

## APPENDIX 2: THE RISK-BASED SITE EVALUATION PROCESS

### CHECKLIST FOR RBSE IMPLEMENTATION AND DOCUMENTATION

The following is a checklist outlining the Risk-Based Site Evaluation (RBSE) process. The categories of information listed and the attached tables function as guides to collect and document the RBSE information and decision-making process for a specific site. Steps one through five involve reviewing appropriate information collected during site characterization that is necessary to make conclusions regarding the extent and magnitude of impact and to conduct the tier evaluation of risk posed by the site. Steps six through seven are where the actual risk calculations are identified and conducted using the appropriate tools available for tier evaluation. The final step involves drawing conclusions about the site conditions and the risks presented by the site, including an assessment of the uncertainty associated with each conclusion. These conclusions are to be documented whether or not further information is needed or a cleanup is recommended. Reports regarding site characterization and risk evaluation submitted for MPCA staff review and approval may be organized based on these steps.

#### 1. Site description and characterization.

The RBSE process begins with the development of a description of the site location and a summary of the geology, hydrogeologic conditions and conceptual model, site history and past operations, chemical use, etc. at the site and surrounding areas. A summary and discussion of analytical test results indicating the nature and extent of environmental impacts should be provided. Appropriate site maps and diagrams are also useful. If necessary, conditions for natural attenuation should be characterized. This information can help to focus future site investigation, if necessary, and provide a context for decision making. Additionally, early consideration of how to involve the community in the development of the plan to characterize the site and at decision-making points should be given.

*References: Introduction and Overview of the RBSE Manual; Site Characterization and Investigation Guidelines; Community Involvement Guidelines; Natural Attenuation of Chlorinated Hydrocarbons; Voluntary Investigation and Cleanup and Superfund programmatic guidance.*

#### 2. Identification of the chemicals of potential concern (COPCs) to be targeted for risk evaluation.

Chemicals of Potential Concern are chemicals which may pose risks based on Tier 1 criteria or standards. This may also mean those chemicals for which analytical data is unavailable, but that may be present at the site based on historical information, or chemicals which were not detected under circumstances of elevated method detection limits. The rationale for selecting COPCs, or for not including compounds as COPCs should be documented. If it is anticipated that background concentrations will be used in risk characterization, the background data should be evaluated and documented. Based on site characterization and the COPC, the potential for short-term hazards or safety concerns must be assessed to determine the need for emergency response or special precautions during site investigation.

*References: Site Characterization and Investigation Guidelines; Soil-Human Health Pathways Guidance (section on short-term hazards); pathway-specific guidelines for Tier Evaluations*



### **3. Identification of current and/or planned resource use.**

A key component of the RBSE process is the identification of current and future property use. This is important in developing an adequate work plan for site characterization, including an adequate sampling and analysis plan; selecting appropriate evaluation criteria as well as selecting a remedy. Table B-1 was developed to assist in this process. A discussion of any differences in resource use at nearby or adjacent properties should also be documented.

*References: Incorporation of Planned Property Use into Site Decisions (Property Use); Ground Water Guidance (Ground Water); Surface Water Guidance and Minn. Rules 7050; Soil-Ecological Pathways Guidance.*

### **4. Receptor and Pathway Evaluation.**

Exposure pathways in which receptors may be at risk or have been impacted must be identified in order to focus the Tier Evaluation used to characterize risk. Table B-2 is designed to help identify and record potential pathways and receptors, as well as identify special considerations.

*References: Pathway-specific guidelines for Tier Evaluations.*

### **5. Identification of Exposure Area(s) and determination of the representative exposure point concentration by pathways for each Exposure Area.**

An Exposure Area is the location of potential contact between a human or environmental receptor and a release of contaminants. An Exposure Area is defined relative to a given pathway and exposure route, and may correspond to a single location, especially in the case of water wells or surface water, an entire site or some portion of it. An Exposure Area may or may not correspond to the extent of contamination at the site; a source area proper; or a source area with an associated plume. An Exposure Area may extend beyond property lines.

