed below.

(b) Shallow Post-1942 Monitoring Wells

These wells typically are constructed of PVC or steel and have a diameter of 2 to 6 inches with a range of depths from 15 to 140 feet. Most of the wells are equipped with short sections of PVC screen set opposite water-bearing sections in the alluvial aquifer or Denver sandstone beds. Some wells are equipped with stainless steel well screens. If the initial checking of the well indicates no complications, an attempt will be made to recover the pipe and screen. In most cases it is expected that the records and field inspection will show that the well casing was cemented in place and that no pulling or salvaging of casing and screen is possible. In that case, the screen portion of the well will be backfilled with clean sand (in accordance with State of Colorado regulations), and the remainder of the borehole will be filled with grout to the land surface. If the depth of the well and the location of the screened interval are such that there is a possibility that the screen extends across more than one aquifer, the entire casing and screened interval will be filled with grout to the land surface.

(c) Pre-1942 Farm Wells

Little is known about the construction of the farm wells that existed at RMA at the time the government acquired the property. It is believed that the drilled farm wells range in diameter from 3 to 18 inches and that their depths range from 15 to 1,000 feet. Some 40 wells are believed to be deeper than 100 feet. The shallow wells probably tapped alluvial or Upper Denver sandstone beds. The deeper wells probably tapped the Arapahoe Formation. To properly close these wells, an attempt will be made to remove the casings prior to grouting the borehole. The techniques used to accomplish this will vary depending upon casing type and well construction, but will include drilling or washing out debris found in the well, pulling the casing, and overdrilling the casing. If the casing cannot be removed, it will be perforated. After pulling or perforating the casing, the borehole will be filled with grout. The grout will be pumped into the borehole using a tremie pipe.

For wells that have contradictory or incomplete well construc-

tion records, information on the original total depth and design of each well will be developed from drilling records acquired during the redrilling/cleaning of the wells and from limited use of borehole geophysical techniques; subsequently, the well will be closed according to the procedures outlined above.

10. Each well located will be surveyed to establish its elevation and map coordinates with respect to an established grid, which is consistent with USATHAMA requirements.

7.0 IRA PROCESS

With respect to the Abandoned Wells IRA, the IRA Process is as follows:

1. The Army afforded the Organizations, DOI, and the State an opportunity to participate, at the equivalent of the RMA Committee level (it was equivalent because the RMA Committee did not exist as such at the time), in the identification and selection of ARARs pertinent to this IRA. In this instance, the participation took the form of the June 9, 1987, meeting with EPA, Shell, and the State, the July 1, 1987, submission of the Technical Plan (which here served as the functional equivalent of the IRA assessment) to EPA, Shell, and the State for review and comment, and the Army's receipt of comments from EPA, Shell, and the State on the Task 37 Technical Plan. By agreement, the plugging and closure of the abandoned wells are to be performed in accordance with the criteria developed in July 1987 by the Army, EPA, Shell, and the State.
2. EPA, Shell, and the State were afforded an opportunity to identify, on a preliminary basis, any potential ARARs.
3. The Army issued this proposed Abandoned Wells Closure IRA Decision Document for a 30-day public comment period. This proposed Decision Document is also supported by an administrative record.
4. Promptly after the close of the comment period on the proposed Decision Document, the Army shall transmit to the other Organizations, DOI, and the State a draft final IRA Decision Document.
5. Within 15 days of issuance of the draft final Abandoned Wells Closure IRA Decision Document, an Organization (or DOI where appropriate) 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 a final Abandoned Wells Closure IRA Decision Document to the other Organizations, DOI, and the State and shall notify the public of the availability of the final IRA with the supporting record. Only preliminary design work for the IRA may be conducted prior to the issuance of the final IRA Decision Document.
7. Thereafter, the Abandoned Wells Closure IRA Decision Document will be subject to judicial review in accordance with Section 113 and 121 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §§ 9613 and 9621.

8.0 ARARs

8.1 ATTAINMENT OF ARARs

The interim action process reported to the Court on June 5, 1987, in United States v. Shell Oil Co. provides that the IRAs (including the Abandoned Wells Closure IRA), shall, to the maximum extent practicable, attain ARARs. A similar provision appears in Paragraph 9.7 of the proposed Consent Decree.

8.2 IDENTIFICATION AND SELECTION OF ARARs

By letter dated October 27, 1987, counsel for the Army requested that EPA, Shell, and the State preliminarily identify in writing the potential ARARs that they believe may be pertinent to the Abandoned Well Closure IRA. Shell responded to the letter without identifying any potential ARARs. EPA did not respond. The State had previously nominated potential ARARs for consideration.

8.3 SELECTION OF ARARs AND DETERMINATION OF ARAR IMPACT

8.3.1 Ambient or Chemical-Specific ARARs

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

For purposes of the Abandoned Wells Closure IRA, there are no pertinent ambient or chemical-specific ARARs.

8.3.2 Location-Specific ARARs

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

For purposes of the Abandoned Wells Closure IRA, there are no pertinent location-specific ARARs.

