



**MINNESOTA POLLUTION CONTROL AGENCY  
SITE REMEDIATION SECTION**

**DRAFT GUIDELINES  
INTRODUCTION AND OVERVIEW OF THE RISK-BASED SITE  
EVALUATION MANUAL**

**WORKING DRAFT, SEPTEMBER 1998**

**Comment Period Ends December 31, 1998**

**Send Written Comments to:**

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**Minnesota Pollution Control Agency**

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**NOTICE**

**THIS DOCUMENT IS A WORKING DRAFT.** The Site Remediation Section of MPCA is developing guidelines for evaluating risks to human health and the environment at sites that may require investigation or response actions pursuant to the Minnesota Environmental Response and Liability Act, Minn. Stat. § 115B.01 to 115B.24 (MERLA).

**DEVELOPMENT OF A SITE REMEDIATION SECTION SITE EVALUATION MANUAL.** The attached document and other documents will be incorporated into a Site Remediation Risk-Based Site Evaluation Manual which will contain guidelines for conducting MERLA-related evaluations, including risk evaluations under the State Superfund program and the MPCA Voluntary Investigation and Cleanup (VIC) Program.

MPCA staff intend to use the policies and procedures in the manual as guidelines to evaluate the need for investigation or remedial actions to address releases and threatened releases of hazardous substances or pollutants or contaminants under MERLA, and the scope and nature of such actions. These policies and procedures are not exclusive and do not have the force and effect of law. MPCA staff may use other policies or procedures to evaluate the need for or adequacy of response actions under MERLA, including procedures set forth in outstanding MPCA Requests for Response Action and Consent Orders. The final standard for all such evaluations is the MERLA statutory requirement that such actions must be reasonable and necessary to protect the public health and welfare and the environment.

The Minnesota state superfund program, governed by the Minnesota Environmental Response and Liability Act (MERLA) and the supplementary rules, and the federal superfund program, governed by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the federal regulations in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), work together to clean up various types of sites.

**~ Continued ~**

~ Continuation ~

Under CERCLA, failure to act consistently with the NCP can result in a party not recovering its response costs from a RP. There is no NCP consistency requirement in MERLA, although under MERLA the costs must be reasonable and necessary. The guidance documents are intended to function in a similar manner to the NCP. However, because the guidance documents do not require every procedural specification of the NCP, parties are advised to consult an attorney early in the cleanup process if they intend cost recovery under CERCLA, which specifically states that the party seeking reimbursement must show that its costs are "consistent" with the NCP.

For removals, investigations and National Priority List sites, the federal and state governments must act consistently with the NCP. Note that CERCLA requires "consistency," or "accordance," as distinguished from "compliance," with the NCP. This infers some flexibility in selecting the appropriate remedy while following the basic requirements of the NCP. The extent of flexibility is still debated in courts. The NCP provides that a party does not have to comply with every single requirement of the NCP verbatim, but that the response action, when evaluated as a whole, be in "substantial compliance" with the NCP and result in a CERCLA-quality cleanup. The courts have emphasized that the community relations aspects are a part of the NCP response action, including the right of the public to participate in the remedial action selection process.

The preamble to the NCP recognizes government programs, like the Minnesota program under MERLA which has similarities to the NCP, that achieve the same objectives, but are not congruent with the NCP in every respect. EPA believes that these governmental bodies, consistent with CERCLA intent, should have flexibility to implement response actions and bring cost recovery actions for those response actions as long as the response actions are not inconsistent with the NCP, even if achieved by different methods. EPA believes that it is not necessary to define what actions are "not inconsistent with the NCP," and will make determinations on a case-by-case basis.

**EXPLANATION:**

**[NOTE TO WORK GROUP: Include qualifying remarks specific to your document in this "explanation" box.]**

*This draft document presents only a portion of a Risk-Based Site Evaluation process currently under development by the MPCA Site Remediation Section staff. MPCA staff involved in your Site should be consulted for pre-screening procedures, including determination of the need for ecological assessment, to be conducted prior to implementing the screening procedures outlined in the current document.*

*Users of this document are responsible for confirming with the MPCA Site staff the version of the working draft to be used.*

*The technical rationale for the procedures outlined in the Site Screening Evaluation Guidelines will be provided in separate support documents available in the future.*