Based on the pattern of contamination (e.g., location and magnitude of hot spots) and current and future site activity, it is necessary to determine whether or not the site conditions or the focus of investigation requires definition of multiple Exposure Areas and grouping of associated data to estimate the exposure point concentration to be used in the tier evaluation. It may be necessary to group data by depth or location or as a function of time. Exposure Areas are determined on a site-specific basis. By separating groups of data according to Exposure Areas and calculating exposure point concentrations for separate Exposure Areas, investigations and remedial actions could potentially be more focused and flexible than if multiple areas had been combined. If only limited analytical data is available for a site, inadequate representation for individual Exposure Areas may require risk characterization of the site as a whole.

Provide any decision rationales used to define multiple Exposure Areas or to group the data. A decision rationale for handling non-detect results must be presented.

*References: Pathway-specific guidelines for Tier Evaluations; Glossary (Exposure Area, exposure point concentration)*



## 6. Determination of risk-based evaluation tools to conduct Tier Evaluation for specific Exposure Areas and pathways.

This step involves selecting the appropriate tools to conduct the risk characterization for the exposure pathways of concern at individual Exposure Areas. Initially, a Tier 1 level of evaluation is conducted, followed by more rigorous evaluation at the Tier 2 or 3 level, if necessary. A level of Tier Evaluation for individual pathways of concerns selected with consequences in mind. For instance, less conservative remediation scenarios may be expected at higher tier levels due to reduced uncertainty associated with increased site information. Another example of the various consequences that need to be considered in selecting the level of Tier Evaluation involves property use. Remedial options may be restricted or may require application of institutional controls if current or future property use is restricted.

Table B-3 identifies the Risk-Based Evaluation Tools with corresponding information and provides a space to record the Exposure Areas requiring the application of a given tool.

*References: Pathway-specific guidelines for Tier Evaluations; Property Use; Community Involvement; Natural Attenuation of Chlorinated Hydrocarbons; Remedy Selection.*

## 7. Risk characterization.

The risk characterization is the result of comparing the risk indicated for specific compounds and suites of compounds that affect the same target endpoint with the target risk level. The target risk level is discussed in the References below or the spreadsheets prepared by the MPCA for these calculations. The exposure (site) concentrations for specific compounds are the inputs for the Excel® spreadsheets used to compute the risk characterization. Attach the completed spreadsheets or documentation from other evaluation tools to the site report. Interpretive comments can be included directly on the spreadsheets or within the body of the report. For pathways which fail the risk-based evaluation, determine if sample number and location provided adequate results for the evaluation before conducting a more rigorous Tier Evaluation. A barely passing risk characterization that involves non-detect results for which method detection limits were elevated should be very thoroughly scrutinized. Discuss any deviations from standard use of the tools.

*References: Pathway-specific guidelines for Tier Evaluations.*

## 8. Conclusions & Recommendations from the Site Characterization and Tier Evaluation.

Conclusions and recommendations from the site characterization, including extent and magnitude of the impact, and the risk characterization developed during the tier evaluation should be detailed in a report(s). The results and recommendations from the tier evaluation may be summarized in Table B-4. Documentation should include a discussion of the level of uncertainty for each conclusion of the risk characterization for specific pathways. Recommendations to conduct additional site investigation may be made if shortcomings are found in the quality of the analytical results or the sampling and analysis plan or if the tier evaluation needs to be refined. If no action is recommended because the pathway is determined to be incomplete, but the potential risk exceeds acceptable target risk levels indicated by the tier evaluation, the recommendations should address protection of human and ecological exposure in the future. Summarize any deviations from the guidance implemented during the RBSE. Provide rationales. Attach maps and sketches. Recommendations for remedy selection activities may include preparing a response action plan, conducting feasibility studies or implementing pilot studies.



The level of inherent uncertainty in the site characterization and tier evaluation can be a function of the amount of site-specific information used to draw conclusions. This as well as other sources of uncertainty should be discussed. An evaluation of the analytical data quality is not necessary or may require only minimal assessment in cases where the data quality has already undergone adequate review in previous reports. The primary purpose of conducting an evaluation of data quality is to identify data to be eliminated, or used only qualitatively, in the evaluation of risk and in the preparation of recommendations regarding the need for additional site characterization.

