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RCRA CORRECTIVE ACTION PLAN

(Final)

Office of Waste Programs Enforcement
Office of Solid Waste

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Foreword

This document was issued by Bruce M. Diamond, Director, Office of Waste Programs Enforcement, and Michael Shapiro, Director, Office of Solid Waste, in May, 1994 as the RCRA Corrective Action Plan Guidance (Final), OSWER Directive Number 9902.3-2A replacing the RCRA Corrective Action Plan Guidance (Interim Final), OSWER Directive 9902.3, dated June, 1988. The interim final guidance was updated with the help of a workgroup made up of representatives from several States and EPA Headquarters and Regions. The updated guidance reflects the experience the Regions and States have gained and changes that have occurred in the corrective action program. In addition, new technical information has been added.

The purpose of the RCRA Corrective Action Plan (CAP) is to aid Regions and States in determining and directing the specific work that a Permittee/Respondent must perform, as part of a complete corrective action program. The CAP will assist the Regions and States in developing corrective action requirements in permits under §3004(u) and (v) and §3005(c)(3) (omnibus) and corrective action orders under §3008(h) and §7003.

The CAP provides a framework for developing a site-specific schedule of compliance to be included in a permit or a corrective action order. It does so by laying out scopes of work for the four main components of a corrective action program. These four components and their objectives are as follows:

- *Interim/Stabilization Measures (ISMs)* - to control or abate threats to human health and/or the environment from releases and/or to prevent or minimize the further spread of contamination while long-term remedies are pursued.
- *RCRA Facility Investigation (RFI)* - to evaluate thoroughly the nature and extent of the releases of hazardous waste and hazardous constituents and to gather necessary data to support the Corrective Measures Study and/or interim/stabilization measures.
- *Corrective Measures Study (CMS)* - to develop and evaluate a corrective measure alternative or alternatives and to recommend the final corrective measure(s).
- *Corrective Measures Implementation (CMI)* - to design, construct, operate, maintain and monitor the performance of the corrective measure(s) selected.

A chapter on interim/stabilization measures (Chapter II) has been added in the final CAP. This optional phase is generally the first phase of corrective action but may be conducted at any time in the process. The term "interim/stabilization measures" is being used in this document to encourage the use of interim measures to achieve stabilization. Interim/stabilization measures are actions to achieve the goal of stabilization, which is stated above and in Chapter II.

Another optional phase, the Release Assessment or Phase I RFI, could be performed by the Permittee/Respondent before an RFI (or as a first phase of an RFI)

and after a RCRA Facility Assessment (RFA) to determine whether interim/stabilization measures are necessary and/or to focus an RFI. A release assessment should be used to minimize corrective action activities (i.e., by focusing the RFI) and not to add another step in the process. See section III.D. ("Phasing of Activities") of Chapter I and the beginning of Chapter III for further discussion and a model scope of work for release assessments.

The CAP provides an overall model for the corrective action process. The scopes of work contained in the CAP should not be considered boilerplate; rather, they should be considered as a menu of possible activities to be required on a site-specific basis. The model scopes of work in the CAP are intended to foster timely, concise, and technically adequate submissions by the Permittee/Respondent. Therefore, when modifying these scopes of work with site-specific information, **only information that is necessary for the subject facility should be required**, in order to minimize the number and length of Permittee/Respondent submissions and implementing agency review time. The implementing agency decides which components will be included in the permit or order.

Chapter I: Corrective Action Process Update

Since the interim final CAP was published in June 1988, several changes have occurred in the RCRA corrective action program. New philosophies and strategies were expressed in the July 1990, RCRA Implementation Study (RIS), and new technical information has become available. The revised CAP reflects these changes, as well as the experience of the Regions and States in implementing the corrective action program. Some of the key changes are discussed below following an introduction to the corrective action program and an explanation of how to use the CAP.

I. Introduction

The objective of a Corrective Action Program at a hazardous waste management facility is to evaluate the nature and extent of the releases of hazardous waste or constituents; to evaluate facility characteristics; and to identify, develop, and implement an appropriate corrective measure or measures to protect human health and environment. The following components are necessary to ensure a complete corrective action program. It should be recognized that the detail required in each of these steps will vary depending on the facility and its complexity; only those tasks appropriate for a specific site should be imposed on the Permittee/Respondent.

1. Locate the source(s) of the release(s) of contaminants (e.g., regulated units, solid waste management units, and other source areas).
2. Characterize the nature and extent of contamination that is both within the facility boundary and migrating beyond the facility boundary. This would include defining the pathways and methods of migration of the hazardous waste or constituents, including the media affected, the extent, direction and speed of the contaminants, complicating factors influencing movement, concentration profiles, etc.
3. Identify areas and populations threatened by releases from the facility.
4. Determine actual and potential threats of releases from the facility to human health and/or the environment in both the short and long term.
5. Identify and implement an interim/stabilization measure or measures to abate the further spread of contaminants, control the source of contamination, or otherwise control the releases themselves.
6. Evaluate the overall integrity of containment structures and activities at the site intended for long-term containment.
7. Identify, develop, and implement a corrective measure or measures to prevent and remediate releases of hazardous waste or constituents from the facility.
8. Design a program to monitor the maintenance and performance of any interim or final corrective measure(s) to ensure that human health and the environment are being protected.

The four main components of a complete corrective action program and their objectives are as follows:

- *Interim/Stabilization Measures (ISMs)* - to control or abate threats to human health and/or the environment from releases and/or to prevent or minimize the further spread of contamination while long-term remedies are pursued.
- *RCRA Facility Investigation (RFI)* - to evaluate thoroughly the nature and extent of the releases of hazardous waste and hazardous constituents and to gather necessary data to support the Corrective Measures Study and/or interim/stabilization measures.
- *Corrective Measures Study (CMS)* - to develop and evaluate a corrective measure alternative or alternatives and to recommend the final corrective measure(s).
- *Corrective Measures Implementation (CMI)* - to design, construct, operate maintain and monitor the performance of the corrective measure(s) selected.

As discussed in section VI of this chapter, all of the components may be streamlined or phased, and alternatives to the "traditional" corrective action process (i.e., RFI → CMS → CMI) may be appropriate.

A RCRA Facility Assessment (RFA) or equivalent assessment will have been conducted at the facilities that are to receive permits and for some facilities that are issued §3008(h) Orders. The results of the RFA should be used as the basis for focusing the RCRA Facility Investigation (RFI) for individual sites and should provide the necessary data to complete the "background information" components of the CAP. In some cases, a Release Assessment (Phase I RFI) may be needed to further focus the RFI or to determine whether ISMs are necessary.

Exhaustive characterization and studies of a facility during the RFI/CMS, in the sense of completely eliminating uncertainty, are generally not required to achieve environmentally protective results. Therefore, it is important for the implementing agencies to clearly define scopes of work to be performed that require the appropriate amount of information to characterize contamination and identify the cleanup alternative(s) without "going overboard." Reasonable time frames should be set for activities such as gathering data and conducting studies.

II. How to Use the CAP

Users of the CAP should understand that it is designed to identify actions that facility Permittees/Respondents may be required to undertake as part of a corrective action program. It does not identify the steps that are the responsibility of the implementing agency. However, some guidance language is provided in the CAP for such agencies and is indicated by brackets ([]) and italics. Additional guidance language is found at the beginning of Chapters II, III, IV, and V, and before the model scopes of work. Specifying conditions that will be placed in orders and permits is one key area of responsibility for implementing agencies. The CAP incorporates certain provisions that are already required by statute or regulations. If the required information is already present in permits or permit applications, the implementing agency may allow the Permittee to reference the appropriate sections of such

documents. The remainder of the CAP is guidance, not a rule, and has not gone through public comment; therefore, use of provisions in the CAP should be justifiable and tailored to fit site-specific conditions.

Regions and States should incorporate the appropriate provisions of the corrective action plan in a draft permit. If public comments are received on these provisions, the implementing agency's response to comments should include a site-specific justification for the provisions in question, with supporting data as appropriate. For guidance on public involvement for corrective action under permits and RCRA §3008 (h) orders, see the *RCRA Public Involvement Manual* (EPA530-R-93-006, September 1993).

Limitations exist on the release or discussion of information during the enforcement process (particularly during negotiations or if a case is referred to the Department of Justice). However, respondents that are issued RCRA §3008 (h) administrative orders have the right to request a hearing concerning any material fact in the order or the terms of the order which may include scopes of work derived from the CAP. Respondents to §3008 (h) orders may request informal settlement conferences. Agencies are encouraged to settle such enforcement actions through informal discussions.

Traditional risk assessment techniques may be a significant factor in designing RFI, CMS, and ISMs work plans. Risk management decisions should be used in selecting corrective measures and ISMs, along with current and future land use scenarios, background levels, health-based and technology-based standards.

To clarify the interaction between the agency and the facility Permittee/Respondent, a flow chart of Permittee/Respondent submittals that may be imposed and the agency actions for the stages of the CAP is represented in Figure 1 below. It is important to note that this is the "traditional" model and many variations of the process are possible (see "Alternate Corrective Action Models" section VI.F. on page nine).

Figure 1. RCRA Corrective Action Process

III. Modifications of CAP Scopes of Work

The CAP scopes of work should not be considered boilerplate. The scopes of work in the CAP are models that should be modified based on site-specific situations. Information generated from investigations such as RCRA Facility Assessments (RFAs) should be used to tailor the scope of work to address facility-specific situations. The following are some examples of situations where modification to the CAP model scopes of work would be appropriate.

- If the contamination problem at a facility is small or simple (e.g., a small soil contamination problem), then the implementing agency may decide to scale down the CAP accordingly. The agency could require excavation and removal by ISMs or by corrective measures after approving a streamlined CMS (e.g., with only the one alternative evaluated).
- If the contamination problem at a facility is complicated, the Health and Safety Plan and Public Involvement Plans may need to be comprehensive. However, in less complicated contamination situations, these plans may be very brief.
- If site-specific conditions require more detail than what has been scoped out in any particular section of the CAP, then these requirements should be enhanced accordingly.
- If there is information on air releases at a site which is sufficient to suggest a remedy which would prevent such an air release, then it would not be necessary to require the Permittee/Respondent to perform an air contamination characterization. The air contamination characterization work under the RFI should be deleted.
- If interim/stabilization measures are underway, scheduled or contemplated at a facility, then the interim/stabilization measures section under the RFI should be modified to specifically reference such measures.
- If possible, the CAP should focus the Permittee/Respondent on specific solid waste management units (SWMUs) and other areas of interest, as well as known waste management activity areas (e.g., waste recycling units).
- If only one corrective measure alternative is appropriate for a given situation, and it would not be necessary to require the Permittee/Respondent to further investigate the possibility of other corrective measure alternatives, then the scopes of work contained in this document should be modified to reflect this situation.

IV. Available Guidance

The Regions and States are encouraged to make available to the Permittee/Respondent existing model plans that are relevant to RCRA activities. For

example, the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities Operating Safety Guidelines* contains a model that can be used for the Health and Safety Plan outlined in the CAP. In addition, guidance documents such as the RCRA Facility Investigation (RFI) Guidance; Interim Final (May 15, 1989, document number PB89-200-299, four volumes available from NTIS, phone number (703) 487-4650) may be referenced. Other corrective action guidance documents and sources of related information are provided in Appendix A.

V. Tailoring the Work to be Performed for the Site

It is necessary to stress the importance of site-specific technical detail in developing corrective action orders, permits, and, particularly, scopes of work. Each facility has unique characteristics and circumstances that need to be considered and incorporated into any requirements for corrective action. Without this up-front detail, many Permittees/Respondents will provide deficient submittals that lack the technical detail necessary to perform a thorough corrective measure program. In addition to providing a detailed scope of work, the implementing agency should also establish a site-specific time frame for completing the work. Enforcement of permit conditions or an order is always easier when specific detail is included. These documents should contain schedules for submittals such as reports and work plans. Without a detailed schedule of compliance in a corrective action permit or a corrective action order, submittals and actions may be delayed or untimely.

VI. New Developments in Corrective Action

A. Streamlining the Corrective Action Process

The introductory remarks in the original CAP (June 1988) stressed the importance of concise submissions based on site-specific detail and that the scopes of work contained in the CAP should not be considered boilerplate. The revised CAP continues to emphasize this policy as well as an overall goal of streamlining the process in an effort to expedite cleanups. Of course, this goal must be balanced with the goal of maintaining the technical integrity of the program. Decisions concerning how and when to streamline the process are to be made at the discretion of the implementing agency.

The revised CAP encourages using alternatives to the traditional sequential approach (e.g., the use of interim measures to achieve stabilization). It presents a menu of options that are to be tailored to individual sites, taking into account site-specific conditions. In addition, some steps have been combined or eliminated to reduce redundancy.

B. Addition of Interim Measures to Achieve Stabilization (Chapter II)

The following chapter, *Interim Measures to Achieve Stabilization* has been added to the CAP as an optional phase to be conducted at the discretion of the implementing agency. The 1990 RIS suggested that the RCRA corrective action program needed to adjust its longtime program emphasis. While final cleanup remains the long-term goal of the corrective action program, the RIS recommended more frequent use, where appropriate, of interim/stabilization measures in the early stages of corrective action to achieve near term environmental protection at facilities with the most serious problems. This approach, which may also be appropriate during later phases of the

process, emphasizes controlling sites by stabilizing identified releases to prevent the further spread of contamination and degradation of the environment. Note that the term "interim/stabilization measures" is being used in this document to encourage the use of interim measures to achieve stabilization.

C. Corrective Action Management Units (CAMUs) and Temporary Units (TUs)

The February 16, 1993, Federal Register (58 FR 8658) finalized provisions for Corrective Action Management Units (CAMUs) and Temporary Units (TUs) under subpart S of 40 CFR Part 264. These units function solely to manage remediation wastes generated at a RCRA facility as a result of required corrective action activities. EPA recognized that the existing regulatory structure of RCRA Subtitle C (e.g., permitting, land disposal restrictions), when applied to management of hazardous wastes for remedial purposes, can often impede the ability to select and implement effective remedies. CAMUs/TUs were developed to expedite hazardous waste cleanups by reducing or eliminating certain waste management requirements of the current RCRA Subtitle C regulations. The use of TUs at a site does not in any way preclude the need for a final remedy to eventually be implemented at the site; whereas CAMUs may be included in a final remedy.

The final CAMU/TU provisions are intended to provide flexibility for decision-makers in implementing protective, reliable, and cost-effective remedies. The CAMU/TU regulations provide the Regional Administrator (RA) with the authority to designate and approve such units if the RA determines criteria specified in 40 CFR § 264.552(c) will be met. If the remediation wastes are managed in accordance with these provisions, remediation waste (as opposed to process or "as-generated" waste) will not be subject to the RCRA land disposal restrictions (LDRs) and the minimum technology requirements (MTRs). The CAMU/TU regulations apply to corrective action implemented under RCRA permits and Section 3008(h) orders.

D. Phasing of Activities

A phased approach to corrective action may be appropriate where a variety of releases (or threats of releases) exist, particularly if some of the releases or threats can be stabilized. Under this approach, the initial investigation should first focus on the areas that pose the greatest threats to human health and the environment and then focus on lower priority areas. Stabilization for the high priority units may be required before focusing the investigation on the lower priority units. Phasing may also be appropriate when determining the extent of contamination if it is believed that substantial migration of contaminants has occurred.

