

Risk Evaluation: Ecological and Other Scenarios

11.1 Ecological Risk Assessment

The preceding sections describe the investigation and assessment of the soil direct contact, ground water, and vapor intrusion (VI) pathways. In addition to these pathways, it is important to evaluate whether site conditions warrant an ecological risk assessment (ERA) or additional human health risk evaluation. This section provides guidance on when and how to evaluate these pathways, and references to additional information sources. The Indiana Department of Environmental Management recommends a step-wise approach to ERA.

11.1.1 Screening Level ERA (SLERA)

Every investigation should include a SLERA. The SLERA includes a desktop review and site inspection to determine if ecologically susceptible areas (ESAs; see Section 2.6) exist at or near the site, and whether a release could have occurred within or migrated to ESAs, resulting in a completed exposure pathway. If not, further ecological risk assessment is not necessary. Investigation reports should document the findings of the SLERA, including information on any rare, threatened, or endangered species in the site vicinity. If such species or their habitats are present on or near the site, additional evaluation may be necessary.

If there is uncertainty regarding whether habitats are contaminated, or if they are expected to be contaminated, then environmental media should be sampled and the results compared to ecological screening levels (ESLs). Pre-existing data may be suitable for screening purposes. However, it is important to ensure that the data are sufficient for this purpose and they should be reviewed for completeness and conformity with data quality objectives (e.g., analytical detection/reporting limits should be lower than the ESLs). Sources of ESLs for soil, sediment, surface water, and/or air include Buchman (2008), USDOE (1997), U.S. EPA (1997f, 2003c) and MacDonald *et al.*, (2000). IDEM will evaluate other ESLs, site-specific ecological remediation objectives, and ecological risk characterizations on their merits.

If the results of the SLERA demonstrate that all potential contaminant concentrations are below appropriate screening levels, then the ecological assessment is complete. If the SLERA identifies potential contaminant concentrations above ESLs within ESAs, it is appropriate to conduct a baseline ERA (U.S. EPA, 1997b).

11.1.2 Baseline ERA

Additional investigation is warranted if potential contaminant concentrations exceed screening levels. Complete guidance for conducting baseline ERAs is outside the scope of this document. However, Ohio EPA (2008) and U.S. EPA (1997b, 1998a, 1998b) contain additional information on baseline ERAs.

11.1.3 Special Considerations for ERA

Data sets and potential contaminants for an ERA may differ from those selected for human health. Exposures may occur in different areas, and different screening levels may apply. Therefore, it may be appropriate to conduct screening for human health and ecological assessments independently. Data quality objective development should consider receptor type, exposure pathway, screening levels, and detection/reporting limits.

Other chemical and physical parameters (e.g., pH, dissolved oxygen levels, total organic carbon levels, redox potential, water temperature) may be relevant to the ERA, depending on the environmental medium and receptors under consideration.