Questions to consider in determining the need for additional site characterization or additional tier evaluation work include:

- Is the extent and magnitude of contamination adequately defined?
- Is the Receptor Survey (human and ecological) adequate?
- Is the analytical data available for all chemicals of potential concern (COPC)?
- Are there other necessary parameters to be tested?
- Are all site characterization issues addressed?
- Has appropriate and proper field methodology been used?
- Have sample holding times been exceeded?
- Are data sources satisfactory?
- Do detection limits exceed target risk levels due to matrix interference dilution, etc.?
- Is the detection frequency questionable?
- Does lab qualified results or surrogates, blanks, spikes and duplicates or analytical methods put into question the quality of the data?
- Are results below background level concentration?
- Are all other data quality concerns addressed?

Summarize any deviations from the guidance or site work plans, including community involvement and sampling and analysis, during the Site Evaluation and provide rationales.

Include the following tables in the site report, as necessary, and include site maps and diagrams showing sampling locations and other pertinent information or results. Provide a list of site documents and other references used in the RBSE.

*References: Site Characterization and Sampling; Property Use; Community Involvement; Pathway-specific guidelines for Tier Evaluations; Natural Attenuation of Chlorinated Hydrocarbons; Remedy Selection; Glossary.*



## Tables

**Table B-1** Current and Future Resource Use

Circle or embolden categories which apply to the site or parcel at which the extent and magnitude of impact is being characterized or where the impact is being evaluated for risk. Discuss any differences in resource use at nearby or adjacent properties.

Resource	Current	Future
Property	<ul style="list-style-type: none"> <li>- Residential or Unrestricted Commercial</li> <li>- Industrial or Restricted Commercial</li> <li>- Recreational</li> <li>- Agricultural</li> <li>- Other : _____</li> </ul>	<ul style="list-style-type: none"> <li>- Residential or Unrestricted Commercial</li> <li>- Industrial or Restricted Commercial</li> <li>- Recreational</li> <li>- Agricultural</li> <li>- Other : _____</li> </ul>
Ground Water	Current and future ground water use will be its highest priority use as a potable supply and/or for food processing and culinary purposes.	
Surface Water	<ul style="list-style-type: none"> <li>- Outstanding Resource Value (ORVW)</li> <li>- Class 1 (Drinking Water) &amp; 2Bd (Aquatic Life &amp; Recreational)</li> <li>- Classes 2A-B, excluding Bd: Protected Fishery</li> <li>- Class 2C-D: Maintained Wetlands and Rough Fish</li> <li>- Classes 3 (Industrial Use), 4 (Crops, Livestock, Wildlife), 5 (Aesthetic Enjoyment &amp; Navigation), 6 (Other), 7 (Drainage Ditch)</li> </ul>	<ul style="list-style-type: none"> <li>- Outstanding Resource Value (ORVW)</li> <li>- Class 1 (Drinking Water) &amp; 2Bd (Aquatic Life &amp; Recreational)</li> <li>- Classes 2A-B, excluding Bd: Protected Fishery</li> <li>- Class 2C-D: Maintained Wetlands and Rough Fish</li> <li>- Classes 3 (Industrial Use), 4 (Crops, Livestock, Wildlife), 5 (Aesthetic Enjoyment &amp; Navigation), 6 (Other), 7 (Drainage Ditch)</li> </ul>
Ecological Habitat		
Discussion		



**Table B-2 Potential Pathways and Receptors**

In Table B-2, mark the cells corresponding to the exposure pathways in which receptors have been impacted or at risk. Make a note if any of the special considerations listed below apply.

**Table B-2. Potential Exposure Pathways and Receptors**

Source/Pathway (Exposure Route)	Current		Future	
	Human Receptors	Ecological Receptors	Human Receptors	Ecological Receptors
Soil exposure (Inhalation, dermal, ingestion; terrestrial food chain for ecological receptor)				
Soil Leaching (Ingestion)		Not Applicable		Not Applicable
Ground Water (Ingestion)		Not Applicable		Not Applicable
Sediment (Dermal, ingestion)				
Surface Water (Inhalation, dermal, ingestion; aquatic food chain for humans)				
Food Chain (Ingestion)		Not Applicable		Not Applicable
Outdoor Air (Inhalation)				

Additional Considerations:

Default assumptions used in the Tier 1 or 2 spreadsheet risk evaluations for the direct-human-contact-with-soil pathway do or may not apply in the following cases.

- Vapor migration into a building;
- Food Chain; and
- Runoff to surface water or sediments.

