

# Chapter 4

## The Corrective Measures Study

Introduction .....	4 - 3
Module 4-1: Requirement for a Corrective Measures Study .....	4 - 15
Module 4-2: Planning the Corrective Measures Study .....	4 - 21
Submodule 4-2-1: Review of Site Information .....	4 - 25
Submodule 4-2-2: Phasing Corrective Measures and Corrective Action Management Units .....	4 - 29
Submodule 4-2-3: Streamlining the Corrective Measures Study .	4 - 33
Submodule 4-2-4: Developing the Objectives of the Corrective Measures Study .....	4 - 37
Submodule 4-2-5: Establishing the Corrective Measures Study Evaluation Process and Criteria .....	4 - 45
Submodule 4-2-6: Select and Screen Candidate Corrective Measures for Study .....	4 - 51
Module 4-3: The Corrective Measures Study Plan .....	4 - 53
Module 4-4: The Corrective Measures Study .....	4 - 61
Module 4-5: The Corrective Measures Study Report .....	4 - 65
References .....	4 - 71

## **Note to the Reader**

On February 16, 1993, EPA promulgated a portion of the proposed Subpart S rule as a final rule (see *Corrective Action Management Units and Temporary Units; Corrective Action Provisions; Final Rule*, 58 FR 8658, Tuesday, February 16, 1993). This final rule sets forth the requirements for establishing corrective action management units (CAMUs) or temporary units during RCRA corrective actions. The specific requirements for CAMUs and temporary units under the final rule differ significantly from the requirements of the proposed rule (see 55 FR 30842-30844, July 27, 1990). Rather than delay publication of this guidance, the DOE Office of Environmental Guidance has chosen not to incorporate these changes into this guidance. Therefore, the discussions of CAMUs and temporary units appearing in this document are based solely on the proposed Subpart S rule. A copy of the final CAMU and temporary unit rule is provided as an appendix to this guidance. A summary of the major provisions of the rule is provided below.

The final rule does not change the most important benefit of establishing a CAMU, namely, remediation wastes (a new class of wastes established in this rule) generated during corrective action can still be disposed of in a CAMU without triggering the land disposal restrictions (LDRs) or minimum technology requirements (MTRs). However, the final rule does make several significant changes in the requirements for CAMUs and temporary units. Briefly, these changes include:

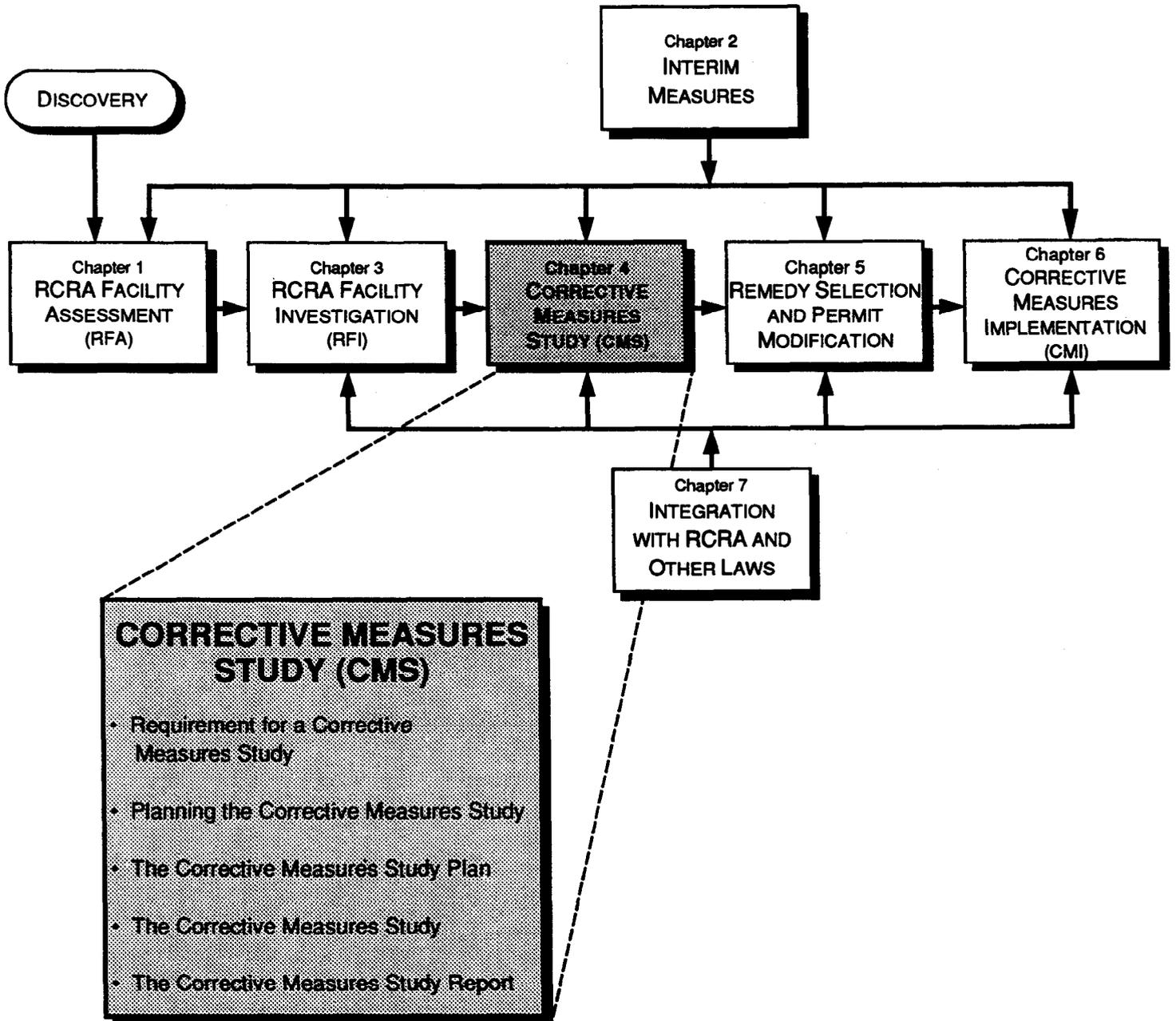
- CAMUs are no longer limited to contiguous areas of contamination, but are now linked primarily to where remediation wastes are managed; that is, designation of CAMUs is now related to the function and purpose they serve in facilitating management of remediation wastes during cleanup rather than to the areal extent of contamination.
- Establishing a new class of wastes called remediation wastes. Only remediation wastes can be managed in a CAMU or temporary unit.
- Permitting disposal of remediation wastes, generated at any location within the boundaries of a facility, in a CAMU.
- Creating a set of specific decision factors that must be considered when establishing CAMUs or temporary units.

## **Note to the Reader**

(continued)

- **Establishing regulations for permits, permit modifications, orders, or order modifications establishing CAMUs or temporary units that include: (1) specific elements that must be included; (2) documentation requirements for the decision; and (3) requirements for public participation in the process.**
- **Establishing requirements for designating regulated units (i.e., land-based units such as landfills, surface impoundments, or waste piles) as CAMUs.**
- **Setting out requirements for closure of CAMUs.**
- **Limiting the designation of temporary units to tanks and container storage units.**
- **Increasing the permissible life of a temporary unit from 180 days to 1 year.**
- **Establishing specific requirements for granting extensions to the operational time limit placed on temporary units.**
- **Providing specific details on how the CAMU and temporary unit final rule will be implemented in States that are: (1) not authorized for the base RCRA program; (2) authorized for the RCRA base program, but not for corrective action; and (3) authorized for corrective action.**

# RCRA Subpart S Corrective Action Process



# Introduction

Sections 264.520 through 264.524 of the proposed Subpart S rule establish the procedural and substantive requirements for the conduct of a Corrective Measures Study (CMS). Similar to a Feasibility Study under CERCLA, the CMS is the process for evaluating the alternatives for the corrective measure.

Many areas of the proposed Subpart S rule are unclear as to their meaning or scope. In these areas, the meaning of the language of the proposed rule has been interpreted on the basis of "best professional judgment." It should also be noted that the presentation sequence for this material (especially on planning the CMS) is not in the exact sequence as presented in the proposed rule, and the guidance presented herein is not intended as a rigid structure. For any number of reasons (e.g., EPA or State requirements, streamlining of the CMS), the CMS process may vary from the sequence as presented. Examples of such variations are presented in this guidance document.

Throughout this chapter, reference is made to EPA. For the sake of clarity, this term was meant to include those States with appropriate RCRA authorization.

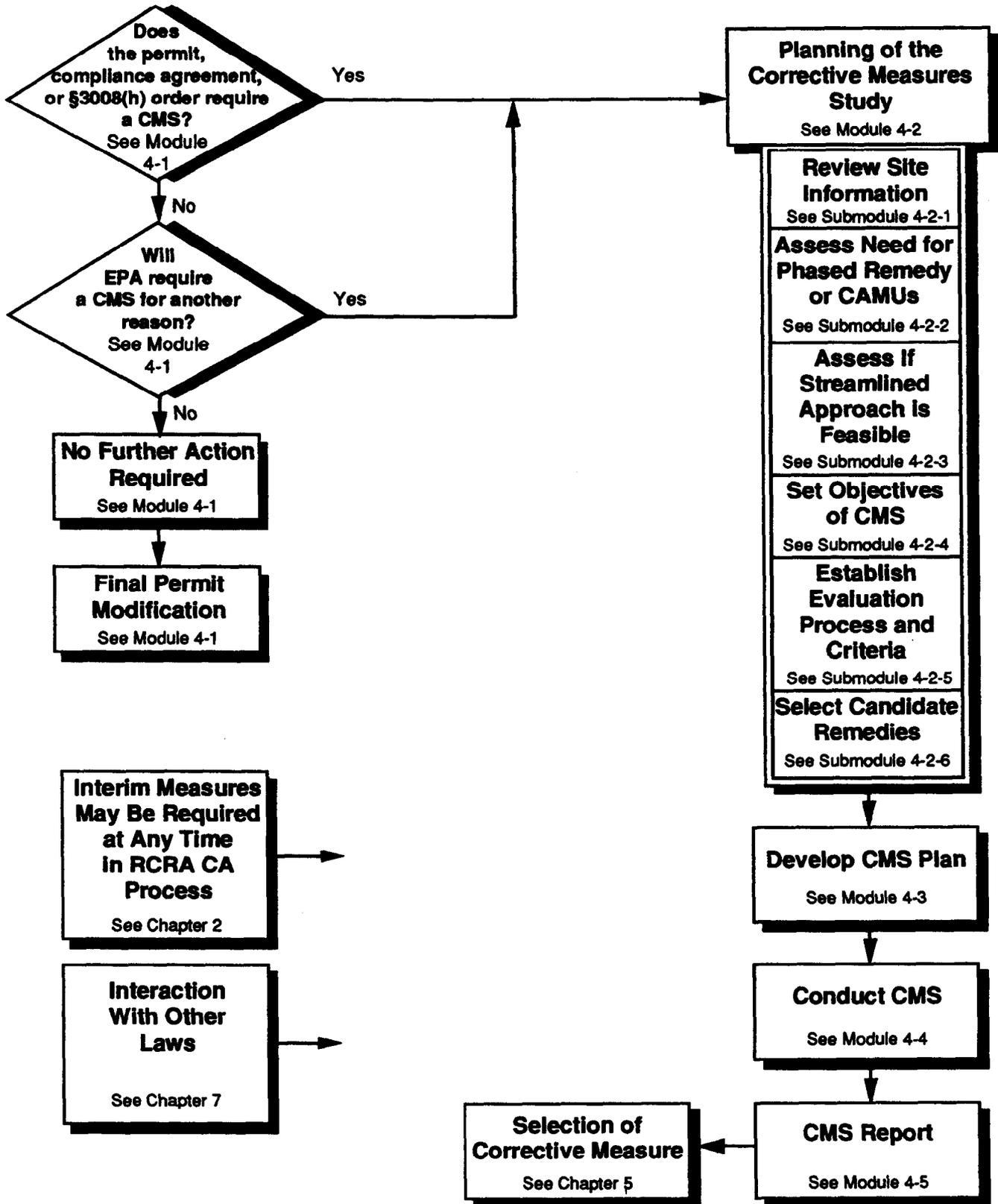
The following modules of this chapter provide a detailed discussion of the CMS process outlined in the graphic on the next page.

## **Module 4-1            Requirement for a Corrective Measures Study**

There are two mechanisms triggering the requirement for a CMS. The primary mechanism for triggering a CMS is the discovery that the concentration of a contaminant released from a solid waste management unit (SWMU) exceeds the action level set for that contaminant. Action levels are media-specific health and environmental-based contaminant concentrations considered protective of human health and the environment. Action levels are often standards issued under other statutes, such as the Maximum Contaminant Levels under the Safe Drinking Water Act.<sup>7</sup> It must be noted that action levels do not necessarily represent the final concentrations that must be achieved through the implementation of a corrective measure. Action levels act as a presumptive contaminant concentration level which, if exceeded, requires the permittee to perform additional investigations, specifically the CMS.

---

<sup>7</sup> Examples of the promulgated standards used as action levels and supplemental mechanisms used to develop action levels are discussed in the proposed Subpart S rule at 55 FR 30814-30820.



**Chapter Four: Corrective Measures Study (CMS)**

The second mechanism for triggering a CMS is proposed 40 CFR §254.520(b), which allows EPA to require a CMS even when contaminant concentrations are below action levels, but where other site-specific considerations, such as impacts to sensitive environments, suggest a need for close evaluation of the need for remediation of the contamination.

Unless already specified in the facility permit or a RCRA §3008(h) order compelling corrective action, conduct of a CMS requires modification of the facility permit or issuance of an additional RCRA §3008(h) corrective action order. Permit modification requires negotiation of the modification with EPA, development of a draft permit, a public notice, a comment and response period, a public meeting (if necessary), incorporation of any revisions into the permit modification, and issuance of the final modified permit. For an interim status facility, EPA issues a RCRA §3008(h) corrective action order requiring the owner/operator to conduct a CMS.

#### **Module 4-2 Planning the Corrective Measures Study**

There are six principal steps to planning a CMS. These steps are: (1) review of existing information about the SWMUs at the facility; (2) determining if a phased remedy or establishing of a corrective action management unit (CAMU) is appropriate; (3) determining if a streamlined CMS is appropriate; (4) defining the objectives of the CMS; (5) establishing the process and criteria for evaluating the alternatives for the corrective measure; and (6) selecting candidate corrective measures for evaluation. Depending upon DOE, EPA, State, or other requirements or constraints, the sequence of steps may vary.

In addition, during the planning process the facility should consider any requirements for compliance with other statutes. Examples include requirements for compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Environmental Policy Act (NEPA), the Clean Water Act (CWA), and the Toxic Substances Control Act (TSCA). Areas where integration with other laws should be considered are discussed in this chapter; however, details are provided in Chapter 7.

##### **Submodule 4-2-1 Review of Site Information**

The first step in the CMS process is a review of information about the release. The majority of this information is in the report(s) resulting from the RCRA Facility Investigation (RFI). Additional information may come from review of other sources, such as reports of releases, the RCRA Facility Assessment (RFA) report, and interim measures reports. Specific information sought during this review includes:

- Waste characteristics, including identity; physical, chemical, and toxicological properties; and quantity or concentration;

- Environmental setting, including information on geology, hydrogeology, topography, population demographics, and relation of the SWMU to other SWMUs at the facility, and the relationship of the facility to the surrounding area;
- Evaluation of the risks posed to human health and the environment by the release;
- Actions (including interim measures) taken at the facility to control or minimize the threat posed by the release; and
- Current conditions at the facility.

