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CRITERIA FOR DETERMINING THE NEED FOR REMEDIATION AND FOR THE SELECTION OF REMEDIAL APPROACHES

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TASK 2 REPORT

CRITERIA FOR DETERMINING THE NEED FOR REMEDIATION AND FOR THE SELECTION OF REMEDIAL APPROACHES

1.0 Approach to the Selection of Criteria

In order to select the criteria to be used in determining the need for remediation, it is necessary to outline the general approach for determining need. The approach used herein requires that certain attributes of inactive waste disposal sites be evaluated to determine if remediation is necessary. It is this process which allows the identification of the criteria which are appropriate for evaluating each site. A similar approach has been applied in determining the selection of remedial approaches.

In the sections which follow, the process used in making determinations will be discussed first. This discussion will then be followed by the identification and description of the criteria. Section 2 addresses the need for remediation. Section 3 addresses the selection of remedial measures. Section 4 addresses compliance with environmental regulations.

2.0 Development of the Criteria for Determining the Need for Remediation

Since the process of determining the need for remediation at CERCLA sites is somewhat different from that of RCRA 3004(u) sites, these will be discussed separately in Sections 2.1 and 2.2, respectively. As will be noted in the sections which follow, the criteria presented are derived from a review of the federal and state regulations and DOE Orders which apply to the sites.

2.1 Determining the Need for Remediation at Potential CERCLA Sites

In the CERCLA process, sites are screened to determine if they have potential for being included on the National Priority List (NPL). This

screening, using the Hazard Ranking System (HRS), or the Modified Hazard Ranking System (mHRS) in the case of sites with contamination from radionuclides, evaluates sites according to criteria contained in the National Oil and Hazardous Substances Contingency plan (NCP). In this way, sites are scored on their relative potential for releases that pose a hazard to health or the environment. Sites which score higher than 28.5 are candidates for the National Priority List (NPL).

The scoring is initially conducted during the Preliminary Assessment (PA) (DOE Phase I). Data collected in the PA are evaluated and the HRS (or mHRS) system is applied. The resulting score is a preliminary determination of the relative hazard/threat posed by the site. A score less than 28.5 is generally considered to pose no threat under the CERCLA program.

The HRS/mHRS considers a number of criteria in developing the relative score. These criteria include:

1. Principal injury, radiation, and exposure hazards

    - o Injestion of contaminated groundwater or surface water
    - o Direct contact with wastes
    - o Fire and explosion
    - o Migration to contaminate drinking water or other human use resources, or to result in direct contact
    - o Waste characteristics, toxicity, and persistence
    - o Radioactive materials.

2. Physical security and safeguard requirements

    - o Accessibility to hazardous substances
    - o Containment of wastes and contamination
    - o Proximity to populations and resources

3. Site location

   - o Environmental setting (depth to aquifer of concern, unsaturated zone permeability, slope, surrounding terrain, distance to surface water)
   - o Land use and resource use
   - o Proximity to populations, sensitive environments, and resources

4. Risk and Natural forces

   - o Migration along surface water, groundwater, and air routes to expose populations or impact natural resources
   - o Chemical toxicity and radioactive materials.

The only criteria addressing artificial forces are containment and fire and explosion. The HRS/mHRS does not address regulations, codes, standards, and guides. However, these issues as well as many of the criteria addressed above are considered further under the selection of remediation. The CERCLA/SARA identify many of these criteria as the bases for assessment of remedial alternatives during the selection process.

The data used in the HRS process usually varies in quality from site to site and may require that some assumptions be made regarding site conditions, waste constituents, migration pathways, and potential receptors in order to develop a site score. When data quality is poor, the resulting score may be an artifact of the assumptions rather than a reasonable representation of the contamination situation. Under such circumstances, additional information (including limited sampling) may be conducted as part of the CERCLA site inspection (DOE Phase IIa) in order to confirm important assumptions. Site scores may then be re-evaluated based on the new data. As a result, site scores may change and additional sites may be removed from consideration. Again, the need for remediation is determined by a site score greater than 28.5.

With the passage of the Superfund Amendments and Reauthorization Act of 1986 (SARA), all facilities, including federal facilities, are required to

undertake a Remedial Investigation/Feasibility Study (RI/FS) for sites which qualify for the NPL (Scores greater than 28.5). Therefore, the criteria for determining need for remediation at CERCLA sites is a site score greater than 28.5.

