1 Introduction

This revised edition of the Primer provides information on the relative risk site evaluation framework being used by the Department of Defense (DoD), in concert with stakeholders, to help sequence environmental restoration work at sites at active military installations, Base Realignment and Closure (BRAC) installations, and formerly used defense properties. It describes the structure and logic underpinning the framework and provides detailed instructions for conducting relative risk site evaluations in the field. It also describes how removal and remedial actions should be factored into relative risk site evaluations.

This document is a product of the Interservice Relative Risk Working Group¾ comprised of representatives from the Army, Navy, Air Force, and Defense Logistics Agency¾ that was formed in May 1994 to develop concepts and implementation procedures for the relative risk site evaluation framework.

This revised edition of the Primer replaces the *Relative Risk Site Evaluation Primer (Interim Edition, Summer 1994)* issued in September 1994, in its entirety. It contains enhanced technical guidelines for performing relative risk site evaluations which have been added in response to DoD initiatives as well as questions and comments received from DoD field elements, regulatory agencies, and stakeholders during the first twenty months of relative risk implementation.

The audience within DoD includes remedial project managers and other environmental personnel responsible for planning, executing, and evaluating environmental restoration activities at DoD installations and formerly used defense sites (FUDS). The audience outside DoD includes federal and state regulatory agencies, local governments, and public stakeholders living or working in the vicinity of DoD installations and FUDS.

1.1 Definition of Relative Risk Site Evaluation

The relative risk site evaluation framework is a methodology used by all DoD Components to evaluate the relative risk posed by a site in relation to other sites. It is a tool used across all of DoD to group sites into high, medium, and low categories based on an evaluation of site information using three factors: the contaminant hazard factor (CHF), the migration pathway factor (MPF), and the receptor factor (RF). Factors are based on a quantitative evaluation of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) hazardous substances, pollutants, or contaminants and a qualitative evaluation of pathways and human and ecological receptors in the four media most likely to result in significant exposure¾ groundwater, surface water, sediment, and surface soils. A representation of this evaluation concept is presented in Figure 1. Figure 1 also depicts possible opportunities for stakeholder input into the technical evaluation.

The relative risk site evaluation framework is a qualitative and easy to understand methodology for evaluating the relative risks posed by sites and should not be equated with more formal risk assessments conducted to assess baseline risks posed by sites. It is a tool to assist in sequencing environmental restoration work (i.e., known requirements such as remedial investigation or cleanup actions) to be done by a DoD Component. It is

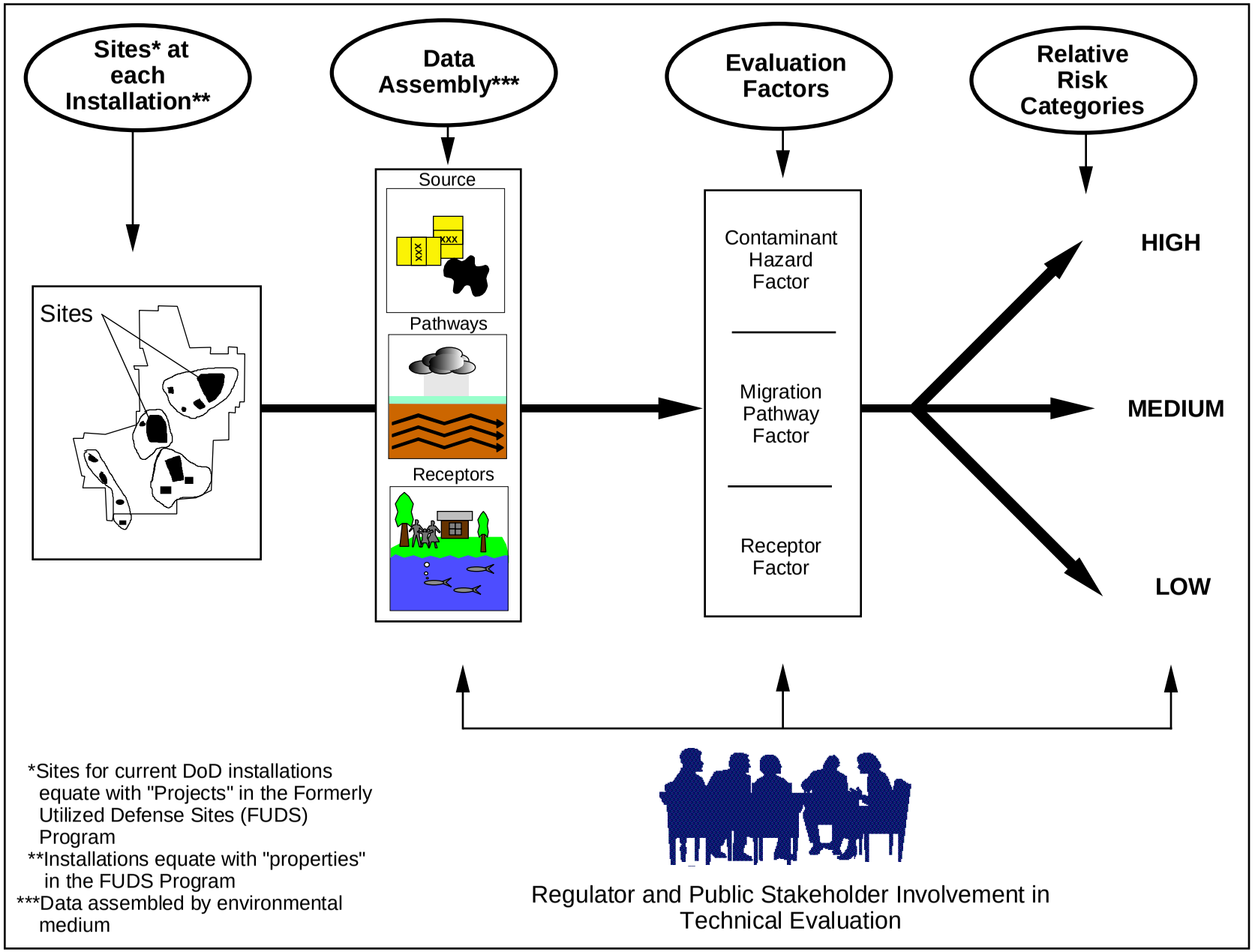


Figure 1. Relative Risk Site Evaluation Concept Summary

designed to handle the broad range of sites that exist at DoD installations and the broad range of data available. Like any risk evaluation tool and perhaps more so than a comprehensive risk assessment, the relative risk site evaluation framework makes use of assumptions and approximations. Users should bear these limitations in mind when applying the framework. Relative risk is not the sole factor in determining the sequence of environmental restoration work, but it is an important consideration in the priority setting process. It should be factored into all priority setting decisions, and should be discussed with regulators and public stakeholders in the environmental restoration process, such as those mentioned above. The grouping of sites into high, medium, or low relative risk categories **is not** a substitute for either a baseline risk assessment or health assessment; **it is not** a means of placing sites into a Response Complete/No Further Action category; and **it is not** a tool for justifying a particular type of action (e.g., the selection of a remedy).

The relative risk site evaluation framework is used by all DoD Components to assess site relative risks at installations and formerly used defense properties. Use of the framework and resulting relative risk information allows DoD and DoD Components to communicate and help establish priorities for environmental restoration work.

The actual funding priority for a site is identified after relative risk information is combined with other important risk management considerations (e.g., the statutory and regulatory status of a particular installation or site, public stakeholder concerns, program execution considerations, and economic factors). A list of common risk management considerations can be found in Appendix E, page 39. These additional risk management considerations can result in a decision to fund work at a site that is not classified as a high relative risk. DoD Components have each developed guidelines for combining relative risk and risk management considerations as part of their planning, programming, and budgeting process. The planning, programming, and budgeting process within DoD is outlined in Appendix E, page 16.

The relative risk site evaluation framework does not address the question of whether work is necessary at a site; it only provides information for use in helping to determine the general sequence in which sites will be addressed. At the DoD headquarters level, it also provides a framework for planning, programming, and budgeting requirements, a topic discussed further in Section 1.6.

Use of the relative risk site evaluation framework is restricted to environmental restoration sites and does not extend to unexploded ordnance (UXO) removal, building demolition/debris removal (BD/DR), potentially responsible party (PRP) activities, or compliance activities.

1.2 Rationale for Relative Risk Site Evaluation

In a 1994 report, entitled *Environmental Cleanup: Too Many High-Priority Sites Impede DoD's Program*, the General Accounting Office (GAO, 3 May 1994) concluded that the method used at that time by regulators and the DoD to determine which sites to work on first resulted in (1) too many similar priorities where too little got done, or (2) instances where DoD's worst sites were not getting priority attention. The report further stated that the approach in 1994, which was based solely on regulation-driven requirements, led to significant cost growth that strained limited resources and forced difficult choices.

Prior to 1994 and the implementation of the relative risk site evaluation concept within DoD, restoration priorities were established at the field level using a variety of methods and factors. At many installations, work priorities were established by DoD and regulatory agency personnel as part of regulatory agreement negotiations. By the end of negotiations, work sequencing was often included in legal agreements in the form of study and cleanup milestones, using information available at that time. The degree to which risk-based considerations were incorporated into scheduling milestone decisions varied considerably within DoD.

Typical legal agreements that contain milestones for sites include Federal Facility Agreements under CERCLA, permits for corrective action under the Resource Conservation and Recovery Act (RCRA), as amended; two-party agreements under federal or state law; and enforcement orders under CERCLA or RCRA, as amended. Because additional data continue to become available for many of the sites with established milestones, and in light of recent budget shortfalls and funding recisions, DoD believes that a risk-based approach should continue to be applied to work sequencing using relative risk as a key factor. The relative risk site evaluation framework described in this revised edition of the Primer provides a means of helping accomplish this objective.

1.3 Development of the Relative Risk Site Evaluation Framework

On 9 November 1993, the Deputy Under Secretary of Defense (Environmental Security) (DUSD[ES]) committed to pursuing relative risk site evaluation in the Defense Environmental Restoration Program (DERP) in consultation with regulators and communities in testimony before the Senate Committee on Energy and Natural Resources (Goodman, 1993).

On 14 April 1994, DUSD(ES) issued *Management Guidance for Execution of the FY94/95 and Development of the FY96 Defense Environmental Restoration Program* (Office of the Under Secretary of Defense [Environmental Security], 1994), which promotes the use of a risk management concept to evaluate the sequence of work at environmental restoration program sites in conjunction with the regulatory agreement status of each site. It directs each service within DoD to begin developing its environmental restoration program using a relative risk site evaluation framework.

In September 1994, DUSD(ES) issued the Interim Edition of the Primer, which contained instructions for performing relative risk site evaluations at sites across DoD. In the fall of 1995, DUSD(ES) decided to revise the Primer, resulting in the issuance of this document.

1.4 Requirements for Relative Risk Site Evaluations

Relative risk site evaluations are required for all sites at active military installations, BRAC installations, and formerly used defense properties that have future funding requirements that are not classified as (1) having “all remedies in place,” (2) ”response complete,” (3) lacking sufficient information, or (4) abandoned ordnance. These four situations are discussed in the following four paragraphs.

Relative risk site evaluations are not required (NR) for sites classified as having all remedies in place (RIP) even though they may be in remedial action operation (RAO) or long-term monitoring (LTM). A RIP determination requires that remedial action construction is complete for a site.

Relative risk site evaluations are not required (NR) for sites classified as response complete (RC). Sites classified as RC are those where a DoD Component deems that no further action (NFA) is required with the possible exception of LTM. A RC determination requires that one of the following apply: (1) there is no evidence that contaminants were released at the site, (2) no contaminants were detected at the site other than at background concentrations, (3) contaminants attributable to the site are below action levels used for risk screening, (4) the results of a baseline risk assessment demonstrate that cumulative risks posed by the site are below established thresholds, or (5) removal and/or remedial action operations (RAOs) at a site have been implemented, completed, and are the final action for the site. Only LTM remains.

Relative risk site evaluations should be based on the information currently available on contaminants, migration pathways, and receptors. Sites lacking sufficient information for the conduct of a relative risk site evaluation should be given a "Not Evaluated" designation and should then be programmed for additional study, a removal action if warranted, or other appropriate response action, including deferral, before they are evaluated.

Sites comprised solely of abandoned ordnance are not subject to the relative risk site evaluation described in this Primer. Such sites should be evaluated using a separate risk procedure, which is discussed in the management guidance cited above (Office of the Under Secretary of Defense [Environmental Security], 1994).

1.5 Implementation of the Relative Risk Site Evaluation Framework

DoD's goal is to conduct relative risk site evaluations at the field level with **the involvement** of the **regulators and public stakeholders** (see Figure 1). The technical evaluation of sites using the evaluation framework can serve as a basis for discussion and negotiation with **regulators and public stakeholders**. In particular, regulators and public stakeholders can help identify receptors, and can make judgments about the extent of contaminant migration in various environmental media at a site. Where they exist, Restoration Advisory Boards (RABs) are an excellent forum for obtaining **public stakeholder input** on these aspects of site relative risk. Other opportunities for public stakeholder involvement may also be appropriate. Regulators and public stakeholders should always **be given the opportunity** to participate in the development and review of relative risk site evaluation data before the data is used in planning and programming.

As lessons are learned during this implementation phase, DoD will continue to make appropriate adjustments and improvements to the framework through the established interservice working group, as has been done in this revised Primer.

1.6 Management Uses of Relative Risk Information

DoD and DoD Components are using the relative risk site evaluation framework as a tool to help sequence work at sites and as a headquarters program management tool. As a program management tool, the framework is being used by DoD and DoD Components to periodically identify the distribution of sites in each of three relative risk categories—high, medium, and low. A series of discrete relative risk site evaluations provides headquarters program managers with a macro-level view of changes in relative risk distributions within DoD over time.

The relative risk site evaluation framework and resulting data also provide DoD with a basis for establishing goals and performance measures for the environmental restoration program. In this regard, DoD has established goals for all DoD Components to reduce relative risk at sites in Defense Environmental Restoration Account (DERA) and BRAC programs or to have remedial systems in place where necessary for these sites, within the context of legal agreements. DoD and DoD Components are tracking progress towards these relative risk reduction goals as one of several program measures of merit (MOMs) at the headquarters level. Another MOM tracks the number of sites where cleanup action has been taken and relative risk has been reduced in one or more media. Resultant information is used to provide the necessary feedback to develop and adjust program requirements and budget projections, as well as to assess whether established goals reflect fiscal reality.

1.7 Organization of This Primer

Section 2 provides a general and factor-by-factor description of the relative risk site evaluation framework. **Section 3** provides detailed instructions for using the framework at the installation or field level to document site evaluations.

Definitions of terms used to explain general concepts and specific elements of relative risk site evaluations are found in **Section 4**. In addition, the Primer contains a reference section (**Section 5**), a list of acronyms and abbreviations (**Section 6**), and five appendices.

Appendix A contains the revised Relative Risk Site Evaluation Worksheet that is used in determining relative risk for a site.

Appendix B contains Comparison Values derived from Preliminary Remediation Goals (PRGs) used by Region IX of the U.S. Environmental Protection Agency (EPA) and from benchmarks used by other organizations for radionuclides and military-unique compounds (B-1); Ambient Water Quality Criteria developed under Section 304(a) of the Clean Water Act (B-2); and sediment screening values developed in part by the National Oceanic and Atmospheric Administration (NOAA) and by the Ontario Ministry of Environment and Energy (B-3). These comparison values are used in determining the CHF for each applicable medium, as described in later sections of this Primer.

Appendix C lists the types of regulatory agreements used in DERA and BRAC restoration programs and their codes, as well as site types and their codes.

Appendix D contains examples of relative risk site evaluations using the Relative Risk Site Evaluation Worksheet. The examples serve as a guide for performing actual site-by-site evaluations at the installation or field level.

Appendix E contains material that can be used for training or as a basis for presentations to interested parties within and outside of DoD. It contains two fact sheets and an extensive briefing. The first fact sheet summarizes the relative risk site evaluation framework. The second provides answers to common questions on the development and use of the relative risk site evaluation framework. The briefing provides information on the origin of relative risk within DoD, the relative risk work group, the structure of the framework itself and its use. It also describes how relative risk is used as a program management tool within DoD and provides technical slides that illustrate detailed aspects of the framework.

2 Description of Relative Risk Site Evaluation Framework

This section provides information on the structure and logic underpinning the relative risk site evaluation framework and provides definitions of each relative risk factor by environmental medium.

The relative risk site evaluation framework is based on information fundamental to risk assessment: sources, pathways, and receptors. These elements are building blocks of a conceptual site model, a tool used in field investigation and risk assessment to organize site information.

Relative risks to human health for cancer and toxicity, as well as to ecological systems, are addressed in the relative risk site evaluation framework.

The framework uses recent/representative site information to evaluate the following four media and their exposure endpoints:

- Groundwater (human endpoint)
- Surface water
  - Human endpoint
  - Ecological endpoint
- Sediments
  - Human endpoint
  - Ecological endpoint
- Surface soils, preferably from a depth of 0-6 inches (human endpoint)

Air is not considered by the relative risk site evaluation framework because the risk through this pathway from DoD sites without soil contamination generally is minimal, and the PRGs for contaminated soils consider inhalation of volatiles and contaminated particles (U.S. EPA, *Region IX Preliminary Remediation Goals, Second Half*, 1 September 1995). (The PRGs for water consider inhalation for water contaminated with volatiles.)

Each environmental medium is evaluated using three factors that relate to the three structural components of the conceptual site model used in risk assessment: CHF (relationship of contaminants to comparison values), MPF (likelihood/extent of contaminant migration), and RF (likelihood of receptor exposure to contamination). Each of these three factors is given a rating (e.g., *Significant*, *Moderate*, or *Minimal* for CHF) based on recent/representative site information for a given medium. For each environmental medium, factor ratings are combined to determine the environmental medium-specific rating of *High*, *Medium*, or *Low*. The site is then placed in an overall category of *High*, *Medium*, or *Low*, based on the highest medium-specific rating. This site-specific process is illustrated schematically in Figure 2. Figure 3 expands on Figure 2 and illustrates the decision framework for the relative risk site evaluations.

As shown in Figure 3, only sites with reliable (i.e., most recent/representative) contaminant data will be evaluated using the framework. Do not perform evaluations on sites classified as RIP and RC, and do not perform evaluations at sites comprised solely of ordnance. If data are available for only one medium, a site can be evaluated for relative risk. If data are absent, sites should be designated “Not Evaluated.” Action on these sites may be deferred, or the sites may be programmed for additional study before they are evaluated. In addition, a removal action or other response action may be appropriate.

Figures 4 through 6 provide definitions of each factor for groundwater, surface water and sediment, and surface soils, respectively. Factors and associated rating definitions should be used together with detailed

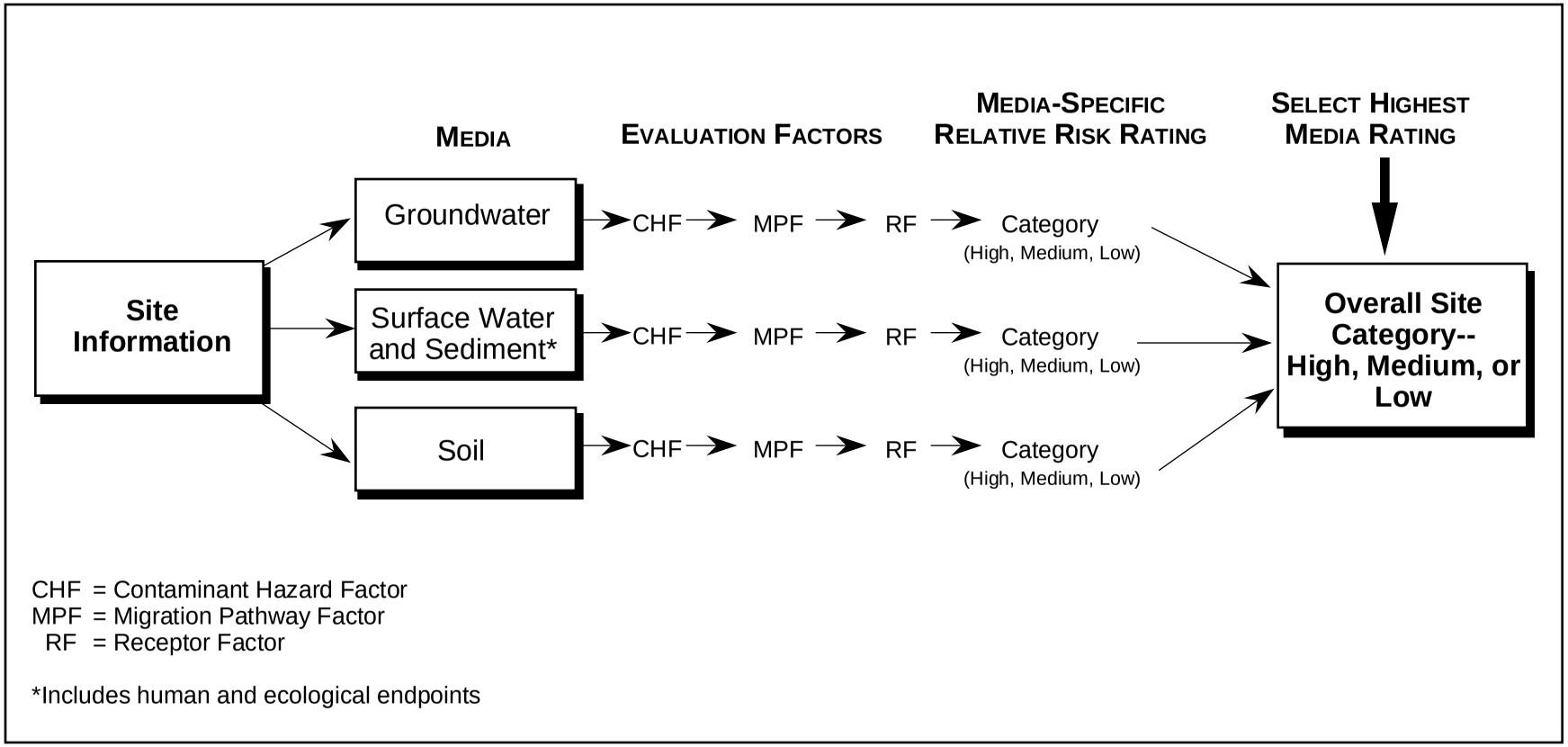
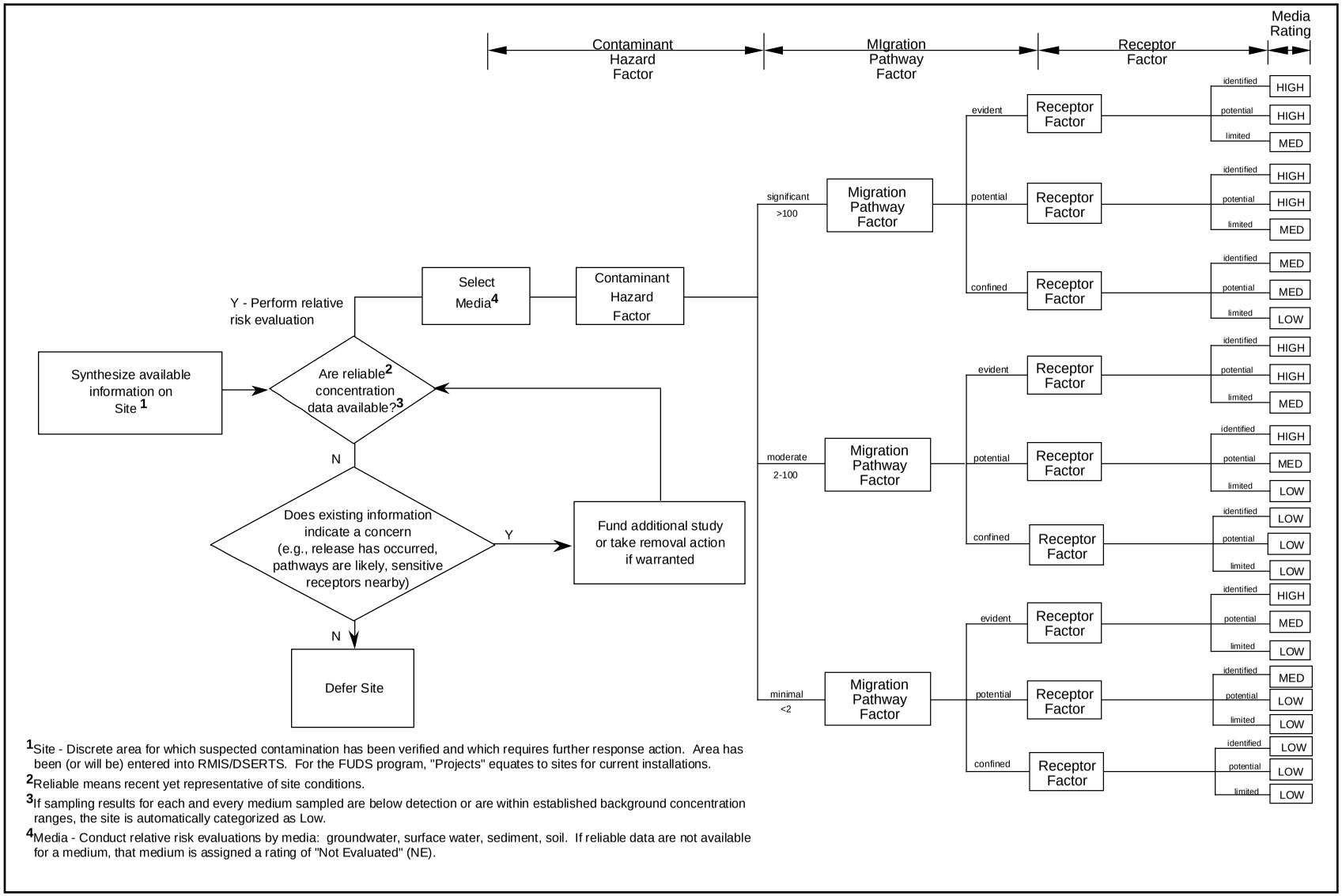


Figure 2. Flow Diagram of the Relative Risk Site Evaluation Framework



1Site - Discrete area for which suspected contamination has been verified and which requires further response action. Area has been (or will be) entered into RMIS/DSERTS. For the FUDS program, "Projects" equates to sites for current installations.

2Reliable means recent yet representative of site conditions.

3If sampling results for each and every medium sampled are below detection or are within established background concentration ranges, the site is automatically categorized as Low.

4Media - Conduct relative risk evaluations by media: groundwater, surface water, sediment, soil. If reliable data are not available for a medium, that medium is assigned a rating of "Not Evaluated" (NE).

