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WORK PLAN FOR THE FEASIBILITY STUDY TASK 10 REPORT NOVEMBER 1990

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WORK PLAN
FOR THE FEASIBILITY STUDY

TASK 10 REPORT

FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

REMEDIAL INVESTIGATION and FEASIBILITY STUDY

November 1990

U.S. DEPARTMENT OF ENERGY
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FMPC-0010-5 2

FINAL

EPA LETTER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

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NOV 13 1990

REPLY TO ATTENTION OF:

5HR-12

Andrew P. Avel
United States Department Of Energy
Feed Materials Production Center
P.O. Box 398705
Cincinnati, Ohio 45239-8705

RE: FS Work Plan
U.S. DOE Fernald
OH6 890 008 976

Dear Mr. Avel:

On October 10, 1990, the United States Department of Energy (U.S. DOE) submitted a revised proposed Feasibility Study (FS) work plan for the remedial action at the Feed Materials Production Center in Fernald, Ohio under the operable unit scheme of the 1990 Consent Agreement.

Comment #5 of the United States Environmental Protection Agency's (U.S. EPA) September 10, 1990, work plan disapproval letter indicated an inaccuracy in the document. In accordance with the operable unit scheme proposed by U.S. DOE in the 1990 Consent Agreement, the scrap metal piles are in operable unit #2, not Operable Unit #3. All of U.S. DOE's documents must coincide with the commitments made in the 1990 Consent Agreement.

U.S. DOE's response to comment #23 is inadequate to address the reasonable maximum exposure (RME) individual in future use scenarios. As discussed in the October 20, 1990, conference call, future use scenarios placed the RME individual in a residential setting within (not at) the boundary of the waste unit. This issue has been settled in discussions with U.S. DOE subsequent to the FS submittal.

Section 2.2.3, Page 5: The first full sentence on this page is not consistent with the first sentence of this paragraph from the proceeding page or the 1990 Consent Agreement. All contaminated soil and ground water is subject to the RI/FS program as Operable Unit #3.

All comment responses, presented with U.S. DOE's October 10, 1990, revision, that dealt with documents other than the FS work plan, will be addressed in those respective documents (i.e., initial screening of alternatives).

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In light of U.S. EPA position on the above-stated issues, U.S. EPA is approving the FS work plan. U.S. DOE should attach this approval letter to the work plan or produce change pages to make the work plan text coincide with previous agreements.

Please contact me at (312) or FTS 886-4436, if there are any questions.

Sincerely,

Catherine A. McCord

Catherine A. McCord
Remedial Project Manager

cc: Richard Shank, OEPA
Graham Mitchell, OEPA-SWDO
Leo Duffy, U.S. DOE - HDQ
Joe LaGrone, U.S. DOE - ORO

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DOE 1989. A Manual for Implementing Residual Materials Guidelines, DOE/CH/8901, June 1989.

DOE 1990. Radiation Protection of the Public and the Environment, DOE Order 5400.5, May 8, 1990.

EPA 1988. Superfund Exposure Assessment Manual, EPA/540/1-88/001, April 1988.

EPA 1989a. Risk Assessment Guidance for Superfund -- Human Health Evaluation Manual, Part A (Interim Final), OSWER Directive 9285.7-01a, December 1989.

EPA 1989b. Exposure Factors Handbook, EPA/600/8-89/043, July 1989.

EPA 1989c. Exposure Assessment Methodology Environmental Impact Statement NESHAPS for Radionuclides, Background Information Document - Volume 1, EPA/520/1-89-005.

1.0 INTRODUCTION

1.1 BACKGROUND

On March 9, 1985, the U.S. Environmental Protection Agency (U.S. EPA) issued a Notice of Noncompliance letter to the U.S. Department of Energy (DOE) identifying the U.S. EPA's major concerns over potential environmental impacts associated with past and present operations at the DOE's Feed Materials Production Center (FMPC) in Fernald, Ohio. Between April 1985 and July 1986, conferences were held between DOE and U.S. EPA representatives to discuss the issues and to identify the steps DOE would take to achieve and maintain compliance.

On July 18, 1986, a Federal Facility Compliance Agreement (FFCA) was jointly signed by DOE and U.S. EPA pertaining to environmental impacts associated with the FMPC. The FFCA was entered into pursuant to Executive Order 12088 to ensure compliance with existing environmental statutes and implementing regulations. In particular, the FFCA was intended to ensure that environmental impacts associated with past and present activities at the FMPC are thoroughly and adequately investigated so that appropriate response actions can be formulated, assessed, and implemented. In response, a sitewide Remedial Investigation and Feasibility Study (RI/FS) was initiated by DOE pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

A Consent Agreement Under CERCLA Section 120 and 106(a) (Consent Agreement), that amended implementation of the July 1986 FFCA, was entered into by DOE and the U.S. EPA in April 1990 and became effective on June 29, 1990. In addition, the FMPC was included on the CERCLA National Priority List (NPL) in November 1989. The RI/FS is now being conducted in accordance with the Consent Agreement; however, all previous work conducted under the FFCA and the resultant data collected are being retained and utilized in fulfillment of the Consent Agreement requirements.

The performance of the RI/FS is in conformance with current U.S. EPA guidance and the guidelines, criteria, and considerations set forth in the National Contingency Plan (NCP) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). In particular, the RI/FS is currently being conducted in accordance with the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (October 1988) and the "National Oil and Hazardous Substances Pollution Contingency Plan" (40CFR300) (March 1990).

A work plan for the sitewide RI/FS was originally issued to the U.S. EPA in December 1986. After a series of technical discussions and negotiations, the final work plan was submitted in March 1988 and received U.S. EPA's approval in May 1988. The approved RI/FS Work Plan included a detailed scope of work only for the RI portion of the study (Tasks 1 through 8). The technical approach to the FS was limited to a general description of nine tasks specified in the "Scope of Work for a Feasibility Study: Feed Materials Production Center," as attached to the FFCA. These tasks included:

- Task 9 - Description of Current Situation
- Task 10 - Work Plan
- Task 11 - Development of Alternatives
- Task 12 - Initial Screening of Alternatives
- Task 13 - Detailed Analysis of Alternatives
- Task 14 - Evaluation and Selection of Preferred Alternatives
- Task 15 - Draft FS Report
- Task 16 - Final FS Report
- Task 17 - Additional Requirements

One reason for the lack of detail on the FS approach was the requirement to prepare a detailed FS work plan (Task 10) at a future point in the RI/FS process. To satisfy this requirement, DOE prepared and submitted an FS Work Plan to the U.S. EPA in August 1988. The FS Work Plan presented herein provides an update to the August 1988 version and documents changes in the FS management strategy for the FMPC to reflect the most recent U.S. EPA guidance, the revisions to the NCP, and the Consent Agreement.

A principal focus of the current FS guidance document was the revision of the FS process to better reflect the provisions and intent of SARA. Management initiatives designed to streamline the remedial action process within the framework of site-specific needs were also emphasized. The nine FS tasks identified in both the FFCA and the RI/FS Work Plan have been revised for consistency with the NCP and current guidance documents; the technical approach to these tasks has also been modified to reflect procedural changes.

1.2 OBJECTIVE

As stated in the RI/FS Work Plan, the purpose of the FS is to develop and evaluate remedial action alternative(s) to protect public health, public welfare, and the environment from releases or threatened releases of hazardous or radioactive substances from the FMPC. The recommendation of a preferred remedy or remedies to be implemented will be made by the DOE to the U.S. EPA based on the findings of the FS. The selection of the remedy or remedies will be documented in a Record of Decision (ROD) to be issued by the U.S. EPA.

While SARA and the 1988 guidance documents did not change this basic objective of the FS, many procedural requirements were modified and new ones added. In particular, in addition to the continuing requirement for remedies to be protective of human health and the environment and to be cost-effective, the guidance now specifies that remedy selection must consider:

- A preference for remedial actions that employ, as principal elements, treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, and contaminants.
- Assessment of permanent solutions and alternative treatment technologies or resource recovery technologies and use them to the maximum extent practicable.
- Off-site transport and disposal without treatment as the least favored alternative where practicable treatment technologies are available.

The principal objective of this Work Plan is to present the technical approach that will be used to satisfy the overall FS goals, as established by the NCP, SARA, and U.S. EPA guidance. This technical approach is presented in Section 3.0. A principal element of any FS is the detailed evaluation of a number of feasible alternatives toward the goal of identifying the preferred alternative(s). The technical approach for this effort has been both expanded and somewhat standardized through the designation of nine specific evaluation criteria in the U.S. EPA's 1988 guidance documents and the hierarchy established by the NCP for the criteria, i.e., threshold, primary balancing, and modifying. Due to the critical role of the detailed analysis of alternatives in the FS process and the need to recognize significant procedural changes with respect to the latest guidance, a separate chapter (Section 4.0) has been devoted to a more detailed presentation of the proposed technical approach to this task.

The tasks described and illustrated in Sections 3.0 and 4.0 provide the baseline technical approach for the FS at the FMPC site. However, it has been recognized that the efficacy of a single, multiyear application of this approach on a sitewide basis would be limited by the wide variety of facilities to be considered, the complex technical issues associated with the site, and the stated intent that remedial actions occur at the earliest possible date. The use of operable units, which represent individual facilities or facility groups for which discrete actions may be performed as incremental steps toward a final remedy, has therefore been adopted.

A second important objective of the FS Work Plan is to update the remedial action management strategy that will optimally proceed to the final remedy. Such a strategy is the subject of Section 2.0, which focuses on the definition of operable units as modified through discussions with the U.S. EPA and the Ohio Environmental Protection Agency (OEPA) since the August 1988 FS Work Plan submittal.

A third objective of this FS Work Plan is to preliminarily identify the applicable or relevant and appropriate requirements (ARARs) as well as any other requirements to be considered (TBC).

This identification of potential ARARs and TBC requirements at the work plan stage will assist in the initial development of alternatives and will facilitate the establishment of final ARARs and TBC requirements in conjunction with involved agencies. A discussion of ARARs and TBC requirements is provided in Section 5.0. Refinement of the ARARs for individual operable units has been ongoing as part of the FS activities for the respective operable units in conjunction with the U.S. EPA and the OEPA.

Section 6.0 presents the management plan and schedule for the FS. The management plan has been developed consistent with the use of operable units, as discussed in Section 2.0.

1.3 OTHER CONSIDERATIONS

1.3.1 NEPA Integration

The National Environmental Policy Act (NEPA) of 1969 established federal requirements that environmental and social impacts associated with federal actions or federally approved and licensed actions be comprehensively evaluated before a final alternative is selected and an action is implemented. In August 1988, the DOE issued DOE Order 5400.4 (Draft) to confirm these requirements and to provide guidance on the integration of the CERCLA and NEPA processes. DOE Order 5400.4 was made final in 1990 and applies to the FMPC RI/FS.

In compliance with DOE Order 5400.4, DOE prepared a NEPA Integration Plan for the FMPC to establish a site-specific process by which the NEPA-based regulations, requirements, and guidelines would be integrated into and satisfied within the context of the RI/FS process and the operable unit approach adopted for the FMPC. To the extent practicable, the DOE integration strategy will be implemented for each operable unit by ensuring that all additional requirements pursuant to NEPA are accounted for in the individual FS reports. Review requirements contained in NEPA will be met for the alternatives for each operable unit and an impact analysis will be prepared for inclusion in the draft and final FS reports. Based on available information, the selection of the preferred alternative will take into account the potential cumulative impacts

of the alternative in conjunction with other operable unit alternatives. The agency and public reviews of the FS reports will be as required by CERCLA; separate NEPA requirements for public comment will be satisfied in conjunction with the CERCLA process.

1.3.2 Integration of Removal Actions

Subsequent to the August 1988 submission of the FS Work Plan, the U.S. EPA and DOE agreed to incorporate CERCLA removal actions into the overall CERCLA management strategy at the FMPC. The effect of these removal actions on the FS process is the need to redefine the baseline site conditions in order to account for the interim actions. That is, the detailed evaluation of alternatives for those operable units affected by removal actions will be performed under the assumption that the DOE recommended removal actions will be implemented, thereby potentially modifying both the nature and extent of the problem being addressed in the FS and the need for and type of long-term remedial action required. As required by CERCLA and the NCP, removal actions will be selected to the extent practicable, to contribute to the efficient performance of the anticipated long-term remedial action.

2.0 FEASIBILITY STUDY MANAGEMENT STRATEGY

2.1 OVERVIEW

The U.S. EPA's most recent RI/FS guidance emphasizes the need for management initiatives designed to streamline the RI/FS process through the consideration of site-specific conditions and needs. Such a site management strategy is to be preliminarily developed as a component of the initial scoping phase of the RI/FS. It is to consider the remedial action objectives, whether removal actions are necessary or appropriate, and whether the site may best be remedied as separate operable units.

The approved RI/FS Work Plan, which predated the new guidance document, pursued the concept of a management strategy through the development of a sitewide RI/FS investigative framework. This framework utilized a dual matrix approach to integrate the potential remedial actions, related informational needs to perform an assessment of the actions, and proposed RI tasks to satisfy the informational needs. Although specific waste management units and other FMPC facilities were individually considered within this framework, no attempt was made to account for the integration of remedial actions or the identification of meaningful operable units.

The objective of the FS management strategy to be presented in this section is to extend the previous work to more fully satisfy the scoping strategy proposed by the U.S. EPA's October 1988 guidance document. In particular, a strategy has been developed that incorporates each of the most significant factors affecting the timing and integration of remedial actions at the FMPC.

2.2 DEFINITION OF OPERABLE UNITS

The development of the FS management strategy began at the time of the RI/FS Work Plan preparation with the identification of those units of the FMPC that required consideration as potential candidates for remediation. This exercise was eventually carried forward to the initial categorization of the individual units into six operable units to form the basis of the overall FS.

The six original operable units were first identified and justified in the August 1988 FS Work Plan and included:

- Operable Unit 1: Waste Storage Units
- Operable Unit 2: Solid Waste Units
- Operable Unit 3: Facilities and Suspect Areas
- Operable Unit 4: Special Facilities
- Operable Unit 5: Environmental Media
- Operable Unit 6: Surface Water Courses

The operable units selected were considered to be consistent with the concept promoted by the U.S. EPA--that operable units represent geographic portions of a site, specific site problems, specific media, etc., that may involve discrete remedial actions comprising incremental steps toward a final remedy.