#### **Submodule 4-2-2 Phasing Corrective Measures and Establishing Corrective Action Management Units**

The second step of the planning process is to evaluate the usefulness of a phased corrective measure and the potential benefits of establishing corrective action management units (CAMUs).

For complex sites where cleanup of the entire facility in a single action is impractical, EPA has the authority to divide the corrective measure into phases.<sup>8</sup> Phasing of a corrective measure is similar to the use of “operable units” under CERCLA, and represents any logically connected set of actions performed sequentially over time, or concurrently at different parts of the facility. If a phased corrective measure is appropriate at the facility, the CMS may also be broken into phases, with each phase of the CMS focusing on a particular phase of the corrective measure. Ideally, using a streamlined approach, a phased CMS requires consideration of both the remedial alternative for the individual phase *and* the ultimate remedial goals for the entire facility. Any phased corrective measure should complement, not impede, future remedial activities at the facility.

---

<sup>8</sup> The proposed rule provides two mechanisms for phasing corrective Measures and is unclear on how EPA will approach the phasing of corrective measures. Under the first mechanism, EPA does not impose conditions on the phasing of a corrective measure, and the corrective measure is referred to as a “phased remedy.” For additional information on phased remedies see the preamble to the proposed rule at 55 FR 30835, and §264.526(d). However, EPA may impose one or more of seven specific conditions as part of phasing-in a corrective measure. Such a corrective measure is referred to as a “conditional remedy” (see the preamble to the proposed rule at 55 FR 30833 and §264.525(f)).

Another consideration for the planning process is the use of CAMUs. Under the proposed Subpart S rule, EPA is authorized to designate an area of broad contamination as a CAMU. The use of CAMUs permits consolidation of several SWMUs into one single unit for purposes of conducting corrective action. The identification of a CAMU usually takes place shortly after the completion of the RFA, but the designation of areas as CAMUs may be revisited during the RFI or the CMS. If CAMUs have not been designated prior to the CMS, the owner/operator should consider proposing any appropriate areas as CAMUs. The primary benefit of using a CAMU to address large areas of contamination (usually the result of releases from a number of SWMUs) at a facility is that land-based treatment and disposal of contaminated materials from within the CAMU are not subject to either land disposal restrictions or minimum technology requirements.

### **Submodule 4-2-3 Streamlining the Corrective Measures Study**

In planning the CMS, the third step is determining whether a streamlined CMS is appropriate. Streamlining involves tailoring the CMS to the complexity and scope of the situation at the facility and is similar to the Streamlined Approach for Environmental Restoration (SAFER) used for CERCLA Remedial Investigations/Feasibility Studies (RI/FS). A streamlined CMS offers several advantages. Most importantly, a streamlined CMS may not require extensive evaluation of numerous alternatives for the corrective measure. A streamlined CMS is appropriate for sites with the following types of conditions:

- The owner/operator proposes a highly protective corrective measure, such as a RCRA clean closure;
- Because of site conditions, there are few alternatives for the corrective measure as justified by proposed 40 CFR 40 CFR 9264.531 - Technical Impracticability;
- Expected future use of the site dictates a highly protective degree of cleanup;
- The remedial solution is straightforward and will use a tested and proven remedial technology; or
- Use of a phased remedy is appropriate.

#### **Submodule 4-2-4 Developing the Objectives for the Corrective Measures Study**

The fourth step in the planning process is developing the objectives of the CMS, primarily through establishing target media cleanup standards (MCS). As opposed to action levels, which are contaminant concentrations used to determine the need for a CMS, MCS are media-specific constituent concentrations which the corrective measure must achieve. The final MCS are set during the remedy selection process; however, setting target MCS provides an extremely useful tool for evaluating alternatives for the corrective measure. The EPA is not required to set, and retains the authority to revise, such target MCS. However, the owner/operator should try to negotiate with EPA for the creation of target MCS for the facility. If EPA is unwilling to set target MCS for the facility, the owner/operator should consider developing their own target MCS for use in evaluating the alternatives for the corrective measure.

#### **Submodule 4-2-5 Establishing the Corrective Measures Study Evaluation Process and Criteria**

The fifth step in planning the CMS is to establish the process and criteria for evaluating each alternative for the corrective measure. The CMS evaluation process and criteria should reflect the general evaluation factors for a CMS. The process and criteria should also reflect the standards and specific factors against which each alternative corrective measure will be judged during the final remedy selection process. The general evaluation factors for a CMS are:

- Performance, reliability, ease of implementation, and potential impacts from each remedial alternative;
- Effectiveness of each remedial alternative in achieving adequate source control;
- Time required to begin and complete each remedial alternative;
- Costs of each remedial alternative; and
- Institutional requirements (e.g., State, local, or public health regulations or permitting requirements) that might impact the implementation of each remedial alternative.

In rating each remedial alternative under these general evaluation factors, it is advisable to address each of the four standards for corrective measures and the five corrective measures selection factors. Under the proposed Subpart S rule, a corrective measure **must**:

- Be protective of human health and the environment;
- Attain final (as opposed to target) MCS;

- Provide source control to reduce or eliminate further releases that may pose a threat to human health and the environment; and
- Comply with the standards for management of wastes generated as part of conducting the corrective measure.

The specific selection factors for the corrective measure are:

- Long-term reliability;
- Reduction of toxicity, mobility, and volume of the contaminants at the facility;
- Short-term effectiveness;
- Implementability; and
- Cost.

#### **Submodule 4-2-6 Select and Screen Candidate Corrective Measures for Study**

The sixth step of planning a CMS is to develop a list of candidate alternatives for the corrective measure. The list of candidate alternatives is developed through analysis of facility conditions and review of information on existing and innovative remedial technologies applicable to the problems at the facility. In addition to the list of alternatives developed by the owner/operator, EPA has the authority to specify remedial alternatives for consideration and study. Following the review of existing information on the candidate alternatives, it is possible to eliminate from consideration any alternative that is impractical or inappropriate to the site conditions.

The final list of alternatives for the corrective measure should always include a “no action” alternative. While selection of a “no action” alternative provides no active remediation of contamination, it is useful as a baseline for comparison with the other alternatives. Further, selection of a “no action” alternative may be justified in some cases. For example, the CMS may show that natural attenuation will result in achieving the MCS. A “no action” alternative may also be appropriate if the owner/operator can show that no additional reduction of risk posed to human health and the environment will result from conducting a corrective measure. A media-specific example for possible justification of a “no action” alternative is a contaminated aquifer that is not, and will not, impact a source or potential source of drinking water. Under the proposed Subpart S rule, EPA may elect not to require remediation to the MCS if the owner/operator can show that the contamination is not a threat to a current or potential source of drinking water or to environmental receptors.

### **Module 4-3 The Corrective Measures Study Plan**

Conducting a CMS includes the development of the CMS Plan. Under the proposed Subpart S rule, EPA may require that the plan follow specific criteria, may include development of the plan in the facility permit schedule of compliance, or may require that the plan be subject to EPA review and approval. Further, under the proposed rule, a requirement for the submission of a CMS plan is at the discretion of EPA. Plan submission is not a mandatory action. However, if EPA requires submission of a plan, the approved plan becomes a part of the facility permit and is subject to the permit schedule of compliance (see 55 FR 30876-30877). The CMS plan should include discussion of:

- Current conditions at the facility;
- The general approach to investigating and evaluating potential remedial alternatives (e.g., use of a phased remedy or streamlined approach);
- Definition of the overall objectives of the CMS;
- A proposed schedule for the CMS;
- Identification of the alternatives for the corrective measure;
- The evaluation process and evaluation criteria for each alternative; and
- The format for presentation of the findings of the CMS.

### **Module 4-4 The Corrective Measures Study**

Conducting CMS testing is a two-step process involving (1) evaluating the effectiveness of each alternative for the corrective action, and (2) analysis and evaluation of the testing results according to the evaluation process and criteria developed during the planning process and described in the CMS plan. While this process is usually conducted during the CMS, under the proposed Subpart S rule EPA has the authority to require testing to occur concurrently with the RFI in order to prevent a delay in conducting the corrective measure. Generally, concurrent testing would occur in the form of treatability studies.

The first phase of conducting the CMS is similar to a treatability study conducted under CERCLA and involves testing each alternative for the corrective measure. Testing of the alternative corrective measures can be either bench- or pilot-scale, depending upon the nature of the technology under evaluation and the level of detail required for the evaluation. With a proven technology, used under conditions similar to those of the site under study, the testing requirements may be minimal, especially if adequate data on the effectiveness of the technology are available for review.

Treatability testing can also be conducted as part of the RFI. However, testing during the RFI should be limited, as the CMS process may show the technology to be inappropriate to the conditions at the facility.

Bench-scale treatability testing is usually performed in a laboratory. Such testing involves conducting a series of treatability tests with different parameters on small quantities of contaminated material. Analysis of the results of these small-scale tests permits evaluation and optimization of the operational parameters of the alternative quickly and at a relatively low cost.

Pilot-scale treatability testing involves building a scaled-down version of a treatment technology and simulates the physical and chemical parameters of that particular remedial technology. Pilot-scale testing should simulate full-scale operations and usually permits only limited variance of operational parameters. The results of a pilot-scale test allow assessment of the overall effectiveness and practicality of a remedial technology.

Once the testing of the alternatives for the corrective measure is complete, each alternative is subjected to the evaluation process developed during the planning process.

#### **Module 4-5 The Corrective Measures Study Report**

During the conduct of the CMS, EPA may require periodic progress reports. Based upon the information in these reports, EPA may change any part of the CMS.

Upon completion of the CMS, the owner/operator prepares a draft CMS report and submits the report to EPA for review and approval. The CMS report must discuss how each alternative for the corrective measure satisfies the standards and selection factors. The key points to discuss in the CMS report are:

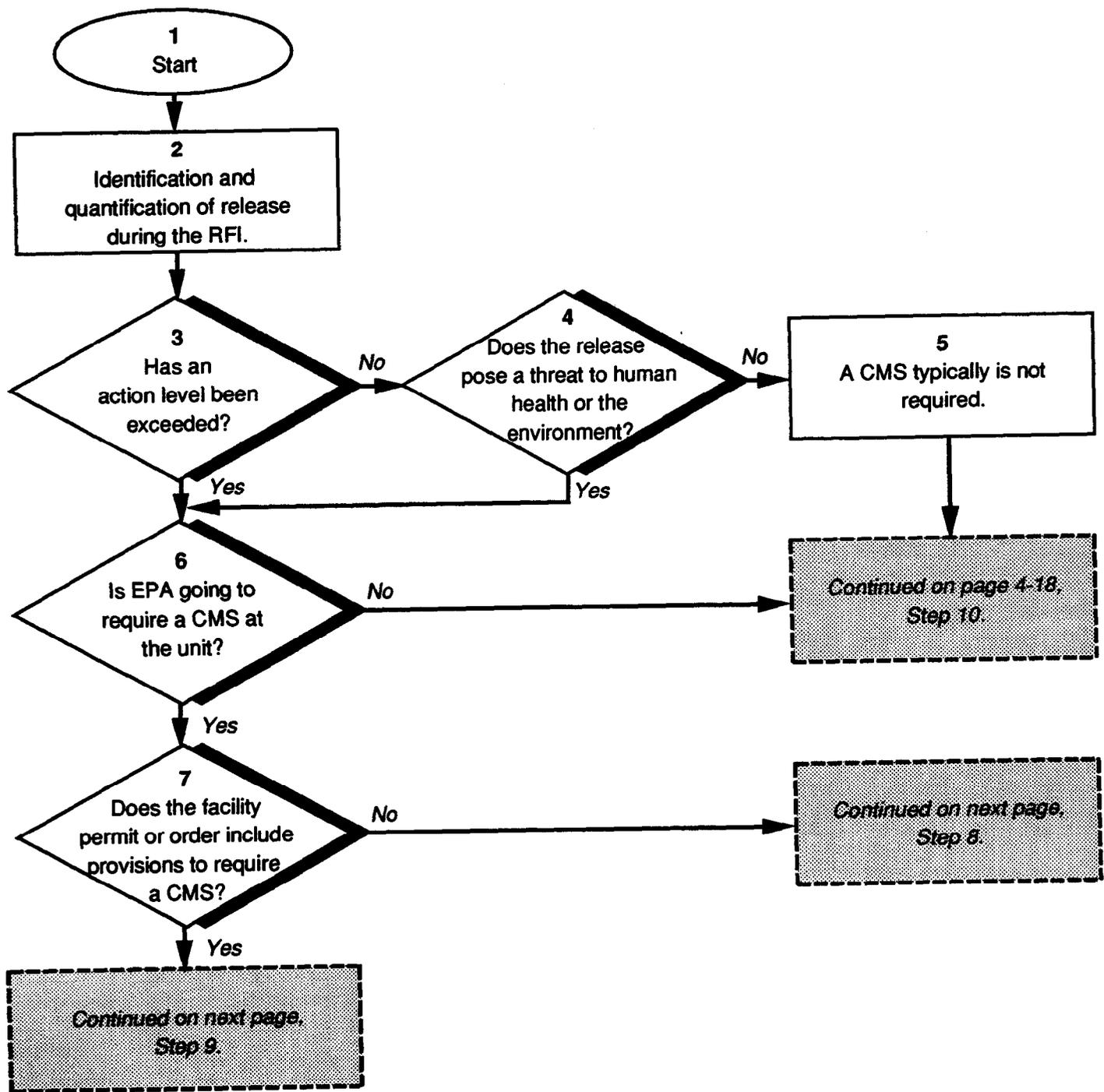
- The history of the facility;
- Current facility conditions, including a summary of risks posed by the facility;
- Identification and a description of each alternative corrective measure;
- Evaluation of each alternative including discussion of:
  - Long-term reliability and effectiveness of each remedy;
  - Reduction of toxicity, mobility, or volume of contaminants at the facility;
  - The short-term effectiveness of each potential remedy;
  - Implementability of each potential remedy;
  - Cost of each remedy; and

- Identification and justification of the owner/operator's preferred corrective measure.

After review of the draft CMS report, EPA may require the owner/operator to conduct additional investigations or studies of other alternative corrective measures. The final, EPA-approved CMS report becomes the basis for the remedy selection process discussed in the next chapter. It should also be noted that the owner/operator's preferred corrective measure is not binding upon EPA. The selection of the corrective measure is solely the responsibility of EPA and is based upon a specific procedure and set of criteria discussed in the next chapter.

**This page intentionally left blank.**

# Module 4-1: Requirement for a Corrective Measures Study



# Module 4-1: Requirement for a Corrective Measures Study

This module will discuss: (1) the mechanisms that trigger the requirement for a Corrective Measures Study (CMS); (2) the need for permit modification or additional RCRA §3008(h) orders; and (3) if applicable the justification of a "Determination of No Further Action."