*References in this document to electronic storage locations apply to MPCA staff access only. Excel spreadsheets of the Screening Criteria Tables are available for Site-specific application upon request to the MPCA Site staff. The requester shall provide MPCA Site staff with a formatted disk with a return self-addressed, stamped disk envelope for duplication of the spreadsheets by the mailing list administrator, Trudy Cramlet. Until further notice, there will be no charge for the spreadsheets.*

**Distribution List:**

**(NOTE TO WORK GROUPS: Copies distributed to non-MPCA staff must be accompanied by instructions to the recipient and where to focus their review. A specific list of questions may be appropriate.)**

**(NOTE TO PERSONS OTHER THAN THE SITE REMEDIATION SECTION (SRS) STAFF: As necessary, please distribute this draft document to selected members of your staff for review and comment. Based on past interactions with SRS, suggested staff are indicated in parenthesis)**

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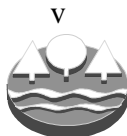
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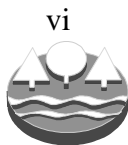
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*Note: For definitions of terms and concepts, please refer to the RBSE Glossary document.*



WORKING DRAFT



# INTRODUCTION AND OVERVIEW OF THE RISK-BASED SITE EVALUATION MANUAL

The Minnesota Pollution Control Agency (MPCA) has prepared this guidance manual to outline a risk-based approach to decision making during site investigation and remedy selection under the state's Superfund and Voluntary Investigation and Cleanup (VIC) Programs. The Risk-Based Site Evaluation (RBSE) Manual provides a preferred process for making decisions based on an evaluation of risks to human health and the environment at sites impacted by hazardous substances that may require investigation or response actions pursuant to the Minnesota Environmental Response and Liability Act, Minn. Stat. § 115B.01 to 115B.24 (MERLA). MPCA staff members with expertise in risk assessment, soil physics, hydrogeology, and remediation technologies have developed this guidance and the accompanying risk evaluation spreadsheets that comprise the RBSE Manual. The RBSE process was developed after review of existing federal and state guidance, and incorporates elements of the Risk-Based Corrective Action (RBCA) process developed by the American Society for Testing and Materials (ASTM).

The RBSE Manual supports the Superfund and VIC Programs mission to protect human health, public welfare and the environment by conducting or overseeing investigations and cleanup actions to return land to economic or other beneficial use under state and federal law. In fulfilling this mission, the MPCA works in partnership with its various customers to make site investigation and clean-up decisions based on protection of human and ecological health as determined through a risk-based decision making process, planned use of property, a preference for detoxification and treatment, and a minimization of cross-media transfer of contaminants. The goals of the RBSE Manual and its chapters are to: a) introduce the evaluation of environmental risk at sites at an early stage in order to focus and expedite investigation efforts and remedy selection, and b) address consistency by providing a context in which decisions regarding site characterization and the risk posed by the release(s) at a site are made and documented.

## ORGANIZATION OF THE MANUAL

The RBSE Manual is organized to facilitate the implementation of the RBSE process. The first section contains an introduction describing the general concepts of the RBSE process. The second section contains the actual chapters describing the implementation of the RBSE process. It begins with a discussion of the site characterization and investigation process for specific media, the incorporation of planned property use into decision-making, community involvement, a description of the MPCA's Baseline Evaluation process, and specific guidance on the tiered evaluations of the various exposure pathways which may exist at a site. The process of remedy selection is also discussed. The third section contains appendices to the Manual and include executive summaries for each chapter of the Manual, a checklist for implementing and documenting the RBSE process and a glossary.



The executive summaries provided in Appendix A offer an expeditious look at the purpose and content of each of the Manual chapters. The tier evaluation chapters provide guidelines on how to complete the risk-based exposure pathway evaluations or tier evaluations for each pathway. Information considered to be the foundation of a well-planned tier evaluation and remedy selection process is presented in the earlier chapters of the Manual.

Technical support documents for selected chapters of the Manual continue to be compiled by MPCA staff and will be provided as future supplements to the RBSE Manual.