It should be noted that Paragraphs 23.2 (e) and (f) of the proposed Consent Decree provide that:

- (e) Wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Spe-

cies Act, 16 U.S.C. §§ 1531 *et seq*, migratory birds to the extent required by the Bald Eagle Protection Act, 16 U.S.C. §§ 668 *et seq*.

- (f) Other than as may be necessary in connection with a Response Action or as necessary to construct or operate a Response Action Structure, there shall be no change permitted in the geophysical characteristics of RMA that has a significant effect on the natural drainage at RMA for floodplain management, recharge of groundwater, operation and maintenance of Response Action Structures, and protection of wildlife habitat(s).

While these provisions are not ARARs, they obviously must be complied with for purposes of this IRA. Based on communications with the U.S. Fish and Wildlife Service, it appears that the Abandoned Wells Closure IRA, as presently described in the Technical Plan and the Proposed Decision Document, will have no adverse impact on any endangered species, migratory birds, or the protection of wildlife habitats because it will accommodate all of the concerns of the U.S. Fish and Wildlife Service.

Moreover, the Army has separately determined that this IRA will not change the physical characteristics of RMA in a manner that will have significant effect on the natural drainage at RMA for floodplain management, recharge of groundwater, and operation and maintenance of Response Action Structures.

8.3.3 Performance, Design, or Other Action-Specific ARARs

8.3.3.1 Type of ARARs

Performance, design, or other action-specific requirements sets controls or restrictions on particular kinds of 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.

8.3.3.2 Well Locating and Sampling

With respect to the agreed upon procedures for locating abandoned wells through the first and second level field search, and evaluation of such wells to determine the need for sampling before closing them and sampling, there are no pertinent action-specific ARARs.

8.3.3.3 Well Closing

The Army has identified the following regulations as relevant and appropriate to the closing of the identified abandoned wells:

- (i) 40 C.F.R. § 144.12 (a) -- Underground Injection Control (UIC) prohibition of movement of fluid into underground sources of

drinking water;

- (ii) 40 C.F.R. § 144.28 (c) (2) -- UIC plugging and abandonment plan for EPA administered program; and
- (iii) 40 C.F.R. § 146.10 -- UIC plugging and abandoning Class I-III wells.

None of the abandoned wells that are the subject of this IRA is properly classified as an UIC injection well within the meaning of 40 C.F.R. § 144.6. The four classes of wells are: (a) Class I -- wells used to inject hazardous waste beneath the lower-most formation that contains, within one-quarter mile of the well bore, an underground source of drinking water; (b) Class II -- wells that inject fluids in connection with conventional or enhanced recovery of oil or natural gas, and wells that inject fluids that are hydrocarbons and are liquid at standard temperature and pressure; (c) Class III -- wells that inject for the extraction of minerals, including mining of sulfur, *in situ* production of uranium, or solution mining of salts and potash; (d) Class IV -- wells used to inject hazardous or radioactive waste into a formation within or above one-quarter mile of a drinking water system or to dispose of unclassified hazardous waste. Moreover, since this IRA is being conducted pursuant to CERCLA, entirely on-site and in compliance with CERCLA Sections 120 and 121, 42 U.S.C. § 9620 and 9621, the regulatory jurisdiction associated with the UIC program for the above-referenced regulations simply does not arise. In these circumstances, the nature of the remedial action is such that the jurisdictional prerequisites of these requirements are not met. Thus, the foregoing regulations are not applicable here.

Nevertheless, these regulations do address problems or situations sufficiently similar to those encountered at the RMA CERCLA site that use of these regulations is well-suited to this site and accordingly they will be treated as "relevant and appropriate." A requirement that is relevant and appropriate must be complied with to the same degree as if applicable. However, there is more discretion in this determination; it is possible for only part of a requirement to be considered relevant and appropriate, the last being dismissed if judged not to be relevant and appropriate in a given case.

Accordingly, the following performance, design or other action-specific ARARs are selected by the Army as relevant and appropriate to this portion of the IRA:

- (i) 40 C.F.R. § 144.12 (a) -- Provides in pertinent part that a well shall not be closed in a manner that allows movement of fluid containing any contaminant into an underground source of drinking water if this causes a violation of a primary drinking water regulation under 40 C.F.R. Part 142 or otherwise may adversely affect the health of persons;
- (ii) 40 C.F.R. § 144.28 (c) (2) -- Provides for submission of a plugging and closure plan that includes the following information:

- (a) The nature, quantity and material to be used in plugging;
- (b) The location and extent (by depth) of the plugs;
- (c) Any proposed test or measurement to be made;
- (d) The amount, size, and location (by depth) of casing to be left in the well;
- (e) The method and location where casing is to be parted; and
- (f) The estimated cost of plugging the well.

The well is to be plugged and closed in accordance with the plan except with notice to and approval by the EPA Regional Administrator.