## **Step 1 Start.**

**Step 2** Identification and quantification of a release from a solid waste management unit (SWMU) most likely will occur during the RCRA Facility Investigation (RFI). The determination whether a CMS is required may occur during the RFI (if adequate data are available) or immediately following completion of the RFI. This determination will be based on EPA review of the RFI report. Note that an administrative order or permit could require that an RFI be performed, but not specifically require a CMS. (Proposed 40 CFR §264.520(a))

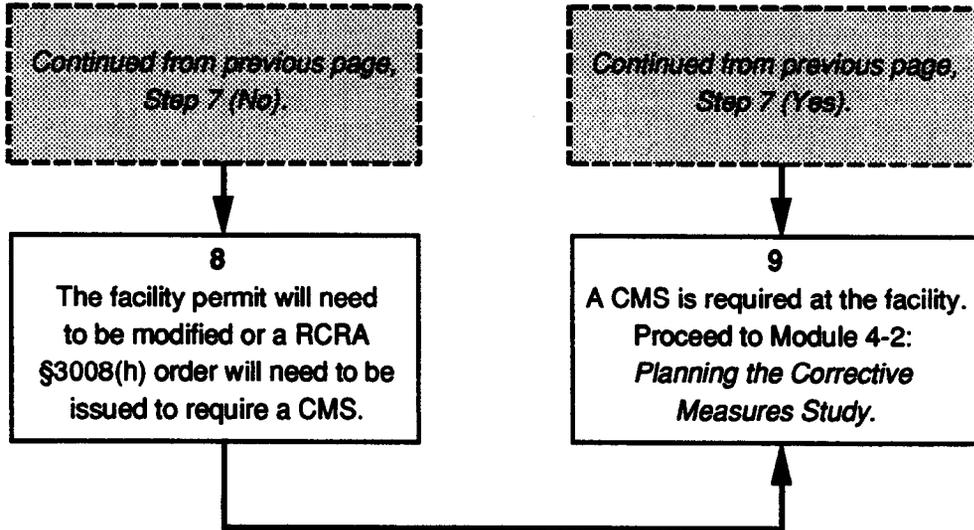
**Step 3** The owner/operator will need to determine if the action level for any contaminant detected at the unit has been exceeded.

**Step 4** If the release is not in excess of an action level, but is of concern because it poses a threat to human health or the environment (e.g., the release threatens a sensitive ecosystem or target population), EPA may require a CMS at the SWMU. (Proposed 40 CFR §264.520(b))

**Step 5** If the release is not in excess of an action level and does not pose a threat to human health or the environment, then a CMS typically is not required at that SWMU.

**Step 6** If the concentration of the contaminant released from the SWMU exceeds the action level for that contaminant or if the release poses a threat to human health or the environment, EPA will usually require a CMS for that SWMU. However, in some cases a CMS may not be required when an action level has been exceeded. For example, if the owner/operator can demonstrate there is no threat posed to human health or the environment by the release, and that the release is not likely to migrate offsite, EPA may elect to not require a CMS at the facility. (Proposed 40 CFR §264.520(c))

**Step 7** If the existing RCRA §3008(h) order or the facility permit specifically requires a CMS under specified conditions, proceed to Step 9. If not, as may be the case with permits or RCRA §3008(h) orders at older facilities, proceed to Step 8.



## Step 8

If the facility permit does not contain a provision to require a CMS, a Class II permit modification or a supplemental §3008(h) order will be required. Obtaining a Class II permit modification requires:

- Submittal of a modification request to the EPA Regional Administrator that: (1) describes the exact change to be made to the permit conditions and supporting documents referenced by the permit, (2) identifies that the modification is a Class II modification, and (3) explains why the modification is needed;
- The permittee to submit the proposed modification to EPA;
- Notification of all parties on the facility mailing list as well as the appropriate State and local government entities;
- Publication of a newspaper notice of the proposed modification;
- A public meeting (if requested); and
- A copy of the proposed modification and any supporting documents be placed at a location accessible to the public.

If EPA does not respond to a Class II permit modification request within 120 days, the facility is authorized to perform the change under the modification up to 180 days only, during which time both parties (EPA and the facility) must fulfill procedural requirements. The modification goes into effect automatically. If a supplemental RCRA §3008(h) order is required, EPA will issue an order specifying the need for a CMS.

The requirements for a Class II permit modification are found at 40 CFR §270.42(b).

## Step 9

A CMS is required for the SWMU and the permit or RCRA §3008(h) order includes provisions to require a CMS. Proceed to Module 4-2: Planning the Corrective Measures Study.

*Continued from page 4-14,  
Step 5 (No),  
Step 6 (No).*



**10**  
"Determination of  
No Further Action"  
requested by the facility.



**11**  
No further corrective action  
to be taken at this time.

## Step 10

If EPA does not intend to require a CMS to be conducted at the unit, then the owner/operator can request a "Determination of No Further Action" at that unit (proposed 40 CFR §264.514). Such a finding permits the owner/operator to request a Class III final modification of the permit for the facility to end the corrective action requirements at that unit, or to request that EPA rescind the RCRA §3008(h) order compelling corrective action. This requires a Class III permit modification which entails:

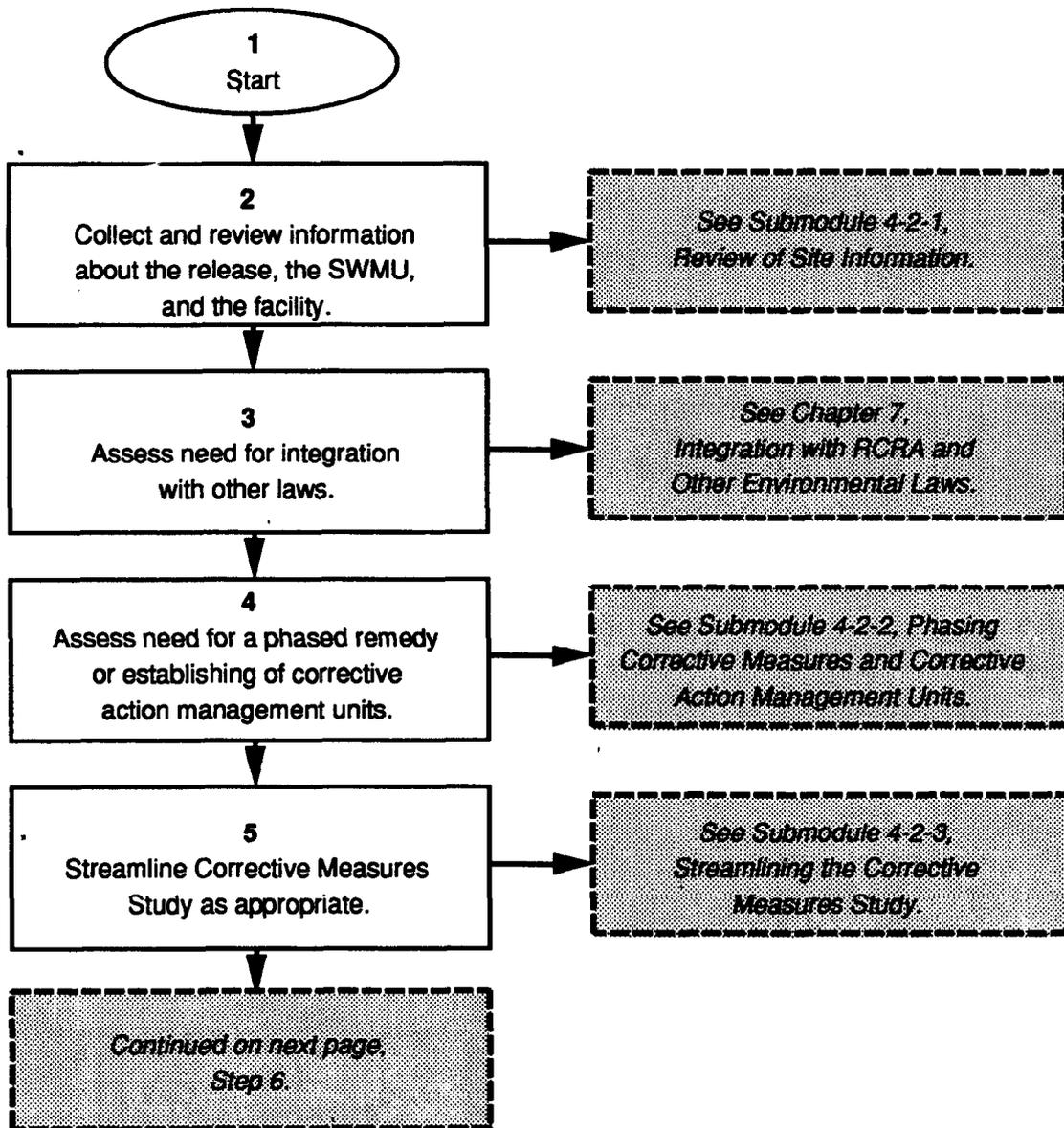
- Submittal of a modification request to the EPA Regional Administrator that: (1) describes the exact change to be made to the permit conditions and supporting documents referenced by the permit; (2) identifies that the modification is a Class III modification; and (3) explains why the modification is needed;
- Notification of all parties on the facility mailing list and the appropriate State and local government entities;
- Publication of a newspaper notice of the request;
- A 60-day comment period;
- A public meeting (on request); and
- A copy of the proposed modification and supporting documents being placed in a location accessible to the public.

The requirements for Class III permit modifications are found at 40 CFR §270.42(c).

## Step 11

Once EPA issues the "Determination of No Further Action" the facility can cease corrective action activities at that SWMU.

# Module 4-2: Planning the Corrective Measures Study



# Module 4-2: Planning the Corrective Measures Study

This module addresses the most important phase of conducting a Corrective Measures Study (CMS). A successful CMS depends largely upon the care and attention to detail which is used in planning the study.

## Step 1 Start.

**Step 2** Collect and review all available information about the solid waste management unit (SWMU) and the release from that SWMU. Information sources include:

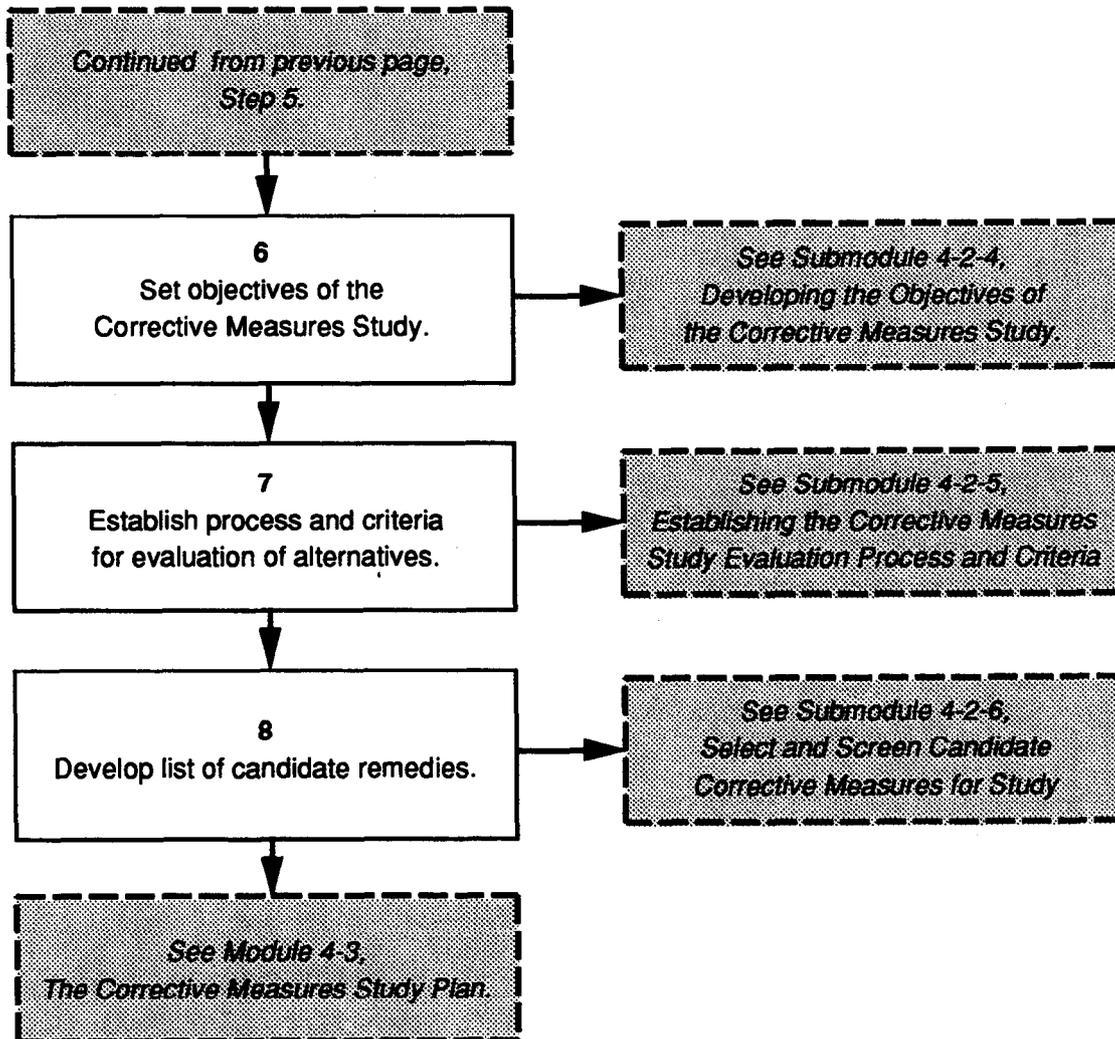
- Reports of releases;
- Reports of interim measures taken at the facility;
- The RCRA Facility Assessment (RFA) report; and
- The RCRA Facility Investigation (RFI) report.

See Submodule 4-2-1 for details on information required for this step.

**Step 3** Assess the need for integration of the CMS with actions taken under other statutes. Examples would include the need for an Environmental Assessment or Environmental Impact Statement required under the National Environmental Policy Act (NEPA) or integration with a Remedial Investigation/Feasibility Study (RI/FS) conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). See Chapter 7 for information on the integration of RCRA Corrective Action with other laws.

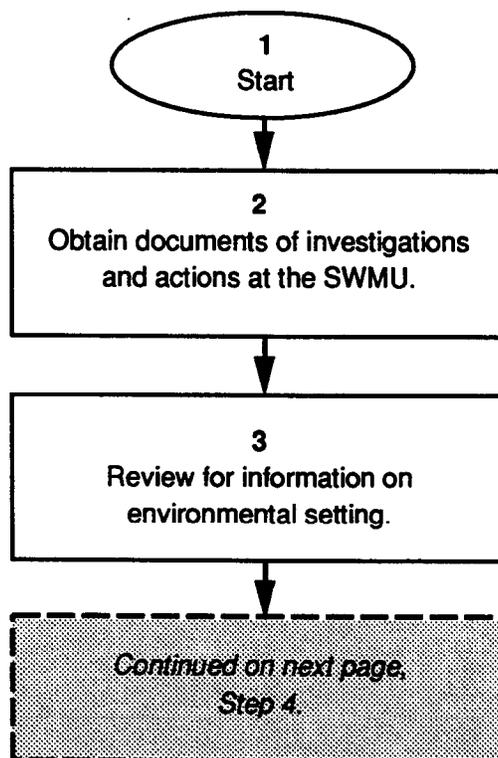
**Step 4** Determine the benefits of either using a phased corrective measure or establishing corrective action management units (CAMUs) at the facility. See Submodule 4-2-2 for information on phased corrective measures and CAMUs.

**Step 5** Consider the use of a streamlined approach to the CMS. Streamlining can greatly simplify the CMS process. Streamlining is similar to the Streamlined Approach for Environmental Restoration (SAFER) used when conducting Remedial Investigations/Feasibility Studies under CERCLA. See Submodule 4-2-3 for a discussion of a streamlined CMS.



