DRAFT
ENGINEERING EVALUATION/COST ANALYSIS
GUIDANCE FOR
NON-TIME-CRITICAL REMOVAL ACTIONS
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1.0 INTRODUCTION

An engineering evaluation/cost analysis (EE/CA) is a comparative analysis of removal action options for a Superfund hazardous waste site. The EE/CA process is the procedure used by response personnel to develop, evaluate, and select a removal action. The EE/CA report is the document that records this analytical process. A formal EE/CA report is required for all non-time-critical removal actions/expedited response actions (ERAs). For other removal actions, site documents (e.g., Action Memoranda, POLREPS, OSC reports) should be expanded to provide better documentation of the analysis of removal action options. To the extent possible, such documents should address the major elements of the formal EE/CA, as described in this guidance.

This document provides guidance on the EE/CA process and report, and is intended for use by EPA and State personnel, removal contractors, and remedial contractors involved in removal activities. This guidance supplements existing removal program requirements, as defined by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the Superfund Amendments and Reauthorization Act of 1986 (SARA), the National Oil and Hazardous Substances Contingency Plan (NCP), the Superfund Removal Procedures, and other removal program policies and procedures. The EE/CA guidance should be used in conjunction with, and not as a substitute for, these other requirements.

The remainder of Section 1 briefly describes the EE/CA contents and discusses factors affecting the EE/CA scope and timing. Section 2 details the EE/CA procedure. Sections 3, 4, and 5 address contracting, cost management, and funding issues, respectively.

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1 ERAs are non-time-critical removal actions taken at NPL sites by remedial contractors, overseen by a Remedial Project Manager (RPM). For more information on ERAs, see "The Role of Expedited Response Actions Under SARA," April 21, 1987 (OSWER Directive #9360.0-15).

2 The National Contingency Plan for Oil and Hazardous Substances (NCP) (40 CFR 300.65) is currently being revised by EPA Headquarters pursuant to SARA.
The EE/CA will be used to satisfy four goals:

1. To provide a methodology for evaluating and selecting an alternative technology for waste disposition to ensure that the technology is sound and appropriate for the specific site;³

2. To provide for adequate public participation in the Agency's process for selecting a removal alternative;⁴

3. To provide improved documentation for removal action selection to facilitate cost recovery efforts;

4. To provide better documentation of the decision-making process for removal actions for inclusion in the administrative record.

All EE/CAs will include the same basic elements, but because the EE/CA will be used to satisfy a number of different goals, the scope and level of detail will vary.

1.1 EE/CA CONTENTS

The basic components of an EE/CA are outlined below. Section 2 of this guidance document explains each of these components in detail.

- Site characterization

- Identification of removal action objectives

- Identification of removal action alternatives

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³ See the "Administrative Guidance for Removal Program Use of Alternatives to Land Disposal," (date) (OSWER Directive #9380.2-1).

• Analysis of removal action alternatives

  -- Selection criteria
  1. Effectiveness
  2. Implementability
  3. Cost

• Comparative analysis of removal action alternatives

• Recommended removal action alternative

1.2 SCOPE AND TIMING

The EE/CA should evaluate final waste disposition for the site. Waste disposition can include treatment, recycling, or disposal. For removal sites that do not involve waste disposition, such as provision of an alternate water supply, the EE/CA should evaluate the final removal solution at the site.

Removal program policy establishes three categories of removal actions based on the urgency of the response: (1) classic emergencies, (2) time-critical removal actions, and (3) non-time-critical removal actions. Classic emergency removal actions are defined as actions that, based on the threat to public health, welfare, and the environment, must be initiated within hours or days after completion of the site evaluation. Time-critical removal actions are defined as actions that, based on the threat to public health, welfare, and the environment, must be initiated within six months after approval of the Action Memorandum. Non-time-critical removal actions/ERAs are defined as actions

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5 OERR is developing EE/CA procedures tailored specifically for these types of actions, titled "Guidance Document for Providing Alternate Water Supplies."

6 See "Environmental Review Requirements for Removal Actions" (footnote 4).
that, based on the threat to public health, welfare, and the environment, may be
delayed for six months or more before the Action Memorandum is approved and on-site
cleanup is initiated. A formal EE/CA report is required only for non-time-critical
removal actions/ERAs. However, as noted earlier, site documentation for other removal
actions should be expanded to provide a better record of the decision-making proces:

The sequence of events for preparation of an EE/CA for non-time-critical removal
actions is outlined below. Each step is then explained in greater detail. Note that
preparation of the EE/CA Approval Memorandum follows the site evaluation. At an
NPL site, the need for a non-time-critical removal action/ERA may be identified later
in the process than the initial site evaluation, for example, during the RI/FS or
implementation of the remedial action itself.

- Site evaluation
- Preparation and approval of EE/CA Approval Memorandum
- Additional site activities to better define the site and characterize waste, if
  necessary
- Preparation of EE/CA report
- Public comment period
- Preparation and approval of Action Memorandum, including responsiveness summary
- Implementation of approved removal action
- Change in scope of work, if necessary

Site evaluation. The site evaluation consists of an assessment of the threat at the site
to determine if a Federally-funded removal action is necessary and, if so, whether the
response is a classic emergency, time-critical, or non-time-critical. Procedures for
performing a site evaluation are described in the NCP and Chapter _____ of the
Superfund Removal Procedures. The site evaluation for non-time-critical removal
actions is basically the same as for other removal actions, except that additional time
is available to collect more in-depth site information. Once the threat is characterized
as non-time-critical, response personnel should perform a thorough site evaluation to
try to identify all of the threats at the site prior to preparing the EE/CA. A detailed
assessment can avoid the need to amend the EE/CA in the future because certain
threats were not detected in the original site evaluation. (As noted above, at NPL
sites, the evaluation of the need for a non-time-critical removal action/ERA may occur in later phases of the remedial response.)

**EE/CA Approval Memorandum.** Before an EE/CA is prepared, the decision to implement a non-time-critical removal action at a site must be documented in an EE/CA Approval Memorandum. (See Appendix A for a model EE/CA Approval Memorandum to be used for non-time-critical removal actions/ERAs.) The EE/CA Approval Memorandum should include:

- background information on the site;
- threats to public health or welfare or the environment;
- enforcement information (not for public release);
- proposed scope of work and cost (104(b)) for the EE/CA, including any additional on-site activities needed to characterize the waste;
- preliminary estimate of the time and funds necessary to complete the removal response, based on the nature of the site problems and waste volume and characteristics;
- expected change in the situation should no action be taken or should action be delayed;
- important policy issues, as necessary.

Note that the final removal action is not proposed at this time. The purpose of the EE/CA Approval Memorandum is to document that the site meets the NCP criteria for initiating a removal action and the response is non-time-critical, and to secure management approval to conduct the EE/CA. The final removal action will be set forth in an Action Memorandum after the public has had the opportunity to comment on the EE/CA.

To determine the appropriate official for approving the EE/CA Approval Memorandum, use the preliminary estimate of the funds needed to complete the removal action. The Regional Administrator may approve actions up to $2 million, and Headquarters must

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7 This section of the EE/CA Approval Memorandum will be used to satisfy the "no action" alternative requirement.
approve actions expected to exceed $2 million.\(^8\) However, for non-NPL sites that qualify as "nationally significant" or precedent-setting, Headquarters must approve the EE/CA Approval Memorandum regardless of estimated cost.\(^9\)

As soon as the EE/CA Approval Memorandum is approved, the Regional community relations staff must be notified that an EE/CA for public review will have to be prepared. In addition, the administrative record for the site must be opened.

**Additional site activities, if necessary.** At some sites, on-site work in addition to the site evaluation may be necessary to better define the site and characterize the wastes as part of the EE/CA process. For example, at a site containing buried drums, it may be more efficient to excavate the drums and stabilize them on site in order to obtain an accurate profile of the waste volume and waste type. At a site containing above-ground tanks, it may be necessary to cut open the tanks to determine the tank's contents. These activities must be approved in the EE/CA Approval Memorandum and may be performed concurrent with preparation of the EE/CA. Activities conducted as part of the EE/CA must be limited to those necessary for waste characterization and site definition (104(b) activities). Final cleanup measures may not be taken until the public has an opportunity to comment on the proposed action.

The contractor who performs the site characterization work cannot be used to conduct the final cleanup due to potential conflict-of-interest. For non-time-critical actions performed by removal personnel, some site characterization activities may be conducted by the Technical Assistance Team (TAT). For site characterization activities that cannot be performed by the TAT because it is not within the contract scope of work, the Response Engineering and Analytical Contractor (REAC) (formerly the Environmental Emergency Response Unit (EERU)) or other contractor must be used rather than the Emergency Response Cleanup Services (ERCS) contractor. (See Chapter 3 on contracting considerations.) Use of the REAC, where the activities are designated as 104(b) activities, prevents the start of the removal time clock. If the

\(^8\) At some NPL sites, the Regional Administrator may be delegated the $2 million exemption authority. Delegation procedures are described in .

\(^9\) See removal program guidance for the definition of "nationally significant" action, .
REAC is used to assist in EE/CA activities, however, they may not be used to perform the final cleanup due to potential conflict-of-interest.

**EE/CA Report.** Using the information obtained thus far, an EE/CA report should be prepared according to the guidance presented in Section 2 of this document. As removal action alternatives are developed and evaluated, it may also be necessary to collect more site information. Data gathering may continue concurrently with preparation of the EE/CA report. The EE/CA report will recommend a final removal action and will be the document released for public comment.

**Public comment.** The EE/CA report will be made available for public comment for a minimum of 21 calendar days. The Region should consider granting a request for a reasonable extension of this time period if such a request is received within the public comment period, and the request is justified. A public meeting may also be held, if the Region believes it is appropriate based on the nature of the site problem and community interest, or if significant requests are made. The Regional community relations staff will be responsible for making arrangements for public notice and review of the EE/CA and, if necessary, for the public meeting. If a public meeting is held, a transcript of the meeting must be prepared. Regional response personnel should support the community relations staff in this effort.

**Action Memorandum, including responsiveness summary.** After the close of the public comment period, an Action Memorandum must be prepared to describe the final removal action. The Action Memorandum should include a refined estimate of the cost and duration of the removal action. The appropriate approving official should be determined based on this new estimate. "Nationally significant" actions at non-NPL sites, however, must be approved by Headquarters. The Action Memorandum should

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10 The proposed NCP revision, scheduled for publication in the Federal Register in July, 1987, would extend the minimum public comment period to 30 days.

11 Additional procedures for conducting public review of the EE/CA report are included in [link].

12 See the Superfund Removal Procedures for instructions on preparing an Action Memorandum.
also include a section describing how the removal action will contribute to the efficient performance of the remedial action to be taken.\textsuperscript{13}

In addition, the Action Memorandum must include, as an attachment, a responsiveness summary. The responsiveness summary is a summary of the significant public comments and EPA’s response to these comments. Any differences between the final removal action and the action recommended in the EE/CA must be explained. Regional response personnel should work closely with the community relations staff in preparing the responsiveness summary.

After the Action Memorandum is signed, a notice of availability of the Action Memorandum and the responsiveness summary must be published in a major local newspaper before the commencement of the removal cleanup, and these documents must be made available to the public.

Implementation of approved removal action. The approved removal action is then implemented. The statutory limits on removal actions apply only to this portion of the removal action, not to previous 104(b) activities associated with preparation of the EE/CA.