Release Assessments (Phase I RFIs), or other RFI phasing activities are also intended to streamline the corrective action process. They may be required to determine whether interim measures/stabilization are necessary and/or to focus an RFI. A release assessment may be performed between the RFA and RFI and may be desirable if there is some uncertainty about releases (e.g., due to subsequent activities) at a facility after the RFA. Note that RFAs are conducted by implementing agencies and release assessments or Phase I RFIs are conducted by Permittees/Respondents. The release assessment should be viewed as a way of focusing an RFI or determining whether interim/stabilization measures are necessary prior to the RFI.

It is important to note that a release assessment is generally used to minimize corrective action activities (i.e., by focusing or streamlining the RFI) and not to add another step in the process. See the beginning of Chapter III for further discussion and a model scope of work for release assessments.

The CMS may be phased as discussed in the CMS section of the document; however, all elements of the facility that are of concern eventually should be addressed in a CMS. Eventually, the CMS will most likely result in a comprehensive evaluation of corrective measures to be implemented at the entire site, even if the study is most logically conducted in phases.

E. Quality Assurance Project Plans and Data Quality Objectives

A fundamental requirement of the RCRA corrective action program is the collection of environmental data that can be documented and are of adequate quality to support decision making. To meet this requirement, data quality objectives (DQOs) should be established through the quality assurance project planning process. A July 7, 1993, memorandum transmitted to the EPA Regions from Sylvia Lowrance, OSW Director, and H. Matthew Bills, Office of Modeling, Monitoring Systems and Quality Assurance Director within the Office of Research and Development, discusses the application of the DQO process to the ground-water monitoring and corrective action program. As a follow-up to the memorandum, the two offices are developing examples of Quality Assurance Project Plans (QAPjPs). These examples are intended to demonstrate that QAPjPs can be of varying complexity depending upon their associated DQOs and that review and approval of QAPjPs designed to achieve less complex DQOs can be expedited in certain cases.

As stated in the July 7, 1993, memorandum, "The overall level of uncertainty that a decision maker is willing to accept in this decision making process is known as a DQO." The memorandum also explains that QAPjPs are used as a management control to ensure that DQOs are defined and documented. QAPjPs may vary in complexity (e.g., in certain cases, sampling and analysis plans may substitute for and be the equivalent of QAPjPs), but the minimum elements of a quality assurance program for all data collection activities in RCRA are outlined in Chapter One (Quality Assurance) of "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (EPA SW-846 Third Edition as amended by Update One, July 1992). For this reason, Chapter One of SW-846 is included as an appendix (Appendix B) to the CAP. References to this appendix also are made in Chapter Three (RFI) and Chapter Five (CMI).

F. Alternate Corrective Action Models

The following sample alternatives to the traditional corrective action model (i.e., RFI → CMS → CMI) are provided as examples. Note that an RFA would precede these activities. Except for use in the term "Interim/Stabilization Measures," the slashes indicate that activities may be conducted concurrently. In addition, more than one scenario may be taking place at a site at one time.

- 1) Release Assessment → No further action
- 2) Release Assessment → Streamlined RFI → No further action

- 3) Release Assessment → Streamlined RFI → CMS → CMI
- 4) Interim/Stabilization Measures → RFI → CMS → CMI
- 5) Interim/Stabilization Measures → RFI → Interim/Stabilization Measures → CMS → CMI
- 6) RFI → Interim/Stabilization Measures → CMS → CMI
- 7) RFI/CMS → CMI
- 8) RFI/CMS/Interim/Stabilization Measures → CMI
- 9) RFI → Streamlined CMS → CMI
- 10) Phased RFI/CMS → CMI
- 11) Phased RFI/CMS/Interim/Stabilization Measures → CMI
- 12) Phased RFI/CMS/CMI

This is not intended to be an exhaustive list but rather examples of some possible scenarios. The following chapter provides more guidance on phasing interim measures to achieve stabilization.

G. Reimbursement of Oversight Costs

EPA is examining various options for recovering oversight costs in the RCRA program. The Agency may issue guidance on this issue in the future.

H. Definitions

To facilitate use of the CAP, a Definitions Section has been added as an appendix (Appendix C). For additional guidance on technical terms used in the Corrective Action Program, the U.S. EPA issued the "Corrective Action Glossary" (OSWER Directive Number 9902.3-1a) in July, 1992. The Glossary is available through NTIS, phone number (703) 487-4650.

Chapter II: Interim Measures To Achieve Stabilization

Introduction

The RIS recommended using interim actions to achieve near-term environmental results at facilities with the most serious problems. The overall goal of this process, termed "stabilization," is to control or abate threats to human health and/or the environment from releases and/or to prevent or minimize the further spread of contamination while long-term remedies are pursued. Since 1992, the U.S. EPA and the States have been implementing a major initiative to achieve this goal. Interim/stabilization measures (ISMs) are the actions used to achieve the goal of stabilization.

The stabilization effort builds on work that has already been initiated at many corrective action sites. Many of the ISMs implemented at numerous RCRA facilities across the country were undertaken to address actual or imminent threats to human health or the environment. Guidance on implementing ISMs was provided in the original CAP, the *RCRA Corrective Action Interim Measures Guidance* (OSWER Directive 9902.4, June 1988), the proposed subpart S rule (55 FR 30880, July 27, 1990), and more recently in the RCRA Stabilization Strategy transmitted to the EPA Regions in a memorandum from Sylvia Lowrance, OSW Director, and Bruce Diamond, OWPE Director (October 25, 1991). The subpart S proposal generally constitutes EPA's most authoritative policy statement on corrective action. As discussed in these guidance documents, a release or threat of a release, need only be potential (i.e., it does not have to be actual or imminent) to require the Permittee/Respondent to implement ISMs.

Although intended to be implemented more quickly than traditional remedial measures, ISMs may be short-term or long-term. Examples of ISMs include: providing bottled water, erecting a fence around heavily contaminated soil, hydraulic containment of a contaminated ground-water plume, and excavating and removing heavily contaminated soil.

To a large extent, the stabilization effort builds on work that has been ongoing in the Regions and States. These agencies historically have required facility Permittee/Respondents to undertake interim measures to address obvious environmental problems, particularly where actual or imminent exposure of human or environmental populations has been identified. However, these actions have often been pursued in conjunction with the final, comprehensive remedy for a facility.

The stabilization initiative focuses limited agency resources on near-term activities to control or abate threats and/or to prevent or minimize the further spread of contamination across many facilities rather than following the traditional process of pursuing final, comprehensive remedies at a few facilities. By imposing such expeditious actions, the extent and incidence of continued environmental degradation from existing releases should be significantly reduced. In addition, the environmental benefit gained by taking this early action should enable greater efficiency in final remedies undertaken.

Timing of Stabilization Activities

Interim/stabilization measures are used to achieve the goal of stabilization and allow the implementing agency to redirect its resources or defer some corrective action activities to address the worst sites (or parts of sites) first.

In many cases, it will be possible to identify early in the corrective action process the need for interim measures. The implementing agency may identify such a need through the combination of the RFA, the facility's rank (using the National Corrective Action Prioritization System (NCAPS)), and stabilization evaluation. Individual solid waste management units (SWMUs) with the worst releases and presenting the most imminent threats can also be identified by using these tools. A phased approach may be taken during the initial RFI information gathering stage to focus the investigation on collecting data to design, implement, and monitor interim measures at high priority SWMUs. The facility-wide RFI (and CMS) can be done concurrently or be put on a slower track while interim measures are implemented at the worst SWMUs first. Although the CMS will generally not be completed when deciding on interim measures, potential final remedies should be under consideration because the interim measures taken to achieve stabilization should be consistent with the final remedy. In cases where they will deviate due to the interim nature of the actions, the interim measures should at a minimum not conflict with the final remedy.

Conditions Appropriate for Stabilization

Several conditions should exist at a facility (or part of a facility) for stabilization to be appropriate. Generally, interim measures are most effective when a specific aspect of the overall contamination at the facility can be isolated. As discussed earlier, exposure threats to humans or ecosystems should be present. If these receptors could be exposed to contaminants within five to 10 years or interim measures could reduce the present or near-term (e.g., less than two years) risks, then this criterion has been met. Addressing releases expeditiously through interim measures may prevent further significant contamination of environmental media. If contaminants are migrating off site, stabilization may be appropriate to stop or slow the migration. Also, if previously implemented interim measures have been unsuccessful in preventing the further spread of contamination, new or modified measures may be needed. Sufficient information about the contaminants and the facility's environmental setting (e.g., site hydrogeology) must be known for stabilization to be a viable option. Finally, a decision to proceed with stabilization activities should be made only if appropriate technologies are available to deal with the known contaminants.

Examples of Interim Measures to Achieve Stabilization

Stabilization can be achieved through a variety of interim measures that are based on site-specific conditions. Stabilization can include source control, contaminated media cleanup, and/or limiting exposure to contamination. As an ecological example of interim measures to limit exposure, migrating waterfowl could be prevented from using open surface impoundments, ponds, etc., with contaminants of ecological concern by placing a temporary cap over the surface impoundments or removing the hot spot contamination from such units.

As another example of a facility that has implemented interim measures to achieve stabilization, consider the following: The initial screening at a chemical manufacturing plant identified dioxin contamination in superficial soils and

trichlorobenzene non-aqueous phase liquid (NAPL) in the bedding of the facility's sewer system. Both of the contaminated areas were located near the facility boundary and posed a threat to a nearby residential area. Interim measures included installing a fence to prevent access, capping the dioxin-contaminated soil and installing a grout wall for hydraulic isolation, and initiating a free-product removal program to eliminate the source and prevent continued NAPL migration along the sewer system.

As a third example, investigations at a wood treating facility identified past releases from unlined impoundments, which resulted in considerable quantities of creosote being present in the ground water as a dense NAPL or DNAPL. Dissolved hazardous waste constituents were present both on and off site in the underlying Karst aquifer. The facility installed a downgradient ground-water extraction trench with extraction sumps to remove free product and contaminated ground water. The extraction system was expanded throughout the stages of corrective action. Early action to remove product and contaminants and to limit the plume's extent was particularly important at this facility because of the uncertain flow patterns associated with many Karst aquifer systems.

The U.S. EPA has developed guidance documents to facilitate implementation of the stabilization initiative. One such document, Stabilization Technologies for RCRA Corrective Actions (EPA/625/6-91/026, August 1991) is a handbook which provides guidance on identifying the types of environmental settings that are amenable to stabilization, various technical approaches to accelerate data gathering, and phasing the RFI. This guidance document also includes a Corrective Action Stabilization Questionnaire (see Appendix D) that can be used immediately after an NCAPS ranking as a first step to gather stabilization-related information. The questionnaire examines individual solid waste management units (SWMUs). In addition, stabilization fact sheets are under final review by the U.S. EPA and should be released in the near future.

The following table provides examples of interim measures that may be implemented for specific media. Note that these may also be used for final remedies.

Example Interim Measures

<u>Ground Water</u> <ul style="list-style-type: none">• Interceptor Trench/Sump/Subsurface Drain• Pump and Treat System (Source Removal and Containment)• Physical Barriers (Covers/Slurry Walls)
<u>Soils</u> <ul style="list-style-type: none">• Run-off/Run-on Control (Diversion or Collection Devices)• Cap/Cover• Source Removal (Excavation)

Surface Water Release (Point and Non-Point)

- Overflow/Underflow Dams
- Filter Fences
- Run-off/Run-on Control (Diversion or Collection Devices)
- Regrading/Revegetation

Gas Migration Control

- Barriers/Collection (e.g., vapor extraction)/Treatment/Monitoring
- Evacuation (Buildings)

Particulate Emissions

- Truck Wash (Decontamination Unit)
- Revegetation
- Application of Dust Suppressant
- Cover/Cap

Interim Measures for Stabilization Scope of Work Outline

The following scope of work outline may be used as a model for the items that could be included to address stabilization activities at a facility. An example of a detailed scope of work for implementing ISMs is provided in Appendix E.

INTERIM MEASURES FOR STABILIZATION SCOPE OF WORK

I. Introduction/Executive Summary - A brief description of any interim/stabilization measures that are being recommended in Section 3 below to achieve stabilization.

II. Current Conditions - A brief description of the current conditions at the site including a review of any interim measures that are underway at the site.

III. Interim Measures for Stabilization (implementing agency will choose applicable requirements)

- A. Interim Measures Objectives
- B. Description of Interim Measures and Conceptual Design (may include performance-based design)
- C. Construction/Implementation (may be phased)
- D. Operation and Maintenance
- E. Waste Management (e.g., CAMU/TU)

- IV. Sampling and Analysis (if applicable)
 - A. Purpose/Data Quality Objectives (may not be as stringent as for RFI)
 - B. Summary of Sampling Activities
 - C. Field Methods and Sample Analysis
 - 1. Sample Locations and Depths
 - 2. Sample Location Maps
 - 3. Summary Tables including sampling methods, holding times, analytical methods, preservation methods, sample depths, etc.
 - 4. Field Quality Control
 - D. Quality Assurance/Quality Control

- V. Project Management
 - A. Project Organization
 - 1. Personnel/Organizational Chart
 - B. Project Schedule
 - C. Reporting Requirements (e.g., Report of Findings)

- VI. Other Submittals
 - A. Health & Safety Plan
 - B. Public Involvement Plan (optional at implementing agency's discretion)
 - C. Final Report on the Success of the ISMs in meeting stated goal of stabilization.

Chapter III: RCRA Facility Investigation

Introduction

As stated in Chapter I, the objective of the RFI is to evaluate thoroughly the nature and extent of the releases of hazardous waste and hazardous constituents and to gather necessary data to support the CMS and/or interim/stabilization measures (ISMs). The RFI may be focused specifically on ISMs data needs. Alternatively, environmental threats may be discovered or other situations may arise that warrant the implementation of ISMs during the RFI.

The RFI model scopes of work (SOWs) are intended to provide guidance for determining the specific work to be performed by the Permittee/Respondent and to foster timely, concise, and technically adequate submissions by Permittees/Respondents. The model scopes of work are also intended to assist in streamlining the corrective action process. To achieve these goals, it is important when using the model scopes of work to consider facility-specific conditions.

Based on facility-specific circumstances some data collection steps may not be necessary. The implementing agency should endeavor to minimize unnecessary and unproductive investigations, and to focus resources on characterizing actual environmental problems at facilities. For example, for inactive units that do not contain substantial volumes of volatile organic compounds, RFIs will rarely need to address air releases. In addition, RFIs may be phased to avoid unnecessary investigations where a concern can be quickly eliminated. These determinations will be made at the discretion of the implementing agencies.

The information collected during the RFI will be used to either determine the need for the next step in the corrective action process -- the CMS and/or ISMs -- or alternatively, used to support the recommendation for no further action. If, as a result of the RFI, a CMS (or ISMs) is determined to be necessary, data collected during the RFI (and release assessment, if performed), should be used to support the decision-making process for identifying potential technologies to be considered during the CMS (or ISMs). Appendix F presents typical geologic data needs for standard technologies, which may be considered during the CMS or ISMs. These scopes of work should be modified as necessary at the discretion of the implementing agency to require *only* that information necessary to complete the RFI.

The RFI stage of the corrective action process requires ongoing interaction between the Permittee/Respondent and the implementing agency. At various times during the RFI, there are requirements to submit reports to the implementing agency. At the end of the following sections, where appropriate, the required report submissions are noted in detail. At the end of this chapter, a proposed schedule is presented, which would indicate where in the RFI process each required report would need to be submitted to the implementing agency.