- Step 6** Set the objectives of the CMS. This will include developing and negotiating target media cleanup standards (MCS) with EPA and making tentative identification of the points of compliance. See Submodule 4-2-4 for a discussion of CMS objectives.
- Step 7** Establish the process and criteria for evaluating each alternative corrective measure under consideration. The evaluation process should reflect the standards and evaluation factors that will be used to select the corrective measure. See Submodule 4-2-5 for a discussion of the CMS evaluation process.
- Step 8** Develop a list of candidate remedies. This process will include an initial screening of the candidate remedies, and the elimination of those remedies that are inappropriate or obviously impractical given site conditions. See Submodule 4-2-6 for more information.

# Submodule 4-2-1: Review of Site Information



# Submodule 4-2-1: Review of Site Information

The review of information about the facility and the solid waste management unit (SWMU) collected during previous investigations provides the majority of the information required for planning the Corrective Measures Study (CMS). This submodule addresses this review process.

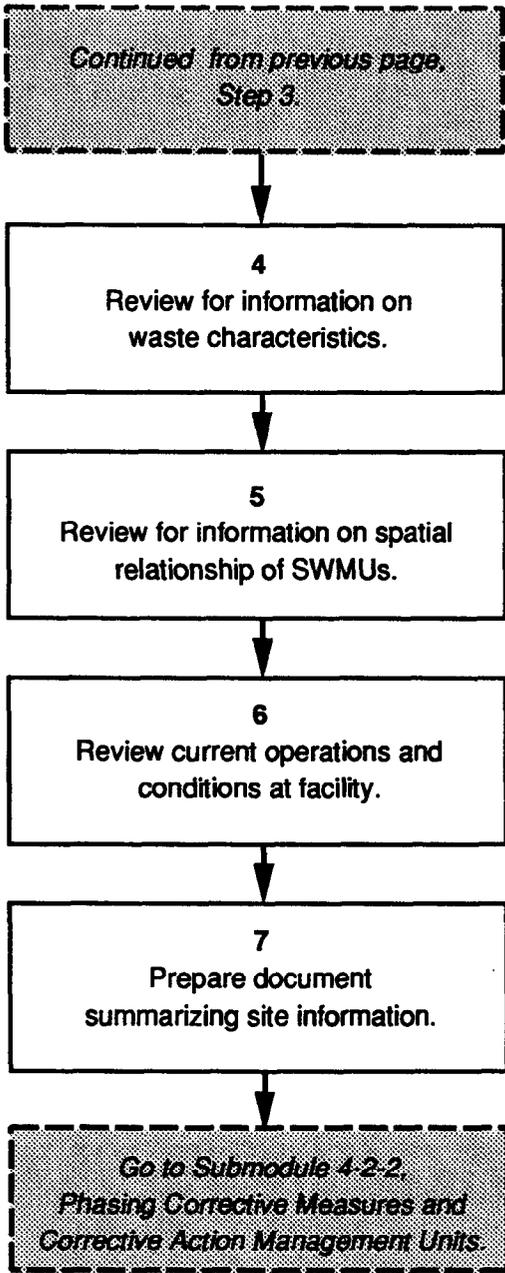
## Step 1 Start.

**Step 2** Obtain copies of all documents concerning investigations and actions taken at the facility that focused on the release from the SWMU under investigation. Documents which are necessary to this step of the CMS include:

- The RCRA Facility Investigation (RFI) report(s);
- The RCRA Facility Assessment (RFA) report;
- Interim measures reports;
- Notices of releases; and
- The facility permit or RCRA §3008(h) order.

**Step 3** Review each document for information on the environmental setting of the facility, including information such as:

- Groundwater -- depth to the uppermost aquifer, aquifer characteristics, groundwater quality, groundwater use, and other hydrogeological information;
- Surface water -- overland distance to nearest surface water body, surface water quality, surface water uses, and other information;
- Air -- air quality, prevailing winds, typical meteorological conditions, and other information; and
- Soil -- type, chemical composition, total organic carbon, cation ion exchange capability, and other characteristics.



## **Step 4**

Review each document for information on the characteristics of the contaminants found at the facility, including:

- Identity of the contaminants;
- Physical, chemical, and toxicological (acute, chronic, and carcinogenic potential) properties;
- Quantity, including an estimate of the quantity and concentration of hazardous waste released to the environment;
- Areal extent of contamination;
- Impacted media (e.g., groundwater, soil); and
- Permitted waste treatment or disposal options (e.g., land disposal restrictions).

## **Step 5**

Review each document for information on the relationship of the SWMU to other parts of the facility, and the relationship of the facility to the surrounding area, including information on:

- Other releases at the facility that might be impacting the same area as the SWMU under investigation;
- Population demographics, and the location of the maximally exposed individual (MEI);
- Sensitive environments that might be impacted by the release;
- Permitted waste treatment or disposal occurring at other SWMUs at the facility; and
- Corrective action activities currently underway at other SWMUs at the facility.

## **Step 6**

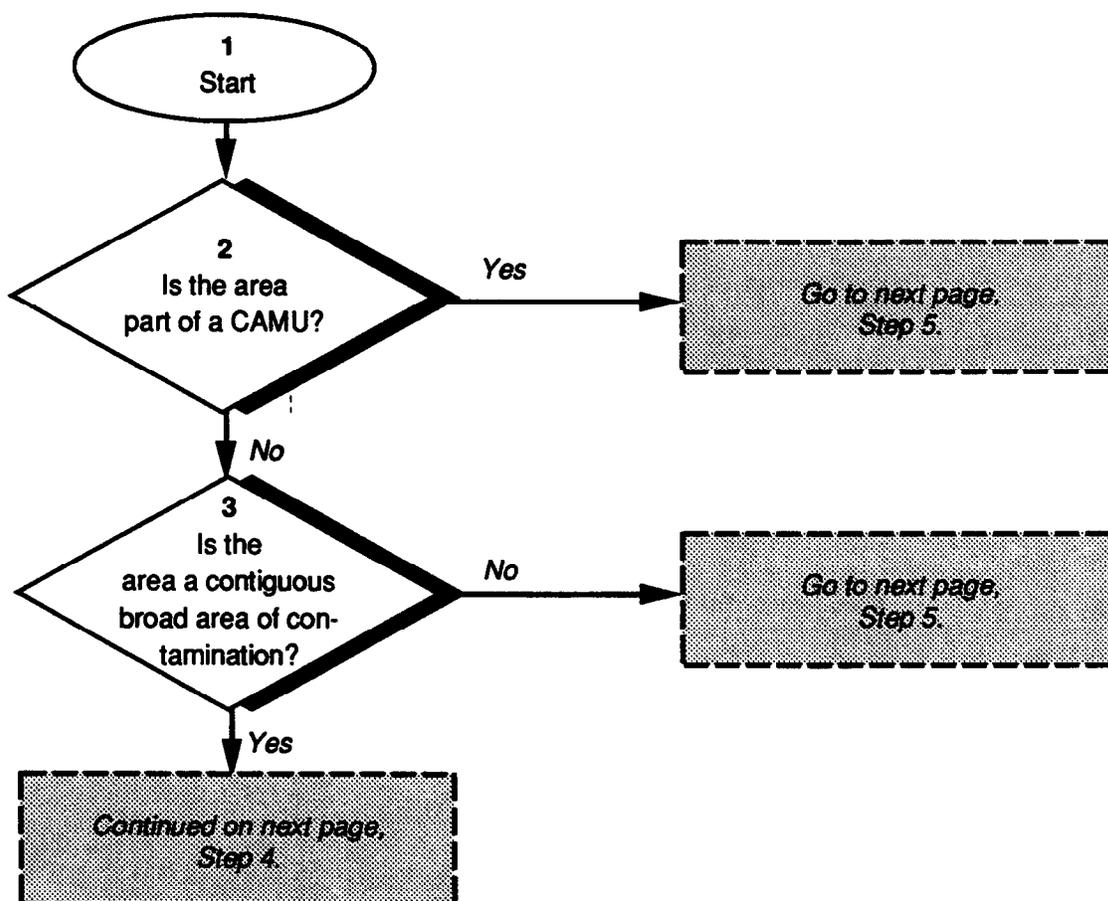
Review each document for information about current operations and conditions at the facility including:

- Types of waste treatment or disposal permitted at the facility, including waste treatment processes regulated under other statutes (e.g., water treatment facilities, injection wells);
- Interim measures taken at the SWMU; and
- Investigations being conducted under other authorities at the facility.

## **Step 7**

Prepare a document summarizing the findings of this review. This document will be used as a reference throughout the CMS process, and will be incorporated into the CMS plan and CMS report.

# Submodule 4-2-2: Phasing Corrective Measures and Corrective Action Management Units



# Submodule 4-2-2: Phasing Corrective Measures and Corrective Action Management Units

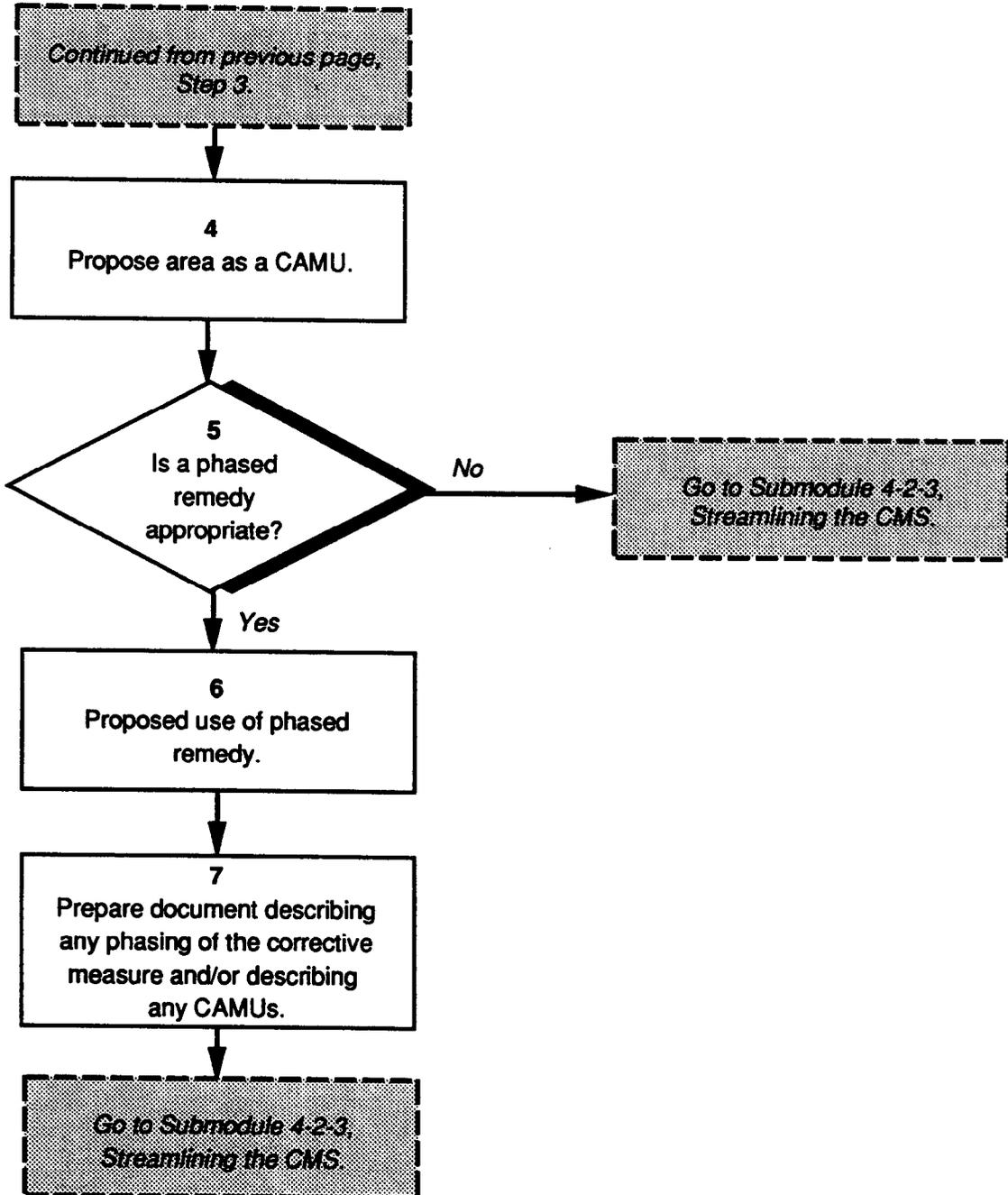
During the Corrective Measures Study (CMS), the owner/operator should evaluate the potential benefits of phasing the corrective measure and the use of corrective action management units (CAMUs) at the facility. These options provide the opportunity to combine efforts at a number of solid waste management units (SWMUs). This submodule will address the use of these options.

## Step 1 Start.

**Step 2** From the information collected during the review of investigations at the facility, determine if the area presently under consideration has been designated part of a CAMU. A CAMU may have been designated by EPA prior to, or as a result of, the RCRA Facility Investigation (RFI).(Proposed 40 CFR §264.551(c))

The designation of an area as a CAMU permits the movement of hazardous waste within the unit during remediation without triggering the land disposal restrictions or minimum technology requirements for a new or lateral expansion of a unit. This is the primary advantage of designating a broad area of contamination as a CAMU. (Proposed 40 CFR §264.551(c)(1) and (2))

**Step 3** If the area represents a contiguous, broad area of contamination (which may also include within its perimeter one or more land-based SWMUs) it may qualify as a CAMU. Examples of SWMUs which may be included in a CAMU are soils surrounding a land-based unit such as a leaking surface impoundment or landfill. Areas that cannot be included in a CAMU include all non-land-based units such as incinerators or tanks. (55 FR 30843)



## Step 4

Contact EPA and propose the area as a CAMU. Only the EPA is authorized to designate an area as a CAMU. EPA's decision will be based upon assessment of the extent and nature of the contamination, location of existing SWMUs within the contaminated area, and the ultimate remedial objectives established for the entire facility.

## Step 5

Once the designation of any CAMUs is completed, consider whether the corrective measure should be implemented in phases. A phased remedy is any logically connected set of actions performed sequentially over time, or concurrently at different SWMUs or CAMUs. The initial phases should be consistent with the ultimate long-term remediation goals of the facility, and should complement, not impede, future actions. (Proposed 40 CFR §264.526(d))

In this step, evaluate the site conditions against the seven specific requirements for a "conditional remedy" (Proposed 40 CFR §264.525(f)). A conditional remedy, a type of phased remedy, is a process whereby the owner/operator is permitted to phase in a remedy over a period of time, contingent upon meeting certain requirements.

A conditional remedy *must*:

- Be protective of human health and the environment;
- Achieve all media cleanup standards (MCS) beyond the facility boundary, as soon as is practicable;
- Prevent further significant environmental degradation through the use of treatment or engineering controls at the source, and the use of engineered measures to prevent further migration of the release within the facility boundary;
- Institute controls to prevent exposure to hazardous wastes at the facility;
- Continue monitoring of releases in order to determine if significant environmental degradation does occur;
- Provide financial assurances; and
- Comply with the waste management standards for waste generated during corrective action.