Figure 3. Relative Risk Site Evaluation Framework: Decision Flowchart

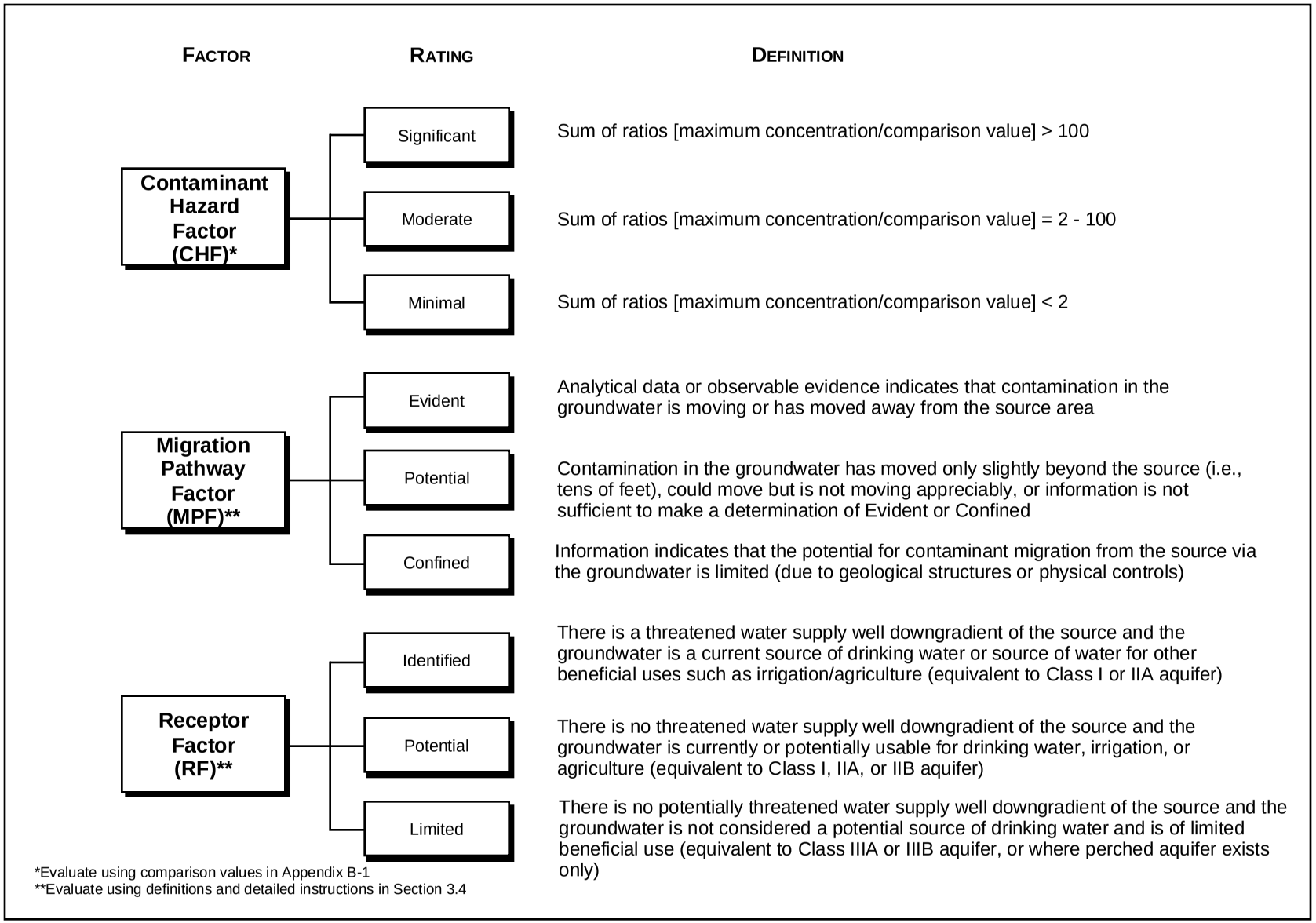


Figure 4. Relative Risk Site Evaluation Factor Information for Groundwater

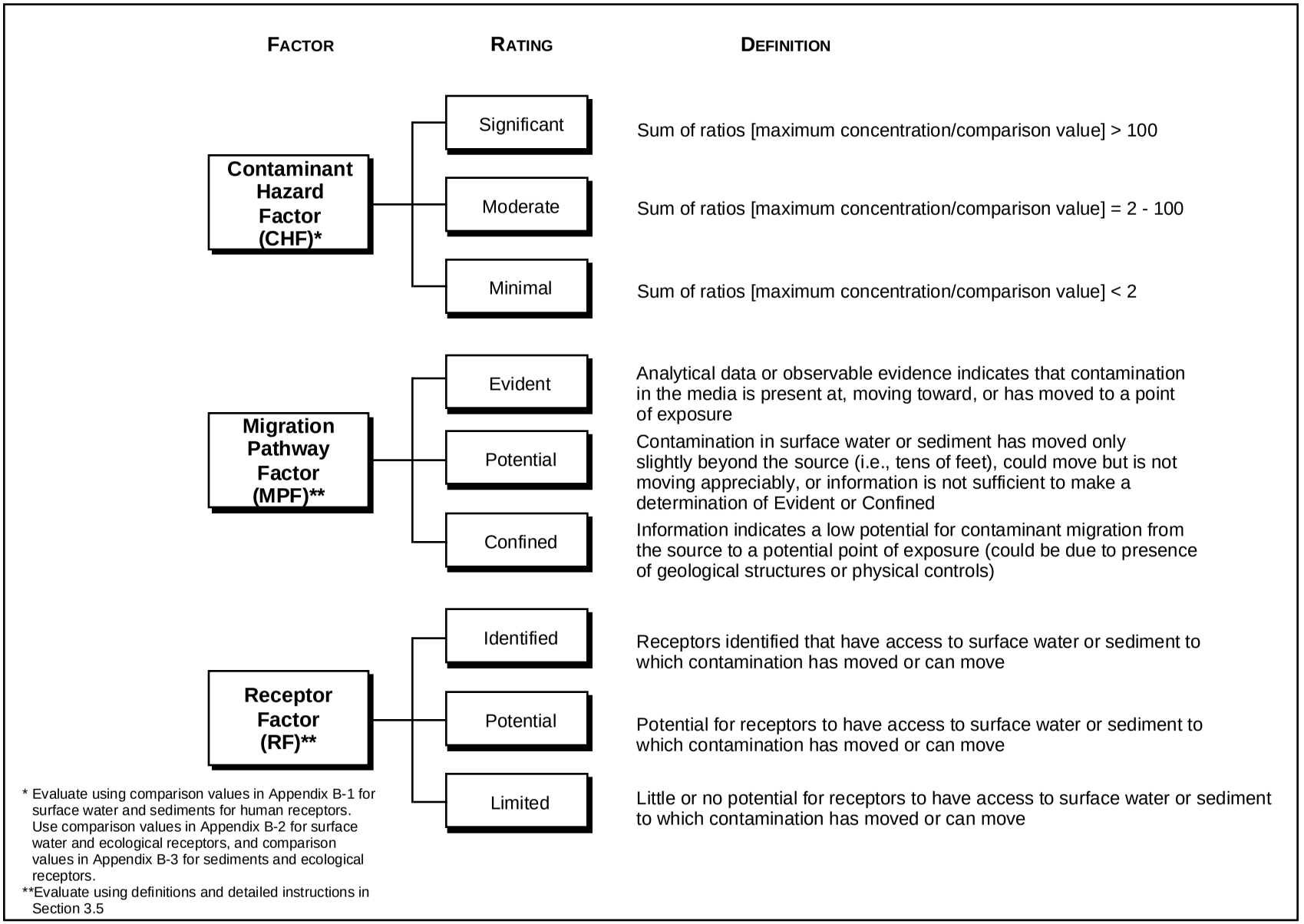


Figure 5. Relative Risk Site Evaluation Factor Information for Surface Water and Sediment

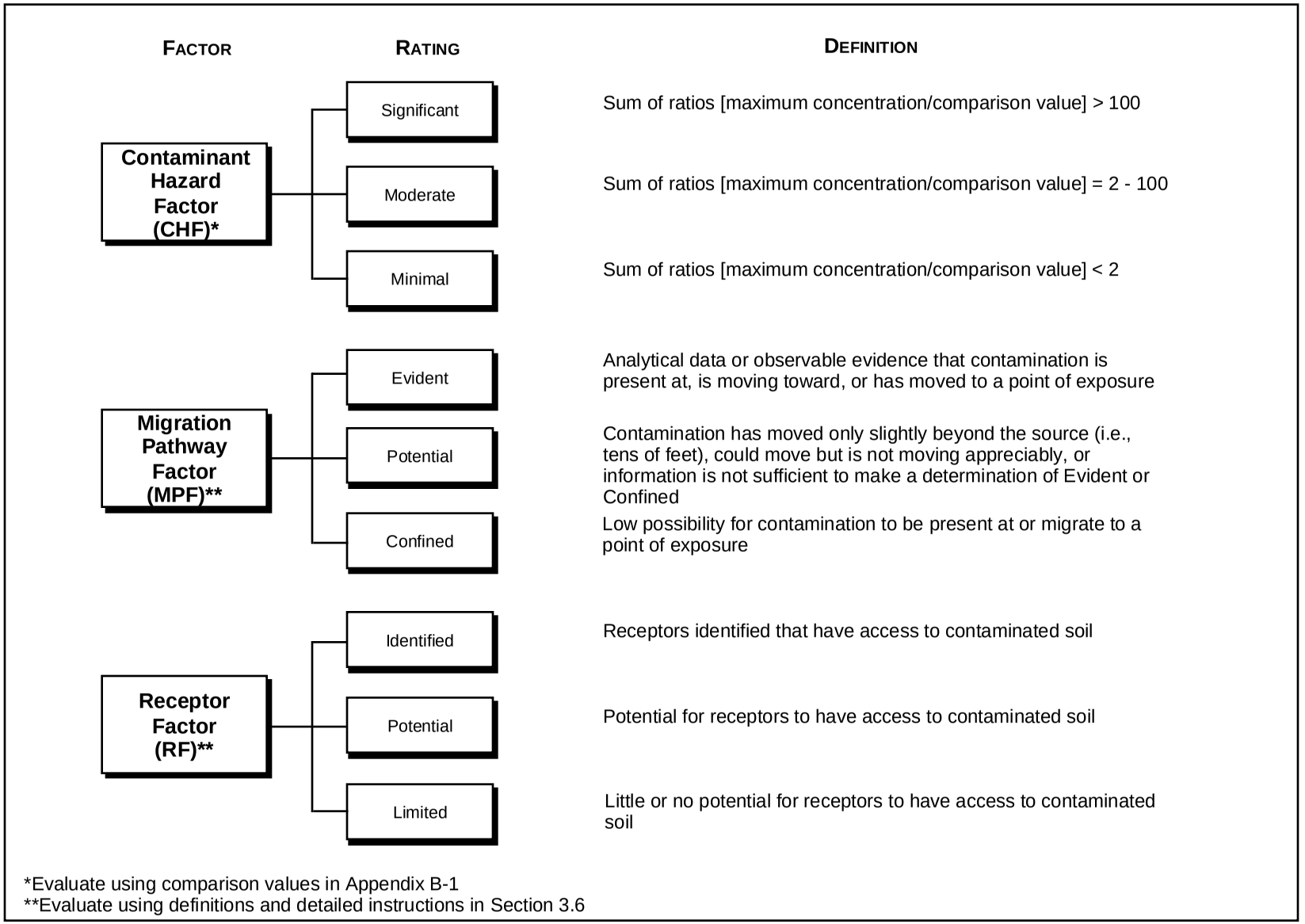


Figure 6. Relative Risk Site Evaluation Factor Information for Soils

instructions in Section 3. Use of factor definitions **and** corresponding instructions in Section 3 ensures a common categorization method across DoD Components.

2.1 Contaminant Hazard Factor

The CHF is based on the ratio of the maximum concentration of a contaminant detected in an environmental medium to a risk-based comparison value for that contaminant in that medium. Detected contamination must be recent yet representative of site conditions. Comparison values are listed in Appendix B.

For carcinogens, the comparison value for human health is the concentration that presents a 1-in-10,000 risk of increased cancer incidence, which is the remedial action threshold for carcinogens defined in the Preamble to the National Oil and Hazardous Substance Pollution Contingency Plan (55 Federal Register 8716, March 8, 1990) and by Directive 9355.0-30 of the Office of Solid Waste and Emergency Response, U.S. EPA (22 April 1991). For non-carcinogens, the comparison value for human health is the concentration that provides an exposed individual with the daily reference dose (RfD), which is the estimated daily exposure level of a contaminant to a human population below which adverse non-cancer health effects are not anticipated.

For ecological endpoint evaluations, comparison values are based on ambient water quality criteria (for the surface water medium) or sediment screening values developed by either NOAA or the Ontario Ministry of Environment and Energy.

For a medium that contains more than one contaminant, the ratios from the individual contaminants are added. A CHF of *significant* (sum of ratios is greater than 100), *moderate* (from 2 to 100), *or minimal* (less than 2) is assigned on the basis of the magnitude of the ratio or sum of ratios. The breakpoints were established by the interservice working group after reviewing the results of a considerable number of site distributions derived from a range of different breakpoints. Further discussion of these breakpoints is provided in Question 11 of the Question and Answer Factsheet, contained in Appendix E. The mechanics of the CHF calculations are described in detail in Section 3.3 of the Instructions.

2.2 Migration Pathway Factor

Information about migration pathways of contamination for a site is summarized as the MPF. MPFs of *evident*, *potential*, or *confined* are determined by matching available site information on pathways with the corresponding definitions about the likelihood of contaminant migration shown in Figures 4 through 6. Individuals or groups performing the relative risk site evaluations should determine the MPF on the basis of consideration of available site information, the definitions in Figures 4 through 6, the detailed instructions associated with medium-specific MPF evaluations in Section 3, and professional judgment.

2.3 Receptor Factor

Information about the present or future likelihood of receptors for each site is summarized as the RF. RFs of *identified, potential*, or *limited* are determined by matching available information on receptors at sites with the definitions in Figures 4 through 6. These statements, like those for the MPF, should be considered on the basis of available information, detailed instructions associated with medium-specific RF evaluations in Section 3, and professional judgment.

Human and ecological receptors (i.e., endpoints for exposure) to be considered are as follows:

- **Groundwater**. Human receptors include those individuals that may be exposed to groundwater contamination via onsite and downgradient water supply wells used for human consumption or in food production. Groundwater can be classified using EPA's *Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy*, Office of Groundwater Protection, 1986. This classification scheme is presented in Table 1 and is used together with definitions and instructions to assist in the determination of the groundwater RF (see Figure 4). Ecological receptors are not evaluated.

- **Surface Water and Sediment**. These two media are discussed together since they potentially affect the same receptors. Human receptors for surface water and sediment share the same migration pathway and, therefore, include those individuals that may be exposed to surface water or sediment contamination through onsite and downgradient water supplies and recreational areas. Receptors include downgradient water supplies used for drinking water, irrigation of food crops, watering of livestock, aquaculture, and recreational activities such as fishing. ***Ecological receptors for surface water and sediment are limited to critical habitats and other environments listed in Table 2 that can be reasonably expected to be impacted by a site.***

- **Surface Soil**. Human receptors include residents, people in schools and daycare, and workers who have direct access to contamination on a frequent basis. Ecological receptors are not considered for evaluation of the surface soil since ecological standards are generally not available for the CHF calculation. Ecological receptors may be incorporated into the soil evaluation if ecological standards become available.

2.4 Site Categorization

For each medium at a site, the CHF, MPF, and RF are combined using the relative risk site evaluation matrix shown in Figure 7 to obtain the relative risk (*High*, *Medium*, or *Low*) for that medium. The highest relative risk site evaluation result for a medium determines the relative risk designation for the site, according to the process illustrated in Figure 2. Where sufficient data are available, evaluate all four environmental media and their associated endpoints for a site, since the data establish a site baseline that is used throughout the relative risk site evaluation process to show changes against the baseline due to the implementation of response actions.

Table 1. EPA Groundwater Classification Guidelines*

Class I Groundwater**	Special groundwater is (1) highly vulnerable to contamination because of the hydrological characteristics of the areas in which it occurs and (2) irreplaceable; no reasonable alternative source of drinking water is available to substantial populations.	If water supply wells in Class I groundwater are threatened, the receptor factor is *Identified*. If water supply wells in Class I groundwater are not threatened the receptor factor is *Potential*.
Class II Groundwater	Current and potential source of drinking water and water having other beneficial uses includes all other groundwater that is currently used (IIA) or is potentially available (IIB) for drinking water, agriculture, or other beneficial use.	If water supply wells in Class IIA groundwater are threatened, the receptor factor is *Identified*. If water supply wells in Class IIA groundwater are not threatened, the receptor factor is *Potential*. If groundwater is Class IIB, the receptor factor is *Potential*.
Class III Groundwater	Groundwater that is not considered a potential source of drinking water and of limited beneficial use (Class IIIA and Class IIIB), is saline (i.e., it has a total dissolved solids level over 10,000 milligrams per liter [mg/l]), or is otherwise contaminated by naturally occurring constituents or human activity that is not associated with a particular waste disposal activity or another site beyond levels that allow remediation using methods reasonably employed in public water treatment systems. Class III also includes groundwater that is not available in sufficient quantity at any depth to meet the needs of an average household. Class IIIA includes groundwater that is interconnected to surface water or adjacent groundwater that potentially could be used for drinking water. Class IIIB includes groundwater that has no interconnection to surface water or adjacent aquifers.	If groundwater is Class III, the receptor factor is *Limited*.

*Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy, Office of Groundwater Protection, December 1986.

**Special groundwater is also ecologically vital; the aquifer provides the base flow for a particularly sensitive ecological system that, if polluted, would destroy a unique habitat (this characteristic is not applicable for relative risk site evaluation since ecological receptors are not evaluated for groundwater)

Table 2. List of Ecological Receptors*
(based on 55 FR 51624, 14 December 1990)

- ✓ Critical habitat[a] for federal designated endangered or threatened species
- ✓ Marine Sanctuary
- ✓ National Park
- ✓ Designated Federal Wilderness Area
- ✓ Areas identified under Coastal Zone Management Act[b]
- ✓ Sensitive areas identified under National Estuary Program[c] or Near Coastal Waters Program[d]
- ✓ Critical areas identified under the Clean Lakes Program[e]
- ✓ National Seashore Recreational Area
- ✓ National Lakeshore Recreational Area
- ✓ Habitat known to be used by federal designated or proposed endangered or threatened species
- ✓ National Preserve
- ✓ National or State Wildlife Refuge
- ✓ Unit of Coastal Barrier Resources System
- ✓ Coastal Barrier (undeveloped)
- ✓ Federal land designated for protection of natural ecosystems
- ✓ Administratively Proposed Federal Wilderness Area
- ✓ Spawning areas critical for the maintenance of fish or shellfish species within river, lake, or coastal tidal waters[f]
- ✓ Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time
- ✓ Terrestrial areas utilized for breeding by large or dense aggregations of animals[g]
- ✓ National river reach designated as Recreational

[a] Critical habitat as defined in 50 CFR 424.02

[b] Areas identified in State Coastal Zone Management plans as requiring protection because of ecological value

[c] National Estuary Program study areas (subareas within estuaries) identified in Comprehensive Conservation and Management Plans as requiring protection because they support critical life stages of key estuarine species (Section 320 of Clean Water Act, as amended)

[d] Near Coastal Waters as defined in Sections 104(b)(3), 304(1), 319, and 320 of Clean Water Act, as amended

[e] Clean Lakes Program critical areas (subareas within lakes, or in some cases entire small lakes) identified by State Clean Lake Plans as critical habitat (Section 314 of Clean Water Act, as amended)

[f] Limited to areas described as being used for intense or concentrated spawning by a given species

[g] For the surface water migration pathway, limited to terrestrial vertebrate species with aquatic or semiaquatic foraging habits

*See Section A.4 of the *Hazard Ranking System Guidance Manual*, OSWER Directive 9345.1-07, November 1992, for sources of information on how to identify these receptors. Information on how to obtain this guidance can be found in Section 5 of this Primer.

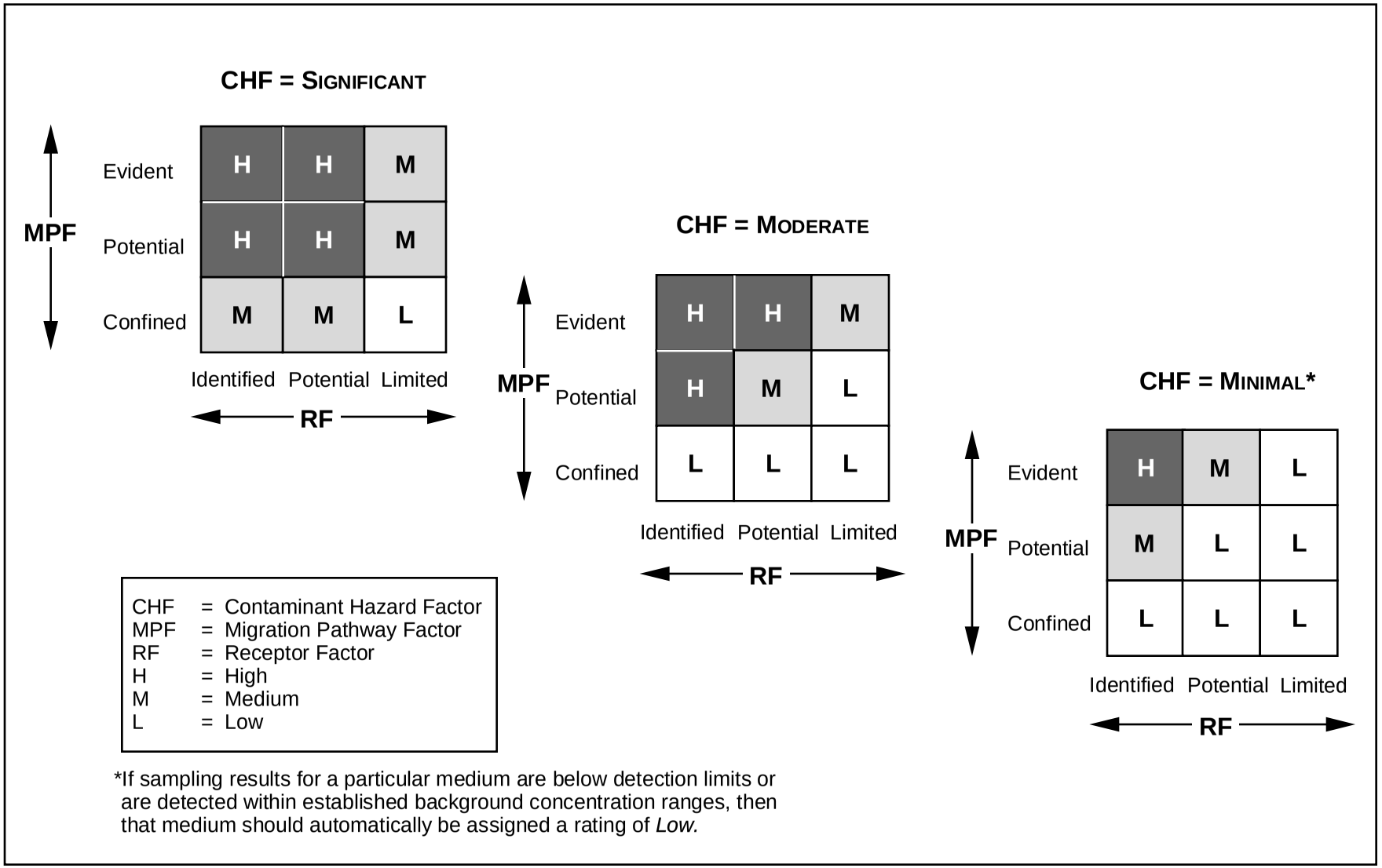


Figure 7. Relative Risk Site Evaluation Matrix

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3 Instructions for Relative Risk Site Evaluations

This section provides a set of general and specific instructions for conducting relative risk site evaluations at installations and formerly used defense sites (FUDS). The general instructions in Section 3.1 apply throughout the evaluation. Instructions on performing medium-specific evaluations and completing specific parts of the Relative Risk Site Evaluation Worksheet follow in Sections 3.2 through 3.6. Because it forms the basis of so much of the evaluation, the CHF, as it applies to all media, is discussed in detail. Following that, instructions for evaluating each medium are given, with specific instructions for each of the factors in that medium.

3.1 General Instructions

Use the Relative Risk Site Evaluation Worksheet, in Appendix A (or its electronic equivalent), to record pertinent information on the site being evaluated. Page 1 of the Worksheet asks for information on the site. Pages 2 through 7 ask for information on each environmental medium (groundwater, surface water [human and ecological endpoints], sediment [human and ecological endpoints], and soil) and cover determinations of the CHF, MPF, and RF for each medium.

Proceed through the Worksheet using the specific instructions in this Primer. Evaluate all media with reliable analytical data at all sites; designate those sites without reliable analytical data as "Not Evaluated." See Figure 3 for an illustration of this decision logic.

Use the most recent yet representative sampling and analysis data from existing restoration documents or databases to complete the Worksheet; additional data gathering activities are not required. Examples of such documents include completed site inspections, remedial investigations, feasibility studies, engineering evaluations/cost analysis studies, records of decision, decision documents, design documents, performance monitoring reports, and equivalent types of information.

When conducting relative risk site evaluations for sites contaminated solely with petroleum, oils, and lubricants (POL), do not use Total Petroleum Hydrocarbon data. Instead, use the concentrations for benzene, toluene, ethylbenzene, and xylene (BTEX) compounds in each medium, together with corresponding BTEX standards, to calculate the CHF. Support for using BTEX compounds in the evaluation of POL contamination can be found in *Use of Risk Based Standards for Cleanup of Petroleum Contaminated Soil* (Department of the Air Force, June 1994).

When conducting relative risk site evaluations for sites contaminated with POL ***and*** other contaminants, use the concentrations for BTEX compounds and the other contaminants present, together with their corresponding comparison values, to calculate the CHF.

Do not perform relative risk site evaluations at sites that are categorized as either "response complete" (RC) or "all remedies in place" (RIP). See Sections 1.4 and 4 for these definitions. Do not perform relative risk site evaluations on sites without reliable concentration data. These sites should be categorized as Not Evaluated (NE). Finally, do not perform relative risk site evaluations on PRP sites and sites comprised solely of ordnance.

3.2 Site Information

The first page of the Worksheet asks for information on the background of the site and a summary of key elements of information about the site.

Site Background Information. Provide a record of basic information on the following: the installation's name (property name for FUDS), location, site name (project name for FUDS), and Restoration Management Information System (RMIS)/Defense Site Environmental Restoration Tracking System (DSERTS) identification number (project number for FUDS), contact person, date of relative risk site evaluation, media evaluated, site execution phase from which data are available (e.g., site inspection, remedial investigation, remedial design), agreement status of the site, and site type. Applicable regulatory agreements and their codes and a list of site types are found in Appendix C. Much of this information is available from existing DoD Component databases and is typically imported from these into appropriate data fields for each site. For example, agreement status and site type codes are available in and obtained from RMIS/DSERTS.

The background information will aid in understanding the quality of information used in site evaluations, the level of uncertainty associated with the data, and anticipated follow-on phases of execution. It will also assist in explaining activities at the site to stakeholders.

Site Summary ("Project Summary" for FUDS). Briefly describe the source of contamination (materials disposed of) at the site, the exposure setting (the site's physical environment), and any potentially exposed human and ecological receptors. The emphasis should be on including the key elements of information used to conduct the relative risk site evaluation. As noted on the summary sheet, you may include a map and/or cross section of the site.

Preparers of worksheets should also determine their Component-specific procedures for submitting relative risk site evaluation documentation.

3.3 Evaluation of Contaminant Hazard Factor

This subsection discusses the general method, common to all environmental media, for evaluating the CHF. The CHF will be *significant, moderate,* or *minimal,* based on summing the ratios of maximum contaminant concentrations in each medium to corresponding comparison values in Appendices B-1, B-2, or B-3, as appropriate. The CHF is *significant* for a medium when the sum of the ratios for that medium exceeds 100, *moderate* when the sum of the ratios is from 2 to 100, and *minimal* when the sum of the ratios is less than 2. (See Figures 8 and 9.)

Select contaminants for inclusion in the CHF evaluation for each medium and list them on the Worksheet. **Only chemicals listed in the appropriate Appendix (B-1, B-2, or B-3) can be included.** Total Petroleum Hydrocarbons (TPH) is not included, and only specific petroleum constituents are listed. **Select only those contaminants having reliable analytical data, using the most recent yet representative sampling and analysis data.** General considerations for selecting contaminants are discussed at the end of this subsection, while considerations specific to each medium are discussed under the specific instructions for the medium. If no reliable concentration data are available for any contaminants for the medium, no evaluation can be made of that medium, and the medium should be rated as "Not Evaluated." If sampling results for a particular medium are below detection limits or are detected within established background

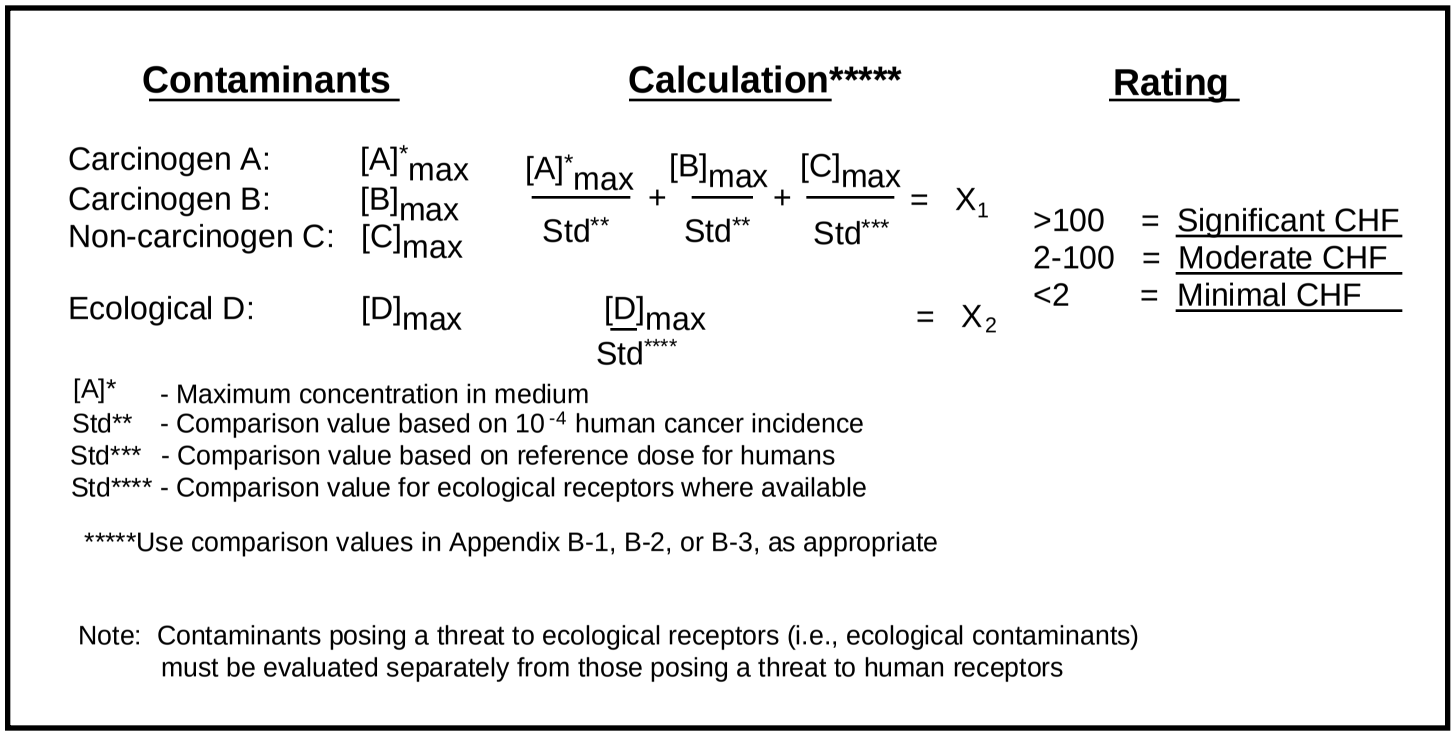

Figure 8. Mechanics of the Contaminant Hazard Factor Calculation

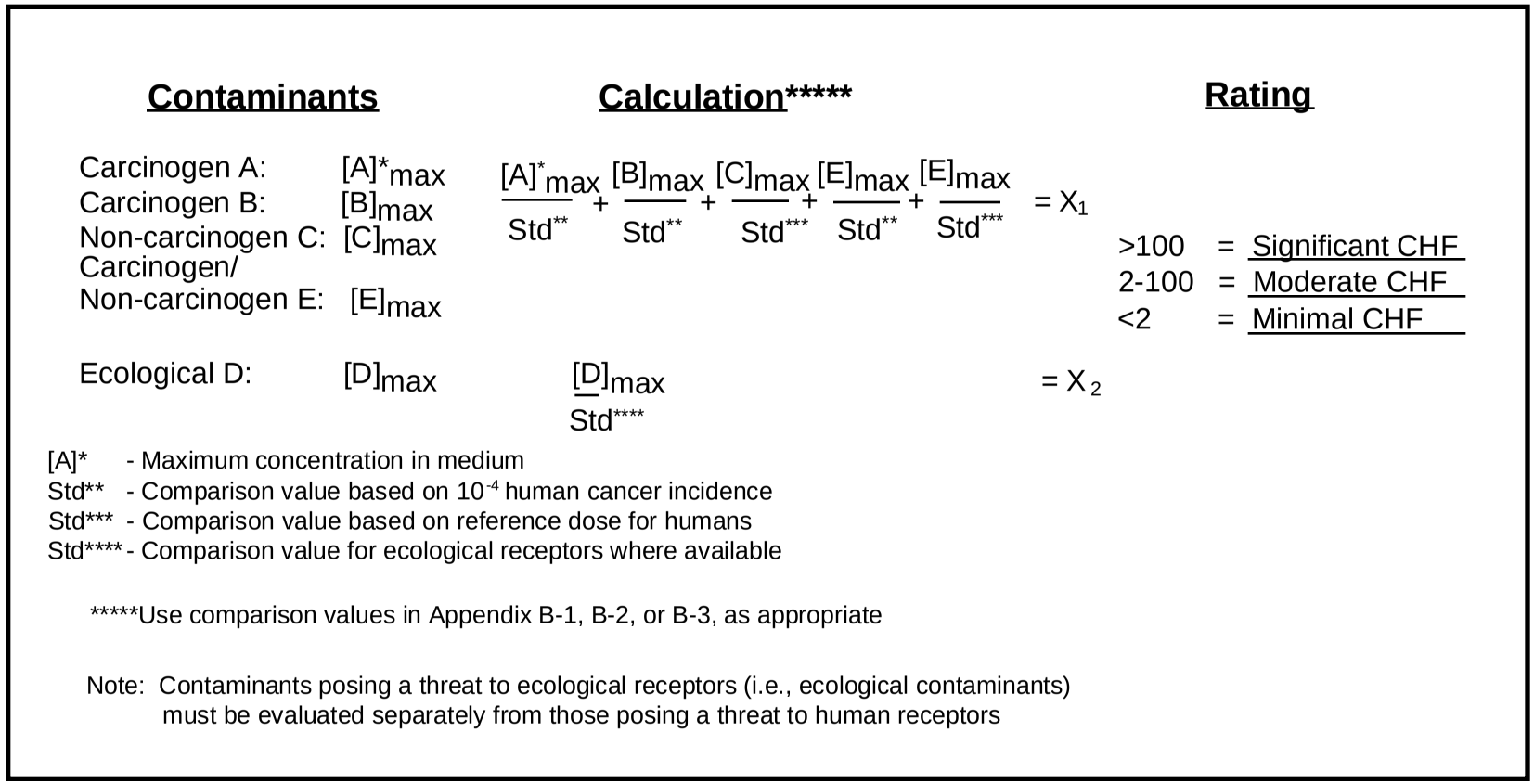

Figure 9. Mechanics of the Contaminant Hazard Factor Calculation for Substances with both Carcinogenic and Non-Carcinogenic Effects

concentration ranges, then that medium should automatically be assigned a rating of *Low*. If sampling results for each and every medium sampled are below detection or are within established background concentration ranges, the site is automatically assigned a category of *Low* (see Figure 3).