Release Assessment [optional phase]

A release assessment may be performed as the first phase of an RFI. This step would take place between the RFA and RFI. The release assessment (or Phase I RFI) may serve as an update to the RFA if there is some uncertainty about releases after the RFA. Some examples of when the release assessment might be appropriate include

when the implementing agency believes confirmatory sampling is needed or when new waste management activities have begun at a facility. In addition, it may help determine if there has been a release to ecological/living resources.

The release assessment may help determine if the RFI should focus on one area before another and/or if interim/stabilization measures are necessary. Therefore, **the release assessment should be viewed as an optional step to minimize corrective action activities (i.e., by focusing or streamlining the RFI) and not as an added step in the process.**

The following scope of work may be used as a model for a release assessment. Note that it serves as an outline, and additional detail may be obtained from the appropriate section of the RFI Scope of Work that follows it.

Release Assessment Scope of Work

1. Release Assessment Investigation
 - 1.1 Objectives
 - Release Assessment Investigation Objectives
 - Rationale for this Release Assessment Investigation
 - 1.2 Description of Current Conditions
 - Facility Background (include findings from RFA--address, at a minimum, each SWMU and AOC identified in the RFA)
 - Summary of previous field conditions/investigations (if any)
 - 1.3 Project Description/Workplan
 - 1) Objectives of Workplan
 - 2) Field Investigation (sample locations map, media to be sampled, number and location of samples to be taken, etc.)
 - 3) Field Sample Collection Procedures
 - 4) Field Measurements
 - 5) QA/QC Procedures
 - 6) Sample Analysis: Methods, Laboratories
 - 7) Data Management: Data Records, Display Format (Tabular, Graphical)
 - 8) Schedule
 - Dates to submit Progress Reports (if necessary)
 - Dates to submit Findings Report
 - 9) Health and Safety Plan
 - 10) Public Involvement Plan (optional at implementing agency's discretion)
2. Findings Report
 - 2.1 Overview
 - Confirmation of Adherence to Workplan
 - Identification and Logging of all Sample Locations
 - Summary of findings
 - 2.2 Data Analysis and Determination of Further Action
 - 1) Analysis of all facility assessments and results
 - 2) Assessment of type and known extent of contamination at each SWMU or area of concern (AOC)

- 3) Recommendation for further action (implementing agency makes decisions)
 - RFI
 - Phase 2 Release Assessment (conducted under rare or unusual circumstances)
 - Interim Measures to achieve stabilization
 - CMS
 - CMI
 - Combinations of the above
 - No Further Action
- 2.3 Provide a Description of the Selected Recommendation
 - Rationale/Objectives
 - Process/Technology/Actions
- 3. Schedule for next phase (addressing major step(s))

[NOTE: With certain exceptions, the provisions set out in Sections I through VII are intended as guidance, and these provisions should be justifiable and tailored to site-specific conditions when incorporated into permits or orders. The exceptions are certain provisions which are based on specific regulatory or statutory requirements applicable to permitting. Regulatory and statutory requirements are binding and do not require site-specific justification. Applicable requirements include: public notice requirements specified in 40 CFR subpart D, requirements in 40 CFR §264.101, and applicable information requirements in 40 CFR § 270.14, including information requirements for SWMUs in § 270.14(d).]

Scope of Work for a RCRA Facility Investigation (RFI)

Purpose

The purpose of the RCRA Facility Investigation (RFI) is to determine the nature and extent of releases of hazardous waste or constituents from regulated units, solid waste management units, and other source areas at a facility and to gather all necessary data to support a Corrective Measures Study. The Permittee/Respondent shall furnish all personnel, materials, and services necessary for, or incidental to, performing the RFI.

Scope

The RCRA Facility Investigation is one step in the corrective action program. The RFI consists of the following components, which for clarity have been designated as sections.

[NOTE: The implementing agency may choose to combine or eliminate some of the sections below. Some typical examples include combining sections III, IV, and V into one "RFI Report" and eliminating section IV.]

Section I: Description of Current Conditions

- A. Facility Background
- B. Preliminary Assessment of Nature and Extent of Contamination
- C. Implementation of Interim/Stabilization Measures

Section II: RFI Workplan

- A. Purpose/Objectives
- B. Project Management
- C. Data Collection/Quality Assurance
- D. Data Management and Reporting
- E. Health and Safety Plan

F. Public Involvement Plan

G. Schedule for Facility Investigation

Section III: Facility Investigation

A. Purpose/Objectives

B. Environmental Setting

C. Source Characterization

D. Contamination Characterization

E. Potential Receptor Identification

Section IV: Preliminary Evaluation of Corrective Measure Technologies by Laboratory or Bench-Scale Studies *[optional]*

Section V: Investigation Results and Analysis

A. Data Analysis

B. Media Cleanup Standards *[where applicable]*

C. Analysis of Risk *[optional]*

Section VI: Progress Reports

Section VII: Proposed Schedule

Section I: Description of Current Conditions

The Permittee/Respondent shall submit, for implementing agency approval, a report (as set forth below) providing the background information on the facility, contamination, and interim measures. The Permittee/Respondent shall indicate in the applicable section if some of this information is not available. This report shall contain information that is consistent with the data gathered during the RFA (and the release assessment, if performed). The current condition report shall be submitted prior to, or concurrently with, the submission of the RFI to allow the implementing agency time to review it.

[NOTE: The RFA (and the release assessment, if performed) may be submitted as the current conditions report, with updates when applicable. The implementing agency also may allow the Permittee/Respondent to reference the appropriate sections of the RFA or other such documents (i.e., permit application or permit). For example, if map information is already present in a permit application, the agency may allow the Permittee to reference the appropriate provisions of the application.]

A. Facility Background

The Permittee's /Respondent's report shall summarize the regional location, pertinent boundary features, general facility physiography, hydrogeology, and historical use of the facility for the treatment, storage, or disposal of solid and hazardous waste. The Permittee's/Respondent's report shall include:

1. Map(s). For permitted facilities, all maps shall be consistent with the requirements set forth in 40 CFR §270.14 and be of sufficient detail and accuracy to locate and report all current and future work performed at the site. (Aerial photographs should be included with SWMUs and AOCs superimposed on them.) Maps shall depict the following (to the extent not already included in map requirements under 40 CFR §270.14 (b)(19) for permitted facilities):

- General geographic location;
- Property lines, with the owners of all adjacent property clearly indicated;
- Topography and surface drainage (with a contour interval of [number] feet and a scale of 1 inch = 100 feet) depicting all waterways, wetlands, flood plains, water features, drainage patterns, and surface-water containment areas;
- All tanks, buildings, utilities, paved areas, easements, rights-of-way, and other features;
- All solid or hazardous waste treatment, storage, or disposal areas active after November 19, 1980;
- All known past solid or hazardous waste treatment, storage or disposal areas regardless of whether they were active on or after November 19, 1980;

- All known past and present product and waste underground tanks or piping;
 - Surrounding land uses (residential, commercial, industrial, agricultural, recreational);
 - The location of all production and groundwater monitoring wells on the facility and within a 2-mile radius of the facility boundary. These wells shall be clearly labeled and ground and top of casing elevations and construction details included (these elevations and details may be included as an attachment); and
 - Wind rose and meteorology.
2. A history and description of ownership and operation, solid and hazardous waste generation, treatment, storage and disposal activities at the facility.
 3. Approximate dates or periods of past product and waste spills, identification of the materials spilled, the amount spilled, the location where spilled, and a description of the response actions conducted (local, state, or federal response units or private parties), including any inspection reports or technical reports generated as a result of the response.
 4. A summary of past permits applied for and/or received, any enforcement actions and their subsequent responses and a list of documents and studies prepared for the facility. This may include information from previous owner/operators, if available.

B. Preliminary Assessment of Nature and Extent of Contamination

The Permittee/Respondent shall prepare and submit, for implementing agency approval, a preliminary report describing the existing information on the nature and extent of contamination.

1. The Permittee's/Respondent's report shall summarize all possible source areas of contamination. This, at a minimum, shall include all RCRA-regulated units, solid waste management units, spill areas, and other suspected source areas of contamination. For each area, the Permittee/Respondent shall identify the following:
 - Location of unit/area (to be depicted on facility map provided in Section I);
 - Quantities of solid and hazardous wastes (both managed and spilled or released);
 - Type of Hazardous waste or constituents (both causing or potentially causing contamination), to the extent known;

- Identification of areas where additional information is necessary; and
 - The results of both the RCRA Facility Assessment (RFA) and a summary of suggested further actions for all SWMUs and Areas of Concern (AOCs) and the release assessment (if performed).
2. The Permittee/Respondent shall prepare a preliminary assessment and description of the existing degree and extent of contamination. This shall include:
- For each medium where the permit or order identifies a release (e.g., soil, ground water, surface water, air, etc.), a description of the existing extent of contamination. This description must include all available monitoring data and qualitative information on the locations and levels of contamination at the facility (both onsite and offsite). Include biodata (e.g., fishkills, distressed vegetation, abnormal individuals of a species, carcasses, tissue studies, etc.). Include a general assessment of the data quality, a map showing the location of all existing sampling points and potential source areas and contour maps showing any existing ground water plumes at the facility (if ground water release). Highlight potential ongoing release areas that would warrant use of interim corrective measures (see Paragraph C. Implementation of Interim/Stabilization Measures).
 - A list and brief description of all previous investigations that have occurred at the facility, who they were conducted for (i.e., agency) and agency contacts.
3. The Permittee/Respondent shall prepare a preliminary assessment and description of potential migration pathways. This shall include:
- All potential migration pathways including information on geology, pedology, hydrogeology, physiography, hydrology, water quality, foodwebs, meteorology, and air quality;
 - Physical properties of contaminants; and
 - An assessment of whether off-site migration of contaminants has occurred; (may include a conceptual model of contaminant migration).
4. The Permittee/Respondent shall describe the potential impact(s) on human health and the environment, including demography, identification of possible sensitive subpopulations (e.g., schools, homes for the elderly, hospitals and ecosystems), ground water and surface water use, and land use.

C. Implementation of Interim/Stabilization Measures

[NOTE: See Chapter II for more guidance and a model scope of work]

The Permittee's/Respondent's report shall document past, present, or proposed interim/stabilization measures at the facility. This shall include:

- Objectives of the interim/stabilization measures: how the measure is mitigating a potential threat to human health and the environment and/or is consistent with and integrated into any long-term solution at the facility;
- Design, construction, operation, and maintenance requirements;
- Schedules for design, construction and monitoring;
- Schedule for progress reports; and
- Data in support of the potential need for future interim measures or related to any assessment undertaken to determine the need for future interim/stabilization measures.

Section II: RFI Workplan

[NOTE: The implementing agency will review the RFI Workplan to determine its technical accuracy and completeness and to determine its effectiveness toward conducting a sound, comprehensive investigation of all contamination at the facility.]

A. Purpose/Objectives

The Permittee/Respondent shall prepare an RFI Workplan. The purpose of the RFI Workplan is to present to the implementing agency the Permittee's/Respondent's specific plans to characterize the nature and extent of contamination. This RFI Workplan shall include the development of several plans, which shall be prepared concurrently. During the RCRA Facility Investigation, it may be necessary to revise the RFI Workplan to increase or decrease the detail of information collected to accommodate facility-specific situations.

[NOTE: The implementing agency generally will require the Permittee/Respondent to test media to determine the presence and levels of hazardous constituents. The implementing agency may use Appendix IX to 40 CFR part 264 - Ground-Water Monitoring List for ground water. For purposes of establishing a list for other media, the implementing agency may use Appendix XI - Concentration-Based Exemption Criteria for Media from the Hazardous Waste Identification Rule (HWIR) proposed rule (57 FR 21450, May 20, 1992). This appendix lists constituents for which analytical methods are available. To streamline the list of constituents requiring analysis, the implementing agency may use other information (e.g., lists of chemicals used at a facility) as appropriate.]

B. Project Management

The Permittee/Respondent shall prepare a Project Management Plan, which

will include a discussion of the technical approach, schedules, (including submittal of the CMS Workplan, if required), budget, and personnel. The Project Management Plan will also include a description of qualifications of personnel performing or directing the RFI, including contractor personnel. This plan shall also document the overall management approach to the RFI.

C. Data Collection/Quality Assurance

To ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented, the Permittee/Respondent shall prepare a Quality Assurance Project Plan (QAPjP) to document all monitoring procedures, sampling, field measurements and sample analyses performed during the investigation to characterize the environmental setting, source, and contamination. The Permittee/Respondent shall use quality assurance, quality control, and chain-of-custody procedures approved by the implementing agency.

These procedures are described in the soon to be released EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5), which will replace Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, (QAMS-005/80, December 29, 1980). The minimum elements of a quality assurance program for data collection activities are in Chapter One of SW-846 [see Appendix B] and are outlined below.

1.0 INTRODUCTION

2.0 QA PROJECT PLAN

- 2.1 Data Quality Objectives
- 2.2 Project Objectives
- 2.3 Sample Collection
- 2.4 Analysis and Testing
- 2.5 Quality Control
- 2.6 Project Documentation
- 2.7 Organization Performing Field or Laboratory Operations
 - 2.7.1 Performance Evaluation
 - 2.7.2 Internal Assessment by QA Function
 - 2.7.3 External Assessment
 - 2.7.4 On-Site Evaluation
 - 2.7.4.1 Field Activities
 - 2.7.4.2 Laboratory Activities
 - 2.7.5 QA Reports

3.0 FIELD OPERATIONS

- 3.1 Field Logistics
- 3.2 Equipment/Instrumentation
- 3.3 Operating Procedures
 - 3.3.1 Sample Management
 - 3.3.2 Reagent/Standard Preparation
 - 3.3.3 Decontamination

- 3.3.4 Sample Collection
- 3.3.5 Field Measurements
- 3.3.6 Equipment Calibration and Maintenance
- 3.3.7 Corrective Action
- 3.3.8 Data Reduction and Validation
- 3.3.9 Reporting
- 3.3.10 Records Management
- 3.3.11 Waste Disposal
- 3.4 FIELD QA AND QC REQUIREMENTS
 - 3.4.1 Control Samples
 - 3.4.2 Acceptance Criteria
 - 3.4.3 Deviations
 - 3.4.4 Corrective Action
 - 3.4.5 Data Handling
- 3.5 QUALITY ASSURANCE REVIEW
- 3.6 FIELD RECORDS
- 4.0 LABORATORY OPERATIONS
 - 4.1 FACILITIES
 - 4.2 EQUIPMENT/INSTRUMENTATION
 - 4.3 OPERATING PROCEDURES
 - 4.3.1 Sample Management
 - 4.3.2 Reagent/Standard Preparation
 - 4.3.3 General Laboratory Techniques
 - 4.3.4 Test Methods
 - 4.3.5 Equipment Calibration and Maintenance
 - 4.3.6 QC
 - 4.3.7 Corrective Action
 - 4.3.8 Data Reduction and Validation
 - 4.3.9 Reporting
 - 4.3.10 Records Management
 - 4.3.11 Waste Disposal
 - 4.4 LABORATORY QA AND QC PROCEDURES
 - 4.4.1 Method Proficiency
 - 4.4.2 Control Limits
 - 4.4.3 Laboratory Control Procedures
 - 4.4.4 Deviations
 - 4.4.5 Corrective Action
 - 4.4.6 Data Handling
 - 4.5 QUALITY ASSURANCE REVIEW
 - 4.6 LABORATORY RECORDS

D. Data Management and Reporting

The Permittee/Respondent shall develop and initiate a Data Management Plan to document and track investigation data and results. This plan shall identify and establish data documentation materials and procedures, project file requirements, and project-related progress reporting procedures and documents. The plan shall also provide the format to be used to present the raw data and conclusions of the investigation.

