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Remedy Selection

A publication of the Hazardous Substance Research Centers' Technical Outreach Services for Communities (TOSC) Program.

Hazardous Substance Research Centers

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The nature and extent of contamination at RCRA corrective action facilities are diverse.
Contamination ranges from small spill areas requiring soil cleanup to extensive on-site and off-site soil, sediment, and groundwater contamination, including polluted drinking water sources.
The Corrective Action program has to be procedurally flexible, with many different approaches to remedy selection. This fact sheet presents the information on several aspects of the remedy selection process for these types of facilities.

Phased Corrective Action

The RCRA Corrective Action Process is a phased approach similar to most other cleanup programs consisting of assessment, investigation, identification and evaluation of cleanup alternatives, and implementation of a selected alternative. Significant efficiencies can be gained by phasing Corrective Action at individual facilities to focus first on areas of the facility that represent the greatest risk to human health and the environment. Response actions can be taken quickly at high priority areas of the facility while low priority areas can be addressed later.

More formally, these phases are labeled and outlined as:

RCRA Facility Assessment - This is the initial stage of the corrective action process and usually involves the property owner, operator and regulating authority. These entities work together to assess whether there has been any releases to soil or groundwater that need further investigation. This phase of the corrective action process includes a review of all records related to the facility, a visit to the facility, and sometimes soil or water sampling.

RCRA Facility Investigation - If during the RCRA Facility Assessment it is determined by the regulating authority that additional investigation is necessary, the facility owner or operator will be required to work with an environmental consultant to write a work plan detailing proposed soil and or ground water sampling to determine the extent and magnitude of any contamination. Upon work plan approval by the regulatory authority, the work plan can be implemented. Having reviewed the results of the RCRA Facility Investigation, the regulatory authority will determine if a Corrective Measures Study will need to be conducted.

Corrective Measures Study - The regulating authority may require A Corrective Measures Study if the results of the RCRA Facility Investigation indicate that some type of cleanup is necessary. The Corrective Measure Study outlines potential cleanup alternatives with a recommendation regarding selection of an alternative. Prior to approving the Corrective

Measures the regulating authority may consult the public, seeking advice on remedy selection. Once the regulating authority selects a remedy the Corrective Measures Implementation phase can begin.

Corrective Measures Implementation - The Corrective Measures Implementation phase involves a detailed discussion of the selected remedy along with a schedule for implementation. Upon approval of the proposed plan and completion of the remedy the facility may be eligible for closure with respect to the RCRA Corrective Action Process.

Risk Assessment

The goal of the Corrective Action program is to control or eliminate risks to human health and the environment. Therefore, remedial decisions should be risk-based. Risk assessments evaluate the nature of the risks at a facility to help determine what remedies will be protective of human health and the environment. Site-specific risk assessments are not necessary at sites where risk-based decisions can be made using standardized risk considerations.
Some of the important steps adapted during risk assessment are as follows;

Data Collection and Evaluation -Data analysis involves evaluating analytical methods; detection limits, qualified and coded data, blanks, and tentatively identified compounds. Results from the data analysis and evaluation process are used to identify chemicals of concern. For some sites, the list of contaminants detected in the release area may be extensive. Carrying a large number of chemicals through the risk assessment can be complex, and may require an unnecessary amount of time and effort. It is important to focus the risk assessment only on contaminants that pose significant risks.

As part of the process to identify chemicals of concern, detected contaminants may be excluded from further consideration if it is determined that concentrations are less than background levels and below health-based levels. In some cases, however, background concentrations may present a significant risk, and while cleanups may or may not eliminate this risk, the background risk may be an important site characteristic to those exposed. The administrative authority will always have the option of considering the risk posed by naturally occurring background constituents separately. Often, however, the comparison of a site with background is unnecessary because of the low risk usually posed by the background constituents compared to site-related contaminants.

Exposure Assessment - An exposure assessment is conducted to estimate a chemical intake for each chemical of concern. A chemical intake is dependent on the magnitude, frequency, and duration of exposure. Several steps are involved in an exposure assessment including characterization of the physical setting of the chemical release area: characterization of current and future land use and exposed populations; identification of complete exposure pathways, including the points of exposure and exposure routes; and estimation of chemical intake.

Toxicity Assessment - The toxicity assessment step in a site-specific risk assessment evaluates the types of adverse health effects associated with chemical exposures, the relationship between the magnitude of exposure and adverse effects, and the uncertainty in toxicological or epidemiological studies. Generally, the toxicity assessment is composed of two components: hazard identification (type of toxic effect) and dose-response assessment (how much is necessary to produce the toxic effect).

