Assessment of Short-Term and Long-Term Risks for Remedy Selection

BACKGROUND: **Section 121(b) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires that, among other factors, both the short-term and long-term health and environmental risks be considered in selecting a remedial technology for implementation at National Priorities List (NPL) sites. The potential effects on human health and the environment that could result from implementation of a remedial action also need to be considered.**

The mandate to consider short-term and long-term risks is reiterated and clarified in the remedy selection process specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). In fact, "long-term effectiveness and permanence" and "short-term protectiveness," both of which are defined in part by measures of perceived or actual risk, are two of nine criteria specified by the NCP that remedial site managers must use to compare and evaluate alternative remedial technologies in the remedy selection process.

This Information Brief, which is one of a series of briefs addressing various CERCLA risk assessment topics, describes the application of short-term and long-term human health risk assessment in the CERCLA remedial decision making process.

STATUTE: **The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)**

REGULATION: **National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule; 55 *FR* 8666, March 8, 1990; 40 CFR Part 300.**

REFERENCES:

1. ***Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part C, Risk Evaluation of Remedial Alternatives), Interim,*** **U. S. Environmental Protection Agency, Office of Emergency and Remedial Response, Publication 9285.7-01C, December 1991.**
2. ***Incorporating Ecological Risk Assessment Into Remedial Investigation/Feasibility Study Work Plans,*** **U. S. Department of Energy, Office of Environmental Guidance, RCRA/CERCLA Division (EH-231), DOE/EH-0391, June 1994.**
3. ***Risk Assessment Guidance for Superfund: Volume II - Environmental Evaluation Manual (Interim Final),*** **U. S. Environmental Protection Agency, Office of Emergency and Remedial Response, Publication EPA/540/1-89/001, March 1989.**
4. ***Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final,*** **U. S. Environmental Protection Agency, Office of Emergency and Remedial Response, OSWER Directive 9355.3-01, October 1988.**
5. ***Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part A, Interim Final),*** **U. S. Environmental Protection Agency, Office of Emergency and Remedial Response, Publication EPA/540/1-89/002, PB90-155581, December 1989.**

Why consider "short-term" and "long-term" risks?

Short-term and long term risks must be considered in selecting remedial actions. Two of the nine criteria that remedial project managers (RPMs) must use in selecting among alternative remedial actions and technologies at CERCLA sites are "long-term effectiveness and permanence," and "short-term protectiveness." These criteria are, in part, defined by the long and short term risks associated with the alternative actions and technologies being evaluated. The NCP specifies that CERCLA remedies must be protective of human health and the environment over the long term, and must also protect people and the environment from immediate threats associated with constructing and operating a remedial technology.

What are "short-term" and "long-term" risks?

Long-term risks. For long-term risks, the focus of the analysis is the *risk remaining on site after remedial action has been taken, or residual risk.* RPMs should look at both the degree of threat

posed by the hazardous substances remaining on site and the adequacy and reliability of any engineering or institutional controls used to manage these substances since reliability of the controls is a central factor in the uncertainty analysis accompanying the residual risk assessment. A complete consideration of long-term risks will include an assessment of how much of the risk derives from treatment residuals and how much derives from untreated wastes. Risks to both human health and the environment are included in this category.

It is not unusual for environmental organisms to be more sensitive to the toxic effects of exposure to hazardous substances than are humans, but this greater sensitivity could go unnoticed by RPMs due to the large number of potential ecological receptors, life stage complexities of certain receptors, and potentially longer time frames that may be needed to observe ecological effects. (N.B. - although greater sensitivity of ecological organisms to chemical contaminants would not be an uncommon observation, this may not be a valid generalization with respect to the ionizing radiation effects of radionuclides).

Short-term risks. For short-term risks, the focus of the analysis is the potential adverse effects on human health and the environment *of constructing and operating the alternative remedial action until the remedial objectives are met*. RPMs should evaluate how the alternative actions protect people in the affected communities as well as the workers implementing the remedial action. Short-term risks include risks such as dust from excavation and transportation of hazardous materials, or air quality impacts from a stripping tower operation. RPMs should consider who may be exposed during remedial actions, what risks they face, how the risks can be mitigated, and what risks can not be controlled. Short-term risks from remedial actions can be especially severe for environmental organisms and ecosystems. Habitat destruction could be a common consequence of remedy construction and operation. More subtle ecological risks can be very difficult to assess, particularly in the short term.

When should RPMs consider short-term and long-term risks?

RPMs should be evaluating short-term and long-term risks of response actions by the early stages of a feasibility study of the potential alternatives. Consideration of these risks is key during initial screening of alternatives, especially if an accelerated or streamlined process for site remediation is employed. RPMs must ensure that they have considered the short and long-term aspects of an alternative's "effectiveness," one of three NCP criteria guiding the initial development and screening of alternatives (the other two being "implementability" and "cost"). Effectiveness in this context is defined as "the degree to which an alternative reduces toxicity, mobility or volume through treatment, minimizes residual risks and affords long-term protection, complies with ARARs, minimizes short-term impacts and how quickly it achieves protection." [40 CFR 300.430(e)(7)(i).]