Soil conditions should be screened for ecological impact if:

- Habitat is present on the contaminated area, AND;
- Endangered, threatened, or special concern species or plant communities are present; OR
- Bioaccumulative or acutely toxic contaminants are present in the top three feet in a total area greater than approximately one acre; OR
- Other contaminants are present in the top three feet in a total area greater than approximately two acres; OR
- The lateral extent of contamination in the upper three feet is unknown, but could be larger than 1-2 acres.

Habitat is vegetation or features used by wildlife for feeding, breeding, resting, etc., such as grassy, brushy, shrubby or wooded areas.

Bioaccumulative compounds are summarized in the Ecological Soil Evaluation document.



**Table B-3 Site-Specific Risk Characterization and Evaluation Tools**

Circle the Evaluation Tools in Table B-3 which apply to the site parcel, or exposure area.

Exposure Route	Receptor	Risk-based criteria or standards for Exposure Route	Evaluation Tool*	Specify Parcel or Exposure Area to which the Tool applies
Soil (Inhalation, dermal, ingestion)	Human	SRVs	Tier 1: resicurr.xls Tier 2: Contact MPCA Risk Assessor or Project Team for Tier 2 evaluation tools (includes industrial or recreational property use)	
Soil Leaching (Ingestion)	Human	SLVs	soilcurr.xls	
Ground Water (Ingestion)	Human	HRLs, MCLs, HBVs	dwcurr.xls	
Sediment (Dermal, Ingestion)	Human		Contact MPCA Risk Assessor or Project Team	
Surface Water (Inhalation, Dermal, Ingestion, Aquatic Food Chain)	Human	Minn. Rules Chpt. 7050	Contact MPCA Project Team. Spreadsheets under development: Tier 1 screening for all waters. Tier 2 evaluation for 4 distinct groups of water classes. Tier 3 guidelines for ORVW; OIRW; acute situations; unusual exposure routes including subsistence diets; criteria lacking.	
Food Chain (Ingestion)	Human		Contact MPCA Risk Assessor or Project Team	
Outdoor Air (Inhalation)	Human	ACLs	Contact MPCA Risk Assessor or Project Team	
Soil (Dermal, Ingestion, Food Chain)	Ecological	Ecological Soil Screening Criteria	eco1curr.xls (direct contact - dermal, ingestion) eco2curr.xls (terrestrial food chain)	
Sediment (Dermal, Ingestion)	Ecological - Benthic Invertebrates	Ecological Sediment Screening Criteria	sedcurr.xls	
Surface Water (Inhalation, dermal, ingestion)	Ecological	Minn. Rules Chpt. 7050	Contact MPCA Project Team. Spreadsheets under development: Tier 1 screening for all waters. Tier 2 evaluation for 4 distinct groups of water classes. Tier 3 guidelines for ORVW; OIRW; acute situations; unusual exposure routes including subsistence diets; endangered species; criteria lacking.	
Air (Inhalation)	Ecological	Not Available	Contact MPCA Risk Assessor or Project Team	

\* *Electronic copies of Excel© spreadsheets are available to those who have or who are requesting most current copy of corresponding guidance documents. Provide request and disk with SAS(disk)E to Trudy Cramlet, MPCA - Metro SRS, 520 N. Lafayette Rd., St. Paul, MN 55155. Reproduction charges for guidance document will be invoiced if payment is not sent with request.*

\* *References: Pathway-specific guidelines for Tier Evaluations*



**Table B-4** Tier Evaluation Results and Recommendations

Tabulate the Tier Evaluation results and recommendations for each exposure area and exposure pathway. Cite data and conclusions documented elsewhere in the report text. Attach necessary maps and sketches. The results of the site characterization, including the extent and magnitude of impact, must be documented in addition to the tier evaluation results.

Exposure Area	Exposure Route	Receptor	Resource Use	Target Risk Levels	Summary of Recommendations Provide complete discussion of decision rationale in report text.
				Pass/Barely Pass Fail/Barely Fail	
				Pass/Barely Pass Fail/Barely Fail	
				Pass/Barely Pass Fail/Barely Fail	
				Pass/Barely Pass Fail/Barely Fail	
				Pass/Barely Pass Fail/Barely Fail	
				Pass/Barely Pass Fail/Barely Fail	





WORKING DRAFT

