

Technical Assistance Plan Grant From The Technical Adviser

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT (SLERA) & PROBLEM FORMULATION

What is Ecological Risk Assessment?

The U.S. Environmental Protection Agency (EPA) defines ecological risk assessment (ERA) as the process through which scientists or risk assessors ‘evaluate the likelihood that adverse ecological effects might occur, or are occurring, due to exposure to one or more stressors’ (EPA 1992).

In the practical application of this concept, ERA is a ‘flexible process for organizing and analyzing data, information, assumptions and uncertainties to evaluate the likelihood of adverse ecological effects’ (EPA 1998).

What is the Framework for Ecological Risk Assessment (ERA)?

The U.S. Environmental Protection Agency (EPA) published its approach for conducting ERAs in the *Framework for Ecological Risk Assessment* (EPA 1992). This protocol served as the basis for and has been superseded by the *Guidelines for Ecological Risk Assessment* (EPA 1998).

The information provided in this community resource guide follows guidance provided in the *Ecological Risk Assessment Guidance for Superfund (ERAGS): Process for Designing and Conducting Ecological Risk Assessments* (EPA 1997). ERAGS was written for application to ecological investigations of hazardous waste sites regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). However, ERAGS is also appropriate for corrective action sites investigated under the Resource Conservation and Recovery Act (RCRA).

Risk assessors and risk managers evaluate actual or potential risks and hazards to plants and animals other than humans or domesticated species that are due to the release of hazardous wastes site-related activities (EPA 1997) using an 8-step process prescribed in ERAGS. These steps (Figure 1) are cited in the EPA Region 4 ERA Bulletins (EPA 2001a) as:

1. Preliminary Problem Formulation and Ecological Effects Evaluation;
2. Preliminary Exposure Estimate and Risk Calculation;
3. Problem Formulation: Assessment Endpoint Selection and Formulation of Testable Hypothesis;
4. Conceptual Model Development;
5. Conceptual Model Measurement Endpoint Selection and Study Design; Site Assessment to Confirm Ecological Sampling and Analysis Plan;
6. Site Field Investigation;

7. Risk Characterization; and,
8. Risk Management.

The primary goals (EPA 2005) of an ERA are:

1. To determine whether harmful effects (i.e., significant risks) are likely for wild animals or plants exposed to site related hazardous chemicals;
2. To calculate a protective cleanup level that would reduce the risk to wild animals or plants, if there is significant risk;
3. To determine the potential impact of cleanup activities on the habitats, plants, or animals; and
4. To provide information that can be used as a baseline for longterm biological monitoring programs to determine if the cleanup is effective.

Risk is a function of both exposure and toxicity. A risk to plants or animals other than humans or domesticated species does not exist if exposure over a long enough period of time to a contaminant at concentrations high enough to cause adverse effects has not occurred.

What is the Screening-Level Ecological Risk Assessment (SLERA)?

The ERA process is divided into two major tiers: the *SLERA* and the detailed Baseline Ecological Risk Assessment (*BERA*). Steps 1 and 2 make up the SLERA. By definition (EPA 1997), the SLERA is:

“A simplified risk assessment that can be conducted with limited data by assuming values for parameters for which data are lacking”.

The purpose of the SLERA (EPA 2001b) is:

“...to assess the need, and if required, the level of effort necessary, to conduct a detailed or baseline ecological risk assessment for a particular site or facility”.

Performing a SLERA helps risk assessors and risk managers to focus the efforts of the ERA. The SLERA is designed to cost and time efficient, using limited site data, assumptions and parameters in exposure models. These models are very conservative and heavily biased to reduce the probability of incorrectly eliminating substances from further consideration.

“...assumed values should consistently be biased in the direction of overestimating risk. This ensures that sites that might pose an ecological risk are studied further” (EPA 1997).

What Steps Are Involved in Conducting a SLERA?

As previously mentioned, the SLERA comprises the first two steps of the BERA. These two steps can be broken down further to detail the technical activities that occur in each phase of development.