Change in scope of work, if necessary. After the Action Memorandum is signed, if any removal action is to be taken that is significantly different from the action contained in the Action Memorandum, the OSC/RPM shall amend the Action Memorandum, prepare an explanation of the differences, and consider the need for an additional public comment period. The need for an additional public comment period must be considered in the following situations:

- A major new threat is discovered that was not in the Action Memorandum, and the threat is non-time-critical.

- The scope of work as set forth in the Action Memorandum changes significantly due to other reasons, and the new action is non-time-critical.

2.0 EE/CA PROCEDURES

This section presents procedures for conducting site-specific engineering evaluations/cost analyses (EE/CAs). Identified are the elements of the EE/CA that should be researched and evaluated prior to initiating a non-time-critical removal action/ERA. In addition, this section presents the general outline that should be followed when writing the EE/CA report. Adherence to this outline will enhance the usefulness of the EE/CA to response personnel in technology transfer. Because situations presented by potential removal actions cannot be generalized to any great extent, the exact level of detail is left to the discretion of the On-Scene Coordinator (OSC)/Remedial Project Manager (RPM) responsible for the site. However, all elements of the EE/CA discussed in this section should be addressed, both procedurally and in the report. It is the responsibility of the OSC/RPM to perform as detailed an evaluation as is appropriate and to properly document such an evaluation.

Each subsection presents a major element of the EE/CA process and corresponds to sections that should be included in the EE/CA report. Section 2.1 describes the type of information that is needed to effectively characterize a site. Section 2.2 discusses factors that influence the identification of removal action objectives. Section 2.3 describes the process that should be used to identify appropriate removal technologies. The process by which site alternatives (which may be comprised of several technologies) are analyzed is presented in Section 2.4. Section 2.5 describes the comparative analysis of the alternatives. Finally, the selection of an alternative is discussed in Section 2.6. Appendix B provides an example of how a removal action could be selected through the EE/CA process defined in this section.

2.1 SITE CHARACTERIZATION

Selecting and justifying an appropriate response action at a site requires an accurate evaluation of the site conditions. The site characterization can also be used to establish a baseline for use in analyzing the environmental impacts of removal actions. Site characterization is the first step in the EE/CA process and may continue concurrently with the remaining steps in the process, as additional information needs are identified. For example, the evaluation of certain technologies may require more
detailed information about waste characteristics than was originally collected in the site characterization phase. For documentation purposes, the amount of detail included in the site characterization depends on the complexity of the site.

Because the EE/CA report will be prepared after the EE/CA Approval Memorandum is approved, much of the information necessary for the site characterization will be available from the Approval Memorandum itself. In addition, existing site documents, such as site evaluation studies, Site Inspection Reports (EPA Form 2070-13), remedial investigation studies, state and local environmental reports, or published engineering evaluations may contain supplementary information on site characterization. For documentation purposes, existing reports that provide sufficient detail need not be rewritten, but may be referenced and attached to the EE/CA report. The site characterization section of the EE/CA report should also include any relevant information collected during the remaining steps of the EE/CA process.

The format below provides a framework for documenting the site characterization information. The following subsections describe this outline in more detail.

- Site description
- Site background
- Analytical data
- Site conditions that justify a removal action

2.1.1 Site Description

In evaluating current site conditions, any observations made during the site evaluation, preparation of the EE/CA, and review of any previously released reports should be considered. A complete assessment of the physical features of the site, nature and extent of contaminants present, and potential impact of the site should include as many of the following factors as are relevant:

- Site location;
- Type of facility and operational status, if appropriate;
- Current site owners and/or operators;
- Present site use;
• Site use or access restrictions;
• Surrounding land use and population density;
• Distance to and description of nearby sensitive environments and ecosystems;
• Distance to and uses of surface waters and ground water;
• Site topography;
• Geological and geotechnical information;
• Hazardous substance- quantities, concentrations, containment, and extent;
• Potential or actual release of contaminants;
• Potential or actual impacts of the site on adjacent properties and neighboring populations.

In writing the EE/CA report, the relevant factors should be discussed. Photographs and figures should be used whenever possible to indicate the location of important features. Analytical data may be presented with the discussion of contaminants or they may be included in the section on analytical data (Section 2.1.3).

2.1.2 Site Background

A review of the site background can identify hazards that are not apparent during a site inspection, and potential areas for further investigation. Relevant information concerning threats posed by contaminants on the site, the roles of potential responsible parties, and any other information that may impact the removal action should be evaluated. State, local, and other Federal files may provide much of the information for this section in the form of inspections, complaint reports, and response notes. These documents will often contain the following information:

• Prior site use;
• Operational history - past and present owners/operators;
Regulatory involvement, including responses, investigations, and litigation by:

- **local agencies** - fire and police departments, and county health and environmental departments;
- **State agencies** - fire marshal and state environmental and conservation agencies/departments; and
- **Federal agencies** - U.S. EPA Emergency Response and other U.S. EPA offices or divisions, and other Federal departments and agencies (e.g., Department of the Interior, Department of Defense, Department of Transportation, or U.S. Coast Guard).

The documents from the sources listed above may be summarized and referenced in the site background section of the EE/CA report. Reports containing sampling results and other analytical data, however, may be discussed in the site description section or in the section on analytical data. Confidential information from these sources should not be included because the EE/CA report will be subject to public review.

### 2.1.3 Analytical Data

In the EE/CA process, analytical data may be generated from several sources. The OSC/RPM will have existing analytical data when the process starts. Additional data may be collected during the site characterization phase of the EE/CA, and finally, more data may be required during the evaluation of individual technologies. In the EE/CA report, all of this data should be summarized in the "Site Description" or "Analytical Data" section for easy reference. Significant findings from the data should be explained in a narrative discussion, including, where appropriate, consideration of the reliability of the data. The actual data can be presented in summary tables either within the section or in an appendix.

Existing analytical data from sources such as site investigations, site evaluations, or studies conducted by other groups (e.g., state or local health or environmental authorities) may be useful in characterizing the threat. The analytical data should be thoroughly reviewed to determine the precision, accuracy, representativeness, completeness, and comparability of the results in previous sampling efforts. These parameters are documented in sampling efforts and laboratory analyses through routine
quality control procedures, such as replicate samples and/or analyses, replicate spiked samples and/or analyses, field blanks, method blanks, and analysis of standard reference materials. Validation and usability of data can be affected by sample matrix, sampling method, contaminant concentration, sampling conditions, analytical methodology, and analytical instrumentation. Any available soil, water, or waste analyses should be evaluated for possible usefulness. Other data, such as air monitoring results, may also be included to substantiate the threats and characterize the site. All data used to justify a response should be supported by quality control data and an evaluation of data quality based on quality assurance documentation. Once the data are of "known quality", they can be compared to existing environmental standards to determine the nature of the threat.

2.1.4 Site Conditions that Justify a Removal Action

Based on the characteristics of the site presented in the previous sections, the conditions that necessitate a response should be described. Again, the information contained in the EE/CA Approval Memorandum may be used for this purpose. Paragraph (b)(2) of Section 300.65 of the NCP lists the following factors that should be considered when determining the appropriateness of a removal action:

(i) Actual or potential exposure to nearby populations, animals, or food chain from hazardous substances or pollutants or contaminants;
(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystem;
(iii) Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;
(iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;
(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;
(vi) Threat of fire or explosion;
(vii) The availability of other appropriate Federal or State response mechanisms to respond to the release;
(vii) Other situations or factors which may pose threats to public health or welfare or the environment.
The degree to which each of the factors is important differs from site to site. In the EE/CA report, each of the relevant factors should be addressed separately, including an evaluation of the potential impact of the hazard. If appropriate, chemical migration and fate and toxicity may be added to the discussion or presented in a separate subsection.

2.2 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

The identification of removal action objectives is a critical step in the development of an EE/CA and the efficient performance of a removal action. The importance of such objectives has been enhanced as a result of the increased scope and sophistication of removals under the Superfund Amendments and Reauthorization Act (SARA).

In essence, removal objectives define the "why," "what," and "when" of a removal action and serve to focus the limited resources of EPA. Within the scope of an EE/CA study, the objectives delineate the limits of acceptable technical performance and administrative factors. It is conceivable that two EE/CAs performed for the same site, under the same circumstances, but with different removal objectives would differ in scope, level of detail, and possibly the ultimate selection of a mitigative approach. For example, designing a response to stabilize a site would require a different approach than designing a response to completely clean up a site.

The remainder of Section 2.2 presents the following categories of objectives that should be considered when developing site-specific removal objectives: statutory limits on removal actions, removal scope, removal scheduling, and criteria and standards (i.e., applicable or relevant and appropriate requirements, ARARs) to be met.

2.2.1 Statutory Limits on Removal Actions

The cost and duration of removal actions are generally limited, by statute, to $2 million and 12 months. At this point in the EE/CA report, a brief description of these statutory limits should be provided, together with a short explanation of the two types of exemptions that are available -- the "emergency" waiver and the "consistency"
waiver. As alternatives are later identified and evaluated, consideration will be given to whether the alternative can be completed within the statutory limits, or whether the response could qualify for an exemption to the limits.

2.2.2 Determination of Removal Scope

The second step in identifying removal action objectives is to determine the removal scope, i.e., what is to be done or accomplished by the removal action. The broad scope of the project should first be defined. This might be total site cleanup, site stabilization, completion of an operable unit (at an NPL site), cleanup of surface hazardous materials, etc.

The next step is to define more specific objectives which are associated with the specific threats and hazardous substances on site. For example, while cleanup of all surface hazardous substances might be the broad project scope, specific objectives might include final disposition of contaminated soils, transformers, capacitors, drums containing PCB-contaminated oils, and drums containing sodium hydroxide pellets. The development of specific objectives is an integral part of the EE/CA process because these objectives will be used as guidelines to identify appropriate removal technologies, and as standards against which the alternatives will be evaluated. Specific objectives that clearly define the scope of the removal action are particularly important in the following situations:

- When the site poses multiple hazards
- When the removal is to be conducted in phases
- When the removal is to address only a subset of the universe of hazards present

Definition of the scope of the project must also include consideration of how the removal action would best contribute to the efficient performance of the remedial action to be taken. SARA section 104(b) states that removal actions should, to the extent practicable, "contribute to the efficient performance of any long-term remedial

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action with respect to the release or threatened release concerned. In short, the goal of this provision is to avoid the need for removal restarts by considering the long-term cleanup plan for the site when designing the removal action. For example, if the State plans to begin a long-term remedial action at the site in two years, the removal action should be designed to ensure that any threats that meet the criteria for initiating a removal action in the NCP are either completely cleaned up, or sufficiently stabilized on site to last until remedial actions begin. Response personnel must also consider threats that may arise in that time due to deteriorating site conditions. By adequately addressing all such threats in the first removal action, the likelihood of removal restarts should be reduced. If there are no plans for another party to perform long-term remedial actions at the site (which may be the case for many non-NPL sites), the threats that meet the NCP criteria should be completely cleaned up, if possible, given the statutory limits on removal actions. The scope of the project should therefore be designed to avoid removal restarts, in accordance with this provision of SARA.

2.2.3 Determination of Removal Schedule

The OSC/RPM should determine the general scheduling objectives for the actions to be performed. Scheduling objectives should include consideration of both the start and completion time for the removal action. The start date will be based primarily on the urgency of the threat. Although formal EE/CAs are only required for actions that can be delayed for six months, the nature of the threat may still dictate that action be initiated within one year or some other time period. The start date may also be influenced by other factors, such as weather conditions and the availability of Regional resources. For example, weather can affect the removal schedule if the objective is to implement the removal action before the rainy season begins. The amount of lead time available before the removal must start can be a major factor in evaluating alternative technologies, because implementation of innovative technologies can involve considerable lead time.