Early in 1989, Operable Unit 6 was made part of Operable Unit 5 to consolidate the remedial action for all environmental media. Other less obvious, yet important changes in operable unit definitions also occurred over time as a result of agency input and the progressive refinement of the sitewide management strategy. The final designation of the operable units is as follows:

- Operable Unit 1: Waste Storage Units
- Operable Unit 2: Other Waste Units
- Operable Unit 3: Production Area and Suspect Areas Outside Production Area
- Operable Unit 4: Silos 1, 2, 3, and 4
- Operable Unit 5: Environmental Media

The definition of operable units, as acknowledged by the FS team at the time of preparation of this updated FS Work Plan and consistent with the operable units identified in the Consent Agreement, is presented in the following sections.

2.2.1 Operable Unit 1 - Waste Storage Units

Operable Unit 1 includes those facilities utilized for the disposal of radiological and (to a lesser extent) chemical wastes from FMPC operations. Related facilities that contain similar waste types are included. Within this context, the following facilities are included in Operable Unit 1:

- Waste Pits 1 through 6
- Burn Pit
- Clearwell

Although areas surrounding these facilities are not considered an integral part of Operable Unit 1, an exception could occur if it is decided that inclusion of a given area would lead to a more effective and efficient remedial action or program. For example, the berms and the underlying soils or perched groundwater may eventually be included as part of Operable Unit 1 within an overall source control action for a given waste storage unit.

The categorization of these units into a distinct operable unit was highly dictated by the expected similarities in remedial technologies and the likelihood of multiple interrelationships in the remedial actions at each waste storage unit. Any potential actions will focus on source control since the receptor environments are being separately addressed under Operable Unit 5. If an action is deemed necessary at any or all of the waste storage units, the technologies will likely be selected primarily on the specific properties of the waste materials and any associated regulatory requirements.

2.2.2 Operable Unit 2 - Other Waste Units

The concept for Operable Unit 2 is very similar to that just described for Operable Unit 1 in that solid waste materials that represent a potential source of contamination to the environment are being addressed. The principal difference in this case has its basis in an allowance by the U.S. EPA that special types of facilities are exempted from the SARA-based preference for remedial actions that reduce the toxicity, volume, or mobility of wastes. One type of exempted facility is a landfill involving a large volume of wastes, but only a small percentage of hazardous chemicals.

At the FMPC, the following units were considered to fall into this category and are included in Operable Unit 2:

- North and South Lime Sludge Ponds
- Active Fly Ash Pile
- Abandoned Fly Ash Pile and Southfield Area
- Sanitary Landfill

Originally, the scrap metal piles were included in this operable unit; however, they are now proposed to be included in Operable Unit 3 due to their physical characteristics, location, and anticipated disposition.

It is expected that the remedial action alternatives for these units will involve more straightforward and widely practiced technologies compared to those associated with Operable Unit 1. The preferential use of treatment technologies may not be practicable for such solid waste units, and the range of acceptable alternatives could focus on containment options or other types of minimum source control actions.

2.2.3 Operable Unit 3 - Production Area and Suspect Areas Outside of Production Area

Operable Unit 3 encompasses the FMPC Production Area and other suspect areas outside of the Production Area. For purposes of defining Operable Unit 3, the Production Area is bounded by the security fence and buffer zone on the north, south, and east. It is bounded on the west by the single fence, and does not generally include the waste pit or K-65 areas except for specific suspect areas.

Within the Production Area, Operable Unit 3 addresses surficial and below-surface contamination of soils and perched groundwater. As discussed above, it will also include the scrap metal piles, the miscellaneous discarded materials and equipment overlying the former drum bailing area, and the Plant 1 Drum Storage Pad. A basic assumption of Operable Unit 3 is that FMPC compliance with Resource Conservation and Recovery Act (RCRA) requirements, Best Management

Practices (BMP) Plan and Spill Prevention, Control, and Countermeasure (SPCC) Plan will adequately address current or future potential releases from underground storage tanks, aboveground drums, piping, and other types of facilities. Nevertheless, if the combination of RI data and knowledge of the FMPC operations allows reliable conclusions as to both the source of perched groundwater or soils contamination and the current status of the release, then such sources (if continuing releases) will be incorporated into Operable Unit 3.

The Suspect Areas which are encompassed by Operable Unit 3 are specific areas within the FMPC property and/or FMPC right-of-ways where past activities may have led to an environmental release from a facility to the localized soils and perched groundwater, or to the facility itself if it is currently abandoned. These media can possibly be outside the FMPC property boundary as in the case of soils contaminated by the wastewater treatment area incinerator. The following is a list of suspect areas currently being addressed under Operable Unit 3: an area within the east buffer zone, the clearwell to the Manhole 175 pipeline, the fire training area, the flagpole area to the south of the administration building (new information indicates that the flagpole in question may have been located north of the current security fence; that area is currently under investigation), the wastewater treatment area incinerator, the K-65 slurry line, the main effluent line, the rubble mound west of the K-65 silos, the rubble mound south of the K-65 slurry line (this has been investigated as both a rubble mound and a suspected past slurry line spill location), and the rubble mound in the northeast corner of the Waste Pit Area.

2.2.4 Operable Unit 4 - Silos 1, 2, 3, and 4

Operable Unit 4 has been established to include those facilities that represent unique technical problems and will likely involve specialized technologies. The three units included in Operable Unit 4 are the two K-65 silos (Silos 1 and 2) and the metal oxide silo (Silo 3). The empty silo (Silo 4) has been included but it has never been used for waste storage and does not exhibit any past, present, or potential for future releases of contaminants.

The analysis of final disposition for the associated materials and the selection of a final remedy will be highly driven by the risk assessment due to the relationship between the action taken and the potential short-term and long-term exposures. Any type of stabilization or treatment technology will be highly specific to the unit being remediated and will likely require laboratory and bench-scale testing to confirm its applicability and effectiveness.

2.2.5 Operable Unit 5 - Environmental Media

Operable Unit 5 includes those environmental media that represent pathways and/or environmental receptors presently or potentially affected by FMPC contaminants. Each of the individual environmental media are defined below:

- Soils: Includes all soils not specifically accounted for in other operable units.
- Groundwater: Includes the Great Miami Aquifer (i.e., the regional aquifer) throughout the study area, with appropriate consideration given to the South Plume Area that is the subject of a separate removal action. Perched groundwater not being addressed under other operable units will also be incorporated into Operable Unit 5.
- Great Miami River: Address the sediments in the Great Miami River and their role as a potential source of contaminants to the overlying water column and the aquatic community. Does not include source control, which is the focus of other operable units.
- Paddys Run: Similar to the Great Miami River, with the additional consideration of the effects of leakage from Paddys Run into the regional aquifer.
- Stormwater Outfall Ditch: Similar to Paddys Run.
- Flora and Fauna: Involves the evaluation of the overall flora and fauna in the regional area, including terrestrial vegetation and animals, aquatic communities in the Great Miami River and Paddys Run, locally grown produce and crops, cattle grazing on potentially affected land areas, wetlands, and threatened and endangered species.

- Air: Although air is still considered to be an integral part of Operable Unit 5 as per the Consent Agreement, it is anticipated that this medium will be eliminated as a candidate for direct remediation. To accomplish this, it will have to be demonstrated that the air pathway does not currently represent an unacceptable dose/health risk and that source controls being addressed under other programs will eliminate any potential for future exposures exceeding acceptable levels. Note, however, that impacts on air quality associated with remedial actions for other operable units will still be evaluated as part of the FS for other operable units.

Although each media will involve separate types of remedial action technologies, they have been grouped together for the following reasons: (1) the need for and degree of remedial action will be highly dependent on the risk assessment; (2) the "no-action" scenario could be progressively changing as source control measures are committed to for other operable units; and (3) specific environmental and/or public health standards will be applicable to each medium.

Based on these three points, it is expected that Operable Unit 5 will be completed concurrent with the last source operable unit (Operable Unit 3). Not only are the issues complex (and possibly changing with time), but the results of all other facets of the RI/FS will play an important role in the FS for this operable unit.

2.3 APPLICATION TO THE FEASIBILITY STUDY MANAGEMENT STRATEGY

The final outcome of the use of operable units as the foundation of the overall management strategy- a-series of FSs logically developed and spread over a multiyear period -- is not only favored by the U.S. EPA (as evidenced in the NCP and guidance documents) but also allows for the incremental startup of remedial actions prior to the eventual completion of the RI/FS for the entire FMPC.

The recommended FS management strategy for the FMPC, consisting of the selection of operable units and the sequencing of corresponding FSs as the supporting RI data, model results, and risk assessment findings become available, will proceed in accordance with this FS Work Plan and the

overall RI/FS schedule (see Section 6.2). Although the intent and commitments of this management strategy are clear, the programmatic and institutional complexities associated with the FMPC must be recognized so that adequate flexibility can be maintained. Among the complicating factors are the uncertain status of plant operations, multiple and sometimes overlapping regulatory programs, existing compliance agreements, and the need for appropriated funds for remediation.

The technical approach for the conduct of an FS is described in Sections 3.0 and 4.0. Within the context of the proposed FS management strategy, this technical approach will be applied to each of the resultant operable units rather than to the FMPC as a whole. It is anticipated, however, that adjustments to the general technical approach will be required for some operable units due to the wide variety of underlying conditions and the progressive findings of the RI.

3.0 TECHNICAL APPROACH: OVERALL FEASIBILITY STUDY

3.1 INTRODUCTION

This section of the Work Plan provides the technical approach that will be used to identify, evaluate, and select remedial action alternatives for the FMPC. The FS procedures are based on those required under CERCLA and SARA. The general components of an FS were initially outlined in the original NCP (November 1985) and further clarified in the April 1985 U.S. EPA document, "Guidance on Feasibility Studies Under CERCLA." The RI/FS Work Plan for the FMPC was based primarily on the specifications of the original NCP and the 1985 U.S. EPA guidance document, in accordance with the scope of work attached to the FFCA. In March 1988 and October 1988, the U.S. EPA issued new draft guidance documents for conducting RI/FSs under CERCLA. In addition, the NCP was revised in March 1990. The significant changes contained therein have been incorporated into this FS Work Plan for the FMPC.

In the completion of an RI/FS for any site, the FS is to be performed in accordance with an overall project framework that is developed at the beginning of the project and periodically updated based on the progressive findings of the RI/FS. Section 2.0 of this Work Plan discussed the framework, termed the FS Management Strategy, for the FMPC. Such a formal strategy is necessary for the FMPC site because of the larger number (approximately 40) of specific candidates for remedial action which must be addressed in the FS.

The remedial action planning strategy for the FMPC is essentially a working strategy that has been reviewed, reconsidered, and updated as the RI/FS proceeded to take into consideration new developments in the project. It has focused to a large degree upon the characterization of media-based remedial actions in combination with the individual physical units to identify and delineate "operable units" for the development and evaluation of the final remedial action alternatives. Additionally, the streamlining options provided in the latest FS guidance document have been evaluated and incorporated, as appropriate, into the project. Certain components of the work

that are used as a basis for completion of the FS, such as the development of the operable unit specific ARARs, are continuing activities as part of the ongoing FS for each operable unit.

The FS for the FMPC is ultimately to be completed in accordance with the FFCA, as modified by the Consent Agreement. The FS technical procedures specified in the FFCA were generally consistent with those described in the U.S. EPA's 1985 guidance document in effect at the time of FFCA signing. As indicated in Section 1.0, however, it has been necessary to update the technical approach to achieve consistency with the Consent Agreement, the NCP, and U.S. EPA's October 1988 guidance document. The guidance document divides the procedures required for completion of the FS into the following broad categories: Development of Alternatives, Screening of Alternatives, and Detailed Analysis of Alternatives. These are further divided into the following activities:

- Development of Alternatives
  - Identify potential treatment technologies and containment/disposal requirements for residuals or untreated waste
  - Screen technologies
  - Assemble technologies into alternatives
  - Identify action-specific ARARs
- Screening of Alternatives
  - Screen alternatives as necessary to reduce the number that will be subjected to detailed analysis
  - Preserve an appropriate range of remedial action options
- Detailed Analysis of Alternatives
  - Further refine alternatives, as necessary
  - Analyze alternatives against nine defined criteria

- Compare alternatives against each other

The overall FS process for the FMPC consists of the following seven tasks:

- Task 10 - Feasibility Study Work Plan
- Task 11 - Development of Alternatives
- Task 12 - Initial Screening of Alternatives
- Task 13 - Detailed Analysis of Alternatives
- Task 14 - Evaluation and Selection of Preferred Alternatives
- Task 15 - Draft Feasibility Study Report
- Task 16 - Final Feasibility Study Report

The remainder of this section will describe the current technical approach on a task-by-task basis. The specific elements to be included in the FS, the rationale for their inclusion, the level of anticipated detail, and the documentation that will accompany the FS report will be discussed.

3.2 TASK 10 - FEASIBILITY STUDY WORK PLAN

The FS Work Plan submitted in August 1988 and the updated FS Work Plan presented herein, which includes an operable unit definition, technical approach, management plan, and schedule for the FS, fulfill the requirements of Task 10 of the approved RI/FS Work Plan for the FMPC and the provisions of the Consent Agreement.

3.3 TASK 11 - DEVELOPMENT OF ALTERNATIVES

In December 1988, a report entitled "Development of Alternatives for the Feasibility Study" (formerly Task 12) was submitted to the U.S. EPA. The following description of the work performed under that task (as contained in the report) is included to provide a complete FS Work Plan which describes the FS at the FMPC. Since the task is already completed, and all of the operable units have progressed to the next task, Initial Screening of Alternatives, the description of Task 11, Development of Alternatives, is reported as it was completed.

This task consisted of the development of remedial action alternatives for each operable unit at the FMPC. These alternatives were selected to protect human health and the environment and included a range of appropriate waste management options such as source control, off-site remedial action, and on-site remedial action, as appropriate. The development of alternatives was accomplished by the completion of activities specific to each operable unit, including:

- Preliminary identification of remedial action objectives
- Development of general response actions
- Identification of the volumes and areas of media/wastes
- Identification and screening of remedial technologies and technology process options
- Evaluation of technology process options
- Assembly of alternatives

Each of these activities, including the underlying development of operable units for application of remedial actions, was accomplished within the framework of the previously discussed FS Management Strategy. The following are brief discussions of the technical scope of work associated with the above six activities.