2.2 Determining the Need for Remediation at Potential RCRA 3004(u) Sites

In the RCRA 3004(u) process, the need for action is dependent on the determination that a waste management unit was used to manage a solid waste (as defined in 40 CFR 260-261), contained hazardous constituents, and has had (or is likely to have) a release. On this basis, some form of action must be taken which includes remedial action. The process of establishing the need for action is shown in Figure 2-1. This process is generally applied to both active and inactive sites. However, the focus of this study is on inactive units. Section 2.2.1 addresses the need for action and Section 2.2.2 addresses the need for remediation.

2.2.1 Determining the Need for Action

In order to make each decision required in the process outlined in Figure 2-1, certain criteria are used to examine available data. Criteria-based evaluations are conducted at the following points:

- o Unit used to manage solid waste
- o Activity involved routine, systematic, and deliberate spills/ releases
- o Unit contained hazardous constituents
- o Documented release of hazardous constituents occurred
- o Clean up has been documented
- o Potential exists for past or future release of hazardous constituents
- o Potential exists for future release of hazardous constituents
- o No release of hazardous constituents is likely to occur.

These criteria are described in more detail below.

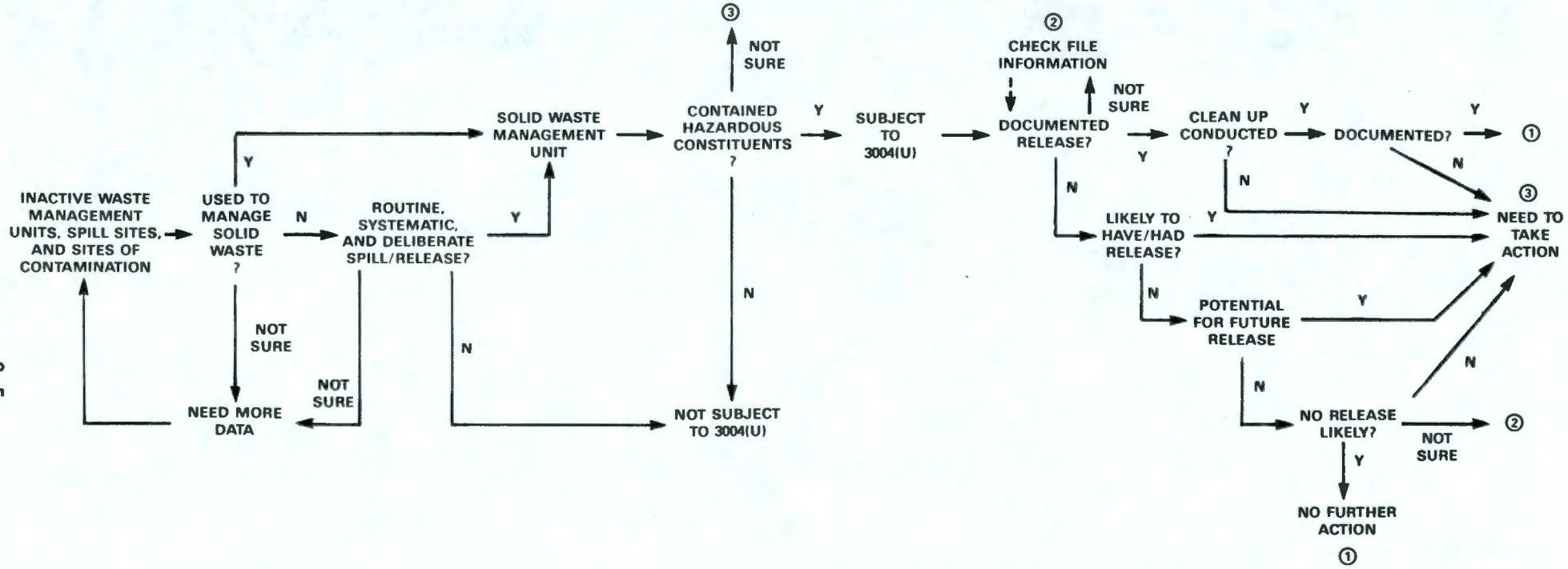


FIGURE 2-1. RCRA 3004(U) Need for Action

Unit Used to Manage Solid Waste

Inactive waste management units, process units, material storage areas, spill sites, and sites of contamination are evaluated to determine whether the unit was used (or is now used) to manage solid waste. This evaluation relies on the definition of solid waste as presented in 40 CFR 261.2. Solid waste includes any discarded material that is abandoned, recycled, or inherently waste-like. Figure 2-2 presents a summary decision chart outlining the process for determining whether a material is a solid waste. The regulatory definition of solid waste excludes materials such as domestic sewage; untreated sanitary wastes mixed with other wastes for discharge to a POTW for treatment; point source discharges regulated under the CWA; irrigation return flows; source, special nuclear, or byproduct material subject to the AEA of 1954; materials subjected to in-situ mining techniques; pulping liquors that are reclaimed; and spent sulfuric acid used to produce virgin sulfuric acid. These exclusions are presented in 40 CFR 261.4. **It should be noted, however, that units containing mixtures of low level byproduct materials and hazardous waste are considered to be units used to manage solid wastes.**