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15 See removal program "Guidance on Implementation of the "Contribute to Remedial Performance" Provision" (footnote 10).
The completion time should also be estimated for the removal action. Again, the nature of the threat will be the most important consideration. In some cases, it may be necessary to achieve beneficial results within a certain timeframe to ensure adequate protection of public health and the environment. A second important factor to consider is the 12 month statutory limit on removal actions. For sites that are not expected to qualify for one of the exemptions to the limits ("emergency" or "consistency" waiver), the objective should be to select a technology that can be implemented within 12 months. For sites that are expected to qualify for an exemption, the objective should be to select a technology that can be implemented within a reasonable amount of time after the 12 month limit. For example, a technology that requires 5 years to complete would not be consistent with the generally short-term nature of removal actions. As with the start date, factors such as weather and the availability of Regional resources may also affect the completion time.

The amount of flexibility in the removal schedule can vary greatly from site to site. Some sites may require adherence to a strict schedule while others allow wider latitude in start and completion times. The scheduling objectives established for a site can be an important decision criteria to screen and further evaluate removal alternatives based on their individual implementation times.

2.2.4 Compliance With Applicable or Relevant and Appropriate Requirements (ARARs)

It is EPA policy to pursue removal actions that will attain or exceed applicable or relevant and appropriate requirements (ARARs) of other Federal and State environmental and public health laws to the maximum extent practicable, considering the exigencies of the situation. Within the EE/CA framework, the OSC/RPM should develop a comprehensive list of those ARARs, given the unique circumstances at the site being addressed. State ARARs should be identified in consultation with the appropriate State representative. Although it may not be possible to fully attain ARARs, the evaluation of removal technologies should consider the ability to comply with the identified cleanup standards and other requirements.

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16 See the "CERCLA Compliance With Other Laws Manual," OSWER Directive 9234.1-01, for more complete information on removal compliance with ARARs.
There are several different types of requirements that may apply to removal actions:

- **Ambient or chemical-specific requirements** set health or risk-based concentration limits in various environmental media for specific hazardous substances or pollutants. Examples: maximum contaminant levels (MCLs), National Ambient Air Quality Standards.

  These requirements set protective cleanup levels for the chemicals of concern in the designated media, or indicate a safe level of air emission or wastewater discharge when these occur in a removal action alternative. If a chemical has more than one such requirement, the more stringent should be complied with, to the extent practicable.

  There are at present a limited number of actual ambient or chemical-specific requirements. In order to achieve protective cleanups, it may frequently be necessary to consider chemical-specific advisory levels such as health effects assessments or reference doses. While not actually ARARs, these chemical-specific numbers may factor significantly into the evaluation of the protectiveness of removal action alternatives.

- **Performance, design, or other action-specific requirements** set controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. These requirements are not triggered by the specific chemicals present at a site, but rather by the particular removal alternatives that are evaluated as part to the EE/CA. Examples: RCRA incineration standards, Clean Water Act pretreatment standards for discharges to publicly-owned treatment works (POTWs).

- **Locational requirements** set restrictions on activities or limits on contaminant levels depending on the characteristics of a site or its immediate environs. Examples: Federal and state siting laws for hazardous waste facilities, sites on the National Register of Historic Places.
Locational requirements may function like action-specific or ambient requirements. Removal action alternatives may be restricted or precluded depending on the location of the site and the requirements that apply or relate to it. On the other hand, the presence of a certain chemical at a site may automatically trigger a location standard, such as more stringent limits for chemicals in wetlands.

Note also that SARA Section 121(e) exempts any on-site response action from having to obtain a Federal, state, or local permit. In general, on-site actions need only comply with the substantive aspects of these ARARs, not with the procedural or administrative aspects. However, these requirements should still be identified in the EE/CA.

ARARs can be identified only on a site-specific basis. They depend on the specific chemicals at a site, the particular actions being evaluated, and the site characteristics. The different ARARs that may apply to the site are identified at different points in the EE/CA process:

- **Site characterization.** During the site characterization phase, ambient/chemical-specific requirements and locational requirements are identified. In addition, the OSC/RPM should determine whether the site wastes are restricted under the RCRA land disposal restrictions (discussed in greater detail below).

- **Analysis of removal action alternatives.** During the detailed analysis of alternatives, the action-specific requirements are identified.

After the applicable or relevant and appropriate laws are identified, the OSC/RPM must determine whether compliance with each of the laws will be possible for the removal action. In making this determination, the OSC/RPM must consider the following:

1. The exigencies of the situation (emergency nature of the threat may preclude meeting an ARAR in order to protect public health and the environment);
2. The statutory time limits on removal actions; and
The criteria listed under SARA section 121(d)(4) providing conditions under which ARARs may be waived. These conditions are:

- **Interim remedy waiver** - the removal action selected is only part of a total site cleanup that will attain such level or standard of control when completed.

- **Greater risk to health and the environment** - compliance with such a requirement will result in greater risk to human health and the environment than alternative options.

- **Technical impracticability** - compliance with such requirement is technically impractical from an engineering perspective.

- **Equivalent standard of performance** - the removal action selected will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criterion, or limitation, through use of another method or approach.

- **Inconsistent application of State requirements with respect to a State standard, requirement, criterion, or limitation** - the State has not consistently applied (or demonstrated the intention to consistently apply) a standard, requirement, criterion, or limitation, in similar circumstances at other response actions.

To the extent that full compliance with ARARs will: (1) unduly delay initiation of a removal; (2) cause a violation of the statutory funding or time limits; or (3) qualify for exception under SARA, ARARs need not be deemed "practicable" and need not be fully attained in the removal action. However, OSCs/RPMs should strive to comply with all ARARs that can be attained for less than $2 million and in less than 1 year. If all ARARs cannot be attained at a site, OSCs/RPMs should ensure that the removal action will attain those ARARs which are most crucial to the proper stabilization of the site and to the proper protection of public health and the environment until remedial action can afford additional protection. The reason(s) for not attaining all ARARs must be thoroughly documented.

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17 SARA section 121(d)(4) specifically provides these waivers for remedial actions, but they are available to removal actions as well.
This section of the EE/CA report should, at a minimum, identify the ambient/chemical-specific requirements, locational requirements, and land disposal restriction requirements. In addition, this section may discuss whether compliance will be possible, or the compliance discussion may be deferred until the specific alternatives are analyzed.

2.2.4.1 RCRA Land Disposal Restrictions

An important factor that may affect the identification and evaluation of removal action alternatives is whether a waste is subject to the land disposal restrictions (LDR) currently being implemented under RCRA (pursuant to the Hazardous and Solid Waste Amendments of 1984). In general, LDR will be phased in over several years to restrict the land disposal of all RCRA wastes, unless certain treatment standards are met. Although certain CERCLA wastes have been granted exemptions and variances from LDR requirements until November, 1988, OERR policy is to comply with LDR to the degree practicable in the intervening period. For more details on how to determine whether a waste is subject to LDR and how to select an appropriate technology, the OSC/RPM should consult the Removal Program LDR Implementation Guidance. A brief overview of how LDR will affect the evaluation of removal technologies is presented below.

The first step in implementing LDR is to determine if the waste at the site is a restricted waste under LDR. This will require prior knowledge about the source of the waste, or use of certain analytical methods described in the LDR regulations. The determination of whether a site waste is restricted under LDR should be documented in this section of the EE/CA report because this determination will affect the initial search for removal alternatives. The second step in LDR implementation is to determine the appropriate treatment standard for the restricted wastes. The treatment standard should also be identified in this section of the EE/CA. For wastes that are subject to LDR, the regulations will identify a treatment standard which is expressed as either a performance standard or a method of treatment. Both types of standards are based on the best demonstrated available technology (BDAT) for treating a waste. For some wastes, the regulations will only establish a performance standard; any

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18 [Citation to be provided]
technology can then be used to treat the waste to the specified standard. These regulations may also identify suitable treatment technologies that may be used, but are not required.

For other wastes, the regulations may specify that a particular technology be used for treatment, such as incineration. However, these regulations will also include a provision that allows any party to submit an application to EPA demonstrating that an alternative treatment method can achieve a level of performance equivalent to that of the BDAT.

The next step in implementing LDR is to determine the appropriate treatment technology. In the EE/CA process and report, this step is first addressed in the identification of removal action alternatives (see Section 2.3). The alternatives that are identified will be analyzed (see Section 2.4) to determine whether they comply with LDR requirements.

The last step in the LDR process is to determine whether the implemented technology has achieved LDR treatment standards. This step will take place during the performance of the removal action itself.

2.2.4.2 Possible Sources of ARARs

Consideration should include, but not be limited to, the following resources and their associated standards:^^

**Surface water** - Removal action alternative technologies can impact surface waters through direct discharge into the surface water or oceans, indirect discharge to publicly-owned treatment works (POTWs), and discharge of dredge or fill material into waters of the U.S., including wetlands. The Clean Water Act (CWA) establishes five categories of standards to control direct and indirect discharge of pollutants. These regulations include technology-based standards, water quality standards, ocean discharge standards, pretreatment standards, and dredge and fill discharge standards.

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^^ More detailed information on each of the legal requirements discussed in this section can be found in the "CERCLA Compliance With Other Laws Manual" (see footnote 16).
Technology-based standards are effluent guideline limitations for a specific industry or industrial category, based on the best available technology economically achievable (BAT) for toxic pollutants and the best conventional pollutant control technology (BCT) for conventional pollutants (i.e., biochemical oxygen demand, pH, total suspended solids, fecal coliform, and oil and grease). For removal actions where no specific industry exists, technology-based effluent limitations have to be imposed on a case-by-case basis. Therefore, best professional judgment is used to identify applicable BCT/BAT equivalent discharge limitations (regulated by 40 CFR 405-471).

Water quality standards establish goals for specific water bodies and also serve as the basis for water quality-based controls beyond the technology-based levels of treatment required by sections 301(b) and 306 of the CWA. A water quality standard consists of two major parts: the first part is the specification of designated uses and the water body's value to public water supplies, fisheries, wildlife, recreation, navigation, agriculture, and industry. The second part of the standard contains the numerical and/or narrative standards to protect the designated use.

The revised water quality standard regulations (40 CFR 131; 48 FR 51400, November 8, 1983 and subsequent notices) emphasize criteria for toxic pollutants in State standards as the basis for permit limitations under the National Pollutant Discharge Elimination System (NPDES). Most State standards do not include numerical criteria for many toxic chemicals. Instead, States utilize narrative water quality standards to prevent the discharge of "toxic material(s) in toxic amounts." If States promulgate numerical standards for toxic chemicals, the standards are usually based on National Ambient Water Quality Criteria (NAWQC) but may be more stringent than EPA water quality criteria to protect designated uses. Criteria and standards for the NPDES are in 40 CFR 125.

Discharges into oceans are subject to specific environmental impact prohibition and limits, and conditions of materials, established in 40 CFR Subchapter H (220-223).
General pretreatment regulations (40 CFR 403) describe general and specific prohibitions to control the introduction of pollutants into POTWs. The goal of the regulations is to protect POTWs and the environment from damage that may occur when hazardous, toxic, or highly concentrated wastes are discharged into a sewer system. In addition, States and local communities may impose limitations and discharge prohibitions which are considered pretreatment standards.