3.3.1 Activity 11.1 - Preliminary Identification of Remedial Action Objectives

Remedial action objectives in the form of media-specific or operable unit-specific goals for protecting human health and the environment were identified based on public health and environmental concerns, the nature of the current problem as defined by RI findings, and applicable guidance and regulatory standards. The remedial action objectives specific to each operable unit were based upon:

- Contaminant(s) of concern
- Exposure pathway(s) and receptor(s)

Due to the fact that the remedial action objectives were dependent upon the identification of applicable or relevant and appropriate requirements (ARARs), which were still under development at the time Task 11 was completed, remedial action objectives were not finalized in this activity. As ARARs are determined, each operable unit will establish specific remedial action objectives as part of Task 12 (Initial Screening Alternatives) and Task 13 (Detailed Analysis of Alternatives).

3.3.2 Activity 11.2 - Development of General Response Actions

This activity consisted of the identification of general response actions that satisfied the preliminary remedial action objectives. General response actions were designated on a media-specific or contaminant-specific basis to address one or more of the following types of potential problems at the FMPC:

- Waste sources (solids, liquids, sludges)
- Leachate generation and release
- Groundwater contamination
- Surface water contamination and infiltration or release
- Air releases and effects
- Contaminated sediments and soils
- Facilities representing a potential environmental release

General response actions represent broad categories of responses that may be taken with respect to a contaminant or medium and include the following:

- No action/institutional controls
- Treatment
- Containment
- Removal
- Disposal
- Combination of the above

In subsequent activities associated with this task, specific technology types and technology process options were identified and evaluated for the above types of general response activities.

3.3.3 Activity 11.3 - Identification of the Volumes and Areas of Media/Wastes

This activity focused on the development of information on areas or volumes of media to which general response actions may be applied. The information was developed from data generated during the RI and during the development of the current situation document. The information was developed, as appropriate, on an operable-unit basis in accordance with the FS Management Strategy. The tabulations included the identification of media and the documentation of areas or volumes. Characterizations (e.g., types and properties of materials, concentration levels, etc.) of the media were provided, as appropriate, with respect to the remedial action objectives.

3.3.4 Activity 11.4 - Identification and Screening of Remedial Technologies and Technology Process Options

The intent of technology screening is to identify and evaluate a large universe of potentially applicable technologies such that a preferred set of technologies can be logically and justifiably selected for incorporation into more broad-based remedial alternatives. A list of potentially applicable technology types (e.g., chemical treatment) and technology process options (e.g., precipitation and ion exchange as a subset of chemical treatment) were first identified based on the preliminary remedial action objectives (Task 11, Activity 11.1), appropriate general response actions (Task 11, Activity 11.2), and the volume/area and characteristics of the media (Task 11, Activity 11.3).

After the master list of potentially applicable technology types and technology process options was developed, an initial screening of the technologies was completed to reduce the number of technologies that were subjected to a more formal and detailed screening in the next activity. The screening level completed during this activity was a broad-based evaluation of whether or not a technology type and/or technology process option can be "effectively implemented." Effectiveness was evaluated in terms of technology capabilities as related to site conditions.

This initial screening was accomplished through a focused review of available literature on each technology as well as from discussions with knowledgeable engineers, scientists, and equipment

suppliers. Any necessary documentation of the initial screening decisions will be provided in the FS report for each operable unit. The result of this broad-based screening was the refinement of the master list of potentially applicable technologies to a smaller list, including both technology types and technology process options that can be effectively used at the site. At least one process option from each effective technology type, as well as a no-action response, survived the screening.

3.3.5 Activity 11.5 - Evaluation of Process Options

This activity involved the evaluation of those technologies which remained under consideration following the broad screening which occurred in Activity 11.4. As indicated, the remaining technologies included at least one representative process option from each effective technology type and a no-action response. The goal of the second level of technology evaluation was to pinpoint the most appropriate process option for each remaining technology type.

Prior to the evaluation, additional information on the technologies was developed as a basis for the more detailed evaluation. The information was developed to allow an evaluation of each technology with respect to the following criteria:

- Effectiveness
- Implementability
- Cost

The evaluation again focused on the general response actions for the corresponding operable unit rather than on the sitewide FMPC remediation. The evaluation emphasized the effectiveness factors, with less effort toward both implementability and cost, and were completed in a relatively qualitative form. The following paragraphs discuss the considerations that were included in these evaluations.

Effectiveness Evaluation

The evaluation of effectiveness, which received the most emphasis, included consideration of the following:

- Potential effectiveness of technology types or technology process options in handling the estimated areas or volumes of media and in meeting the contaminant reduction goals identified in the general response actions
- Effectiveness of the technology in protecting human health and the environment during the construction and implementation phase
- Reliability of the technology with respect to the contaminants and conditions at the site

Implementability Evaluation

The implementability evaluation focused primarily on institutional issues related to implementability, such as the availability of disposal facilities. Technical implementability was also considered, but with less emphasis, since this criterion was already considered in the initial screening of technologies (Activity 11.4) and somewhat overlaps with the previous evaluation of effectiveness.

Cost Evaluation

Estimates of relative capital and operation and maintenance costs were developed. The cost estimates were qualitatively developed (high, medium, or low) on the basis of comparisons among the technologies.

3.3.6 Activity 11.6 - Assembly of Alternatives

The last activity in the development of alternatives was the assembly of technology types and/or technology process options into alternatives for the entire operable unit. In this process, general response actions and technology process options representative of various technology types for each medium or individual unit were combined to form alternatives for the operable unit. Alternatives developed included representatives of the following, including combinations thereof:

- Appropriate treatment alternative(s)
- Appropriate containment alternative(s)
- No-action alternative

The representative process option in the alternative was used as the basis for subsequent screening of the alternatives. If the alternative remains an option after the alternative screening, further differentiation of the process options will occur as a part of the Detailed Evaluation of Alternatives for the FS.

After the full set of alternatives was assembled, a description of each was prepared. This documentation included information necessary to adequately describe the alternative and to document the logic behind the assembly of general response actions into specific remedial action alternatives. Information such as the following was provided:

- Location and type of activities, including specific technologies
- Estimates of quantities involved
- Identification of technology process options which are used to represent similar process options in the alternative, if appropriate
- Management options for handling of residuals

3.4 TASK 12 - INITIAL SCREENING OF ALTERNATIVES

The initial screening of alternatives will consist of the identification of a reduced list of alternatives for remedial action at the FMPC site. The initiation point for the task will be the list of remedial alternatives assembled as part of Task 11. The screening of alternatives will be accomplished by the completion of the following three specific activities:

- Refinement of alternative definition
- Preliminary evaluation of alternatives
- Screening of alternatives

The refinement of the definition and description of alternatives will be an expansion of the descriptions prepared as part of the Assembly of Alternatives (Activity 11.6). The preliminary evaluation will be the process in which the initial comparison of technical performance and cost is made among the alternatives. Alternative screening will be the process of deciding which alternatives are preferential, thereby reducing the number to be retained for detailed analysis. Streamlining provisions incorporated into the most recent U.S. EPA FS guidance document, upon which this FS Work Plan is largely based, will be appropriately incorporated into the screening of alternatives.

Each of the three principal activities of the Initial Screening of Alternatives is further discussed in the following paragraphs.

3.4.1 Activity 12.1 - Refinement of Alternative Definition

The refinement of the definition of alternatives will focus on providing more detailed information on the volumes and areas of the media of interest and on the sizes and capacities of the technology process options that comprise the various alternatives. The interactions of potentially contaminated media will also be more closely evaluated as part of this activity, since an understanding of these relationships will be necessary for preparing the refined definition of alternatives. Any changes in the remedial action alternatives necessitated by the progressive refinement in the definition of operable units will also be made at this point in the FS process.

The following specific information will be developed, as appropriate, for each of the various alternatives:

- Volumes and/or areas of the media of interest and the potential interrelationships of the media
- Size and configuration of removal, treatment, or containment systems
- Flow rates for treatment options

- Spatial requirements for construction of treatment/containment technologies, including staging requirements for materials
- Distances for disposal options (e.g., transport distances to off-site treatment/disposal facilities and distances for discharge pipelines)
- Time frame for achievement of treatment, containment, or removal goals

3.4.2 Activity 12.2 - Preliminary Evaluation of Alternatives

In the screening evaluation, the alternatives characterized by the refined definition will be evaluated in terms of the following:

- Short- and long-term effectiveness
- Short- and long-term implementability
- Short- and long-term cost

Within this framework, short-term refers to the construction and implementation period and long-term refers to the time after the remedial action is complete.

The purpose of this screening is to further reduce the number of alternatives that will be subjected to detailed analysis as part of the next task. While the alternative screening is more general than the subsequent detailed analysis, it will be sufficiently detailed to distinguish significant advantages and disadvantages among the alternatives. A key distinction between the screening and the subsequent Detailed Analysis of Alternatives is that during screening the emphasis in comparison will be between similar alternatives, with the most promising carried forward for further analysis, while the detailed analysis will be used for comparisons among all alternatives.

The effectiveness of each alternative will be evaluated based on the effectiveness in protecting human health and the environment and in reducing the toxicity, mobility, or volume of the contaminants involved.

The implementability of each alternative will be evaluated on the basis of the following:

- Technical Feasibility: Ability to construct, reliably operate, and meet technology-specific regulations until a remedial action is complete

- Administrative Feasibility: Ability to obtain regulatory approvals, availability of off-site treatment/disposal capacity, and availability of specific equipment and specialists, if necessary

The cost evaluation will include consideration of both capital and operation and maintenance costs and will be based on generic unit costs, vendor information, typical cost curves, cost estimating guides, and other appropriate information. Cost estimates will be similar to those to be developed for the detailed analysis (Task 13), but will be less detailed and for the purpose of relative comparisons of the various alternatives.

3.4.3 Activity 12.3 - Screening of Alternatives

The screening of alternatives will be a comparison of the evaluation data among the alternatives and the identification for further consideration of those alternatives with the most favorable composite evaluations. A simple numeric ranking system will be adopted by DOE for conducting this comparative evaluation. The ranking system involves the assignment of rating values between 1 and 5 for each of a series of distinct evaluation factors. The evaluation factors correspond to the CERCLA effectiveness and implementability decision criteria, as follows:

- Effectiveness:
  - Short-term protection of human health
  - Short-term protection of the environment
  - Long-term protection of human health
  - Long-term protection of the environment
  - Reduction of mobility, toxicity, or volume of waste

- Implementability - Technical Feasibility:
  - Constructability
  - Operational reliability
  - Maintenance

- Ability to meet technology-specific regulations

- Implementability - Administrative Feasibility:

  - Agency approvals
  - Availability of services
  - Specialized equipment and personnel

Modification of the implementability factors may be appropriate for some operable units to most effectively account for the important technical and programmatic issues peculiar to a given operable unit.

Rating values are assigned to the selected factors for each alternative. The rating value assignments, although quantitative in nature, remain subjective and are based on both experience and the overall characteristics of the remedial action alternatives. If a particular evaluation factor is considered unfavorable for a given alternative, a rating value of "1" is assigned for that factor. Likewise, if a particular evaluation factor is considered highly favorable, a rating value of "5" is assigned to that factor for that specific alternative. Rating scores of "2" through "4" are used to distinguish between varying degrees of unfavorable and favorable criteria.

The individual rating values are added to provide a total score for each alternative. The highest possible score for the set of factors given above is 25 for effectiveness and 35 for implementability, for a total of 60. The total score is used to rank the alternatives in order of overall preference and to eliminate the least preferred alternatives from further consideration in the Detailed Analysis of Alternatives (Task 13).

The cost evaluation of the initial screening process is used to eliminate those alternatives which have estimated costs that greatly exceed the costs of other alternatives, but which do not provide greater public health, environmental, or engineering benefits as measured by the aforementioned ranking system. Cost, however, will not be at the screening stage to choose between alternatives that include treatment as a principal element and nontreatment alternatives.

3.4.4 Activity 12.4 - Screening of Alternatives Report

In accordance with the requirements set forth in the Consent Agreement, a Screening of Alternatives Report will be prepared at the completion of Task 12. This report, which will be prepared for each operable unit, has been designated as a primary document under the Consent Agreement and will be subject to the review and approval process specified for such documents.

3.5 TASK 13 - DETAILED ANALYSIS OF ALTERNATIVES

Those alternatives that survive the alternative screening in Task 12 can be considered as the preferred candidates for implementation at the FMPC. Task 13 will consist of the development of specific detailed evaluations of each of these alternatives. The Detailed Analysis of Alternatives will be accomplished by the completion of two specific activities:

- Refinement of alternative definition
- Comparison of each alternative with established evaluation criteria

3.5.1 Activity 13.1 - Refinement of Alternative Definition

Definitions of alternatives will be refined to the extent necessary to complete the Detailed Analysis of Alternatives. Specifically, refinements to definitions will be made to allow for the consistent application of evaluation criteria to the alternatives and for the development of cost estimates with an accuracy of plus 50 percent to minus 30 percent. Information to be developed will include the following, as appropriate:

- Preliminary design calculations
- Process flow diagrams
- Sizing of key process components
- Preliminary site layouts
- Development of assumptions, limitations, and uncertainties

3.5.2 Activity 13.2 - Comparison of Alternatives with Evaluation Criteria

In accordance with the current FS guidance document, each alternative will be evaluated on the basis of (i.e., compared against) the following nine criteria:

- Threshold Criteria:

  - Overall protection of human health and the environment
  - Compliance with ARARs

- Primary Balancing Criteria:

  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume
  - Short-term effectiveness
  - Implementability
  - Cost

- Modifying Criteria

  - State acceptance
  - Community acceptance

The first two criteria (i.e., overall protection of human health and the environment and compliance with ARARs) are considered Threshold Criteria that each alternative must satisfy in order to be eligible for selection. (An exception to this rule is allowed where a waiver can be obtained for a specific ARAR.) The evaluation of the effectiveness of protection with respect to human health and the environment will be based on a composite of factors assessed under other criteria, particularly long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

The next five criteria (i.e., long-term effectiveness and permanence, reduction of toxicity, mobility, or volume, short-term effectiveness, implementability, and cost) are Primary Balancing Criteria for the evaluation of alternatives. These criteria encompass the principal technical, cost, institutional, and risk concerns. In the evaluation of alternatives, these criteria will be considered as a group, even though evaluations will be developed individually for each criterion.