## **THE RBSE PROCESS - A GENERAL DESCRIPTION**

For most pathways (ground water being an exception), the decision-making framework is described in terms of a tiered process of quantitative risk evaluation and analysis. The tiers represent increasingly complex exposure scenarios requiring escalating levels of scrutiny and site-specific information. Depending on the site-specific circumstances, decision making may proceed through the different tiers sequentially or exclude those tiers that do not apply. Tier evaluation ultimately leads to establishing site specific cleanup goals, which may be promulgated standards (as for ground water and surface water) or, as in the case of soil, are generic or site-specific criteria derived for the site. For potential hazardous substance release sites reported to the MPCA but which have not yet entered the Superfund or VIC programs, MPCA staff will conduct a preliminary evaluation based primarily on qualitative data. This Baseline Evaluation assesses the need for a tier evaluation of a potential release site based on the potential impact to receptors. In the tier evaluations, each exposure pathway is evaluated separately and, in the end, may require differing levels of tier evaluation or site investigation. The following exposure pathways are addressed in the current Manual:

Soil -- human and ecological contact;

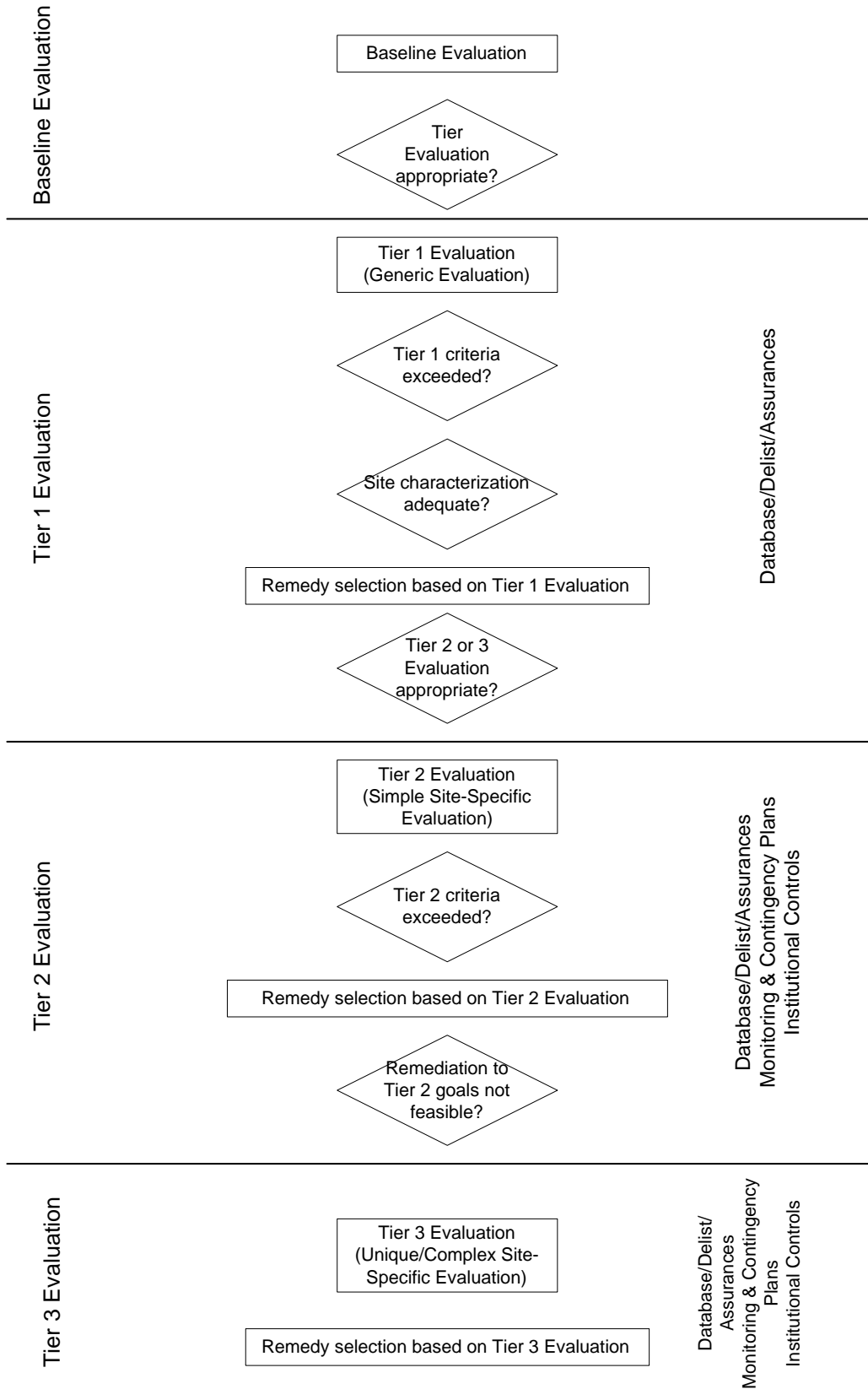
- Sediment -- human and ecological contact;
- Soil leaching to groundwater;
- Ambient air for humans;
- Ground water;
- Surface water; and
- Food chain.