Components of toxicity assessment are outlined below:

- Qualitative and quantitative toxicity information is obtained for constituents being evaluated
- Exposure periods for which toxicity values are necessary are identified
- Toxicity values for no carcinogenic effects are determined
- Toxicity values for carcinogenic effects are determined

Risk Characterization - The risk characterization summarizes and combines the results from the exposure and toxicity assessments. Site risks are characterized after reviewing output from the toxicity and exposure assessments, by quantifying risks from individual chemicals, quantifying risks from multiple chemicals, combining risks across exposure pathways, and evaluating the uncertainty associated with the risk estimate.

Risk characterization also includes an assessment of risks stemming from uncertainties associated with the site-specific risk assessment process. EPA's *Risk Assessment Guidance For Superfund Volume 1: Human Health Evaluation Manual, Part A* (EPA 1989) provides additional guidance on the assessment of uncertainty. In the final step, the site-specific risk estimate is compared to the acceptable risk for the site.

Evaluation of remedial alternatives

The other purpose of a Corrective Measures Study (CMS) is to identify and evaluate potential Corrective Action remedial alternatives. The CMS should focus on realistic remedies. Presumptive remedies are preferred technologies for common categories of sites to ensure consistency in remedy selection and implementation and to reduce the cost and time required investigating and remediating similar types of sites. EPA encourages the use of Superfund presumptive remedies at RCRA Corrective Action sites. The CMS should determine whether any presumptive remedy is appropriate for the Corrective Action.

Superfund remedial actions must also attain state requirements that are more stringent than federal requirements to the extent that they are also applicable or relevant and appropriate and are identified to USEPA in a timely manner.

The following statutory preferences should be considered in the development and evaluation of remedial alternatives:

- Remedial actions that involve treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances through treatment are preferred over remedial actions not involving such treatment.

- Off-site transport and disposal of hazardous substances or contaminated materials without treatment is considered the least favorable remedial alternative when practicable treatment technologies are available.
- Remedial actions using permanent solutions, alternative treatment technologies, or resource recovery technologies that, in whole or in part, will result in a permanent and significant decrease in toxicity, mobility, or volume of a hazardous substance are preferred.

U.S EPA's RI/FS Guidance (USEPA, 1988) state that the treatment alternatives should range from an alternative that, to the degree possible, would eliminate the need for long-term management (including monitoring) at the site to other alternatives that treat the principal threats posed by hazardous substances at a site but that vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed.

Public participation

Through RCRA, Congress gave EPA broad authority to provide for public participation in the regulatory program. RCRA §7004(b) directs EPA to provide for, encourage, and assist participation in the development, revision, implementation, and enforcement guideline, information, or program under Act.

The RCRA public participation requirements bring government, private industry, and citizens together to make important decisions about hazardous waste, solid waste, and UST facilities. Specifically, these groups' and individuals have a stake in RCRA's hazardous waste management program, such as corrective action, and state authorization. On a broader level, the public also has tremendous interest in EPA's rulemaking process and environmental justice.

Public involvement in the RCRA presents unique needs and opportunities. Public participation informs the public of the types of wastes and a management method which intends to employ and allows the public an opportunity to voice its concerns about these risks. Public participation also fosters community relations and can help to avoid delays and future litigation by addressing public concerns up front.

Institutional controls

Controls, which restrict the use of land and other resources, are often a key element of environmental cleanups. Institutional control refers to non-engineering measures. Institutional controls are usually legal controls intended to influence human activities in such a way as to prevent or reduce exposure to hazardous wastes or hazardous constituents.

The role that institutional controls play in the risk management approach for a facility is based on site-specific conditions and should be considered during the remedy selection process. Like any other remedial alternative, institutional controls should be rigorously

evaluated to determine their appropriateness, feasibility, and long-term effectiveness in protecting human health and the environment

EPA has developed guidance on the use of institutional controls at Superfund and RCRA corrective action sites, and the guidance should be consulted for additional information concerning their applicability and use.

- *Institutional Controls: A Site Managers Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups. EPA/540/F-00-005.* September 2000 Situations in which institutional controls may be an appropriate component of a remedy or are necessary to ensure that a remedy is protective include the following:

- Where cleanup is protective for industrial but not residential exposures.

- Where ground water will remain contaminated for a period of time such that well drilling should be prevented.

- Where surface water will remain contaminated such that fishing advisories or restrictions should be imposed.

- Where soils are remediated at the surface but contamination at higher concentrations remains in the subsurface.

- Where contaminant concentrations in soils are reduced to a level appropriate for residential use but a specific activity, such as gardening, might result in an unacceptable exposure.

- Where contamination is capped to prevent exposure and/or reduce leaching to ground water, and activities that may degrade the cap must be prohibited.

The use of an institutional control to meet a performance standard should include a mechanism to ensure the maintenance of the institutional control. Only certain types of institutional controls have such mechanisms (e.g., easements, zoning, and use restrictions). For institutional controls that do not have such mechanisms, an alternative mechanism for maintaining protectiveness should be put into place.

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