The last two criteria (state acceptance and community acceptance) reflect state regulatory agency and public concerns and apparent preferences for certain alternatives and are considered

Modifying Criteria. The OEPA has been and remains an active participant in the review of RI/FS findings and reports. The concerns of the state are, therefore, being addressed as the project progresses. During the performance of Task 13, alternatives may not be thoroughly evaluated with respect to the community acceptance criteria since available information is often limited until the time that the FS report is issued for public comment. There remains a requirement, however, to evaluate community and state acceptance as part of the Record of Decision for each operable unit.

A detailed discussion of the procedures for the detailed evaluation of each alternative is given in Section 4.0. The analysis of individual alternatives will be documented in the form of narrative discussions and supporting tabulations and figures, as necessary. The discussion for each alternative will include a description of the alternative and the detailed assessment relative to each criterion.

3.6 TASK 14 - EVALUATION AND SELECTION OF PREFERRED ALTERNATIVES

This task will consist of the comparative evaluation of alternatives based on the detailed analysis of each alternative with respect to the nine specific criteria. The state and community acceptance criteria are typically accounted for in the alternative selection process; however, the full incorporation of state and community concerns and acceptance is best addressed as part of the Responsiveness Summary for the Record of Decision, following the public comment period on the Proposed Plan. The advantages and disadvantages of each alternative relative to other alternatives will be identified and summarized. The summary will include documentation of relative strengths and weaknesses of each alternative, effects of variations in key uncertainties, and key differences (qualitative and/or quantitative) among alternatives. This analysis will be used as a basis to evaluate the tradeoffs among alternatives. The results of this evaluation will be used to identify the "preferred alternative" for remediation of each operable unit at the FMPC site, subject to the concurrence and approval of the U.S. EPA.

A key element in both the Detailed Evaluation of Alternatives and the Evaluation and Selection of the Preferred Alternative in Task 14 is the determination of cost-effectiveness. A working definition of cost-effectiveness is that, if the incremental costs and incremental benefits become highly disproportionate, then the more costly alternative can be eliminated from further consideration. While cost is a quantifiable criterion, a major area of potential criticism for any decision based on this definition is the qualitative, subjective method typically used to rank the effectiveness, implementability, and toxicity/mobility/volume reduction criteria.

In order to achieve some level of quantification for the latter four criteria, thereby allowing the development of an "effectiveness score" to compare against a "cost score," DOE will incorporate an analytic hierarchy methodology into Task 14. Not only will the resultant quantification of the cost-effectiveness evaluation provide clarity for justifying the alternative selection, but the application of a uniform methodology across operable units will ensure consistency in the selection of the most appropriate remedial alternative for each operable unit.

The method to be applied to the alternative selection process is a modification of the Analytic Hierarchy Process (AHP) developed by Saaty (1980). The AHP has been successfully implemented on several Oak Ridge National Laboratory waste cleanup projects (Richter Pack, 1987) and a number of other projects (Golden et al., 1990). A major advantage of the AHP is that it allows for both quantitative input (e.g., chemical and radionuclide concentrations) and qualitative judgment (i.e., professional judgment on the implementability of a remedial action). Application of the AHP will involve four major steps:

1. Develop a hierarchy of criteria to be used to select a remedial alternative
2. Determine weighting factors for each criterion
3. Compile information needed to evaluate remedial alternatives with respect to each other and to the criteria
4. Synthesize input data using AHP to identify the remedial alternative with the most favorable overall ranking

Consistent with CERCLA requirements, the criteria mentioned in Step 1 have been defined to be short-term effectiveness, long-term effectiveness and permanence, implementability, and the reduction of toxicity, mobility, or volume through treatment.

Step 2 will require that weighting factors be assigned to each criterion to indicate the relative importance of each criterion in the decision process. Using the AHP, quantitative weights will be assigned to the criteria by knowledgeable engineers and scientists with direct, applicable CERCLA experience. In accordance with the NCP [Section 300.430(f)(1)(ii)(E)], the weighting factors will emphasize long-term effectiveness and permanence and reduction in toxicity, mobility, or volume through treatment. The criteria will be considered one pair at a time so that only two criteria are being considered simultaneously. A scale of 1 to 9 will be used for the pair-wise comparisons, as follows:

Rating	Description
1	A and B "are equally important"
3	A is "weakly more important than" B
5	A is "strongly more important than" B
7	A is "demonstrably more important than" B
9	A is "absolutely more important than" B

A variety of experienced professionals involved in the RI/FS process will be used to assign the rating values to the four criteria. The use of a large number of individuals will reduce the effect that biased perspectives might play in the determination of weighting factors.

Step 3 will be performed by individual operable unit FS teams at this level of the evaluation since detailed, operable unit-specific data will be required. All of the alternatives will be compared to each other simultaneously rather than pair-wise. It will be possible to rank alternatives on a qualitative basis or on a quantitative basis, incorporating a variety of input data to describe each alternative. This analysis will consider the preference for treatment as a principal element and

the bias against off-site land disposal of untreated waste as stated in the NCP [Section 300.430(f)(1)(ii)(E)].

Step 4 will use AHP to perform the necessary numerical operations on: (1) the previously developed hierarchy of criteria; (2) the previously determined weighting factors for the criteria; and (3) the qualitative or quantitative data that describe each remedial alternative. The result is a numerical "effectiveness score" that provides a relative quantitative ranking of the alternatives.

3.7 TASK 15 - DRAFT FEASIBILITY STUDY REPORT

A draft FS report presenting the methods and results of Tasks 11 through 14, including the identification of a "preferred remedial action alternative," will be prepared. To the degree practical, the report will be prepared in a format similar to that outlined in the U.S. EPA's guidance document. This outline is presented in Table 3-1. The report will be provided to the U.S. EPA in accordance with the terms of the Consent Agreement.

3.8 TASK 16 - FINAL FEASIBILITY STUDY REPORT

A final FS report will be prepared which incorporates the comments of the U.S. EPA and the OEPA. The final FS report will be issued as specified in the Consent Agreement.

3.9 ADDITIONAL REQUIREMENTS

The FS reporting requirements end with the Final Feasibility Study Report (Task 16), which has been designated as a primary document in the Consent Agreement. In order to achieve compliance with the Consent Agreement, however, additional documents must be prepared subsequent to the issuance of the FS report. These include the Proposed Plan (Task 17) and the Responsiveness Summary for public comments received on the Proposed Plan (Task 18). The Proposed Plan has been designated as a primary document for purposes of the Consent Agreement. In addition, DOE is committed to prepare the Draft Record of Decision (Task 19) in its role as the lead federal agency for the RI/FS. These three documents will be prepared for each of the operable units.

TABLE 3-1

FEASIBILITY STUDY REPORT OUTLINE
(PRELIMINARY)

EXECUTIVE SUMMARY

1.0 INTRODUCTION

- 1.1 PURPOSE AND ORGANIZATION OF REPORT
- 1.2 BACKGROUND INFORMATION (Summarized from RI Report)
  - 1.2.1 Site Description
  - 1.2.2 Site History
  - 1.2.3 Nature and Extent of Contamination
  - 1.2.4 Contaminant Fate and Transport
  - 1.2.5 Baseline Risk Assessment

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

- 2.1 INTRODUCTION
- 2.2 REMEDIAL ACTION OBJECTIVES -
  Presents the development of remedial action objectives for each medium of interest (i.e., groundwater, soil, surface water, air, etc.). For each medium, the following should be discussed:

  - Contaminants of interest
  - Allowable exposure based on risk assessment
  - Allowable exposure based on ARARs
  - Development of remedial action objectives

- 2.3 GENERAL RESPONSE ACTIONS -
  For each medium of interest, describes the estimation of areas or volumes to which treatment, containment, or exposure technologies may be applied.
- 2.4 IDENTIFICATION AND SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS - For each medium of interest, describes:
  - 2.4.1 Identification and Screening of Technologies
  - 2.4.2 Evaluation of Technologies and Selection of Representative Technologies

TABLE 3-1
(Continued)

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 DEVELOPMENT OF ALTERNATIVES
Describes rationale for combination of technologies/media into alternatives.
Note: This discussion may be by medium or for the site as a whole.

3.2 SCREENING OF ALTERNATIVES

3.2.1 Introduction

3.2.2 Alternative 1

3.2.2.1 Description

3.2.2.2 Evaluation
- Effectiveness
- Implementability
- Cost

3.2.3 Alternative 2

3.2.3.1 Description

3.2.3.2 Evaluation

3.2.4 Alternative 3

3.2.5 Summary of Screening

4.0 DETAILED ANALYSIS OF ALTERNATIVES

4.1 INTRODUCTION

4.2 INDIVIDUAL ANALYSIS OF ALTERNATIVES

4.2.1 Alternative 1

4.2.1.1 Description

4.2.1.2 Assessment
- Overall Protection
- Compliance with ARARs
- Long-Term Effectiveness and Permanence
- Reduction of Mobility, Toxicity, or Volume
- Short-Term Effectiveness
- Implementability

TABLE 3-1
(Continued)

4.0 TECHNICAL APPROACH: DETAILED EVALUATION OF ALTERNATIVES

4.1 INTRODUCTION

Section 3.0 presents a review of nine tasks that represent the technical approach for the FS portion of the sitewide RI/FS at the FMPC. A principal element of the FS is Task 13, Detailed Analysis of Alternatives, which is summarily addressed in Section 3.5. However, due to the critical role of this task in the FS process, as well as the need to recognize significant procedural changes with respect to the latest U.S. EPA guidance, a separate section (Section 4.0) has been devoted to a more thorough presentation of the proposed technical approach to the Detailed Analysis of Alternatives.

The alternatives selected for detailed analysis will be reviewed to determine if sufficient information has been generated for each alternative during the Development of Alternatives and Initial Screening tasks to allow for consisitent application of the evaluation criteria set forth below and to develop order-of-magnitude cost estimates (+50%/-30%). An alternative definition which is insufficient to meet this requirement will be further developed at the begining of this task and prior to evaluation of the alternative.

The detailed evaluation of alternatives will be completed in a fashion that demonstrates and documents the capacity of each alternative to satisfy the statutory requirements that must be addressed. These include the requirements of CERCLA and SARA to:

- Protect human health and the environment
- Attain ARARs or support grounds for a waiver
- Be cost-effective
- Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable

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- Satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element or provide an explanation as to why it does not

Additional statutory considerations relative to the recent emphasis on evaluating long-term effectiveness and related considerations include the following:

- Long-term uncertainties associated with land disposal
- The goals, objectives, and requirements of the Solid Waste Disposal Act (SWDA)
- Persistence, toxicity, and mobility of hazardous substances and constituents and their propensity to bioaccumulate
- Short- and long-term potential for adverse health effects and human exposure
- Long-term maintenance costs
- Potential for future remedial action costs if the action implemented fails
- Potential threat to human health and the environment associated with excavation, transportation, and redisposal or containment

To promote a systematic approach to the evaluation of alternatives in terms of these statutory requirements, the following nine evaluation criteria have been adopted by the U.S. EPA for use in the detailed evaluation of alternatives:

- Threshold Criteria

  - Overall protection of human health and the environment
  - Compliance with ARARs

- Primary Balancing Criteria

  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume
  - Short-term effectiveness
  - Implementability
  - Cost

- Modifying Criteria

  - State acceptance
  - Community acceptance

As indicated in Section 3.5.2, the compliance with ARARs and the protection of human health and the environment criteria relate to statutory findings that must met by an alternative prior to its consideration for selection as a remedial action. These are Threshold Criteria that draw from the findings of the evaluation of the Primary Balancing Criteria. Evaluation of the Primary Balancing Criteria represents the principal technical effort of Task 13 in that technical feasibility and reliability must be comprehensively addressed while considering cost, institutional, and risk concerns. The state and community acceptance criteria reflect agency and public concerns and preferences for alternatives. These are typically accounted for in the final selection process after the public comment period on the proposed plan.

The extent (level of detail) of analysis of the alternatives will be based on the extensiveness of the available data base, the number and types of alternatives remaining from the screening step (Task 12), and the level of developmental analysis completed as part of the FS prior to this activity. The results of treatability studies completed as part of the RI will be incorporated into this detailed analysis.

Task 13 will also evaluate environmental impacts associated with the various alternatives to satisfy NEPA requirements. This evaluation will occur concurrent with, and consistent with, the CERCLA criteria set forth above.

The following sections discuss the pertinent considerations relative to each of the nine evaluation criteria that form the technical approach to Task 13. The considerations and specifications are based largely on those presented in the October 1988 RI/FS guidance document.

4.2 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The evaluation of overall protection of human health and the environment will consider the degree to which each alternative protects and maintains the protection of human health and the environment. The evaluation will be completed based on the composite results of alternative evaluations against other criteria, especially:

- Short-term effectiveness
- Long-term effectiveness and permanence
- Compliance with ARARs

The analysis will indicate how each alternative achieves protection and reduces risk as well as the time frame necessary to achieve these levels of protection. The evaluation will also indicate how risks are reduced (e.g., waste destruction, reduction in mobility, etc.).

4.3 COMPLIANCE WITH ARARs

The evaluation for this factor will be based on an assessment of whether or not each alternative complies with federal and state ARARs and TBC requirements. During the evaluation of each alternative, the pertinent ARARs will be identified and the ability of the alternative to fulfill the requirement will be assessed. The October 1988 guidance document defines the following categories of ARARs:

- Contaminant Specific: These define acceptable exposure levels and are to be used in establishing remedial action objectives.

- Action specific: These typically set controls or restrictions for particular treatment or disposal activities and include such requirements as the RCRA minimum technology standards.

- Location specific: These typically set restrictions within specific locations such as wetlands, floodplains, historic sites, etc.

Other appropriate criteria, advisories, and guidance may be considered in the analysis. These involve consideration of federal and state guidelines that are not ARARs, but that have been identified as TBC requirements.

Section 5.0 of this Work Plan provides more detailed information on ARARs that have been tentatively identified as applicable to the FMPC RI/FS.

