Ecological Risk Assessment and Its Application to the Remediation Process

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Ecological Risk Assessment

A process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors

Framework for Ecological Risk Assessment
USEPA Risk Assessment Forum (1992)

EPA Ecological Risk Assessment

- Planning
- Problem Formulation
- Analysis
- Risk Characterization

Planning Phase

- Establish management goals
- Determine purpose of the risk assessment
- Identify scope, complexity and focus of ERA

Problem Formulation

- Integrate available information
- Develop Assessment Endpoints
- Develop Conceptual Model
- Develop Analysis Plan

Problem Formulation
Site Information

- Site history
- Description of activities
- Environmental settings
- Identification of potential contaminants
- Identification of potential areas of impact

Problem Formulation
Assessment Endpoints

- Ecological relevance
- Susceptibility to known or potential stressors
- Relevance to management goals

Problem Formulation
Conceptual Model

- Ecological model
- Relationship between contaminants and receptors

Problem Formulation
Analysis Plan

- Identify data gaps and formulate sampling plan
- Quality assurance
- Statistical analyses

Analysis Phase

- Data collection
- Evaluate and describe exposure
- Evaluate and describe ecological effects

Analysis Phase
Exposure Analysis

- Measure contaminant concentrations in abiotic and biotic media
- Model exposures as appropriate

Analysis Phase
Ecological Effects

- Simple to complex
- Environmental benchmarks
- Literature surveys
- Models
- Laboratory tests
- Field surveys

Risk Characterization

- Defines relationships between stressors, effects and the ecosystem
- Risk Estimation and Description
- Uncertainty Analysis

Risk Characterization
Evaluation of Risk

- Hazard Quotients
- Statistical significance
- Weight of Evidence

Resources

- Guidelines for Ecological Risk Assessment (EPA/630/R-95/002F)
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA/540/R-97/006)
- Various guidance documents from Oak Ridge National Laboratories (www.esd.ornl.gov/programs/ecorisk/ecorisk.html)

Application of Ecological Risk Assessment to the Remediation Process

Connecticut DEP Guidance for Site Characterization

- Site Characterization Guidance Document (Draft – June, 2000)
- Transfer Act Site Assessment Guidance Document (November, 1991)

Site Characterization

- Phased approach to defining environmental conditions at a site
- Support decisions regarding the need to remediate
- Conceptual Site Model Approach

Recommendations

- Integrate the consideration of ecological risk into the Site Characterization process
- Use a tiered approach to refine level of complexity
- Iterative process, as needed
- Draft guidance is being prepared

Phase 1 Site Characterization

Purpose: To compile existing information regarding a site

Decision: Is there a potential for a release to have occurred from the site?

Phase 1 Site Characterization

- Tasks
  - Site history
  - Physical description
  - Review of previous investigations and remediation
  - Site walkover
  - Develop Conceptual Site Model
- Scoping Level ERA

Scoping Level ERA

- Purpose:
  - To determine the need for an evaluation of potential ecological risks due to site related activities
- Prerequisites:
  - Completion of a Phase 1 Site Characterization

Scoping Level Tasks

- Review existing data
  - Site location & history
  - Land and/or water uses
  - Known or suspected chemical releases
  - Potentially affected media

Scoping Level Tasks

- Review ecological information
  - Ecological resources/habitat on or in the vicinity of the site
  - Ecological species present or expected, including threatened or endangered species
  - Site visit observations

Scoping Level Decision

Are ecological risks suspected?

1. Have releases occurred at the site?
2. Are ecological resources present at or in the vicinity of the site?

If “Yes” or “Unknown” for both questions, continue evaluation of ecological risks

Phase 2 Site Characterization

Purpose: To refine Conceptual Site Model

Decision: Has a release occurred at the site?

Phase 2 Site Characterization

- Tasks
  - Identify Areas of Concern and potential release mechanisms
  - Identify substances of concern
  - Identify migration pathways, receiving media and receptors
  - Update Conceptual Site Model
- Re-visit Scoping Level ERA, eliminating uncertainty

Scoping Level Decision

Are ecological risks suspected?

1. Have releases occurred at the site?
2. Are ecological resources present at or in the vicinity of the site?

If “Yes” for both questions, continue evaluation of ecological risks

Phase 3 Site Characterization

Purpose: To define the nature and extent of releases that have occurred at the site

Decision: Is remediation needed?

Phase 3 Site Characterization

- Tasks
  - Characterization of affected media
  - Update Conceptual Site Model
- Conduct a Screening Level ERA

Screening Level ERA

- Purpose:
  - To determine the potential ecological risks due to site related activities
- Prerequisites:
  - Completion of Phase 1, 2 and 3 Site Characterization & Scoping Level ERA

Screening Level Tasks

- Identify site-specific ecological receptors
- Identify complete and incomplete exposure pathways
- Screen media concentrations against environmental benchmarks
- Evaluate impacts to wildlife

Screening Level Decision

- Are risks to ecological population potentially occurring?
- If Yes, decide:
  - To proceed with Site Specific ERA

    OR
  - Develop a Remedial Action Plan

Site Specific ERA

- Purpose:
  - To better define the potential for ecological risks to occur due to site-related activities
- Prerequisites:
  - Completion of Phase 1,2,and 3 Site Characterization
  - Completion of Scoping and Screening Level ERA

Site Specific ERA Tasks

- Conduct appropriate field and laboratory studies
- Revise screening level ERA using site specific assumptions

Site Specific ERA Decision

- Are risks to ecological populations potentially occurring?
- If Yes, develop a Remedial Action Plan

Conclusions

- ERA is an integral part of successful site remediation
- Consideration of ecological risks required by various State and Federal programs
- CT DEP proposes a tiered approach to ERA, linking the evaluation to the Site Characterization process

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