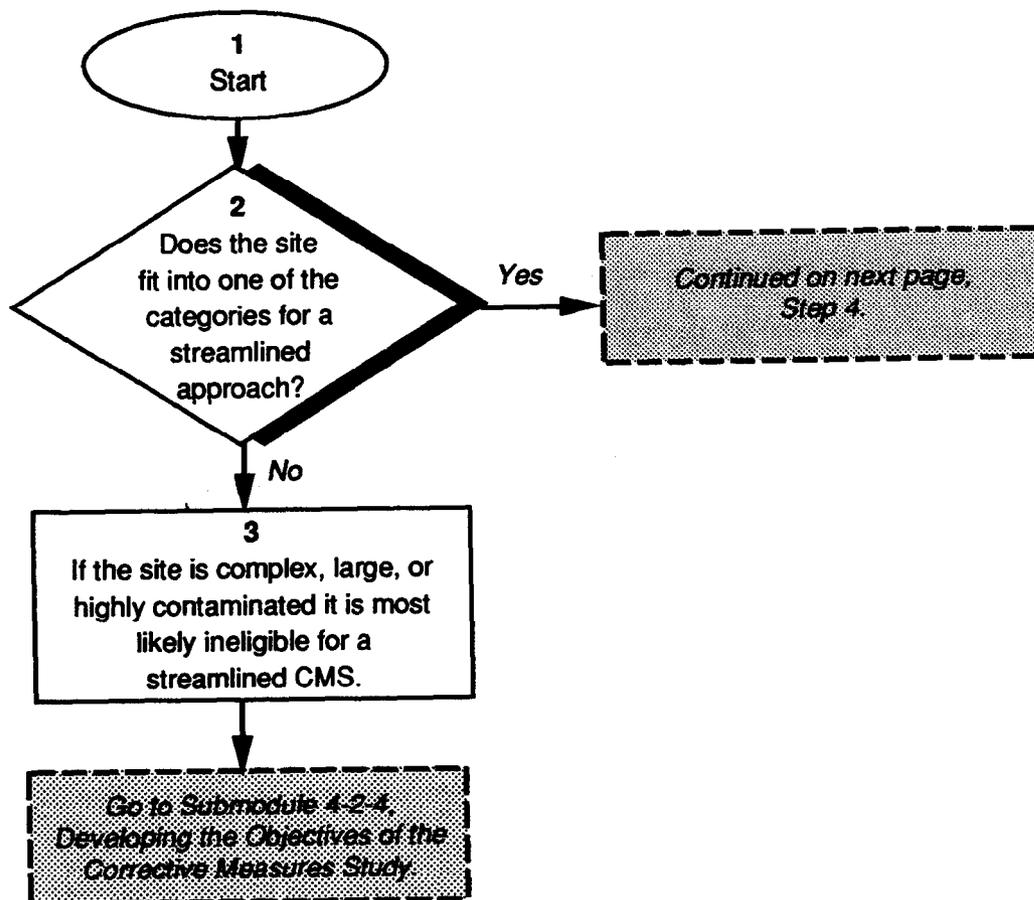
## Step 6

If appropriate to site conditions, propose the use of a phased or conditional corrective measure to EPA. With the proposal, provide all necessary supporting information required for review during the decision-making process.

## Step 7

Develop a document describing any CAMUs designated by EPA, and/or describing any phasing of the CMS. This document will be used throughout the CMS process, and will eventually be incorporated into the CMS plan and CMS report.

# Submodule 4-2-3: Streamlining the Corrective Measures Study



# Submodule 4-2-3: Streamlining the Corrective Measures Study

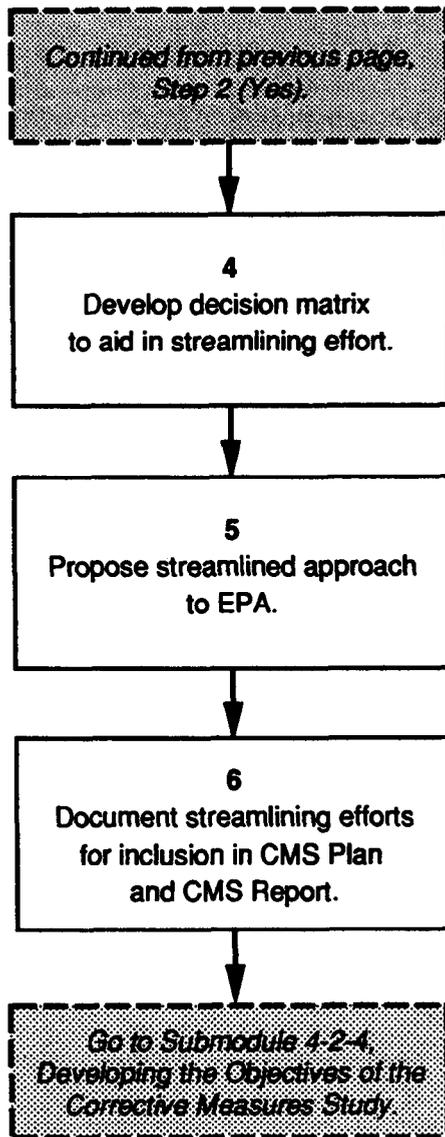
In the preamble to the proposed Subpart S rule, EPA states that corrective measures at RCRA facilities will often be straightforward, presenting only a minimal need for evaluation of alternatives for the corrective measure (55 FR 30821). With this in mind, EPA proposes to allow streamlining of the Corrective Measures Study (CMS) under certain conditions, in an effort to speed the corrective action process. Streamlining is similar to the Streamlined Approach for Environmental Restoration (SAFER) used when conducting Remedial Investigations/Feasibility Studies under CERCLA. This submodule addresses streamlining the CMS.

## Step 1 Start.

**Step 2** From the information collected during the review of investigations at the facility, determine if the facility falls into one of these categories:

- The owner/operator proposes a highly protective corrective measure, such as a RCRA clean closure.
- Because of site conditions, there are few, if any, alternatives for the corrective measure.
- Expected future use of the site dictates a highly protective cleanup.
- The remedial solution is straightforward and will use a tested and proven remedial technology.
- Use of a phased or conditional remedy is appropriate.

**Step 3** The use of a streamlined CMS is generally not appropriate for complex, large, or highly contaminated sites, or sites where very different remedial technologies exist for addressing the type of contamination at the facility.



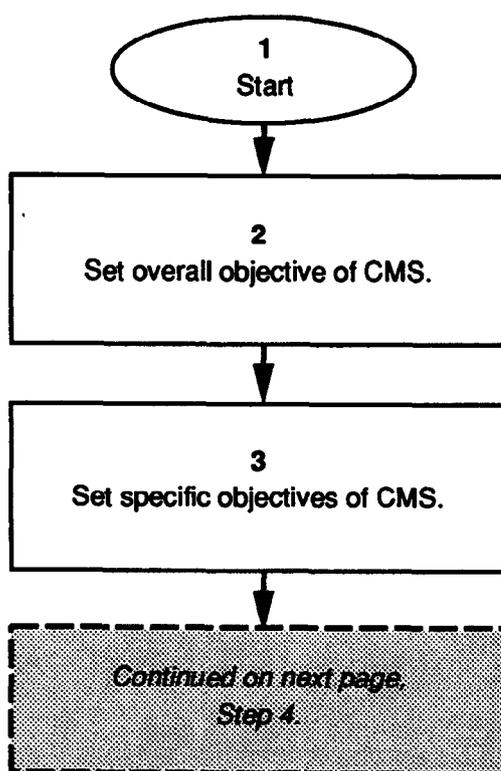
**Step 4** Streamlining involves planning the CMS in such a way that as additional information is collected, that information is used to determine the next action to be taken.

The key to using a streamlined approach to the CMS is to first develop a decision matrix. This matrix should reflect the key decisions that must be made, list the specific information required to make those decisions, and list any critical evaluation factors, which, if not met, would eliminate a potential corrective measure from further consideration. Once this decision matrix is complete (or as complete as possible), analyze the matrix for critical points where, depending on the actual data collected, avenues of investigation can be eliminated or where specific decisions must be made. For example, if the SWMU contains deteriorating drums of the RCRA listed waste U055, 40 CFR §268 (the LDR) requires that the waste be treated by incineration or fuel substitution. This requirement limits the possible alternatives for the treatment of the waste, so other avenues of investigation can be eliminated early in the CMS process.

**Step 5** Contact EPA and propose the use of a streamlined approach to conduct the CMS. When proposing the use of a streamlined approach to the CMS process, provide all supporting documentation (usually the findings in the RCRA Facility Investigation Report) to aid in the decision-making process.

**Step 6** Prepare a document describing and justifying any streamlining of the CMS. This document will be used as part of the CMS plan and CMS report.

# Submodule 4-2-4: Developing the Objectives of the Corrective Measures Study



# Submodule 4-2-4: Developing the Objectives of the Corrective Measures Study

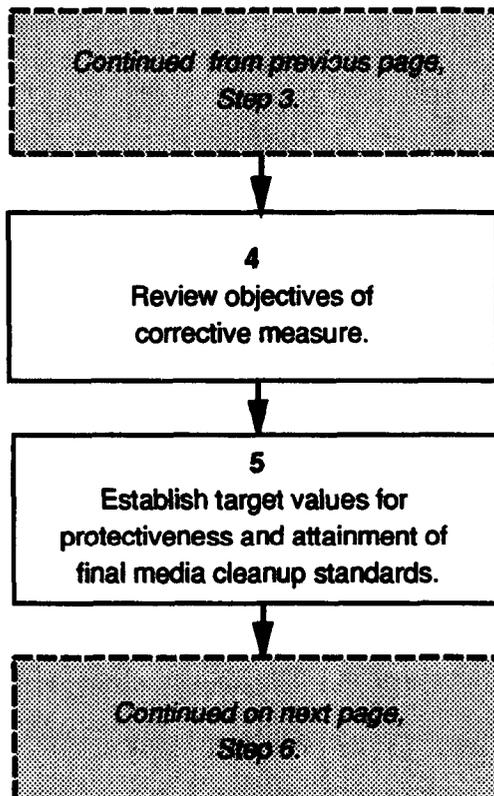
This submodule discusses the process of setting objectives for the Corrective Measures Study (CMS). Clearly defined objectives, both general and specific, provide not only an excellent planning tool, but also a means of evaluating the progress of the CMS.

## Step 1 Start.

**Step 2** The overall objective of the CMS is to provide an analysis of the alternatives for the corrective measure. This analysis will be used as the basis for selecting the final remedy (see Chapter 5).

**Step 3** Achieving the overall CMS objective involves fulfilling a number of specific objectives. Establishing the objectives that lead to fulfilling the overall objective is a critical part of the planning process. These objectives not only provide direction to the rest of the planning process, they are also useful in assessing the progress of the CMS. Some examples of specific objectives for the CMS are:

- Ensuring that the draft CMS report provides all necessary information for the remedy selection process, and will require minimal revisions;
- Completion of the CMS within an established time frame;
- Minimizing delays in the CMS process; and
- Minimizing the effort expended studying alternatives which are impractical.



## Step 4

Evaluation of the alternatives for the corrective measure requires establishing target objectives to be achieved through implementation of the corrective measure. The proposed Subpart S rule sets four standards for a corrective measure (Proposed 40 CFR §264.525(a)). The corrective measure *must*:

- Be protective of human health and the environment;
- Attain final media cleanup standards (MCS);
- Provide source control to reduce or eliminate further releases of hazardous wastes or hazardous waste constituents that may pose a threat to human health and the environment; and
- Comply with the standards for management of wastes generated as part of conducting the corrective measure.

The remainder of this submodule discusses establishing definitive targets that will fulfill each of these standards.

## Step 5

The most important target values are those which provide for the protectiveness standard and the degree of attainment of final MCS. These two standards are closely linked. The MCS are media-specific health- and environmental-based contaminant concentrations which must be achieved by the corrective measure. The primary sources of MCS are promulgated standards deemed protective of human health and the environment (e.g., Maximum Contaminant Levels). When such standards do not exist, the corrective measure must achieve an adequate level of protection. For example, a lifetime risk from exposure to carcinogenic hazardous substances has been established within the range of one additional incidence of cancer in 10,000 persons to one additional cancer incidence per 1,000,000 persons. (Proposed 40 CFR §264.525(d))

While EPA is required to establish the final MCS during the remedy selection process, the development of a target MCS is a discretionary function. Further, these target MCS are in no way binding. Depending upon site-related factors, final MCS may be significantly different from the target MCS.

If EPA is unwilling to establish target MCS, the owner/operator should consider developing their own target MCS values for use during the evaluation process. Any target MCS developed by the owner/operator should use the methodology for establishing the final MCS (see Chapter 5) and should be technically valid. The owner/operator should recognize that such values are unlikely to be recognized by EPA, but provide the owner/operator a valuable tool in evaluating the alternatives.

Other definitive target values for the protectiveness standards might include:

- Engineered life span of the corrective measure;
- Acceptable risk arising from implementation; or
- Maximum acceptable time before the corrective measure shows beneficial results.

*Continued from previous page,  
Step 5.*



**6**  
Establish target value  
for source control.



**7**  
Establish target value for compliance  
with waste management standards.



**8**  
Development of data quality objectives.



*Continued on next page,  
Step 9.*

**Step 6** Establishing a target value for source control will provide a means for evaluating the source control standard. Ideally, the target value would be complete source control and prevention of any further releases from the SWMU. However, site conditions might make such a goal unattainable or unrealistic. In this case, the owner/operator should provide justification for selection of a lesser standard.

**Step 7** The target value for compliance with the requirements of the waste management standard should be based upon compliance with all applicable solid and hazardous waste management standards. Any waivers of required waste management practices that may be authorized by EPA should also be considered.

**Step 8** In addition to developing the overall, specific, and target objectives, development of data quality objectives (DQOs) may be required as part of planning the CMS. This function may be incorporated into, or borrow heavily from, the DQOs developed for the RFI. DQOs are used to ensure that all data collection efforts will provide sufficient data at a specified quality level to support the CMS. Developing DQOs includes preparation of a document outlining:

- Data collection strategy;
- Sample collection strategy;
- Standards for field measurements;
- Sample analysis; and
- Data management.

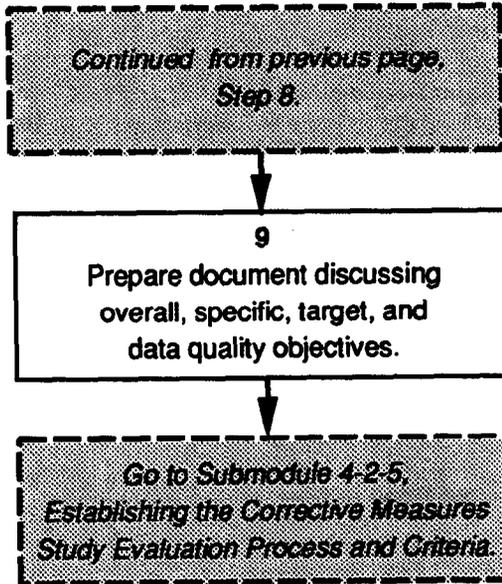
Detailed information on the development of DQOs can be found in these EPA documents:

*RCRA Corrective Action Plan (Interim Final)*  
EPA Document No. EPA/530-SW-88-028  
OSWER Directive 9902.3  
June 1988

*Data Quality Objectives for Remedial Response Activities*  
EPA Document EPA/540/G-87/003  
OSWER Directive No. 9355.0-7B  
1987

*Interim Guidelines and Specification for Developing Quality Assurance Project Plans*  
EPA Document QAMS-005/80  
1980

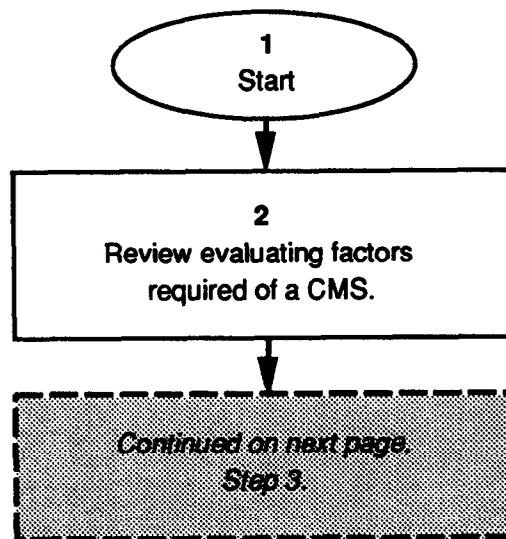
*RCRA Facility Investigation (RFI) Guidance (Four-Volume Set) (Final)*  
EPA Document OSW:530/SW-89-031  
OSWER Directive No. 9502.00-6C  
1989



**Step 9**

Prepare a document discussing the overall, specific, target, and data quality objectives of the CMS, and submit this document to EPA. This document will also be used as part of the CMS plan and the CMS final report.