1. Data Record

The data record shall include the following:

- Unique sample or field measurement code;
- Sampling or field measurement location and sample or measurement type;
- Sampling or field measurement raw data;
- Laboratory analysis ID number;
- Property or component measured; and
- Result of analysis (e.g., concentration).

2. Tabular Displays

The following data shall be presented in tabular displays:

- Unsorted (raw) data;
- Results for each medium or for each constituent monitored;
- Data reduction for statistical analysis;
- Sorting of data by potential stratification factors (e.g., location, soil layer, topography); and
- Summary data.

3. Graphical Displays

The following data shall be presented in graphical formats (e.g., bar graphs, line graphs, area or plan maps, isopleth plots, cross-sectional plots or transects, three dimensional graphs, etc.):

- Sampling location and sampling grid;
- Boundaries of sampling area, and areas where additional data are required;
- Levels of contamination at each sampling location;
- Geographical extent of contamination;
- Contamination levels, averages, and maxima;
- Changes in concentration in relation to distance from the source, time, depth or other parameters;

- Features affecting intramedia transport; and
- Potential receptors.

E. Health and Safety Plan

The Permittee/Respondent shall submit a Health and Safety Plan for all field activity, although it does not require review and approval by the implementing agency. The Health and Safety Plan shall be developed as a stand alone document but may be submitted with the RFI Workplan.

1. Major elements of the Health and Safety Plan shall include:
 - Facility description including availability of resources such as roads, water supply, electricity, and telephone service;
 - Description of the known hazards and evaluation of the risks associated with each activity conducted;
 - A list of key personnel and alternates responsible for site safety, response operations, and protection of public health;
 - Delineation of work area;
 - Description of protective clothing or other protective items to be worn by personnel in work area;
 - Procedures to control site access;
 - Description of decontamination procedures for personnel and equipment;
 - Site emergency procedures;
 - Emergency medical care needed for injuries and toxicological problems;
 - Description of requirements for an environmental surveillance program;
 - Routine and special training required for response personnel; and
 - Procedures for protecting workers from weather-related problems.
2. The Facility Health and Safety Plan shall be consistent with:
 - NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);
 - EPA Order 1440.1 - Respiratory Protection;

- EPA Order 1440.3 - Health and Safety Requirements for Employees engaged in Field Activities;
- Facility Contingency Plan;
- EPA Standard Operating Safety Guide (1984);
- OSHA regulations particularly in 29 CFR 1910 and 1926;
- State and local regulations; and
- Other applicable EPA guidance as provided.

F. Public Involvement Plan

[NOTE: It is strongly recommended that the implementing agency oversee Permittee's /Respondent's public involvement activities. Public involvement is an important part of RCRA corrective action. The public must be notified of significant changes to permits and orders regarding corrective action. In some cases, they also must be provided with the opportunity to review and comment on the changes. Notice requirements for permits are set out at 40 CFR Part 270 subpart D. Further guidance on this process is in the CMS, and in the document entitled RCRA Public Involvement Manual (EPA/530-R-93-006, September, 1993).]

All Public Involvement Plans prepared by the Permittee/Respondent shall be submitted to the implementing agency for comment and approval prior to use. Permittees/Respondents must never appear to represent or speak for the implementing agency before the public, other government officials, or the media.

Public Involvement activities that may be required of the Permittee/Respondent include the following:

1. Conducting an open house or informal meeting (i.e., availability session) in a public location where people can talk to agency officials and Permittee/Respondent on a one-to-one basis;
2. Preparing fact sheets summarizing current or proposed corrective action activities (all fact sheets should be reviewed by the implementing agency prior to public distribution);
3. Communicating effectively with people who have vested interest in the corrective action activities, (e.g., providing written or verbal information in the foreign language of a predominantly non-English-speaking community); and
4. Maintaining an easily accessible repository (such as a town hall or public library or the facility itself, in some limited circumstances) of information on the facility-specific corrective action program, including the order or permit, approved workplans, and/or other reports.

A schedule for community relations activities shall be included in the Public Involvement Plan.

G. Schedule for Facility Investigation

[NOTE: Schedules should be as detailed as possible, but can be represented as a series of contingent activities (e.g., sampling beginning within 30 days of RFI Workplan approval). This schedule may be required or revised during the next section entitled "Facility Investigation".]

1. Sampling
2. Analysis
3. Reports
4. Public Involvement Activities
5. Laboratory or Bench-Scale Studies

Section III: Facility Investigation

A. Purpose/Objectives

The Facility Investigation phase of an RFI is the first step of the *implementation* process. Prior to this implementation phase, all documentation and reports for the Description of Current Conditions and RFI Workplan are drafted and submitted to the implementing agency for review and approval. The Permittee/Respondent must have approval prior to implementing the procedures outlined in the RFI Workplan. Throughout the RFI implementation phase, it is critical that the Permittee/Respondent comply with report submission requirements. The Permittee/Respondent shall submit both progress reports and a draft RFI Report, which must be submitted to the implementing agency for review. At the direction of the implementing agency, the Permittee/Respondent shall develop in final format the RFI Report, which will incorporate any comments received on the draft report.

The Permittee/Respondent shall conduct those investigations (including sampling) as approved in the RFI Workplan with all modifications to: characterize the facility (Environmental Setting); define the source (Source Characterization); define the degree and three dimensional extent of contamination (Contamination Characterization); and identify actual or potential receptors.

The investigations should result in data of adequate technical quality to support the development and evaluation of the corrective measure alternative(s) during the Corrective Measures Study (CMS) and/or ISMs.

[NOTE: As discussed in the 40 CFR part 264 subpart S proposed rule (55 FR 30875-30876, July 27, 1990), the implementing agency may require the Permittee/Respondent to conduct a CMS whenever concentrations of hazardous constituents in an aquifer, surface water, soils, or air exceed action levels for any environmental medium. Action levels are health- and environmental-based

levels determined by the agency to be indicators for protection of human health and the environment. EPA's recommended action levels are set out in the subpart S proposed rule. EPA currently is working on revisions to the recommended levels and will provide notice of any changes to the subpart S recommendations.]

The site investigation activities (including sampling) shall follow the plans set forth in the RFI Workplan.

[NOTE: The implementing agency may require the investigation to be phased (e.g., by media or SWMU/Area of Contamination), the amount of information collected to be limited, and/or the level of detail to be reduced.]

B. Environmental Setting

The Permittee/Respondent shall collect information to supplement and verify existing information on the environmental setting at the facility (when information already submitted to the implementing agency is not sufficient). The implementing agency may request additional information not included on the following lists. The Permittee/Respondent shall characterize the following areas (the implementing agency should require characterization of some or all of the following areas depending on the specifics of the site):

1. Hydrogeology

The Permittee/Respondent shall conduct a program to evaluate hydrogeologic conditions at the facility. This program shall provide the following information:

- A description of the regional and facility-specific geologic and hydrogeologic characteristics affecting ground-water flow beneath the facility, including:
 - Regional and facility-specific stratigraphy including: description of strata including strike and dip, and identification of stratigraphic contacts;
 - Structural geology including: description of local and regional structural features (e.g., folding, faulting, tilting, jointing, etc.);
 - Depositional history;
 - Areas and amounts of recharge and discharge;
 - Influence of tidal actions on groundwater flow regimes near coastal areas or large rivers;
 - Regional and facility-specific ground-water flow patterns; and
 - Seasonal variations in the ground-water flow regime.

- An analysis of any topographic features that might influence the ground-water flow system. (Note: Stereographic analysis of aerial photographs may aid in this analysis.)
- A representative and accurate classification and description of the hydrogeologic units based on field data, tests, and cores that may be part of the migration pathways at the facility (i.e., the aquifers and any intervening saturated and unsaturated zones), including, but not limited to:
 - Hydraulic conductivity, intrinsic permeability (particularly when non-aqueous phase liquids (NAPLs) are present), and porosity (total and effective);
 - Lithology, grain size, sorting, degree of cementation;
 - An interpretation of hydraulic interconnections between saturated zones; and
 - The attenuation capacity and mechanisms of the natural earth materials (e.g., ion exchange capacity, organic carbon content, mineral content, etc.).
- Based on field studies and cores, structural geology and hydrogeologic cross sections showing the extent (depth, thickness, lateral extent) of hydrogeologic units that may be part of the migration pathways identifying:
 - Sand and gravel in unconsolidated deposits;
 - Zones of fracturing or channeling in consolidated and unconsolidated deposits;
 - Zones of higher permeability or low permeability that might direct and restrict the flow of contaminants;
 - The uppermost aquifer: geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs;
 - Water-bearing zones above the first confining layer that may serve as a pathway for contaminant migration, including perched zones of saturation; and
 - All other geologic formations, or parts thereof, yielding a significant amount of ground water.
- Based on data obtained from ground-water monitoring wells and piezometers installed upgradient and downgradient of the potential contaminant source, a representative description of water level or fluid pressure monitoring including:

- Water level contour and/or potentiometric maps;
- Hydrologic cross sections showing vertical flow gradients;
- The flow system, including the vertical and horizontal components of flow; and
- Any temporal changes in hydraulic gradients, (due to tidal or seasonal influences, etc.)
- A description of man-made influences that may affect the hydrogeology of the site, identifying:
 - Active and inactive local water-supply and production wells with an approximate schedule of pumping; and
 - Man-made hydraulic structures (pipelines, french drains, ditches, unlined ponds, septic tanks, NPDES outfalls, retention areas, etc.).

2. Soils

[NOTE: Soil characterization includes the chemical, physical, and mineralogical analysis of soils. The implementing agency may vary the required level of characterization based on data needs for the CMS/ISMs. Where removal of contaminated soil is the logical remedial action, limited physical information may be required. Where in-situ soil treatment may be the remedial action, a full characterization may be appropriate. Where an estimation of contaminant transport is necessary, some type of intermediate level characterization may be required.]

The Permittee/Respondent shall conduct a program to characterize the soil and rock units potentially affected by contaminant release(s). Such characterization shall include, but not be limited to, the following information:

- Where remediation by removal of soils is the only corrective measure option, provide map(s) and perpendicular cross sections showing:
 - The extent of contamination;
 - Depth of groundwater; and
 - The consistency and distribution of soils (using the Unified Soil Classification System (USCS) (ASTM D 2487));

[NOTE: The above information is important for stability of cuts. If such factors are not considered when excavating, piling, or sloping material, the stability of surrounding walls and piles of material may be compromised.]

- Where remediation by removal is the likely option, and it is necessary to determine the extent of migration (e.g., to assess the mobility of wastes from an unlined surface impoundment or landfill), provide the following in addition to the requirements immediately above:
 - Depth to bedrock and the characteristics of the bedrock including discontinuities such as faults, fissures, joints, fractures, sinkholes, etc.;
 - A detailed soil survey conducted according to USDA Soil Conservation Service (SCS) procedures including:
 - USDA Textural Soil Classification and soil profiles showing stratifications or zones which may affect or direct the subsurface flow;
 - Hydraulic conductivity and the SCS hydrologic group classification of A, B, C or D;
 - Relative permeability (only if the waste may have changed the soil's hydraulic conductivity, such as concentrated organics);
 - Storage capacity (if excavated soil will be stored);
 - Shrink-swell potential (where extreme dry weather could lead to the formation of cracks);
 - Potential for contaminant transport via erosion, using the Universal Soil Loss Equation;
 - Soil sorptive capacity;
 - Cation exchange capacity;
 - Soil organic content; and
 - Soil pH.
 - The following contaminant characteristics must be included:
 - Physical state;
 - Viscosity;
 - pH;
 - pKa;

- Density;
 - Water solubility;
 - Henry's Law Constant;
 - K_{ow} ;
 - Biodegradability; and
 - Rates of hydrolysis, photolysis and oxidation.
- Where in-situ soil treatment will likely be the remediation, the above information and the following additional information must be provided:
 - Bulk density;
 - Porosity;
 - Grain size distribution;
 - Mineral content;
 - Soil moisture profile;
 - Unsaturated hydraulic conductivity;
 - Effect of stratification on unsaturated flow; and
 - Infiltration and evapotranspiration.

3. Surface Water and Sediment

The Permittee/Respondent shall conduct a program to characterize the surface water bodies likely to be affected by releases from the facility. Such characterization shall include the following activities and information:

- Description of the temporal and permanent surface water bodies including:
 - For lakes and estuaries: location, elevation, surface area, inflow, outflow, depth, temperature stratification, and volume;
 - For impoundments: location, elevation, surface area, depth, volume, freeboard, and purpose of impoundment;
 - For streams, ditches, drains, swamps and channels: location, elevation, flow, velocity, depth, width, seasonal fluctuations, and flooding tendencies (i.e., 100-year event);
 - For wetlands obtain any available delineation;

- Containment measures in place (e.g., levees, concrete lining, etc.)
- Drainage patterns; and
- Evapotranspiration rates.
- Description of the chemistry of the natural surface water and sediments. This includes determining:
 - pH;
 - total dissolved solids;
 - total suspended solids;
 - biological oxygen demand;
 - alkalinity;
 - conductivity;
 - dissolved oxygen profiles;
 - nutrients (NH_3 , $\text{NO}_3^-/\text{NO}_2^-$, PO_4^{3-});
 - chemical oxygen demand;
 - total organic carbon; and
 - specific contaminant concentrations.
- Description of sediment characteristics including:
 - Deposition area;
 - Thickness profile; and
 - Physical and chemical parameters (e.g., grain size, density, organic carbon content, ion exchange capacity, pH, etc.).

4. Air

The Permittee/Respondent shall provide information characterizing the climate in the vicinity of the facility. Such information shall include:

- A description of the following parameters:
 - Annual and monthly rainfall averages;
 - Monthly temperature averages and extremes;
 - Wind speed and direction;

- Relative humidity/dew point;
 - Atmospheric pressure;
 - Evaporation data;
 - Development of inversions; and
 - Climate extremes that have been known to occur in the vicinity of the facility, including frequency of occurrence.
- A description of topographic and man-made features that affect air flow and emission patterns, including:
 - Ridges, hills, or mountain areas;
 - Canyons or valleys;
 - Surface water bodies (e.g., rivers, lakes, bays, etc.);
 - Wind breaks and forests; and
 - Buildings.

[NOTE: The above descriptions should be updated to include any air modeling that is performed.]

C. Source Characterization

[NOTE: The implementing agency may focus source characterization on the specific units, disposal areas, or other areas (e.g., exposure pathways) that have been identified by the agency to be of concern.]