For each contaminant listed on the Worksheet, record the most recent yet representative maximum detected concentration of that contaminant in that medium at that site on the Worksheet. Adjacent to this value record the appropriate comparison value for the contaminant from Appendix B-1, B-2, or B-3. (See the instructions for each medium for the comparison values appropriate to that medium.) Calculate the ratio to be listed on the Worksheet by dividing the maximum concentration by the comparison value. Select only those contaminants having reliable analytical data, using the most recent sampling and analysis data **which is representative of the site**.

Sum the column of ratio values to obtain the total value (Figures 8 and 9). Where a lengthy series of analyses has been carried out, it is not necessary to list every contaminant found. However, **the Worksheet should include all contaminants of concern that are attributable to the site**, especially those that produce the highest ratios of observed concentrations to their comparison values. The highest ratios do not necessarily result from contaminants with the highest concentrations. Extremely carcinogenic or toxic compounds may have very low comparison values and therefore result in the highest ratios.

The existence of high ratio values will lead to a higher rating for the CHF. Note that the CHF is *significant* when the sum of the ratios exceeds 100. Every attempt should be made to include all contaminants of concern present at a site for the CHF calculation in order to be able to compare current site evaluations with future ones.

In selecting contaminants with reliable analytical data, review the contaminants that have been detected in the medium and that can be reasonably attributed to the site. Attribution implies that the contaminant concentrations are distinguishable from background concentrations. **Do not include naturally occurring compounds that are detected within established background concentration ranges.** Additionally, if all analytical data are within established background ranges for a medium or site, automatically assign that medium or site a rating of *Low*. All contaminants that have been reliably reported at concentrations near or above the detection limit can be included.

For contaminants with reliable analytical data, record only the maximum concentration found in the medium for each contaminant. The contaminants need not have been detected at the same location, but contaminant data should be recent and representative of conditions at the site. Additional considerations specific to each medium are discussed in the instructions for that medium.

To implement the requirements of this section (use reliable data, do no use results that are less than detection limits, do no use results within background ranges) media with CHF values below 0.005 will be assigned a category of *Low*.

3.4 Evaluation of Groundwater

The evaluation of the groundwater medium is summarized in Figure 4. Groundwater contaminant data used in site evaluations must be based on groundwater samples affected by the site. The sampling location need not be on installation property, but contamination must be attributable to the site. The groundwater sample location (i.e., a well) may be a source of drinking water or irrigation water, or it may be a monitoring well. A well that is confirmed to be upgradient from the site **does not** provide suitable data for this evaluation.

If a well is thought to be influenced by more than one site, exercise additional care in selecting the data to be used. Select only contaminants that can reasonably be linked to past practices at the site. If, for example, a site was contaminated by trichloroethylene (TCE) and an adjacent site had been shown to have chromium contamination, even though both TCE and chromium may appear in groundwater samples downgradient from the sites, restrict the evaluation of each site solely to the specific contaminants that can be reasonably linked to the site. Depending on past practices, this could be both the TCE and chromium or just the chromium or just the TCE.

Contaminant Hazard Factor (CHF). Review the most recent yet representative analytical data to determine what contaminants have been detected in groundwater at or near the site and which of these contaminants can be reasonably attributed to the site. Attribution implies that the contaminant concentrations are distinguishable from background concentrations. For metals, analyses are often available for both the dissolved fraction and the "total" concentration. The dissolved data are preferred for this evaluation and should be used if available.

For each contaminant listed on the Worksheet, note a maximum detected concentration in ug/l. Adjacent to this value, record the comparison value for the contaminant, using the values in Appendix B-l. For groundwater use the value listed under "water," which is reported in units of ug/l.

Migration Pathway Factor (MPF). The migration of a contaminant from a site into and through groundwater is dependent upon a complex interaction of the physical and chemical properties of the contaminant, the hydrologic environment surrounding the site, and the presence or absence of physical factors that could impede transport. The likelihood of transport of contaminants via groundwater is evaluated qualitatively as *evident*, *potential*, or *confined* (see Figure 4), based on available information for a site and professional judgment.

The MPF is evaluated as *evident* only if analytical data or direct observation indicates that contamination in the groundwater is moving or has moved away from the area under the source. The data used in this evaluation may be from a water supply well or monitoring well (see Figure 10 for illustrations).

The MPF is *potential* under the following conditions:

- Contamination in the groundwater is largely restricted to the area directly under the source or only slightly beyond the edge of the source (i.e., tens of feet)
- There is no evidence of appreciable contaminant migration in groundwater, but subsurface soil contamination has been identified, the contaminants have physical properties that suggest they are mobile, and there are no known barriers to migration. A leaking underground storage tank above the water table is an example.
- Information is not available to support an MPF of *evident* or *confined*.

The MPF is *confined* at sites where the contaminants in the source have very little potential to migrate to groundwater, or where contaminated groundwater has little potential to be transported down-gradient. Confined conditions may be due to physical barriers to migration, such as a hydraulic barrier created by an installed and properly operating removal or remedial action, or a confining clay layer between the source and groundwater. There may be limited net precipitation (i.e., 0 to 5 inches per year) to

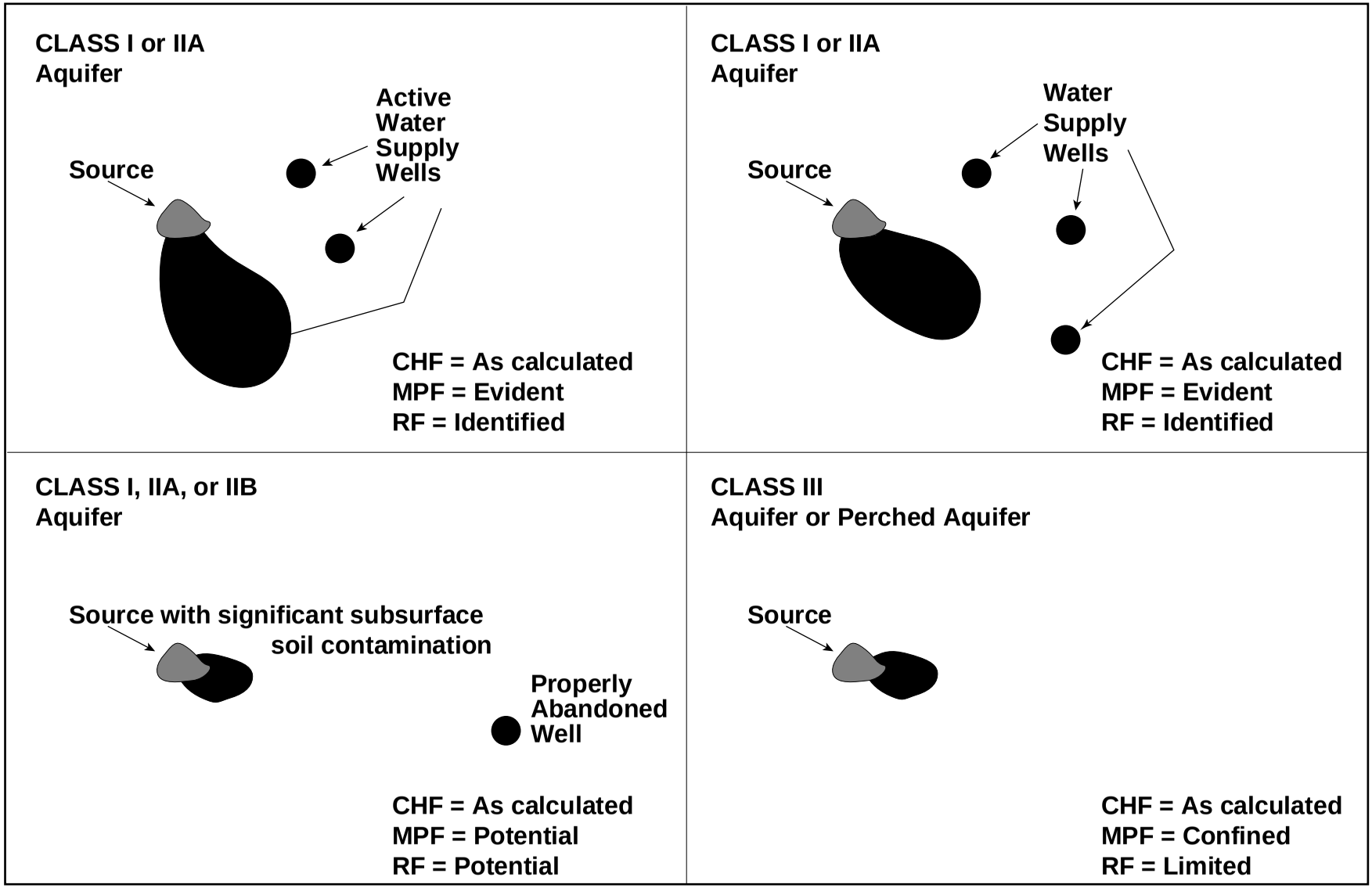

Figure 10. Example Scenarios for the Groundwater Medium

drive soil contamination towards groundwater, and/or groundwater may be located several hundred feet below the ground surface with very long travel times for contamination to reach groundwater.

Receptor Factor (RF). Possible RFs are *identified, potential,* and *limited* (see Figure 4). Only human receptors are considered for groundwater exposure, and no distinction is made for the type of receptor (e.g., workers versus residents) or the number of receptors.

Evaluate the RF as *identified* if a currently used water supply well downgradient from the source is threatened. A threatened water supply well is one that is impacted by contamination, or will likely be impacted by contamination within a reasonable timeframe. The water supply must be equivalent to either EPA Class I or Class IIA groundwater, as outlined in Table 1. The RF is *potential* if there are no threatened water supply wells downgradient from the source, but the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture. The water supply should be equivalent to EPA Class I, Class IIA, or Class IIB groundwater (Table 1). The RF is *limited* when there is no potentially threatened groundwater supply well downgradient from the source and the groundwater is not considered to be a potential source of drinking water and is of limited beneficial use. This is a water supply equivalent to Class III groundwater (Table 1), such as saline water or an aquifer with insufficient production to meet the needs of an average household, for example, a perched aquifer (see Figure 10). Do not include properly abandoned wells in the RF evaluation.

3.5 Evaluation of Surface Water and Sediment

The evaluations for the surface water and sediment media are summarized in Figure 5. Consult a topographic map that includes the site under evaluation when evaluating surface water and sediment factors. A topographic map will reveal surface water features that potentially can be affected by the site and will provide a view of potential migration pathways toward surface water receptors. Either water or sediment samples can be used to document the presence and migration of contaminants (and in some cases receptors) for this evaluation.

Contaminant Hazard Factor (CHF). For contaminants in surface water with a potential for human exposure, use comparison values in Appendix B-1 under "water," which are reported in units of ug/l. For contaminants in surface water with a potential for ecological exposure, use comparison values in Appendix B-2, which are reported in units of ug/l. For contaminants in sediment with a potential for human exposure, use values in Appendix B-1 under the "soil" column, which are reported in units of mg/kg. For contaminants in sediments with a potential for ecological exposure, use comparison values in Appendix B-3, which are reported in units of mg/kg. Only contaminants with comparison values in the appropriate tables are to be included in the CHF calculation. A *significant* CHF is greater than 100. A *moderate* CHF is from 2 to 100. A *minimal* CHF is less than 2. (See Figures 8 and 9.)

Review the most recent yet representative analytical data to determine what contaminants have been detected in surface water and sediment at or near the site and which of these contaminants can be reasonably attributed to the site. Attribution implies that the contaminant concentrations

are distinguishable from background concentrations. Samples collected from surface streams, drainage ditches, rivers, lakes, wetlands, and embayments are all appropriate. Samples do not have to be collected adjacent to the site, but greater distances often make attribution to the site more difficult, and dilution from downstream tributaries often reduces observed contaminant concentrations.

For metals in surface water samples, analyses are often available for both the dissolved fraction and the "total" concentration. If they are available, use the data on the dissolved fraction.

Sediment is the result of deposition of solid material from the water. Obtain sediment samples from surface water bodies receiving runoff from the site or from areas such as swales and ditches that are known to have transported water from the site.

For each contaminant listed on the Worksheet, note a maximum detected concentration. Use units of ug/l for water samples and mg/kg for sediment samples. Adjacent to this value record the comparison value for the contaminant using the appropriate subsection of Appendix B.

Migration Pathway Factor (MPF). The likelihood of transport of contaminants via surface water or sediment is evaluated qualitatively as *evident*, *potential*, or *confined* (see Figure 5). Base MPF evaluations on available information and professional judgment. The MPF is *evident* if analytical data or direct observation indicates that contaminants in surface water and sediments are present at a point of exposure for a surface water receptor or have moved in surface water or sediments away from the source towards a point of exposure for a surface water receptor. Water or sediment samples can provide the analytical data. Showing the actual movement of contaminated runoff from a source toward a point of exposure is needed for direct observation (see Figure 11).

The MPF is *potential* in any instance where there is information to suggest contamination could move away from the source toward a point of exposure for a surface water receptor, or has moved slightly beyond the source area (i.e., tens of feet). Where there is insufficient information to support an MPF of *evident* or *confined*, the MPF defaults to *potential*.

Application of the *confined* MPF to a site requires information that transport of contaminants from the source by surface water to a potential point of exposure to a surface water receptor is restricted. Reasons to believe such a condition could exist include the following:

- The site has engineered runon/runoff controls that can effectively interrupt transport of contaminants to surface water.
- Removal or remedial actions have been implemented that restrict the movement of contaminants away from the source.
- The contamination at the source is below the ground surface and is not subject to erosion or interaction with surface water. For example, leaking underground storage tanks may result in subsurface soil and groundwater contamination but not contamination of surface water.
- Topographic conditions prevent surface water from leaving the immediate area of the site. If there is effectively no runoff from the site to surface water, there will be no migration of contaminants to points of exposure. This may also occur in areas with very low rainfall, perhaps with only nearby ephemeral streams. In some areas surface water may be completely lost to groundwater recharge.

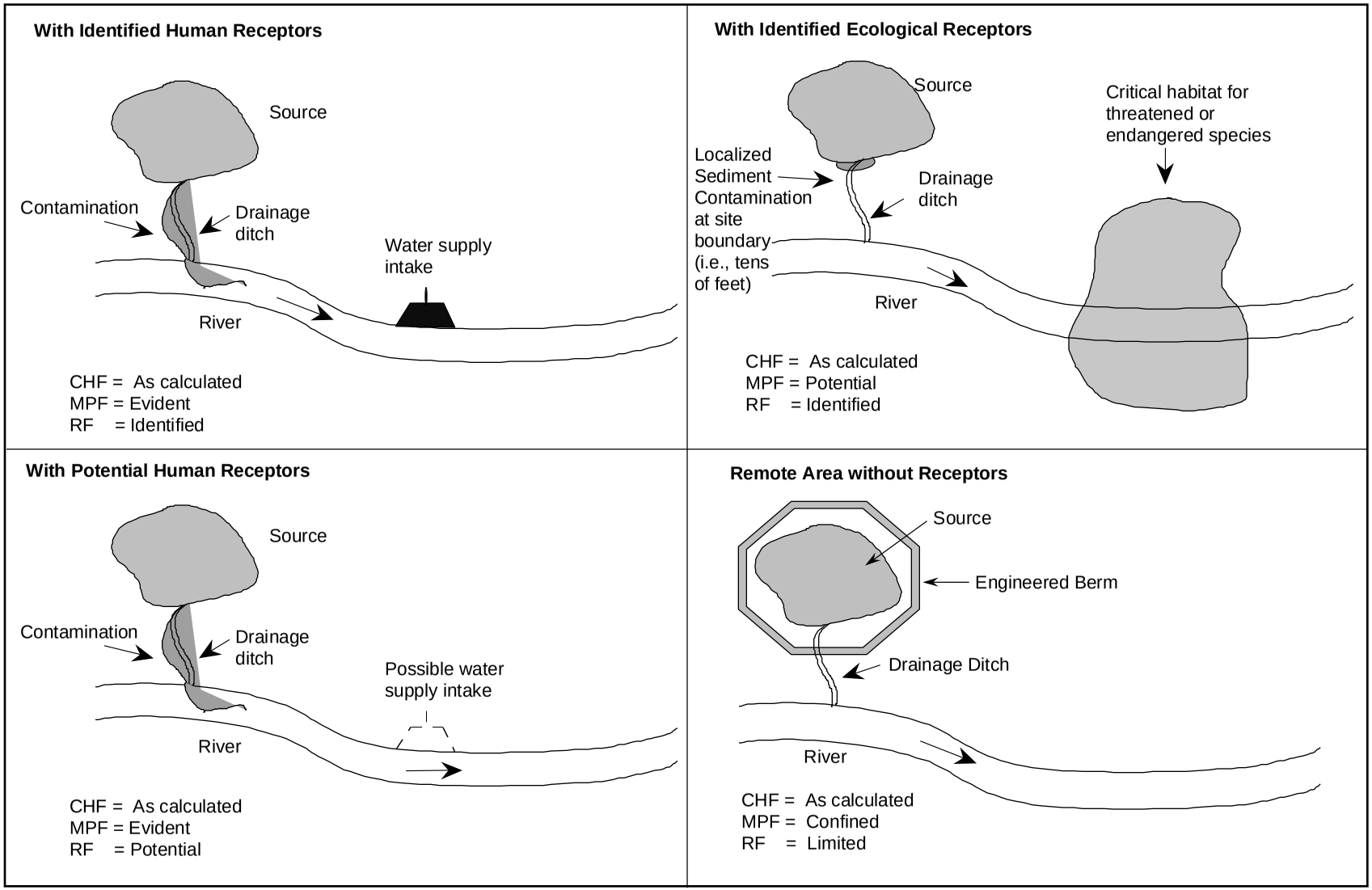

Figure 11. Example Scenarios for the Surface Water and Sediment Media

Note that the rationale for a *confined* MPF must be based upon hydrologic factors; water must be prevented from coming into contact with contaminated sources or moving to a potential point of exposure for a surface water receptor. The chemical or physical characteristics of the contaminants, although important in determining transport mechanisms, will not in themselves prevent such transport. The chemical and physical properties of a contaminant may determine whether it will be transported primarily in a dissolved form or adsorbed on particulate matter, but if the contaminant is in contact with surface water and subject to erosive forces, it will tend to move. Further, the existence of manmade structures, such as dams, or the presence of lakes and reservoirs in the surface water pathway does not necessarily imply a *confined* condition. Although the travel time for the contaminants will undoubtedly be affected by such structures, the migration pathway may still be uninterrupted.

Receptor Factor (RF). Receptors could be subject to a number of exposure scenarios associated with surface water and sediment. Surface water can be a source of drinking water and is often used for recreational activities such as boating, swimming, and fishing. Human exposure could occur through the use of surface water for drinking water, the incidental ingestion of surface water during recreational activity, dermal contact with surface water or sediments, ingestion of aquatic species caught in the water body for human consumption, and the use of surface water for watering livestock or irrigation of human food crops. Aquatic species, considered part of the human food chain, could potentially include fresh and marine species, such as finfish, shellfish, shrimp, squid, snails, and crayfish. Ecological receptors to be considered are restricted to those areas specifically identified in Table 2.

The RF can be *identified, potential*, or *limited* (see Figure 5). Rate the RF as *identified* whenever receptors have been specifically identified as having access to surface water or sediment to which the contaminants have moved or can move. This could potentially include the use of water as drinking water, for irrigating human food crops, for watering livestock, and for supporting recreational activity, including fishing. It could also include the presence of ecological areas downstream from the site and within the surface water migration pathway (see Figure 11).

The RF is *potential* if there are no known uses of surface water as outlined above, but the potential for such use is thought to exist because of nearby populations or predicted future development.

The RF is *limited* when it is unlikely that human population will come into contact with the water or sediment and when there are no ecological receptors apparent. These conditions, as they apply to humans, may be met in remote areas or areas in which access is highly restricted.

3.6 Evaluation of Surface Soils

Samples for the soil evaluation should be from a depth of 0 to 6 inches. If samples are not available from this interval, samples from depths up to 24 inches can be used. Preference is given to shallower samples when there is a choice. In no instance should samples deeper than 24 inches be used. For the purpose of this evaluation, the hazard posed by subsurface soil contaminants (e.g., a buried leaking storage tank deeper than 24 inches) is assumed to be assessed by the evaluation of groundwater (based on actual groundwater sampling data), which would be the most probable pathway of deep soil contaminant migration to humans.

Contaminant Hazard Factor (CHF). For contaminants in surface soils with a potential for human exposure, use comparison values in Appendix B-1 under "soil," which are reported in units of mg/kg. Contaminants in soils with a potential for ecological exposure are not evaluated since comparison values for such contaminants do not currently exist. A *significant* CHF is greater than 100. A *moderate* CHF is from 2 to 100. A *minimal* CHF is less than 2 (see Figures 8 and 9).

Review the most recent yet representative analytical data to determine what contaminants have been detected in surface soils at the site. Attribution of the contaminants to the site requires that the observed concentrations are distinguishable from background.

For each contaminant listed on the Worksheet, note a maximum detected concentration in mg/kg (ppm). Adjacent to this value, record the comparison value for the contaminant, using the values in Appendix B-1.

Migration Pathway Factor (MPF). The likelihood of transport of contaminants through soil is evaluated qualitatively as *evident*, *potential*, or *confined* (see Figure 6 for definitions). Base MPF evaluations on available information and professional judgment. Assign *evident* to the MPF if analytical data or direct observation indicates that contamination is present at, is moving toward, or has moved to a point of exposure. This may be determined through analysis of runoff or observation of secondary sources as a result of the slumping of soil or wind erosion.

Assign *potential* to the MPF if contamination has moved only slightly beyond the source (i.e., tens of feet) or it could move but is not moving appreciably. Where there is insufficient information to support an MPF of *evident* or *confined*, the MPF defaults to *potential* (see Figure 12). This rating would be appropriate when the there is no evidence of movement from an unconfined source or when berms surrounding sources are old, eroding, or otherwise unmaintained.

To apply the *confined* MPF to a site requires information that transport of contaminated surface soil from the site to a point of exposure is restricted. Reasons to believe such confinement exists include the presence of site barriers such as buildings, maintained berms, and pavement or caps that prevent contact with the contaminated soil or prevent the contaminated soil from moving to a point of exposure. When conducting relative risk site evaluations for soils, take into account remedies implemented to contain or confine soil contamination.

Receptor Factor (RF). Soil receptors include only those humans with the potential to come into contact with contaminated surface soils, including residents, persons attending school or daycare on the site or in proximity to the site, and workers who have direct access to soil contamination on a frequent long-term basis.

The RF can be *identified*, *potential*, or *limited* (see Figure 6 for definitions). The RF is *identified* if analytical data or direct observation indicates that people reside or frequently work, recreate, or attend school or daycare in the area of contamination. If there are no workplaces, residences, schools, or daycare centers in the area of contamination, but access is not restricted, the RF is *potential* (see Figure 12).

Evaluate the RF as *limited* when it is unlikely that humans will come into contact with the contaminated soil. This would be appropriate when the MPF is *confined.*

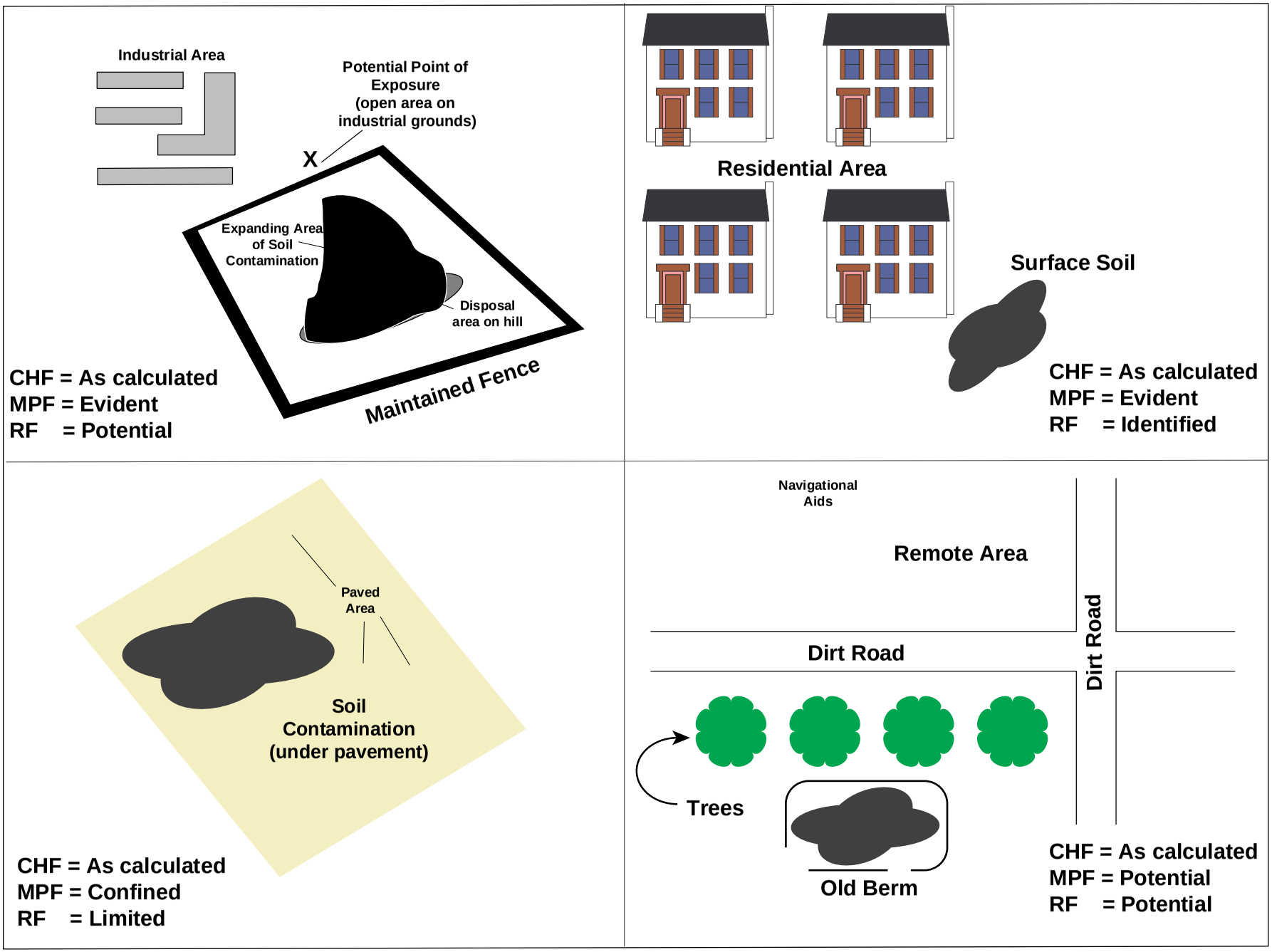

Figure 12. Example Scenarios for the Soil Medium

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4 Terms and Definitions

Base Realignment and Closure (BRAC)	Refers to policy, procedures, authorities, and responsibilities for closing or realigning military installations across the Department of Defense. Includes environmental restoration activities.
Baseline Risk Assessment	An analysis of the potential adverse health effects (current or future) caused by contaminant releases from a site in the absence of any actions to control or mitigate these releases.
Cancer Risk	Incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogen.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, establishes a comprehensive framework for identifying, investigating, and cleaning up releases of hazardous substances to the environment. CERCLA authorizes the President to take response actions when a release or the threat of a release is discovered. Through Executive Order 12580, signed in January 1987, the President directs the Secretary of Defense to implement investigation and cleanup measures in consultation with EPA for releases of hazardous substances from facilities under the jurisdiction of the Secretary.
Defense Environmental Restoration Account (DERA)	A transfer account, established by the Defense Appropriation Act of 1984, that funds the Installation Restoration Program for active installations and the Formerly Used Defense Sites Program for formerly owned or used installations. The account also funds the other goals of the Defense Environmental Restoration Program.
Defense Environmental Restoration Program (DERP)	A program established by Congress in 1984 to evaluate and clean up contamination from past DoD activities (Title 10 U.S. Code 2701-2707 and 2810.)
Defense Site Environmental Restoration Tracking System (DSERTS)	The Defense Site Environmental Restoration Tracking System (DSERTS) is a personal computer program used by installation and command level restoration program managers. It automates collection and reporting of information on sites addressed by the Defense Environmental Cleanup Programs (Installation Restoration and Base Realignment and Closure).
Exposure Point	A location of potential contact between a receptor and a chemical or physical agent.