# Submodule 4-2-5: Establishing the Corrective Measures Study Evaluation Process and Criteria



# Submodule 4-2-5: Establishing the Corrective Measures Study Evaluation Process and Criteria

The Corrective Measures Study (CMS) provides the information for the selection of the corrective measure. An obvious requirement is for the CMS to provide information on each of the criteria used to select the corrective measure. This submodule discusses establishing the CMS evaluation process and criteria.

## Step 1 Start.

**Step 2** During a CMS each alternative corrective measure must be evaluated on the basis of five factors (Proposed 40 CFR §264.522(a)). These factors are:

- Evaluation of the performance reliability, ease of implementation, and potential impacts from each remedial alternative;
- Assessment of the effectiveness of each remedial alternative in achieving adequate source control;
- Assessment of the time required to begin and complete each remedial alternative;
- Estimation of the costs of each remedial alternative; and
- Assessment of institutional requirements (e.g., State, local, or public health regulations or permitting requirements) that might impact the implementation of each remedial alternative.

*Continued from previous page,  
Step 2.*



**3**  
Review standards and selection  
factors for corrective measures.



**4**  
Review objectives of CMS.



*Continued on next page,  
Step 5.*

### Step 3

With the CMS evaluation factors in mind, review the four standards and five selection factors used during the final selection of the corrective measure by EPA (Proposed 40 CFR §264.525(a) and (b)). Under the proposed Subpart S rule a corrective measure *must*:

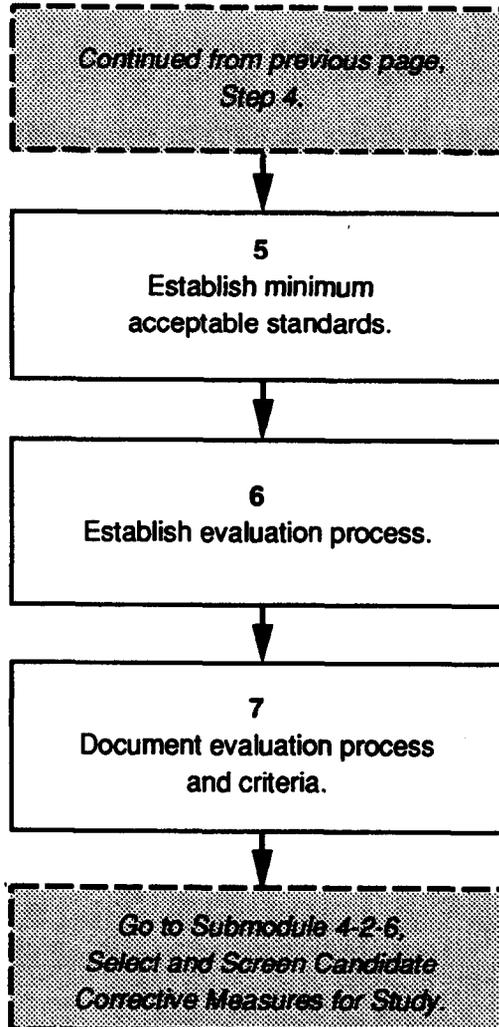
- Provide protection of human health and the environment;
- Attain final media cleanup standards (MCS);
- Provide source control to reduce or eliminate further releases that may pose a threat to human health and the environment; and
- Comply with the standards for management of wastes generated during the corrective measure.

The factors used in selecting the final corrective measure are:

- Long-term reliability (greater than 30 years);
- Reduction of toxicity, mobility, and volume of the contaminants;
- Short-term effectiveness (the time until the implemented corrective measure results in a demonstrated reduction of risk to human health and the environment), including the risks associated with implementing the corrective measure;
- Ease of implementation and implementability; and
- Cost.

### Step 4

Review the objectives set for the CMS. The most important CMS objectives are the target MCS established by EPA.



## **Step 5**

With the CMS evaluation factors, standards for corrective measures, specific remedy selection factors, and objectives of the CMS in mind, establish a list of specific parameters that will be examined during the evaluation process. Where possible, establish a quantifiable minimum acceptable standard for each parameter. Some examples of specific parameters include:

- The effectiveness of the alternative in achieving target MCS;
- Useful life of the remedy;
- Demonstrated reliability of the alternative;
- The time required for mobilization and construction;
- Time until beneficial effects of the remedial alternative are demonstrated;
- The acceptable degree of risk to human health and the environment associated with implementing the remedy; and
- Fully loaded direct and indirect capital and operational costs.

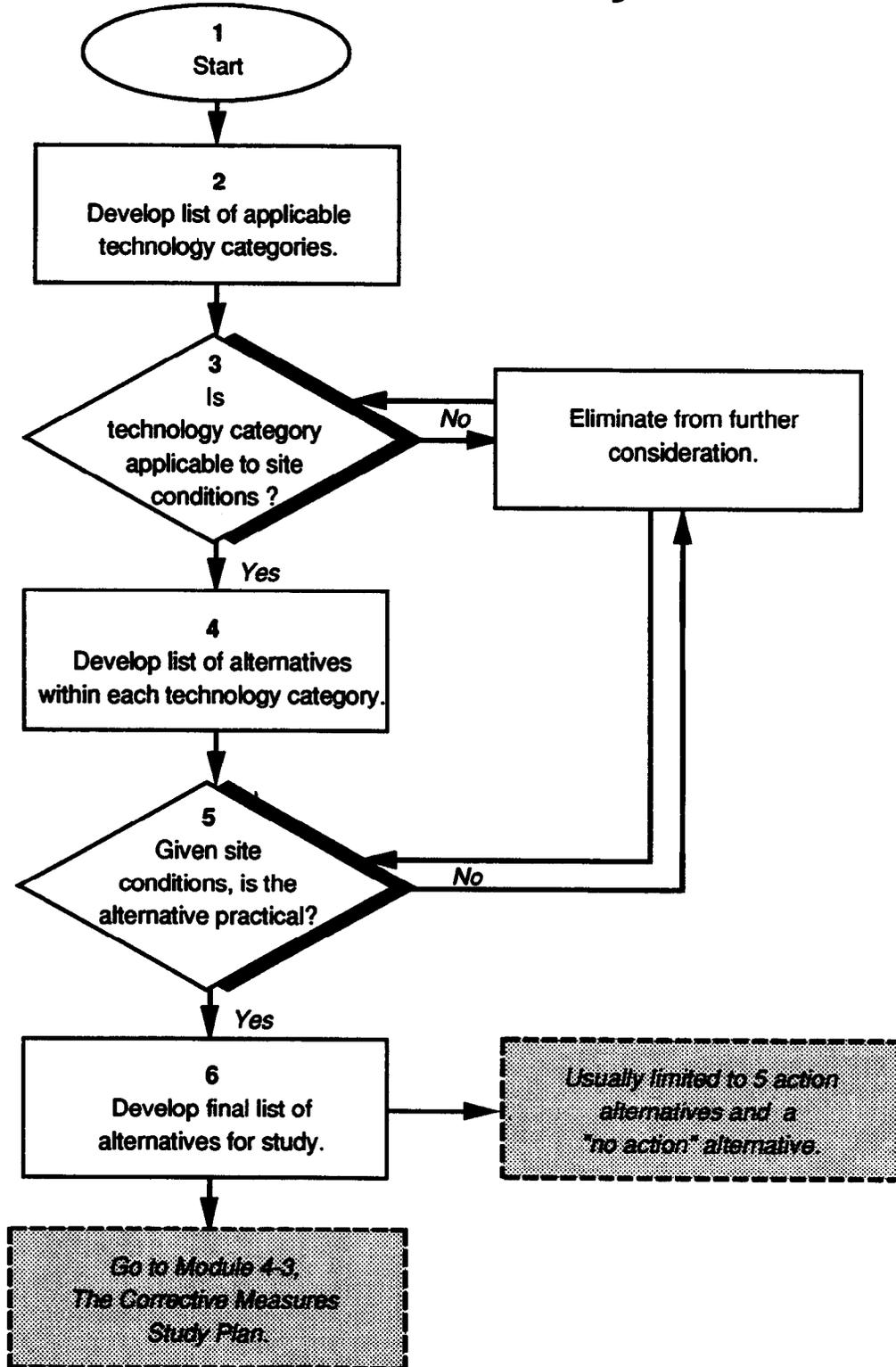
## **Step 6**

Establish the sequence for evaluation of each alternative. While the proposed Subpart S rule places equal weight on all the corrective measures standards and remedy selection factors, developing a sequence for the evaluation will provide a framework for conducting the evaluation and will aid in preparing the final CMS report.

## **Step 7**

Prepare a document which discusses the evaluation process and criteria established for the CMS. This document will be incorporated into the CMS plan, and the CMS final report.

# Submodule 4-2-6: Select and Screen Candidate Corrective Measures for Study



# Submodule 4-2-6: Select and Screen Candidate Corrective Measures for Study

The final phase of planning the Corrective Measures Study (CMS) is to select and screen alternatives for the corrective measure.

## **Step 1 Start.**

**Step 2** With the information collected during the review of site information and the objectives developed for the CMS, prepare a list of the general types of remedial technology that may be appropriate to site conditions. This list may include technologies such as incineration, pump and treat systems, or capping.

It should be noted that some permits or orders, particularly those established prior to 1989, required the conduct of a Preliminary Evaluation of Corrective Measures Technologies (PECMT). This evaluation, generally required prior to the RFI, involved identifying candidate technologies so that baseline data needs to evaluate these technologies could be collected during the RFI. If a PECMT was required, it should be used as the starting point for this exercise.

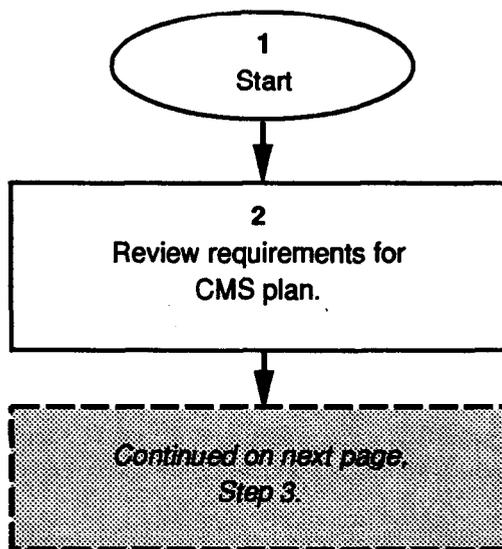
**Step 3** Do not include any technology that obviously would not apply given the site conditions. For example, at a site with an air release, a pump and treat system for groundwater would be inappropriate to include in the list of remedial technologies.

**Step 4** Develop a representative list of candidate remedies within each technology category. Review available information on each candidate corrective measure.

**Step 5** Eliminate from consideration any candidate which is impractical due to site or other conditions. For example, a candidate remedy that has been shown to be effective only in small-scale applications should not be considered for a large-scale corrective measure.

**Step 6** Prepare the final list of candidate remedies that will be evaluated in the CMS. This list should generally contain no more than five action alternatives, and should also contain a "no action" alternative. The "no action" alternative is used as a baseline to compare the other alternatives. An alternative which only reduce exposure (i.e., a fence) should not be considered a "no action" alternative. Such an action should be considered as a separate, limited-action alternative.

# Module 4-3: The Corrective Measures Study Plan



# Module 4-3: The Corrective Measures Study Plan

The Corrective Measures Study (CMS) plan is the principal document used during the conduct of the CMS. The CMS plan should incorporate all the information required for conducting the CMS, and should act as a key reference if questions or problems arise during the CMS. This module is devoted to discussing the CMS plan.

## Step 1 Start.

**Step 2** The requirements for the CMS plan are specified in proposed 40 CFR §264.523 and are discussed at 55 FR 30821 - 30823. According to these sections of the preamble and the proposed rule, the CMS plan should include discussion of the following elements:

- Current conditions at the site;
- The general approach to investigating and evaluating potential remedial alternatives (e.g., use of a phased remedy, streamlined approach);
- Description of the objectives of the CMS;
- A proposed schedule for the CMS;
- Identification of the alternatives for the corrective measure;
- The evaluation process and evaluation criteria for each alternative (including target media cleanup standards (MCS)); and
- The format for presentation of the findings of the CMS.

Each element will be discussed in additional detail in this module. It should be noted that parts of the CMS plan discussed below may be described in other documents that have already been prepared as part of the CMS effort. If so, the plan discussed in this section should incorporate, either directly or by reference, these documents.

*Continued from previous page,  
Step 2.*



**3**  
Description of current site conditions.



**4**  
Description of general  
approach to CMS.



**5**  
Discuss objectives of CMS.



*Continued on next page,  
Step 6.*

### Step 3

The description of the current site conditions should include a summary of information on:

- Environmental setting of the site, including appropriate information on:
  - Hydrogeology;
  - Soils;
  - Surface water;
  - Air quality and meteorological information;
- The affected media and extent of the contamination;
- Waste characteristics, including:
  - Identification of all contaminants found at the site;
  - Action levels for each contaminant found at the site;
  - The target MCS for each contaminant;
  - Important chemical and physical properties of each contaminant;
  - Health- or environment-based toxicological information (e.g., RfD, carcinogenic potential);
  - Waste quantity; and
- Potential receptors.