Direct discharge of dredge and fill into surface waters is specifically regulated in CWA section 404 and implemented under 40 CFR 230 and 33 CFR 320-330. EPA may prohibit the discharge of dredge material if adverse environmental effects are expected, including the violation of applicable water quality standards. Protecting wetlands is one of the primary goals of the CWA Section 404.

Groundwater - Removal actions do not attempt to reduce contamination levels in groundwater because of time and cost constraints. A groundwater classification system has been developed by the EPA Office of Groundwater Protection. Groundwater is placed in one of three classification categories (I, II, or III) based on ecological use, replaceability, and vulnerability. The classification system and accompanying "Guidelines for Groundwater Classification" provide a systematic procedure for obtaining site-specific information on groundwater and integrating this information into the determination of groundwater importance. This system, and any promulgated State groundwater classification systems, should be considered in the impact analysis.

Drinking Water - The drinking water standards established under the Safe Drinking Water Act of 1974 (SDWA) require that certain levels for microbial, inorganic, organic, and radionuclide contaminants be met. EPA has promulgated contaminant-specific ambient standards known as maximum contaminant levels (MCLs) for ten inorganics, six organic pesticides, total trihalomethanes, certain radionuclides, and coliform bacteria (40 CFR 141). MCLs are enforceable standards based upon consideration of adverse health effects of a contaminant, available treatment

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technologies, and costs of treatment. Maximum contaminant level goals (MCLGs), in contrast, are strictly health-based and are considered non-enforceable health goals. MCLGs have been developed for eight organic contaminants and for fluoride. The Safe Drinking Water Act Amendments of 1986 require EPA to promulgate MCLs for 83 specific contaminants by June 1989. A list of currently proposed MCLs and MCLGs can be found in 50 FR 46902 and 46936, November 13, 1985.

Under the Safe Drinking Water Act Amendments of 1986, States are mandated to develop within three years, programs to protect wells that supply public drinking water systems from contaminants that flow into the wells from the surface or subsurface. State wellhead protection programs may contain requirements for protecting a municipal water source or replacing it if contaminated. The Office of Groundwater Protection or appropriate State officers should be contacted for applicable standards.

In addition, RCRA maximum concentration limits for 14 toxic compounds have been adapted as part of RCRA groundwater protection standards (40 CFR 264.94).

Soils - Two general types of threats should be considered when developing criteria for soils: (1) direct contact by intruders onto the site, and (2) contamination of other environmental media by soils. Unfortunately, there are no currently promulgated Federal environmental criteria or standards for contaminants in soil, except PCBs. (PCBs are regulated under the Toxic Substance Control Act at 40 CFR 761. The TSCA-issued, "Polychlorinated Biphenyls Spill Cleanup Policy", 52 FR 10688-10710, April 2, 1987, defines cleanup standards for certain PCB spills into various media.) In the past, however, the Agency for Toxic Substances and Disease Registry (ATSDR) has set action levels for certain chemicals.

Air - Removal activities can impact the air through chemical pollution and noise pollution. Chemical pollution can result from incineration, the release of gases from chemical reactions, or the volatilization of chemicals during soil excavation or movement. Emission standards and exemptions promulgated under the Clean Air Act, as well as State air quality implementation plans, may be found in 40 CFR 61-69. Noise pollution can be contributed by transportation, construction, and equipment operation. Subchapter G, 40 CFR - Noise Abatement Programs and 24 CFR 51 - the
Use of Day/Night Average Noise Levels, should be incorporated when applicable. It is not expected that noise pollution will be a frequent problem at removal sites.

In addition to the protection of these general environmental resources, the OSC/RPM should also consider ARARs protecting other specific environmental and cultural resources as follows:

- **Sole Source Aquifers** - The SDWA permits EPA to designate aquifers that are the sole and primary drinking water source for an area, and which, if contaminated, would present a significant hazard to human health, as "sole source aquifers" (40 CFR 149). Plans demonstrating that the quality of groundwater and the protection of human health and the environment will be maintained must be submitted for Federally-financed projects affecting critical aquifer protection areas.

- **Archaeological and Historic Resources** - The National Historic Preservation Act of 1966 and the Preservation of Historical Archaeological Data Act of 1974 require that proposed actions account for effects on properties listed in, or eligible for, listing on the National Register of Historic Places, and that such actions minimize harm to significant historical and cultural resources. The Historic Preservation Advisory Council should be consulted to identify and determine the potential effects of proposed activities. Uniform regulations for the protection of archaeological resources have been promulgated by the Department of Defense (32 CFR 229), Forest Service (36 CFR 296), and the Department of the Interior (43 CFR 7). The Soil Conservation Service also provides for the protection of historical and archaeological properties encountered in implementing its programs (7 CFR 656).

- **Wild and Scenic Rivers** - The Wild and Scenic Rivers Act (36 CFR Part 297, section 7) provides for the protection of rivers designated as "wild and scenic, or recreational," and the land adjacent to such rivers. The construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project directly affecting any "wild and scenic" river is expressly forbidden by this Act. If a removal action will affect lands adjacent to a "wild and scenic" river, the
agency head must enter into cooperative agreements with the U.S. Forest Service, and State or local officials for the management of the lands.

- **Wetlands** - Executive Order 11990 requests that government agencies establish policies and regulations to protect wetlands. Wetlands are unique ecosystems that are covered with non-flood waters during part of the year (refer to U.S. Fish and Wildlife Circular 39 (1956), and later revisions resulting from the National Wetlands Inventory for defined wetland areas). Such areas generally include swamps, bogs, marshes, and other low-lying areas. The wetlands serve as a habitat for many species of wildlife, aid in natural purification of water, and maintain and recharge groundwater sources. Applicable regulations have been promulgated by the Department of Agriculture (7 CFR 1940), the Federal Emergency Management Agency (44 CFR 9), the U.S. Army Corps of Engineers (33 CFR 320-330), and EPA (40 CFR 230-233).

- **Floodplains** - Executive Order 11988 establishes a policy for floodplain management. Identification and mapping of flood plains and special flood-related erosion are covered at 44 CFR 65. One-hundred year floodplains are designated on Flood Hazard Boundary maps and Flood Insurance Rate maps prepared by the Department of Housing and Urban Development. Land management and use criteria are discussed at 44 CFR 60. Because of the interrelationship between wetlands and floodplains, the references listed above also apply.

- **Coastal Zones** - The Coastal Zone Management Act of 1972, as amended at 216 USC 14.51, et seq., requires that any activities affecting land or water uses in the coastal zone of a State or territory be coordinated with the appropriate State agency responsible for administering the State's approved coastal management program.

- **Critical Habitats of Threatened and Endangered Species** - The Endangered Species Act of 1973 requires that proposed Federal actions avoid jeopardizing the continued existence of listed endangered species, or modification of their habitats. The Secretary of the Interior has determined that certain habitats are critical to the continuing existence of threatened or endangered species, and has
developed a list of designated habitats for wildlife, plants, marine mammals, and fish to be protected (50 CFR 17 and 50 CFR 226-227). The U.S. Fish and Wildlife Service should be consulted for more detailed information concerning endangered or threatened plant and animal species and their habitats. The Fish and Wildlife Coordination Act (16 USC 661 et seq.) also protects fish and wildlife from actions that may modify natural streams or any body of water. If a removal action impounds, diverts, or deepens the channel of any stream or body of water, EPA must first consult with the Army Corps of Engineers, U.S. Fish and Wildlife Service, and/or the appropriate State fish and wildlife agency to ascertain the impact on wildlife and develop mitigation measures if necessary.

- **Prime and Unique Farmlands** - Farmlands producing specific high-value food and fiber crops are defined at 7 CFR 657 and inventoried by the Department of Agriculture Soil and Conservation Service (SCS). The Farmland Protection Policy Act (7 CFR 658) outlines procedures to identify and take into account adverse effects of programs on preservation of prime and unique farmlands.

- **Federal Parklands and Wilderness Areas** - These are areas of recognized scenic, recreational, archaeological, or historical value. The Park Service Organic Act establishes the conservation of scenery, natural and historic objects, and wildlife in national parks, monuments, and reservations as a primary management objective. The Wilderness Act establishes the nondegradation, maximum restoration, and protection of wilderness areas as primary management goals. The Department of the Interior should be consulted if any impact relevant to these acts is possible as a result of proposed actions.

- **National Forests and National Grasslands** - The U.S. Forest Service is required by the Forest and Rangeland Renewable Resources Planning Act of 1974 and the National Forest Management Act of 1976 to prepare Federal and regional management plans. The effects of a proposed technology on these plans should be evaluated.

Appendix D lists, by Region, the telephone number of the EPA section or branch responsible for preparing EPA-lead Environmental Impact Statements (EISs). The section staff can provide the OSC/RPM guidance on the environmental resources that
need to be considered, and the appropriate agency to contact if a removal alternative will affect these resources. The Army Corps of Engineers has also developed procedures for preparing EISs (33 CFR 230) which may be helpful.

Improvements in resources used by people should also be considered as many of these resources directly affect the welfare of local communities. The OSC/RPM should note the ability of alternatives to protect actual and potential human uses of resources, especially commercial, residential, aesthetic, and cultural uses.

2.3 IDENTIFICATION OF REMOVAL ACTION ALTERNATIVES

Based on the objectives developed in the previous section, technologies that are appropriate should be identified. The determination of whether a technology should be identified and further analyzed is left to the OSC/RPM's discretion. In addition, if the OSC/RPM knows that the public will raise concern about the appropriateness of particular technology that has not already been identified, then that technology should be identified in this section. If different waste streams requiring different technologies are present at the site, it may be necessary to develop several sets of alternatives comprised of the various technologies.

The process of identifying technologies should draw upon previous experience with the technologies and the contaminants to be mitigated as well as knowledge of potential uses of the technologies. Information on potential removal technologies may be obtained from EPA sources such as the Superfund Technology Transfer Program, the Superfund Innovative Technology Evaluation Program, the Removal Alternative Technology List, the Superfund Regional Technology Transfer Contact, best demonstrated available technologies (BDATs) to treat wastes banned from land disposal identified by the EPA Office of Solid Waste, or from industry publications. Examples of removal technologies associated with different waste matrices are shown in Table 2-1 and Table 2-2. Emerging technologies may be identified but removal cleanup

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funds may not be used to fund them. In addition to removal technologies, institutional controls, such as curtailing certain types of land use at a site by a deed restriction, may also be considered when identifying removal action alternatives.

In accordance with the "Administrative Guidance for Removal Program Use of Alternatives to Land Disposal," the OSC/RPM should identify appropriate technologies based on the following three waste categories: (1) recyclable/recoverable materials; (2) wastes restricted from land disposal; and (3) all CERCLA wastes not otherwise restricted, and all RCRA wastes not included in Categories 1 and 2. Category 1 wastes will generally be required to be recycled/recovered. Category 2 wastes will require pretreatment prior to land disposal, an alternative to land disposal, or disposal at a specific type of facility (e.g., TSCA-permitted). Direct land disposal may be among the options considered for Category 3 wastes.

Category 2 wastes may include wastes that are restricted from land disposal under LDR. The LDR requirements should be met to the degree practicable. If the regulation for the restricted waste only specifies that a performance standard must be met prior to land disposal, the OSC/RPM may identify any technologies that seem appropriate for meeting the standard. The OSC/RPM should consider whether any technologies that may be recommended in the regulation are suitable for the wastes on site.