Feasibility Study (FS)	Based on data collected during the remedial investigation, options for final cleanup actions are developed and evaluated in the FS. The FS is divided into two phases: (1) an initial screening of alternatives, followed by (2) the detailed analysis of alternatives. The detailed analysis considers, among other things, cost-effectiveness, short- and long-term effectiveness, and the overall protection of human health and the environment.
Hazard Quotient	The ratio of a single substance exposure level over a specified time period (e.g., subchronic) to a reference dose for that substance derived from a similar exposure period.
Interim Remedial Action (IRA)	An early response action that may be identified and implemented at any time during the study or design phase. IRAs are limited in scope, and they address only areas or media for which a final remedy will be developed by the RI/FS process. An IRA should be consistent with the final remedy for a site.
Media	Environmental media subject to relative risk evaluation, namely groundwater, surface water, sediment, and soils.
Measures of Merit (MOM)	DoD has developed Measures of Merit (MOMs) to define goals, measure how well these goals are achieved, and assess program effectiveness. MOM #1 sets forth goals for relative risk reduction at sites in DERP over time. MOM #3 tracks the number of sites where cleanup action has been taken and relative risk has been reduced in one or more media.
National Oil and Hazardous Substances Pollu–tion Contingency Plan (NCP)	Located at 40 Code of Federal Regulations 300, the NCP establishes EPA's response policy and lays out the key response steps for implementing CERCLA.
No Further Action (NFA)	A no-further-action designation for a site means that response actions are either complete or not required and no additional actions are warranted. A no-further-action decision can be made at different points in the process if data indicate that risks are within acceptable levels.
Not Required (NR)	A site status classification that means that relative risk site evaluation is not required. This classification applies to sites designated "Response Complete" (RC) or all "Remedies in Place" (RIP).
Petroleum, Oil, and Lubricants (POL)	For example, jet fuel, gasoline, and their sludges.

Preliminary Assessment (PA)	A limited-scope investigation designed to distinguish between sites that pose little or no threat to human health and the environment and sites that require further investigation. The PA is typically based on installation record searches, visual site inspections, and interviews of site personnel. It is required at sites listed on the Federal Facility Hazardous Waste Compliance Docket.
Preliminary Remediation Goals (PRGs)	Relative risk PRGs are concentration levels set for individual chemicals that, for carcinogens, correspond to a specific cancer risk level of 1 in 1 million and, for noncarcinogens, correspond to a Hazard Quotient of 1. They are generally selected when Applicable or Relevant and Appropriate Requirements (ARARs) are not available.
RCRA Facility Assessment (RFA)	The first step in the RCRA corrective action process. The RFA acts as a screen, first identifying and then eliminating solid waste management units (SWMUs), environmental media, or entire facilities from further consideration for corrective action. RFAs are performed as part of the RCRA permitting process.
Receptor	A human individual or individuals, ecological population, or sensitive environment subject to, or potentially subject to, the hazard of contaminant exposure. Sensitive environments considered as receptors are listed in Table 2.
Reference Dose (RfD)	An estimated daily exposure level of a contaminant to a human population below which no adverse noncancer health effects are anticipated.
Relative Risk	The grouping of sites in DERP into High, Medium, and Low categories based on an evaluation of site information using three key factors: the contaminant hazard factor (CHF), the migration pathway factor (MPF), and the receptor factor (RF).
Remedial Action (RA)	Involves the construction, operation, and implementation of the final cleanup remedy. Long-term RAs require continued monitoring, operation, and maintenance for a number of years.
Remedial Action Operation (RAO)	A site status classification that applies after all remedies are in place, but before a response complete decision is made.
Remedial Design (RD)	Involves the development of the actual design of the selected cleanup remedy, including preparation of all technical drawings and specifications needed to implement the cleanup action.

Remedial Investigation (RI)	A field investigation that is more extensive than an SI. Its purpose is to characterize the nature and extent of contamination at a site. The RI also assesses the risks posed by on-site contamination to human health and the environment.
Remedies in Place (RIP)	A site status classification that implies that all required removal and/or remedial actions are in place at a site. If a site required a remedial action for contaminated groundwater and a second such action for contaminated soils, both actions would need to be in place (e.g., operating successfully for groundwater and construction completion for soil) at the site before making an RIP designation.
Removal Action	Taken to respond to a release, or threat of a release, of hazardous substances, pollutants, or contaminants so as to prevent, minimize, or mitigate harm to human health or the environment. Such actions may be taken during any phase of the site cleanup.
Resource Conservation and Recovery Act (RCRA)	RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), requires the establishment of a management system for hazardous waste (Subtitle C), non-hazardous solid waste (Subtitle D), and underground storage tanks (Subtitle I). RCRA also provides corrective action authority for cleanup of non-hazardous solid waste management units.
Response Complete (RC)	A "response complete" designation means that a Component deems that no further action is required at the site with the exception of long-term monitoring. A RC determination requires that (1) there is no evidence that contaminants were released at the site, (2) no contaminants other than background levels were detected at the site, (3) contaminants attributable to the site are below action levels used for risk screening, (4) the results of a baseline risk assessment demonstrate that cumulative risks posed by the site are below established thresholds, or (5) removal and/or remedial actions at a site have been implemented, completed, and are the final action for the site.
Restoration Management Information System (RMIS)	A DoD database used to track information on the status and progress of activities at sites in the DERP. It is used to support the Annual Report to Congress and is linked with DSERTS.

Site	A discrete area where contamination has been verified, requiring further response action. By definition, a site has been or will be entered into RMIS. For the Formerly Utilized Defense Sites (FUDS) program, a *site* is equivalent to a "project" and an *installation* is equivalent to a "FUDS Property." Hence, there may be multiple projects on a single FUDS property.
Site Inspection (SI)	Performed if the PA recommends further investigation. SI investigations typically collect waste and environmental samples to determine the hazardous substances present at a site and whether they are being released to the environment.
Slope Factor (SF)	A plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used to estimate an upper-bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a carcinogen.
Source	Area where hazardous substances or petroleum products have been deposited, stored, released, disposed of, or placed.

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U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, Directive 9355.0-30, April 1991.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *The Hazard Ranking System Guidance Manual*, Directive 9345.1-07, Interim Final, November 1992. Section A.4 of this document contains sources of information for identifying sensitive environments listed in Table 2 of this Primer. Copies of this section can be obtained by calling the Cleanup Program Office at (703) 697-7475 or through the National Technical Information Service at 1-800-553-NTIS.

U.S. Environmental Protection Agency, *Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance; Final Rule*, 57 *Federal Register* 60848, 22 December 1992.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Superfund Chemical Data Matrix - Appendix B, Tables*, Directive 9360.4-18-1, June 1994 (as updated).

U.S. Environmental Protection Agency, *Region IX Preliminary Remediation Goals, Second Half*, 1 September 1995.

6 List of Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirements
BRAC	Base realignment and closure
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CAS	Chemical Abstracts Service
CHF	Contaminant Hazard Factor
CHHPM	Center for Human Health and Preventative Medicine
DERA	Defense Environmental Restoration Account
DERP	Defense Environmental Restoration Program
DLA	Defense Logistics Agency
DSERTS	Defense Site Environmental Restoration Tracking System
DoD	Department of Defense
DUSD(ES)	Deputy Under Secretary of Defense (Environmental Security)
EPA	U.S. Environmental Protection Agency
ER-L	Environmental Response-Low
FS	Feasibility Study
FUDS	Formerly Used Defense Sites
FY	Fiscal Year
GAO	Government Accounting Office
GW	Groundwater
HEAST	Health Effects Assessment Summary Tables
HSWA	Hazardous and Solid Waste Amendments
ID	Identification
IRA	Interim Remedial Action
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
LOEL	Lowest Observed Effects Level
LTM	Long-Term Monitoring
mg/kg	Milligrams per kilogram
MPF	Migration Pathway Factor

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NOAA	National Oceanic and Atmospheric Administration
NR	Not Required
PA	Preliminary Assessment
PAH	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCi/kg	Picocuries per kilogram
PCi/l	Picocuries per liter
POL	Petroleum, Oil, and Lubricants
ppb	Parts per billion
ppm	Parts per million
PRG	Preliminary Remediation Goal
RA	Removal Action
RAO	Remedial Action Operation
RAB	Restoration Advisory Board
RIP	Remedies in Place
RC	Response Complete
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RF	Receptor Factor
RFA	RCRA Facility Assessment
RfD	Reference Dose
RI	Remedial Investigation
RMIS	Restoration Management Information System
SARA	Superfund Amendments and Reauthorization Act
SF	Slope Factor
SI	Site Inspection
Std	Standard
SW	Surface Water
TCE	Trichloroethylene
TPH	Total Petroleum Hydrocarbons
UXO	Unexploded Ordnance
µg/l	Micrograms per liter

APPENDIX A

REVISED

Relative Risk Site Evaluation Worksheet

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RELATIVE RISK SITE EVALUATION WORKSHEET

SITE[1] BACKGROUND INFORMATION

Installation/Property Name for FUDS: _____ **Date Entered /Updated (day, month, year):** _____

Location (City/County State): _____ **Media Evaluated (GW, SW, Sediment, Soil, Sed Eco, Soil Eco.):** _____

Site (Name/DSERTS ID)/Project (Name/Project No.) for FUDS: _____ **Phase of Execution (SI, RI, FS, EE/CA, IRA, RD/RA, or equiv. RCRA Stage):** _____

Point of Contact (Name/Phone): _____ **Agreement Status (enter appropriate DERP Site code):** _____

SITE SUMMARY

(Include only the key elements of information used to conduct the relative risk site evaluation. Attach map view of site if desired.)

Brief Site Description (include site type, materials disposed of, dates of operation, and other relevant information):

Brief Description of Pathways (Groundwater, Soil, Surface Water [Human], Surface Water [Ecological], Sediment [Human], Sediment [Ecological]):

Brief Description of Receptors (Human and Ecological):

---

1 The term *Site* is defined as a discrete area for which suspected contamination has been verified and requires further response action. A *Site* by definition has been, or will be, entered into RMIS/DSERTS. For the FUDS Program, "projects" equates to sites for current installations.

GROUNDWATER

CONTAMINANT HAZARD FACTOR[1] (CHF)

Contaminant	Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[2]
		Total	

1 Evaluate for human contaminants only
2 Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100) ____

Moderate (if Total 2-100) ____

Minimal (if Total <2) ____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the groundwater is moving or has moved away from the source area

Potential - Contamination in the groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates that the potential for contaminant migration from the source via the groundwater is limited (due to geological structures or physical controls)

(Place an "X" next to one below)

Evident ____

Potential ____

Confined ____

Brief Rationale for Selection: _____

RECEPTOR FACTOR (RF)

Identified - There is a threatened water supply downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer)

Potential - There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture, (equivalent to Class I, IIA, or IIB aquifer)

Limited - There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only)

(Place an "X" next to one below)

Identified ____

Potential ____

Limited ____

Brief Rationale for Selection: _____

Groundwater Category _____

(High, Medium, Low)

SURFACE WATER/HUMAN ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant	Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[1]
		Total	

[1]Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)____

Moderate (if Total 2-100)____

Minimal (if Total <2)____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident _____

Potential _____

Confined _____

Brief Rationale for Selection: _____

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified _____

Potential _____

Limited _____

Brief Rationale for Selection: _____

Surface Water/Human Endpoint Category _____

(High, Medium, Low)

SEDIMENT/HUMAN ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant	Max. Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio[1]

[1]Ratio = Max. Concentration/Comparison Value

Total

(Place an "X" next to one below)

Significant (if Total >100)_____

Moderate (if Total 2-100)_____

Minimal (if Total <2)_____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident _____

Potential _____

Confined _____

Brief Rationale for Selection: _____

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified _____

Potential _____

Limited _____

Brief Rationale for Selection: _____

Sediment/Human Endpoint Category _____

(High, Medium, Low)

SURFACE WATER/ECOLOGICAL ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant	Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[1]

[1]Ratio = Max. Concentration/Comparison Value

Total

(Place an "X" next to one below)

Significant (if Total >100)____

Moderate (if Total 2-100)____

Minimal (if Total <2)____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident ____

Potential ____

Confined ____

Brief Rationale for Selection: _____

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified ____

Potential ____

Limited ____

Brief Rationale for Selection: _____

Surface Water/Ecological Endpoint Category _____

(High, Medium, Low)

SEDIMENT/ECOLOGICAL ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant	Max. Concentration	units	Comparison Value	units	Ratio[1]
				Total	

[1]Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)____

Moderate (if Total 2-100)____

Minimal (if Total <2)____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident _____

Potential _____

Confined _____

Brief Rationale for Selection: _____

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contaminant has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contaminant has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contaminant has moved or can move

(Place an "X" next to one below)

Identified _____

Potential _____

Limited _____

Brief Rationale for Selection: _____

Sediment/Ecological Endpoint Category _____

(High, Medium, Low)

SOIL*

Contaminant Hazard Factor[1] (CHF)

Contaminant	Max. Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio[2]
		Total	

1 Evaluate for human contaminants only
2 Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)___

Moderate (if Total 2-100)___

Minimal (if Total <2)____

Migration Pathway Factor (MPF)

Evident - Analytical data or observable evidence that contamination is present at, is moving toward, or has moved to a point of exposure

Potential - contamination has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Low possibility for contamination to be present at or migrate to a point of exposure

(Place an "X" next to one below)

Evident ____

Potential ____

Confined ____

Brief Rationale for Selection: _____

Receptor Factor (RF)

Identified - Receptors identified that have access to contaminated soil

Potential - Potential for receptors to have access to contaminated soil

Limited - Little or no potential for receptors to have access to contaminated soil

(Place an "X" next to one below)

Identified ____

Potential ____

Limited ____

Brief Rationale for Selection: _____

Soil Category _____
(High, Medium, Low)

*Soil samples should be from a depth of 0–6 inches. If samples are not available from the 0–6 inch interval, results from depths up to, but not exceeding, 24 inches can be used.

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APPENDIX B

COMPARISON VALUES FOR CONTAMINANT HAZARD FACTOR EVALUATION

APPENDIX B-1

Comparison Values for Human Endpoint Evaluations

APPENDIX B-2

Ambient Water Quality Criteria for Ecological Endpoint Evaluations

APPENDIX B-3

Sediment Criteria for Ecological Endpoint Evaluations

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APPENDIX B-1

RELATIVE RISK COMPARISON VALUES

The Comparison Values contained in this Appendix were derived from the U.S. Environmental Protection Agency (EPA) Region IX Preliminary Remediation Goals, which are updated semiannually by Region IX. The Comparison Values presented in this Appendix, unless otherwise indicated, were derived from *Region IX Preliminary Remediation Goals [PRGs], Second Half 1995, September 1, 1995.* The Region IX values are based upon toxicological information documented by the EPA in the Integrated Risk Information System (IRIS) and Health Effects and Assessment Summary Tables (HEAST) data bases. Other reference sources, as footnoted, were used if and when Region IX data were not available.

The Comparison Values presented for soils utilize conservative exposure assumptions developed by Region IX for residential scenarios. Comparison Values that are based on non-carcinogenic exposure endpoints (nc) (i.e., references doses, RfDs) are translated directly into the table. Values based on carcinogenic exposure endpoints (ca) are modified to reflect a 10^{-4} computed risk value. The EPA has determined that a computed risk of 10^{-4} to 10^{-6} (i.e., one-in-ten thousand to one-in-one-million) is acceptable, depending on other prevailing circumstances. The Preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (55 Federal Register 8716, March 8, 1990) defines the remedial action threshold for carcinogens as 10^{-4}. For the purposes of computing the relative risk, the DOD Workgroup has deemed 10^{-4} to be adequate. The Region IX PRG table presents the values correlating to a 10^{-6} risk. Therefore, all carcinogenic values presented in the PRG tables have been multiplied by a factor of 100 to become the Relative Risk Comparison Values.

The Comparison Values representing military-unique materials (e.g., explosives, propellants, chemical agent materials, and by-products) have been incorporated into the overall, alphabetical listing of materials. When Region IX values were not available, the Comparison Values were calculated using Region IX guidance. The reference doses were obtained from a number of sources, as footnoted. The toxicological data conducted by the military (or DOD contractors), is currently being evaluated to establish environmental clean-up criteria for chemical agents and by-product materials. The criteria are now being reviewed by the Steering Committee for Standards in Emergency Response, Restoration, Remediation, and Demilitarization of Chemical Warfare Material. In addition, efforts are ongoing to develop pragmatic exposure assumptions, to replace the default assumptions generally used in EPA calculations.

Criteria for radionuclides are provided in a separate table at the end of Appendix B-1. They have been derived from the *EPA-Office of Solid Waste and Emergency Response, OSWER Directive 9360.4-18-1, Superfund Chemical Data Matrix.* All levels presented are based on Carcinogenic exposure endpoints; therefore, the values presented by EPA have been multiplied by 100 to reflect the 10^{-4} risk Comparison Values (as described above). Representatives of the EPA, Department of Energy, Nuclear Regulatory Commission, and DOD have been working together to develop environmental criteria (in picocuries per kilogram [pCi/kg]) to represent the fraction of total annual dosages (in milli-radiation equivalent man per year [mrem/yr]) permitted, per recent regulations and guidance.

Please note that synonyms have been added to Appendix B-1 to facilitate its use. In instances where no Chemical Abstract System (CAS) number was available, a unique identifier has been assigned to the analyte for database function purposes.

The Relative Risk Comparison Values will be formally updated as part of future Primer revisions to address new data issued from EPA or other sources. The Relative Risk Comparison Values will be posted on the Internet through the U.S. Army Center for Health Promotion and Preventative Medicine home page.

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Acenaphthene		83-32-9	3.6E+02	nc	3.7E+02	nc
Acenaphthylene		207-08-9	6.1E+02	ca	9.2E+01	ca
Acephate		30560-19-1	5.1E+03	ca	7.7E+02	ca
Acetaldehyde	c	75-07-0			9.4E+01	nc
Acetamide,2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl)-(9Cl)		15972-60-8	5.5E+02	ca	8.4E+01	ca
Acetanilide,2-chloro-2',6'-diethyl-N-(methoxymethyl)-		15972-60-8	5.5E+02	ca	8.4E+01	ca
Acetic acid, 2-ethoxyethyl ester		111-15-9	2.0E+04	nc	1.1E+04	nc
Acetic acid, ethenyl ester		108-05-4	6.5E+04	nc	3.7E+04	nc
Acetic acid, ethyl ester		141-78-6	5.9E+04	nc	3.3E+04	nc
Acetic acid, ethylene ether		108-05-4	6.5E+04	nc	3.7E+04	nc
Acetic acid, vinyl ester		108-05-4	6.5E+04	nc	3.7E+04	nc
Acetochlor		34256-82-1	1.3E+03	nc	7.3E+02	nc
Acetone		67-64-1	2.0E+03	n	6.1E+02	nc
Acetone Cyanohydrin		75-86-5	5.2E+01	nc	2.9E+01	nc
Acetonitrile		75-05-8	3.9E+02	nc	2.2E+02	nc
Acetophenone		98-86-2	4.2E+03	nc	3.7E+03	nc
Acetoxyethane		141-78-6	5.9E+04	nc	3.3E+04	nc
1-Acetoxyethylene		108-05-4	6.5E+04	nc	3.7E+04	nc
Acid, ethylenebis(dithio-manganese salt		12427-38-2	3.2E+02	nc	1.8E+02	nc
Acid,methyl-,2-(1-methylethoxy)phenyl ester		114-26-1	2.6E+02	nc	1.5E+02	nc
Acifluorfen		50594-66-6	8.5E+02	nc	4.7E+02	nc
Acrolein		107-02-8	1.2E+03	nc	7.3E+02	nc
Acrylaldehyde		107-02-8	1.3E+03	nc	7.3E+02	nc
Acrylamide		79-06-1	9.8E+00	ca	1.5E+00	ca
Acrylic Acid		79-10-7	3.2E+04	nc	1.8E+04	nc
Acrylic acid, ethyl ester	c	140-66-2	6.5E+01	ca	2.3E+01	ca
Acrylic Aldehyde		107-02-8	1.3E+03	nc	7.3E+02	nc
Acrylon		107-13-1	1.3E+01	ca	3.7E+02	ca
Acrylonitrile		107-13-1	1.3E+01	ca	3.7E+02	ca
Adamsite	a	578-94-9	3.6E+01	ca	NA	NA
2-Aethylamino-4-Isopropylamino-6-Chlor-1,3,5-Triazin		1912-24-9	2.0E+02	ca	3.0E+01	ca
Alachlor		15972-60-8	5.5E+02	ca	8.4E+01	ca
Alar		1596-84-5	9.8E+03	nc	5.5E+03	nc
Aldicarb		116-06-3	6.5E+01	nc	3.7E+01	ca
Aldicarb Sulfone		1646-88-4	6.5E+01	nc	3.7E+01	nc
Aldrin		309-00-2	2.6E+00	ca	4.0E-01	ca
Ally		5585-64-8	1.6E+04	nc	9.1E+03	nc
Allyl Alcohol		107-18-6	3.3E+02	nc	1.8E+02	nc
Allyl Chloride		107-05-1	3.3E+03	nc	1.8E+03	nc
Allylic Alcohol		107-18-6	3.3E+02	nc	1.8E+02	nc
Alpha, Beta-Dichloroethane		107-06-2	4.4E+01	ca	1.2E+01	ca
Alpha,Alpha'-Dithiodis(Methylthio) Formamide		137-26-8	3.3E+02	nc	1.8E+02	nc
alpha,beta-Dichloroethane		107-06-2	4.4E+01	ca	1.2E+01	ca
Alpha,Gamma-Butadiene		106-99-0	8.6E-01	ca	1.1E+00	ca
Alpha-Chloropropylene		107-05-1	3.3E+03	nc	1.8E+03	nc
Alpha-Chlorotoluene		100-44-7	1.4E+02	ca	6.6E+00	ca
Aluminum		7429-90-5	7.7E+04	nc	3.7E+04	nc
Aluminum Phosphide		20859-73-8	3.1E+01	nc	1.5E+01	nc
Amdro		67485-29-4	2.0E+01	nc	1.1E+01	nc
Ametryn		834-12-8	5.9E+02	nc	3.3E+02	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
4-Aminoaniline		106-50-3	1.2E+04	nc	6.9E+03	nc
p-Aminoaniline		106-50-3	1.2E+04	nc	6.9E+03	nc
4-(4-Aminobenzy)Aniline		101-77-9	1.8E+02	ca	2.7E+01	ca
6-Aminocaproic Acid		105-60-2	3.3E+04	nc	1.8E+04	nc
Aminocaproic Lactam		105-60-2	3.3E+04	nc	1.8E+04	nc
1-Amino-4-Chlorobenzene		106-47-8	2.6E+02	nc	1.5E+02	nc
Aminocyclohexane		108-91-8	1.3E+04	nc	7.3E+03	nc
3-Amino-2,5-Dichlorobenzoic Acid		133-90-4	9.8E+02	nc	5.5E+02	nc
4-Amino-6-(1,1-Dimethyl)-3-(Methylthio)-1,2,4-Triazin-One		21087-64-9	1.6E+03	nc	9.1E+02	nc
m-Aminophenol		591-27-5	4.6E+03	nc	2.6E+03	nc
Bis(2-Aminophenyl)Methane		101-77-9	1.8E+02	ca	2.7E+01	ca
Bis(p-Aminophenyl)Methane		101-77-9	1.8E+02	ca	2.7E+01	ca
4-Aminopyridine		504-24-5	1.3E+00	nc	7.3E-01	nc
4-Amino-6-Tert-Butyl-3-(Methlythio)-as-Triazin-5(4H)-one		21087-64-9	1.6E+03	nc	9.1E+02	nc
Amitraz		33089-61-1	1.6E+02	nc	9.1E+01	nc
Ammonia	c	7664-41-7	NA	NA	1.0E+03	nc
Ammonium Sulfamate		7773-06-0	1.3E+04	nc	7.3E+03	nc
Amoben		133-90-4	9.8E+02	nc	5.5E+02	nc
Aniline		62-53-3	1.9E+01	nc	1.1E+01	nc
Aniline, p-chloro-		106-47-8	2.6E+02	nc	1.5E+02	nc
Aniline,N,N-dimethyl-		121-69-7	1.3E+02	nc	7.3E+01	nc
Aniline,N-phenyl-		122-39-4	1.6E+03	nc	9.1E+02	nc
Anthracene		120-12-7	1.9E+01	nc	1.8E+03	nc
Anthracin		120-12-7	1.9E+01	nc	1.8E+03	nc
Antimonious Oxide		1309-64-4	3.1E+01	nc	1.5E+01	nc
Antimony and compounds		7440-36-0	3.1E+01	nc	1.5E+01	nc
Antimony Pentoxide		1314-60-9	3.8E+01	nc	1.8E+01	nc
Antimony Peroxide		1309-64-4	3.1E+01	nc	1.5E+01	nc
Antimony Potassium Tartrate		28300-74-5	6.9E+01	nc	3.3E+01	nc
Antimony Tetroxide		1332-81-6	3.1E+01	nc	1.5E+01	nc
Antimony Trioxide		1309-64-4	3.1E+01	nc	1.5E+01	nc
Antimony-Oxide		1309-64-4	3.1E+01	nc	1.5E+01	nc
Apollo		74115-24-5	8.5E+02	nc	4.7E+02	nc
Aramite		140-57-8	1.8E+03	ca	2.7E+02	ca
Aroclor 1016		12674-11-2	4.9E+00	nc	2.6E+00	nc
Aroclor 1254		11097-69-1	1.4E+00	nc	7.3E-01	nc
Aroclor		1336-36-3	6.6E+00	ca	8.7E-01	ca
Arsenic		7440-38-2	2.2E+01	nc	4.5E+00	ca
Arsine	a	7784-42-1	3.6E+01	ca	NA	NA
Assure		76578-12-6	5.9E+02	nc	3.3E+02	nc
Asulam		3337-71-1	3.3E+03	nc	1.8E+03	nc
Atrazine		1912-24-9	2.0E+02	ca	3.0E+01	ca
Avenge		43222-48-6	5.2E+03	nc	2.9E+03	nc
Avenge (Difenzoquat)		43222-48-6	5.2E+03	nc	2.9E+03	nc
Avermectin B1		71751-41-2	2.6E+01	nc	1.5E+01	nc
1-Aza-2-Cycloheptanone		105-60-2	3.3E+04	nc	1.8E+04	nc
Azabenzene		110-86-1	6.5E+01	nc	3.7E+01	nc
2-Azacycloheptanone		105-60-2	3.3E+04	nc	1.8E+04	nc
2H-azepin-2-one,hexahydro-		105-60-2	3.3E+04	nc	1.8E+04	nc
Azobenzene		103-33-3	4.0E+02	ca	6.1E+01	ca
Barium		7440-39-3	5.3E+03	nc	2.6E+03	nc
Barium Cyanide		542-62-1	7.7E+03	nc	3.7E+03	nc
Baygon		114-26-1	2.6E+02	nc	1.5E+02	nc
Bayleton		43121-43-3	2.0E+03	nc	1.1E+03	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Baythroid		68359-37-5	1.6E+03	nc	9.1E+02	nc
Benefin		1861-40-1	2.0E+04	nc	1.1E+04	nc
Benomyl		17804-35-2	3.3E+03	nc	1.8E+03	nc
Bentazon		25057-89-0	1.6E+02	nc	9.1E+01	nc
Benz(a)Anthracene		56-55-3	6.1E+01	ca	9.2E+00	ca
3,4-Benz(e)Acephenanthrylene		205-99-2	6.1E+01	ca	9.2E+01	ca
1,2-Benzacenaphthene		206-44-0	2.6E+03	ca	1.5E+03	nc
Benzaldehyde		100-52-7	6.5E+03	nc	3.7E+03	nc
Benzenamine,2,6-dinitro-N,N-dipropyl-4-		1582-09-8	5.8E+03	ca	8.7E+02	ca
Benzenamine,4,4'-methylenebis-		101-77-9	1.8E+02	ca	2.7E+01	ca
Benzene		71-43-2	1.4E+02	ca	3.9E+01	ca
Benzene Carbaldehyde		100-52-7	6.5E+03	nc	3.7E+03	nc
Benzene Chloride		108-90-7	1.6E+02	nc	3.9E+01	nc
Benzene, 1,1'-oxybis(2,3,4,5,6-pentabromo-(9Cl)		1163-19-5	6.5E+02	nc	3.7E+02	ca
Benzene, chloro-		108-90-7	1.6E+02	nc	3.9E+01	nc
Benzene, hexachloro-		118-74-1	2.8E+01	ca	4.2E+00	ca
Benzene, methyl-		108-88-3	1.9E+03	nc	7.2E+02	nc
Benzene, p-dichloro-		106-46-7	7.4E+02	ca	4.7E+01	ca
Benzene, 1,2,4-trichloro-		120-82-1	6.2E+02	nc	1.9E+02	nc
Benzene, 1,2-(1,8-naphthylene)-		206-44-0	2.6E+03	ca	1.5E+03	nc
Benzene, hydrazodi-		122-66-7	5.6E+01	ca	8.4E+00	ca
Benzenecarbinol		100-51-6	2.0E+04	nc	1.1E+04	nc
Benzenecarbonal		100-52-7	6.5E+03	nc	3.7E+03	nc
1,4-Benzenediamine		106-50-3	1.2E+04	nc	6.9E+03	nc
p-Benzenediamine		106-50-3	1.2E+04	nc	6.9E+03	nc
1,3-Benzene-dicarbonitrile,2,4,5,6-tetrachloro-		1897-45-6	4.0E+03	ca	6.1E+02	ca
Benzenedicarboxylate		117-84-0	1.3E+03	nc	7.3E+02	nc
1,2-Benzenedicarboxylic Acid, Bis(2-Ethylhexyl)Ester		117-81-7	3.2E+03	ca	4.8E+02	ca
1,2-Benzenedicarboxylic Acid, Dimethyl Ester		131-11-3	1.0E+05	nc	3.7E+05	nc
1,4-Benzenedicarboxylic Acid, Dimethyl Ester (9Cl)		120-61-6	6.5E+03	nc	3.7E+03	nc
1,4-Benzenediol		123-31-9	2.6E+03	nc	1.5E+03	nc
p-Benzenediol		123-31-9	2.6E+03	nc	1.5E+03	nc
Benzenemethanol		100-51-6	2.0E+04	nc	1.1E+04	nc
Benzenemethanol,4-chloro-alpha-(4-chlorophenyl)-alpha-		115-32-2	1.0E+02	ca	1.5E+01	ca
Benzenethiol	c	108-98-5	7.8E-01	nc	3.7E-01	nc
Benzenol		108-95-2	3.9E+04	nc	2.2E+04	nc
2,3-Benzfluoranthene		205-99-2	6.1E+01	ca	9.2E+00	ca
Benzhydrol,4,4'-dichloro-alpha-(trichloromethyl)-		115-32-2	1.0E+02	ca	1.5E+01	ca
Benzidine		92-87-5	1.9E-01	ca	2.9E-02	ca
Benzo Leather Blacke		1937-37-7	5.2E+00	ca	7.8E-01	ca
Benzo(a)Pyrene		50-32-8	6.1E+00	ca	9.2E-01	ca
Benzo(b)Fluoranthene		205-99-2	6.1E+01	ca	9.2E+00	ca
Benzo(def)Phenanthrene		129-00-0	2.0E+03	nc	1.1E+03	nc
Benzo(j)Fluoranthene		205-82-3	6.1E+01	ca	NA	NA
Benzo(jk)Fluorene		206-44-0	2.6E+03	ca	1.5E+03	nc
Benzo(k)Fluoranthene		207-08-9	6.1E+02	ca	9.2E+01	ca
Benzodioxathiepin-3-Oxide		115-29-7	3.3E+00	nc	1.8E+00	nc
Benzoepin		115-29-7	3.3E+00	nc	1.8E+00	nc
11,12-Benzofluoranthene		207-08-9	6.1E+02	ca	9.2E+01	ca
2,3-Benzofluoranthene		205-99-2	6.1E+01	ca	9.2E+00	ca