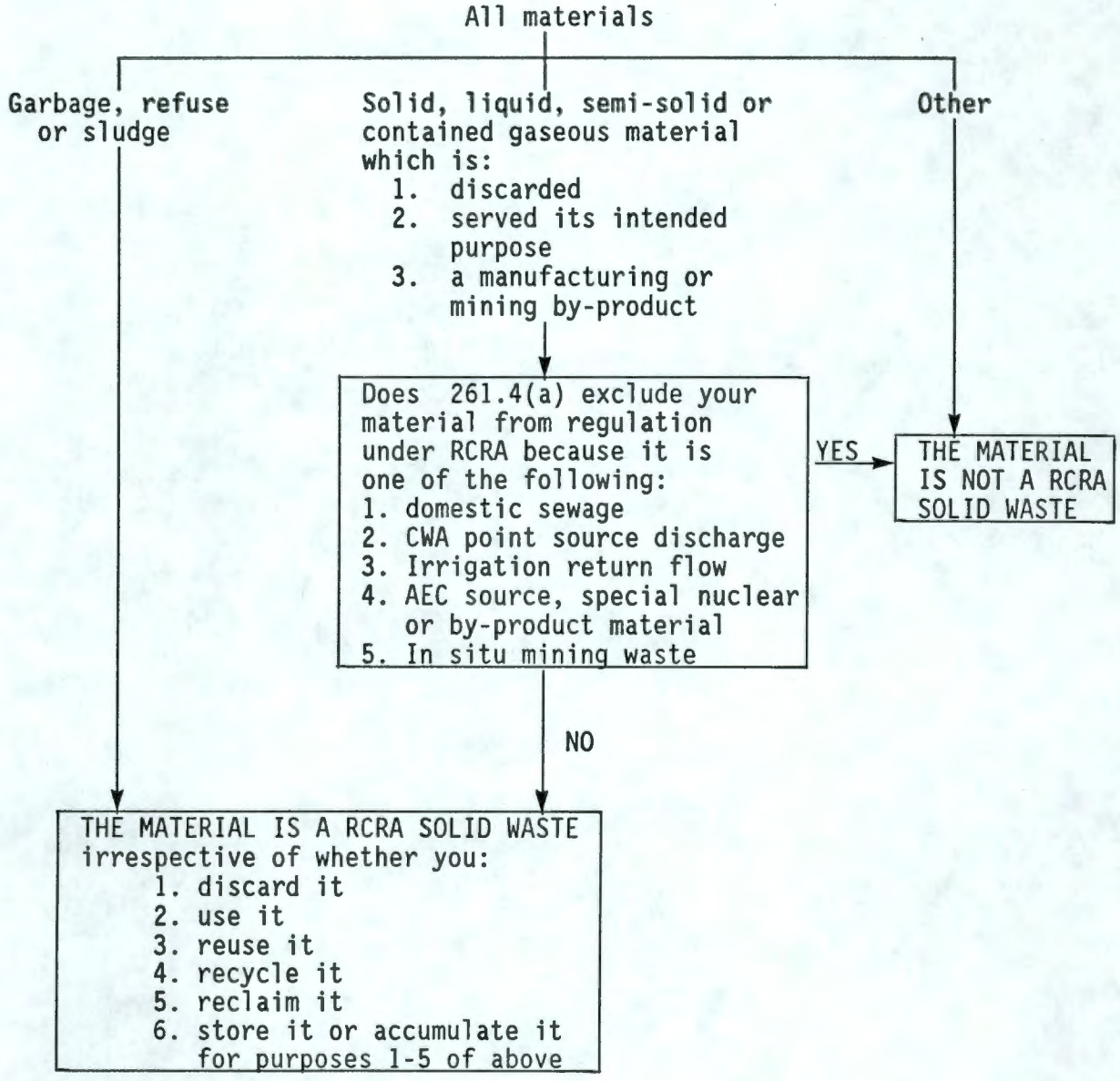
Another factor considered in the evaluation is whether the unit is any discernible waste management unit from which hazardous constituents might migrate. This includes containers, tanks, surface impoundments, waste piles, land treatment units, landfills, incinerators, underground injection wells, recycling units, wastewater treatment units, other treatment units, etc.