### Step 4

The description of the general approach should include appropriate information on:

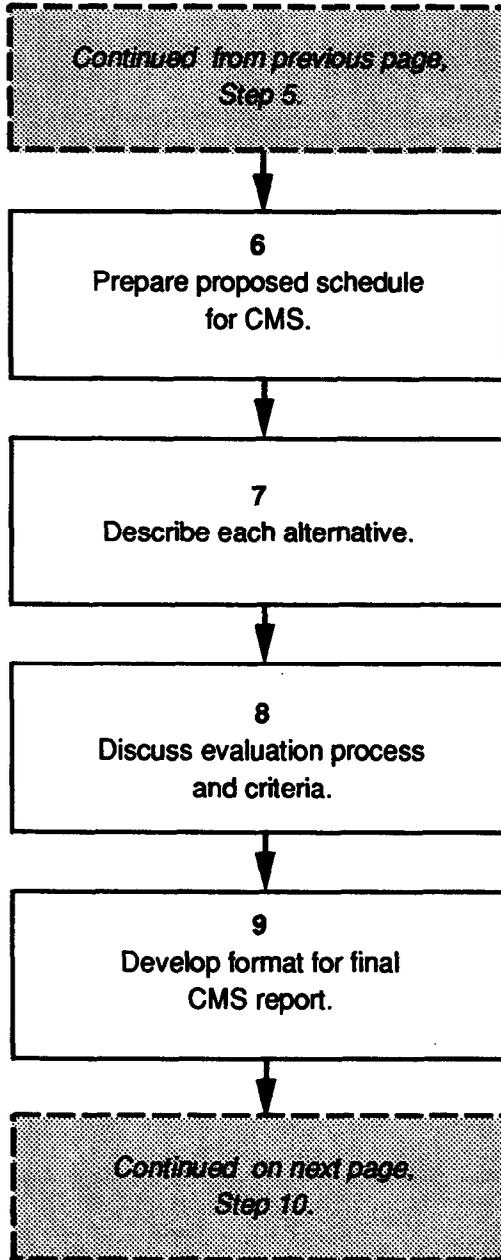
- Establishment of corrective action management units (CAMUs);
- Phasing of the corrective measure (including any conditions placed on phasing);
- Justification for a streamlined approach to the CMS; and
- Any required integration with other laws. (55 FR 30821-30823)

### Step 5

The discussion of the objectives of the CMS should incorporate all objectives of the CMS which were developed during the CMS planning process. Included should be statements outlining the:

- Overall objectives of the CMS;
- Specific objectives of the CMS;
- Target objectives for the corrective measure; and
- Data quality objectives for any treatability studies conducted during the CMS.

This discussion should also include information on how these objectives will be used to direct and evaluate the progress of the CMS. (55 FR 30821-30823)



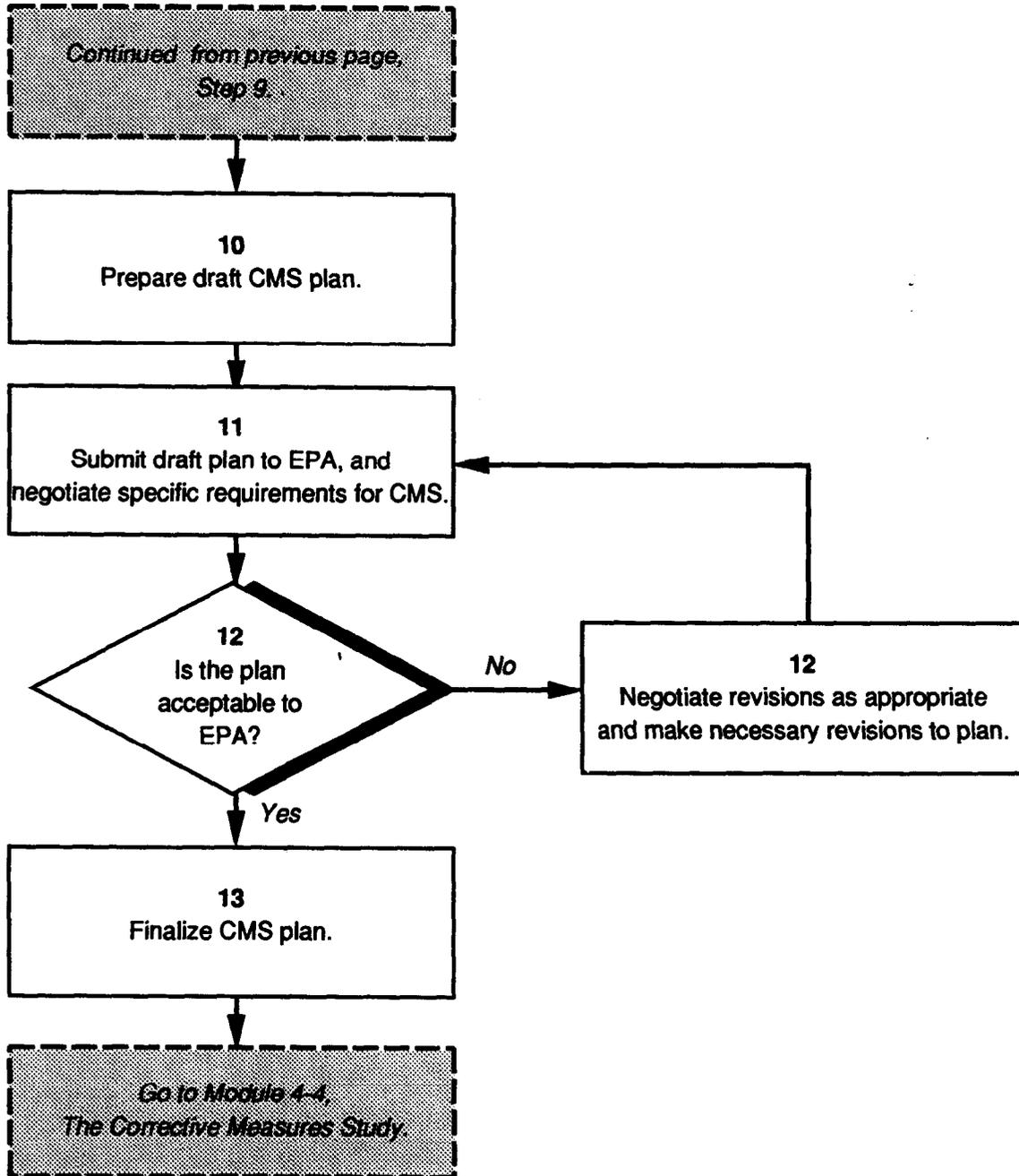
**Step 6** The proposed schedule for conducting the CMS should include references to major milestones (e.g., completion of treatability testing, the draft CMS report). The proposed schedule should also reflect any other operations undertaken concurrently at the same solid waste management unit (SWMU). For example, if parts of the RCRA Facility Investigation (RFI) and CMS are being conducted concurrently, the proposed schedule should include reference to the major milestones of the RFI. Because the schedule will become a part of the facility permit, the schedule should be developed to be as flexible as possible. (55 FR 30821-30823)

**Step 7** The CMS plan must include a brief discussion of each of the alternatives under consideration. The discussion of each alternative should include:

- How the alternative works;
- Results from previous usage under similar site conditions;
- Anticipated limitations of the alternative; and
- An estimate of the time needed to implement the alternative. (55 FR 30821-30823)

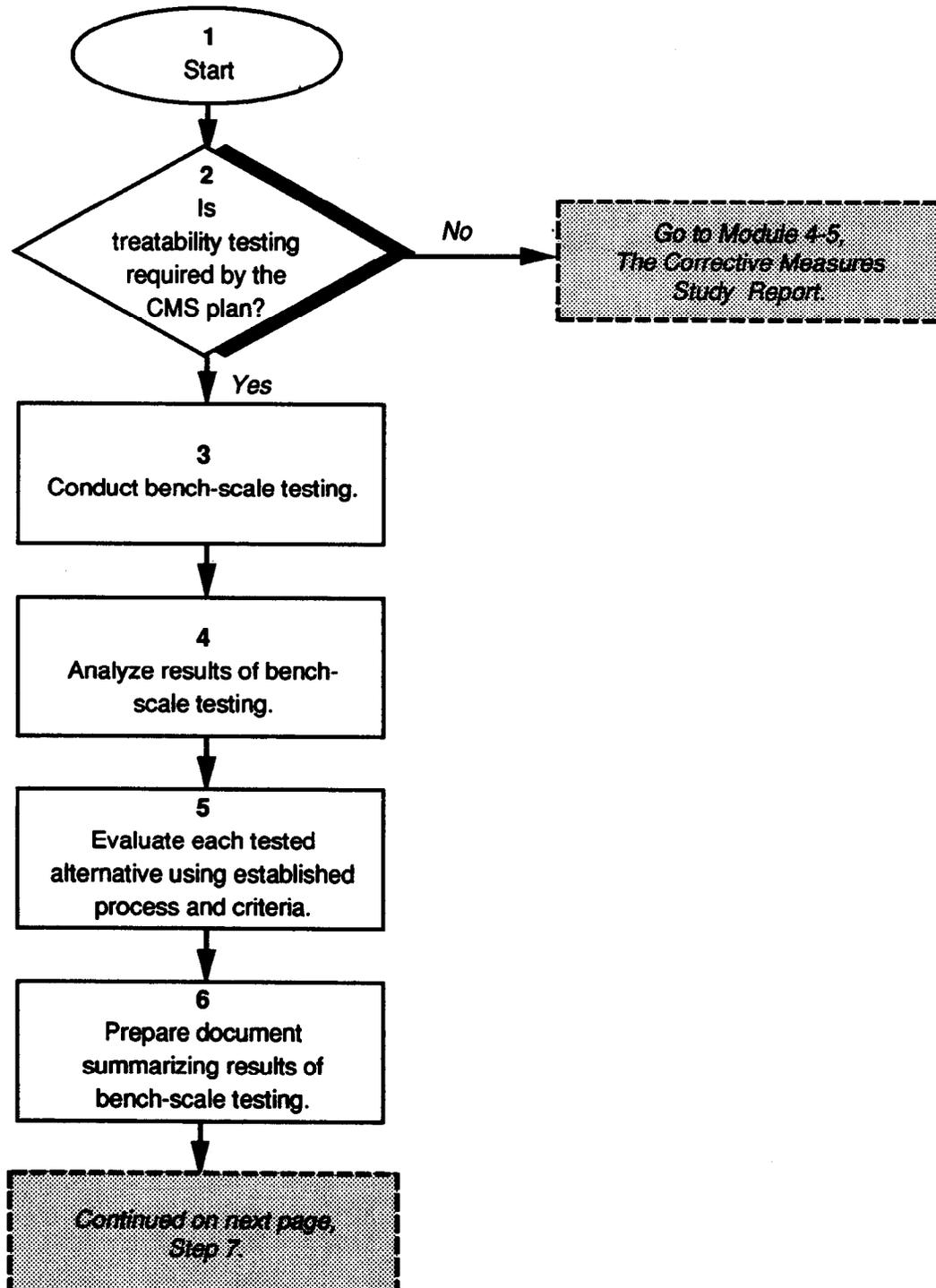
**Step 8** The plan should discuss the CMS evaluation process established in the proposed Subpart S rule as well as the facility-specific evaluation process and criteria developed during the planning process. (55 FR 30821-30823)

**Step 9** Inclusion of the format for presenting the results of the CMS is not mandatory, but may be required by EPA. EPA also has the authority to specify a format for the final CMS report. If EPA does not require a standardized report format, the owner/operator should develop a standardized format for the CMS report. A standardized report format simplifies developing reports, and offers a degree of consistency between reports developed for different sites. (55 FR 30821-30823)



- Step 10** Prepare the draft CMS plan.
- Step 11** Submit the draft CMS plan to EPA for review. The draft plan represents DOE's opportunity to negotiate on certain conditions. Although the plan should be developed to comply with the requirements under the RCRA Corrective Action program, the plan should propose only those activities which are necessary to the selection of an appropriate corrective measure.
- Step 12** If EPA requires revisions, revise and resubmit the draft plan to EPA. This activity may require meetings with EPA and negotiation on certain points. For example, the extent of any treatability testing should be limited to that which is required to evaluate the technology. The DOE should try to avoid requirements to conduct original or theoretical research during the evaluation of corrective measures technologies.
- Step 13** Adopt the final, EPA-approved plan, and incorporate the plan into the facility permit.

# Module 4-4: The Corrective Measures Study



# Module 4-4: The Corrective Measures Study

Once the planning process and the Corrective Measures Study (CMS) plan are completed, conducting the actual testing of each alternative is largely a matter of implementing the plan. However, it is during this process that the important task of eliminating inappropriate remedies occurs. This module addresses the actual conduct of the CMS.

## **Step 1 Start.**

**Step 2** Determine if treatability studies are required by the CMS Plan (see 55 FR 30822).

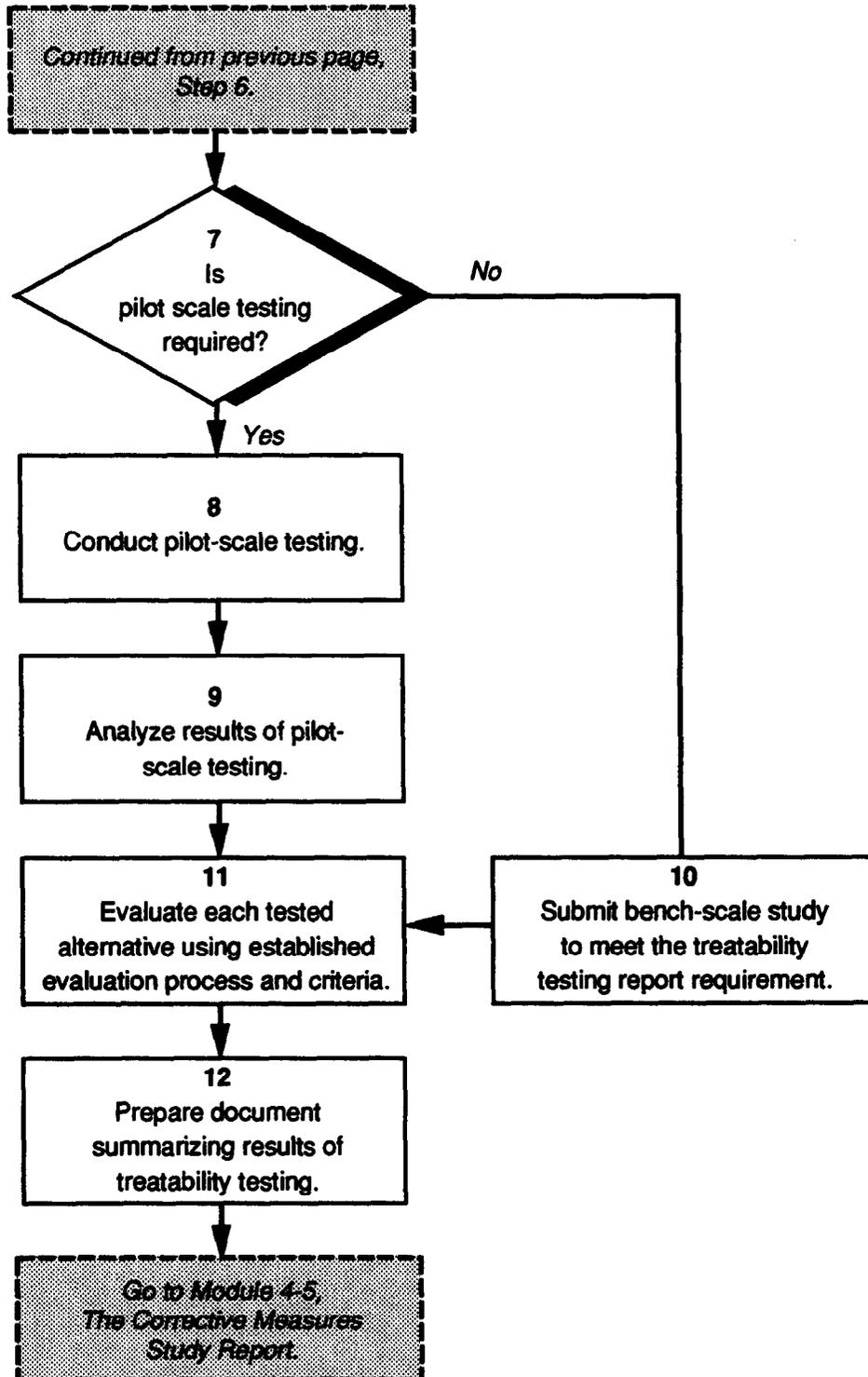
**Step 3** For each alternative, conduct any bench-scale treatability testing that is required by the CMS plan.