The Permittee/Respondent shall collect analytical data to characterize the wastes and the areas where wastes have been placed, collected or removed including: type; quantity; physical form; disposition (containment or nature of disposal); and any facility characteristics that may affect or have affected a release (e.g., facility security, engineered barriers). This shall include quantification of the following specific characteristics, at each source area:

1. Unit/Disposal Area/Area of Concern Characteristics:
 - Location of unit/disposal area;
 - Type of unit/disposal area;
 - Design features;
 - Operating practices (past and present) including the history of releases;
 - Period of operation;

- Age of unit/disposal area;
 - General physical conditions; and
 - Method used to close the unit/disposal area.
2. Waste Characteristics:
- Type of waste placed in the unit;
 - Hazardous classification (e.g., flammable, reactive, corrosive, oxidizing or reducing agent);
 - Quantity; and
 - Chemical composition.
 - Physical and chemical characteristics;
 - Physical form (solid, liquid, gas);
 - Physical description (e.g., powder, oily sludge);
 - Temperature;
 - pH;
 - General chemical class (e.g., acid, base, solvent);
 - Molecular weight;
 - Density;
 - Boiling point;
 - Viscosity;
 - Solubility in water;
 - Cohesiveness of the waste;
 - Vapor pressure; and
 - Flash point.
 - Migration and dispersal characteristics of the waste;
 - Sorption;
 - Biodegradability, bioconcentration, biotransformation;
 - Photodegradation rates;

- Hydrolysis rates; and
- Chemical transformations.

The Permittee/Respondent shall document the procedures used in making the above determinations.

D. Contamination Characterization

The Permittee/Respondent shall collect analytical data on ground water, soils, surface water, sediment, air, and subsurface gas likely to be affected by releases from the facility. This data shall be sufficient to define the extent, origin, direction, and rate of movement of contaminant plumes. Data shall include:

- time and location of sampling;
- media sampled;
- concentrations found;
- conditions during sampling; and
- the identity of the individuals performing the sampling and analysis.

The Permittee/Respondent shall address the following types of contamination at the facility:

1. Groundwater Contamination

The Permittee/Respondent shall conduct a groundwater investigation to characterize any plumes of contamination at the facility. This investigation shall, provide the following information:

- A description of the horizontal and vertical extent of any immiscible or dissolved plume(s) originating from the facility;
- The horizontal and vertical direction of contaminant movement;
- The velocity of contaminant movement;
- The horizontal and vertical concentration profiles of Appendix IX constituents in the plume(s);
- An evaluation of factors influencing the plume movement; and
- An extrapolation of future contaminant movement over the time period specified by the implementing agency.

The Permittee/Respondent shall document the procedures used in making the above determinations (e.g., well design, well construction, geophysics, modeling, etc.).

[NOTE: It may be helpful for the Permittee/Respondent to refer to applicable guidance documents such as "RCRA Ground-water Monitoring Technical Enforcement Guidance Document (TEGD)," OSWER Directive 9950.1, September 1986.]

2. Soil Contamination

The Permittee/Respondent shall conduct an investigation to characterize the contamination of the soil and rock units above the water table in the vicinity of the contaminant release. The investigation shall include the following information:

- A description of the vertical and horizontal extent of contamination;
- A description of contaminant and soil chemical properties within the contaminant source area and plume. This includes contaminant solubility, speciation, adsorption, leachability, exchange capacity, biodegradability, hydrolysis, photolysis, oxidation and other factors that might affect contaminant migration and transformation;
- Specific contaminant concentrations;
- Velocity and direction of contaminant movement; and
- An extrapolation of future contaminant movement over the time period specified by the implementing agency.

The Permittee/Respondent shall document the procedures used in making the above determinations.

[NOTE: Analytical data collected under Section III.C. "Source Characterization", Number 2. "Waste Characteristics" may be relevant to this section. This data may be used to supplement this section or elements of the two sections regarding waste characteristics may be combined.]

3. Surface Water and Sediment Contamination

The Permittee/Respondent shall conduct a surface water investigation to characterize contamination in surface water bodies resulting from contaminant releases at the facility. The Permittee/Respondent may also be required to characterize contamination from storm water runoff.

The investigation shall include the following information:

- A description of the horizontal and vertical extent of any immiscible or dissolved plume(s) originating from the facility, and the extent of contamination in underlying sediments;
- The horizontal and vertical direction of contaminant movement;
- The contaminant velocity;

- An evaluation of the physical, biological, and chemical factors influencing contaminant movement;
- An extrapolation of future contaminant movement over the time period specified by the implementing agency; and
- A description of the chemical and physical properties of the contaminated surface waters and sediments. This includes determining the pH, total dissolved solids, specific contaminant concentrations, etc.

The Permittee/Respondent shall document the procedures used in making the above determinations.

4. Air Contamination

The Permittee/Respondent shall conduct an investigation to characterize the particulate and gaseous contaminants released into the atmosphere. This investigation shall provide the following information:

- A description of the horizontal and vertical direction and velocity of contaminant movement;
- The rate and amount of the release; and
- The chemical and physical composition of the contaminants(s) released, including horizontal and vertical concentration profiles.

The Permittee/Respondent shall document the procedures used in making the above determinations.

5. Subsurface Gas Contamination

The Permittee/Respondent shall conduct an investigation to characterize subsurface gases emitted from buried hazardous waste and hazardous constituents in the ground water. This investigation shall include the following information:

- A description of the horizontal and vertical extent of subsurface gas migration;
- The chemical composition of the gases being emitted;
- The rate, amount, and density of the gases being emitted; and
- Horizontal and vertical concentration profiles of the subsurface gases emitted.

The Permittee/Respondent shall document the procedures used in making the above determinations.

E. Potential Receptor Identification

The Permittee/Respondent shall collect data describing the human populations and environmental systems that currently or potentially are at risk of contaminant exposure from the facility. Chemical analysis of biological samples may be needed. Data on observable effects in ecosystems may also be required by the implementing agency. The following characteristics shall be identified:

1. Local uses and possible future uses of ground water:
 - Type of use (e.g., drinking water source: municipal or residential, agricultural, domestic/non-potable, and industrial) and
 - Location of ground water users including wells and discharge areas.
2. Local uses and possible future uses of surface waters characterized in the "Environmental Setting" or "Contamination Characterization" Sections above:
 - Domestic and municipal (e.g., potable and lawn/gardening watering);
 - Recreational (e.g., swimming, fishing);
 - Agricultural;
 - Industrial; and
 - Environmental (e.g., fish and wildlife propagation).
3. Authorized or unauthorized human use of or access to the facility and adjacent lands, including but not limited to:
 - Recreation;
 - Hunting;
 - Residential;
 - Commercial;
 - Zoning; and
 - Relationship between population locations and prevailing wind direction.
4. A demographic profile of the people who use or have access (authorized or unauthorized) to the facility and adjacent land, including, but not limited to: age; sex; sensitive subgroups; and environmental justice concerns.

5. A description of the ecology of the facility and adjacent areas, including habitat and species present and expected to be present.
6. A description of the biota in surface water bodies on, adjacent to, or affected by the facility.
7. A description of any state and federal endangered or threatened species (both proposed and listed) near the facility.

Section IV: Preliminary Evaluation of Corrective Measure Technologies by Laboratory or Bench-Scale Studies *[optional]*

The Permittee/Respondent may conduct laboratory and/or bench scale studies to determine the applicability of a corrective measure technology or technologies to facility conditions. These studies may be conducted at any time during the RFI; the intent is to collect information that will be useful in evaluating potential technologies and to conduct additional studies when sufficient data is available and useful. The Permittee/Respondent shall analyze the technologies, based on literature review, vendor contracts, and past experience to determine the testing requirements.

[NOTE: Appendix F presents standard geologic data requirements for consideration in the technology decision process, and Appendix A provides references for technical assistance (e.g., "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" - Chapter 5).]

The Permittee/Respondent shall develop a testing plan identifying the type(s) and goal(s) of the study or studies, the level of effort needed, and the procedures to be used for data management and interpretation.

Upon completion of the testing, the Permittee/Respondent shall evaluate the testing results to assess the technology or technologies with respect to the site-specific questions identified in the test plan.

The Permittee/Respondent shall prepare a report summarizing the testing program and its results (if studies are performed), both positive and negative.

Section V: Investigation Results and Analysis

The Permittee/Respondent shall prepare an analysis and summary of all facility investigations and their results. The investigation data should be sufficient in quality (e.g., quality assurance procedures have been followed) and quantity to describe the nature and extent of contamination, potential threat to human health and/or the environment, and to support the Corrective Measures Study and/or ISMs.

A. Data Analysis

The Permittee/Respondent shall analyze all facility investigation data outlined in Section III and prepare a report on the type and extent of contamination at

the facility including sources and migration pathways. The report shall describe the extent of contamination (qualitative/quantitative) in relation to background levels indicative for the area.

B. Media Cleanup Standards

The Permittee/Respondent shall provide information as required by the implementing agency to support the agency's selection/development for media cleanup standards of any releases that may have adverse effects on human health and the environment due to migration of waste constituents. Media cleanup standards are to contain such terms and provisions as necessary to protect human health and the environment, including, the provisions stated below.

[NOTE: Implementing agencies should determine which of the following items under 1 through 4 below are necessary on a site-specific basis.]

1. Ground-water Cleanup Standards

The Permittee/Respondent shall provide information to support the implementing agency's selection/development of ground-water cleanup standards for all of the Appendix IX constituents found in the ground water during the Facility Investigation (Section III). The implementing agency may require the following information:

- For any constituents for which an MCL has been promulgated under the Safe Drinking Water Act, the MCL value;
- Background concentration of the constituent in the ground water; or
- An alternate standard (e.g., an alternate concentration limit (ACL) for a regulated unit) to be approved by the implementing agency.

2. Soil Cleanup Standards

The Permittee/Respondent shall provide information to support the implementing agency's selection/development of soil cleanup standards. The implementing agency may require the following information:

- The volume and physical and chemical characteristics of the wastes in the unit;
- The effectiveness and reliability of containing, confining, and collecting systems and structures in preventing contaminant migration;
- The hydrologic characteristics of the unit and the surrounding area, including the topography of the land around the unit;

- The patterns of precipitation in the region;
- The existing quality of surface soils, including other sources of contamination and their cumulative impacts on surface soils;
- The potential for contaminant migration and impact to the underlying groundwater;
- The patterns of land use in the region;
- The potential for health risks caused by human exposure to waste constituents; and
- The potential for damage to domestic animals, wildlife, food chains, crops, vegetation, and physical structures caused by exposure to waste constituents.

3. Surface Water and Sediment Cleanup Standards

The Permittee/Respondent shall provide information to support the implementing agency's selection/development of surface water and sediment cleanup standards. The implementing agency may require the following information:

- The volume and physical and chemical characteristics of the wastes in the unit;
- The effectiveness and reliability of containing, confining, and collecting systems and structures in preventing contaminant migration;
- The hydrologic characteristics of the unit and the surrounding area, including the topography of the land around the unit;
- The patterns of precipitation in the region;
- The quantity, quality, and direction of ground-water flow;
- The proximity of the unit to surface waters;
- The current and potential uses of nearby surface waters and any water quality standards established for those surface waters;
- The existing quality of surface waters, including other sources of contamination and their cumulative impacts on surface waters;
- The potential for damage to domestic animals, wildlife, food chains, crops, vegetation and physical structures caused by exposure to waste constituents;
- The patterns of land use in the region; and

- The potential for health risks caused by human exposure to waste constituents.

4. Air Cleanup Standards

The Permittee/Respondent shall provide information to support the implementing agency's selection/development of air cleanup standards. The implementing agency may require the following information:

- The volume and physical and chemical characteristics of the wastes in the unit, including its potential for the emission and dispersal of gases, aerosols and particulates;
- The effectiveness and reliability of systems and structures to reduce or prevent emissions of hazardous constituents to the air;
- The operating characteristics of the unit;
- The atmospheric, meteorological, and topographic characteristics of the unit and the surrounding area;
- The existing quality of the air, including other sources of contamination and their cumulative impact on the air;
- The potential for health risks caused by human exposure to waste constituents; and
- The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.

5. Other Relevant Cleanup Standards

The Permittee/Respondent shall identify all relevant and applicable standards for the protection of human health and the environment (e.g., National Ambient Air Quality Standards, Federally approved state water quality standards, etc.).

C. Analysis of Risk *[optional]*

The implementing agency may require the Permittee/Respondent to prepare an analysis of risk at the facility. This analysis may include ecological as well as human health risk. Generally a baseline risk assessment would be conducted during the RFI stage with further analysis occurring during the CMS stage.

[NOTE: While some implementing agencies may require the Permittee/Respondent to conduct a risk assessment, the policy on conducting risk assessments in the corrective action program is evolving. Currently, their use is optional at the discretion of the implementing agency and should be based on site-specific conditions. Appendix G presents a list of available guidance for conducting risk assessments.]

Section VI: Progress Reports

The Permittee/Respondent will, at a minimum, provide the implementing agency with signed [monthly, bimonthly, or quarterly] progress reports. These reports may be required to contain the following information, but agency requirements are not limited to this list:

1. A description and estimate of the percentage of the RFI completed;
2. Summaries of *all* findings in the reporting period, including results of any sampling and analysis;
3. Summaries of *all* changes made in the RFI during the reporting period;
4. Summaries of *all* contacts with representative of the local community, public interest groups or State government during the reporting period;
5. Summaries of *all* contacts made regarding access to off-site property;
6. Summaries of *all* problems encountered during the reporting period;
7. Actions being taken to rectify problems;
8. Changes in relevant personnel during the reporting period;
9. Projected work for the next reporting period; and
10. Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

Section VIII: Proposed Schedule

The Permittee/Respondent will provide the implementing agency with RFI reports according to the following schedule:

<u>Facility Submission</u>	<u>Due Date</u>
Description of Current Conditions (Section I)	[DATE]
RFI Workplan (Section II)	[DATE]
Draft RFI Report (Sections III and V)	[NUMBER] days after RFI Workplan Approval
Final RFI Report (Sections III and V) comments on Draft RFI	[NUMBER] days after the implementing agency Report, (date

of approval
of the CMS

may be tied to this submittal
Workplan, if required,)

Laboratory and Bench-
Scale Studies
(Section IV)

Concurrent with Final RFI
Report

Progress Reports on
Sections I through V

[MONTHLY, BI-
MONTHLY, other]

[see Section VI above for guidance on progress reports.]

Chapter IV: Corrective Measures Study

Introduction

The purpose of the Corrective Measures Study (CMS) portion of the RCRA corrective action process is to identify and evaluate potential remedial alternatives for the releases that have been identified at a facility. The scope and requirements of the CMS, however, need to be balanced with the expeditious initiation of remedies and rapid restoration of contaminated media, both major goals of the RCRA corrective action program. In keeping with these goals, the implementing agency may allow a streamlined approach to remedy selection, enabling a facility to move from facility investigation to corrective measures implementation more rapidly. Information gathered during the implementation of ISMs should be used to augment the CMS and avoid duplicative efforts. Aspects of the implemented ISMs may be viewed as an early and focused CMS. In some cases, the ISMs may substitute for the final CMS/CMI after review and approval by the implementing agency. The Permittee/Respondent shall furnish all personnel, materials, and services necessary for, or incidental to, performing the CMS.

It is anticipated that Permittees/Respondents of larger sites with complex environmental problems may need to evaluate several alternative remedial approaches in determining the most appropriate remedy for the facility. For other RCRA facilities, however, it may be appropriate for the implementing agency to allow the Permittee/Respondent to evaluate only one alternative.

