

Risk Assessment for RCRA Corrective Action

For facilities that have releases of hazardous waste or constituents into soil, groundwater, surface water, and/or air, EPA and 43 authorized states and territories, work with responsible facilities to investigate and clean up hazardous releases under the Resource Conservation and Recovery Act (RCRA) Corrective Action Program. Human health and ecological risk assessment is an integral part of the RCRA Corrective Action site cleanup process. The Corrective Action program may use risk assessment to assess baseline risk, establish cleanup levels, evaluate the effectiveness of remedial measures, and to decide the end of cleanup activities.

Environmental Indicators:

While the ultimate goal of the RCRA Corrective Action Program is to achieve final cleanups, the intermediate progress and success of the program is monitored by tracking two Environmental Indicators (EIs), the human exposure EI (HHEI) and the groundwater EI (GWEI). VDEQ uses EPA's process to perform these evaluations and details about the EI determination process can be found at:

<http://www.epa.gov/epawaste/hazard/correctiveaction/eis/index.htm>.

While the EI process is similar to risk assessment in some ways, it is a separate process aimed to focus efforts on early risk reduction, risk communication, and resource protection and does not substitute for the risk assessment requirements in support of final cleanups which are described on this website.

Human Health Risk Assessment:

Risk assessment is the evaluation of scientific information on the hazardous properties of environmental agents (hazard characterization), the dose-response relationship (dose-response assessment), and the extent of human exposure to those agents (exposure assessment). The product of the risk assessment is a statement regarding the probability that populations or individuals so exposed will be harmed and to what degree (risk characterization).

Risk assessment may be screening level (semi-quantitative) or quantitative. Quantitative risk assessment may be performed to evaluate baseline conditions or to demonstrate completion of mitigation/remediation.

Screening level risk assessment: Screening level risk assessments are performed to identify the Hazardous Waste Management Units (HWMUs)/ Solid Waste Management Units (SWMUs)/Areas of Concern (AOCs) that fail the [risk based screening criteria](#) and need to be investigated further. Screening must be done for both the residential land use scenario and a general industrial land use scenario. Screening must also address cross-media transfer which includes soil to groundwater transfer at a minimum and [ecological risk](#) when necessary. To understand the use and application of screening level risk assessment in RCRA CA, please refer to Risk Based Screening Flowchart for [soil](#), [groundwater](#), [vapor intrusion](#), and [surfacewater/sediments](#).

The standard list of analytes for Corrective Action facilities is taken from the list of Hazardous Constituents in Appendix VIII of Part 261 for soils and from the list of Hazardous Constituents in Appendix IX of Part 264 for groundwater. In some cases this list may be reduced if the site history is well known. Site-specific constituents not included in either Appendix VIII or IX may also need to be included. The facility is encouraged to discuss the analyte list with the CA project manager before developing the sampling plan.

DEQ has developed the following tables as tools to be used in the screening step of the risk assessment. The user should enter the maximum concentration detected in each applicable medium. The table will identify the contaminants of potential concern (COPC) to be further evaluated. Note that the first four tables require the user to collect and enter site-specific background concentrations. Links for screening tables are provided below:

Soils: Site Specific Background (See RCRA Corrective Action Fact Sheet #5 - [Inorganic Constituent Background Determinations During RCRA Corrective Action Investigations](#) for guidance on screening site soil data against background concentrations.

Note: There are no risk-based screening levels for some of the possible chemicals of concern. In some of these cases [proxy screening levels based on substances with similar chemical structures](#) are substituted.

1. [Soils: Site Specific Background](#)
2. [Groundwater: Site Specific Background](#)
3. [Surface Water: Site Specific Background](#)
4. [Sediment: Site Specific Background](#)
5. [Soils: Residential Receptor and fate-and-transport](#)
6. [Soils: Industrial Receptor and fate-and-transport](#)
7. [Groundwater: Residential Receptor](#)
8. [Vapor Intrusion: Sub-slab or Shallow \(<5 feet\) Soil Gas](#) (preferred for sites with existing buildings): Residential Receptor
9. [Vapor Intrusion Sub-slab or Shallow \(<5 feet\) Soil Gas](#) (preferred for sites with existing buildings): Industrial Receptor
10. [Vapor Intrusion: Deep Soil Gas](#): Residential Receptor
11. [Vapor Intrusion: Deep Soil Gas](#): Industrial Receptor
12. [Vapor Intrusion: Groundwater](#): Residential Receptor
13. [Vapor Intrusion: Groundwater](#): Industrial Receptor
14. [Surface Water \(Fresh\)](#): Human Consumption of Water and Aquatic Organisms
15. [Surface Water \(Marine\)](#): Human Consumption of Aquatic Organisms

Quantitative Risk Assessment:

The protocols used in RCRA risk assessment is based on the USEPA Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals) (RAGS Part B) and USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (2002).