Routine, Systematic, and Deliberate Spill/Release

Under certain circumstances, process units may be considered as being subject to RCRA 3004(u). Spills and/or releases from process units and production areas not associated with regulated discharges or waste management units are potential candidates. In general, spills or releases from process/production areas and units which are routine, systematic, and deliberate may be considered further. This criterion excludes accidental spills from process/production areas in which wastes have not been managed.

FIGURE 2-2

DEFINITION OF A SOLID WASTE



Spills or releases from waste management units (SWMUs) are considered evidence of release rather than a separate site requiring separate action.

Unit Contained Hazardous Constituents

A solid waste management unit (SWMU) is not considered subject to RCRA 3004(u) corrective action unless it contained hazardous constituents. Hazardous constituents are those identified in 40 CFR 261, Appendix VIII and also include the hazardous waste characteristics of ignitability, corrosivity, reactivity, and EP toxicity (as defined in 40 CFR 261.21-24). If available data are insufficient to determine that a unit contained hazardous constituents, then "remedial" action must be taken to make that determination.

Documented Release of Hazardous Constituents Occurred

A documented release refers to evidence that hazardous constituents have been released to the environment from the waste management unit. Such evidence may include:

- o Official reports of prior releases or spills
- o Sampling or monitoring data
- o Documented visual observations of release.

The nature of the waste management unit itself can determine if a release has occurred. Certain types of waste management unit construction and use are associated with release of wastes to the environment (e.g., percolation ponds, french drains, process wastewater ditches).

Such documented releases may require remedial action unless cleanup has already been performed and documented.

Documentation of Cleanup

If contamination resulting from a waste management unit or routine, systematic, and deliberate spills has been cleaned up (including the

potential for further releases), then generally no more remedial action is required. However, this determination of no need for remediation is based on documentation of the cleanup conducted. This determination relies on official reports of sampling conducted after cleanup to verify that the residual concentrations of hazardous constituents (chemicals/radionuclides), in terms of sampling locations, analyses, and findings, meet accepted cleanup criteria. Information on the method of cleanup is also examined in conjunction with the sampling data to determine if the actions taken meet the RCRA criteria of background concentrations or no migration. Without such documentation, additional "remedial" action may be required to provide such verification or to further clean up the site should residual contamination remain.

Potential for Past or Present Release

In the absence of documentation of release of hazardous constituents to the environment, a determination must be made as to whether the unit under consideration could have or could now be releasing hazardous constituents to the environment. This determination is based on engineering judgment with regard to SWMU construction, structural integrity, age, operating practices, and waste characteristics (form, materials compatibility, constituents, etc.). If there is a potential for a release to the environment to have occurred (or to now be occurring), then remedial action is required to verify the presence/absence of release and to cleanup contamination.

Potential for Future Release

The RCRA 3004(u) corrective action program requires the determination of whether there is the potential for future release of hazardous constituents from a SWMU. Such a determination is based on engineering judgment with regard to SWMU construction, structural integrity, age, operating practices, waste residuals, and waste characteristics (form, materials compatibility, constituents, etc.). Remedial action is indicated where there is a potential for future releases to the environment.

No Release Likely to Occur

The final factor in considering the need for remediation, is a final determination that no release is likely to occur. This is based on engineering judgment of any other factors, not already considered, that could lead (or have led) to a release of hazardous constituents to the environment.

2.2.2 Determining the Need for Remediation

Figure 2-1 presented the decision process used to determine if there is a need for action to be taken with regard to a particular SWMU. The "need for action" represents the need to remediate or otherwise address remaining questions regarding the sites under consideration. This need to remediate category can be subdivided into two activities: verification and remediation. A site will fall into either category (but not both) based on the analysis in Section 2.2.1. A site will require verification if it needs to be determined that:

- no hazardous constituents are present in the unit
- no release of hazardous constituents has/will occur
- no residual contamination remains from insufficiently documented cleanups or past/present releases.

In each case, sampling will be required to make these determinations and, based on these determinations, the need for action will be re-evaluated to recategorize the site as not subject to RCRA 3004(u), requiring no further action, or requiring remediation. Sampling programs are based on the assumption that all available file information and records has been considered in the earlier evaluations.