Studies needed for developing sound, environmentally protective remedies may be relatively straightforward at some RCRA facilities, and may not require extensive evaluation of a number of remedial alternatives. Such "streamlined" CMS's can be tailored to fit the complexity and scope of the remedial situation presented by the facility. For example, if the environmental problems at a facility were limited to a small area of soils with low-level contamination, the CMS might be limited to a single treatment approach that is known to be effective for such types of contamination. In a different situation, such as with a large municipal-type landfill, it may be obvious that the source control element of the CMS should be focused on containment options, while contaminated media remediation may require more extensive study. It is anticipated that a streamlined or highly focused CMS may be appropriate in the following types of situations:

1. "Low risk" facilities. Facilities where environmental problems are relatively small, and where releases present minimal exposure concerns. Such facilities might have limited on-site soil contamination.
2. High quality remedies proposed by the Permittee/Respondent. The Permittee/Respondent may propose a remedy which is highly protective (such as an action which would remediate to non-detectable levels) and which is consistent with all other remedial objectives.
3. Facilities with straightforward remedial solutions. For some contamination problems, standard engineering solutions can be applied that have proven effective in similar situations. An example might be cleanup of soils contaminated with PCBs by excavation, removal and treatment, then disposal.

4. Phased remedies. At some facilities the nature of the environmental problem will dictate development of the remedy in phases, which would focus on one aspect (such as groundwater remediation) of the remedy, or one area of the facility that requires immediate measures to control further environmental and human exposure problems. In these situations, the CMS could be focused on that specific element of the overall remedy, with follow-up studies as appropriate to deal with the remaining remedial needs at the facility. Such studies should be documented in later CMS phases. For particularly large facilities, several phases should be designated.

It is also recognized that, in contrast to the above situations, some facilities with very extensive or highly complex environmental problems will likely require an assessment of a number of alternative remedial technologies or approaches. The following are examples of situations which would likely need relatively extensive studies to be done to support sound remedy selection decisions:

1. "High risk" facilities with complex remedial solutions. Such facilities might have large volumes of both concentrated wastes and contaminated soils, for which several treatment technologies could be applied to achieve varying degrees of effectiveness (such as reduction of toxicity or volume), in conjunction with different types of containment systems for residuals.
2. Contaminant problems for which several different approaches are practicable. There may be several, quite distinct technical approaches for remediating a problem at a facility, each of which offers varying degrees of long-term reliability, and could be implemented over different time frames. In such cases, remedy selection decisions will necessarily involve a difficult balancing of competing goals and interests. Such decisions must be supported with adequate information.
3. Facilities for which innovative treatment technologies may be viable.

In addition to the above examples of situations calling for either a limited, or relatively complex CMS, other studies will fall in the middle of that range. Given the wide range of possibilities for structuring the CMS, this guidance encourages the implementing agency to focus the evaluation on appropriate remedies, tailoring the scope and substance of the study to fit the complexity of the situation. It will also be the responsibility of the implementing agency to determine what level of evaluation and documentation is necessary in order to support the ultimate remedy selection for the facility.

The implementing agency has the discretion to not require sections of the plan and/or report that are specified in this guidance, in those site-specific situations where all the requirements may not be appropriate. The implementing agency also may require the Permittee/Respondent to conduct additional studies beyond what is discussed in the scope of work in order to support the CMS. The Permittee/Respondent will furnish all personnel, materials and services necessary to conduct the additional tasks.

[NOTE: With certain exceptions, the provisions set out in sections I through IV are intended as guidance, and these provisions should be justifiable and tailored to site-specific conditions when incorporated into permits or orders. The exceptions are certain provisions which are based on specific regulatory or statutory requirements applicable to permitting. Regulatory and statutory requirements are binding and do not require site-specific justification. Applicable requirements include: public notice requirements specified in 40 CFR subpart D and requirements in 40 CFR §264.101. The following Scope of Work (SOW) for the Corrective Measures Study is intended to be a flexible document capable of addressing both simple and complex site situations.]

Scope of Work for a Corrective Measures Study (CMS)

Purpose

The purpose of the Corrective Measures Study (CMS) portion of the RCRA corrective action process is to identify and evaluate potential remedial alternatives for the releases that have been identified at a facility.

Scope

A Corrective Measures Study Workplan and Corrective Measures Study Report are, unless otherwise specified by the implementing agency, required elements of the CMS. The CMS consists of the following components:

Section I: Corrective Measures Study Workplan

Section II: Corrective Measures Study Report

- A. Introduction /Purpose
- B. Description of Current Conditions
- C. Corrective Action Objectives
- D. Identification, Screening and Development of Corrective Measure Alternatives
- E. Evaluation of A Final Corrective Measure Alternative
- F. Recommendation by a Permittee/Respondent for a Final Corrective Measure Alternative
- G. Public Involvement Plan

Section III: Progress Reports

Section IV: Proposed Schedule

Section I: Corrective Measures Study Workplan

The Corrective Measures Study (CMS) Workplan may be required by the implementing agency. If required, it shall include the following elements:

1. A site-specific description of the overall purpose of the Corrective Measure Study;
2. A description of the corrective measure objectives, including proposed target media cleanup standards (e.g., promulgated federal and state standards, risk derived standards) and points of compliance or a description of how a risk assessment will be performed (e.g., guidance documents);
3. A description of the specific corrective measure technologies and/or corrective measure alternatives which will be studied;
4. A description of the general approach to investigating and evaluating potential corrective measures;
5. A detailed description of any proposed pilot, laboratory and/or bench scale studies;

[NOTE: Appendix A provides references for technical assistance (e.g., "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" - Chapter 5.)]

6. A proposed outline for the CMS Report including a description of how information will be presented; and
7. A description of overall project management including overall approach, levels of authority (include organization chart), lines of communication, project schedules, budget and personnel. Include a description of qualifications for personnel directing or performing the work.

Section II: Corrective Measures Study Report

The Corrective Measures Study (CMS) Report shall include the following elements:

A. Introduction/Purpose

The Permittee/Respondent shall describe the purpose of the document and provide a summary description of the project.

B. Description of Current Conditions

The Permittee/Respondent shall include a brief summary/discussion of any new information that has been discovered since the RFI current conditions report was finalized. This discussion should concentrate on those issues which could significantly affect the evaluation and selection of the corrective measures alternative(s).

[NOTE: The implementing agency may allow the Permittee/Respondent to

reference the RFI current conditions report in lieu of additional discussion in this section.]

C. Media Cleanup Standards

The Permittee/Respondent may propose media cleanup standards. The standards must be based on promulgated federal and state standards, risk derived standards, all data and information gathered during the corrective action process (e.g., from interim measures, RCRA Facility Investigation, etc.), and/or other applicable guidance documents. If no other guidance exists for a given contaminant and media, the Permittee/Respondent shall propose and justify a media cleanup standard.

[NOTE: The implementing agency may set cleanup standards before the CMS stage. The information to support the agency's decision may be submitted by the Permittee/Respondent as part of the investigation analysis (see Section V of the RFI scope of work). The Permittee/Respondent may propose to modify the media cleanup standards during the CMS. As a result of this or other new information, the implementing agency may modify the cleanup standards. Final media cleanup standards are determined by the implementing agency when the remedy is selected and are documented in the Statement of Basis/Response to Comments (SB/RTC) or permit modification.]

D. Identification, Screening, and Development of Corrective Measure Alternatives

1. Identification: List and briefly describe potentially applicable technologies for each affected media that may be used to achieve the corrective action objectives. The Permittee/Respondent should consider including a table that summarizes the available technologies. Depending on the site-specific situation, the implementing agency may require the Permittee/Respondent to consider additional technologies.

The Permittee/Respondent should consider innovative treatment technologies, especially in situations where there are a limited number of applicable corrective measure technologies. Innovative technologies are defined as those technologies utilized for remediation other than incineration, solidification/stabilization, and pumping with conventional treatment for contaminated groundwater *[see Appendix C]*. Innovative treatment technologies may require extra effort to gather information, to analyze options, and to adapt the technology to the site-specific situation. Treatability studies and on-site pilot scale studies may be necessary for evaluating innovative treatment technologies.

2. Screening *[optional]*: When the Permittee/Respondent is required to, or chooses to, evaluate a number of corrective measures technologies, the Permittee/Respondent will evaluate the technology limitations to show why certain corrective measures

technologies may prove unfeasible to implement given existing waste and site-specific conditions.

Likewise, if only one corrective measure alternative is being analyzed, the Permittee/Respondent must indicate any technological limitations given waste and site-specific conditions at the facility for which it is being considered. The Permittee/Respondent should consider including a table that summarizes these findings.

3. Corrective Measure Development *[optional]*: As required by the implementing agency, the Permittee/Respondent shall assemble the technologies that pass the screening step into specific alternatives that have potential to meet the corrective action objectives for each media. Options for addressing less complex sites could be relatively straight-forward and may only require evaluation of a single or limited number of alternatives.

Each alternative may consist of an individual technology or a combination of technologies used in sequence (i.e., treatment train). Depending on the site specific situation, different alternatives may be considered for separate areas of the facility. List and briefly describe each corrective measure alternative.

E. Evaluation of a Final Corrective Measure Alternative

For each remedy which warrants a more detailed evaluation, including those situations when only one remedy is being proposed, the Permittee/Respondent shall provide detailed documentation of how the potential remedy will comply with each of the standards listed below. These standards reflect the major technical components of remedies including cleanup of releases, source control and management of wastes that are generated by remedial activities. The specific standards are provided below.

1. Protect human health and the environment.
2. Attain media cleanup standards set by the implementing agency.
3. Control the source of releases so as to reduce or eliminate, to the extent practicable, further releases that may pose a threat to human health and the environment.
4. Comply with any applicable standards for management of wastes.
5. Other Factors.

In evaluating the selected alternative or alternatives the Permittee/Respondent shall prepare and submit information that documents that the specific remedy will meet the standards listed above. The following guidance should be used in completing this evaluation. This guidance provides examples of the types of information that would be supportive; the implementing agency may require additional information.

1. Protect Human Health and the Environment

Corrective action remedies must be protective of human health and the environment. Remedies may include those measures that are needed to be protective, but are not directly related to media cleanup, source control, or management of wastes. An example would be a requirement to provide alternative drinking water supplies in order to prevent exposures to releases from an aquifer used for drinking water purposes. Another example would be a requirement for the construction of barriers or for other controls to prevent harm arising from direct contact with waste management units. Therefore, the Permittee/Respondent shall include a discussion on what types of short term remedies are appropriate for the particular facility in order to meet this standard. This information should be provided in addition to a discussion of how the other corrective measure alternatives meet this standard.

2. Attain Media Cleanup Standards Set by the Implementing Agency

Remedies will be required to attain media cleanup standards set by the implementing agency which may be derived from existing state or federal regulations (e.g. groundwater standards) or other standards. The media cleanup standards for a remedy will often play a large role in determining the extent of and technical approaches to the remedy. In some cases, certain technical aspects of the remedy, such as the practical capabilities of remedial technologies, may influence to some degree the media cleanup standards that are established.

As part of the necessary information for satisfying this requirement, the Permittee/Respondent shall address whether the potential remedy will achieve the preliminary remediation objective as identified by the implementing agency as well as other, alternative remediation objectives that may be proposed by the Permittee/Respondent. The Permittee/Respondent shall also include an estimate of the time frame necessary for each alternative to meet these standards.

3. Control the Sources of Releases

A critical objective of any remedy must be to stop further environmental degradation by controlling or eliminating further releases that may pose a threat to human health and the environment. Unless source control measures are taken, efforts to clean up releases may be ineffective or, at best, will essentially involve a perpetual cleanup. Therefore, an effective source control program is essential to ensure the long-term effectiveness and protectiveness of the corrective action program.

The source control standard is not intended to mandate a specific remedy or class of remedies. Instead, the Permittee/Respondent is encouraged to examine a wide range of options. This standard should not be interpreted to preclude the equal consideration of using other protective remedies to control the source, such as partial waste removal, capping, slurry walls, in-situ treatment/stabilization and consolidation.

[NOTE: When evaluating potential alternatives, further releases from sources of contamination are to be controlled to the extent practicable. This qualifier is

intended to account for the technical limitations that may in some cases be encountered in achieving effective source control. For some very large landfills, or large areas of widespread soil contamination, engineering solutions such as treatment or capping to prevent further leaching may not be technically practicable, to eliminate further releases above health-based contamination levels. In such cases, source controls may need to be combined with other measures, such as plume management or exposure controls, to ensure an effective and protective remedy.]

As part of the CMS Report, the Permittee/Respondent shall address the issue of whether source control measures are necessary, and if so, the type of actions that would be appropriate. Any source control measure proposed should include a discussion on how well the method is anticipated to work given the particular situation at the facility and the known track record of the specific technology.

4. Comply With Any Applicable Standards for Management of Wastes.

The Permittee/Respondent shall include a discussion of how the specific waste management activities will be conducted in compliance with all applicable state or federal regulations (e.g., closure requirements, land disposal restrictions).

5. Other Factors

There are five general factors that will be considered as appropriate by the implementing agency in selecting/approving a remedy that meets the four standards listed above. These factors represent a combination of technical measures and management controls for addressing the environmental problems at the facility. The five general decision factors include:

- a. Long-term reliability and effectiveness;
- b. Reduction in the toxicity, mobility or volume of wastes;
- c. Short-term effectiveness;
- d. Implementability; and
- e. Cost.

The implementing agency may request the Permittee/Respondent to provide additional information to support the use of these factors in the evaluation of viable remedial alternatives. Examples of the types of information that may be requested are provided below:

a. Long-term Reliability and Effectiveness

Demonstrated and expected reliability is a way of assessing the risk and effect of failure. The Permittee/Respondent may consider whether the technology or a combination of technologies have been used effectively under analogous site conditions, whether failure of any one technology in the alternative would have an immediate impact on receptors, and whether the alternative would have the flexibility to deal with uncontrollable changes at the site (e.g., heavy rain storms, earthquakes, etc.).

Most corrective measure technologies, with the exception of destruction, deteriorate with time. Often, deterioration can be slowed through proper system operation and maintenance, but the technology eventually may require replacement. Each corrective measure alternative should be evaluated in terms of the projected useful life of the overall alternative and of its component technologies. Useful life is defined as the length of time the level of effectiveness can be maintained.

b. Reduction in the Toxicity, Mobility or Volume of Wastes

As a general goal, remedies will be preferred that employ techniques, such as treatment technologies, that are capable of eliminating or substantially reducing the inherent potential for the wastes in SWMUs (and/or contaminated media at the facility) to cause future environmental releases or other risks to human health and the environment. There may be some situations where achieving substantial reductions in toxicity, mobility or volume may not be practical or even desirable. Examples might include large, municipal-type landfills, or wastes such as unexploded munitions that would be extremely dangerous to handle, and for which the short-term risks of treatment outweigh potential long-term benefits.

Estimates of how much the corrective measures alternatives will reduce the waste toxicity, volume, and/or mobility may be helpful in applying this factor. This may be done through a comparison of initial site conditions to expected post-corrective measure conditions.

c. Short-term Effectiveness

Short-term effectiveness may be particularly relevant when remedial activities will be conducted in densely populated areas, or where waste characteristics are such that risks to workers or to the environment are high and special protective measures are needed. Possible factors to consider include fire, explosion, exposure to hazardous substances and potential threats associated with treatment, excavation, transportation, and redisposal or containment of waste material.

d. Implementability

Implementability will often be a determining variable in shaping remedies. Some technologies will require state or local approvals prior to construction, which may increase the time necessary to implement the remedy. In some cases, state or local restrictions or concerns may necessitate eliminating or deferring certain technologies or remedial approaches from consideration in remedy selection. Information to consider when assessing implementability may include:

1. The administrative activities needed to implement the corrective measure alternative (e.g., permits, rights of way, off-site approvals, etc.) and the length of time these activities will take;
2. The constructibility, time for implementation, and time for beneficial results;
3. The availability of adequate off-site treatment, storage capacity, disposal services, needed technical services and materials; and
4. The availability of prospective technologies for each corrective measure alternative.

e. Cost

The relative cost of a remedy may be an appropriate consideration, especially in those situations where several different technical alternatives to remediation will offer equivalent protection of human health and the environment, but may vary widely in cost. However, in those situations where only one remedy is being proposed, the issue of cost would not need to be considered. Cost estimates could include costs for: engineering, site preparation, construction, materials, labor, sampling/analysis, waste management/disposal, permitting, health and safety measures, training, operation and maintenance, etc.