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
3,4-Benzofluoranthene		205-99-2	6.1E+01	ca	9.2E+00	ca
8,9-Benzofluoranthene		207-08-9	6.1E+02	ca	9.2E+01	ca
Benzoic Acid		65-85-0	1.0E+05	nc	1.5E+05	nc
Benzoic acid,3-amino-2,5-dichloro-		133-90-4	9.8E+02	nc	5.5E+02	nc
Benzoicaldehyde		100-52-7	6.5E+03	nc	3.7E+03	nc
Benzotrichloride		98-07-7	3.4E+00	ca	5.2E-01	ca
Benzyl Alcohol		100-51-6	2.0E+04	nc	1.1E+04	nc
Benzyl Chloride		100-44-7	1.4E+02	ca	6.6E+00	ca
Beryllium and compounds		7440-41-7	1.4E+01	ca	1.6E+00	ca
beta-Chloronaphthalene		91-58-7	5.2E+03	nc	2.9E+03	nc
beta-Ethoxyethyl acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
BHC		608-73-1	2.5E+01	ca	3.7E+00	ca
N,N'-Bianiline		122-66-7	5.6E+01	ca	8.4E+00	ca
Bidrin		141-66-2	6.5E+00	nc	3.7E+00	nc
2,3,1',8'-Binaphthylene		207-08-9	6.1E+02	ca	9.2E+01	ca
Biphenthrin (Talstar)		82657-04-3	9.8E+02	nc	5.5E+02	nc
1,1-Biphenyl		92-52-4	3.3E+03	nc	1.8E+03	nc
Biphenyl, polychloro-		1336-36-3	6.6E+00	ca	8.7E-01	ca
Bis(4-aminophenyl)methane		101-77-9	1.8E+02	ca	2.7E+01	ca
Bis(p-aminophenyl)methane		101-77-9	1.8E+02	ca	2.7E+01	ca
Bis(beta-chloroethyl) ether		111-44-4	7.4E+00	ca	9.8E-01	ca
Bis(2-Chloroethyl)Ether		111-44-4	7.4E+00	ca	9.8E-01	ca
bis(2-chloroethyl)sulfide	d	505-60-2	2.7E+00	nc	2.6E-01	nc
Bis(2-Chloroisopropyl)Ether		39638-32-9	3.9E+02	ca	2.7E+01	ca
Bis(Chloromethyl)Ether		542-88-1	1.4E-02	ca	5.2E-03	ca
Bis(2-Chloro-1-Methylethyl)Ether		108-60-1	6.3E+02	ca	9.6E+01	ca
1,1-Bis(p-Chlorophenol)-2,2,2-Trichloroethanol		115-32-2	1.0E+02	ca	1.5E+01	ca
Bis(1-chloro-2-propyl)ether		108-60-1	6.3E+02	ca	9.6E+01	ca
Bis((dimethylamino)carbono-thioyl)disulphide		137-26-8	3.3E+02	nc	1.8E+02	nc
Bis(dimethylthiocarbamoyl) disulfide		137-26-8	3.3E+02	nc	1.8E+02	nc
Bis(2-Ethylhexyl)Phthalate		117-81-7	3.2E+03	ca	4.8E+02	ca
Bis(p-isocyanoto-phenyl)methane		101-68-8	3.7E-01	nc	2.1E-01	nc
Bis(pentabromophenyl) ether		1163-19-5	6.5E+02	nc	3.7E+02	ca
Bisphenol A		80-05-7	3.3E+03	nc	1.8E+03	nc
Bivinyl		106-99-0	8.6E-01	ca	1.1E+00	ca
Boron		7440-42-8	5.9E+03	nc	3.3E+03	nc
Bromodichloromethane		75-27-4	1.4E+02	ca	1.8E+01	ca
Bromoethene		593-60-2	4.5E+01	ca	1.0E+01	ca
Bromoform		75-25-2	5.6E+03	ca	8.5E+02	ca
Bromofume		106-93-4	5.1E-01	ca	7.6E-02	ca
Bromomethane		74-83-9	1.5E+01	nc	8.7E+00	nc
4-Bromophenyl Phenyl Ether	c	101-55-3	4.5E+03	nc	2.1E+03	nc
Bromophos		2104-96-3	3.3E+02	nc	1.8E+02	nc
Bromoxynil		1689-84-5	1.3E+03	nc	1.8E+02	nc
Bromoxynil Octanoate		1689-99-2	1.3E+03	nc	7.3E+02	nc
Butadiene		106-99-0	8.6E-01	ca	1.1E+00	ca
1,3-Butadiene		106-99-0	8.6E-01	ca	1.1E+00	ca
1,3-Butadiene,2-chloro-		126-99-8	6.3E+00	nc	1.4E+01	nc
Butane, 1-chloro-		109-69-3	1.0E+03	sat nc	2.4E+03	nc
1-Butanol		71-36-3	6.5E+03	nc	3.7E+03	nc
2-Butenal, (E)-		123-73-9	1.6E+00	nc	5.9E-01	ca
2-Butenal		123-73-9	1.6E+00	ca	5.9E-01	ca
1,2-Butene Oxide		106-88-7	3.7E+02	nc	2.1E+02	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
1-Butene Oxide		106-88-7	3.7E+02	nc	2.1E+02	nc
Butene, 1,2-epoxy-		106-88-7	3.7E+02	nc	2.1E+02	nc
2-Butoxy Ethanol		111-76-2	3.7E+02	nc	2.1E+02	nc
Butoxyethanol		111-76-2	3.7E+02	nc	2.1E+02	nc
2-Butoxy-1-Ethanol		111-76-2	3.7E+02	nc	2.1E+02	nc
n-Butoxyethanol		111-76-2	3.7E+02	nc	2.1E+02	nc
Butyl Benzyl Phthalate		85-68-7	1.3E+04	nc	7.3E+03	nc
Butyl Cellosolve		111-76-2	3.7E+02	nc	2.1E+02	nc
Butyl Chloride		109-69-3	1.0E+03	sat nc	2.4E+03	nc
n-Butyl chloride		109-69-3	1.0E+03	sat nc	2.4E+03	nc
Butylate		2008-41-5	3.3E+03	nc	1.8E+03	nc
sec-Butylbenzene	c	135-98-8	7.8E+02	nc	6.1E+01	nc
tert-Butylbenzene	c	104-51-8	7.8E+02	nc	6.1E+01	nc
Butyl-3-(Methylthio)-1,2,4-Triazin-5-One		21087-64-9	1.6E+03	nc	9.1E+02	nc
Butylphthalyl Butylglycolate		85-70-1	6.5E+04	nc	3.7E+04	nc
Cacodylic Acid		75-60-5	2.0E+02	nc	1.1E+02	nc
Cadmium and compounds		7440-43-9	3.8E+01	nc	1.8E+01	nc
Calcium Cyanide		592-01-8	3.1E+03	nc	1.5E+03	nc
Caprolactam		105-60-2	3.3E+04	nc	1.8E+04	nc
Captafol		2425-06-1	5.2E+03	ca	7.8E+02	ca
Captan		133-06-2	1.3E+04	ca	1.9E+03	ca
Carbamic acid, methyl-,o-isopropoxyphenyl ester		114-26-1	2.6E+02	nc	1.5E+02	nc
Carbamic acid,diisobutylthio-, s-ethyl ester		2008-41-5	3.3E+03	nc	1.8E+03	nc
Carbamic acid,methyl-,2,3-dihydro-2,2-dimethyl-7-benzofuranyl		1563-66-2	3.3E+02	nc	1.8E+02	nc
Carbaryl		63-25-2	6.5E+03	nc	3.7E+03	nc
Carbazole		86-74-8	2.2E+03	ca	3.4E+02	ca
Carbitol		111-90-0	1.1E+05	nc	7.3E+04	nc
Carbitol Cellosolve		111-90-0	1.1E+05	nc	7.3E+04	nc
Carbofuran		1563-66-2	3.3E+02	nc	1.8E+02	nc
Carbon Dichloride		127-18-4	7.0E+02	ca	1.1E+02	ca
Carbon Disulfide		75-15-0	1.6E+01	nc	2.1E+01	nc
Carbon Tetrachloride		56-23-5	4.7E+01	ca	1.7E+01	ca
Carbosulfan		55285-14-8	6.5E+02	nc	3.7E+02	nc
Carboxin		5234-68-4	6.5E+03	nc	3.7E+03	nc
Cellosolve Acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
Cellosolve		110-80-5	2.6E+04	nc	1.5E+04	nc
Chloral		302-17-0	1.3E+02	nc	7.3E+01	nc
Chlorallylene		107-05-1	3.3E+03	nc	1.8E+03	nc
Chloramben		133-90-4	9.8E+02	nc	5.5E+02	nc
Chlorambene		133-90-4	9.8E+02	nc	5.5E+02	nc
Chloramide		10599-90-3	6.5E+03	nc	3.7E+03	nc
Chloramine		10599-90-3	6.5E+03	nc	3.7E+03	nc
Chloranil		118-75-2	1.1E+02	ca	1.7E+01	ca
Chlordane		57-74-9	3.4E+01	ca	5.2E+00	ca
Chlordane, alpha- (2)		57-74-9	3.4E+01	ca	5.2E+00	ca
Chlordane, gamma-		57-74-9	3.4E+01	ca	5.2E+00	ca
Chlorimuron-Ethyl		90982-32-4	1.3E+03	nc	7.3E+02	nc
Chlorinated Biphenyl		1336-36-3	6.6E+00	ca	8.7E-01	ca
Chlorine		7782-50-5	7.7E+03	nc	3.7E+03	nc
Chloro-1,3-butadiene, 2-		126-99-8	6.3E+00	nc	1.4E+01	nc
Chloro-2,2-methylaniline hydrochloride, 4-		3165-93-3	9.7E+01	ca	1.5E+01	ca
Chloro-2-methylaniline, 4-		95-69-2	7.7E+01	ca	1.2E+01	ca

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
1-Chloro-4-Nitrobenzene		95-69-2	7.7E+01	ca	1.2E+01	ca
4-Chloro-Alpha-(4-Chlorophenyl)-Alpha-Benzenemethanol		115-32-2	1.0E+02	ca	1.5E+01	ca
Chloroacetaldehyde	c	107-20-0	5.4E+02	nc	2.5E+02	nc
Chloroacetic Acid		79-11-8	1.3E+02	nc	7.3E+01	nc
2-Chloroacetophenone		532-27-4	7.5E-02	nc	5.2E-02	nc
4-Chloroaniline		106-47-8	2.6E+02	nc	1.5E+02	nc
p-Chloroaniline		106-47-8	2.6E+02	nc	1.5E+02	nc
4-Chlorobenzenamine		106-47-8	2.6E+02	nc	1.5E+02	nc
Chlorobenzene		108-90-7	1.6E+02	nc	3.9E+01	nc
p-Chlorobenzene		106-46-7	7.4E+02	ca	4.7E+01	ca
Chlorobenzilate		510-15-6	1.6E+02	ca	2.5E+01	ca
p-Chlorobenzoic Acid		74-11-3	1.3E+04	nc	7.3E+03	nc
Chlorobenzol		108-90-7	1.6E+02	nc	3.9E+01	nc
4-Chlorobenzotrifluoride		98-56-6	1.3E+03	nc	7.3E+02	nc
2-Chloro-4,6-Bis(Ethylamino)-s-Triazine		122-34-9	3.7E+02	ca	5.6E+01	ca
1-Chloro-3,5-Bisethylamino-2,4,6-Triazine		122-34-9	3.7E+02	ca	5.6E+01	ca
Chlorobutadiene		126-99-8	6.3E+00	nc	1.4E+01	nc
2-Chloro-1,3-Butadiene		126-99-8	6.3E+00	nc	1.4E+01	nc
1-Chlorobutane		109-69-3	1.0E+03	sat nc	2.4E+03	nc
Chlorodibromomethane		124-48-1	5.3E+02	ca	1.0E+02	ca
2-Chloro-N-(2,6-Diethyl)Phenyl-N-Methoxymethylacetamide		15972-60-8	5.5E+02	ca	8.4E+02	ca
6-Chloro-N,N'-Diethyl-1,3,5-Triazine-2,4-Diamine		122-34-9	3.7E+02	ca	5.6E+01	ca
2-Chloro-2,6'-Diethyl-N-(Methoxy-methyl)Acetanilide		15972-60-8	5.5E+02	ca	8.4E+02	ca
Chlorodifluoroethane		75-45-6	5.7E+02	sat nc	8.7E+04	nc
1-Chloro-1,1-Difluoroethane		75-45-6	5.7E+02	sat nc	8.7E+04	nc
1-Chloro-2,3-Epoxypropane		106-89-8	1.2E+01	nc	2.0E+00	nc
3-Chloro-1,2-Epoxypropane		106-89-8	1.2E+01	nc	2.0E+00	nc
Chloroethane		75-00-3	3.1E+04	nc	8.6E+03	nc
(2-Chloroethoxy)ethene	c	110-75-8	2.0E+03	nc	1.5E+02	nc
2-Chloroethyl Ether		111-44-4	7.4E+00	ca	9.8E-01	ca
2-Chloroethyl Phosphonic Acid		16672-87-0	3.3E+02	nc	1.8E+02	nc
2-Chloroethyl Vinyl Ether	c	110-75-8	2.0E+03	nc	1.5E+02	nc
Bis(2-Chloroethyl)Ether		111-44-4	7.4E+00	ca	9.8E-01	ca
Bis(beta-Chloroethyl)Ether		111-44-4	7.4E+00	ca	9.8E-01	ca
Chloroform		67-66-3	5.3E+01	ca	1.6E+01	ca
Chloromethane		74-87-6	2.0E+02	ca	1.5E+02	ca
2-(Chloromethyl)Oxirane		106-89-8	1.2E+01	nc	2.0E+00	nc
4-Chloro-2-Methylaniline Hydrochloride		3165-93-3	9.7E+01	ca	1.5E+01	ca
4-Chloro-2-Methylaniline		95-69-2	7.7E+01	ca	1.2E+01	ca
Chloromethylbenzene		100-44-7	1.4E+02	ca	6.6E+00	ca
beta-Chloronaphthalene		91-58-7	5.2E+03	nc	2.9E+03	nc
4-Chloro-1-Nitrobenzene		91-58-7	5.2E+03	ca	2.9E+03	nc
o-Chloronitrobenzene		88-73-3	1.8E+03	ca	2.7E+02	ca
p-Chloronitrobenzene		100-00-5	2.5E+03	ca	3.7E+02	ca
1-Chloro-4-Nitrobenzene		100-00-5	2.5E+03	ca	3.7E+02	ca
2-Chlorophenol		95-57-8	3.3E+02	nc	1.8E+02	nc
p-Chlorophenyl chloride		106-46-7	7.4E+02	ca	4.7E+01	ca
4-Chlorophenylamine		106-47-8	2.6E+02	nc	1.5E+02	nc
Chlorophenylmethane		100-44-7	1.4E+02	ca	6.6E+00	ca
Chloropicrin	a	76-06-2	1.6E+02	nc	NA	NA
Chloroprene		126-99-8	6.3E+00	nc	1.4E+01	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
3-Chloroprene		107-05-1	3.3E+03	nc	1.8E+03	nc
Beta-Chloroprene		126-99-8	6.3E+00	nc	1.4E+01	nc
2-Chloropropane		75-29-6	3.5E+02	sat nc	1.7E+02	nc
3-Chloropropene		107-05-1	3.3E+03	nc	1.8E+03	nc
Bis(1-Chloro-2-Propyl)Ether		108-60-1	6.3E+02	ca	9.6E+01	ca
3-Chloro-1,2-Propylene Oxide		106-89-8	1.2E+01	nc	2.0E+00	nc
3-Chloropropylene		107-05-1	3.3E+03	nc	1.8E+03	nc
Chlorothanlonil		1897-45-6	4.0E+03	ca	6.1E+02	ca
o-Chlorotoluene		95-49-8	3.4E+02	nc	1.2E+02	nc
Chlorpropham		101-21-3	1.3E+04	nc	7.3E+03	nc
Chlorpyrifos		2921-88-2	2.0E+02	nc	1.1E+02	nc
Chlorpyrifos-Methyl		5598-13-0	6.5E+02	nc	3.7E+02	nc
Chlorsulfuron		64902-72-3	3.3E+03	nc	1.8E+03	nc
Chlorthiophos		602-38-56-4	5.2E+01	nc	2.9E+01	nc
Chrome leather brilliant blacker		1937-37-7	5.2E+00	ca	7.8E-01	ca
Chromium		7440-47-3	3.0E+03	ca	1.8E+02	nc
Chrysene		218-01-9	2.4E+03	ca	9.2E+02	ca
cis-1,2-Dichloroethylene		156-59-2	5.9E+01	nc	6.1E+01	nc
cis-Butenedioic Anhydride		108-31-6	6.5E+03	nc	3.7E+03	nc
cis-Dichloroethylene		156-59-2	5.9E+01	nc	6.1E+01	nc
Colbalt		7440-48-4	4.6E+03	nc	2.2E+03	nc
Copper and compounds		7440-48-4	2.8E+03	nc	1.4E+03	nc
Copper Cyanide		544-92-3	3.8E+02	nc	1.8E+02	nc
Counter Solid Insecticide		13071-79-9	1.6E+00	nc	9.1E-01	nc
2-Cresol		95-48-7	3.3E+03	nc	1.8E+03	nc
3-Cresol		108-39-4	3.3E+03	nc	1.8E+03	nc
4-Cresol		106-44-5	3.3E+02	nc	1.8E+02	nc
m-Cresol		108-39-4	3.3E+03	nc	1.8E+03	nc
o-Cresol		95-48-7	3.3E+03	nc	1.8E+03	nc
p-Cresol		106-44-5	3.3E+02	nc	1.8E+02	nc
p-Cresylic acid		106-44-5	3.3E+02	nc	1.8E+02	nc
Crotonal		123-73-9	1.6E+00	ca	5.9E-01	ca
Crotonaldehyde		123-73-9	1.2E+00	ca	5.9E-01	ca
Crotonaldehyde, (E)-		123-73-9	1.2E+00	ca	5.9E-01	ca
Cumene		98-82-8	4.9E+01	sat nc	1.9E+01	nc
Cyanazine		21725-46-2	5.3E+01	ca	8.0E+00	ca
Cyanide (free)		57-12-5	1.3E+03	nc	7.3E+02	nc
Cyanide of potassium		151-50-8	3.3E+03	nc	1.8E+03	nc
Cyanide of sodium		143-33-9	2.6E+03	nc	1.5E+03	nc
2-Cyanoethanol		109-78-4	2.0E+04	nc	1.1E+04	nc
2-Cyanoethyl Alcohol		109-78-4	2.0E+04	nc	1.1E+04	nc
Cyanogen		460-19-5	2.6E+03	nc	1.5E+03	nc
Cyanogen Bromide		506-68-3	5.9E+03	nc	3.3E+03	nc
Cyanogen Chloride		506-77-4	3.3E+03	nc	1.8E+03	nc
Cyanopropene-1		126-98-7	1.3E+00	nc	1.0E+00	nc
Cyclohexanamine		108-91-8	1.3E+04	nc	7.3E+03	nc
Cyclohexane, methyl-		108-87-2	5.6E+04	nc	3.1E+04	nc
Cyclohexanone		108-94-1	1.0E+05	max	1.8E+05	nc
Cyclohexlamine		108-91-8	1.3E+04	nc	7.3E+03	nc
Cyclohexyl Amine		108-91-8	1.3E+04	nc	7.3E+03	nc
Cyclohexyl Ketone		108-94-1	1.0E+05	max	1.8E+05	nc
Cyclohexylamine		108-91-8	1.3E+04	nc	7.3E+03	nc
Cyclohexylmethane		108-87-2	5.6E+04	nc	3.1E+04	nc
Cyclonite		121-82-4	4.0E+02	ca	6.1E+01	ca
1,8-Cyclopenta(de)Naphthalene		207-08-9	6.1E+02	ca	9.2E+01	ca
Cyhalothrin/Karate		68085-85-8	3.3E+02	nc	1.8E+02	nc
Cypermethrin		52315-07-8	6.5E+02	nc	3.7E+02	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Cyromazine		66215-27-8	4.9E+02	nc	2.7E+02	nc
Daconil 2787		1897-45-6	4.0E+03	ca	6.1E+02	ca
Dacthal		1861-32-1	6.5E+02	nc	3.7E+02	nc
Dalapon		75-99-0	2.0E+03	nc	1.1E+03	nc
Danitol		39515-41-8	1.6E+03	nc	9.1E+02	nc
2,4-DCP		120-83-2	2.0E+02	nc	1.1E+02	nc
DDD		72-54-8	1.9E+02	ca	2.8E+01	ca
4,4-DDD		72-54-8	1.9E+02	ca	2.8E+01	ca
DDE		72-55-9	1.3E+02	ca	2.0E+01	ca
4,4-DDE		72-55-9	1.3E+02	ca	2.0E+01	ca
DDT		50-29-3	1.3E+02	ca	2.0E+01	ca
4,4-DDT		50-29-3	1.3E+02	ca	2.0E+01	ca
Decabromobiphenyl Ether		1163-19-5	6.5E+02	nc	3.7E+02	ca
Decabromodiphenyl Ether		1163-19-5	6.5E+02	nc	3.7E+02	ca
Decabromodiphenyl Oxide		1163-19-5	6.5E+02	nc	3.7E+02	ca
DEHP		117-81-7	3.2E+03	ca	4.8E+02	ca
Demeton		8065-48-3	2.6E+00	nc	1.5E+00	nc
Di-(p-chlorophenyl) trichloromethylcarbinol		115-32-2	1.0E+02	ca	1.5E+01	ca
Diallate		2303-16-4	7.3E+02	ca	1.1E+02	ca
p-Diaminobenzene		106-50-3	1.2E+04	nc	6.9E+03	nc
1,2-Diaminoethane		107-15-3	1.3E+03	nc	7.3E+02	nc
Diazinon		333-41-5	5.9E+01	nc	3.3E+01	nc
Dibenz[ah]anthracene		53-70-3	6.1E+00	ca	9.2E-01	ca
Dibenz(a,h)Acridine	j	RRSE-001	6.1E+01	ca	NA	NA
Dibenz(a,j)Acridine		224-42-0	6.1E+00	ca	9.2E-01	ca
Dibenz(a,h)Anthracene		53-70-3	6.1E+00	ca	9.2E-01	ca
Dibenzo(b,e)(1,4)dioxin,2,3,7,8-tetrachloro-		1746-01-6	3.8E-04	ca	4.5E-05	ca
Dibenzo-p-dioxin,2,3,7,8-tetrachloro-		1746-01-6	3.8E-04	ca	4.5E-05	ca
7H-Dibenzo(c,g)Carbazole		RRSE-002	6.1E+01	ca	NA	NA
Dibenzo(b,jk)Fluorene		207-08-9	6.1E+02	ca	9.2E+01	ca
Dibenzofuran		132-64-9	2.6E+02	nc	1.5E+02	nc
1,2,5,6-Dibenzonaphthalene		218-01-9	2.4E+01	ca	9.2E+02	ca
Dibenzo(a,e)Pyrene		RRSE-003	6.1E+00	ca	NA	NA
Dibenzo(a,h)Pyrene		RRSE-004	6.1E+00	ca	NA	NA
Dibenzo(a,i)Pyrene		RRSE-005	6.1E-01	ca	NA	NA
Dibenzo(a,l)Pyrene		RRSE-006	6.1E-01	ca	NA	NA
1,4-Dibromobenzene		106-37-6	6.5E+02	nc	3.7E+02	nc
Dibromochloromethane		124-48-1	5.3E+02	ca	1.0E+02	ca
1,2-Dibromo-3-Chloropropane		96-12-8	3.2E+01	ca	4.8E+00	ca
Dibromoethane		106-93-4	5.1E-01	ca	7.6E-02	ca
1,2-Dibromoethane		106-93-4	5.1E-01	ca	7.6E-02	ca
Dibutyl Phthalate		84-74-2	6.5E+03	nc	3.7E+03	nc
Dicamba		1918-00-9	2.0E+03	nc	1.1E+03	nc
Dichloro-2-butene, 1,4-		764-41-0	7.6E-01	ca	1.2E-01	ca
2,5-Dichloro-3-Aminobenzoic Acid		133-90-4	9.8E+02	nc	5.5E+02	nc
4,4'-Dichloro-alpha-(Trichloro-methyl)Benzydrol		115-32-2	1.0E+02	ca	1.5E+01	ca
1,4-Dichlorobenzene(p)		106-46-7	7.4E+02	ca	4.7E+01	ca
1,2-Dichlorobenzene		95-50-1	2.3E+03	nc	3.7E+02	nc
1,3-Dichlorobenzene		541-73-1	2.8E+03	nc	NA	NA
1,4-Dichlorobenzene		106-46-7	7.4E+02	ca	4.7E+01	ca
p-Dichlorobenzene		106-46-7	7.4E+02	ca	4.7E+01	ca
3,3'-Dichlorobenzidine		91-94-1	9.9E+01	ca	1.5E+01	ca
3,3-Dichlorobenzidine		91-94-1	9.9E+01	ca	1.5E+01	ca