Table 2-1 presents an overview of the verification process based on the verification sampling conducted. A site will fall into one of the categories (I, II, or III) identified in Table 2-1 as described above. The outcome of verification is to further refine the separation of sites into those that are not subject to RCRA 3004(u), require no further action, or

require remediation. Sites that do not require verification of the need for action are automatically considered for remediation.

TABLE 2-1 NEED FOR ACTION (VERIFICATION PROCESS)

I. Verify no hazardous constituents are present

   A. If present, evaluate release potential and determine additional need for action

   B. If not present, site not subject to RCRA 3004(u)

II. Verify no release of hazardous constituents occurred

   A. Sampling program should include the following

      1. sampling to verify release of hazardous constituents

      2. sampling to determine levels of residual contamination

      3. evaluations of potential future release that may require additional investigation as part of this effort

   B. If no contamination is found and there is no potential for future release, then no further action is required

   C. If no contamination is found and there is potential for future release, then remediation must be performed to prevent future release

(continued)

TABLE 2-1 NEED FOR ACTION (VERIFICATION PROCESS) (continued)

D. If contamination is found, then remediation must be performed to address residual contamination

III. Verify no residual contamination remains from past/present releases or insufficiently documented cleanups

A. Sampling program should include the following

1. sampling to verify no residual contamination remains

2. sampling to determine residual levels of contamination

3. evaluations of potential future releases that may require additional investigation as part of this effort

B. If no contamination found and there is no potential for future release, then no further action is required

C. If no contamination is found and there is potential for future release, then remediation must be performed to prevent future release

D. If contamination is found, then remediation must be performed to address residual contamination

3.0 Development of Criteria for Selecting a Remediation Approach

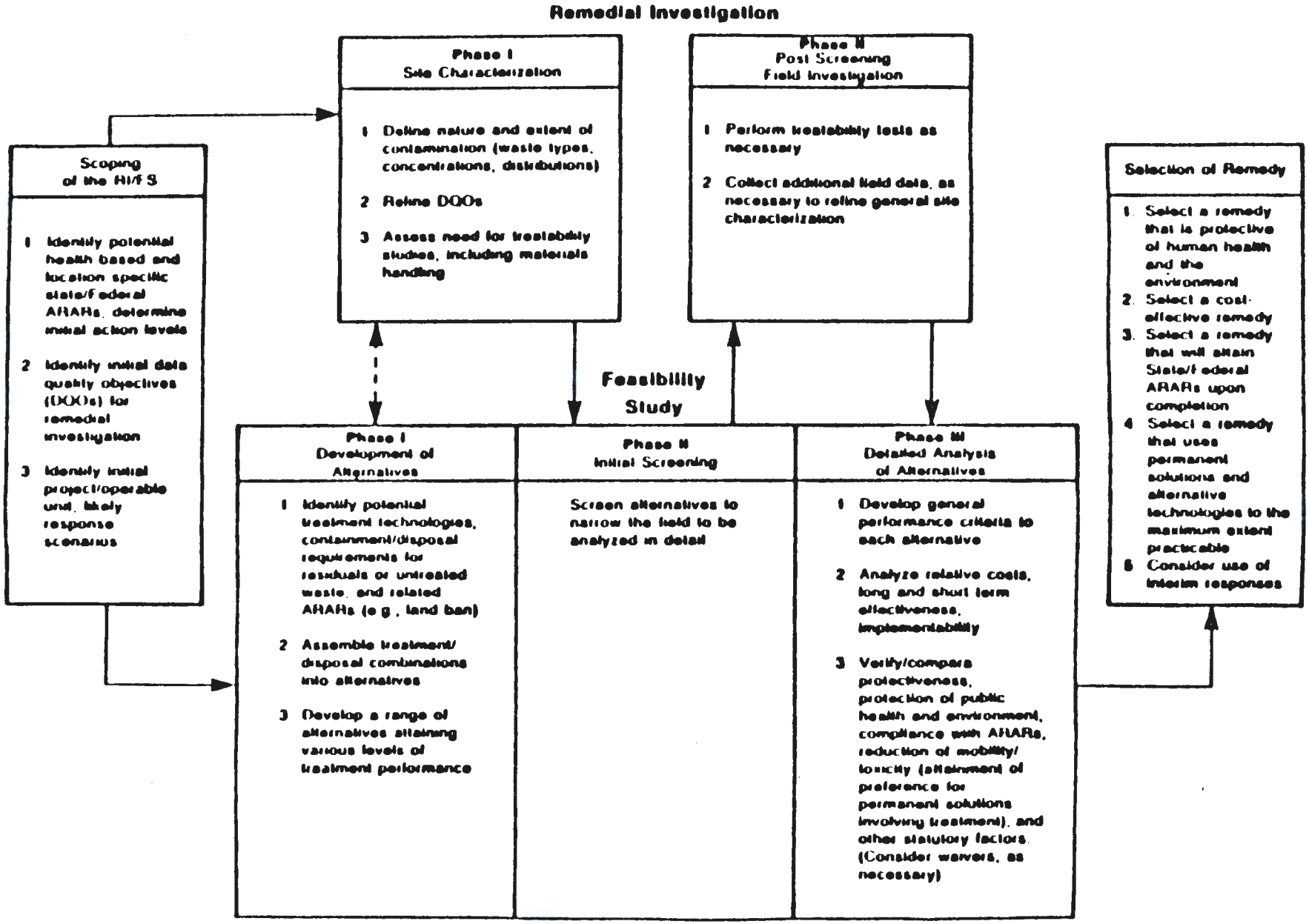
The remediation of CERCLA sites and RCRA 3004(u) are similar. Therefore, the CERCLA process will be discussed as the basic approach, and the differences applicable to RCRA 3004(u) will be discussed as deviations to this basic process.