4.4 LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness is a measure of the technical effectiveness of the alternative to protect human health and the environment after achievement of the remedial response objectives. The long-term effectiveness assessment will focus on the effectiveness of each alternative in protecting human health and the environment from residuals or untreated materials remaining on site. The long-term effectiveness and permanence of each alternative will be evaluated on the basis of the following three analysis factors:

- Magnitude of residual risk
- Adequacy of controls
- Reliability of controls

4.4.1 Magnitude of Residual Risk

The evaluation for this factor will be based on the identification and assessment of risks posed to the community and the environment by untreated waste or treatment residuals remaining after the achievement of the remedial response objectives. The evaluation of residual risks will include consideration of the following:

- Nature of residuals
  - Type (including treatment residuals and untreated residual contamination)
  - Quantities
  - Characteristics (radioactivity, toxicity, mobility, and bioaccumulation potential)
  - Location
- Nature of potential receptors
  - Type (human or environmental)
  - Characteristics (numbers and locations)
- Potential risks and impacts
  - Expected exposure levels compared to acceptable levels
  - Cumulative doses compared to acceptable limits
- Necessity for five-year review

The magnitude of residual risks will be qualitatively and quantitatively assessed, as appropriate. A distinction will be made between on-site workers and the community as a whole. The methodology for this assessment will be consistent with that formulated for the risk assessment in Task 4 of the RI which was detailed in a companion document, entitled: "Work Plan: ARARs and the Baseline Risk Assessment, Remedial Investigation and Feasibility Study, U.S. Department of Energy, Feed Materials Production Center, Fernald, Ohio." The Work Plan was prepared to conform with the U.S. EPA's "Superfund Exposure Assessment Manual" (1988). The FS risk assessment is proceeding in accordance with this Work Plan, with the exception of those changes necessary to reflect the most recent U.S. EPA guidance from the following 1989 documents: (1) "Risk Assessment Guidance for Superfund, Human Health Evaluation Manual (Volume I);" and (2) "Risk Assessment Guidance for Superfund, Environmental Evaluation Manual (Volume II)."

One exception to the established CERCLA methodology for the FS risk assessment occurs for Operable Unit 5: Environmental Media. In particular, a difficult issue exists as to the method of handling continuing sources from other operable units for purposes of quantifying the residual risk from an environmental clean-up action taken under Operable Unit 5. The only condition that would change relative to the baseline (i.e., no-action) risk assessment will result from whatever remedial action is being evaluated under Operable Unit 5. This would imply that the other sources will remain as continuing or future releases to the environmental medium under consideration. However, since the Operable Unit 5 FS will likely be driven by a pre-established clean-up level (i.e., a performance standard), the evaluation of future compliance with this standard should take credit for the most likely, yet conservative future scenario for the source terms--in this case, a reduction in releases from the individual source units to the maximum levels of residual release that could still achieve the remediation objectives for each source unit.

DOE has adopted the latter scenario for Operable Unit 5. The justification is that the practical value of the residual release scenario to the CERCLA decision process far outweighs the methodological noncompliance associated with having to change the baseline condition as the analysis proceeds from the FS risk assessment. A check will be made, however, to confirm that a significant change in the FS decision process would not occur if the continuing releases had been retained for purposes of the FS risk assessment.

4.4.2 Adequacy of Controls

The evaluation for this factor will be based on an assessment of the adequacy and suitability of controls (physical, institutional, or other) that will be used to manage residuals or untreated waste at the site in protecting human health and the environment. The evaluation of the adequacy of controls will include consideration of the following:

- Type and degree of long-term management required (e.g., containment, monitoring, and maintenance)
- Time frame necessary for individual management practices to be implemented

- Ability of management practices to meet performance specifications of the alternative
- Difficulties and uncertainties associated with the individual management practices

4.4.3 Reliability of Controls

The evaluation for this factor will be based on an assessment of the long-term reliability of any physical, institutional, or other controls implemented to provide continued protection from residuals and untreated wastes at the FMPC. The evaluation of the reliability of controls will include consideration of the following:

- Potential need for replacement components
- Maintenance requirements for control systems
- Risks to human health and the environment posed by the need for replacement of systems or components

The final disposition of the FMPC site and any related institutional controls will also be addressed under this criterion.

4.5 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

CERCLA, through the promulgation of SARA, includes a statutory preference for the application of those technologies that reduce the toxicity, mobility, or volume of wastes and contaminated materials. This portion of the detailed evaluation is designed to assess the characteristics of each alternative with respect to this statutory requirement. The evaluation will include consideration of the following:

- Treatment process and remedy
- Amount of hazardous or radioactive material destroyed or treated
- Reduction in toxicity, mobility, or volume
- Irreversibility of the treatment
- Type and quantity of treatment residue
- Ability to satisfy statutory preference for treatment

4.5.1 Treatment Process and Remedy

The treatment processes for each alternative will be evaluated with respect to their ability to address the principal chemical or radiological threats posed by the operable unit. Any special requirements associated with the process to achieve this capability will be considered. The presence of radioactive and mixed wastes at the FMPC will require the consideration of several innovative technologies, thereby underscoring the importance of this criterion.

4.5.2 Amount of Hazardous or Radioactive Material Destroyed or Treated

This evaluation will include the quantitative determination of the amount (volume or mass) of contaminated material that would be destroyed and/or treated as a result of implementing each alternative. The potential need to consider both radionuclides and hazardous chemicals will introduce additional complexity into this determination.

4.5.3 Reduction in Toxicity, Mobility, or Volume

This evaluation will include qualitative and quantitative determinations, as appropriate, of the reduction in toxicity, mobility, and/or volume/mass of toxic contaminants that could be achieved through the implementation of each alternative. Radioactive wastes can be directly evaluated in terms of reducing mobility and volume. In terms of toxicity, the evaluation will be influenced by the importance of the chemical toxicity associated with each radionuclide. For example, uranium toxicity may be found to be an important consideration in the risk assessment and, therefore, in the evaluation of remedial actions.

4.5.4 Irreversibility of the Treatment

This evaluation will focus on the determination of the extent to which effects of treatment (i.e., reduction in toxicity, mobility, or volume) are irreversible. The evaluation will also identify and consider those conditions which affect irreversibility.

4.5.5 Type and Quantity of Treatment Residue

The residuals associated with the treatment process in each alternative will be evaluated with respect to the following:

- Nature of residuals
- Quantities and characteristics (radiological, chemical, and physical) of residuals
- Human health and environmental risks posed by residuals (Section 4.3.1)

4.5.6 Statutory Preference for Treatment

This will include an evaluation of whether the treatment processes address the principal threats to human health and the environment and the ability of the processes to reduce the hazards posed by the principal threats. The completion of this technology-based factor will provide the key input to the evaluation of long-term effectiveness, as discussed in Section 4.4.

4.6 SHORT-TERM EFFECTIVENESS

Short-term effectiveness is a measure of the technical effectiveness of the alternative to protect human health and the environment over the short term. The short-term effectiveness assessment will consider the effectiveness of each alternative in protecting human health and the environment from the initiation of remedial action activities up to the time when the response objectives are achieved. The short-term effectiveness of each alternative will be evaluated on the basis of the following four analysis factors:

- Protection of the community during remedial action
- Protection of workers during remedial action
- Environmental impacts associated with implementation of the remedial action
- Time frame for achievement of the remedial response objectives

4.6.1 Protection of the Community during Remedial Action

The evaluation for this factor will be based on the identification and assessment of the risks posed to the community and will include consideration of the following:

- Type and magnitude of risk (e.g., spill during waste transport)
- Nature and location of potential receptors
- Controllability of the risk
- Availability and effectiveness of mitigative measures

Risks will be qualitatively and quantitatively assessed as appropriate. At the FMPC, the risks posed to the community could vary considerably depending on the types of actions being evaluated. Any action involving off-site transport and disposal would likely represent the greatest potential impact to the community. For on-site activities, airborne releases would have the most direct potential impact on the community in the short term, with any work involving the K-65 silos representing the greatest concern. Short-term risks associated with soils, surface water, or groundwater would be less likely and could be more easily mitigated before the community was affected.

4.6.2 Protection of Workers during Remedial Action

The evaluation for this factor will be based on the identification and assessment of risks posed to personnel involved in the supervision and completion of the remedial action effort. It will include consideration of the following:

- Type and magnitude of risk (e.g., exposure to radioactive or hazardous compounds)
- Number of exposed workers and duration of exposure
- Controllability of the risk
- Availability and effectiveness of mitigative measures

Risks will be qualitatively and quantitatively assessed as appropriate. The presence of radiological waste materials at the FMPC requires special consideration when evaluating worker protection. In particular, the "as low as reasonably achievable" (ALARA) goals will be evaluated as a critical determinant of the relative acceptability of a given alternative. For purposes of the FS at the FMPC, DOE and Westinghouse Materials Company of Ohio (WMCO) plant personnel and other contractor personnel located at the FMPC, will be considered under the category of "worker protection," to distinguish these individuals from the community as a whole.

4.6.3 Environmental Impacts Associated with Implementation of the Remedial Action

The evaluation for this factor will be based on the identification and assessment of the environmental impacts associated with implementation of each alternative and will include consideration of the following:

- Nature and extent of the impact
- Magnitude of the impact
- Duration of the impact
- Avoidability/reversibility of the impact
- Availability and effectiveness of mitigative measures

Impacts will be qualitatively and quantitatively assessed, as appropriate.

4.6.4 Time Frame for Achievement of Remedial Response Objectives

The evaluation for this factor will be based on the determination of the time required to achieve protection for the entire site or individual operable units associated with specific site areas or threats. It will include consideration of the time frame for achievement of the following:

- Protection against public health or environmental threats being addressed by a specific action
- The overall remedial response objectives for the specific operable unit associated with the alternative being evaluated

4.7 IMPLEMENTABILITY

The implementability assessment will evaluate the technical and administrative feasibility of implementing each alternative. The implementability of each alternative will be evaluated on the basis of three principal factors: technical feasibility, administrative feasibility, and the availability of necessary services and materials.

4.7.1 Technical Feasibility

The technical feasibility of each alternative will be evaluated on the basis of each of the following:

- Ability to construct and operate technology
- Reliability of technology
- Ease of undertaking additional remedial actions (if necessary)
- Monitoring considerations

Ability to Construct and Operate Technology

The ability to construct and operate the technology will be evaluated on the basis of both the difficulties and uncertainties related to construction and operation. This factor will consider not only the developmental status of any physical process units but also any site-specific constraints such as subsurface conditions, space limitations, etc.

Reliability of Technology

Technological reliability will be evaluated based on the ability of a given technology to meet specified efficiencies or performance goals and on the probability that technical problems will result in nonperformance and schedule delays. As mentioned previously, the emphasis on permanent solutions and the presence of radioactive and mixed wastes will likely require consideration of numerous technologies that are still in a developmental phase. Existing information will be used to the extent practical, with the results of any laboratory- or bench-scale studies to be completed in Task 5 of the RI providing additional performance data.

Ease of Undertaking Additional Remedial Actions

The ease of undertaking additional remedial actions will be evaluated on the basis of the difficulty of implementing future remedial actions, if necessary. In the case of the FMPC, the importance of this factor depends on how the operable units have been selected within the FS management strategy described in Section 2.0. Since the interdependencies of various actions were given primary consideration in the formulation of operable units (i.e., the operable units were selected so as to best achieve an independence of actions across operable units), the importance of this evaluation factor has been significantly reduced.

Monitoring Considerations

The ability to monitor the effectiveness of each alternative will be evaluated. The evaluation will consider the exposure pathways that exist and the ability to adequately monitor these individual pathways. The evaluation will also consider the risks of exposure that exist should monitoring be inadequate to detect the failure of various components of each alternative.

4.7.2 Administrative Feasibility

The administrative feasibility of implementing each alternative will be evaluated on the basis of the coordination requirements with local, state, and federal regulatory agencies from whom permits, approvals, and/or notifications are necessary for the implementation of the alternative. The evaluation will consider the following:

- Number of agencies involved and the specific requirements
- Potential permitting requirements for on-site and off-site activities, if necessary
- Long-term reporting or other requirements

4.7.3 Availability of Necessary Services and Materials

The availability of services and materials will consider several issues, including the availability of off-site treatment, storage, or disposal capacity; availability of necessary on-site equipment and specialists; and availability of the proposed technologies for each alternative.

Availability of Treatment, Storage, or Disposal Services

The availability of off-site treatment/storage/disposal services will be evaluated on the basis of the following:

- Availability of services
- Locations of services
- Capacities of available services relative to FMPC needs with respect to each alternative
- Effects of lack of availability on implementation

The evaluation will include consideration of all necessary off-site services for each alternative. Those alternatives associated with mixed waste will likely be severely constrained by the lack of off-site treatment, storage, and disposal services.

Availability of Necessary Equipment and Specialists

Certain alternatives may be developed which include the need for specialized equipment and possibly specialized technical personnel. Each alternative will be evaluated with respect to the equipment requirements and the availability of equipment as well as the need for specially trained or experienced personnel to set up or operate the equipment, or to implement a specific component of an alternative. The anticipated need to consider innovative and possibly unproven technologies for some operable units at the FMPC could exacerbate the need for specialized equipment and experts.

Availability of Proposed Technologies

The current or projected availability of technologies that are included in each alternative will be evaluated as well as their status (e.g., proven, pilot scale only, etc.) with respect to the proposed application. The evaluation will also consider the nature of future technological developments required before full-scale application is possible, the time frame for full-scale availability, and the ability to obtain the technology on a competitive-bid basis.