This first phase of treatability testing as part of the CMS is usually performed in a laboratory. Bench-scale testing involves conducting a series of treatability tests with different parameters on small quantities of contaminated material. Analysis of the results of these small-scale tests permits evaluation and optimization of the operational parameters of the alternative quickly and at a relatively low cost.

**Step 4** Analyze the results from the bench-scale testing, and summarize these results.

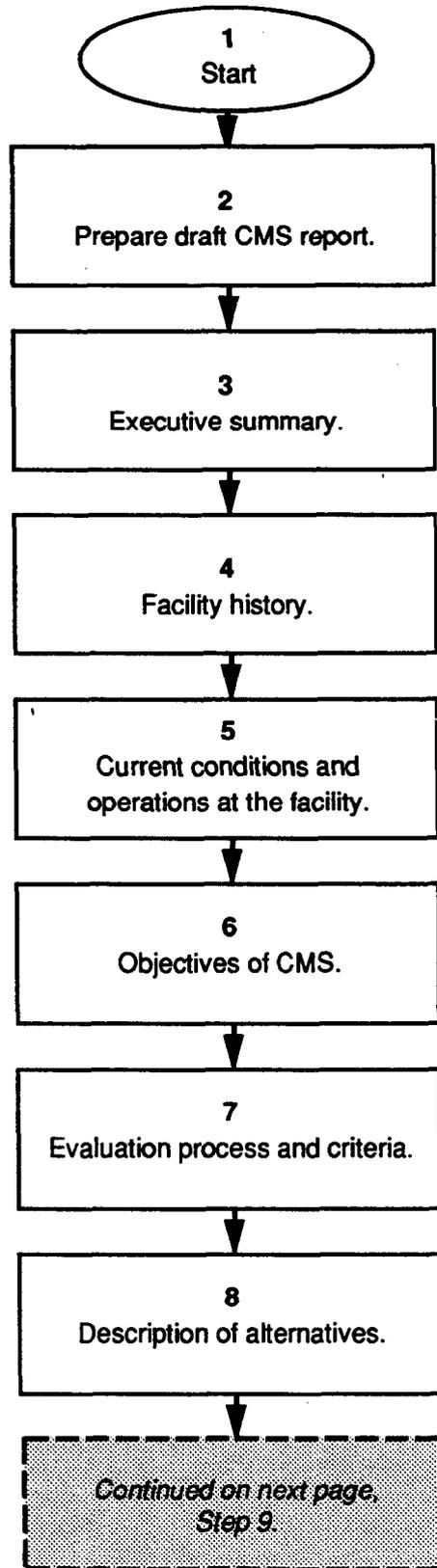
**Step 5** Evaluate each alternative using the evaluation process and criteria discussed in the CMS plan. Eliminate from further consideration those alternatives which demonstrate obvious impracticality at this scale of testing.

**Step 6** Prepare a document summarizing the findings of the bench-scale treatability tests and evaluation of the alternatives. This document will be used in developing the CMS report.



- Step 7** For each alternative that remains following bench-scale testing, evaluate the need for pilot-scale testing.
- Step 8** Conduct any required pilot-scale treatability testing. Pilot-scale treatability testing involves building a scaled-down version of a treatment technology. Pilot-scale testing should simulate full scale operations and usually permits only limited variance of operational parameters. The results of a pilot-scale test allow assessment of the overall effectiveness and practicality of a remedial technology.
- Step 9** Analyze the results of the pilot-scale testing to determine:
- The effectiveness of the corrective measure in reducing the toxicity, mobility, and volume of the waste;
  - The maximum rate of operation or the expected rate of reduction of the contamination; and
  - The optimal operating parameters.
- Step 10** Submit the bench-scale testing document required in Step 6 to meet any requirements for treatability testing reporting.
- Step 11** Evaluate each alternative using the evaluation process and criteria discussed in the CMS plan. Eliminate from consideration those alternatives that are impractical or unreliable.
- Step 12** Prepare a document summarizing the findings of the bench- and pilot-scale treatability tests and evaluation of each alternative. This document will be used in developing the CMS report.

# Module 4-5: The Corrective Measures Study Report



# Module 4-5: The Corrective Measures Study Report

The Corrective Measures Study (CMS) Report is the principal document used during the selection of the corrective measure. All activities and effort expended in the CMS process to this point have been aimed at developing this report. The CMS report should incorporate or summarize all the information collected during the CMS. In many cases, the information required in the CMS report is included in documents prepared as part of other CMS activities, and should incorporate these documents, either directly or by reference.

## **Step 1 Start.**

**Step 2** From the information collected during the review of investigations, the final CMS plan, the results of any treatability studies, and the analysis of the alternative corrective measures, prepare a draft CMS report. The CMS report must include the following items. (Proposed 40 CFR §264.524)

**Step 3** An executive summary highlighting the important findings of the CMS and identifying the preferred alternative for the corrective measure.

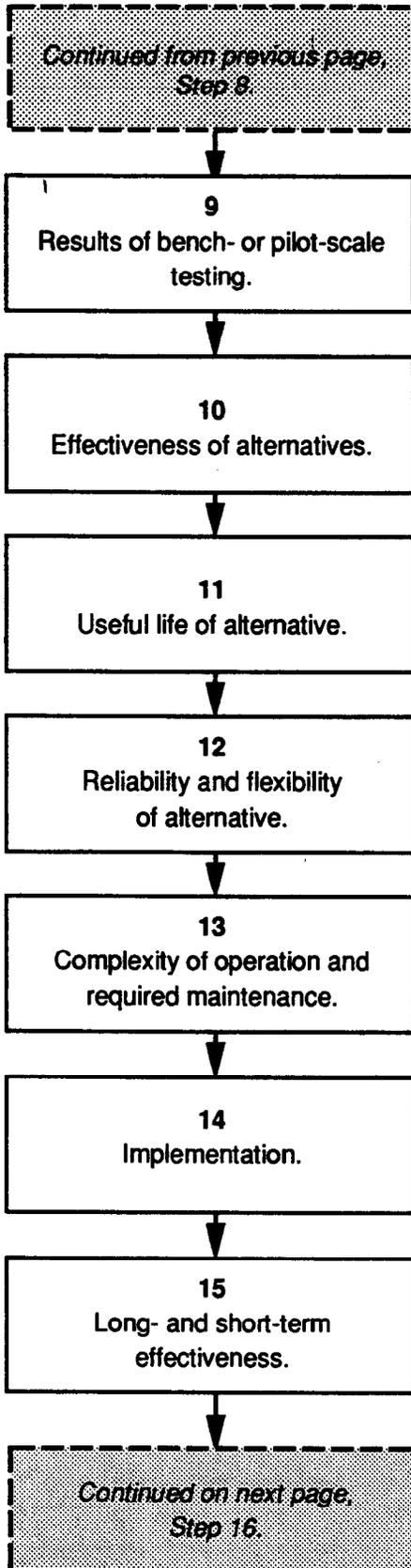
**Step 4** A brief discussion of the site history based upon the documents reviewed during the planning process.

**Step 5** A brief discussion of the current conditions and operations at the site, including reference to other investigations or remedial activities occurring at the site.

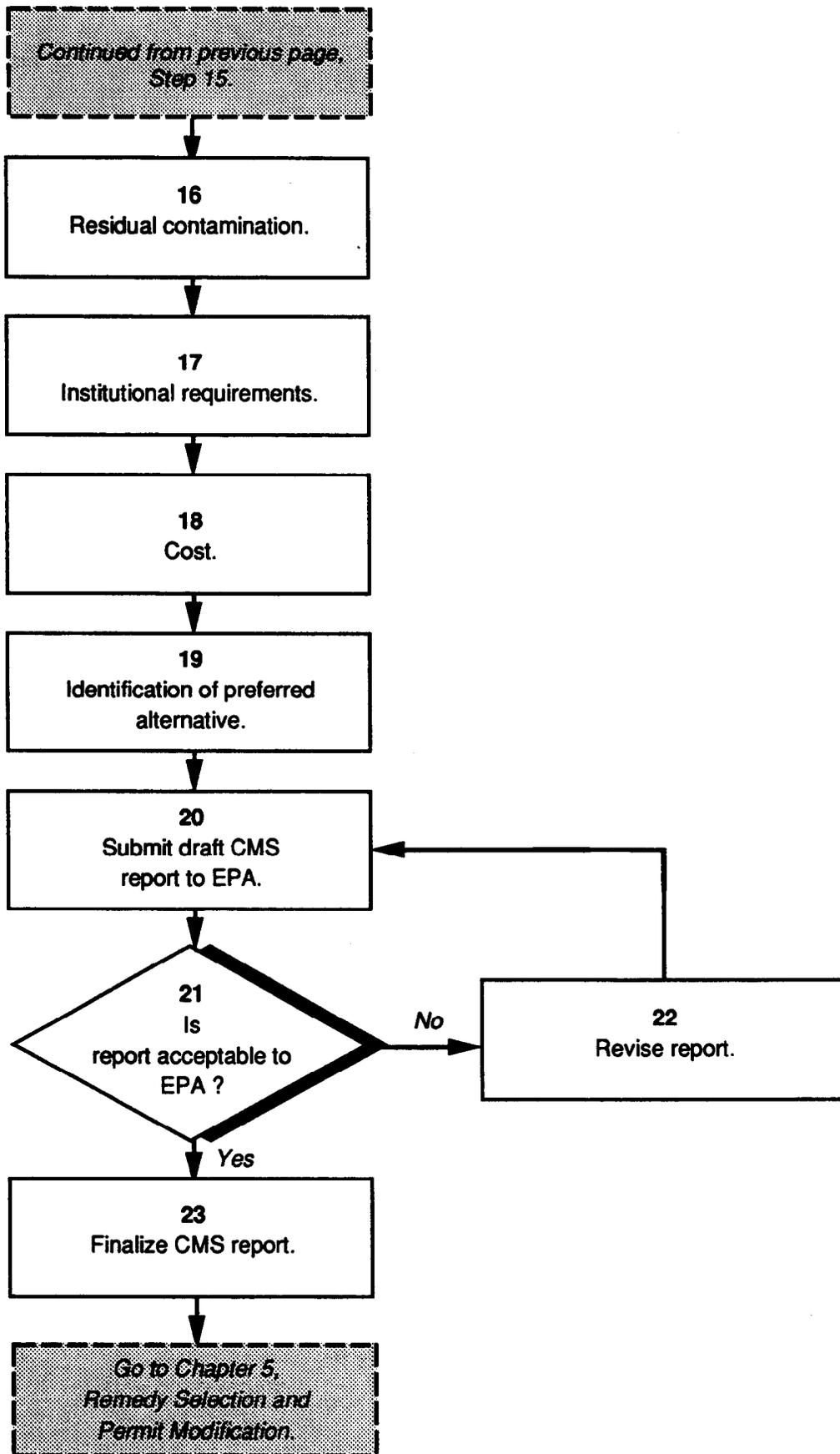
**Step 6** A discussion of the objectives set for the CMS during the planning process, in particular any target media cleanup standards that were developed.

**Step 7** A brief discussion of the process and criteria used to evaluate the alternatives.

**Step 8** Identification and a brief description of each alternative corrective measure studied during the CMS.



- Step 9** A description and summary of any bench- or pilot-scale testing performed.
- Step 10** An assessment of the effectiveness of the alternative, in terms of the ability of the alternative to perform the intended function.
- Step 11** An estimate of the useful life of the remedy, including a discussion of any replacement or repair which might be needed.
- Step 12** A discussion of the demonstrated reliability and flexibility of the remedy operating under actual site or similar conditions.
- Step 13** A discussion of the complexity of the operation of, and maintenance required by, the remedy.
- Step 14** A description of the implementability and an estimate of the time required for implementation of each potential remedy, including a discussion of any potential obstacles to implementation and the time until beneficial results are seen.
- Step 15** A discussion of the long- and short-term effectiveness of each potential remedy including discussion of any potential risks to human health and the environment associated with the remedy and possible means to mitigate these risks.



- Step 16** An estimate of any residual contamination at the site following completion of the corrective measure; and the potential for, and risks associated with, human exposure to residual contamination.
- Step 17** A listing of all institutional requirements for the alternative (e.g., permits, public health standards).
- Step 18** The estimated total cost of each remedy including a breakdown of the fully loaded direct and indirect capital and operation costs for the life of the corrective measure.
- Step 19** Identification and justification of the owner/operator's preferred corrective measure.
- Step 20** Submit the draft report to EPA for review and approval.
- Step 21** Upon review of the draft CMS report, EPA may require the owner/operator to conduct analyses of additional alternatives. EPA may also require the owner/operator to expand upon the investigation of an alternative already evaluated during the CMS. If the report has been returned by EPA for additional work, conduct any additional investigations, revise, and resubmit the report to EPA for review and approval.
- Step 22** Once accepted, the final CMS report will be used by EPA as the basis for the final selection of the corrective measure at the site. The final remedy selection process is discussed in the next chapter.
- Step 23** Finalize the CMS report. Proceed to the next phase of corrective action, selection of the corrective measure and permit modification (discussed in Chapter 5).

**This page intentionally left blank.**

# References

*A Guide to Developing Superfund Proposed Plans*  
OSWER Directive No. 9335.03-02FS-2  
November 1989

*Corrective Action During Interim Status*  
OSWER Directive 9481.09-84  
July 1984

*Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities (Proposed Rule)*  
55 FR 30798, Friday, July 27, 1990

*Corrective Action: Technologies and Applications (Seminar Publication)*  
EPA/625/4-89/020  
September 1989

*Data Quality Objectives for Remedial Response Activities:  
Volumes 1 and 2*  
OSWER Directive No. 9355.0.07B  
March 1987

*Draft Guidance on Developing Superfund Decision Documents*  
OSWER Directive 9355.3-02  
March 1988

*Enforcement Actions Under RCRA and CERCLA at Federal Facilities*  
OSWER Directive No. 9992.0  
January 1988

*Federal Facilities Hazardous Waste Compliance Manual*  
OSWER Directive No. 9992.4  
January 1990

*Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Interim Final)*  
EPA/540/G-89/004  
October 1988

*Guide for Conducting Treatability Studies Under CERCLA (Interim Final)*  
EPA/540/2-89/058  
December 1989

*Public Participation in Environmental Restoration Activities*  
DOE/EH-0221  
November 1991

*RCRA Corrective Action Interim Measures Guidance (Interim Final)*  
OSWER Directive 9902.4  
June 1988

*RCRA Corrective Action Plan (Interim Final)*  
OSWER Directive No. 9902.3  
June 1988

*RCRA Facility Assessment Guidance*  
PB-87-1-7769  
OSWER Directive 9502.00-05  
October 1986

*RCRA Facility Investigation Guidance (Four-Volume Set) (Final)*  
OSWER Directive No. 9502.00-6C  
OSW:530/SW-89-031  
May 1989

*The Resource Conservation and Recovery Act (RCRA)*  
*(as amended by the Hazardous and Solid Waste Amendments (HSWA))*  
42 U.S.C. §6901 et seq.