If the regulation for the restricted waste specifies that a particular technology, such as incineration, must be used to treat the waste, the EE/CA must, at a minimum, identify this technology. It is possible, however, that the BDAT may not be considered further in the detailed analysis. For example, many CERCLA wastes are mixtures and it may not be technically feasible to apply certain BDATs to these wastes.

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22. Emerging technologies may be candidates for the Superfund innovative Technology Evaluation (SITE) program.

23. Institutional controls are non-engineering solutions used at hazardous waste sites to prevent public access to contaminated ground water, surface water, or soils. Institutional controls include deed restrictions, easements, purchases of land and/or water systems, and reliance on State and local laws (e.g., zoning laws and laws regulating drilling and operation of drinking water wells).

## Table 2-1

**Alternatives to Land Disposal**

*As Applied to Waste Matrices at Removal Actions*

### Drummmed Liquids
- Chemical reaction and neutralization
- Detonation
- Fixation and neutralization
- Incineration
- Neutralization
- Recycling
- Solidification

### Drummmed Solids
- Detonation
- Recycling
- Treatment

### Gas Migration
- Carbon filtration on borehole
- Detonation
- Detonation of gas cylinders
- Ventilation system
  - ventilation and flaring of methane
  - including air conditioning
  - radon reduction system including air conditioning

### Ground Water
- Airstripping
- Carbon filtration
- Ion exchange filtration/distillation
- Treatment
- Treatment-recirculation

### Solids
- Chemical degradation with acids
- Incineration
  - off site
  - on-site infrared/thermal destruction
  - on-site rotary kiln
- Treatment
  - low-temperature thermal desorption
  - KPEG
**DRAFT***
DO NOT CITE OR QUOTE

**TABLE 2-1 (Continued)**

SURFACE WATER

<table>
<thead>
<tr>
<th>Carbon filtration</th>
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<tbody>
<tr>
<td>Commercial wastewater treatment</td>
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<tr>
<td>Oil/water separation</td>
</tr>
<tr>
<td>Sorbent booms</td>
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<tr>
<td>Treatment</td>
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</tbody>
</table>

These technologies have been applied to the waste matrices listed at removal actions since the beginning of the Superfund Program. This information is based on data in the ERD Removal Tracking System.
<table>
<thead>
<tr>
<th>GAS MIGRATION</th>
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<tr>
<td>Chemical treatment</td>
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<tr>
<td>Recycling/recovery</td>
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<tr>
<td>GROUNDWATER</td>
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<tr>
<td>Carbon-steel electrodes</td>
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<tr>
<td>Granular activated carbon adsorption</td>
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<tr>
<td>In-situ biodegradation</td>
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<tr>
<td>In-situ bioreclamation</td>
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<tr>
<td>In-situ treatment (vacuum extraction process)</td>
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<tr>
<td>Recycling/recovery (distillation and reclamation)</td>
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<tr>
<td>LEACHATE</td>
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<tr>
<td>Aerobic biological treatment</td>
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<td>Centrifugation</td>
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<td>Dechlorination</td>
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<tr>
<td>Distillation</td>
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<tr>
<td>Fixed film fluid bed reaction</td>
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<tr>
<td>Fluidized bed combustion</td>
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<tr>
<td>Fluidized bed combustion (circulating bed combustion)</td>
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<tr>
<td>Granular activated carbon adsorption</td>
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<tr>
<td>In-situ biodegradation</td>
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<tr>
<td>Ion exchange</td>
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<td>Microscreening</td>
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<td>Neutralization</td>
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<td>Oxidation/reduction</td>
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<tr>
<td>Precipitation</td>
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<td>Pyrolytic reaction</td>
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<tr>
<td>Recycling/recovery (distillation &amp; reclamation)</td>
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<tr>
<td>Rotary kiln incineration</td>
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<td>SOLIDS</td>
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<tr>
<td>Centrifugation</td>
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<tr>
<td>Chemical treatment</td>
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<tr>
<td>Dechlorination</td>
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<tr>
<td>Dewatering</td>
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<td>Encapsulation</td>
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<tr>
<td>Extraction/soil flush-wash</td>
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<td>Filtration</td>
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<tr>
<td>Fluidized bed combustion</td>
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<tr>
<td>Mobile infrared incineration</td>
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<tr>
<td>Neutralization</td>
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<td>Oxidation</td>
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<td>Oxidation/reduction</td>
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<td>Powdered activated carbon</td>
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<td>Precipitation</td>
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<td>Pyrolytic reaction</td>
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<td>Recycling/recovery</td>
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<td>Rotary kiln incineration</td>
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<td>Solidification</td>
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<td>Stabilization</td>
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<th>SOILS</th>
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<td>Centrifugation</td>
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<td>Chemical treatment</td>
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<td>Dechlorination</td>
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<td>Dewatering</td>
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<td>Extraction/flush-wash</td>
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<td>Fluidized bed combustion</td>
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<tr>
<td>In-situ biodegradation</td>
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<td>In-situ bioreclamation</td>
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<td>In-situ treatment</td>
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<td>- vacuum extraction process</td>
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<td>- soil vitrification</td>
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<td>Mobile infrared incineration</td>
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<td>Neutralization</td>
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<td>Oxidation</td>
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<td>Precipitation</td>
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<td>Pyrolytic reaction</td>
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<td>Rotary kiln incineration</td>
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<td>Soil washing</td>
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<tr>
<td>Solidification</td>
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<tr>
<td>Stabilization</td>
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<td>Volatilization (mobile solids roaster/dryer)</td>
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<td>SURFACE WATER</td>
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<tr>
<td>Oxidation/reduction</td>
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This is by no means an exhaustive list. Technologies not listed can also be considered.
If the OSC/RPM believes that the specified BDAT may not work on the site wastes, or that other technologies may achieve the same level of performance and be more appropriate for the wastes on site, additional treatment technologies may be identified in the EE/CA.

For the EE/CA report, all applicable technologies should be included. While the consideration of a particular technology may be minimal, it and all other appropriate technologies should be listed in order to show that they were considered. In some cases, it may be helpful to consider only a category of technology, such as incineration, rather than listing all the specific types of incineration that may be applicable as separate technologies (e.g., rotary kiln, fluidized bed). If on-site incineration is considered inappropriate because the site is in a residential neighborhood, it may then be possible to screen out all types of incineration at one time as one technology category (under administrative considerations), rather than screening each type separately.

2.4 ANALYSIS OF REMOVAL ACTION ALTERNATIVES

After the removal action alternatives have been identified those that do not have obvious flaws should undergo a detailed analysis in order to select the alternative to be implemented. The analysis should be based on the following criteria:

- Effectiveness
- Implementability
- Cost

The effectiveness of an alternative is determined by its ability to solve the hazardous waste problem in a safe and lasting manner. Implementability is the ability of the alternative to meet the administrative and technological requirements. Cost is simply the cost of the alternative. Each of these criteria have long and short-term considerations that should be addressed. Short-term refers to the period from the initiation of the removal alternative to the completion of the removal action. Long-term refers to the period from the completion of the removal action until the hazardous substances are removed from the site or destroyed. For purposes of
documenting the analysis, the EE/CA report should include sections covering all three of the criteria for each alternative. The analysis methods may entail an in-depth discussion, a grading approach, or a determination of the advantages and disadvantages of the alternatives. Supplementary use of tables, diagrams, and other analytical and presentation methods is encouraged. The following sections provide a more detailed explanation of the criteria to be used in the analysis of the alternatives.

2.4.1 Effectiveness

When determining the effectiveness of an alternative, its ability to achieve the goals of the removal action should be established. To be considered are the abilities to mitigate the threat, protect public health and the environment, comply with chemical-specific ARARs and remain effective over time. Parts of this analysis may be used to satisfy the requirements for an environmental impact statement.

2.4.1.1 Short-term Considerations

Reducing the Threat

One of the goals of any removal action is to mitigate the threats posed by hazardous substances to the public health and the environment. This may be accomplished through containment, diversion, removal, destruction, treatment or disposal. The degree to which the alternative reduces the threat should be determined. This determination should be based on changes in environmental conditions, public resources and releases of hazardous substances.

Effects on Public Health and the Environment

Adverse effects of the action might include contamination of air resulting from on-site incineration, runoff into surface water from excavation of contaminated soil, contamination of drinking water, or destruction of wetland areas by constructing an access road to the site. The OSC/RPM should especially

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25 See "Environmental Review Requirements for Removal Actions" (see footnote 4).
consider sensitive environmental areas and public resources (e.g., commercial and recreational uses), and distinguish inevitable effects from merely possible effects so that the evaluation of alternatives can provide an estimate of the probability of adverse effects. Equally important is recognizing that some effects are irreversible. It is important to note which significant adverse effects are reversible or irreversible. The effects that the action has on workers at the site should also be taken into account.

**Compliance with Chemical-specific ARARs**

The chemical-specific ARARs for an alternative should have been determined during the consideration of removal action objectives. Any additional chemical specific ARARs that are associated with a particular alternative should be identified at this stage of the analysis. The ability of an alternative to comply with all of these ARARs should be addressed in this section. The analysis should be based on design specifications or performance evaluations. For example, the ability of an alternative to achieve treatment standards should be a major factor in the analysis for LDR-subject wastes. For those ARARs that cannot be met, it should be established how close an alternative will come to compliance.

**2.4.1.2 Long-term Considerations**

**Useful Life**

The alternative should be evaluated in terms of the projected service life; some may deteriorate with time (e.g., erosion of clay cap). While deterioration may be slowed or reduced through proper operation and maintenance, any system or structure may eventually require replacement.

**Reduction of future threats**

The ability of the alternative to reduce any threat to public health or the environment from residual wastes should be evaluated. Alternatives that provide only a temporary fix or result in the creation of new threats will not be
appropriate unless there are plans for longer-term mitigation (i.e., future remedial actions).

2.4.2 Implementability

With the initiation of an alternative there are many administrative and technological factors to be considered. These factors range from availability of equipment to public acceptance of the techniques. The implementability of an alternative depends on the effects these factors will have on initiating an action and seeing it through to completion.

2.4.2.1 Short-term Considerations

Technical Feasibility

A. Operation and Maintenance Requirements

The evaluation of operation and maintenance (O+M) should emphasize the availability of labor, materials, and equipment. In addition, frequency and complexity of necessary O+M required by the alternative over the life of the project should be considered. Alternatives that require frequent or complex O+M will usually be less reliable than those that require less O+M.

B. Environmental Conditions

Environmental conditions, such as terrain and climate, should be considered when evaluating a technology. Climate may affect the performance of a proven technology. For example, a generally reliable oil/water separator would be inoperable in freezing temperatures without the use of special additional equipment, such as heaters. Terrain may also affect performance. For example, a technology that discharges particulates into the ambient air may require the presence of prevailing air currents to disperse the emissions. A site located in a mountain valley may pose a problem for the technology because the surrounding air currents provide insufficient dispersion of the particulates.
C. Constructability

Site-specific characteristics that could delay or prohibit construction and implementation of a proposed alternative must be assessed. For example, the inaccessibility of a site or the presence of a large number of trees in the contaminated area may significantly delay implementation of an alternative. Certain alternatives that require zoning clearances and local permits could delay or prohibit implementation. (Such requirements may be discussed here or as part of the analysis of administrative considerations.) Implementation times should be estimated and provide for weather conditions, unanticipated site conditions, and necessary safety precautions. Alternatives should be evaluated in terms of the most likely construction schedule, based on experience at similar sites.