4.8 COST

4.8.1 Cost Documentation

The cost evaluation will include:

- Documentation of costs for each of the alternatives
- Present worth and sensitivity analyses

Capital costs, both direct (construction) and indirect (nonconstruction and overhead), and operation and maintenance (postconstruction) costs will be considered in the detailed evaluation of alternatives, as appropriate. Costs will be developed within an accuracy of plus 50 percent to minus 30 percent. The following is a listing of the types of costs to be included in the evaluation:

- Capital Costs (Direct):
  - Construction costs (materials, labor, and equipment needed to construct all facilities associated with an alternative)
  - Equipment costs (primary and secondary equipment needed to enact the remedy; these remain until the remediation is complete)
  - Land and site development costs (land purchase and site preparation)
  - Buildings and services costs (process and nonprocess buildings, utility connections, and purchased services)
  - Relocation expenses (temporary or permanent accommodations for affected nearby residents--not expected at Fernald)

- Disposal costs (transportation and disposal of waste and construction materials)

- Capital Costs (Indirect):

  - Engineering expenses (administration, design, construction supervision, drafting, and treatability testing)

  - Legal fees and license or permit costs (administrative and technical costs of obtaining licenses and/or permits to install and operate)

  - Start-up and shakedown costs (costs incurred during remedial action start-up)

  - Contingency allowance (funds to cover unforeseen circumstances)

- Operation and Maintenance Costs (Annual Costs):

  - Operating labor costs - Wages, salaries, training, overhead, and fringe benefits of labor needed for postconstruction operations

  - Maintenance materials and labor costs - Costs for labor, parts, and other resources required for routine maintenance of facilities and equipment

  - Auxiliary materials and energy - Costs of such items as chemicals and electricity for treatment plant operations, water and sewer services, and fuel

  - Disposal of residues - Costs to treat or dispose of residuals from treatment processes

  - Purchased services - Sampling costs, laboratory fees, and professional fees for activities such as monitoring that may be necessary

  - Administrative costs - Administrative costs not included under other categories:

    - Insurance, taxes, and licensing costs - Costs of such items as liability and sudden accidental insurance; real estate taxes on purchased land or rights-of-way; licensing fees for certain technologies; and permit renewal and reporting costs

- Maintenance reserve and contingency funds - Annual payments into escrow funds to cover costs of anticipated replacement or rebuilding of equipment and any large unanticipated operation and maintenance costs

- Rehabilitation costs - Costs for maintaining equipment or structures that wear out over time

- Costs of periodic site review - Costs for site reviews conducted at least every five years if wastes above health-based levels remain at the site

4.8.2 Present Worth and Sensitivity Analyses

In addition to the development of cost estimates, the cost evaluation will include a present-worth analysis. The present-worth analysis for each alternative will be used to evaluate expenditures that accumulate over different time periods by discounting all future costs to a common base year. The following assumptions will be used in the completion of the analysis:

- Base year will be the current year
- Discount rate of 5 percent (before taxes and after inflation)
- 30-year period of performance, unless a more appropriate period is stipulated for a given action

If necessary and appropriate, the present-worth analysis for a remedial alternative will be subjected to a cost sensitivity analysis. The need for a sensitivity analysis will be based upon the degree of uncertainty concerning the assumptions used to develop the present-worth analysis for each alternative. Particular attention will be given to the identification of factors in alternatives for which small changes in the cost values of the factors may result in significant changes in overall costs of the alternative. If a cost sensitivity analysis is completed for an alternative(s), the following factors will be used as sensitivity parameters, as appropriate:

- Effective life of the alternative
- Operation and maintenance costs

- Duration of cleanup in terms of both project duration and the time to achieve the cleanup goals
- Volumes of contaminated material to be handled as related to site uncertainties
- Alternative design assumptions and parameters
- Discount rate

4.9 STATE ACCEPTANCE

The evaluation of state acceptance is designed to address the technical and administrative issues and concerns of the state of Ohio regarding the alternatives under consideration. In the case of the RI/FS at the FMPC, the OEPA is an active participant in project reviews along with the U.S. EPA. The OEPA is provided with work plans, data reports, and other project deliverables for review and comment. Periodic technical information exchange meetings are also held to promote the timely input of the OEPA in the RI/FS process. Therefore, state concerns regarding the RI/FS have been and will continue to be incorporated into the project as it develops. The evaluation of state acceptance should, therefore, be a straightforward criterion to satisfy throughout the FS and ROD processes.

4.10 COMMUNITY ACCEPTANCE

Information on community acceptance of each alternative for the FMPC will likely be fragmentary and incomplete during the detailed evaluation of alternatives for each operable unit. The designated forum for public input is the public comment period that will occur upon issuance of the Proposed Plan. At that time, public concerns will be fully addressed. For purposes of Task 13, the evaluation of community acceptance of each alternative will be based solely on community positions on specific alternatives that have been documented during the FS process.

5.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

5.1 INTRODUCTION

One of the major concerns in the development of remedial action alternatives for sites which are being investigated under CERCLA is the degree of human health and environmental protection afforded by each alternative. The NCP and U.S. EPA policy state that in the process of the development and selection of remedial action alternatives, primary consideration should be given to alternatives that attain or exceed the ARARs as defined by the NCP and amended by SARA. The purpose of this requirement is to make CERCLA remedial actions consistent with pertinent federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate. Also included is the provision that state ARARs must be met if they are more stringent than federal requirements.

SARA defines an ARAR as:

- Any standard, requirement, criterion, or limitation under any federal environmental law
- Any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than the associated federal standard, requirement, criteria, or limitation

Applicable requirements are those federal and state requirements that would be legally applicable to a remedial action if that action was not undertaken pursuant to CERCLA. Federal statutes that are specifically cited in CERCLA include the Solid Waste Disposal Act (SWDA), the Toxic Substances Control Act (TSCA), the Safe Drinking Water Act (SDWA), the Clean Air Act (CAA), the Clean Water Act (CWA), and the Marine Protection Research and Sanctuaries Act (MPRSA). Relevant and appropriate requirements are those federal and state human health and environmental requirements that apply to circumstances sufficiently similar to those encountered at CERCLA sites wherein their application would be appropriate although not legally required. Relevant and appropriate requirements carry the same weight as applicable requirements.

U.S. EPA has also indicated that other federal and state criteria, advisories, and guidance, as well as local ordinances, be considered as appropriate in the development of remedial action alternatives. These types of requirements have been termed factors to be considered (TBC) and are assigned on a site-specific basis.

ARARs can be categorized into three broad classifications, as follows:

- Chemical-Specific ARARs - Usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values for each chemical of concern. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment.
- Location-Specific ARARs - Restrictions placed on the concentration of a chemical or the conduct of activities solely because they occur in special locations.
- Action-Specific ARARs - Usually technology- or activity-based requirements or limitations on actions taken with respect to waste management and site cleanup.

SARA identifies six circumstances under which ARARs may be waived:

- The remedial action is only a part of a total remedial action where the final remedy will attain the ARAR upon completion.
- Compliance with the ARAR will result in a greater risk to human health and the environment than alternative options.
- Compliance with the ARAR is technically impracticable from an engineering perspective.
- An alternative remedial action will attain an equivalent standard of performance through the use of another method or approach.
- The ARAR is a state requirement that the state has not consistently applied (or demonstrated the intent to apply consistently) in similar circumstances.

- Compliance with the ARAR will not provide a balance between protecting human health and the environment and the availability of Superfund money for response at other facilities. (This waiver is only available for Superfund-financed remedial actions under Section 104 of CERCLA).

In this section, the ARARs for the FMPC are presented for purposes of establishing a baseline for further discussions among involved agencies. The presentation is preliminary and has been completed to the extent practical without the consideration of risk-based issues that will be addressed in the risk assessment.

5.2 PRELIMINARY IDENTIFICATION OF ARARs

The establishment of final federal and state ARARs for the evaluation of remedial action alternatives for each operable unit at the FMPC will be a progressive, multistep process involving interactive discussions among DOE, U.S. EPA, and OEPA. The purpose of this section is to identify a comprehensive, preliminary list of ARARs to initiate the communications among involved agencies at an early stage in the FS process. Many of the identified ARARs may eventually be found not to be applicable or relevant and appropriate to certain operable units at the FMPC; others may be added based on subsequent discussions or regulatory changes.

Table 5-1 presents the federal and state ARARs and TBC requirements that have been preliminarily identified for the FMPC. The ARARs have been broken down into their respective groupings, as follows:

- Chemical Specific
- Location Specific
- Action Specific
- TBCs

TABLE 5-1
SUMMARY LIST OF POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND GUIDANCE TO BE CONSIDERED

Chemical-Specific ARARs

Requirement	Description
Resource Conservation and Recovery Act (RCRA), (40CFR260-272)	Sets standards applicable to hazardous waste treatment, storage, and disposal
RCRA/Solid Waste (40CFR240-257)	Sets standards applicable to solid waste treatment, storage, and disposal
Safe Drinking Water Act (40CFR141-149) a. Maximum contaminant levels (MCLs) b. Maximum contaminant level goals (MCLGs)	Remedial actions may provide cleanup to the MCLs considered pursuant to SARA Section 121(d)(2)(A)(ii)
NRC Regulations for Standards for Protection Against Radiation (10CFR20)	Establishes doses, levels, and concentrations for restricted and unrestricted areas (10CFR20.101-105)
EPA Regulations for Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40CFR192)	Establishes cleanup limits for uranium and thorium mill tailings in soil and groundwater
Clean Air Act (42USC7401, et. seq.) a. National Ambient Air Quality Standards (NAAQS) for six criteria pollutants (40CFR50)	Identifies primary and secondary standards for six "criteria pollutants" (i.e., lead, particulates)
b. National Emission Standards for Radionuclides Emissions from DOE Facilities (40CFR61 Subpart H)	Provides annual limits of 10 mrem/yr (whole body) for air emissions (except radon) from DOE facilities
NRC Licensing Requirements for Land Disposal of radioactive Waste (10CFR61)	Provides for protection of the general population from releases of radioactivity (<25 mrem/yr)

TABLE 5-1 (Continued)
SUMMARY LIST OF POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND GUIDANCE TO BE CONSIDERED

Chemical-Specific ARARs (Continued)

Requirement	Description
Ohio Regulations	
a. Air Pollution	Escape, releases, emissions to open air
OAC3745-15-07	Prevention of air pollution nuisance
OAC3745-17-07	Nondegradation policy
OAC3745-17-05	Particulate emissions to air
OAC3745-17-07	Emissions of organics to air
OAC3745-17-08	Fugitive dust emissions
OAC3745-21-07	Air quality
b. Water Pollution	
OAC3745-81	Drinking water rules, sets MCLs for gross alpha, beta and radium-226 and radium-228
OAC3745-31	Set requirements for wastewater treatment facilities
OAC3745-1	Water Quality standards, 3745-01-4(D) sets the criterion applicable to all waters, 3745-01-05 sets forth the antidegradation policy for state waters, 3745-01-07 presents specific surface water quality criteria for both acute and chronic effects on aquatic organisms, 3745-01-21 describes use designations for the Great Miami River, 3745-1-32(c)(9) sets standards for radioactive materials in receiving waters of the Ohio River
c. Radiation Protection OAC 3701-38	Ohio Radiation Protection Standards provide concentration limits for discharge of radioactive materials into air or water in unrestricted areas

TABLE 5-1 (Continued)
SUMMARY LIST OF POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND GUIDANCE TO BE CONSIDERED

Location-Specific ARARs

Requirement	Description
Rivers and Harbors Act of 1899 (33CFR320 to 327)	Remedial alternatives may effect the Great Miami River
Ohio Location Standards (OAC3745-54-18)	Governs the location of hazardous waste treatment, storage, or disposal with respect to floodplains
Regulations of activities affecting waters of the U.S. (33CFR320 to 329)	COE regulations apply to both wetlands and navigable (33CFR320-329), and for Ohio (OAC3745-32) waters
Fish and Wildlife Coordination Act (40CFR6.302)	Provides for coordination of the impacts on wetlands and protected habitats

TABLE 5-1 (Continued)
SUMMARY LIST OF POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND GUIDANCE TO BE CONSIDERED

Action-Specific ARARs

Requirements	Description
Resource Conservation and Recovery Act (RCRA) (40CFR260-272)	Sets standards applicable to hazardous waste treatment, storage, and disposal
RCRA/Solid Waste (40CFR240-257)	Sets standards applicable to solid waste treatment, storage, and disposal
Clean Water Act Ambient Water Quality Criteria (40CFR104-140)	Alternatives include discharge to surface waters
NRC Licensing Requirements for Land Disposal of Radioactive Waste (10CFR61)	Provides criteria for siting, decontamination, decommissioning, and disposition of uranium tailings and wastes (Appendix A)
NRC Regulations for Licensing of Source Material (10CFR40)	Provides requirements for siting, design, operation, closure, and control after closure for radioactive waste disposal facilities
EPA Regulations for Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40CFR192)	Provides standards for control of residual radioactive materials from inactive uranium processing sites
Ohio General Radiation Protection Standards (OAC3701-70)	Applies to all facilities that receive, possess, use, store, transfer, etc., any source of radiation
Ohio Radiation Protection Standards (OAC3701-38)	Applies to all facilities that receive, possess, use, store, transfer, etc., any source of radiation
Air Pollution Nuisances Prohibited (OAC3745-15-07)	Prohibits air emissions that could be constituted as a public nuisance

TABLE 5-1 (Continued)
SUMMARY LIST OF POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND GUIDANCE TO BE CONSIDERED

TBCs

Requirements	Description
Executive Order 11988 Floodplain Management	Provides considerations for management of floodplain areas
Executive Order 11990 Protection of the Wetlands	Provides considerations for protection of wetlands
Radioactive Waste Management (DOE Order 5820.2A)	Sets requirements for management of radioactive wastes at DOE facilities
Radiation Protection of the Public and the Environment (DOE Order 5400.5)	Sets requirements for protection of the public and the environment from radioactive materials at DOE facilities
CERCLA Program (DOE Order 5400.4) (Draft)	Provides direction for DOE to implement a CERCLA program
Hazardous and Radioactive Mixed Waste Management (DOE Order 5480.2) (December 13, 1982)	Establishes hazardous waste management procedures for facilities operated under authority of the Atomic Energy Act of 1954, as amended
Plan for Implementing EPA Standards for UMTRA Sites (UMTRA-DOE/AL-163)	Presents guidance for implementing EPA standards on uranium mill tailings remedial action sites
Technical Approach Document (UNTRA-DOE/AL 050425)	Presents the technical approach used by DOE for remediation of uranium mill tailings remedial action sites
Remedial Action Planning and Disposal Cell Design (UMTRA-DOE/AL 400503)	Presents guidance for complying with 40CFR192 for planning and disposal cell design for uranium mill tailings remedial action sites

TABLE 5-1 (Continued)
SUMMARY LIST OF POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND GUIDANCE TO BE CONSIDERED

TBCs (Continued)

Requirements	Description
Project Surveillance and Maintenance Plan (UMTRA-DOE/AL 350124)	Presents guidance for surveillance and maintenance of uranium mill tailings remedial action sites.
Minimum Technology Guidance for Final Covers on Hazardous Waste Landfills and Surface Impoundments (EPA)	Presents guidance for final covers of hazardous waste landfills and surface impoundments.