F. Recommendation by Permittee/Respondent for a Final Corrective Measure Alternative

In the CMS Report, the Permittee/Respondent may recommend a preferred remedial alternative for consideration by the implementing agency. Such a recommendation should include a description and supporting rationale for the proposed remedy, consistent with the remedial standards and the decision factors discussed above. Such a recommendation is not required and the implementing agency still retains the role of remedy selection.

G. Public Involvement Plan

After the CMS has been performed by the Permittee/Respondent and the implementing agency has selected a preferred alternative for proposal in the Statement of Basis, it is the agency's policy to request public comment on the Administrative Record and the proposed corrective measure(s). Changes to the proposed corrective measure(s) may be made after consideration of public comment. The implementing agency may also require that the Permittee/Respondent perform additional corrective measures studies. If the public is interested, a public meeting may be held. After consideration of the public's comments on the proposed corrective measure, the agency develops the Final Decision and Response to

Comments (RTC) to document the selected corrective measure, the agency's justification for such selection, and the response to the public's comment. Additional public involvement activities may be necessary, based on facility specific circumstances.

[NOTE: Notice requirements for permits are set out at 40 CFR Part 270

subpart D. See RCRA Public Involvement Manual [EPA/530-R-93-006, September 1993 for further guidance.]

Section III: Progress Reports

The Permittee/Respondent will, at a minimum, provide the implementing agency with signed [monthly, bimonthly, or quarterly] progress reports. These reports may be required to contain the following information, but agency requirements are not limited to this list:

1. A description and estimate of the percentage of the CMS completed;
2. Summaries of *all* findings in the reporting period, including results of any pilot studies;
3. Summaries of *all* changes made in the CMS during the reporting period;
4. Summaries of *all* contacts with representative of the local community, public interest groups or State government during the reporting period;
5. Summaries of *all* contacts made regarding access to off-site property;
6. Summaries of *all* problems encountered during the reporting period;
7. Actions being taken to rectify problems;
8. Changes in relevant personnel during the reporting period;
9. Projected work for the next reporting period; and
10. Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

Section IV: Proposed Schedule

The Permittee/Respondent will provide the implementing agency with CMS reports according to the following schedule:

<u>Facility Submission</u>	<u>Due Date</u>
CMS Workplan (Section I)	[DATE]
Draft CMS Report (Section II)	[NUMBER] days after CMS Workplan Approval

Final CMS Report (Sections II) [NUMBER] days after the implementing agency comments on Draft CMS Report

Progress Reports on Sections I and II [MONTHLY, BI-MONTHLY, other]
[see Section III above for guidance on progress reports.]

Chapter V: Corrective Measures Implementation

Introduction

The purpose of the Corrective Measures Implementation (CMI) portion of the RCRA corrective action process is to design, construct, operate, maintain and monitor the performance of the corrective measure(s) selected by the implementing agency. Thus far in the corrective action program, the CMI process generally entailed a conceptual design phase for the selected remedy, a detailed review of intermediate plans and specifications by the implementing agency, and the development of final plans and specifications.

The new CAP encourages implementing agencies to make the process more flexible and streamlined. Intermediate design plans may or may not be required at specific design points (30, 50, 60, 90, and/or 95% are given as examples). Other sections may be combined or eliminated.

For example, a CMI Workplan may be submitted to the implementing agency rather than the Conceptual Design (Section I), Intermediate Plans and Specifications (Section III), and Construction Workplan (Section V). The implementing agency may approve (or conditionally approve with comments) the CMI Workplan and not require submittal of Final Plans and Specifications (Section IV) and Construction Workplan (Section V). A Health and Safety Plan (Section VIII) and Public Involvement Plan (Section IX) also may be included in a CMI Workplan. Implementing agencies may consider other approaches to expedite the process and initiate implementation of corrective measure(s) more quickly.

As discussed in Chapter II, one such approach involves initiating ISMs prior to the CMI. Plans submitted for ISMs (e.g., health and safety plans, public involvement plans) may be used or updated during the CMI, particularly since ISMs should be compatible with final corrective measures. In most cases this will be true, with the only changes being an expansion/adjustment of the ISMs to constitute a final remedy.

Another approach to expedite the CMI process involves setting final remedial (or stabilization) media cleanup standards but not specifying the process by which the standards would be attained. This performance-based approach should lower oversight by the implementing agency and promote faster cleanup. The implementing agency should give special consideration to the types of progress reports (see Section X) it will require from the Permittee/Respondent so that it can monitor progress toward achieving the media cleanup standards if this approach is taken.

[NOTE: With certain exceptions, the provisions set out in sections I through XI are intended as guidance, and these provisions should be justifiable and tailored to site-specific conditions when incorporated into permits or orders. The exceptions are certain provisions which are based on specific regulatory or statutory requirements applicable to permitting. Regulatory and statutory requirements are binding and do not require site-specific justification. Applicable requirements include: financial responsibility requirements in RCRA sections 3004(u) and 3004(v) and 40 CFR § 264.101.]

Scope of Work for Corrective Measures Implementation

Purpose

The purpose of the Corrective Measures Implementation (CMI) program is to design, construct, operate, maintain and monitor the performance of the corrective measure or measures selected by the implementing agency. Corrective measures are intended to protect human health and/or the environment from releases from the facility. The Permittee/Respondent will furnish all personnel, materials and services necessary to implement the corrective measures program.

Scope

The documents required for Corrective Measures Implementation are, unless the implementing agency specifies otherwise, a Conceptual Design, Operation and Maintenance Plan, Intermediate Plans and Specifications, Final Plans and Specifications, Construction Workplan, Construction Completion Report, Corrective Measure Completion Report, Health and Safety Plan, Public Involvement Plan, and Progress Reports. The scope of work (SOW) for each document is specified below. The SOW's are intended to be flexible documents capable of addressing both simple and complex site situations. If the Permittee/Respondent can justify, to the satisfaction of the implementing agency, that a plan and/or report or portions thereof are not needed in the given site-specific situation, then the implementing agency may waive that requirement.

The implementing agency may require the Permittee/Respondent to conduct additional studies beyond what is discussed in the SOW's in order to support the CMI program. The Permittee/ Respondent will furnish all personnel, materials and services necessary to conduct the additional tasks.

[NOTE: See introduction for discussion on streamlining sections of the CMI Scope of Work.]

The CMI consists of the following components, which for clarity are designated as sections in this Scope of Work.

- Section I: Conceptual Design (15% Design Point)
 - A. Introduction/Purpose
 - B. Corrective Measures Objectives
 - C. Conceptual Model of Contaminant Migration

- D. Description of Corrective Measures
- E. Project Management
- F. Project Schedule
- G. Design Criteria
- H. Design Basis
- I. Waste Management Practices
- J. Required Permits
- K. Long-lead Procurement Considerations
- L. Appendices

Section II: Operation and Maintenance Plan

- A. Introduction/Purpose
- B. Project Management
- C. System Description
- D. Personnel Training
- E. Start-up Procedures
- F. Operation and Maintenance Procedures
- G. Replacement Schedule for Equipment and Installed Components
- H. Waste Management Practices
- I. Sampling and Analysis
- J. Corrective Measure Completion Criteria
- K. Operation and Maintenance Contingency Procedures
- L. Data Management and Documentation Requirements

Section III: Intermediate Plans and Specifications (30, 50, 60, 90 and/or 95% Design Point)

Section IV: Final Plans and Specifications (100% Design Point)

Section V: Construction Workplan

- A. Introduction/Purpose

- B. Project Management
- C. Project Schedule
- D. Construction Quality Assurance/Quality Control Programs
- E. Waste Management Procedures
- F. Sampling and Analysis
- G. Construction Contingency Procedures
- H. Construction Safety Procedures
- I. Documentation Requirements
- J. Cost Estimate/Financial Assurance

- Section VI: Construction Completion Report
- Section VII: Corrective Measure Completion Report
- Section VIII: Health and Safety Plan
- Section IX: Public Involvement Plan
- Section X: Progress Reports
- Section XI: Proposed Schedule

Section I: Conceptual Design (15% Design Point)

The Permittee/Respondent shall prepare a Conceptual Design (CD) that clearly describes the size, shape, form, and content of the proposed corrective measure; the key components or elements that are needed; the designer's vision of the corrective measure in the form of conceptual drawings and schematics; and the procedures and schedules for implementing the corrective measure(s). It should be noted that more than one conceptual design may be needed in situations where there is a complex site with multiple technologies being employed at different locations. The implementing agency may require approval of the CD prior to implementation. The CD must, at a minimum, include the following elements:

- A. Introduction/Purpose: Describe the purpose of the document and provide a summary description of the project.
- B. Corrective Measures Objectives: Discuss the corrective measure objectives including applicable media cleanup standards.
- C. Conceptual Model of Contaminant Migration: Present a conceptual model of the site and contaminant migration. The conceptual model consists of a working hypothesis of how the contaminants may move from the release source to the receptor population. The conceptual model is developed by looking at the applicable physical parameters (e.g., water solubility, density, Henry's Law Constant, etc.) for each contaminant and assessing how the contaminant may migrate given the existing site conditions (geologic features, depth to groundwater, etc.). Describe the phase (water, soil, gas, non-aqueous) and location where contaminants are likely to be found. This analysis may have already been done as part of earlier work (e.g., Current Conditions Report). If this is the case, then provide a summary of the conceptual model with a reference to the earlier document.
- D. Description of Corrective Measures: Considering the conceptual model of contaminant migration, qualitatively describe what the corrective measure is supposed to do and how it will function at the facility. Discuss the feasibility of the corrective measure and its ability to meet the corrective measure objectives.
 1. Data Sufficiency: Review existing data needed to support the design effort and establish whether or not there is sufficient accurate data available for this purpose. The Permittee/Respondent must summarize the assessment findings and specify any additional data needed to complete the corrective measure design. The implementing agency may require or the Permittee/Respondent may propose that sampling and analysis plans and/or treatability study workplans be developed to obtain the additional data. Submittal times for any new sampling and analysis plans and/or treatability study workplans will be determined by the implementing agency and will be included in the project schedule.
- E. Project Management: Describe the management approach including levels of authority and responsibility (include organization chart), lines of communication and the qualifications of key personnel who will direct the

corrective measure design and the implementation effort (including contractor personnel).

- F. Project Schedule: The project schedule must specify all significant steps in the process and when all CMI deliverables (e.g., Operation and Maintenance Plan, Corrective Measure Construction Workplan, etc.) are to be submitted to the implementing agency.
- G. Design Criteria: Specify performance requirements for the overall corrective measure and for each major component. The Permittee/Respondent must select equipment that meets the performance requirements.
- H. Design Basis: Discuss the process and methods for designing all major components of the corrective measure. Discuss the significant assumptions made and possible sources of error. Provide justification for the assumptions.
 - 1. Conceptual Process/Schematic Diagrams.
 - 2. Site plan showing preliminary plant layout and/or treatment area.
 - 3. Tables listing number and type of major components with approximate dimensions.
 - 4. Tables giving preliminary mass balances.
 - 5. Site safety and security provisions (e.g., fences, fire control, etc.).
- I. Waste Management Practices: Describe the wastes generated by the construction of the corrective measure and how they will be managed. Also discuss drainage and indicate how rainwater runoff will be managed.
- J. Required Permits: List and describe the permits needed to construct and operate the corrective measure. Indicate on the project schedule when the permit applications will be submitted to the applicable agencies and an estimate of the permit issuance date.
- K. Long-Lead Procurement Considerations: The Permittee/Respondent shall prepare a list of any elements or components of the corrective measure that will require custom fabrication or for some other reason must be considered as long-lead procurement items. The list must include the reason why the items are considered long-lead items, the length of time necessary for procurement, and the recognized sources of such procurement.
- L. Appendices including:
 - 1. Design Data - Tabulations of significant data used in the design effort;
 - 2. Equations - List and describe the source of major equations used in

the design process;

3. Sample Calculations - Present and explain one example calculation for significant or unique design calculations; and
4. Laboratory or Field Test Results.

Section II: Operation and Maintenance Plan

The Permittee/Respondent shall prepare an Operation and Maintenance (O&M) Plan that outlines procedures for performing operations, long term maintenance, and monitoring of the corrective measure. A draft Operation and Maintenance Plan shall be submitted to the implementing agency simultaneously with the draft Plans and Specifications (see Section III). A final Operation and Maintenance Plan shall be submitted to the implementing agency simultaneously with the final Plans and Specifications. The O&M plan shall, at a minimum, include the following elements:

- A. Introduction/Purpose: Describe the purpose of the document and provide a summary description of the project.
- B. Project Management: Describe the management approach including levels of authority and responsibility (include organization chart), lines of communication and the qualifications of key personnel who will operate and maintain the corrective measures (including contractor personnel).
- C. System Description: Describe the corrective measure and identify significant equipment.
- D. Personnel Training: Describe the training process for O&M personnel. The Permittee/Respondent shall prepare, and include in the technical specifications governing treatment systems, the contractor requirements for providing: appropriate service visits by experienced personnel to supervise the installation, adjustment, start up and operation of the treatment systems, and training covering appropriate operational procedures once the start-up has been successfully accomplished.
- E. Start-Up Procedures: Describe system start-up procedures including any operational testing.
- F. Operation and Maintenance Procedures: Describe normal operation and maintenance procedures including:
 1. Description of tasks for operation;
 2. Description of tasks for maintenance;
 3. Description of prescribed treatment or operation conditions; and
 4. Schedule showing frequency of each O&M task.
- G. Replacement Schedule for Equipment and Installed Components.
- H. Waste Management Practices: Describe the wastes generated by operation of the corrective measure and how they will be managed. Also discuss

drainage and indicate how rainwater runoff will be managed.