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
1,4-Dichloro-2-Butene		764-41-0	7.6E-01	ca	1.2E-01	ca
Dichloro(2-Chlorovinyl)arsine	e	541-25-3	3.9E+01	nc	3.7E+00	nc
Dichlorodiethyl Ether		111-44-4	7.4E+00	ca	9.8E-01	ca
Dichlorodifluoromethane		75-71-8	1.1E+02	nc	3.9E+02	nc
Dichlorodiisopropyl Ether		108-60-1	6.3E+02	ca	9.6E+01	ca
1,1-Dichloroethane		75-34-3	8.4E+02	nc	8.1E+02	nc
1,2-Dichloroethane (EDC)		107-06-2	4.4E+01	ca	1.2E+01	ca
2,2'-Dichloroethyl Ether		111-44-4	7.4E+00	ca	9.8E-01	ca
1,2-Dichloroethylene (cis)		156-59-2	5.9E+01	nc	6.1E+01	nc
1,2-Dichloroethylene (Total)		540-59-0	7.5E+01	nc	5.5E+01	nc
1,2-Dichloroethylene (trans)		156-60-5	1.7E+02	nc	1.2E+02	nc
1,1-Dichloroethylene		75-35-4	3.8E+00	ca	4.6E+00	ca
1,2-Dichloroethylene (mixture)		540-59-0	7.5E+01	nc	5.5E+01	nc
1,2-Dichloroethylene, (z)-		156-59-2	5.9E+01	nc	6.1E+01	nc
2,4-Dichlorohydroxybenzene		120-83-2	2.0E+02	nc	1.1E+02	nc
2,4-Dichlorophenol		120-83-2	2.0E+02	nc	1.1E+02	nc
4-(2,4-Dichlorophenoxy)Butyric Acid (2,4-DB)		94-82-6	5.2E+02	nc	2.9E+02	nc
2,4-Dichlorophenoxyacetic Acid (2,4-D)		94-75-7	6.5E+02	nc	3.7E+02	nc
Di-(p-Chlorophenyl)-Trichloromethyl-carbinol		115-32-2	1.0E+02	ca	1.5E+01	ca
Dichloropropane		78-87-5	6.8E+01	ca	1.6E+01	ca
1,2-Dichloropropane		78-87-5	6.8E+01	ca	1.6E+01	ca
2,3-Dichloropropanol		616-23-9	2.0E+02	nc	1.1E+02	nc
Dichloropropene		542-75-6	5.1E+01	ca	8.1E+00	ca
1,3-Dichloropropene		542-75-6	5.1E+01	ca	8.1E+00	ca
Dichlorvos		62-73-7	1.5E+02	ca	2.3E+01	ca
Dicofol		115-32-2	1.0E+02	ca	1.5E+01	ca
Dicyclopentadiene		77-73-6	NA	NA	4.2E-01	nc
Dieldrin		60-57-1	2.8E+00	ca	4.2E-01	ca
Diethyl mercaptosuccinate s-ester with O,O-		121-75-5	1.3E+03	nc	7.3E+02	nc
O,O-Diethyl Mercaptosuccinate		121-75-5	1.3E+03	nc	7.3E+02	nc
Diethyl Phthalate		84-66-2	5.2E+04	nc	2.9E+04	nc
(Diethylamino)Ethane		121-44-8	1.0E+01	nc	1.2E+01	nc
1,4-Diethylene Dioxide		123-91-1	1.8E+03	ca	1.0E+02	ca
Diethylene Glycol Ethyl Ether		111-90-0	1.1E+05	nc	7.3E+04	nc
Diethylene Glycol, Monobutyl Ether		112-34-5	3.7E+02	nc	2.1E+02	nc
Diethylene Glycol, Monoethyl Ether		111-90-0	1.0E+05	nc	7.3E+04	nc
1,4-Diethyleneoxide		123-91-1	1.8E+03	ca	1.0E+02	ca
N,N-Diethylethanamine		121-44-8	1.0E+01	nc	1.2E+01	nc
Diethylformamide		617-84-5	7.2E+02	nc	4.0E+02	nc
Di(2-Ethylhexyl)Adipate		103-23-1	3.7E+02	nc	5.6E+01	nc
Di(2-Ethylhexyl)Orthophthalate		117-81-7	3.2E+03	ca	4.8E+02	ca
Di(2-Ethylhexyl)Phthalate		117-81-7	3.2E+03	ca	4.8E+02	ca
Diethylstilbestrol		56-53-1	9.5E-03	ca	1.4E-03	ca
Difenzoquat (Avenge)		43222-48-6	5.2E+03	nc	2.9E+03	nc
Diflubenzuron		35367-38-5	1.3E+03	nc	7.3E+02	nc
1,1-Difluoroethane		75-37-6	NA	NA	6.9E+04	nc
Dihydro-2,2-Dimethyl-7-Benzofuranyl Ester		1563-66-2	3.3E+02	nc	1.8E+02	nc
Dihydroxybenzene		123-31-9	2.6E+03	nc	1.5E+03	nc
1,4-Dihydroxybenzene		123-31-9	2.6E+03	nc	1.5E+03	nc
p-Dihydroxybenzene		123-31-9	2.6E+03	nc	1.5E+03	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Diisobutylthiocarbamic Acid s-Ethyl Ester		2008-41-5	3.3E+03	nc	1.8E+03	nc
4,4'-Diisocyanatodiphenyl-methane		101-68-8	3.7E-01	nc	2.1E-01	nc
Diisopropyl Methylphosphonate (DIMP)		1445-75-6	5.2E+03	nc	2.9E+03	nc
S-2-Diisopropylaminoethyl O-ethyl methylphosphonothioate	i	50782-69-9	2.7E-01	nc	2.6E-02	nc
Dimethipin		55290-64-7	1.3E+03	nc	7.3E+02	nc
Dimethoate		60-51-5	1.3E+01	nc	7.3E+00	nc
3,3'-Dimethoxybenzidine	c	119-90-4	3.2E+03	ca	4.8E+02	ca
Dimethyl 1,4-benzenedicarboxylate		120-61-6	6.5E+03	nc	3.7E+03	nc
Dimethyl Dithiophosphate		121-75-5	1.3E+03	nc	7.3E+02	nc
Dimethyl Phthalate		131-11-3	1.0E+05	nc	3.7E+05	nc
Dimethyl-p-Phthalate		120-61-6	6.5E+03	nc	3.7E+03	nc
Dimethyl Terephthalate		120-61-6	6.5E+03	nc	3.7E+03	nc
Dimethylamdioethoxy-phosphoryl cyanide	f	77-81-6	1.6E+01	nc	1.5E+00	nc
Dimethylamine		124-40-3	6.2E-02	nc	3.5E-02	nc
Bis((Dimethylamino) Carbonothiol) Disulphide		137-26-8	3.3E+02	nc	1.8E+02	nc
(Dimethylamino)benzene		121-69-7	1.3E+02	nc	7.3E+01	nc
Dimethylaminoethoxy-cyanophosphine oxide	f	77-81-6	1.6E+01	nc	1.5E+00	nc
Bis(p-Dimethylaminophenyl) Methane		101-61-1	9.7E+02	ca	1.5E+02	ca
Dimethylaniline		121-69-7	1.3E+02	nc	7.3E+01	nc
2,4-Dimethylaniline Hydrochloride		21436-96-4	7.7E+01	ca	1.2E+01	ca
2,4-Dimethylaniline		95-68-1	5.9E+01	ca	9.0E+00	ca
N-N-Dimethylaniline		121-69-7	1.3E+02	nc	7.3E+01	nc
7,12-Dimethylbenzanthracene		57-97-6	6.1E-01	ca	NA	NA
Dimethylbenzene		1330-20-7	9.9E+02	sat nc	1.4E+03	nc
1,3-Dimethylbenzene		108-38-3	9.9E+02	sat nc	1.4E+03	nc
1,4-Dimethylbenzene		106-42-3	9.9E+02	sat nc	5.2E+02	nc[c]
p-Dimethylbenzene		106-42-3	9.9E+02	sat nc	5.2E+02	nc[c]
N,N-Dimethylbenzeneamine		121-69-7	1.3E+02	nc	7.3E+01	nc
Dimethyl-1,4-Benzene dicarboxylate		120-61-6	6.5E+03	nc	3.7E+03	nc
3,3'-Dimethylbenzidine		119-93-7	4.8E+00	ca	7.3E-01	ca
(((1,1-Dimethylethyl)Thio)Methyl) o,o-Diethyl Ester		13071-79-9	1.6E+00	nc	9.1E-01	nc
N,N-Dimethylformamide		68-12-2	6.5E+03	nc	3.7E+03	nc
1,1-Dimethylhydrazine		57-14-7	1.7E+01	ca	2.6E+00	ca
1,2-Dimethylhydrazine		540-73-8	1.2E+00	ca	1.8E-01	ca
2,4-Dimethylphenol		105-67-9	1.3E+03	nc	7.3E+02	nc
2,6-Dimethylphenol		576-26-1	3.9E+01	nc	2.2E+01	nc
3,4-Dimethylphenol		95-65--8	6.5E+01	nc	3.7E+01	nc
4,6-Dimethylphenol		105-67-9	1.3E+03	nc	7.3E+02	nc
Dimethylphenylamine		121-69-7	1.3E+02	nc	7.3E+01	nc
Dimethylphosphoramido-cyanidic acid, ethyl ester	f	77-81-6	1.6E+01	nc	1.5E+00	nc
Bis(Dimethylthiocarbamoyl) Disulfide		137-26-8	3.3E+02	nc	1.8E+02	nc
1,1-Dimethyl-3-(3-Trifluoromethyl-phenyl)Urea		2164-17-2	8.5E+02	nc	4.7E+02	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
1,1-Dimethyl-3-(alpha, alpha, alpha-Trifluoro-m-Tolyl)Urea		2164-17-2	8.5E+02	nc	4.7E+02	nc
Dinitotoluene		121-14-2	1.3E+02	nc	7.3E+01	nc
1,2-Dinitrobenzene		528-29-0	2.6E+01	nc	1.5E+01	nc
1,3-Dinitrobenzene		99-65-0	6.5E+00	nc	3.7E+00	nc
1,4-Dinitrobenzene		100-25-4	2.6E+01	nc	1.5E+01	nc
4,6-Dinitro-o-cyclohexyl Phenol		131-89-5	1.3E+02	nc	7.3E+01	nc
2,6-Dinitro-N,N-Dipropyl-4-Benzenamine		1582-09-8	5.8E+03	ca	8.7E+02	ca
2,4-Dinitrophenol		51-28-5	1.3E+02	nc	7.3E+01	nc
1,6-Dinitropyrene		RRSE-007	2.8E-01	ca	NA	NA
1,8-Dinitropyrene		RRSE-008	6.1E-01	ca	NA	NA
Dinitrotoluene Mixture		25321-14-6	6.5E-01	ca	9.9E-02	ca
2,4-Dinitrotoluene		121-14-2	1.3E+02	nc	7.3E+01	nc
2,6-Dinitrotoluene		606-20-2	6.5E+01	ca	3.7E+01	ca
2,4-Dinitrotouol		121-14-2	1.3E+02	nc	7.3E+01	nc
Dinitro-4-Trifluoromethylaniline		1582-09-8	5.8E+03	ca	8.7E+02	ca
Dinoseb		88-85-7	6.5E+01	nc	3.7E+01	nc
Di-n-Octyl Phthalate		117-84-0	1.3E+03	nc	7.3E+02	nc
Dioxane		123-91-1	1.8E+03	ca	1.0E+02	ca
1,4-Dioxane		123-91-1	1.4E+03	ca	1.0E+02	ca
p-Dioxane		123-91-1	1.4E+03	ca	1.0E+02	ca
Dioxin		1746-01-6	3.8E-04	ca	4.5E-05	ca
1,4-Dioxyacyclohexane		123-91-1	1.4E+03	ca	1.0E+02	ca
Diphenamid		957-51-7	2.0E+03	nc	1.1E+03	nc
Diphenyl Fast Brown		16071-86-6	4.8E+00	ca	7.2E-01	ca
1,2-Diphenyl hydrazine		122-66-7	5.6E+01	ca	8.4E+00	ca
4,4'-Diphenyl Methane Diisocyante		101-68-8	3.7E-01	nc	2.1E-01	nc
Diphenylamine		122-39-4	1.6E+03	nc	9.1E+02	nc
N,N-Diphenylamine		122-39-4	1.6E+03	nc	9.1E+02	nc
N,N'-Diphenylhydrazine		122-66-7	5.6E+01	ca	8.4E+00	ca
1,2-Diphenylhydrazine		122-66-7	5.6E+01	ca	8.4E+00	ca
Dipropanoate (9Cl)		123-73-9	1.6E+00	ca	5.9E-01	ca
Dipropyl-4-(Trifluoromethyl) Benzenamine		1582-09-8	5.8E+03	ca	8.7E+02	ca
Diquat		85-00-7	1.4E+02	nc	8.0E+01	nc
Direct Black 38		1937-37-7	5.2E+00	ca	7.8E-01	ca
Direct black N		1937-37-7	5.2E+00	ca	7.8E-01	ca
Direct Blue 6		2602-46-2	5.5E+00	ca	8.3E-01	ca
Direct Brown 95		16071-86-6	4.8E+00	ca	7.3E-01	ca
Disulfide,bis(dimethylthio carbamoyl)		137-26-8	3.3E+02	nc	1.8E+02	nc
Disulfoton		298-04-4	2.6E+00	nc	1.5E+00	nc
1,4-Dithiane		505-29-3	6.5E+02	nc	3.7E+02	nc
Diuron		330-54-1	1.3E+02	nc	7.3E+01	nc
Divinylene Oxide		110-00-9	6.5E+01	nc	3.7E+01	nc
Dodine		2439-10-3	2.6E+02	nc	1.5E+02	nc
Dual (Metolaclor)		51218-45-2	9.8E+03	nc	5.5E+03	nc
EDC		107-06-2	4.4E+01	ca	1.2E+01	ca
Endocide		115-29-7	3.3E+00	nc	1.8E+00	nc
Endosol		115-29-7	3.3E+00	nc	1.8E+00	nc
Endosulfan		115-29-7	3.3E+00	nc	1.8E+00	nc
Endothall		145-73-3	1.3E+03	nc	7.3E+02	nc
Endrin		72-20-8	2.0E+01	nc	1.1E+01	nc
Epichlorohydrin		106-89-8	8.6E+00	nc	2.0E+00	nc
Epoxybutane		106-88-7	3.7E+02	nc	2.1E+02	nc
1,2-Epoxybutane		106-88-7	3.7E+02	nc	2.1E+02	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
1,2-Epoxy-3-Chloropropane		106-89-8	8.6E+00	nc	2.0E+00	nc
2,3-Epoxypropylchloride		106-89-8	8.6E+00	nc	2.0E+00	nc
EPTC (S-Ethyl Dipropylthio-carbamate)		759-94-4	1.6E+03	nc	9.1E+02	nc
1,2-Ethandiol		107-21-1	1.3E+05	nc	7.3E+04	nc
Ethane, 1,2-Dibromo-		106-93-4	5.1E-01	ca	7.6E-02	ca
Ethane, 1,2-Dichloro-		107-06-2	4.4E+01	ca	1.2E+01	ca
1,2-Ethanediamine		107-15-3	1.3E+03	nc	7.3E+02	nc
1,2-Ethanediylbis (Carbamodithioato)2-Manganese		12477-38-2	3.2E+02	nc	1.8E+02	nc
1,2-Ethanediylbis (carbamodithioato) (2-)-manganese		12427-38-2	3.2E+02	nc	1.8E+02	nc
1,2-Ethanediyl-biscarbamodithioc Acid, Manganese Complex		12477-38-2	3.2E+02	nc	1.8E+02	nc
Ethanoic acid, ethenyl ester		108-05-4	6.5E+04	nc	3.7E+04	nc
Ethanol, 2-(2-ethoxyethoxy)-		111-90-0	1.0E+05	nc	7.3E+04	nc
Ethanol, 2-butoxy-		111-76-2	3.7E+02	nc	2.1E+02	nc
Ethanol, 2-ethoxy-		110-80-5	2.6E+04	nc	1.5E+04	nc
Ethanol, 2-ethoxy-,acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
Ethanol, 2-methoxy-		109-86-4	6.5E+01	nc	3.7E+01	nc
Ethanol, 2-methoxy-,acetate		110-49-6	1.3E+02	nc	7.3E+01	nc
Ethanol,2,2,2-trichloro-1,1-bis(p-chlorophenyl)-		115-32-2	1.0E+02	ca	1.5E+01	ca
Ethenyl Ester Acetic Acid		108-05-4	6.5E+04	nc	3.7E+04	nc
Ethenylbenzene		100-42-5	2.2E+03	sat nc	1.6E+03	nc
Ethephon (2-Chloroethyl Phosphonic Acid)		16672-87-0	3.3E+02	nc	1.8E+02	nc
Ether, 2-chloroethyl vinyl	c	110-75-8	2.0E+03	nc	1.5E+02	nc
Ether,bis(2-chloro-1-methylethyl)		108-60-1	6.3E+02	ca	9.6E+01	ca
Ether,bis(pentabromophenyl)		1163-19-5	6.5E+02	nc	3.7E+02	ca
Ether,tert-butyl methyl		1634-04-4	3.3E+02	nc	1.8E+02	nc
Ethion		563-12-2	3.3E+01	nc	1.8E+01	nc
2-Ethoxyethanol Acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
2-Ethoxyethanol		110-80-5	2.6E+04	nc	1.5E+04	nc
2-(2-Ethoxyethoxy)Ethanol		111-90-0	1.0E+05	nc	7.3E+04	nc
Ethoxyethyl acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
beta-Ethoxyethyl Acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
2-Ethoxyethyl Ester Acetic Acid		111-15-9	2.0E+04	nc	1.1E+04	nc
Ethyl 2-propenoate	c	140-66-2	6.5E+01	ca	2.3E+01	ca
Ethyl Acetate		141-78-6	5.9E+04	nc	3.3E+04	nc
Ethyl Acrylate		140-88-5	4.6E+01	ca	2.3E+01	ca
Ethyl benzene		100-41-4	6.9E+02	sat nc	1.3E+03	nc
Ethyl carbitol		111-90-0	1.0E+05	nc	7.3E+04	nc
Ethyl cellosolve		110-80-5	2.6E+04	nc	1.5E+04	nc
Ethyl Chloride		75-00-3	1.1E+03	nc	7.1E+02	nc
O-Ethyl S-(2-diisopropyl-aminoethyl) methylthiolphosphonoate	i	50782-69-9	2.7E-01	nc	2.6E-02	nc
Ethyl dimethylamido-cyanophosphate	f	77-81-6	1.6E+01	nc	1.5E+00	nc
Ethyl dimethyl-phosphoramidocyanidate	f	77-81-6	1.6E+01	nc	1.5E+00	nc
S-Ethyl Dipropylthiocarbamate		759-94-4	1.6E+03	nc	9.1E+02	nc
Ethyl Ester Acetic Acid		141-78-6	5.9E+04	nc	3.3E+04	nc
Ethyl Ester Acrylic Acid	c	140-66-2	6.5E+01	ca	2.3E+01	ca
Ethyl Ester-2-Propenoic Acid	c	140-66-2	6.5E+01	ca	2.3E+01	ca

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Ethyl ethanoate		141-78-6	5.9E+04	nc	3.3E+04	nc
Ethyl Ether		60-29-7	3.8E+03	sat	1.2E+03	nc
Ethyl Methacrylate		97-63-2	3.8E+02	sat	5.5E+02	nc
Ethyl N,N-dimethyl-aminocyanophosphate	f	77-81-6	1.6E+01	nc	1.5E+00	nc
Ethyl N,N-isobutyl-thiocarbamate		2008-41-5	3.3E+03	nc	1.8E+03	nc
Ethylamineisopropylamine-s-triazine		1912-24-9	2.0E+02	ca	3.0E+01	ca
Ethylbenzene		100-41-4	6.9E+02	sat nc	1.3E+03	nc
Ethylbenzol		100-41-4	6.9E+02	sat nc	1.3E+03	nc
O-Ethyl S-(2-diispropylaminoethyl) methylphosphonothioate	i	50782-69-9	2.7E-01	nc	2.6E-02	nc
Ethyl N,N-dimethyl-phosphoramidocyanidate	f	77-81-6	1.6E+01	nc	1.5E+00	nc
Ethylene Cyanohydrin		109-78-4	2.0E+04	nc	1.1E+04	nc
Ethylene Diamine		107-15-3	1.3E+03	nc	7.3E+02	nc
Ethylene Dibromide		106-93-4	5.1E-01	ca	7.6E-02	ca
Ethylene Dichloride		107-06-2	4.4E+01	ca	1.2E+01	ca
1,2-Ethylene Dichloride		107-06-2	4.4E+01	ca	1.2E+01	ca
Ethylene Ester Acetic Acid		108-05-4	6.5E+04	nc	3.7E+04	nc
Ethylene Glycol		107-21-1	1.3E+05	nc	7.3E+04	nc
Ethylene glycol ethyl ether		110-80-5	2.6E+04	nc	1.5E+04	nc
Ethylene glycol methyl ether		109-86-4	6.5E+01	nc	3.7E+01	nc
Ethylene glycol methyl ether acetate		110-49-6	1.3E+02	nc	7.3E+01	nc
Ethylene glycol monoethyl ether		110-80-5	2.6E+04	nc	1.5E+04	nc
Ethylene glycol monoethyl ether acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
Ethylene Glycol, Monobutyl Ether		111-76-2	3.7E+02	nc	2.1E+02	nc
Ethylene glycol, dipropionate(8Cl)		123-73-9	1.6E+00	ca	5.9E-01	ca
Ethylene Oxide		75-21-8	1.2E+01	ca	2.4E+00	ca
Ethylene tetrachloride		127-18-4	7.0E+02	ca	1.1E+02	ca
Ethylene Thiourea (ETU)		96-45-7	7.4E+01	ca	1.1E+01	ca
Ethylene, tetrachloro-		127-18-4	7.0E+02	ca	1.1E+02	ca
Ethylene,1,2-dichloro-, (z)		156-59-2	5.9E+01	nc	6.1E+01	nc
Ethylenebis(dithiocarbamic acid),manganese salt		12427-38-2	3.2E+02	nc	1.8E+02	nc
1,2-Ethylenediamine		107-15-3	1.3E+03	nc	7.3E+02	nc
1,2-Ethylenediylbis (Caromodithioato)Manganese		12427-38-2	3.2E+02	nc	1.8E+02	nc
Ethylglycol acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
2-Ethylhexyl Phthalate		117-81-7	3.2E+03	ca	4.8E+02	ca
Bis(2-Ethylhexyl)Phthalate		117-81-7	3.2E+03	ca	4.8E+02	ca
Ethyl p-Nitrophenyl Phenylphosphorothioate		2104-64-5	6.5E-01	nc	3.7E-01	nc
Ethylnitrosourea	c	759-73-9	4.6E-01	ca	4.8E-02	ca
Ethyloxirane		106-88-7	3.7E+02	nc	2.1E+02	nc
Ethylphosphorodimethylamido-cyanidate	f	77-81-6	1.6E+01	nc	1.5E+00	nc
Ethylphthalyl Ethyl Glycolate		84-72-0	1.0E+05	max	1.1E+05	nc
ETU		96-45-7	7.4E+01	ca	1.1E+01	ca
Express		101200-48-0	5.2E+02	nc	2.9E+02	nc
Fenamiphos		22224-92-6	1.6E+01	nc	9.1E+00	nc
Fluometuron		2164-17-2	8.5E+02	nc	4.7E+02	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Fluoranthene		206-44-0	2.6E+03	ca	1.5E+03	nc
Fluorene		86-73-7	3.0E+02	nc	2.4E+02	nc
Fluoride		7782-41-4	3.9E+03	nc	2.2E+03	nc
Fluoridone		59756-60-4	5.2E+03	nc	2.9E+03	nc
Flurprimidol		56425-91-3	1.3E+03	nc	7.3E+02	nc
Flutolanil		66332-96-5	3.9E+03	nc	2.2E+03	nc
Fluvalinate		69409-94-5	6.5E+02	nc	3.7E+02	nc
Folpet		133-07-3	1.3E+04	ca	1.9E+03	ca
Fomesafen		72178-02-0	2.3E+02	ca	3.5E+01	ca
Fonofos		944-22-9	1.3E+02	nc	7.3E+01	nc
Formaldehyde		50-00-0	9.8E+03	ca	5.5E+03	ca
Formic Acid		64-18-6	1.0E+05	nc	7.3E+04	nc
Fosetyl-al		39148-24-8	1.0E+05	max	1.1E+05	nc
Free cyanide		57-12-5	1.3E+03	nc	7.3E+02	nc
Furan		110-00-9	6.5E+01	nc	3.7E+01	nc
2,5-Furandione		108-31-6	6.5E+03	nc	3.7E+03	nc
Furazolidone		67-45-8	1.2E+01	ca	1.8E+00	ca
Furfural		98-01-1	2.0E+02	nc	1.1E+02	nc
Furium		531-82-8	8.9E-01	ca	1.3E-01	ca
Furmecyclox		60568-05-0	1.5E+03	ca	2.2E+02	ca
GA	f	77-81-6	1.6E+01	nc	1.5E+00	nc
GB	g	107-44-8	7.8E+00	nc	7.3E-01	nc
GD	h	96-64-0	2.0E+00	nc	1.8E-01	nc
Glufosinate-Ammonium		77182-82-2	2.6E+01	nc	1.5E+01	nc
Glycidaldehyde		765-34-4	2.6E+01	nc	1.5E+01	nc
Glycol monomethyl ether		109-86-4	6.5E+01	nc	3.7E+01	nc
Glycol monomethyl ether acetate		110-49-6	1.3E+02	nc	7.3E+01	nc
Glycolethyl ether acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
Glyphosate		1071-83-6	6.5E+03	nc	3.7E+03	nc
Haloxyfop-Methyl		69806-40-2	3.3E+00	nc	1.8E+00	nc
Harmony		79277-27-3	8.5E+02	nc	4.7E+02	nc
HCH (alpha)		319-84-6	7.1E+00	ca	1.1E+00	ca
HCH (beta)		319-85-7	2.5E+01	ca	1.1E+00	ca
HCH (gamma) Lindane		58-89-9	3.4E+01	ca	5.2E+00	ca
HCH -technical		58-89-9	3.4E+01	ca	5.2E+00	ca
HD	d	505-60-2	2.7E+00	nc	2.6E-01	nc
Heptachlor		76-44-8	9.9E+00	ca	1.5E+00	ca
Heptachlor Epoxide		1024-57-3	4.9E+00	ca	7.4E-01	nc
Hexabromobenzene		87-82-1	1.3E+02	nc	7.3E+01	nc
Hexachloro-5-norbornene-2,3-dimethanol cyclic sulfite		115-29-7	3.3E+00	nc	1.8E+00	nc
Hexachlorobenzene		118-74-1	2.8E+01	ca	4.2E+00	ca
Hexachlorobicyclo(2.2.1)-2-heptene-5,6-bisoxymethylene sulfite		115-29-7	3.3E+00	nc	1.8E+00	nc
Hexachlorobutadiene		87-68-3	5.7E+02	ca	8.6E+01	ca
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH) -Technical		608-73-1	2.5E+01	ca	3.7E+00	ca
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH), Alpha		319-84-6	7.1E+00	ca	1.1E+00	ca
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH), Beta		319-85-7	2.5E+01	ca	3.7E+00	ca
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH), Gamma - Lindane		58-89-9	3.4E+01	ca	5.2E+00	ca
Hexachlorocyclopentadiene		77-47-4	4.5E+02	nc	2.6E+02	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
1,2,3,7,8,9-Hexachlorodibenzeno-p-Dioxin		19408-74-3	7.2E-03	ca	1.1E-03	ca
Hexachlorodibenzo-p-Dioxin (Mix)		19408-74-3	7.2E-03	ca	1.1E-03	ca
Hexachlorodibenzo-p-dioxin mixture (HxCDD)		19408-74-3	7.2E-03	ca	1.1E-03	ca
Hexachloroethane		67-72-1	3.2E+03	ca	4.8E+02	ca
Hexachloropentadiene		77-47-4	4.5E+02	nc	2.6E+02	nc
Hexachlorophene		70-30-4	2.0E+01	nc	1.1E+01	nc
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)		121-82-4	4.0E+02	ca	6.1E+01	ca
Hexahydro-2-azepinone		105-60-2	3.3E+04	nc	1.8E+04	nc
Hexahydro-2H-Azepin-2-one		105-60-2	3.3E+04	nc	1.8E+04	nc
Hexahydrobenzenamine		108-91-8	1.3E+04	nc	7.3E+03	nc
Hexahydro-1,3,5-Trinitro-1,3,5-Triazine		121-82-4	4.0E+02	ca	6.1E+01	ca
1,6-Hexamethylene Diisocyanate		822-06-0	NA	NA	1.0E-01	nc
Hexane		110-54-3	2.9E+02	nc	3.5E+02	nc
n-Hexane		110-54-3	2.9E+02	nc	3.5E+02	nc
Hexazinone		51235-04-2	2.2E+03	nc	1.2E+03	nc
Hexone		108-10-1	5.2E+03	nc	2.9E+03	nc
HMX	b	2691-41-0	3.3E+03	nc	1.8E+03	nc
1,2,3,7,8,9-HxCDD		19408-74-3	7.2E-03	ca	1.1E-03	ca
Hydracrylonitrile		109-78-4	2.0E+04	nc	1.1E+04	nc
Hydrazine, Hydrazine Sulfate		302-01-2	1.5E+01	ca	2.2E+00	ca
Hydrazodibenzene		122-66-7	5.6E+01	ca	8.4E+00	ca
Hydrocyanic acid, potassium salt		151-50-8	3.3E+03	nc	1.8E+03	nc
Hydrocyanic acid, sodium salt		143-33-9	2.6E+03	nc	1.5E+03	nc
Hydrogen Chloride	c	7647-01-0	NA	NA	2.1E+02	nc
Hydrogen Cyanide		74-90-8	1.6E+03	nc[a]	6.2E+00	nc
Hydrogen Sulfide		7783-06-4	NA	NA	2.0E+00	nc
Hydroquinone		123-31-9	2.6E+03	nc	1.5E+03	nc
p-Hydroquinone		123-31-9	2.6E+03	nc	1.5E+03	nc
Hydroxybenzene		108-95-2	3.9E+04	nc	2.2E+04	nc
1-Hydroxy-2,4-Dimethylbenzene		105-67-9	1.3E+03	nc	7.3E+02	nc
1-Hydroxy-3-Methylbenzene		108-39-4	3.3E+03	nc	1.8E+03	nc
4-Hydroxynitrobenzene		100-02-7	4.8E+03	nc	2.3E+03	nc
p-Hydroxyphenol		123-31-9	2.6E+03	nc	1.5E+03	nc
3-Hydroxypropanenitrile		109-78-4	2.0E+04	nc	1.1E+04	nc
3-Hydroxypropionitrile		109-78-4	2.0E+04	nc	1.1E+04	nc
Hydroxytoluene		100-51-6	2.0E+04	nc	1.1E+04	nc
4-Hydroxytoluene		106-44-5	3.3E+02	nc	1.8E+02	nc
p-Hydroxytoluene		106-44-5	3.3E+02	nc	1.8E+02	nc
Imazalil		35554-44-0	8.5E+02	nc	4.7E+02	nc
Imazaquin		81335-37-7	1.6E+04	nc	9.1E+03	nc
Indeno(1,2,3-cd)Pyrene		193-39-5	6.1E+01	ca	9.2E+00	ca
Iprodione		36734-19-7	2.6E+03	nc	1.5E+03	nc
Iron	c	7439-89-6	2.3E+04	nc	1.1E+04	nc
Isobutanol		78-83-1	2.0E+04	nc	1.1E+04	nc
Isobutyl methyl ketone		108-10-1	5.2E+03	nc	2.9E+03	nc
Bis(p-Isocyanotophenyl) Methane		101-68-8	3.7E-01	nc	2.1E-01	nc
Isophorone		78-59-1	4.7E+04	ca	7.1E+03	ca
Isophthalonitrile,tetrachloro-		1897-45-6	4.0E+03	ca	6.1E+02	ca
Isophthlonitrile,2,4,5,6-tetrachloro-		1897-45-6	4.0E+03	ca	6.1E+02	ca