5.3 FEDERAL ARARs

Federal ARARs and other criteria, advisories, or guidelines from specific laws include the following:

- Safe Drinking Water Act (42USC300f, et. seq. and 40CFR141 to 149) - Establishes Maximum Contaminant Levels (MCLs) which are enforceable standards for chemicals in public drinking water supplies. They not only consider health factors but also the economic and technical feasibility of removing a contaminant from a water supply system. The EPA has recently proposed MCL goals (MCLGs) for several organic and inorganic compounds in drinking water. MCLGs are nonenforceable guidelines that do not consider the technical feasibility of contaminant removal. The SDWA also authorizes the following programs:

  - The Underground Injection Control (UIC) Program
  - The Sole-Source Aquifer Program
  - The Wellhead Protection Program

- Toxic Substances Control Act (15USC2601, et. seq. and 40CFR702 to 799) - Regulates the use and disposal of polychlorinated biphenyls (PCBs) and asbestos.

- Resource Conservation and Recovery Act (42USC6901, et. seq. as amended and 40CFR260 to 279) - Establishes the criteria and standards for identification, management, and disposal of hazardous waste.

- Federal Water Pollution Control Act, As amended by the Clean Water Act (33USC-1251, et. seq. and 40CFR104 to 140) - Governs point-source discharges through the National Pollutant Discharge Elimination System (NPDES), dredge and fill activities which may degrade or disturb wetlands or other aquatic habitats, and oil or hazardous substance spills to waters of the United States.

- Ambient Water Quality Criteria - Criteria for 64 chemicals were established in 1980, pursuant to Section 304(a)(1) of the CWA. AWQC are available for the protection of human health from exposure to chemicals in drinking water, from ingestion of aquatic biota, and for the protection of fresh-water and salt-water aquatic life.

- Regulation of Activities Affecting Waters of the U.S. (33CFR320 to 329) - U.S. Army Corps of Engineers (COE) regulations that are applicable to wetlands and navigable waters.

- Endangered Species Act of 1978 (16USC1531, et. seq.) - Provides for consideration of the impacts of remedial actions on endangered and threatened species.

- Fish and Wildlife Coordination Act (16USC661, et. seq. and 40CFR6.302) - Provides for consideration of the impacts on wetlands and protected habitats.

- Fish and Wildlife Improvement Act of 1978 (16USC742a) - Provides for consideration of the impacts on wetlands and protected habitats.

- Clean Air Act (42USC4701, et. seq. and 40CFR61, Subparts H and Q)) - Through the National Ambient Air Quality Standards (NAAQS) it identifies primary and secondary standards for six "criteria" pollutants, and through the National Emission Standards for Radionuclides Emissions from DOE facilities, it provides annual exposure limits from air emissions from DOE facilities.

- EPA Regulations for Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40CFR192) - Applies to the control of residual radioactive material at designated processing or repository sites under Section 108 of the Uranium Mill Tailings Radiation Control Act of 1978 and to restoration of such sites following any use of subsurface minerals under Section 104(h) of the above-referenced act.

- NRC Regulations for Standards for Protection against Radiation (10CFR20) - Establishes standards for protection against radiation hazards arising out of activities under licenses issued by the U.S. Nuclear Regulatory Commission (NRC) and issued pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974.

- NRC Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content (10CFR40, Appendix A) - Establishes technical and long-term site surveillance criteria relating to siting, operation, decontamination, decommissioning, and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located.

- The Atomic Energy Act of 1954 (42USC2011, as amended) - Authorizes the conduct of atomic energy activities.

- Licensing Requirements for Land Disposal of Radioactive Waste (10CFR61) - Establishes procedures and criteria for the land disposal of radioactive wastes.

5.4 STATE OF OHIO ARARs

The state of Ohio ARARs and other criteria, advisories, or guidance include the authority of the Ohio Environmental Protection Agency (OEPA) to manage federal environmental programs.

The OEPA shares several responsibilities with other Ohio agencies including the Department of Health, the Department of Natural Resources (ODNR), and the Public Utilities Commission:

- Ohio Water Pollution Control Act (ORC Chapter 6111) -OEPA has the authority to administer all of the federally mandated water discharge programs, including the NPDES programs for all source categories (OAC3745-33-01 through 3745-33-05), and an effective pretreatment program (OAC3745-3). ORC 6111 also prohibits pollution of waters of the state.

- Solid and Hazardous Waste Disposal Law (OAC Chapter 3734) - OEPA has been developing extensive solid and hazardous waste regulations (OAC3745 Chapters 27 through 70). These programs are administered by the Solid and Hazardous Waste Division of OEPA.

- Water Quality Standards (OAC3745-1) - Ohio has developed water quality standards applicable to state surface water (OAC3745-1-04), an antidegradation policy (OAC3745-1-05) and has designated water use criteria for all major surface water bodies (OAC3745-1-07 to 32).

- Drinking Water Rules - The rules for public drinking water are set forth by OAC3745-81-01 to 55, and includes MCLs. OAC3745-82 sets secondary contaminant standards.

- Water Well Installation - For new wells intended for human consumption, well installation is regulated under OAC3745-9 by OEPA and ODNR.

- The Underground Injection Well Control Program - Approvals for injection wells are required from the ODNR and OEPA. The requirements for permits to inject fluids via wells are set forth in OAC3745-34.

- Water System - Authority to establish and enforce rules regarding private water systems is granted to the Department of Health under OAC3701. The Department of Health governs plan approvals, procedures, construction, and abandonment for private water systems (OAC3701-28). Community and public water supply systems are governed and approved by the OEPA under OAC3745-83 to 95.

- Radiation Standards - Standards for protection and handling of equipment and materials associated with ionizing radiation are governed by rules set by the Department of Health under OAC3701-38.

- Air Pollution Control (ORC3704, OAC3745-15, OAC3745-17) - Establishes the authority of Ohio EPA to regulate and control air pollution within the state under ORC 3704.03. Requires person responsible for any air contaminant source to install,

employ, maintain, and operate such emissions, ambient air quality, meteorological, or other monitoring devices or methods as director prescribes. Requires the sampling of emissions at such locations, intervals and in a manner which the director prescribes. Requires the maintenance of records and filing of periodic reports with the director on the location, size, and height of emissions outlets, as well as the rate, duration, and composition of emissions.

5.5 GUIDANCE TO BE CONSIDERED (TBC)

Because ARARs may not exist or may not be sufficient to protect human health and the environment at a CERCLA site, it is necessary when determining cleanup requirements or designing a remedy to evaluate nonlegally binding or promulgated criteria, advisories, guidance, or policies for protective cleanup levels. The U.S. EPA and support agencies may, as appropriate, identify other advisories, criteria, or guidance to be considered for a particular remediation activity. This TBC category consists of advisories, criteria, or guidance that are not ARARs were developed by EPA, other federal agencies, or states.

The application of the ARARs to the FMPC is complicated by the fact that DOE and radionuclides (particularly uranium) have been exempted from most environmental regulations. From a radiological standpoint, DOE has been primarily self-regulating for environmental activities, and has established its own policies for environmental monitoring, waste disposal, and limits of exposure to employees and the public. U.S. EPA regulations regarding the handling and disposal of wastes containing radionuclides are under programs set up by the Uranium Mill Tailings Act and the NRC. It should also be noted that DOE orders are not promulgated requirements but fall under the category of TBCs.

A brief discussion of each of the primary Federal TBCs presently being considered is given below.

- Health Effects Assessments - Presents toxicity data for specific chemicals for use in public health assessments. Also considered applicable are Cancer Potency Factors (CPFs) and referenced doses provided in the Human Health Evaluation Manual (EPA 1989).

- Groundwater Protection Strategy - Documents EPA policy to protect groundwater for its highest present or potential beneficial use. The strategy designates three categories of groundwater:

  - Class 1 - Special Groundwaters: Waters that are highly vulnerable to contamination and are either irreplaceable or ecologically vital sources of drinking water.

  - Class 2 - Current and Potential Sources of Drinking Water and Waters Having other Beneficial Uses: Waters that are currently used or that are potentially available for use.

  - Class 3 - Groundwater not a Potential Source of Drinking Water and of Limited Beneficial Use: Class 3 groundwater units are further subdivided into the following two subclasses:

    a. Subclass 3A includes groundwater units that are highly to intermediately interconnected to adjacent groundwater units of a higher class and/or surface waters. They may, as a result, be contributing to the degradation of the adjacent waters. They may be managed at a similar level as Class 2 groundwaters, depending upon the potential for producing adverse effects on the quality of adjacent waters.

    b. Subclass 3B is restricted to groundwater units characterized by a low degree of interconnection to adjacent surface waters or other groundwater units of a higher class within the Classification Review Area. These groundwaters are naturally isolated from sources of drinking water in such a way that there is little potential for producing adverse effects on quality. They have low resource value outside of mining or waste disposal.

- DOE Order for CERCLA Program (5400.4) (Draft) - Provides direction for DOE to implement a CERCLA program.

- DOE Order for Radiation Protection of the Public and the Environment (5400.5) (February 8, 1990) - Establishes standards and requirements with respect to protection of the public and the environment against radiation.

- DOE Order for Hazardous and Radioactive Mixed Waste Management (5480.2) (December 13, 1982) - Establishes hazardous waste management procedures for facilities operated under authority of the Atomic Energy Act of 1954, as amended.

- DOE Order for Environmental Protection, Safety, and Health Protection Information Reporting Requirements (5484.1) (February 24, 1981) - Establishes the requirements

and procedures for reporting and investigating matters of environmental protection, safety, and health protection significant to DOE operations.

- DOE Order for Quality Assurance (5700.6B) (September 23, 1986) - Establishes DOE's quality assurance program.
- DOE Order for Radioactive Waste Management (5820.2A) (September 26, 1988) - Establishes policies and guidelines for the management of radioactive waste and contaminated facilities.
- DOE Plan for Implementing EPA Standards for UMTRA Sites (UMTRA-DOE/AL-163) (January 1984) - Presents guidance for implementing EPA standards on uranium mill tailing remedial action sites.
- DOE Technical Approach Document - Revision II (UMTRA-DOE/AL-050425.0002) (December 1989) - Presents the technical approach for remediation of uranium mill tailings remedial action sites.
- DOE Remedial Action Planning and Disposal Cell Design (UMTRA-DOE/AL 400503) (January 1989) - Presents guidance for complying with the proposed 40CFR192 for planning and disposal cell design for uranium mill tailings remedial action sites.
- DOE Project Surveillance and Maintenance Plan (UMTRA-DOE/AL 350124) - Presents guidance for surveillance and maintenance of uranium mill tailings remedial action sites.
- Executive Order 11988 - Presents requirements for federal agencies to protect floodplains.
- Executive Order 11990 - Presents requirements for federal agencies to protect wetlands.
- NRC Regulatory Guide for Termination of Operating Licenses for Nuclear Reactors (NRC Regulatory Guide 1.86) (June 1974) - Establishes acceptable surface radioactivity contamination levels for releases of equipment and facilities for unrestricted use.

5.6 APPLICATION OF ARARs TO THE FMPC

Many of the potential ARARs identified above will principally apply to the construction and operational aspects of a remedial action.. For some operable units, however, a more critical

application of ARARs will be for the determination of whether an action is necessary and, if so, the cleanup levels that would be required to adequately protect public health and the environment at the FMPC. This determination requires a consideration of the complete source-pathway-receptor framework and will ultimately be accomplished within the context of the risk assessment.

The presence of both hazardous chemicals and radionuclides (i.e., mixed wastes) at the FMPC, as well as the lack of specifically applicable precedent cases, introduce particular complexities to the application of ARARs to the FMPC. Considerable interpretation of ARARs and their applicability can be expected, with each of the three components of an exposure scenario requiring careful, site-specific analyses as part of the risk assessment.

5.6.1 Sources of Chemicals and Radionuclides

For purposes of this discussion, the sources of hazardous chemicals and radionuclides represent those sites or environmental units that are potential candidates for remedial action at the FMPC--that is, those units for which specific cleanup levels may be established. If site-specific conditions warrant such an approach, applicable requirements may be directly applied to the source unit. A case in point would be the need to attain MCL standards for groundwater used as a potable water supply.

In most cases, however, the acceptable levels of residual contamination at the source will be dictated by the corresponding, site-specific impacts on public health or the environment. The controlling factors become the acceptable levels of dose, exposure, or risk. In such cases, the application of either ARARs or an approach employing specific advisory levels will center on the exposure point concentrations rather than the source terms. It is this approach that will require the most rigorous technical and institutional interpretation and justification for the FMPC and is discussed further in Section 5.6.3.

5.6.2 Pathways to Receptors

The levels of allowable exposure at a receptor location can only be related back to a cleanup level at the source if each component of the exposure scenario is identified and analyzed. These components include migration pathways, exposure pathways, exposure frequency, and exposure duration. No applicable requirements exist for pathway definition but numerous agency guidances and precedent cases can be interpreted as relevant and appropriate requirements. Considerable uncertainty in the pathways analysis remains, however, due to the following:

- Potential differences in the pathways of key concern to radionuclide exposure versus hazardous chemical exposure
- Differences in DOE technical guidance (DOE 1988, DOE 1989, DOE 1990) and USEPA technical guidance (EPA 1988, EPA 1989a, EPA 1989b, EPA 1989c) regarding pathway analysis
- Inconsistencies in approach used in previous applications at other sites that are generally similar to, though critically different from, the FMPC.

An example of the latter two points is the determination of the pathway boundary. U.S. EPA guidance would typically establish the most critical receptor at the controlled boundary of the site--a scenario that would appear to be appropriate for the FMPC. DOE guidelines for deriving residual soil contamination levels at DOE facilities, however, assume the most conservative "unrestricted access" scenario that considers a hypothetical receptor to reside at the source location itself. Such an unrestricted access condition does not seem appropriate for the FMPC. The eventual decision on such a pathway scenario will greatly influence the risk assessment and related cleanup levels and may require considerations that extend beyond published guidance documents and previous work at other sites.

A related issue is the potential for different exposure pathways for radionuclides and hazardous chemicals that may result in inappropriate pathway scenarios. For example, the use of an unrestricted access scenario may be appropriate for an analysis of exposure to long-lived radionuclides resulting from cattle grazing. It may not, however, be reasonable for the assessment

of chemical toxicity via the ingestion of groundwater. The latter case could result in an MCL cleanup standard for all groundwater underlying the FMPC. The preceding examples reveal the need to derive the most appropriate pathway scenarios that can be consistently applied to both radionuclide dose assessments and chemical exposure analyses. The resolution of this and related issues are proceeding and a recommended strategy will be proposed for U.S. EPA review.