Step 1: Screening-Level Problem Formulation and Ecological Effects Evaluation

This step is sometimes also referred to as the screening-level problem formulation and toxicity evaluation'. It includes all the functions of problem formulation and ecological effects analysis (steps 3 and 4 of the ERA as listed above), *but on a screening level*.

Specific tasks involved in completing this step are:

- *Site Visit;*
- *Problem formulation, which includes:*
 - Toxicity evaluation;
 - Development of conceptual model exposure pathways;
 - Development of assessment endpoints; and
 - Development of questions and/or hypotheses.
- *Ecological effects evaluation.*

In Step 1, ecological risk assessors gather information about the site, visit and inspect the site, and review available scientific literature to determine levels at which site contaminants are known to have adverse effects. The information collection phase provides a historical view of the site and its operation. Data collection may also give clues as to what contaminants are present or have been used at the site, and where and whether a contaminant release has occurred.

The purpose of the site visit is to determine what problem exists at the site and whether there is a potential risk to the environment. During the site visit, investigators may observe the layout of the site and the ecological setting to determine: dominant plant and animal species present at the site that might be at risk of exposure; how the contaminants might be transported in the environment to places accessed by animals or to places where endangered plant species grow; and, how plants and wildlife might be affected by site contaminants.

The problem formulation step addresses the question of whether ecological risks exist at a site by focusing attention on a few representative plant and animal species or groups of species that are found at the site. Investigators summarize their analysis of the behavior of contaminants in the environment by developing a conceptual site model (CSM). The CSM is often a tabular or graphic representation of how contaminants behave in the environment moving from the point of release to the point at which exposure occurs to the specific plants and animals being evaluated at the site.

In the final phase of Step 1, ecological risk assessors review available scientific literature to identify actual contaminant *levels that will not cause adverse effects* (i.e., No-Observed-Adverse-Effects-Levels, NOAELs) in potentially exposed site-specific plant and animal species. After weight the uncertainties associated with the data collected during the investigation, the most sensitive plant and animal species are considered for further study.

Step 2: Screening-Level Exposure Estimate and Risk Calculation

Specific Tasks involved in completing this step are:

- *Estimating exposures*; and
- *Risk calculation*.

In Step 2, ecological risk assessors calculate how much of a contaminant plants and animals are exposed to at a particular site. Assessors use this information to compare levels of contamination to levels that are known to cause harm. Risk characterization is accompanied by an assessment of the uncertainties associated with the risk estimates.

Scientific Management Decision Point (SMDP)

Based upon the results of Step 2, risk managers and natural resource trustees can decide whether there is a need for future action and what appropriate action should be taken. The SMDP may indicate negligible risk or continuation to a BERA. This process is captured in what is referred to as the *scientific management decision point* (SMDP). A list of state and federal natural resource trustees are listed in the EPA Region 4 Ecological Risk Assessment Bulletin (EPA 2001a).

References

[USEPA] U.S. Environmental Protection Agency, 1992. [*Framework for Ecological Risk Assessment*](#).; EPA/630/R-92/001.

[USEPA] U.S. Environmental Protection Agency, 1997. [*Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*](#). EPA/540/R-97/006. June.

[USEPA] U.S. Environmental Protection Agency, 1998. [*Guidelines for Ecological Risk Assessment*](#). Risk Assessment Forum, Washington, DC. EPA/630/R095/002F, 1998.

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*Community Fact Sheet Screening-Level Ecological Risk Assessment
Anniston PCB Site*

[USEPA] U.S. Environmental Protection Agency, 2001b. [The Role of Screening-Level Risk Assessment and Refining Contaminants of Concern in Baseline Ecological Risk Assessments](#). Publication 9345.0-14, USEPA Office of Solid Waste and Emergency Response. EPA 540/F-01/014. June.

[USEPA] U.S. Environmental Protection Agency, 2005. Fact Sheet: What is Ecological Risk Assessment? ONLINE at <http://www.epa.gov/region5/superfund/ecology/html/whatisera.html>. Last updated January 3, 2005.

**Figure 1. 8-Step CERCLA Ecological Risk Assessment Process
(From EPA 1997)**