3.1 Selecting a Remedial Approach (CERCLA)

For CERCLA sites with scores greater than 28.5, the site is a candidate for the National Priorities List (NPL) and subject to the remedial investigation/feasibility study (RI/FS) process. Figure 2-3 illustrates the RI/FS process as proposed under SARA. As may be noted from the illustration, the process proceeds through a series of steps leading to the selection of an appropriate response. The process of selecting a remedy is further delineated in Figure 2-4.

The process begins with the identification of individual technologies and combining them into alternatives. An alternative consists of a string of technologies that together form the complete remediation. For example, a site with groundwater contamination may be remediated with an alternative such as pumping groundwater, treating the wastewater either in an on-site wastewater treatment plant or in a treatment system designed for the remediation, and reinjection of the treated water. The same site could be remediated by installing a subsurface barrier, extracting contaminated groundwater within the barrier, treating the groundwater (as described above), and reinjecting the groundwater. A barrier alone or groundwater removal (without consideration of treatment) would not represent a complete action and evaluation of such a situation could result in selection of an inappropriate or costly remedy.

FIGURE 2-3. PROPOSED REMEDY SELECTION PROCESS UNDER REAUTHORIZATION.



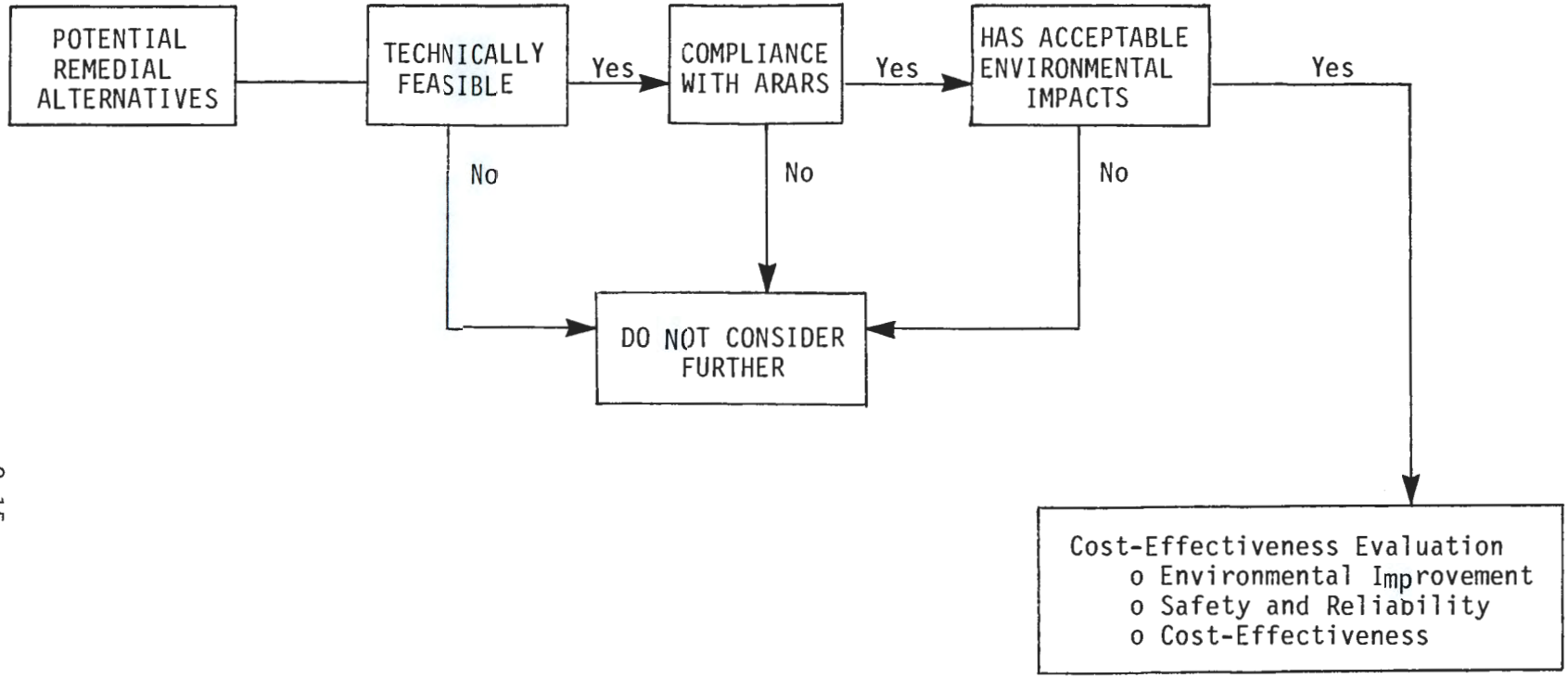


FIGURE 2-4 SELECTION OF A REMEDIAL APPROACH

The evaluation process presented in Figure 2-4 outlines a series of analytical questions that require evaluation of criteria associated at each decision point. These decision points are noted below:

- o Technology feasibility
- o Compliance with regulatory standards, criteria, etc.
- o Acceptability of environmental impacts
- o Cost-effectiveness (environmental improvements, health risk, reliability, and safety).

From this process, inappropriate remedial alternatives may be eliminated and the relative merits of the remaining alternatives are the basis for final selection.

Each of these decision points and the criteria supporting the selection of a remedial alternative is described below.

Technology Feasibility

The feasibility of the technologies considered for remediation focuses on the performance of the technologies given the site conditions, site location, and waste characteristics, and the ability to complete the remediation within a reasonable time. Relevant criteria include:

- o Locational Factors Affecting Technology Effectiveness:
  - site geology (materials, fracturing)
  - natural forces (seismic, landslide, subsidence)
  - site hydrogeology (aquifer characteristics, groundwater movement)
  - floodplain impacts

  Overall, this criterion involves the evaluation of site-related characteristics that could prevent the technology from being used effectively or preclude its construction/operation at the site. In some cases, engineering design can overcome site-related problems.

- Time to Achieve Beneficial Results

  This criterion involves consideration of the time period over which the remedial action is conducted before cleanup is achieved. No specific time period has been set by EPA as "appropriate." However, a period of 10 to 15 years is generally considered as a rule of thumb. Although cleanup standards are considered in the next decision point, evaluations of probable waste quantities compared against technology treatment/removal requirements can provide a base estimate for evaluation purposes.

Remedial alternatives that will not be effective under the site conditions present or that will not be able to complete the cleanup within a reasonable time period are eliminated from further consideration.

Compliance With Regulatory Standards

SARA requires that the cleanup conducted must meet all applicable or relevant and appropriate regulations (ARARs). This includes any standard, requirement, criteria, or limitation under any Federal environmental law and any standard, requirement, criteria, or limitation under a State environmental or facility siting law under a program authorized or delegated by the Federal government that is more stringent than the Federal requirement. Thus, this cleanup standard includes quality standards for environmental media (air, groundwater, surface water, etc.), regulatory prohibitions and constraints (i.e., land disposal prohibitions), and worker/public health considerations. Table 2-2 provides a list of some ARARs to be considered in selecting a remedy.

Any remedial alternative that is unable to achieve the applicable ARARs either in terms of actual cleanup or exceedance of the ARARs during cleanup (e.g., radiation exposure during exhumation) will be eliminated from further consideration unless the action can be so performed or designed as to meet the ARARs.