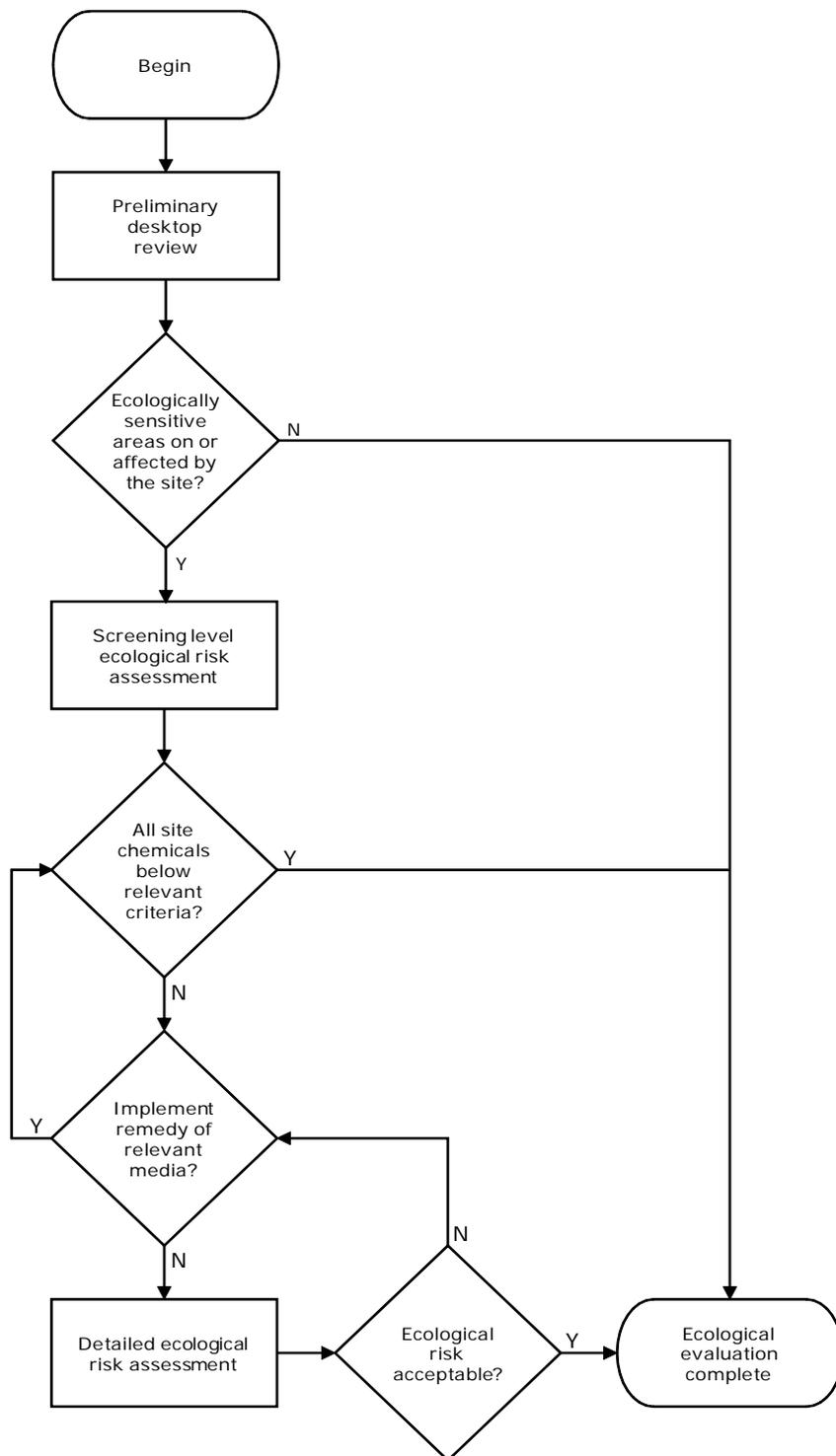
Persistent, bioaccumulative, and toxic (PBT) chemicals are of particular concern for ecological risk. PBTs move through the food chain and affect upper trophic levels. Ohio EPA (2008) provides some examples:

- Aldrin
- Chlordane
- DDT/DDD/DDE
- Dieldrin
- Hexachlorobenzene
- Hexachloro-1,3-butadiene
- Hexachlorocyclohexanes (alpha-HCH, beta-HCH, gamma-HCH, or lindane)
- Mercury and its compounds
- Polychlorinated biphenyls (PCBs)
- 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)
- Toxaphene

U.S. EPA (2000b) contains additional information on bioaccumulative chemicals.

SLERAs and baseline ERAs may identify representative receptors or species of concern based on the ESA(s) or species present at or near the site. If protection of an upper trophic level species is an assessment endpoint (e.g., river otter), the risk assessment should also evaluate effects to species lower on the food chain (e.g., fish, macroinvertebrates).

Figure 11-A: Ecological Risk Evaluation Process



11.2 Human Health Risk Evaluation: Other Scenarios

Sections 8, 9, and 10 provide methods for evaluating risks for a number of human health exposure scenarios. Site-specific conditions may warrant the evaluation of additional scenarios. Evaluations should consider both current and reasonable future uses of sites and off-site impacted areas.

Selected examples of possible site-specific exposure scenarios appear below, arranged by media. IDEM does not offer specific guidance on conducting these site-specific evaluations but refers users to guidance (including but not limited to U.S. EPA 1989a, 1991a, 1991g, 1996a, 1996b, 2002f, 2004b, 2009g). Investigators may also wish to consult IDEM when evaluating site-specific scenarios. IDEM will evaluate risk characterizations for these scenarios on a site by site basis.

Surface Water

Surface water includes (but is not limited to) rivers, streams, wetlands, reservoirs, lakes, and ponds. Possible exposure scenarios for surface water include use as drinking water, recreational exposure activities, and ingestion of fish.

Sediment

Sediments are primarily particulate matter, typically mixtures of clay, silt, sand, organic matter, and minerals that often lie below water. Sediment contamination often occurs in conjunction with surface water contamination, and sediments can be a major repository for toxic and persistent chemicals released into overlying surface waters. Exposure may occur directly through recreational activities or indirectly through fish ingestion.

Soil

In addition to those described in Sections 8 and 9, other soil-related scenarios may be important on a site-specific basis. Specifically, uptake by biota may be of concern for crops, grazing animals, and/or game animals.

Ground Water

Sections 9 and 10 provide information on the risks associated with the direct contact and VI scenarios for ground water. Possible additional scenarios include indirect exposure through irrigation of crops, plant uptake, and water for livestock. In some cases, utility workers digging trenches may also undergo exposure to volatiles in shallow ground water.

Air

For certain sites, air deposition may be significant. Direct deposition to plants or particulate deposition on soil may be of concern for crops or livestock.