- I. Sampling and Analysis: Sampling and monitoring activities may be needed for effective operation and maintenance of the corrective measure. To ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented, the Permittee/Respondent shall prepare a Quality Assurance Project Plan (QAPjP) to document all monitoring procedures, sampling, field measurements and sample analyses performed during these activities. The Permittee/Respondent shall use quality assurance, quality control, and chain-of-custody procedures approved by the implementing agency. These procedures are described in the soon to be released EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5), which will replace Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, December 29, 1980.
- J. Corrective Measure Completion Criteria: Describe the process and criteria (e.g., groundwater cleanup goal met at all compliance points for 1 year) for determining when corrective measures have achieved media cleanup goals. Also describe the process and criteria for determining when maintenance and monitoring may cease. Criteria for corrective measures such as a landfill cap must reflect the need for long-term monitoring and maintenance. Satisfaction of the completion criteria will trigger preparation and submittal of the Corrective Measures Completion Report.
- K. O&M Contingency Procedures:
 1. Procedures to address system breakdowns and operational problems including a list of redundant and emergency back-up equipment and procedures;
 2. Alternate procedures to be implemented if the corrective measure suffers complete failure. The alternate procedures must be able to prevent release or threatened releases of hazardous wastes or constituents which may endanger human health and/or the environment or exceed media cleanup standards;
 3. The O&M Plan must specify that, in the event of a major breakdown and/or complete failure of the corrective measure (includes emergency situations), the Permittee/Respondent will orally notify the implementing agency within 24 hours of the event and will notify the implementing agency in writing within 72 hours of the event. Written notification must, at a minimum, specify what happened, what response action is being taken and/or is planned, and any potential impacts on human health and/or the environment; and
 4. Procedures to be implemented in the event that the corrective measure is experiencing major operational problems, is not performing to design specifications and/or will not achieve the cleanup goals in the expected time frame. For example, in certain

circumstances both a primary and secondary corrective measure may be selected for the Facility. If the primary corrective measure were to fail, then the secondary would be implemented. This section would thus specify that if the primary corrective measure failed, then design plans would be developed for the secondary measure.

- L. Data Management and Documentation Requirements: The O&M Plan shall specify that the Permittee/Respondent collect and maintain the following information:
1. Progress Report Information
 2. Monitoring and laboratory data;
 3. Records of operating costs; and
 4. Personnel, maintenance and inspection records.

This data and information should be used to prepare Progress Reports and the Corrective Measure Completion Report.

[NOTE: See Section X for guidance on what kind of information may be required in progress reports.]

Section III: Intermediate Plans and Specifications (30, 50, 60, 90 and/or 95% Design Point)

[NOTE: The Permittee/Respondent may propose or the implementing agency may require the submittal of several intermediate plans and specifications (e.g., at the 60% Design Point) or none at all.]

The Permittee/Respondent shall prepare draft Plans and Specifications that are based on the Conceptual Design but include additional design detail. A draft Operation and Maintenance Plan and Construction Workplan shall be submitted to the implementing agency simultaneously with the draft Plans and Specifications. The draft design package must include drawings and specifications needed to construct the corrective measure. Depending on the nature of the corrective measure, many different types of drawings and specifications may be needed. Some of the elements that may be required are:

- General Site Plans
- Process Flow Diagrams
- Mechanical Drawings
- Electrical Drawings
- Structural Drawings
- Piping and Instrumentation Diagrams
- Excavation and Earthwork Drawings
- Equipment Lists
- Site Preparation and Field Work Standards
- Preliminary Specifications for Equipment and Material

General correlation between drawings and technical specifications is a basic requirement of any set of working construction plans and specifications. Before submitting the project specifications to the implementing agency, the

Permittee/Respondent shall:

- Proofread the specifications for accuracy and consistency with the conceptual design and
- Coordinate and cross-check the specifications and drawings.

Section IV: Final Plans and Specifications (100% Design Point)

The Permittee/Respondent shall prepare Final Plans and Specifications that are sufficient to be included in a contract document and be advertised for bid. A final Operation and Maintenance Plan and Construction Workplan shall be submitted to the implementing agency simultaneously with the final Plans and Specifications. The final design package must consist of the detailed drawings and specifications needed to construct the corrective measure. Depending on the nature of the corrective measure, many different types of drawings and specifications may be needed. Some of the elements that may be required are:

- General Site Plans
- Process Flow Diagrams
- Mechanical Drawings
- Electrical Drawings
- Piping and Instrumentation Diagrams
- Structural Drawings
- Excavation and Earthwork Drawings
- Site Preparation and Field Work Standards
- Construction Drawings
- Installation Drawings
- Equipment Lists
- Detailed Specifications for Equipment and Material

General correlation between drawings and technical specifications is a basic requirement of any set of working construction plans and specifications. Before submitting the final project specifications to the implementing agency, the Permittee/Respondent shall proofread the specifications for accuracy and consistency with the preliminary design; and coordinate and cross-check the specifications and drawings.

Section V: Construction Workplan

The Permittee/Respondent shall prepare a Construction Workplan which documents the overall management strategy, construction quality assurance procedures and schedule for constructing the corrective measure. A draft Construction Workplan shall be submitted to the implementing agency simultaneously with the draft Plans and Specifications and draft Operation and Maintenance Plan. A final Construction Workplan shall be submitted to the implementing agency simultaneously with the final Plans and Specifications and final Operation and Maintenance Plan. Upon receipt of written approval from the implementing agency, the Permittee/Respondent shall commence the construction process and implement the Construction Workplan in accordance with the schedule and provisions contained therein. The Construction Workplan must be approved by the implementing agency prior to the start of corrective measure

construction. The Construction Workplan must, at a minimum, include the following elements:

- A. Introduction/Purpose: Describe the purpose of the document and provide a summary description of the project.
- B. Project Management: Describe the construction management approach including levels of authority and responsibility (include organization chart), lines of communication and the qualifications of key personnel who will direct the corrective measure construction effort and provide construction quality assurance/quality control (including contractor personnel).
- C. Project Schedule: The project schedule must include timing for key elements of the bidding process, timing for initiation and completion of all major corrective measure construction tasks as specified in the Final Plans and Specifications, and specify when the Construction Completion Report is to be submitted to the implementing agency.
- D. Construction Quality Assurance/Quality Control Programs: The purpose of construction quality assurance is to ensure, with a reasonable degree of certainty, that a completed corrective measure will meet or exceed all design criteria, plans, and specifications. The Construction Workplan must include a complete Construction Quality Assurance Program to be implemented by the Permittee/Respondent.
- E. Waste Management Procedures: Describe the wastes generated by construction of the corrective measure and how they will be managed.
- F. Sampling and Analysis: Sampling and monitoring activities may be needed for construction quality assurance/quality control and/or other construction related purposes. To ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented, the Permittee/Respondent shall prepare a Quality Assurance Project Plan (QAPjP) to document all monitoring procedures, sampling, field measurements and sample analysis performed during these activities. The Permittee/Respondent shall use quality assurance, quality control, and chain-of-custody procedures approved by the implementing agency. These procedures are described in the soon to be released EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5), which replaces Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, December 29, 1980.
- G. Construction Contingency Procedures:
 1. Changes to the design and/or specifications may be needed during construction to address unforeseen problems encountered in the field. Procedures to address such circumstances, including notification of the implementing agency, must be included in the Construction Workplan;

2. The Construction Workplan must specify that, in the event of a construction emergency (e.g. fire, earthwork failure, etc.), the Permittee/Respondent will orally notify the implementing agency within 24 hours of the event and will notify the implementing agency in writing within 72 hours of the event. The written notification must, at a minimum, specify what happened, what response action is being taken and/or is planned, and any potential impacts on human health and/or the environment; and
 3. Procedures to be implemented if unforeseen events prevent corrective measure construction. For example, in certain circumstances both a primary and secondary corrective measure may be selected for the Facility. If the primary corrective measure could not be constructed, then the secondary would be implemented. This section would thus specify that if the primary corrective measure could not be constructed, then design plans would be developed for the secondary measure.
- H. Construction Safety Procedures: Construction safety procedures should be specified in a separate Health and Safety Plan. [See Section VIII]

I. Documentation Requirements

The Permittee/Respondent shall describe how analytical data and results

will be evaluated, documented, and managed.

[See Appendix B]

J. Cost Estimate/Financial Assurance

[NOTE: See 40 CFR § 264.101]

Financial assurance for corrective measure construction and operation may be required by an enforcement order, facility permit, or permit modification. The Construction Workplan must include a cost estimate and specify which financial mechanism will be used and when the mechanism will be established. The cost estimate shall include both construction and operation and maintenance costs. An initial cost estimate shall be included in the draft Construction Workplan and a final cost estimate shall be included in the final Construction Workplan. The financial assurance mechanism may include a performance or surety bond, a trust fund, a letter of credit, financial test and corporate guarantee equivalent to that in 40 CFR. § 265.143 or any other mechanism acceptable to the implementing agency.

Financial assurance mechanisms are used to assure the implementing agency that the Permittee/Respondent has adequate financial resources to construct and operate the corrective measure.

Section VI: Construction Completion Report

The Permittee/Respondent shall prepare a Construction Completion (CC) Report

which documents how the completed project is consistent with the Final Plans and Specifications. A CC Report shall be submitted to the implementing agency when the construction and any operational tests have been completed. The CC Report shall, at a minimum, include the following elements:

1. Purpose;
2. Synopsis of the corrective measure, design criteria, and certification that the corrective measure was constructed in accordance with the Final Plans and Specifications;
3. Explanation and description of any modifications to the Final Plans and Specifications and why these were necessary for the project;
4. Results of any operational testing and/or monitoring, indicating how initial operation of the corrective measure compares to the design criteria;
5. Summary of significant activities that occurred during construction. Include a discussion of problems encountered and how they were addressed;
6. Summary of any inspection findings (include copies of key inspection documents in appendices);
7. As built drawings or photographs; and
8. Schedule indicating when any treatment systems will begin full scale operations.

Section VII: Corrective Measure Completion Report

The Permittee/Respondent shall prepare a Corrective Measure Completion (CMC) Report when the Permittee/Respondent believes that the corrective measure completion criteria have been satisfied. The purpose of the CMC Report is to fully document how the corrective measure completion criteria have been satisfied and to justify why the corrective measure and/or monitoring may cease. The CMC Report shall, at a minimum, include the following elements:

1. Purpose;
2. Synopsis of the corrective measure;
3. Corrective Measure Completion Criteria: Describe the process and criteria for determining when corrective measures, maintenance and monitoring may cease. Corrective measure completion criteria were given in the final Operation and Maintenance (O&M) Plan;
4. Demonstration that the completion criteria have been met. Include results of testing and/or monitoring, indicating how operation of the corrective measure compares to the completion criteria;
5. Summary of work accomplishments (e.g., performance levels achieved,

total hours of treatment operation, total treated and/or excavated volumes, nature and volume of wastes generated, etc.);

6. Summary of significant activities that occurred during operations. Include a discussion of problems encountered and how they were addressed;
7. Summary of inspection findings (include copies of key inspection documents in appendices); and
8. Summary of total operation and maintenance costs.

Section VIII: Health and Safety Plan

The Permittee/Respondent shall submit a Health and Safety Plan for all field activity, although it does not require review and approval by the implementing agency. The Health and Safety Plan shall be developed as a stand alone document but may be submitted with the CMI Workplan. The Health and Safety Plan must, at a minimum, include the following elements:

1. Objectives: Describe the goals and objectives of the health and safety program (must apply to on-site personnel and visitors). The health and safety plan must be consistent with the Facility Contingency Plan, OSHA Regulations, NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985), all state and local regulations and other implementing agency guidance as provided.
2. Hazard Assessment: List and describe the potentially hazardous substances that could be encountered by field personnel during construction and/or operation and maintenance activities. Discuss the following:
 - Inhalation Hazards
 - Dermal Exposure
 - Ingestion Hazards
 - Physical Hazards
 - Overall Hazard Rating

Include a table that, at a minimum, lists: known contaminants, highest observed concentration, media, symptoms/effects of acute exposure.

3. Personal Protection/Monitoring Equipment
 - Describe personal protection levels and identify all monitoring equipment for each operational task.
 - Describe any action levels and corresponding response actions (i.e., when will levels of safety be upgraded).
 - Describe decontamination procedures and areas.

4. Site Organization and Emergency Contacts

List and identify all contacts (include phone numbers). Identify the nearest hospital and provide a regional map showing the shortest route from the facility to the hospital. Describe site emergency procedures and any site safety organizations. Include evacuation procedures for neighbors (where applicable).

Include a facility map showing emergency station locations (first aid, eye wash areas, etc.).

Section IX: Public Involvement Plan

[NOTE: It is strongly recommended that the implementing agency oversee the Permittee's/Respondent's public involvement activities. Public involvement is an important part of RCRA corrective action. The public must be notified of significant changes to permits and orders regarding corrective action. In some cases, they also must be provided with the opportunity to review and comment on the changes. Further guidance on this process is in the document entitled RCRA Public Involvement Manual (EPA/530-R-93-006, September 1993).]

All Public Involvement Plans prepared by the Permittee/Respondent shall be submitted to the implementing agency for comment and approval prior to use. Permittees/Respondents must never appear to represent or speak for the implementing agency before the public, other government officials, or the media.

Public Involvement activities that may be required of the Permittee/Respondent include, the following:

1. Conducting an open house or informal meeting (i.e., availability session) in a public location where people can talk to agency officials and Permittee/Respondent on a one-to-one basis;
2. Preparing fact sheets summarizing current or proposed corrective action activities (all fact sheets should be reviewed by the implementing agency prior to public distribution);
3. Communicating effectively with people who have vested interest in the corrective action activities, (e.g., providing written or verbal information in the foreign language of a predominantly non-English-speaking community); and
4. Maintaining an easily accessible repository (such as a town hall or public library or the facility itself, in some limited circumstances) of information on the facility-specific corrective action program, including the order or permit, approved workplans, and/or other reports.

A schedule for community relations activities shall be included in the Public Involvement Plan.

Section X: Progress Reports

The Permittee/Respondent will, at a minimum, provide the implementing agency with signed [monthly, bimonthly, or quarterly] progress reports during corrective measure design, construction, operation and maintenance. The implementing agency may adjust the frequency of progress reporting to address site-specific needs. For example, more frequent progress reports may be needed to track critical activities such as corrective measure construction and start-up. Progress reports must, at a minimum, include the following elements:

1. A description of significant activities (e.g., sampling events, inspections, etc.) and work completed/work accomplishments (e.g., performance levels achieved, hours of treatment operation, treated and/or excavated volumes, concentration of contaminants in treated and/or excavated volumes, nature and volume of wastes generated, etc.) during the reporting period;
2. Summary of system effectiveness. Provide a comparison of system operation to predicted performance levels (applicable only during operation of the corrective measure);
3. Summaries of all findings (including any inspection results);
4. Summaries of all contacts with representatives of the local community, public interest groups or State government during the reporting period;
5. Summaries of all problems or potential problems encountered during the reporting period;
6. Actions being taken and/or planned to rectify problems;
7. Changes in personnel during the reporting period;
8. Projected work for the next reporting period; and
9. If requested by the implementing agency, the results of any sampling tests and/or other data generated during the reporting period.

Section XI: Proposed Schedule

The Permittee/Respondent will provide the implementing agency with CMI reports according to the following schedule:

<u>Facility Submission</u>	<u>Due Date</u>
Conceptual Design (Section I)	[DATE]
Operation and Maintenance Plan (Section II)	[DATE]
Intermediate Plans and	[NUMBER] days after

Specifications (Section III)	Conceptual Design Approval
Final Plans and Specifications (Sections IV)	[NUMBER] days after the implementing agency comments on Intermediate Plans and Specifications (date of approval may be tied to submittal of the CMI Workplan, if required)
Construction Workplan (Section V)	Concurrent with Final Plans and Specifications (or approval thereof)
Construction Completion Report (Section VI)	[DATE]
Corrective Measure Completion Report (Section VII)	[DATE] (based on when completion criteria are believed to have been satisfied)
Health and Safety Plan (Section VIII)	[DATE]
Public Involvement Plan (Section IX)	[DATE]
Progress Reports on Sections I through IX <i>[see Section X above for guidance on progress reports.]</i>	[MONTHLY, BI- MONTHLY, other]