TABLE 2-2 REPRESENTATIVE APPLICABLE OR RELEVANT AND APPROPRIATE STANDARDS

Environmental Protection Standards (Federal and State)
- Clean Water Act
- Safe Drinking Water Act
- Clean Air Act
- Executive Orders related to floodplains
- Resource Conservation and Recovery Act (Subtitles C and D) as amended
- Washington Dangerous Waste Regulation
- Toxic Substances and Control Act
- Air and Radiation regulations

Occupational Health Protection Standards
- OSHA requirements

DOT hazardous materials transport rules

Department of Energy Orders pertaining to radioactive waste management

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Acceptable Environmental Impacts

The remedial action performed will have impacts upon the environment. Some remedial actions could cause greater contamination or threat to human health than if either that action were not taken; or another action were taken. A remedial alternative should be eliminated from further consideration if it will result in:

- Significant increases in pollutant loading from existing sources or a new facility to air, surface water, or groundwater
- Known/expected significant adverse effects on the environment
- Known/expected significant adverse effects on human use of environmental resources (recreational areas, drinking water, etc.)
- Known/expected adverse effects on environmentally sensitive resources or areas (aquifer recharge zones, archeological or historical sites, endangered or threatened species and their habitats, etc.) (Guidance on Feasibility Studies Under CERCLA, USEPA, 1985).

The adverse effects must be considered in conjunction with ARARs as well as mitigative measures that may be incorporated to eliminate or reduce the impacts before a remedial alternative is eliminated.

Cost-Effectiveness

Remedial alternatives that have passed through the evaluation for technical feasibility, compliance with ARARs, and acceptability of environmental impacts then undergo a cost-effectiveness evaluation to determine the relative merits of each alternative (of which there may be several). Based on this evaluation, a specific alternative is selected as providing the most benefits and the least impacts at reasonable cost.

The cost-effectiveness evaluation is part of the feasibility study process and includes consideration of:

- Environmental improvements - some remedial alternatives may meet ARARs and some may exceed the ARARs. This will result in a range of improvement in the environment both in contaminant concentration reductions and environmental recovery from the previous contamination.

- Reliability - different technologies have different maintenance and upkeep requirements as well as different lifespans. An alternative with more continuous operation over a longer period may be both more effective and less costly than an alternative that must be completely replaced one or more times during the cleanup process.

- Safety - this includes evaluation of the short-term and long-term effects of the remediation on worker and nearby populations. Risks considered are fire, explosion, and exposure to hazardous substances resulting from the remediation (Guidance on Feasibility Studies Under CERCLA, USEPA, 1985).

- Cost - the present worth costs of remedial alternatives are evaluated. In this way, the capital and operating and maintenance costs associated with each alternative may be readily compared.

Other factors may be included in this evaluation. For example, SARA requires preference be given to remedial alternatives that destroy the wastes or destroys their toxicity, mobility, etc. Under this requirement, measures such as leaving the wastes in place even though other protective measure such as capping are applied are less preferable than exhumation and incineration (as examples). This preference as written into SARA will have to be balanced with the safety issues associated with the exhumation of some radioactive wastes or contaminated areas.

3.2 Selection of Remediation for RCRA 3004(u) Sites

The process and criteria used to select a remedial alternative for a 3004(u) site is essentially the same as that for a CERCLA site. Under current EPA policy and guidance, a SWMU requiring corrective action will undergo an RI/FS process. The basic difference in the selection process involves the cleanup criteria and cost.

As described above, SARA requires compliance with ARARs. The 1984 RCRA amendments do not add this requirement, therefore, RCRA actions at this time must be consistent with the RCRA cleanup standards under the closure standard, groundwater corrective action, and land disposal prohibitions. The closure standard requires that a site be cleaned up to background concentrations or closed in compliance with the closure requirements for a RCRA landfill. Groundwater corrective action requires cleanup to background concentrations, generic drinking water standards (such as MCLs) applicable to all facilities, or health-based standards specific to the situation (ACLs). The land disposal prohibitions require that wastes to be disposed into "land" units (such as a new landfill constructed as part of a remedial action) must meet certain concentration limits or disposal is not allowed.

As the RCRA program currently stands, cleanup to background concentrations is the established requirement with which corrective actions must be consistent. Allowances are made to pursue other standards (MCLs and ACLs, as identified above) as an alternative, but this would be made on a case-by-case basis through submission of data and negotiation with the State of Washington and EPA Region X.

It should be noted that one approach under consideration in promulgating the RCRA corrective action regulations is for EPA to establish health-based cleanup target levels in each medium. The draft regulations are currently being prepared and EPA's commitment to this alternative is not yet established.

The second area of difference between RCRA 3004(u) and CERCLA cleanups is that cost is not a factor in selecting remediation at 3004(u) sites. All other factors identified above in the cost-effectiveness evaluation would still apply.