Baseline risk assessment: This is a quantitative analysis of the potential adverse health effects (current or future) caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases (i.e., under an assumption of no action). The baseline risk assessment contributes to the site characterization and subsequent development, evaluation, and selection of appropriate response alternatives. The results of the baseline risk assessment are used to help determine whether additional response action is necessary at the site, develop or modify clean-up goals, help support selection of the "no further action" or use of institutional controls, where appropriate. The purpose of baseline risk assessment is to document the magnitude of risk at a site and the primary causes of that risk. The [screening level risk assessment](#) (discussed above) may be used in lieu of baseline risk assessment to evaluate if potential risk to residential receptor exists and if the facility has agreed to demonstrate, through institutional control and other enforceable mechanisms, that residential future use of property will be prohibited.

The HWMUs/SWMUs/AOCs that fail the risk based human health screening criteria must be evaluated in a baseline quantitative human health risk assessment, unless the facility proposes to remove or decontaminate the contaminated media to meet acceptable cleanup levels that are protective of human health and environment. The quantitative risk assessment must be based on an approved land use scenario for the facility (see RCRA Corrective Action Fact Sheet #1 Land Use Assumptions for [RCRA Corrective Action](#) Baseline Risk Assessments and may need to include residential (adult and child) receptors and an industrial receptor (adult). Additional receptors such as recreational user and/or fish/shellfish consumers may be included based on site-specific information.

Risk assessment, quantitative and semi-quantitative, generally includes the following steps:

1. [Data Collection and Evaluation](#),
2. [Exposure Assessment](#),
 - a. [Conceptual Site Model](#)
 - b. [Exposure Point Concentrations](#)
 - c. [Chemical Intakes and Exposure Concentrations](#)
3. [Toxicity Assessment](#), and
4. [Risk Characterization](#).

The risk assessment results must show the risk in comparison to the [current risk based performance standards](#). If the [current risk based performance standards](#) are not met, risk-based cleanup goals for each environmental medium must be developed. The desired clean-up goal is unrestricted use of all media so that no unacceptable risk is posed to child residential receptors. However, a restricted site-specific land use scenario (e.g. industrial) may be appropriate for some sites with sufficient justification (see RCRA Corrective Action Fact Sheet #1

Land Use Assumptions for [RCRA Corrective Action](#) Baseline Risk Assessments. A land use scenario should be proposed and approved by the Department prior to the quantitative risk assessment. The quantitative risk assessment can be performed for each unit individually or for a group of units or for the entire site. Any proposed groupings should be presented to the Department for approval prior to the quantitative risk assessment.

Recommended tool for quantitative risk assessment: [REAMS software](#).

Data Presentation:

The result of the baseline risk assessment can be presented for each unit or group of units or for the entire site, as approved by the Department. The contribution of each constituent in each medium to the cumulative risk and hazard index for specific target organs (if applicable) may be included. The facility may use tables provided in RAGS part D (<http://www.epa.gov/oswer/riskassessment/ragsd/tables.htm>) to present the risk assessment. Use of standardized tables facilitates DEQ's review of the risk assessment and insures that all required information is submitted to support the results.

Quantitative Risk Assessment -Ecological Risk:

Ecological risk assessment is an appraisal of the actual or potential risk of contaminants from a hazardous waste site on plants and animals other than people. Ecological risk assessment may be conducted only if there is a habitat capable of supporting ecological receptors is present and likely to have received contaminants. Therefore, ecological screening may not be needed at all HWMUs/SWMUs/AOCs. For ecological receptors, determining the level of risk is complicated and is a function of the receptors of concern, the nature of the adverse effects caused by the contaminants, and the desired condition of the ecological resources. For guidance on conducting an ecological risk assessment see [Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments](#). Also see the [EPA Region 3 Ecological Risk Assessment website](#) for additional guidance on ecological risk assessments.

The HWMUs/SWMUs/AOCs that fail the lowest [risk based ecological screening criteria](#) must be evaluated in a baseline quantitative ecological risk assessment, unless the facility proposes to remove or decontaminate the contaminated media to meet acceptable cleanup levels.

For Screening Level Ecological Risk Assessments (SLERA), screening criteria for the following media should be consulted in the order of preference listed.

- [Freshwater and freshwater sediments](#)
- [Marine and marine sediment](#)
- [Soils, invertebrates and microbial process](#)
- [Aquatic biota](#)
- [Terrestrial plants](#)
- [Wildlife](#)

Risk Evaluation of the Remedy - Short term impact: Acute Inhalation Risk:

To assess potential health impact from air discharges due to remediation techniques (e.g., air sparging, SVE, etc.), air concentrations are compared against the acute inhalation risk (1 hour) concentrations. Please refer to DEQ technical paper titled 'Conducting screening level human health risk assessment for soil remediation technologies' dated May 2008. The hierarchy of reference to obtain these concentrations is provided below:

- AEGL-1: <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm>
- EPRG-1: <http://orise.orau.gov/emi/scapa/chem-pacs-teels/erpg-definitions.htm>
- TEEL-1: http://www.atlintl.com/DOE/teels/teel/teel_pdf.html