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Isopropalin		33820-53-0	9.8E+02	nc	5.5E+02	nc
Isopropene cyanide		126-98-7	1.3E+00	nc	1.0E+00	nc
Isopropoxymethylphosphonyl fluoride	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Isopropoxymethylphosphoryl fluoride	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Isopropyl methanefluorophosphate	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Isopropyl Methyl Phosphonic Acid		1832-54-8	6.5E+03	nc	3.7E+03	nc
Isopropyl methylfluorophosphate	g	107-44-8	7.8E+00	nc	7.3E-01	nc
o-Isopropyl methylphosphonofluoridate	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Isopropyl-methyl-phosphoryl fluoride	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Isoxaben		82558-50-7	3.3E+03	nc	1.8E+03	nc
Karate/Cyhalothrin		68085-85-8	3.3E+02	nc	1.8E+02	nc
Kepone		143-50-0	2.5E+00	ca	3.7E-01	ca
L	e	541-25-3	3.9E+01	nc	3.7E+00	nc
Lactofen		77501-63-4	1.3E+02	nc	7.3E+01	nc
Lead		7439-92-1	4.0E+02	nc	4.0E+00	nc
Lead (Tetraethyl)		78-00-2	6.5E-03	nc	3.7E-03	nc
Lewisite	e	541-25-3	3.9E+01	nc	3.7E+00	nc
Lindane		58-89-9	3.4E+01	ca	5.2E+00	ca
Linuron		330-55-2	1.3E+02	nc	7.3E+01	nc
Lithium		7439-93-2	1.5E+03	nc	7.3E+02	nc
Londax		83055-99-6	1.3E+04	nc	7.3E+03	nc
m-Dimethylbenzene		108-38-3	9.9E+02	sat nc	1.4E+03	nc
m-Hydroxytoluene		108-39-4	3.3E+03	nc	1.8E+03	nc
m-Xylene		108-38-3	9.9E+02	sat nc	1.4E+03	nc
m-Xylenol		105-67-9	1.3E+03	nc	7.3E+02	nc
Malathion		121-75-5	1.3E+03	nc	7.3E+02	nc
Maleic acid anhydride		108-31-6	6.5E+03	nc	3.7E+03	nc
Maleic Anhydride		108-31-6	6.5E+03	nc	3.7E+03	nc
Maleic Hydrazide		123-33-1	3.3E+04	nc	1.8E+04	nc
Malononitrile		109-77-3	1.3E+00	nc	7.3E-01	nc
Mancozeb		8018-01-7	2.0E+03	nc	1.1E+03	nc
Maneb		12427-38-2	3.3E+02	nc	1.8E+02	nc
Maneb 80		12427-38-2	3.3E+02	nc	1.8E+02	nc
Manganese and compounds		7439-96-5	3.8E+02	nc	1.8E+02	nc
Manganese ethylene bis-dithiocarbamate		12427-38-2	3.3E+02	nc	1.8E+02	nc
Manganese (Tradename)		12427-38-2	3.3E+02	nc	1.8E+02	nc
MBIK		108-10-1	5.2E+03	nc	2.9E+03	nc
Mephosfolan		950-10-7	5.9E+00	nc	3.3E+00	nc
Mepiquat		24307-26-4	2.0E+03	nc	1.1E+03	nc
Mercaptosuccinic acid diethyl ester		121-75-5	1.3E+03	nc	7.3E+02	nc
Mercury (Inorganic)	c	7439-97-6	2.3E+01	nc	1.1E+01	nc
Mercury (Methyl)		22967-92-6	6.5E+00	nc	3.7E+00	nc
Merphos		150-50-5	2.0E+00	nc	1.1E+00	nc
Merphos Oxide		78-48-8	2.0E+00	nc	1.1E+00	nc
Metalaxyl		57837-19-1	3.9E+03	nc	2.2E+03	nc
Methacrylonitrile		126-98-7	1.3E+00	nc	1.0E+00	nc
Methamidophos		10265-92-6	3.3E+00	nc	1.8E+00	nc
Methane,chlorodibromo-		124-48-1	5.3E+02	ca	1.0E+02	ca
Methanol		67-56-1	3.3E+04	nc	1.8E+04	nc
Methidathion		950-37-8	6.5E+01	nc	3.7E+01	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Methomyl		16752-77-5	1.6E+03	nc	9.1E+02	nc
Methoxy ether of Propylene glycol		107-98-2	4.6E+04	nc	2.6E+04	nc
1-Methoxy-2-Propanol		107-98-2	4.6E+04	nc	2.6E+04	nc
Methoxy-5-nitroaniline, 2-		99-59-2	9.7E+02	ca	1.5E+02	ca
Methoxychlor		72-43-5	3.3E+02	nc	1.8E+02	nc
Methoxyethanol		109-86-4	6.5E+01	nc	3.7E+01	nc
2-Methoxyethanol Acetate		110-49-6	1.3E+02	nc	7.3E+01	nc
2-Methoxyethanol		109-86-4	6.5E+01	nc	3.7E+01	nc
Methoxyhydroxyethane		109-86-4	6.5E+01	nc	3.7E+01	nc
2-Methoxy-2-Methyl Propane		1634-04-4	3.3E+02	nc	1.8E+02	nc
2-Methoxy-5-Nitroaniline		99-59-2	9.7E+02	ca	1.5E+02	ca
Methyl 1,1-dimethylethyl ether		1634-04-4	3.3E+02	nc	1.8E+02	nc
Methyl Acetate		79-20-9	2.0E+04	nc	6.1E+03	nc
Methyl Acrylate		96-33-3	1.5E+02	nc	1.8E+02	nc
Methyl Alcohol		67-56-1	3.3E+04	nc	1.8E+04	nc
Methyl Benzene		108-88-3	1.9E+03	nc	7.2E+02	nc
Methyl Bromide		74-83-9	1.5E+01	nc	8.7E+00	nc
Methyl Cellosolve		109-86-4	6.5E+01	nc	3.7E+01	nc
Methyl Cellosolve Acetate		110-49-6	1.3E+02	nc	7.3E+01	nc
Methyl Chloride		74-87-6	2.0E+02	ca	1.5E+02	ca
Methyl Chlorocarbonate		79-22-1	6.5E+04	nc	3.7E+04	nc
Methyl Ethyl Ketone		78-93-3	8.7E+03	nc	1.9E+03	nc
Methyl Hydrazine		60-34-4	4.0E+01	ca	6.1E+00	ca
Methyl Isobutyl Ketone		108-10-1	5.2E+03	nc	2.9E+03	nc
Methyl Methacrylate		80-62-6	5.2E+03	nc	2.9E+03	nc
Methyl Parathion		298-00-0	1.6E+01	nc	9.1E+00	nc
Methyl Styrene (Alpha)		98-83-9	1.8E+03	nc	4.3E+02	nc
Methyl Styrene (mixture)		25013-15-4	2.2E+02	nc	6.0E+01	nc
Methyl tert-Butyl Ether		1634-04-4	3.3E+02	nc	1.8E+02	nc
Methyl Tertbutyl		1634-04-4	3.3E+02	nc	1.8E+02	nc
Methyl Toluene		1330-20-7	9.9E+02	sat	1.4E+03	nc
Methyl-4-Pentanone		108-10-1	5.2E+03	nc	2.9E+03	nc
2-Methyl-5-Nitroaniline		99-55-8	1.3E+03	ca	2.0E+02	ca
2-Methylaniline (o-Toluidine)		100-61-8	1.9E+02	ca	2.8E+01	ca
2-Methylaniline Hydrochloride		636-21-5	2.5E+02	ca	3.7E+01	ca
Methylaniline, 2- (o-Toluidine)		100-61-8	1.9E+02	ca	2.8E+01	ca
Methylbenzene		108-88-3	1.9E+03	nc	7.2E+02	nc
4-(2-Methyl-4-Chlorophenoxy)Butyric Acid		94-81-5	6.5E+02	nc	3.7E+02	nc
2-(2-Methyl-4-Chlorophenoxy)Propionic Acid		93-65-2	6.5E+01	nc	3.7E+01	nc
2-Methyl-4-Chlorophenoxyacetic Acid		94-74-6	3.3E+01	nc	1.8E+01	nc
2-(2-Methyl-1,4-Chlorphenoxy)Propionic Acid		16484-77-8	6.5E+01	nc	3.7E+01	nc
3-Methylcholanthrene		193-39-5	6.1E+01	ca	9.2E+00	ca
5-Methylchrysene		RRSE-009	3.2E+00	ca	NA	NA
Methylcyclohexane		108-87-2	5.6E+04	nc	3.1E+04	nc
1-Methyl-2,4-Dinitrobenzene		121-14-2	1.3E+02	nc	7.3E+01	nc
4,4'-Methylene bis(N,N'-Dimethyl)Aniline		101-61-1	9.7E+02	ca	1.5E+02	ca
4,4'-Methylene bis(2-Chloroaniline)		101-14-4	3.4E+02	ca	5.2E+01	ca
Methylene Bromide		74-95-3	6.5E+02	nc	3.7E+02	nc
Methylene Chloride		75-09-2	1.1E+03	ca	4.3E+02	ca
4,4-Methylene Dianiline		101-77-9	1.8E+02	ca	2.7E+01	ca

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Methylene Diphenyl Diisocyanate		101-68-8	3.7E-01	nc	2.1E-01	nc
Methylene(b)4-Phenylisocyanate		101-68-8	3.7E-01	nc	2.1E-01	nc
Methylenebis (4-Phenyleneisocyanate)		101-68-8	3.7E-01	nc	2.1E-01	nc
Methylenebis(p-Phenylene Isocyanate)		101-68-8	3.7E-01	nc	2.1E-01	nc
4,4'- Methylenebis-benzeneamine		101-77-9	1.8E+02	ca	2.7E+01	ca
4,4'-Methylenebis (N,N'-Dimethyl) Benzeneamine		101-61-1	9.7E+02	ca	1.5E+02	ca
1,1-Methylenebis (4-Isocyanatobenzene)		101-68-8	3.7E-01	nc	2.1E-01	nc
4,4'-Methylenedianiline		101-77-9	1.8E+02	ca	2.7E+01	ca
4,4'-Methylenediphenyl Isocyanate		101-68-8	3.7E-01	nc	2.1E-01	nc
4,4'-Methylene iso (N,N'-Dimethyl) Aniline		101-61-1	9.7E+02	ca	1.5E+02	ca
2-(1-Methylethoxy) Phenolmethylcarbamate		114-26-1	2.6E+02	nc	1.5E+02	nc
Methylfluorophosphonic acid, isopropyl ester	g	107-44-8	7.8E+00	nc	7.3E-01	nc
1-Methyl-4-Hydroxybenzene		106-44-5	3.3E+02	nc	1.8E+02	nc
Methylisopropoxy-fluorophosphine oxide	g	107-44-8	7.8E+00	nc	7.3E-01	nc
N-Methylmethanamine		124-40-3	6.2E-02	nc	3.5E-02	nc
Methyl-2-(1-Methylethoxy)Phenyl Ester Acid		114-26-1	2.6E+02	nc	1.5E+02	nc
2-Methyl-5-Nitroaniline		99-55-8	1.3E+03	ca	2.0E+02	ca
2-Methyl-4-Pentanone		108-10-1	5.2E+03	nc	2.9E+03	nc
2-Methylphenol (o-Cresol)		95-48-7	3.3E+03	nc	1.8E+03	nc
3-Methylphenol (m-Cresol)		108-39-4	3.3E+03	nc	1.8E+03	nc
4-Methylphenol (p-Cresol)		106-44-5	3.3E+02	nc	1.8E+02	nc
p-Methylphenol		106-44-5	3.3E+02	nc	1.8E+02	nc
Methylphosphonofluoridic acid 1,2,2-trimethylpropyl ester	h	96-64-0	2.0E+00	nc	1.8E-01	nc
Methylphosphonofluoridic acid 1-methylethyl ester	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Methylphosphonofluoridic acid isopropyl ester	g	107-44-8	7.8E+00	nc	7.3E-01	nc
2-Methyl-2-Propenenitrile		126-98-7	1.3E+00	nc	1.0E+00	nc
Bis(2-Methylpropyl) Carbamothioic Acid s-Ethyl Ester		2008-41-5	3.3E+03	nc	1.8E+03	nc
p-Methyltoluene		106-42-3	1.6E+03	sat nc	5.2E+02	nc[c]
Metolaclor		51218-45-2	9.8E+03	nc	5.5E+03	nc
Metolaclor (Dual)		51218-45-2	9.8E+03	nc	5.5E+03	nc
Metribuzin		21087-64-9	1.6E+03	nc	9.1E+02	nc
Michler's base		101-61-1	9.7E+02	ca	1.5E+02	ca
Mirex		2385-85-5	2.5E+01	ca	3.7E+00	ca
Molinate		2212-67-1	1.3E+02	nc	7.3E+01	nc
Molybdenum		7439-98-7	3.8E+02	nc	1.8E+02	nc
Monochloramine		10599-90-3	6.5E+03	nc	3.7E+03	nc
Monochlorobenzene		108-90-7	1.6E+02	nc	3.9E+01	nc
Monoethylene Glycol		107-21-1	1.3E+05	nc	7.3E+04	nc
Monohydroxybenzene		108-95-2	3.9E+04	nc	2.2E+04	nc
MTBE		1634-04-4	3.3E+02	nc	1.8E+02	nc
Mustard	d	505-60-2	2.7E+00	nc	2.6E-01	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Naled		300-76-5	1.3E+02	nc	7.3E+01	nc
2,7-Naphtalenedisulfonic acid, 4-amino-3-((4'-((2,4-		1937-37-7	5.2E+00	ca	7.8E-01	ca
Naphthalene		91-20-3	8.0E+02	nc	2.4E+02	nc
2-Naphthylamine	c	91-59-8	4.9E-01	ca	5.2E-02	ca
1,2-(1,8-Naphthylene)Benzene		120-82-1	6.2E+02	nc	1.9E+02	nc
Napropamide		15299-99-7	6.5E+03	nc	3.7E+03	nc
Nickel (Soluble Salts)		7440-02-0	1.5E+03	nc	7.3E+02	nc
Nitran		1582-09-8	5.8E+03	ca	8.7E+02	ca
Nitrapyrin		1929-82-4	9.8E+01	nc	5.5E+01	nc
Nitrate		14797-55-8	1.0E+05	max	5.8E+04	nc
Nitric Oxide		10102-43-9	6.5E+03	nc	3.7E+03	nc
Nitrite		14797-65-0	6.5E+03	nc	3.7E+03	nc
5-Nitroacenaphthene		RRSE-010	5.4E+02	ca	NA	NA
2-Nitroaniline		88-74-4	3.9E+00	nc	2.2E+00	nc
3-Nitroaniline		99-09-2	2.3E+02	nc	1.1E+02	nc
4-Nitroaniline		100-01-6	2.3E+02	nc	1.1E+02	nc
Nitrobenzene		98-95-3	3.3E+01	nc	1.8E+01	nc
p-Nitrochlorobenzene		100-00-5	2.5E+03	ca	3.7E+02	ca
Nitrochlorobenzene, para		100-00-5	2.5E+03	ca	3.7E+02	ca
6-Nitrochrysene		RRSE-011	6.1E-01	ca	NA	NA
2-Nitrofluorene		RRSE-012	6.1E+02	ca	NA	NA
Nitrofurantoin		67-20-9	4.6E+03	nc	2.6E+03	nc
Nitrofurazone		59-87-0	3.0E+01	ca	4.5E+00	ca
Nitrogen Dioxide	c	101102-44-0	7.8E+04	nc	3.7E+04	nc
Nitrogen-monoxide-		10102-43-9	6.5E+03	nc	3.7E+03	nc
Nitroguanidine		556-88-7	6.5E+03	nc	3.7E+03	nc
4-Nitrophenol		100-02-7	4.8E+03	nc	2.3E+03	nc
p-Nitrophenol		100-02-7	4.8E+03	nc	2.3E+03	nc
2-Nitropropane		79-46-9	NA	NA	3.5E+03	ca
1-Nitropyrene		RRSE-013	6.1E+01	ca	NA	NA
4-Nitropyrene		RRSE-014	6.1E+01	ca	NA	NA
N-Nitroso-N-methylethylamine		10595-95-6	2.0E+00	ca	3.1E-01	ca
N-Nitrosodi-n-Butylamine		924-16-3	8.2E+00	ca	1.2E+00	ca
N-Nitrosodiethanolamine		1116-54-7	1.6E+01	ca	2.4E+00	ca
N-Nitrosodiethylamine		55-18-5	3.0E-01	ca	4.5E-02	ca
N-Nitrosodimethylamine		62-75-9	8.7E-01	ca	1.3E-01	ca
N-Nitrosodiphenylamine		86-30-6	9.1E+03	ca	1.4E+03	ca
N-Nitrosodi-n-propylamine		621-64-7	6.3E+00	ca	9.6E-01	ca
N-Nitroso-N-Methylethylamine		10595-95-6	2.0E+00	ca	3.1E-01	ca
N-Nitrosopyrrolidine		930-55-2	2.1E+01	ca	3.2E+00	ca
m-Nitrotoluene		99-08-1	6.5E+02	nc	3.7E+02	nc
o-Nitrotoluene	c	88-72-2	2.0E+04	nc	6.1E+01	nc
p-Nitrotoluene		99-99-0	6.5E+02	nc	3.7E+02	nc
5-Norbornene-2,3-dimethanol, 1,4,5,6,7,7-hexachloro-, cyclicsulfite		115-29-7	3.3E+00	nc	1.8E+00	nc
Norflurazon		27314-13-2	3.1E+03	nc	1.5E+03	nc
NuStar		85509-19-9	4.6E+01	nc	2.6E+01	nc
O,O-Dimethyl phosphorodithioate		121-75-5	1.3E+03	nc	7.3E+02	nc
O,O-Dimethyl thiophosphate		121-75-5	1.3E+03	nc	7.3E+02	nc
o-Benzenedicarboxylic acid, dioctyl ester		117-84-0	1.3E+03	nc	7.3E+02	nc
o-Isopropoxyphenyl N-methylcarbamate		114-26-1	2.6E+02	nc	1.5E+02	nc
O-Isopropyl methylisopropoxy-fluorodphosphine oxide	g	107-44-8	7.8E+00	nc	7.3E-01	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
o-Phenylenepyrene		193-39-5	6.1E+01	ca	9.2E+00	ca
Octabromodiphenyl Ether		32536-52-0	2.0E+02	nc	1.1E+02	nc
Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	b	2691-41-0	3.3E+03	nc	1.8E+03	nc
Octamethylpyrophosphoramide		152-16-9	1.3E+02	nc	7.3E+01	nc
Octyl phthalate		117-84-0	1.3E+03	nc	7.3E+02	nc
N-Octyl phthalate		117-84-0	1.3E+03	nc	7.3E+02	nc
Oryzalin		19044-88-3	3.3E+03	nc	1.8E+03	nc
Oxacyclopentadiene		110-00-9	6.5E+01	nc	3.7E+01	nc
Oxadiazon		19666-30-9	3.3E+02	nc	1.8E+02	nc
Oxamyl		23135-22-0	1.6E+03	nc	9.1E+02	nc
1,4-Oxathiane	b	15980-15-1	1.0E+05	sat nc	2.6E+07	nc
Oxybenzene		108-95-2	3.9E+04	nc	2.2E+04	nc
1,1'-Oxybis(2-Chloro)Ethane		111-44-4	7.4E+00	ca	9.8E-01	ca
2,2'-Oxybis(1-Chloropropane)		108-60-1	6.3E+02	ca	9.6E+01	ca
1,1'-Oxybis(2,3,5,6-Pentabromo-(9Cl)-Benzene		1163-19-5	6.5E+02	nc	3.7E+02	ca
Oxyfluofen		42874-03-3	2.0E+02	nc	1.1E+02	nc
Oxytol acetate		111-15-9	2.0E+04	nc	1.1E+04	nc
p,p'-Bis(Dimethylamino) Diphenylmethane		101-61-1	9.7E+02	ca	1.5E+02	ca
p,p-Dimethylamino-diphenylmethane		101-61-1	9.7E+02	ca	1.5E+02	ca
Paclobutrazol		76738-62-0	8.5E+02	nc	4.7E+02	nc
Paradichlorobenzene		106-46-7	7.4E+02	ca	4.7E+01	ca
Paranaphthalate		120-12-7	1.9E+01	nc	1.8E+03	nc
Paraquat		4685-14-7	2.9E+02	nc	1.6E+02	nc
Parathion		56-38-2	3.9E+02	nc	2.2E+02	nc
PCB		1336-36-3	6.6E+00	ca	8.7E-01	ca
PCB 1016		12674-11-2	4.9E+00	nc	2.6E+00	nc
PCBs		1336-36-3	6.6E+00	ca	8.7E-01	ca
PCE		127-18-4	7.0E+02	ca	1.1E+02	ca
Pebulate		1114-71-2	3.3E+03	nc	1.8E+03	nc
Pendimethalin		40487-42-1	2.6E+03	nc	1.5E+03	nc
Pentabromo-6-Chloro Cyclohexane		87-84-3	1.9E+03	ca	2.9E+02	ca
Pentabromodiphenyl Ether		1163-19-5	6.5E+02	nc	3.7E+02	ca
Bis(Pentabromophenyl)Ether		1163-19-5	6.5E+02	nc	3.7E+02	ca
Pentachlorobenzene		608-93-5	5.2E+01	nc	2.9E+01	nc
Pentachloronitrobenzene		82-68-8	1.7E+02	ca	2.6E+01	ca
Pentachlorophenol		87-86-5	2.5E+02	ca	5.6E+01	ca
Pentachlorophenyl Chloride		118-74-1	2.8E+01	ca	4.2E+00	ca
2-Pentanone, 4-Methyl-		108-10-1	5.2E+03	nc	2.9E+03	nc
PERC		127-18-4	7.0E+02	ca	1.1E+02	ca
Perchlorobenzene		118-74-1	2.8E+01	ca	4.2E+00	ca
Perchloroethylene (PCE)		127-18-4	7.0E+02	ca	1.1E+02	ca
Permethrin		52645-53-1	3.3E+03	nc	1.8E+03	nc
Phenmedipham		13684-63-4	1.6E+04	nc	9.1E+03	nc
Phenol		108-95-2	3.9E+04	nc	2.2E+04	nc
Phenol, 2,4-dichloro-		120-83-2	2.0E+02	nc	1.1E+02	nc
Phenol, o-isopropoxy-, methylcarbomate		114-26-1	2.6E+02	nc	1.5E+02	nc
N-Phenylaniline		122-39-4	1.6E+03	nc	9.1E+02	nc
N-Phenylbenzenamine		122-39-4	1.6E+03	nc	9.1E+02	nc
Phenylcarbinol		100-51-6	2.0E+04	nc	1.1E+04	nc
1,4-Phenylenediamine		106-50-3	1.2E+04	nc	6.9E+03	nc
m-Phenylenediamine		108-45-2	3.9E+02	nc	2.2E+02	nc
p-Phenylenediamine		106-50-3	1.2E+04	nc	6.9E+03	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
1,10-(1,2-Phenylene)Pyrene		193-39-5	6.1E+01	ca	9.2E+00	ca
2,3-Phenylenepyrene		193-39-5	6.1E+01	ca	9.2E+00	ca
2,3-o-Phenylenepyrene		193-39-5	6.1E+01	ca	9.2E+00	ca
Phenylethane		100-41-4	6.9E+02	sat nc	1.3E+03	nc
Phenylethylene		100-42-5	2.2E+03	sat nc	1.6E+03	nc
Phenylmercuric Acetate		62-38-4	5.2E+00	nc	2.9E+00	nc
Phenylmethanal		100-52-7	6.5E+03	nc	3.7E+03	nc
Phenylmethane		108-88-3	1.9E+03	nc	7.2E+02	nc
Phenylphenol		90-43-7	2.3E+04	ca	3.5E+03	nc
2-Phenylphenol		90-43-7	2.3E+04	ca	3.5E+03	nc
Phorate		298-02-2	1.3E+01	nc	7.3E+00	nc
Phosmet		732-11-6	1.3E+03	nc	7.3E+02	nc
Phosphine		7803-51-2	2.0E+01	nc	1.1E+01	nc
Phosphonofluoridic acid, methyl-, isopropyl ester	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Phosphonothioic acid, methyl-, S-[2-[bis(1-methylethyl-amino)ethyl] O-ethyl ester	i	50782-69-9	2.7E-01	nc	2.6E-02	nc
Phosphonothioic acid, methyl-, S-(2-(diisopropylamino)ethyl) O-ethyl ester	i	50782-69-9	2.7E-01	nc	2.6E-02	nc
Phosphorodithioic acid,o,o-diethyl s-(((1,1-		13071-79-9	1.6E+00	nc	9.1E-01	nc
Phosphorus (white)	c	7723-14-0	1.6E+00	nc	7.3E-01	nc
Phospphonofluoridic acid, methyl-, 1-methylethyl ester	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Phosvin		1314-84-7	2.3E+01	nc	1.1E+01	nc
Phthalic acid, bis(2-ethylhexyl) ester		117-81-7	3.2E+03	ca	4.8E+02	ca
Phthalic acid, dimethyl ester		131-11-3	1.0E+05	nc	3.7E+05	nc
Phthalic acid, dioctyl ester		117-84-0	1.3E+03	nc	7.3E+02	nc
Phthalic acid, methyl ester		131-11-3	1.0E+05	nc	3.7E+05	nc
p-Phthalic Acid		100-21-0	7.8E+04	nc	3.7E+04	nc
Phthalic Anhydride		85-44-9	1.6E+05	nc	7.3E+04	nc
Picloram		1918-02-1	4.6E+03	nc	2.6E+03	nc
Pinacoloxymethylphosphoryl fluoride	h	96-64-0	2.0E+00	nc	1.8E-01	nc
Pinacolyl methylphosphonofluoridate	h	96-64-0	2.0E+00	nc	1.8E-01	nc
Pirimiphos-Methyl		23505-41-1	6.5E+02	nc	3.7E+02	nc
Polybrominated Biphenyls		13336-36-3	5.0E+00	ca	7.6E-01	ca
Polychlorinated Biphenyls		1336-36-3	6.6E+00	ca	8.7E-01	ca
Polychlorinated Terphenyls		RRSE-015	1.4E+01	ca	1.5E+00	ca
Polychlorobiphenyl		1336-36-3	6.6E+00	ca	8.7E-01	ca
Potassium Cyanide		151-50-8	3.3E+03	nc	1.8E+03	nc
Potassium Silver Cyanide		506-61-6	1.3E+04	nc	7.3E+03	nc
Prochloraz		67747-09-5	3.0E+02	ca	3.3E+04	ca
Profluralin		26399-36-0	3.9E+02	nc	2.2E+02	nc
Prometon		1610-18-0	9.8E+02	nc	5.5E+02	nc
Prometryn		7287-19-6	2.6E+02	nc	1.5E+02	nc
Pronamide		23950-58-5	4.9E+03	nc	2.7E+03	nc
Propachlor		1918-16-7	8.5E+02	nc	4.7E+02	nc
Propane, 1-Chloro-2,3-Epoxy-		106-89-8	8.6E+00	nc	2.0E+00	nc
Propanil		709-98-8	3.3E+02	nc	1.8E+02	nc
2-Propanol, 1-Methoxy-		107-98-2	4.6E+04	nc	2.6E+04	nc
Propargite		2312-35-8	1.3E+03	nc	7.3E+02	nc
Propargyl Alcohol		107-19-7	1.3E+02	nc	7.3E+01	nc
Propazine		139-40-2	1.3E+03	nc	7.3E+02	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
2-Propenal		107-02-8	1.3E+03	nc	7.3E+02	nc
Propene, 3-Chloro-		107-05-1	3.3E+03	nc	1.8E+03	nc
Propenenitrile		107-13-1	1.3E+01	ca	3.7E+02	ca
2-Propenenitrile		107-13-1	1.3E+01	ca	3.7E+02	ca
2-Propenenitrile,2-methyl-		126-98-7	1.3E+00	nc	1.0E+00	nc
2-Propene-1-ol		107-18-6	3.3E+02	nc	1.8E+02	nc
2-Propenoic acid, ethyl ester	c	140-66-2	6.5E+01	ca	2.3E+01	ca
Propenol		107-18-6	3.3E+02	nc	1.8E+02	nc
1-Propenol-3		107-18-6	3.3E+02	nc	1.8E+02	nc
Propham		122-49-9	1.3E+03	nc	7.3E+02	nc
Propiconazole		60207-90-1	8.5E+02	nc	4.7E+02	nc
Propionic acid, 2-(2,4,5-Trichlorophenoxy)		93-72-1	5.2E+02	nc	2.9E+02	nc
Propionitrile, 3-Hydroxy-		109-78-4	2.0E+04	nc	1.1E+04	nc
Propoxur		114-26-1	2.6E+02	nc	1.5E+02	nc
Propyl-alpha,alpha,alpha-Trifluoro-p-Toluidine		1582-09-8	5.8E+03	ca	8.7E+02	ca
n-Propylcarbinyl Chloride		109-69-3	1.0E+03	sat nc	2.4E+03	nc
Propylene Aldehyde		107-02-8	1.3E+03	nc	7.3E+02	nc
Propylene Glycol		57-55-6	1.0E+05	nc	7.3E+05	nc
Propylene Glycol, Monoethyl Ether		111-35-3	4.6E+04	nc	2.6E+04	nc
Propylene Glycol, Monomethyl Ether		107-98-2	4.6E+04	nc	2.6E+04	nc
Propylene Oxide		75-56-9	NA	NA	2.2E+01	ca
Pursuit		81335-77-5	1.6E+04	nc	9.1E+03	nc
Pydrin		51630-58-1	1.6E+03	nc	9.1E+02	nc
Pyrene		129-00-0	2.0E+03	nc	1.1E+03	nc
beta-Pyrene		129-00-0	2.0E+03	nc	1.1E+03	nc
Pyridine		110-86-1	6.5E+01	nc	3.7E+01	nc
Quinalphos		13593-03-8	3.3E+01	nc	1.8E+01	nc
Quinoline		91-22-5	3.7E+00	ca	5.6E-01	ca
RDX		121-82-4	4.0E+02	ca	6.1E+01	ca
Resmethrin		10453-86-8	2.0E+03	nc	1.1E+03	nc
Ronnel		299-84-3	3.3E+03	nc	1.8E+03	nc
Rotenone		83-79-4	2.6E+02	nc	1.5E+02	nc
s-((tert-Butylthio)methyl) o,o-Diethylphosphorodithioate		13071-79-9	1.6E+00	nc	9.1E-01	nc
s-Ethylbis(2-Methylpropyl)carbamothioate		2008-41-5	3.3E+03	nc	1.8E+03	nc
s-Triazine,2-Chloro-4,6-bis(Ethylamino)-		122-34-9	3.7E+02	ca	5.6E+01	ca
s-Triazine,2-Chloro-4-Ethylamino-6-Isopropylamino-		1912-24-9	2.0E+02	ca	3.0E+01	ca
Sarin	g	107-44-8	7.8E+00	nc	7.3E-01	nc
Savey		78578-05-0	1.6E+03	nc	9.1E+02	nc
Selenious Acid		7783-00-8	3.3E+02	nc	1.8E+02	nc
Selenium		7782-49-2	3.8E+02	nc	1.8E+02	nc
Selenourea		630-10-4	3.3E+02	nc	1.8E+02	nc
Sethoxydim		74051-80-2	5.9E+03	nc	3.3E+03	nc
Silver and compounds		7440-22-4	3.8E+02	nc	1.8E+02	nc
Silver Cyanide		506-64-9	6.5E+03	nc	3.7E+03	nc
Simazine		122-34-9	3.7E+02	ca	5.6E+01	ca
Sodium Azide		26628-22-8	2.6E+02	nc	1.5E+02	nc
Sodium Cyanide		143-33-9	2.6E+03	nc	1.5E+03	nc
Sodium Diethyldithiocarbamate		20624-25-3	1.6E+02	ca	2.5E+01	ca
Sodium Fluoroacetate		62-74-8	1.3E+00	nc	7.3E-01	nc
Sodium Metavanadate		13718-26-8	6.5E+01	nc	3.7E+01	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Soman	h	96-64-0	2.0E+00	nc	1.8E-01	nc
Strontium (Stable)		7440-24-6	4.6E+04	nc	2.2E+04	nc
Strychnine		57-24-9	2.0E+01	nc	1.1E+01	nc
Styrene		100-42-5	2.2E+03	sat nc	1.6E+03	nc
Succinic acid		121-75-5	1.3E+03	nc	7.3E+02	nc
Sulfur Mustard	d	505-60-2	2.7E+00	nc	2.6E-01	nc
Systhane		88671-89-0	1.6E+03	nc	9.1E+02	nc
Tabun	f	77-81-6	1.6E+01	nc	1.5E+00	nc
Talstar (Biphenthrin)		82657-04-3	9.8E+02	nc	5.5E+02	nc
TBTO (Tributyltin Oxide)		56-35-9	2.0E+00	nc	1.1E+00	nc
TCDD		1746-01-6	3.8E-04	ca	4.5E-05	ca
2,3,7,8-TCDD (Dioxin)		1746-01-6	3.8E-04	ca	4.5E-05	ca
TCMTB		3689-24-5	3.3E+01	nc	1.8E+01	nc
Tebuthiuron		34014-18-1	4.6E+03	nc	2.6E+03	nc
Temephos		3383-96-8	1.3E+03	nc	7.3E+02	nc
Terbacil		5902-51-2	8.5E+02	nc	4.7E+02	nc
Terbufos		13071-79-9	1.6E+00	nc	9.1E-01	nc
Terbutryn		886-50-0	6.5E+01	nc	3.7E+01	nc
Terephthalic Acid, Dimethyl Ester		120-61-6	6.5E+03	nc	3.7E+03	nc
tert-Butyl Methyl Ether		1634-04-4	3.3E+02	nc	1.8E+02	nc
1,2,4,5-Tetrachlorobenzene		95-94-3	2.0E+01	nc	1.1E+01	nc
2,4,5,6-Tetrachloro-1,3-Benzene-dicarbonitrile		1897-45-6	4.0E+03	ca	6.1E+02	ca
2,3,7,8-Tetrachlorobenzo-1,4- Dioxin		1746-01-6	3.8E-04	ca	4.5E-05	ca
2,3,7,8-Tetrachlorobenzo-p-Dioxin		1746-01-6	3.8E-04	ca	4.5E-05	ca
2,3,7,8-Tetrachlorodibenzo(be)(1,4)Dioxin		1746-01-6	3.8E-04	ca	4.5E-05	ca
1,1,1,2-Tetrachloroethane		630-20-6	4.8E+02	ca	4.3E+01	ca
1,1,2,2-Tetrachloroethane		79-34-5	9.0E+01	ca	5.5E+00	ca
Tetrachloroethylene		127-18-4	7.0E+02	ca	1.1E+02	ca
1,1,2,2,-Tetrachloroethylene		127-18-4	7.0E+02	ca	1.1E+02	ca
2,3,4,6-Tetrachlorophenol		58-90-2	2.0E+03	nc	1.1E+03	nc
p,a,a,a-Tetrachlorotoluene		5216-25-1	2.2E+00	ca	3.4E-01	ca
Tetrachlorovinphos		961-11-5	1.9E+03	ca	2.8E+02	ca
Tetraethyldithiopyrophosphate		3689-24-5	3.3E+01	nc	1.8E+01	nc
Tetrahydro-1,4-Dioxin		123-91-1	1.4E+03	ca	1.0E+02	ca
Tetrahydro-p-Dioxin		123-91-1	1.4E+03	ca	1.0E+02	ca
Tetramethylenethiuram Disulphide		137-26-8	3.3E+02	nc	1.8E+02	nc
Tetramethylthiuram Bisulfide		137-26-8	3.3E+02	nc	1.8E+02	nc
Tetryl	a	479-45-8	7.8E+02	nc	NA	NA
Thallic Oxide		1314-32-1	5.4E+00	nc	2.6E+00	nc
Thallium Acetate		563-68-8	6.9E+00	nc	3.3E+00	nc
Thallium Carbonate		6533-73-9	6.1E+00	nc	2.9E+00	nc
Thallium Chloride		7791-12-0	6.1E+00	nc	2.9E+00	nc
Thallium Nitrate		10102-45-1	6.9E+00	nc	3.3E+00	nc
Thallium Selenite		12039-52-0	6.9E+00	nc	3.3E+00	nc
Thallium Sulfate		7446-18-6	6.1E+00	nc	2.9E+00	nc
2-(Thicyanomethylithio)-benzothiazole (TCMTB)		3689-24-5	3.3E+01	nc	1.8E+01	nc
Thiobencarb		28249-77-6	6.5E+02	nc	3.7E+02	nc
2-(Thiocyanomethylthio)-Benzothiazole		3689-24-5	3.3E+01	nc	1.8E+01	nc
Thiodiglycol	b	111-48-8	1.0E+05	max	1.4E+07	nc
Thiofanox		39196-18-4	2.0E+01	nc	1.1E+01	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
Thiolcarbamate		2008-41-5	3.3E+03	nc	1.8E+03	nc
Thiophanate-Methyl		23564-05-8	5.2E+03	nc	2.9E+03	nc
Thiram		137-26-8	3.3E+02	nc	1.8E+02	nc
Tin		7440-31-5	4.6E+04	nc	2.2E+04	nc
TNT		118-96-7	1.5E+03	ca	2.2E+02	ca
Toluene		108-88-3	1.9E+03	nc	7.2E+02	nc
Toluene hexahydride		108-87-2	5.6E+04	nc	3.1E+04	nc
Toluene, 2,4-Dinitro-		121-14-2	1.3E+02	nc	7.3E+01	nc
Toluene-2,4-Diamine		95-80-7	1.4E+01	ca	2.1E+00	ca
Toluene-2,5-Diamine		95-70-5	3.9E+04	nc	2.2E+04	nc
Toluene-2,6-Diamine		823-40-5	1.3E+04	nc	7.3E+03	nc
o-Toluidine		100-61-8	1.9E+02	ca	2.8E+01	ca
p-Toluidine		106-49-0	2.3E+02	ca	3.5E+01	ca
p-Toluidine,alpha,alpha,alpha-trifluoro-2,6-dinitro-N,N-dipropyl		1582-09-8	5.8E+03	ca	8.7E+02	ca
Toluol		108-88-3	1.9E+03	nc	7.2E+02	nc
Tolylchloride		100-44-7	1.4E+02	ca	6.6E+00	ca
Toxaphene		8001-35-2	4.0E+01	ca	6.1E+00	ca
Tralomethrin		66841-25-6	4.9E+02	nc	2.7E+02	nc
trans-2-Butenal		123-73-9	1.6E+00	ca	5.9E-01	ca
1,2-trans-dichloroethylene		156-60-5	1.7E+02	nc	1.2E+02	nc
Triallate		2303-17-5	8.5E+02	nc	4.7E+02	nc
Triasulfuron		82097-50-5	6.5E+02	nc	3.7E+02	nc
as-Triazin-5(4H)-one,4-amino-6-tert-butyl-3-(methylthio)-		21087-64-9	1.6E+03	nc	9.1E+02	nc
1,2,4-Tribromobenzene		615-54-3	3.3E+02	nc	1.8E+02	nc
Tribromomethane		75-25-2	5.6E+03	ca	8.5E+02	ca
Tributyltin Oxide (TBTO)		56-35-9	2.0E+00	nc	1.1E+00	nc
2,4,6-Trichloroaniline Hydrochloride		33663-50-2	1.5E+03	ca	2.3E+02	ca
Trichloroaniline Hydrochloride, 2,4,6-		33663-50-2	1.5E+03	ca	2.3E+02	ca
2,4,6-Trichloroaniline		634-93-5	1.3E+03	ca	2.0E+02	ca
1,2,4-Trichlorobenzene		120-82-1	6.2E+02	nc	1.9E+02	nc
2,2,2-Trichloro-1,1-di-(4-Chloro-phenyl)Ethanol		115-32-2	1.0E+02	ca	1.5E+01	ca
1,1,1-Trichloroethane		71-55-6	3.0E+03	nc	1.3E+03	nc
1,1,2-Trichloroethane		79-00-5	1.4E+02	ca	2.0E+01	ca
Trichloroethylene (TCE)		79-01-6	7.1E+02	ca	1.6E+02	ca
Trichlorofluoromethane		75-69-4	7.1E+02	nc	1.3E+03	nc
2,4,5-Trichlorophenol		95-95-4	6.5E+03	nc	3.7E+03	nc
2,4,6-Trichlorophenol		88-06-2	4.0E+03	ca	6.1E+02	ca
2-(2,4,5-Trichlorophenoxy) Propionic Acid (2,4,5-TP)		93-72-1	5.2E+02	nc	2.9E+02	nc
2,4,5-T		93-76-5	6.5E+02	nc	3.7E+02	nc
2,4,5-Trichlorophenoxyacetic Acid		93-76-5	6.5E+02	nc	3.7E+02	nc
1,1,2-Trichloropropane		598-77-6	5.1E+01	nc	3.0E+01	nc
1,2,3-Trichloropropane		96-18-4	6.6E-01	ca	1.6E-01	ca
1,2,3-Trichloropropene		96-19-5	7.5E+01	nc	3.0E+01	nc
1,1,2-Trichloro-1,2,2-Trifluoroethane		76-13-1	4.1E+03	sat	5.9E+04	nc
Tridiphane		58138-08-2	2.0E+02	nc	1.1E+02	nc
Triethylamine		121-44-8	2.2E+01	nc	1.2E+01	nc
N-(m-Trifluoromethylphenyl)-N',N'-Dimethylurea		2164-17-2	8.5E+02	nc	4.7E+02	nc
Trifluralin		1582-09-8	5.8E+03	ca	8.7E+02	ca
Trimethyl Phosphate		512-56-1	1.2E+03	ca	1.8E+02	ca

