



# ENVIRONMENTAL RESTORATION

*U.S. Army Environmental Center*

## ECOLOGICAL RISK ASSESSMENT

### What is an Ecological Risk Assessment (ERA)?

Generally speaking, an ERA is the process that evaluates the likelihood that adverse ecological effects are occurring or may occur as the result of exposure to one or more stressors. In the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Resource Conservation and Recovery Act (RCRA) Corrective Action, ERA is used specifically to mean a qualitative and/or quantitative evaluation of the actual or potential impacts of contaminants from hazardous waste sites on plants and animals. Human beings and domesticated animals are not included in this definition. For an ecological risk to exist, the contaminant must have the ability to cause an adverse effect, and it must co-occur with or be in contact with a plant or animal long enough and at a strong enough intensity to cause the adverse effect.

### Legal Authorities

The CERCLA law mandates the protection of "human health and the environment." By performing an ERA, Department of Defense (DoD) is assessing the risks to the environment and determining the need for remedial action. The following sections in CERCLA specifically state a requirement for protection of the environment: Sections 104, 105(a)(2), 121(b)(1), 121(c) and 121(d). The implementing regulation that states when and where to conduct an ERA

is found in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) under 40CFR300.

Sections 3004(u) and (v), and 3008(h) of RCRA require a corrective action program for releases of hazardous wastes or hazardous constituents from solid waste management units. In a 1996 proposed regulation on corrective action (61 Fed. Reg. 19431 (May 1, 1996)), EPA notes that an ERA is necessary. This rule is analogous in many ways to the NCP. RCRA-specific ERA guidance is not available. Generally, EPA and the states use EPA's CERCLA guidance documents.

### The ERA Process

Most ERAs are performed during the investigation phase of a restoration project (i.e., during the Remedial Investigation/Feasibility Study (RI/FS) or RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) phase). ERAs are generally divided into two levels: a screening level ERA and a baseline ERA. A screening level ERA is a simplified risk assessment that can be conducted with limited data and uses conservative assumptions to minimize the chances of concluding that there is no risk when, in fact, a risk exists. In a baseline ERA, the conservative assumptions are eliminated and replaced with best estimates to more accurately assess the site's risk.

Regardless of whether a screening level or baseline ERA is being conducted, the following process is followed: Planning, Problem Formulation, Analysis, Risk

Characterization, and Risk Management. During both the Planning and Risk Management steps, it is vital for the risk assessor (the person responsible for conducting the ERA) to talk to the risk manager (the person responsible for the installation's restoration project as a whole; generally this is the remedial project manager (RPM) or his/her supervisor). This is because they both bring important perspectives to the table. During the middle of the ERA, the RPM will be less involved in day-to-day decisions, but still should remain aware of what is going on.

## Screening Level ERA

In 1997, EPA published *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (ERAGS). This document lays out a process for conducting a two-tiered ERA (screening level and baseline), broken into eight distinct steps. EPA also identified up to six locations throughout the ERA where the project should be reviewed and future work reevaluated prior to progressing. EPA calls these decision points the Scientific/Management Decision Points (SMDPs). The first two steps of the ERAGS process encompass the screening level ERA:

- **Step 1 — Screening Level Problem Formulation and Ecological Effects Evaluation**
- **Step 2 — Screening Level Preliminary Exposure Estimate and Risk Calculation**

## The Five Components To Every ERA

1. **Planning.** The Planning component involves the determination of the level-of-effort necessary for the ERA. ERA management goals and objectives are determined (i.e., what plant, animal or ecosystem is at risk and might need protection), the focus of the ERA is laid out, and the timeframe for the assessment is set.
2. **Problem Formulation.** The overall strategy for estimating risk at a site is developed in Problem Formulation. During this component, the site's conceptual model is created, the plants and animals potentially at risk are defined (i.e., the assessment and measurement endpoints are set) and a plan is written that describes the data to be analyzed and the process to be used to calculate the risk.
3. **Analysis.** This component of the ERA consists of data collection, the technical evaluation of the data, the calculation of existing and potential exposures, and ecological effects at the site.
4. **Risk Characterization.** The likelihood and severity of the risk is related back to the assessment endpoints, and the ERA's uncertainty is described in the Risk Characterization. A good description of the risk, to include the level of adverse effects, is important for interpreting the risk results.
5. **Risk Management.** In this component, the results of the ERA are integrated with other considerations to make and justify remedial decisions. In a screening level ERA, the risk management decision is whether a baseline ERA is needed. At the end of a baseline ERA, the risk manager must balance risk reductions from site cleanup with the impacts caused by the cleanups themselves.