D. Demonstrated Performance

The analysis of alternatives should not be based on the presumed performance of untested methods. Consideration should be given to innovative processes that have been proven dependable in the field. It is important to identify when an alternative has been tested in pilot studies, but has not performed well in the field.

E. Timeliness

An analysis of alternatives based on ability to mitigate the threat in a timely manner should consider both technology-specific and site-specific factors. Technology-specific timing factors are the characteristics associated with a particular alternative that are not affected by local site conditions. Examples of technology-specific factors include timeliness of the approval process for that alternative, contracting considerations, mobilization times, demonstration test requirements, and time until capacity is available. Use of innovative technologies, for example, may require significant lead time for Headquarters approval and site-specific contracting. Site-specific timing factors are those factors that are dependent on the specific nature of the site and its wastes. Site-specific factors include the amount and type of wastes, as well as the
physical location of the site. For example, if a site is in a remote area, a
technology that requires heavy equipment may need extra lead time to build an
access road to the site. The expected lead times associated with each alternative
should be compared to the scheduling objectives.

F. Compliance with Action-specific ARARs

Action-specific ARARs for an alternative can be identified in this section of the
analysis. The state ARARs should be developed in consultation with the
appropriate state representative. This section of the EE/CA should list the
action-specific ARARs for each alternative and the ability to comply with the
ARARS should be discussed. The EE/CA should thoroughly document the reasons
for not achieving compliance with any identified ARARs.

Administrative Considerations

The ability to implement an alternative may be limited by more than just
technology. Some actions may require special permits or may be considered
unacceptable by the public or local officials. Since these factors can delay the
initiation of an action, they need to be considered and addressed in this section
of the report. The discussion may include:

- public acceptance of the alternative;
- state and local concerns about the technology;
- necessary cooperation of other agencies;
- permitting requirements (permits are not required for activities that
  occur solely on the site);
- possible transportation of hazardous materials;
- impact on adjoining property use or value;
- for off-site options, necessary compliance with the Off-site Disposal
  Policy;
- compliance with location-specific ARARs identified in section 2.2.

One factor that must be discussed is the ability of an alternative to meet the statutory
limits on the removal action.
2.4.2.2 Long-term Considerations

Those aspects of an alternative that affect its long-term implementability are the operation and maintenance requirements after closure, and the ability to monitor results and detect failures.

Operation and Maintenance

The availability of equipment and personnel for the operation and maintenance requirements of an alternative should be addressed in this section.

Monitoring Results

The existence of monitoring techniques and procedures should be discussed along with the likelihood of detecting a failure of the removal solution using these techniques and procedures.

2.4.3 Cost

Detailed cost analyses should be performed for each of the alternatives being considered. To analyze project costs, the OSC/RPM should perform the following two steps and may perform an optional third step:

1. Estimate the capital and operation and maintenance costs.
2. Using the capital and O+M estimates, calculate the present worth.
3. Evaluate the sensitivity of each of the present worth calculations to changes in such parameters as the discount rate or the component costs, if appropriate.

2.4.3.1 Cost Estimation

The OSC/RPM should identify all capital and operation and maintenance costs for each alternative. The Removal Cost Management Manual provides guidance on developing cost projections. The following items are considered capital costs and operation and maintenance costs:
• Direct Capital Costs
  - Construction costs
  - Equipment and material costs
  - Land and site acquisition costs
  - Buildings and services costs
  - Relocation expenses
  - Transport and disposal costs
  - Analytical costs

• Indirect Capital Costs
  - Engineering and design expenses
  - Legal fees and license or permit costs
  - Startup and shakedown costs
  - Contingency allowances

• Operation and Maintenance Costs
  - Operational costs
  - Maintenance costs
  - Monitoring costs
  - Support costs

Many sources of cost information exist, including the ERCS contract price list, the "Remedial Action Costing Procedures Manual," September 1985 (OSWER Directive #9355.0-10), vendor estimates, and estimates for similar projects. For items not on the ERCS contract price list and for projects where outside bids are being considered, costs over a year old should be updated using an appropriate economic index, such as the Engineering News Record Construction Cost Index for construction costs, the Marshall and Stevens Index for treatment facility costs, the American City and County Municipal Cost index for manpower costs, and the Producer Price Index for Finished Goods, published by the U.S. Department of Labor in the Monthly Labor Review.
2.4.3.2 Present Worth Calculation

After the costs have been identified and estimated, the present worth must be calculated. Present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs, usually operation and maintenance costs, to a common base year, usually the present. Present worth analysis produces a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the alternative. For projects that will last less than one year (generally, projects that do not require operation and maintenance), the present worth is simply the one time cost of performing the action. In this case, the cash flow discounting method used to determine the present worth is not necessary. The present worth analysis is particularly important when comparing technologies with different operating lifetimes. For example, present worth analysis allows comparison of a project that takes less than one year to complete (the present worth would be the one time cost with no discounting required) with a project that takes three years to complete (with all future costs discounted to the present). Appendix C provides a detailed explanation of how to perform a present worth analysis. For the purposes of the EE/CA report, the final present worth figure and the assumptions used in calculating that figure should be included in the text. The detailed computations should be attached as an appendix to the report.

In conducting the present worth analysis for projects longer than 1 year, assumptions must be made regarding the discount rate. As outlined in OMB Circular No. A-94, a discount rate of 10 percent before taxes and after inflation should be assumed. This rate represents the average rate of return on private investment.

For alternatives that include operation and maintenance after one year, two present worth analyses must be performed. The first analysis should calculate the total cost of the option over the full life of the project (see Appendix C). The second analysis should calculate the total cost of the option to the removal program for one year, assuming that all operation and maintenance costs will be assumed by another party after one year. For purposes of comparing alternatives, the cost of the option to the removal program for one year should be used for those projects that require long-term operation and maintenance.
2.4.3.3 Sensitivity Analysis

After the present worth of an alternative is calculated, the OSC/RPM may choose to determine the effects of variations in the cost assumptions through a sensitivity analysis. A sensitivity analysis assesses the effect that variations in specific assumptions associated with the design, implementation, operation, discount rate, and effective life of an alternative can have on the present worth. It is recognized that many components of a removal action, such as the cost of transport, the effective life of an alternative, or future operation and maintenance costs, as well as external factors such as the discount rate, are subject to a great degree of uncertainty. The sensitivity of these costs to uncertainties can be observed by varying the cost assumptions and noting their effect on the present worth. Performing a sensitivity analysis might be appropriate in situations where the OSC/RPM is unsure of the amount of wastes present, the time it will take the wastes to be destroyed, or fluctuations in the future price of cleanup services. An example of how changes in the discount rate could affect the decision as to which alternative would be more or less costly is presented in Example 3 of Appendix C.

2.5 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

After each alternative is summarized individually, a comparative analysis of the advantages and disadvantages of each alternative, weighed against those of the other alternatives, should be performed. The analysis should emphasize the differences between the alternatives. The comparative analysis provides a basis for the selection process. This analysis is particularly important when two or more alternatives have similar characteristics, when one of the selection criteria is given greater weight in the analysis, or when an alternative has significant disadvantages, but these are outweighed by its greater benefits. For the convenience of review, it is suggested that tables be used to supplement the comparative analysis in the EE/CA report.

2.6 RECOMMENDED REMOVAL ACTION ALTERNATIVE SELECTION

The decision as to what alternative should ultimately be recommended lies with the OSC/RPM. This decision requires a combined consideration of all the selection criteria.
concerning the alternatives and the site itself, experience gained from previous similar situations, and best professional judgment. For each site the criteria will have different degrees of importance and one criteria may be compromised in order to conform to another. In particularly complex situations or where the OSC/RPM has no experience with a specific technology, the Regional Response Team (RRT) may be consulted. The paragraphs below contain some of the key aspects of each criteria that will influence the selection of an alternative.

2.6.1 Effectiveness

Preference should be given to those alternatives that completely destroy, immobilize, or recycle the hazardous substance. The alternative should reduce the threat and not have adverse effects on public health or the environment. Those alternatives that satisfy the most chemical-specific requirements will be preferred. If no other actions will be taken at the site, the alternative should be long-lasting and provide long-term protection.

2.6.2 Implementability

Technical Feasibility

Those alternatives that involve complex technology may not be as reliable and require more "down" time than less complicated ones. The equipment, personnel and material should be readily available; alternatives that require special materials or operators may be shut down for long periods while awaiting parts or labor. The location of the site should be compatible with the operating parameters of the equipment or process (e.g., a process that is cold-sensitive may not be appropriate for a site in central Maine). Size and accessability of the site should be kept in mind, some alternatives may require too much space or have special construction requirements. Lab results should not be used to determine if an alternative will meet the performance criteria; operational test or field data should be available to make this decision. An alternative should not involve slow processes or lengthy construction periods that delay progress for an excessive period of time.
Note that the Region has the authority to select an available alternative technology with costs within the $2 million statutory limit. The use of innovative alternative technologies always requires Headquarters approval, regardless of the cost of the removal action.

**Administrative Considerations**

Alternatives that satisfy the greatest number of location and action-specific ARARs are preferred. The public acceptability of the alternative should always be kept in mind. Preference will be given to those alternatives that will fall within the statutory limitations of the removal actions.

2.6.3 Cost

The cost criterion will be used to weigh the relative costs of alternative technologies that meet the objectives and selection criteria discussed above, and will help fulfill contracting requirements. The cost of removal actions is limited to $2 million by SARA, unless a statutory exemption is granted. Among similar alternatives, generally, those with the lowest present worth are preferred. However, alternatives to land disposal that cost more than land disposal may be selected, if justified.

Incremental differences in cost among the protective alternatives should be balanced against the benefits of meeting the objectives and other criteria. A more timely, more protective, or more technically or administratively feasible option may have a higher present worth than another alternative. To select a more costly removal alternative, the cost must be considered reasonable in the best professional judgment of the OSC/RPM, and with respect to contracting requirements.
3.0 CONTRACTING CONSIDERATIONS

Response personnel may use contractors to assist in performing the EE/CA and preparing the report. The following contracting options are available:

- **Technical Assistance Team (TAT)** -- see chapter ___ of the Superfund Removal Procedures and the TAT Users Manual for more information.

- **TAT Special Projects** -- see chapter ___ of the Superfund Removal Procedures and the TAT Users Manual for more information.

- **Response Engineering and Analytical Contractor (REAC)** - contact the Environmental Response Team (ERT) for more information. Note, however, that the Region will have to fund the use of REAC.

- **Site-specific contract** -- may be used if sufficient time is available. Response personnel should contact the Contracts Management Section of the Emergency Response Division, and the Procurement and Contracts Management Division in EPA Headquarters for more information.

- **REM contractors** -- may be used if the site is on the National Priorities List. If the removal action is a removal-lead project, the On-Scene Coordinator should contact the Remedial Project Manager for the site to arrange for the use of the REM contractors. Consult the "Superfund Remedial Design and Remedial Action Guidance" for more information.

Response personnel may **not**, however, use the Emergency Response Cleanup Services (ERCS) contractors, mini-ERCS contractors, or any other cleanup contractor to perform the EE/CA due to potential conflict of interest. Response personnel must also ensure that conflict of interest situations do not occur if any of the contractors listed above are used. Any contractor assisting in preparation of the EE/CA may not be used to perform the final cleanup.