(iii) 40 C.F.R. § 146.10 (a)-(c)--

- (a) Prior to closing Class I to III wells the well shall be plugged in a manner which will not allow the movement of fluids either into or between underground sources of drinking water. The Director may allow Class III wells to use other plugging materials if he is satisfied that such materials will prevent movement of fluids into or between underground sources of drinking water.
- (b) Placement of the cement plugs shall be accomplished by one of the following:
 - (1) The Balance method;
 - (2) The Dump Bailer method;
 - (3) The Two-Plug method; or
 - (4) An alternative method approved by the Director, which will reliably provide a comparable level of protection to underground sources of drinking water.
- (c) The well to be closed shall be in a state of static equilibrium with the mud weight equalized top to bottom, either by circulating the mud in the well at least once or by a comparable method prescribed by the Director, prior to the placement of the cement plug(s).

In conformance with these relevant and appropriate ARARs, the Army will not close the wells in a manner that allows the movement of fluid containing contaminants

into any underground source of drinking water (40 C.F.R. § 144.12 (a)), a plugging and closure plan will be prepared and provided to EPA, Shell, and the State (40 C.F.R. § 144.28 (c) (2)), and the plugging and closure will be done consistent with the provisions of 40 C.F.R. § 146.10 (a)-(c).

Colorado also nominated Section 5 (Abandonment Regulations) of the Revised and Amended Rules and Regulations for Water Well and Pump Installation Contractors for consideration as ARARs. Section 5 provides in pertinent part that:

- (a) Small diameter wells formerly producing from unconfined material shall be closed by filling with sand or gravel to the static water level, then with inert materials to within 10 feet of the surface. The top 10 feet shall be filled with concrete, neat cement, or other approved material.
- (b) Large diameter wells formerly producing from unconfined material shall be closed by filling with sand or gravel to the top of the water level with inert material to the surface and by installing a permanent water-tight cover of adequate strength at the top of the casing. On farm lands the top 5 feet of casing shall be removed, the hold filled with sand or gravel to the top of the water level with inert materials to within 5 feet of the surface, and shall be capped with concrete or steel 5 feet below the surface.
- (c) Wells formerly completed in confined and unconfined formations or in confined formations only shall be closed by plugging with concrete, neat cement, or other approved material at the first impervious strata above each zone and cement grouted from the surface to a depth of 10 feet. No plug shall be less than 5 feet in length.

Since these provisions are not more stringent than those in 40 C.F.R. § 146.10, they do not warrant treatment as ARARs in this context.

Colorado's other suggestion that a State of Colorado Well Abandonment Affidavit should be filed with the Colorado Division of Water Resources is plainly not an ARAR. Moreover, it will be sufficient for the Army to file a copy of the plugging and closure plan that will be developed in accordance with 40 C.F.R. § 144.28 (c) (2) to ensure that an adequate record of these actions will be readily available to state residents.

9.0 SCHEDULE

The following milestones for the Abandoned Wells Closure Interim Response Action are based on the assumption that no more than 400 wells will be involved in the second phase of the Abandoned Wells Closure program. In addition, it is also assumed that very few of the wells not found during phase one (*i.e.*, Task 37) will be included in the second phase. In most cases, wells were painstakingly searched for until found or until all historical and physical clues were exhausted. Unless additional information can be found, more searching for these wells will be futile. If the above assumptions prove to be incorrect or if adverse weather or field conditions hamper operations, then the milestones listed below may not be attainable.

- May 25, 1988 All well searches under Task 37 will be completed. Well closures will begin (assuming no Dispute Resolution is sought).
- Sep 27, 1988 All well closures to be completed and draft final Task 37 report distributed. Award of a new Task Order Contract for future RMA cleanup. Task 3 of this new contract will be the second phase of the Abandoned Wells Closure IRA program.
- Dec 2, 1988 Provide a status update and enhanced schedule based on discussions with the contractor.
- Mar 3, 1989 Field searches and surveys for the post-1942 wells started along with any pre-1942 wells included in the second phase.
- May 1, 1989 Initiate closure of all second phase wells.
- Nov 3, 1989 Draft Final Abandoned Wells Closure IRA report.
- Feb 23, 1990 Final Abandoned Wells Closure IRA report, including comments and responses, distributed.

10.0 REFERENCES

RIC 86317R01

Environmental Science and Engineering, Inc., 1986, October. Rocky Mountain Arsenal Water Quantity/Quality Survey, Initial Screening Program, Final Draft Report. USATHAMA Contract Number DAAK11-84-D-0016, Task Number 4, ESE, HLA, Resource Consultants.

RIC 85343R01

Morrison-Knudsen Engineers, Inc., 1985, August. Report on Pre-1942 Wells at Rocky Mountain Arsenal. Holme, Roberts, and Owen, Denver.

RIC 87277R03

Ebasco Services Incorporated, 1987, May. Abandoned Well Program, Draft Final Technical Plan. USATHAMA Contract Number DAAK11-84-D-0017, Task Number 37, Ebasco Services Incorporated, Geraghty & Miller, Incorporated.