5.6.3 Receptor Dose, Exposure, or Risk Levels

Within the context of the source-pathway-receptor framework, the principal ARARs are those associated with the establishment of acceptable receptor dose, exposure, or risk levels. In the case of hazardous chemicals, if no applicable requirements are available, relevant and appropriate requirements (as defined by the U.S. EPA) will be identified. These may include (but are not limited to) national primary drinking water standards, MCLs, NAAQS, state water quality standards, and federal AWQC.

For chemicals for which ARARs are not available, the U.S. EPA has provided guidance on the use and application of other chemical-specific advisory levels, such as carcinogenic potency factors for carcinogens or reference doses for noncarcinogens. While not actually ARARs, such reference levels will be used to determine risk-based cleanup levels in a site-specific approach. In choosing criteria appropriate for the estimation of potential site-related health risks, variations in duration and frequency of exposure will be considered.

In the case of radionuclides, DOE has prepared guidelines for residual radioactivity at formerly utilized sites to be used to derive site-specific concentration levels in environmental media. Site-specific source concentrations can be derived for individual isotopes by conducting a pathway analysis to calculate appropriate source-to-dose conversion factors. These factors are applied to a basic dose limit of 100 millirem per year committed effective dose equivalent (CEDE). The DOE limit is determined for a dose commitment for an individual for a 50-year period. This approach is recommended by the International Commission on Radiation Protection and the National Council on Radiation Protection and Measurements. It represents the most appropriate quantity

to use for specifying radiation doses to individuals in the vicinity of the FMPC. Other dose limits have been promulgated that are not considered to be appropriate for the RI/FS at the FMPC. These apply to unrestricted exposure of individual members of the public and include: (1) the NRC's specification for maximum permissible dose (10CFR20); (2) the U.S. EPA's Uranium Fuel Cycle dose limits (40CFR190); and (3) the U.S. EPA CAA standards (40CFR61). A final determination of receptor limits appropriate to the site-specific conditions and needs at the FMPC will be made as part of the risk assessment. The recommended dose, exposure, and/or risk criteria, along with supporting justification, will be provided to the U.S. EPA for review.

In addition to radiation dose limits, radionuclide concentration limits have been promulgated for specific radionuclides in specific media. In 40CFR192, the U.S. EPA has set forth limits for radium-226 and radium-228 concentrations in soil for inactive uranium and thorium processing sites. Similarly, for radium-226 and radium-228 in drinking water, a concentration limit has been specified by the U.S. EPA. The appropriateness of these concentration limits for radionuclides in specific media, and for other radionuclides for which concentration limits can be derived, will be evaluated with respect to the site-specific pathways and receptors at the FMPC.

6.0 MANAGEMENT PLAN AND SCHEDULE

6.1 MANAGEMENT PLAN

As discussed in Section 3.0 of this Work Plan, the FS for the FMPC will be performed as Tasks 10 through 16 of the RI/FS. Tasks 12 through 16 will be performed for each operable unit. The management plan previously developed and periodically updated for the management, control, and staffing of the RI/FS will, therefore, be appropriate for the FS portion of the work.

The project management organization for the RI/FS is shown in Figure 6-1. The organization has a full, operable unit structure, with Operable Unit Managers responsible for the full performance of both the RI and the FS for their respective operable units. The individual Operable Unit Managers report to the RI/FS Technical Manager to promote integration across the operable units, with the latter individual reporting to the RI/FS Project Director.

The RI/FS Project Director reports directly to DOE's Assistant Environmental Manager at the FMPC. In order to insure proper oversight of the RI/FS process, DOE has assigned environmental staff to each operable unit. These staff positions regularly interact with their project counterparts (Operable Unit Managers) to stay abreast of current findings, to provide guidance and direction, and to coordinate DOE involvement in the operable unit RI/FS. DOE's management structure for the FMPC RI/FS is shown in Figure 6-2.

Depending on the complexity of the operable units, separate individuals reporting to the Operable Unit Manager have been assigned responsibility for the everyday activities on the RI and FS portions of some operable units. The quality assurance and health and safety aspects of the FS will be the responsibility of the RI/FS Quality Assurance and Health and Safety Officers, respectively.

FIGURE 6-1

FMPC RI/FS PROJECT MANAGEMENT STRUCTURE

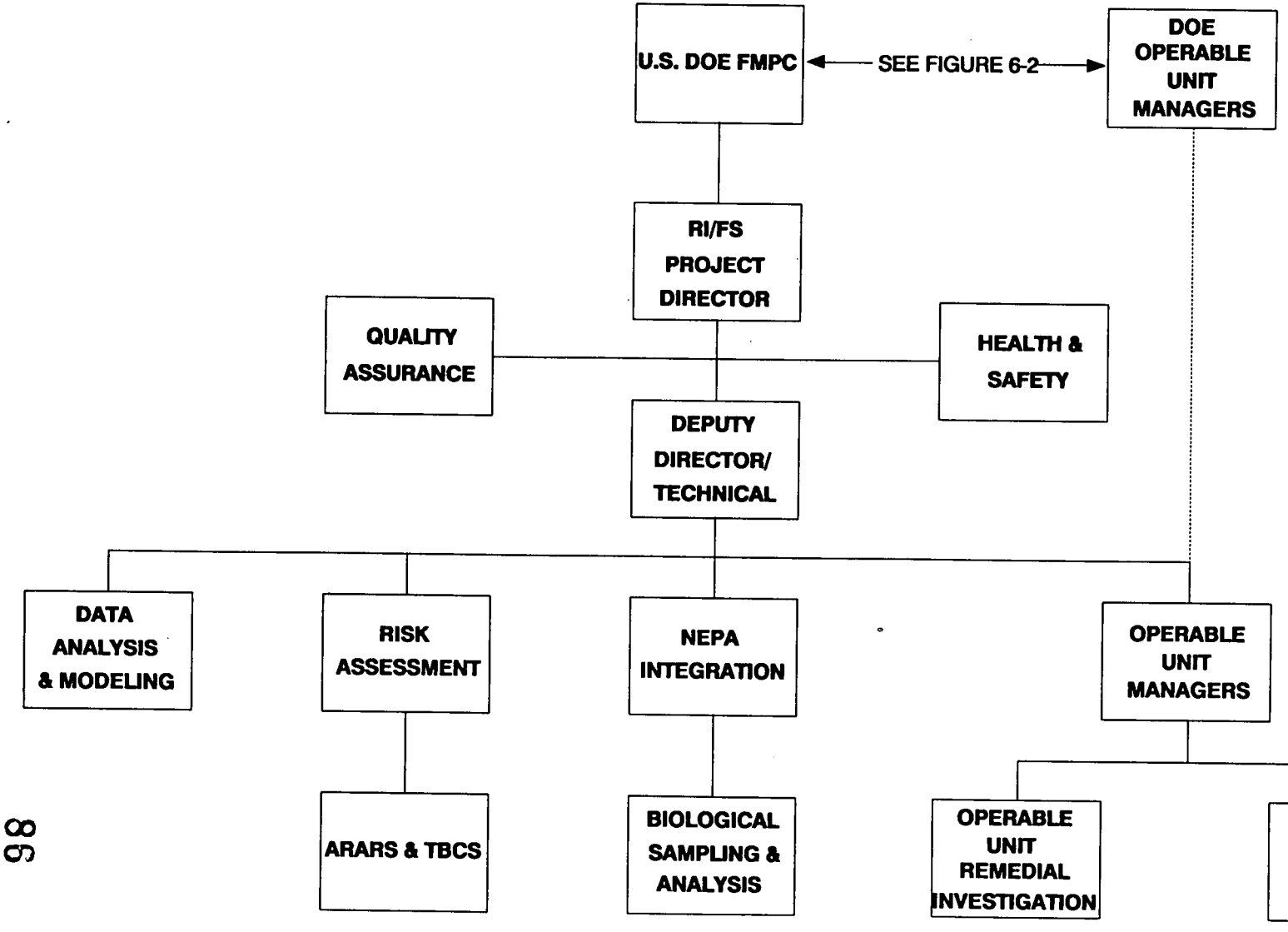
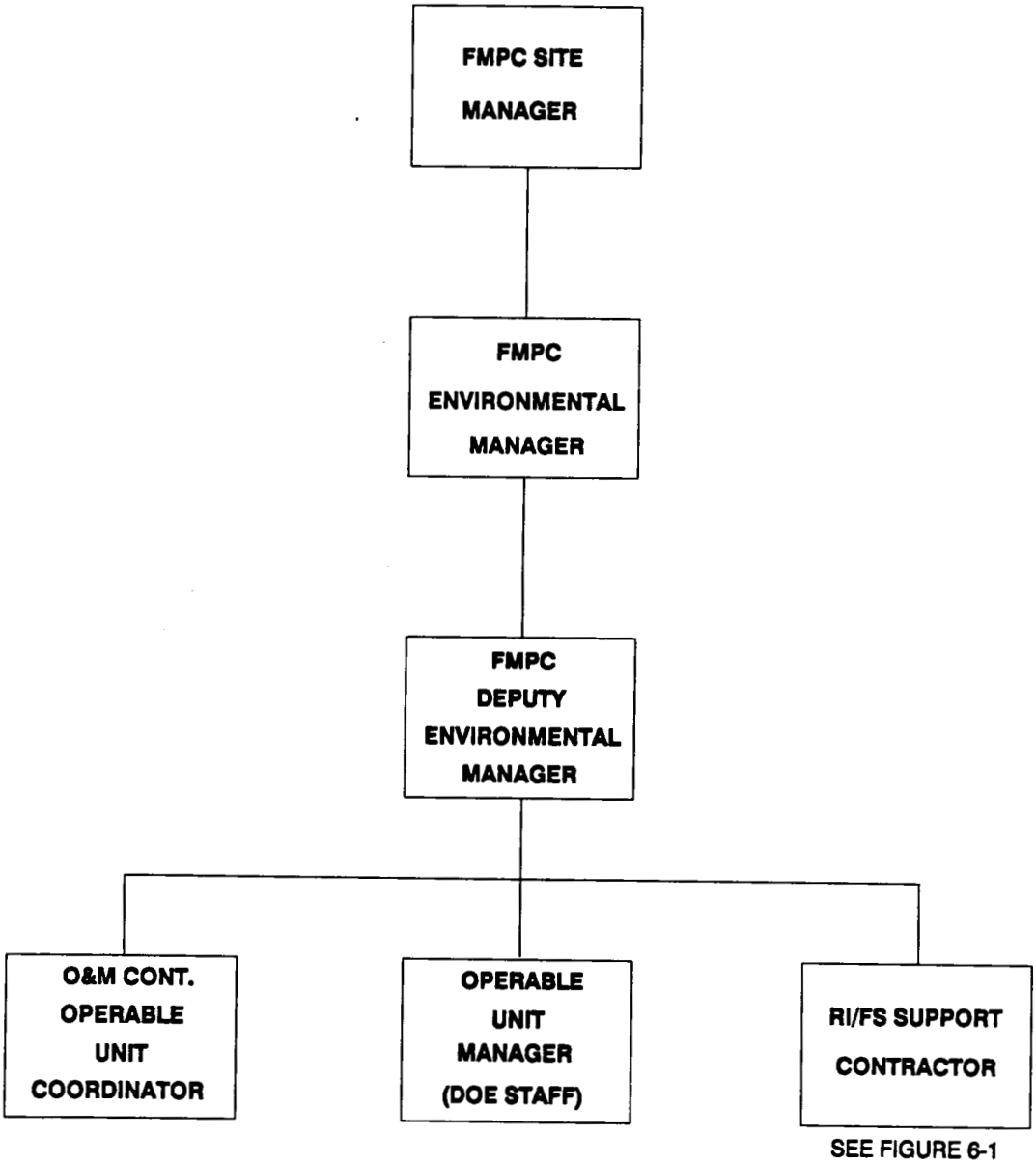


FIGURE 6-2

U.S. DEPARTMENT OF ENERGY
FMPC RI/FS MANAGEMENT STRUCTURE



SEE FIGURE 6-1

The technical staff carrying out the individual work elements of the FS have also been segregated by operable unit. The reasons for this staffing strategy are include (1) the capacity to perform several concurrent FSs for different operable units; (2) the opportunity to staff the FS for each operable unit with engineers and scientists with the most relevant expertise; (3) the ability to assign separate FSs to appropriate contractor offices, thereby allowing for the availability of additional resources; and (4) the allowance for each team to attain a comprehensive knowledge of the data base and issues related to the corresponding operable unit.

The engineers and scientists performing the individual FS tasks will be qualified, experienced individuals in each principal technical area (e.g., environmental engineers, chemical engineers, civil engineers, environmental scientists, regulatory specialists, etc.).

Separate from the operable unit teams are groups of technical specialists that provide appropriate support across all operable units. These technical teams have been established for the risk assessment, ARARs and TBC identification, hydrogeologic analysis and modeling, data base management, biological sampling and analysis, and NEPA integration. Each group of technical specialists is headed by a senior-level Task Manager, who also reports to the RI/FS Technical Manager to ensure integration and consistency of technical approach across the operable units.

All monthly reports required for the FS will be accomplished through the current RI/FS reporting process. Community relations activities will also be performed as part of the overall RI/FS function, in accordance with the Community Relations Plan.

6.2 SCHEDULE

The FS deliverables and the corresponding submission dates to the U.S. EPA for each operable unit are presented in Table 6-1 and currently remain in effect. Any future changes in this schedule will require the concurrence of the U.S. EPA, in accordance with the Consent Agreement.

TABLE 6-1

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY DELIVERABLES SUBMISSION DATES

	RI Report/ Risk Assessment	Initial Screening of Alternatives Report	Feasibility Study Report*
Operable Unit 1	February 18, 1991	July 23, 1990	March 25, 1991
Operable Unit 2	February 11, 1991	October 29, 1990	March 25, 1991
Operable Unit 3	April 8, 1991	September 24, 1990	May 15, 1991
Operable Unit 4	August 27, 1990	June 4, 1990	November 25, 1990
Operable Unit 5	April 8, 1991	August 27, 1990	May 15, 1991

* Upon request by DOE, the deliverable dates for the FS Report may be extended by twenty (20) days.