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26 Formerly known as the Environmental Emergency Response Unit (EERU).
4.0 COST MANAGEMENT

Costs directly associated with developing the Approval Memorandum, performing the EE/CA, and preparing the report are CERCLA Section 104(b) expenditures. As 104(b) expenditures, EE/CA costs are not charged against the project ceiling, but are recoverable. It will therefore be necessary to track EE/CA costs and cleanup costs separately. Cost segregation should not present a problem if a contractor such as REAC is employed specifically to conduct the EE/CA. If TAT is used, however, separate Technical Direction Documents (TDDs) should be prepared for the EE/CA preparation and cleanup portions of the removal action. Costs that are attributable to the EE/CA (and are therefore Section 104(b) costs) include sampling and analytical costs (including National Contract Lab Program costs) incurred in support of selecting an option or in preparing the report itself and manpower used to gather information on response options. Sampling and analytical costs incurred during implementation of the selected removal action are not 104(b) costs.
5.0 EE/CA FUNDING

Funding for the EE/CA may come from either the Headquarters or Regional budget. In developing the SCAP, Regions should estimate total costs for projected non-time-critical projects, including both EE/CA and cleanup costs. EE/CA costs may then be funded out of Regional allowances. If necessary, however, Headquarters may also provide funds for EE/CA preparation.
6.0 ENFORCEMENT
APPENDIX A

EE/CA APPROVAL MEMORANDUM OUTLINE

This memorandum format is to be used for documentation of threat pursuant to Section 300.65 of the NCP and is a record of decision for both HQ and RA approved engineering evaluation/costs analyses (EE/CAs).

I.=headings

SUBJECT: EE/CA Request for the ABC Site, XYZ State

EE/CA APPROVAL MEMORANDUM

Site/Spill-ID: 

Category of Removal: (State that the removal is 1) a non-time-critical action and/or 2) of national significance)

FROM: On-Scene Coordinator/Remedial Project Manager

TO: Regional Administrator (or AA, OSWER, if appropriate)

THRU: Regional Division Director, as appropriate

II. BACKGROUND

The background section should contain information on the location of the site, the incident characteristics (including the history of the site, general character of the site, and issues relevant to waste management), summary of quantity and types of substances present, State and local authorities' role, and actions to date, including previous and current actions to abate threat. Each of these information points is described below.

A. Site Description

1. Describe the site's physical location.
2. Discuss the general character of the site.
3. Provide supporting documentation.

B. Incident Characteristics

1. Discuss the history of the incident.
2. Discuss the relevant issues relating to current waste management practices.
C. Quantities and Types of Substances Present

1. Describe the hazardous substances in terms of categories or classes of chemicals.

2. Describe the sampling methodology.

D. State and Local Authorities' Roles

1. Briefly describe State and local actions to date.

2. Summarize the potential for continued State and local response.

E. Actions to Date

1. Discuss any previous actions to abate threat.

2. Discuss any current actions to abate threat.

III. THREAT TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT
(Include determination that threat is non-time-critical)

Removals address two distinct criteria. The first is a threat to the public health, welfare and the environment. The second criterion is the availability of non-CERCLA response mechanisms. The following threats are considered in determining the appropriateness of a removal action:

- Actual or potential exposure to hazardous substances or pollutants or contaminants by nearby populations, animals, or food chain;

- Actual or potential contamination of drinking water supplies or sensitive ecosystems;

- Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;

- High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;

- Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;

- Threat of fire or explosion;

- The availability of other appropriate Federal or State response mechanisms to respond to the release;

- Other situations or factors which may pose threats to public health, welfare or the environment.
OSCs should make sure that their Approval Memoranda discuss the ways in which the release meets these NCP criteria. Sections A and B below provide some specific examples of the type of material to include.

A. Threats to Public Health and Welfare
   1. Describe the threats to public health and welfare.
   2. Describe all actual or potential impacts on human health and welfare.

B. Threats to the Environment
   1. Describe threats to the environment.
   2. Discuss all actual or potential impacts on the affected area.

IV. ENFORCEMENT (not for public release)

The purpose of this section is to assist in making the determination of the potential for response action by PRPs. This information should be referenced here as "see attachment" and placed on a separate page entitled "Enforcement Sensitive." This section includes information on the enforcement strategy (summarized), the status of notice letters and/or negotiations, the available enforcement authority, potentially responsible parties, previous enforcement actions, the probability of recovering costs, and the recommended enforcement strategy if there is no strategy currently in place. This section also should contain information on the potential for responsible party response. In some Regions, this section of the Approval Memorandum may be prepared by enforcement personnel.

A. Enforcement Strategy
   1. Briefly summarize the enforcement strategy.
   2. Briefly summarize the enforcement actions.

B. Status of Enforcement Actions
   1. Potentially responsible parties.
      a. Describe the number and types of potentially responsible parties (e.g., transporters and owners or operators of production facilities or waste disposal facilities).
      b. Indicate if the PRP has taken action. If so, mention whether or not the action was adequate.
      c. Describe what efforts are being undertaken to obtain additional PRP response.
d. Give the date(s) that notice letter(s) were sent and a summary of the responses of the recipients (e.g., the PRPs have agreed to clean up the site or the PRPs have denied involvement at the site). If negotiations are underway, describe the activities under discussion.

2. Discuss the probability of recovering costs.

V. PROPOSED PROJECT AND COSTS

A. Objectives of the EE/CA: A short statement should be made describing the specific tasks involved in preparation of the EE/CA, including any on-site activities necessary (e.g., drum excavation), and the results sought by the EE/CA as they pertain to the threat(s) discussed in IV.

B. The estimated total EE/CA project ceiling (104(b) costs) and an itemized breakout of the following cost categories which comprise the total ceiling: TAT costs, intramural costs, National Contract Lab Program analytical costs, and ERT/REAC costs. (REM contractor costs would be included at NPL sites, if appropriate.) For example, the total project ceiling may be established in the following manner:

<table>
<thead>
<tr>
<th>Cost Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAT costs</td>
<td>10,000</td>
</tr>
<tr>
<td>NCLP analytical services</td>
<td>20,000</td>
</tr>
<tr>
<td>ERT study</td>
<td>20,000</td>
</tr>
<tr>
<td>Indirect (HQ and Region)</td>
<td>45,000</td>
</tr>
<tr>
<td><strong>TOTAL 104(b) COSTS</strong></td>
<td><strong>$95,000</strong></td>
</tr>
</tbody>
</table>

If any CERCLA funds have already been allocated for this site, give the amount and tasks involved. Indicate obligations to date, if appropriate.

C. EE/CA Schedule: The estimated period of performance should be given, with interim milestones, as appropriate.

D. Estimated Cost and Duration of Removal Action: The approximate cost and duration of the final removal action, based on the nature of the site problems and waste volume and characteristics.

VI. EXPECTED CHANGE IN THE SITUATION SHOULD NO ACTION BE TAKEN OR SHOULD ACTION BE DELAYED

Describe any expected changes in the situation should no action be taken or action be delayed. Include a description of a worst-case scenario should no action be taken. These changes may include:

- Spread in scope of contamination. For example, the ground water contaminant plume may spread through a larger area.
• Change in nature of contamination. For example, incompatible substances may come into contact with each other, producing added threats such as fire/explosion or formation of poisonous gases such as hydrogen cyanide.

• Increased threat to human health and the environment if action is delayed or denied. For example, the contaminant plume may soon reach drinking water wells or phosphine gas or other poisonous gases may be produced.

• Additional response actions required if the initial response is delayed or denied resulting in a longer, more costly removal. For example, the drums will deteriorate further, leaking additional contaminants into the ground.

VII. IMPORTANT POLICY ISSUES (Only as necessary and applicable)

If applicable, include a separate section on important policy issues that are significant to this request. These issues may include:

• Provision for cost sharing (cost sharing is applicable only in a small number of cases and applies only to removals at NPL sites that were publicly operated, either by a State or a political subdivision thereof, at the time of the release and a remedial action is ultimately undertaken at the site)

• The division of responsibilities among Federal and/or State agencies

• Off-site disposal availability and compliance with OSWER's Off-site Policy

• Compliance with other environmental statutes

• Special coordination needs/issues of national significance (e.g., dioxin) and similar issues

• Contiguous sites (if multiple locations are recommended by the Region for consideration as one site, give justification for such consideration).

Issues should be fully explained and include a discussion on the efforts being made to resolve the issue and/or decisions that must be made before a resolution is reached.
VIII. REGIONAL RECOMMENDATION

Use a paragraph such as: "Because conditions at the XYZ Site meet the NCP Section 300.65 criteria for a removal action, I recommend your approval of the engineering evaluation/cost analysis (EE/CA) request. The estimated total costs of performing the EE/CA are $X. You may indicate your approval or disapproval by signing below."

Approve: _______________________________ Date: __________________
Disapprove: _______________________________ Date: __________________
APPENDIX B

EE/CA PROCESS SCENARIO

The following is a hypothetical scenario for the EE/CA process for a non-time-critical removal action. The scenario follows the EE/CA sequence discussed in Section 2 of this guidance. This scenario is only an example that highlights the decision process involved in an EE/CA and is not intended to correlate to an actual situation.

Site Characterization

In a site evaluation conducted by EPA, approximately 1700 abandoned drums were discovered on property that was once used as a farm. Sampling results indicated that 500 of the drums contained sludge and oil with PCB concentrations ranging between 92 ppm and 700 ppm. The 1200 remaining drums contained benzene, trichloroethylene, phenol, and other organics. There was no evidence that any of the drums were leaking. The drums were located in a covered barn in the middle of a field. The closest thoroughfare, a dirt road, was located approximately 500 yards away. This scenario will address the disposition of the PCB-contaminated sludge and oil, although the same process would occur concurrently for the drums containing organic solvents.

The contents of the drums containing the PCB wastes presented health threats through direct contact and inhalation. The OSC did not initiate a removal action immediately because the site was not located near residents, contaminant migration was not occurring, there was no fire/explosion threat, no signs of trespassing were visible, and local authorities had fenced the site. Due to the concentrations present, however, the decision was made to initiate removal action within one year.

Conditions at the site posed the threat of direct contact with hazardous substances through a potential release, and thus met the NCP section 300.65 criteria for a removal action. However, due to the stable nature of the drums, response actions were not required within six months, thus making this response a non-time-critical removal action. An EE/CA Approval Memorandum to perform an EE/CA was submitted and approved by the Regional Administrator. The EE/CA was performed as described below.
Identification of Removal Action Objectives

After completing the initial site evaluation, the OSC was able to formulate the basic objectives of the impending removal action. Response could be delayed six months, due to the restricted access of the site and the stability of the shed and drums, but would be necessary within one year. In addition, the response would be subject to the statutory limits of one year and $2 million. The scope of the response should provide total cleanup of the site by removing and disposing of the drums, thereby ensuring protection of human health and the environment. Disposal technologies that permanently reduced the waste toxicity, volume, and/or mobility would be preferred.

Identification of Removal Action Alternatives

Based on the general objectives of the removal action, the OSC researched potentially useful technologies and identified the following PCB disposal options for consideration:

1) Solidification and landfilling (off site) of the drummed liquids.

2) Encapsulation (on site) of the drummed liquids.

3) Incineration (on or off site) of the liquids, with landfilling of the crushed drums and incineration residuals.

4) Dechlorination (on or off site) of the liquids, landfilling of the crushed drums and residual solids, and recycling of the recovered oil.

5) Wet-air oxidation (on or off site) of the liquids, landfilling of the crushed drums, and carbon filtration (as needed) of the effluent.

6) Biodegradation (onsite) of the liquids, with landfilling of the crushed drums and residual matrix.