Tier evaluations rely on an appropriate and adequate level of site characterization so that meaningful results are used to evaluate the risk posed through the various exposure pathways. In other words, the RBSE process involves site characterization, from which tier evaluation is conducted. Site characterization activities serve to verify or refine site conditions, which underlies all site decisions. The tier evaluations provide a consistent means for evaluating exposure pathways for the purpose of making decisions regarding the scope of site investigation, the determination or selection of appropriate cleanup criteria or standards, and the need for and selection of remedial actions and cleanup goals. While a site may be evaluated at Tier 1 without fully characterizing the extent and magnitude of a release, the RBSE process does not inherently eliminate the need for a full characterization of site impacts. The attached flow chart illustrates the decision making process (or operating framework) as described in the RBSE Manual; major elements are further described below:





# RISK-BASED SITE EVALUATION OPERATING FRAMEWORK



## **BASELINE EVALUATION**

An important function of the state Superfund and VIC Programs is to identify potential contaminated sites that may require investigation and/or remediation, but that have not yet entered the Superfund or VIC programs. This first requires: a) site identification and classification, and b) collection of a minimum set of site data which allows the site to be evaluated through the risk-based evaluation process. This process is referred to as the Baseline Evaluation, and primarily relates to identification or confirmation of a release versus the evaluation of the quantitative risks posed by that release (and appropriate remedial options) as conducted through a tier evaluation. One goal of this process is to classify so that those sites which appear to pose the greatest threat to human health and the environment receive expeditious attention. It must be noted that the Baseline Evaluation is designed to be implemented by MPCA staff, and information about it is included in this manual for informational purposes only.

During the Baseline Evaluation, the scope of site investigation depends on the existing level of information available for the site. Initially, the minimum amount of information is collected in order to confirm a release of regulated contaminants and to make a preliminary estimate of its potential impact to human health and the environment. Additional historic and limited quantitative information may be required to complete the Baseline Evaluation or to develop work plans for quantitative data collection sufficient to conduct the tier evaluations. Although, for simple sites, the data collected during the Baseline Evaluation may be sufficient to conduct a quantitative Tier 1 Evaluation if it includes adequate quantitative analytical data.

## **TIER 1 EVALUATION**

Tier 1 Evaluation is often the first quantitative risk evaluation conducted since it requires the least amount of site-specific quantitative data. If the site is determined to present a potential risk to human health or the environment under the generic exposure scenario assumed for this evaluation, its results may help focus further information gathering.

During a Tier 1 Evaluation, once the minimum site information regarding contaminants of concern, affected media, nature and extent of impact, exposure pathways and potential receptors has been collected, quantitative site data are compared to Tier 1 soil criteria for individual compounds to determine if individual contaminants or groups of contaminants with similar toxicological effects presents a potential risk. Potential risk can be impacted by the additive effects of groups of compounds. The Tier 1 soil criteria, which are available in a spreadsheet, are inherently conservative for most sites. They were derived using a set of general assumptions and conservative exposure-assessment models designed to be applicable to as many sites as possible. Promulgated standards are applied for some pathways.

Sites or releases where potential risk does not exceed acceptable risk levels as indicated by the Tier 1 evaluation (i.e., the site or release “passes” the screening) need no further investigation or remediation. Sites where potential risk exceeds acceptable target risk levels indicated by the Tier 1 evaluation (the site or release “fails” the screening) require additional information and re-evaluation through Tier 1, Tier 2 or Tier 3 Evaluation, or may be remediated to a cleanup goal based on Tier 1 criteria or existing standards. If it is determined that the exposure scenario for the planned use of the property is more complex than the Tier 1 Evaluation model, Tier 2 or 3 Evaluation is required. For example, the risk-evaluation models developed for Tier 1 criteria would not specifically deal with a site in an agricultural setting involving food production; such a site would require Tier 3 Evaluation. The Tier 1 Evaluation model assumes residential property use.



## **TIER 2 EVALUATION**

Tier 2 Evaluation typically involves the use of limited, site-specific information and/or current and future property use determinations. The site contaminant concentrations are compared against Tier 2 criteria which, for the soil contact or leaching pathways, are usually refinements of Tier 1 criteria using site-specific assumptions or limited site-specific data. For instance, deriving site-specific Tier 2 criteria for the soil leaching pathway might entail replacing the general ground-water depth used to derive the Tier 1 criteria with the site-specific ground-water depth. In addition, future property use could be limited to industrial operations only, in which case Tier 2 criteria for direct human contact with soil would be based on an industrial exposure scenario rather than the residential exposure scenario used as a default in developing the Tier 1 criteria.