The detailed analysis of remedial alternatives provides the means by which facts are assembled and evaluated to develop the rationale for a remedy section. Short and long-term risk evaluations should be performed at this stage as well, because they will be needed to document statutory and regulatory criteria used for final remedy selection - "protectiveness," "long-term effectiveness and permanence," and "short-term effectiveness" [40 CFR 300.430(e)(9)(A),(C) and (E)]. It could be a costly mistake, both in terms of project resources and public confidence, to have to revisit short and long-term risk in order to adequately document these criteria, after a preferred remedy is proposed.

How should long-term risks be evaluated when comparing remedial alternatives?

For long-term risks, RPMs should primarily be concerned with the magnitude of the residual risks remaining from untreated waste or treatment residuals at the conclusion of the remedial activities (e.g., after source/soil containment and/or treatment are complete, or after ground water plume management activities are concluded). Risk may be measured by numerical standards such as cancer risk levels or the volume or concentration of contaminants in waste, media, or treatment residuals remaining on the site. The residual risk assessment should take into account a treatment residual's volume, toxicity, mobility and propensity to bioaccumulate. Key questions to ask are:

- What is the magnitude of the remaining risks?
- What **remaining sources** of risk can be identified? How much is due to treatment residuals, and how much is due to untreated residual contamination?
- Will a **5-year review** be required?

How should short-term risks be evaluated when comparing remedial alternatives?

For short-term risks, RPMs primary concern should be the effects of the alternative during the

construction and implementation phase until the remedial response objectives are met (e.g., a cleanup target has been achieved). Alternatives should be evaluated with respect to:

Risks to the Community - i.e., human health risks due to the construction or operation of the remedial action, such as fugitive dust emissions from excavations, transportation of hazardous materials or air quality impacts from air stripping operations. RPMs should ask:

What are the risks to the community during the remedial action that must be addressed?

- How will the risks to the community be addressed and mitigated?
- What risks remain to the community that can not be readily controlled?

Risks to Workers - i.e., worker's health risks resulting from the construction and operation of the remedial actions. (N.B. - in addition to protecting against the "hazardous substance aspects" of the health risks associated with the implementation of a response action, i.e., the subject of this Information Brief, RPMs must also ensure that response actions must be carried out in compliance with all worker health and safety requirements relating to the safe conduct of work. While the latter are not the specific focus of this Information Brief, they must be considered during the overall evaluation of risk to workers). RPMs should ask:

- What are the risks to the workers that must be addressed?
- What are the risks to the workers that can not be readily controlled?
- How will the risks to the workers be addressed and corrective actions implemented?

Risks to the Environment - i.e., the potential adverse effects to environmental organisms and ecosystems, particularly with respect to toxic and habitat impacts, and potential injuries to natural resources and the services they provide. RPMs should ask:

- What environmental impacts are expected with the construction and implementation of the alternative?
- What are the available mitigation measures to be used and what is their reliability to minimize potential impacts?
- What are the impacts that can not be avoided should the alternative be implemented?

Although analysis of short-term risk involves the same basic steps as a baseline risk assessment, generally the latter is more quantitative and involves a greater level of effort than a risk analysis of alternatives (see box). However, the evaluation of risk associated with remedial alternatives may involve a greater degree of uncertainty than does the baseline assessment, primarily due to the need to project the effectiveness of each alternative over time, based on engineering estimates.

	Baseline Risk Assessment	**Risk Analysis of Alternatives**
Contaminant Sources	Uncontrolled site	Remedial activity and residual contamination May include chemicals not present under baseline conditions (i.e., those created during remediation)
Timing of Releases	Releases due to natural processes	Releases due to implementation of remedy
Exposed Populations	Local	Local and remediation workers
Duration	Includes lifetime exposure	Long-term includes lifetime exposure Short-term only includes less-than-lifetime exposure

How is risk evaluation used in the five-year review?

Five-year reviews will be conducted for NPL sites at which contaminants remain in place following the completion of the remedial activities. These reviews, which may include a quantitative evaluation of long-term risk, are intended to determine if the remedy continues to assure long-term protectiveness. They may be conducted at different levels of analytical rigor, for example: (1) a review of the prior risk evaluations (as documented in the ROD and ROD Summary), (2) recalculation of the original baseline risk assessment to account for new data (e.g., monitoring data, toxicity values), and (3) development of a new risk assessment if site conditions have changed substantially.

Questions of policy or questions requiring policy decisions will not be dealt with in EH-413 Information Briefs unless that policy has already been established through appropriate documentation. Please refer any questions concerning the subject material covered in this Information Brief to John Bascietto, RCRA/CERCLA Division, EH-231, (202) 586-7917.