A screening level ERA is a highly conservative, desktop study, where little or no field data (other than visual observations) are collected or analyzed. Typically, a literature search on the known contaminants is performed and existing site data is collected. To estimate the risk, a highly conservative fate and effects model is utilized to calculate hazard quotients. The three end results of a screening level ERA are: 1) no significant risk exists, so the assessment should stop; 2) very significant risk exists, and an interim action should be initiated; or 3) there is insufficient information to make a remedial decision, so a baseline ERA should be performed. In many cases, a combination of the first and third options results, with some contaminants and exposure pathways dropping out at the end of the screen while others are carried forward into the baseline ERA.



The evaluation of ecological effects resulting from implementing various cleanup options should be discussed in the FS or CMS report. Under the context of the NCP's nine criteria, the risk manager should consider the following factors:

- Whether the cleanup alternative is protective of the environment
- The magnitude of the observed or expected effects and who or what will be affected (e.g., an individual, a local population or a community)
- The likelihood that these effects will occur or will continue
- The short- and long-term effects of the remedial options on the site habitats and the surrounding ecosystem
- Whether the affected area is highly sensitive or ecologically unique
- The recovery potential of the affected receptors and expected persistence of the contaminants

# More Information

## Where to Seek Assistance

Within the Army, several organizations and groups are available to assist installations with ERA questions and issues. These include:

- The U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM) has ERA experts in many fields and, as the representative arm of the Army Surgeon General, has the role of reviewing and approving ERAs (AR 200-1, Sections 1-18 & 11-9).
- The U.S. Army Corps of Engineers, Hazardous, Toxic and Radiological Waste (HTRW) Center of Expertise has personnel with technical expertise in risk assessment and also performs technical review of selected documents.
- The Army Biological Technical Assistance Group (BTAG) was established in 1993 to assist installations in the area of ERA. The BTAG is composed of personnel from the U.S. Army Environmental Center (USAEC), CHPPM and the U.S. Army Corps of Engineers. In February 2000, the BTAG assisted in the publication of the *Tri-Service Remedial Project Manager's Handbook for Ecological Risk Assessment*. This document is available on the USAEC Web site ([aec.army.mil](http://aec.army.mil)). If BTAG assistance is desired, please contact Mary Ellen Maly, USAEC, at (410) 436-1511 (DSN 584); or e-mail: [MaryEllen.Maly@aec.apgea.army.mil](mailto:MaryEllen.Maly@aec.apgea.army.mil).

## Baseline ERA

Steps 3 through 8 of the ERAGS process encompass the baseline ERA. These steps are shown below:

- Step 3 — Baseline Risk Assessment Problem Formulation
- Step 4 — Study Design and Data Quality Objectives
- Step 5 — Field Verification of Sampling Design
- Step 6 — Site Investigation and Analysis of Exposure and Effects
- Step 7 — Risk Characterization
- Step 8 — Risk Management

A baseline ERA uses much more site-specific information than a screening level ERA, and it emphasizes best estimates, replacing overly conservative estimates with actual site data. Proceeding to a baseline ERA is recommended when there is a need to reduce uncertainty. Short-term laboratory or limited field studies (e.g., collecting more water or soil, or collecting a better sample of a particular animal population) are generally performed to fill data gaps. Ideally, there are two outcomes of a baseline ERA. Either the assessment has shown that no unacceptable risk exists, or it has shown that there is an unacceptable risk that warrants remedial action. Occasionally, a second phase of baseline ERA is needed to further reduce uncertainty in order to determine the proper remedial course of action.

## Important Points To Remember

- Ecological risk is not occurring if: 1) the contaminant is no longer present; 2) the contaminant did not/will not contact a susceptible ecological component; and 3) contact with the contaminant did not/will not occur long enough or in sufficient intensity to cause a negative effect.
- Attempt to get early agreement by all parties on criteria for determining “adequate protection” and “unacceptable risks” before the ERA begins.
- Don’t skip the planning phase! If you don’t know what your goals and objectives are, the risk manager will have a hard time interpreting the results of the ERA.
- Development of appropriate Assessment Endpoints and their corresponding Measurement Endpoints is critical to ensuring that your results will be useful.

## ERA & Risk Management — How To Use The Results Of Your Assessment

Risk assessment and risk management are two distinctly different processes. In risk assessment, the likelihood of whether a risk is present and at what magnitude is decided. However, the assessment does not tell what needs to be cleaned up. Rather, the risk manager makes that decision in the FS or CMS phase of the project. Risk management is the process of combining the risk assessment results with other considerations to make and justify a response decision (i.e., what, if anything, needs to be done to protect the environment?). Some examples of these other considerations include tradeoffs between human health and ecological concerns, ecological impacts of the remedial options, and the costs of the options.