Sites or releases where potential risk does not exceed acceptable target risk levels as indicated by the Tier 2 evaluation need no further investigation or remediation but may require monitoring or tracking (e.g., property-use restrictions). Sites where potential risk exceeds acceptable target risk levels as indicated by the Tier 2 evaluation proceed to remediation to a cleanup goal based on Tier 2 criteria or to Tier 3 Evaluation.

## **TIER 3 EVALUATION**

Tier 3 Evaluation uses site-specific data to derive very site-specific criteria/remediation goals, using: a) methodologies similar to those used in developing the Tier 1 and 2 soil criteria, or b) more complex modeling based on the site-specific data. Investigation or remediation based on Tier 3 Evaluation is necessary in cases where remediation to Tier 2 remediation goals is not feasible or when site conditions are so unusual as to require a unique approach to setting remediation goals.

A Tier 3 Evaluation may or may not require new information from additional site investigation. For example, during a Tier 2 Evaluation, information or site data previously used in the Tier 1 Evaluation is evaluated using different assumptions regarding planned use of the property and might result in the site passing the Tier 2 evaluation using the same information or data. Alternatively, that same data may be subjected to contaminant transport models used in a Tier 3 Evaluation that are more accurate for the site conditions than those applied in the Tier 2 Evaluation.

The decision to implement a remedy that will not meet clean-up goals derived from Tier 3 criteria or existing standards is possible only at the Tier 3 Evaluation level. Standards or the derived clean-up goals may be impossible to meet due to technical or economical unfeasibility of a corrective action alternative, for example. The overall cleanup goal of protection of public health and the environment must be met, however. Because the Tier 3 Evaluation involves detailed site-specific considerations of unique circumstances, it is at this level where documentation sufficient to support deviations from the established process is possible.

## **RBSE IMPLEMENTATION AND DOCUMENTATION**

The checklist contained in Appendix B is designed to encourage proper documentation of site investigation results and site decisions and their rationales. It may also assist in expediting or focusing the site investigation and the evaluation of risk to human health and environment by highlighting the decision factors involved in the investigation and evaluations. Reports may be organized based on the checklist sequence and categories. Well organized and comprehensive documentation commonly expedites MPCA staff review and approval.



## COMMON MISCONCEPTIONS ABOUT THE RBSE PROCESS

- Risk can be determined by individual contaminant concentration.

The RBSE process applies the toxicological concept of additivity to estimate risk from a specific exposure pathway. Comparing individual contaminant concentrations to derived risk-based criteria may result in the underestimation of the risk posed by that pathway.

- Tier evaluation is the equivalent of site characterization.

Tier evaluation requires information collected during site characterization to assess environmental risk and focus decisions regarding the need for additional site investigation or remedy selection. The site characterization process verifies site conditions and reflects decisions made through the tier evaluation process. The two processes complement each other.

- Tier evaluation is always required to implement a remedial action.

In fact, some sites, once adequately characterized, clearly call for a remedial action that, as a result of past experience at similar sites, can be considered presumptive. In these cases, tier evaluation beyond the first tier may not necessarily be required. A site-specific tier evaluation (Tier 2 or 3 Evaluation) may be necessary for grossly or complex contaminated sites or in instances where a release is known or suspected to extend off the property.

- In proceeding to higher tiers, the level of protectiveness lessens.

The level of protectiveness contained in criteria, promulgated standards, and clean up goals is a result of statutory requirements, rules, and existing guidance. The tiered approach is designed to reduce the level of uncertainty as one moves up through the tiers; the level of protectiveness stays the same.

- The RBSE approach relies too heavily on the use of institutional controls.

The approach recognizes that there are several methods to reduce or eliminate risk to human health and the environment. Stress is placed, however, on a balanced analysis incorporating elements of feasibility. In addition, statutory authority recognizes institutional controls as an element to ensure the protectiveness of a remedy, not as remedies in and of themselves.



## APPENDIX 1: 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.

<b>Exposure Area</b>	<b>Exposure Route</b>	<b>Receptor</b>	<b>Resource Use</b>	<b>Target Risk Levels</b>	<b>Summary of Recommendations</b> 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	



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