With further research the OSC was able to eliminate all but two of the alternatives. The alternatives selected for further consideration were incineration and dechlorination.
Analysis of Removal Action Alternatives

The OSC then performed an in-depth analysis of the two remaining options, based on the three selection criteria. The significant findings of this analysis are described below.

Effectiveness

On-site incineration was an innovative technology that had the potential to completely destroy the waste, thus eliminating the threat. Additionally, incineration could meet most of the applicable chemical-specific ARARs. The OSC evaluated the public health and environmental impacts of air contamination from incineration and determined that under normal operating conditions nearby residents would be most at risk. These impacts could be minimized through the careful monitoring of wind direction and precautionary small scale evacuations. The likelihood of a major accident (e.g. an explosion within the incinerator resulting in a release) was considered small, and the location and precautions mentioned would limit any acute effects.

On-site dechlorination, another innovative technology, would destroy PCBs in the liquids and reduce the threat. The possibility existed that dechlorination would not destroy all the PCBs in the sludge and, therefore, would not meet all the chemical-specific ARARs. The OSC determined that dechlorination presented virtually no on-site public health or environmental impacts under normal operating conditions and little risk of a major accident. Treated oil would be recycled as feedstock for an industrial boiler (a nearby facility, willing to accept the oil, had been located).

Long-term threats to public health and the environment due to chronic exposures, in the case of a major accident involving either alternative, would be limited to the surrounding farmland and two small streams. Soil and stream sediment could be excavated to clean up the after-effects of an accident. The flora and fauna surveys that the OSC coordinated revealed no protected species or sensitive environments in the potentially affected area.
Both alternatives would require landfiling empty drums and residual solids. The surrounding property and the farm was slated for development within three years.

Implementability

Both on-site incineration and on-site dechlorination were innovative technologies which raised technical and administrative feasibility questions.

Technical Feasibility

The time available under this non-time-critical situation would allow for pilot studies to determine the technical feasibility of both alternatives. The information, about the alternatives, that the pilot study would provide, includes: operation and maintenance requirements; performance dependability; effects of site-specific environmental conditions; effects of site characteristics on constructability; timeliness; and the ability of the alternative to comply with action-specific ARARs. The pilot studies would also demonstrate the ability of incineration to completely destroy the wastes, and how well dechlorination performed on the sludge.

Administrative Considerations

Obtaining the State permits for the mobile incinerators that were currently available would have required negotiations with State officials. Much controversy was expected from nearby residents concerned about emissions from on-site incineration. An additional administrative consideration was that of issuing an RFP to procure one of a limited number of mobile incinerators. The OSC determined there was adequate time for competitive procurement in the non-time-critical situation. It was estimated that on-site incineration could commence within seven months. Transportation of the residual wastes and compliance with the Off-Site Disposal Policy was taken into account.

The dechlorination unit would also require awarding a site-specific contract. However, no special permits would be required and public acceptance of this method would be high. The dechlorination start-up time was estimated at three months. Transportation of residual wastes and compliance with the Off-Site Disposal Policy were considered.
Cost

The OSC determined that both alternatives would require similar startup and operating costs. While the dechlorination unit could process liquids faster than the incinerator, testing would be required on the sludge phase which would annul any cost savings of that option. Residual waste disposal costs would be incurred by both options.

RECOMMENDED ALTERNATIVE

Based on significant findings from analyzing the selection criteria for each option, the OSC performed a comparative analysis. Although the dechlorination option had few environmental impacts or administrative considerations, it presented considerable uncertainty regarding the technical feasibility of treating the sludge phase. This uncertainty presented the possibility of excessive testing and operational costs for dechlorination. Based on this analysis, the OSC produced an EE/CA report that recommended incineration as the selected non-time-critical removal action alternative.

During the public comment period, much controversy arose over the decision to incinerate, rather than dechlorinate, the wastes. The local health department felt that the health of residents within a two-mile radius of the incinerator would be jeopardized. However, the OSC pointed out that no residents lived within two miles along the prevailing downwind direction from the site.

The OSC responded to the citizen's concerns by including in the Action Memorandum provisions for constant monitoring of wind direction and frequent, periodic downrange air sampling during incineration. The OSC submitted the Action Memorandum, with the responsiveness summary, selecting and justifying on-site incineration as the appropriate alternative.
APPENDIX C

Example Calculation of Present Worth

Present worth analysis is a method of evaluating the expected utility of a given project by discounting all expected future cash flows to a common base year, usually the present, using a predetermined rate of return (discount rate). This calculation is necessary in order to account for changes in the value of the dollar over the long term. In order to calculate the present worth of a project, assumptions must be made about the discount rate. For the purposes of EPA projects, a prescribed discount rate of 10 percent before taxes and after inflation will be used (OMB Circular No. A-94). This figure represents the average rate of return on private investments.

The following examples illustrate how to calculate the present worth of a project using differing assumptions about future cash flows and the discount rate. Example 3 shows the results of a sensitivity analysis of discount rate assumptions.

Example 1

A project is being considered that has initial capital expenditures of $20,000 and operation and maintenance (O&M) costs of $1,000 per year. The expected lifetime of the project is 5 years. Assume that the average rate of return on private investments is 10 percent, which is also the prescribed rate used by EPA to evaluate projects. What is the present worth of this project?

Initial capital expenditures are already in the base year and do not need to be discounted. The O&M costs must be discounted for the five year period and added to the capital costs to obtain the present worth.

Step 1:

If the expected future cash flows are equal throughout the expected lifetime of the project, the annuity factor can be calculated using the following formula (published annuity factor tables can also be used):

\[
\text{Annuity factor} = \frac{1}{R} \times \left(1 - \frac{1}{(1 + R)^n}\right)
\]

where \( R = \) discount rate (.10); and
\( n = \) number of years of estimated useful life (5).

By inserting the numbers, an annuity factor of 3.791 is obtained.
Step 2:

The value of O&M can then be calculated by multiplying the expected annual cash flow by the annuity factor.

\[
\text{O&M value} = \text{Annual cash flow} \times \text{Annuity factor}
\]

\[
$3,791 = $1,000 \times 3.791
\]

Step 3:

The present worth of the project will be the sum of the base year costs (capital costs) and all discounted future costs.

\[
\text{Base year costs} + \text{O&M value} = \text{Total present worth of project}
\]

\[
$20,000 + $3,791 = $23,791.
\]

Example 2

A project is being considered that has initial capital expenditures of $20,000. The expected lifetime of the project is 5 years. Operation and maintenance costs for the first two years are expected to be $2,000 per year and $1,000 per year every year after. Assume that the average rate of return on private investments is 10 percent. What is the present worth of this project?

This example is similar to the example above, except that O&M costs are not maintained at an even level throughout the estimated lifetime of the project.

The present worth calculation of years 1-2 can be done just as in the previous calculation. The value is $3,472 (1.736 \times $2,000). The present worth for years 3-5 can be calculated by discounting the annuity factor for years 3-5 to the base year. This can done using the following formula:

Step 1:

\[
\text{Annuity factor (yrs 3-5)} = \frac{1}{(1+R)^N} \times \text{Annuity factor for 3 years}
\]

where \( R \) = the discount rate (.10); and
\( N \) = the first year of the period (3)

This calculation yields an annuity factor that has been adjusted to the base year of 2.055.
Step 2:

O&M Value (yrs 3-5) = Annual cash flow x Annuity factor (yrs 3-5)

$2,055 = $1,000 \times 2.055$

Step 3:

The present worth of the project will be the sum of the base year costs (capital costs) and all discounted future costs.

Base year costs + O&M value (1-2) + O&M value (3-5) = Total present worth

$20,000 + $3,472 + $2,055 = $25,527$

Example 3 - Sensitivity Analysis

Three projects are being considered: Project 1 will take eleven months to complete at a cost of $60,000. Project 2 has initial capital expenditures of $40,000 and operation and maintenance costs of $2,000 per year for five years. Project 3 has initial capital expenditures of $10,000 and operation and maintenance costs of $10,000 per year for five years. The OSC has noted that Project 2 will require $50,000 in outlays over a five year lifetime while Project 3 will require $60,000 in total outlays. The OSC must determine the present worth of the three alternatives to perform a meaningful cost comparison. Additionally, the OSC is unsure about the average return on private investments and wants to determine the sensitivity of the present worth to varying discount rates. The OSC wants to use 4 percent and 13 percent as alternative discount rates. How do the present worths compare to the 10 percent discount rate for all three projects?

The present worth of the projects can be calculated using the formula from Example 1. Because Project 1 incurs all costs within the one year, no discounting needs to be done (the present worth is the estimated cost of the project). The following table lists the present worth of the projects using discount rates of 4, 10 and 13 percent.

<table>
<thead>
<tr>
<th>Initial Capital Outlay</th>
<th>Yearly O&amp;M</th>
<th>Present Worth at 4%</th>
<th>Present Worth at 10%</th>
<th>Present Worth at 13%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Project 2</td>
<td>$40,000</td>
<td>$2,000</td>
<td>$48,904</td>
<td>$47,582</td>
</tr>
<tr>
<td>Project 3</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$54,516</td>
<td>$47,908</td>
</tr>
</tbody>
</table>

As can be seen from the calculations above, changes in the discount rate along with changes in the estimates for costs that have to be discounted can affect the decision on which project to choose. In this example, and on a present worth only basis,
Project 2 would be preferred at a discount rate of four percent whereas Project 3 would be preferred using a discount rate of thirteen percent.
## APPENDIX D

### Regional EIS Contacts

<table>
<thead>
<tr>
<th>Region</th>
<th>Responsibility</th>
<th>Telephone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region 1</td>
<td>Office of Government Relations and Environmental Review</td>
<td>FTS 835-3414, Commercial 617-565-3414</td>
</tr>
<tr>
<td>Region 2</td>
<td>Office of Policy and Management - Environmental Impacts Branch</td>
<td>FTS 264-1840, Commercial 212-264-1840</td>
</tr>
<tr>
<td>Region 3</td>
<td>NEPA Compliance Section - Environmental Impact and Marine Policy Branch</td>
<td>FTS 597-6289, Commercial 215-597-6289</td>
</tr>
<tr>
<td>Region 4</td>
<td>NEPA Review Staff - NEPA Compliance Section Environmental Assessment</td>
<td>FTS 257-3776, Commercial 404-347-3776</td>
</tr>
<tr>
<td>Region 5</td>
<td>General: Environmental Review Branch</td>
<td>FTS 886-7500, Commercial 312-886-7500</td>
</tr>
<tr>
<td>Region 6</td>
<td>Wastewater treatment: Environmental Planning Section</td>
<td>FTS 353-2315, Commercial 312-353-2315</td>
</tr>
<tr>
<td>Region 6</td>
<td>Site Assessment Section - Superfund Enforcement Branch</td>
<td>FTS 255-6740, Commercial 214-655-6740</td>
</tr>
<tr>
<td>Region 7</td>
<td>Environmental Review Branch</td>
<td>FTS 757-2823, Commercial 913-236-2823</td>
</tr>
<tr>
<td>Region 8</td>
<td>Office of External Affairs</td>
<td>FTS 564-1696, Commercial 303-293-1696</td>
</tr>
<tr>
<td>Region 9</td>
<td>Federal Activities Branch</td>
<td>FTS 455-8177, Commercial 415-974-8177</td>
</tr>
<tr>
<td>Region 10</td>
<td>EIS and Energy Review Section</td>
<td>FTS 399-8505, Commercial 206-442-8505</td>
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