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Analyte	Note	CAS#	Soil (mg/kg)	Qualifier	Water (ug/L)	Qualifier
1,2,4-Trimethylbenzene	c	95-63-6	3.9E+01	nc	3.0E+00	nc
1,3,5-Trimethylbenzene	c	108-67-8	3.1E+01	nc	2.4E+00	nc
1,3,5-Trinitrobenzene		99-35-4	3.3E+00	nc	1.8E+00	nc
Trinitroglycerin	a	RRSE-016	1.0E+02	nc	NA	NA
Trinitrophenylmethylnitramine		479-45-8	6.5E+02	nc	3.7E+02	nc
2,4,6-Trinitrotoluene		118-96-7	1.5E+03	ca	2.2E+02	ca
unsym-Trichlorobenzene		120-82-1	6.2E+02	nc	1.9E+02	nc
Uranium (Soluble Salts)		7440-61-1	2.3E+02	nc	1.1E+02	nc
Urea,1,1-dimethyl-3-(alpha, alpha, alpha-trifluoro-m-tolyl)-		2164-17-2	8.5E+02	nc	4.7E+02	nc
Urea,N,N-dimethyl-N'-(3(trifluoromethyl)phenyl)-		2164-17-2	8.5E+02	nc	4.7E+02	nc
Vanadic anhydride		1314-62-1	6.9E+02	nc	3.3E+02	nc
Vanadium		7440-62-2	5.4E+02	nc	2.6E+02	nc
Vanadium oxide		1314-62-1	6.9E+02	nc	3.3E+02	nc
Vanadium pentaoxide, non-fused form		1314-62-1	6.9E+02	nc	3.3E+02	nc
Vanadium Pentoxide		1314-62-1	6.9E+02	nc	3.3E+02	nc
Vanadium Sulfate		13701-70-7	1.5E+03	nc	7.3E+02	nc
Vanadyl Sulfate		27774-13-6	1.5E+03	nc	7.3E+02	nc
Vernam		1929-77-7	6.5E+01	nc	3.7E+01	nc
Vinclozolin		50471-44-8	1.6E+03	nc	9.1E+02	nc
Vinyl 2-Chloroethyl Ether	c	110-75-8	2.0E+03	nc	1.5E+02	nc
Vinyl Acetate		108-05-4	6.5E+04	nc	3.7E+04	nc
Vinyl beta-Chloroethyl Ether	c	110-75-8	2.0E+03	nc	1.5E+02	nc
Vinyl Bromide		593-60-2	4.5E+01	ca	1.0E+01	ca
Vinyl Chloride		75-01-4	5.2E-01	ca	2.0E+00	ca
Vinyl Cyanide		107-13-1	1.3E+01	ca	3.7E+02	ca
Vinyl Ester Acetic Acid		108-05-4	6.5E+04	nc	3.7E+04	nc
Vinylbenzene		100-42-5	2.2E+03	sat nc	1.6E+03	nc
Vinylbenzol		100-42-5	2.2E+03	sat nc	1.6E+03	nc
VX	i	50782-69-9	2.7E-01	nc	2.6E-02	nc
Warfarin		81-81-2	2.0E+01	nc	1.1E+01	nc
Xylene		1330-20-7	9.9E+02	sat	1.4E+03	nc
Xylene (Mixed)		1330-20-7	9.9E+02	sat	1.4E+03	nc
1,3-Xylene		108-38-3	9.9E+02	sat nc	1.4E+03	nc
1,4-Xylene		106-42-3	9.9E+02	sat nc	1.4E+03	nc[c]
Isomers of xylene		1330-20-7	9.9E+02	sat	1.4E+03	nc
m-Xylene		108-38-3	9.9E+02	sat nc	1.4E+03	nc
o-Xylene		95-47-6	9.9E+02	sat	1.4E+03	nc
p-Xylene		106-42-3	9.9E+02	sat nc	5.2E+02	nc[c]
Xylenes (isomers and mixtures)		1330-20-7	9.9E+02	sat	1.4E+03	nc
2,4-Xylenol		105-67-9	1.3E+03	nc	7.3E+02	nc
Zenkor		21087-64-9	1.6E+03	nc	9.1E+02	nc
Zinc		7440-66-6	2.3E+04	nc	1.1E+04	nc
Zinc Cyanide		557-21-1	3.3E+03	nc	1.8E+03	nc
Zinc Phosphide		1314-84-7	2.3E+01	nc	1.1E+01	nc
Zineb		12122-67-7	3.3E+03	nc	1.8E+03	nc
Zineb Delete		12122-67-7	3.3E+03	nc	1.8E+03	nc

RELATIVE RISK COMPARISON VALUES
General Organic/Inorganic Analytes

Notes:
All values presented in scientific notation - e.g., 2.5E+02 = 2.5 x 10^2 = 250
mg/kg - milligrams per killogram; equivalent to parts per million
ug/L - micrograms per Liter; equivalent to parts per billion
nc - value based on a non-cancer exposure endpoint
ca - value based on a carcinogenic exposure endpoint
sat - substance achieved point of saturation at this value
max -set at 100,000 mg/kg for soils (nonvolatiles)
Footnote in the qualifer column applies only to the associated media value. For example, the footnote "c" in the qualifier column for 1,4-Dimethylbenzene applies only to the value for water of 5.2E+02 ug/l.

a - Memorandum, HSHB-ME-SH, U.S. Army Environmental Hygiene Agency, 18 Nov 1993, subject: Risk-Based Soil Action Levels, Operation Safe Removal, Phase II, Spring Valley.

b - Opresko, D., et al, Estimated Control Limits, Technologies and Regulatory Requirements for Remediating Sites Potentially Contaminated with Nonstockpile Chemical Materiels, Final Draft Report, Oak Ridge National Laboratory, November 1994. These numbers are draft, as of March 1996.

c - U.S. Environmental Protection Agency, Region III, Risk-Based Concentration Table, July December 1995, October 20, 1995.

d - Oak Ridge National Laboratory, Draft Data Analysis for Sulfur Mustard (HD), April 1996.

e - Oak Ridge National Laboratory, Draft Data Analysis and Derivation of Reference Doses for Lewisite (CAS NO 541-25-3), January 1996.

f - Oak Ridge National Laboratory, Draft Data Analysis for Nerve Agent GA, April 1996

g - Oak Ridge National Laboratory, Draft Data Analysis for Nerve Agent GB, April 1996

h - Oak Ridge National Laboratory, Draft Data Analysis for Nerve Agent GD, April 1996

i - Oak Ridge National Laboratory, Draft Data Analysis for Nerve Agent VX, April 1996

j - No Chemical AbstractSystem (CAS) Number available, unique identifier assigned for database tracking

RELATIVE RISK COMPARISON VALUES
Radionuclides

Analyte	CAS#	Soil (pCi/kg)	Water (pCi/L)
Plutonium 236	15411-92-4	1.60E+06	9.50E+01
Plutonium 238	13981-16-3	3.60E+05	2.20E+01
Plutonium 239	15117-48-3	3.50E+05	2.10E+01
Plutonium 240	14119-33-6	3.50E+05	2.10E+01
Plutonium 241	14119-32-5	2.20E+07	1.30E+03
Plutonium 242	13982-10-0	3.60E+05	2.20E+01
Plutonium 243	15706-37-3	7.20E+08	4.30E+04
Plutonium 244	14119-34-7	3.60E+05	2.20E+01
Radium 226	13982-63-3	6.60E+05	4.00E+01
Radon 222	14859-67-7	5.70E+07	3.40E+03
Thorium 227	15623-47-9	1.80E+07	1.10E+03
Thorium 228	14274-82-9	7.20E+06	4.30E+02
Thorium 229	15594-54-4	3.80E+06	2.30E+02
Thorium 230	14269-63-7	6.10E+06	3.70E+02
Thorium 231	14932-40-2	2.00E+08	1.20E+04
Thorium 232	7440-29-1	NA	NA
Thorium 234	15065-10-8	2.00E+07	1.20E+03
Tritium	10028-17-8	NA	NA
Uranium 233	13968-55-3	5.00E+06	3.00E+02
Uranium 234	13966-29-5	5.00E+06	3.00E+02
Uranium 235	15117-96-1	5.00E+06	3.00E+02
Uranium 238	7440-61-1	NA	NA

Note - Values taken from EPA SCDM database
and adjusted for 1 in 10,000 cancer risk.

APPENDIX B-2

RELATIVE RISK COMPARISON VALUES

Ambient Water Quality

Ambient Water Quality Criteria (AWQC) have been developed under Section 304(a) of the Clean Water Act for priority toxic pollutants as guidelines from which states develop water quality standards. The criteria used to develop the Relative Risk Comparison Values were extracted from *Title 40, Code of Federal Regulations, Part 131, Chapter I, as amended*. These Comparison Values represent promulgated Federal criteria. Additional State requirements vary; thus, these are not represented in this table. The U.S. Environmental Protection Agency (EPA) criteria used in this Appendix are for fresh water and marine chronic exposures; although, acute exposure values have been used (and identified) where no chronic levels exist. Also, the EPA's Lowest Observed Effects Levels are used (as indicated by footnotes) in the absence of established AWQC.

The AWQ Relative Risk Comparison Values should be used for the assessment of surface waters where the potentials for impacts on ecological health are of primary interest.

Please note that synonyms have been added to Appendix B-2 to facilitate its use. In instances where no Chemical Abstract System (CAS) number was available, a unique identifier has been assigned to the analyte for database function purposes.

The Relative Risk Comparison Values will be formally updated as part of future Primer revisions to address new data issued from EPA or other sources, including military unique compounds. The Relative Risk Comparison Values will be posted on the Internet through the U.S. Army Center for Health Promotion and Preventative Medicine home page.

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RELATIVE RISK COMPARISON VALUES
Ambient Water Quality

Analyte	CAS Number	Fresh LeL ug/L	Foot	Marine ER-L ug/L	Foot
Acenaphthene	83-32-9	5.20E+02	a,b	7.10E+02	a,b
Acrolein	107-02-8	2.10E+01	a	5.50E+01	a,b
Acrylaldehyde	107-02-8	2.10E+01	a	5.50E+01	a,b
Acrylic Aldehyde	107-02-8	2.10E+01	a	5.50E+01	a,b
Acrylon	107-13-1	2.60E+03	a	NA	
Acrylonitrile	107-13-1	2.60E+03	a	NA	
Aldrin	309-00-2	3.00E+00	b	1.30E+00	b
Alpha, Beta-Dichloroethane	107-06-2	2.00E+04	a	1.13E+05	a,b
Antimony	7440-36-0	3.00E+01	d	5.00E+02	d
Aroclor	1336-36-3	1.40E-02		3.00E-02	
Arsenic (III)	22569-72-8	1.90E+02		3.60E+01	
1,2-Benzacenaphthene	206-44-0	3.98E+03	a,b	1.60E+01	a
Benzene	71-43-2	5.30E+03	a,b	7.00E+02	a
Benzene, hexachloro-	118-74-1	3.68E+00	d	NA	
Benzene, methyl-	108-88-3	1.75E+04	a,b	5.00E+03	a
Benzene,1,2-(1,8-naphthylene)-	206-44-0	3.98E+03	a,b	1.60E+01	a
Benzene,hydrazodi-	122-66-7	2.70E+02	a,b	NA	
1,2-Benzenedicarboxylic Acid, Bis(2-Ethylhexyl)Ester	117-81-7	3.60E+02	d	3.60E+02	d
Benzenol	108-95-2	2.56E+03	a	5.80E+03	a,b
Benzidine	92-87-5	2.50E+03	a,b	NA	
Benzo(jk)Fluorene	206-44-0	3.98E+03	a,b	1.60E+01	a
Benzodioxathiepin-3-Oxide	115-29-7	5.60E-02		9.00E-03	
Benzoepin	115-29-7	5.60E-02		9.00E-03	
Beryllium	7440-41-7	5.30E+00	a	NA	
BHC	680-73-1	1.00E+02	a,b	3.00E-01	a,b
Biphenyl, polychloro-	1336-36-3	1.40E-02		3.00E-02	
Bis(2-Ethylhexyl)Phthalate (DEHP)	117-81-7	3.60E+02	d	3.60E+02	d
Cadmium	7440-43-9	1.10E+00	c	9.30E+00	
Carbon Dichloride	127-18-4	8.40E+02	a	4.50E+02	a
Carbon Tetrachloride	56-23-5	3.52E+04	a,b	5.00E+04	a,b
Chlordane	57-74-9	4.00E-03		4.00E-03	
Chlordane, alpha- (2)	57-74-9	4.00E-03		4.00E-03	
Chlordane, gamma-	57-74-9	4.00E-03		4.00E-03	
Chlorinated Naphthalenes	RRSE-021	1.60E+03	a,b	7.50E+00	a,b
Chlorinated Benzenes	RRSE-022	5.00E+01	a	1.29E+02	a
Chlorinated biphenyl	1336-36-3	1.40E-02		3.00E-02	
Chlorine	7782-50-5	1.10E+01		7.50E+00	
Chloro-3-methylphenol, 4- (p-Chloro-m-cresol)	59-50-7	3.00E+01	a,b	NA	
p-Chloro-m-Cresol	59-50-7	3.00E+01	a,b	NA	
Chloroform	67-66-3	1.24E+03	a	NA	
4-Chlorophenol	106-48-9	NA		2.97E+04	a,b
Chlorpyrifos	2921-88-2	4.00E-02		6.00E-03	
Chromium (III)	1308-14-1	2.10E+02	c	1.03E+04	a,b
Chromium (VI)	7440-47-3	1.10E+01		5.00E+01	
Copper	7440-50-8	1.20E+01	c	2.90E+00	b
Cyanide	57-12-5	5.20E+00		1.00E+00	b
Cyanide (free)	57-12-5	5.20E+00		1.00E+00	
2,4-DCP	120-83-2	5.70E+03	a	NA	
4,4-DDD	72-54-8	6.00E-01	a,b	3.60E+00	a,b
DDE	72-55-9	1.05E+03	a,b	1.40E+01	a,b
4,4-DDE	72-55-9	1.05E+03	a,b	1.40E+01	a,b

RELATIVE RISK COMPARISON VALUES
Ambient Water Quality

Analyte	CAS Number	Fresh LeL ug/L	Foot	Marine ER-L ug/L	Foot
DDT	50-29-3	1.00E-03		1.00E-03	
4,4-DDT	50-29-3	1.00E-03		1.00E-03	
DEHP	117-81-7	3.60E+02	d	3.60E+02	d
Demeton	8065-48-3	1.00E-01		1.00E-01	
Di(2-ethylhexyl)orthophthalate	117-81-7	3.60E+02	d	3.60E+02	d
Dibenzo(b,e)(1,4)dioxin, 2,3,7,8-tetrachloro-	1746-01-6	1.00E-05	a	NA	
Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-	1746-01-6	1.00E-05	a	NA	
Dichlorobenzenes (total)	25321-22-6	7.63E+02	a	1.97E+03	a,b
1,2-Dichloroethane (EDC)	107-06-2	2.00E+04	a	1.13E+05	a,b
Dichloroethylenes (total)	25323-30-3	1.16E+04	a,b	2.24E+05	a,b
2,4-Dichlorohydroxybenzene	120-83-2	5.70E+03	a	NA	
2,4-Dichlorophenol	120-83-2	5.70E+03	a	NA	
Dichloropropane	26638-19-7	5.70E+03	a	3.04E+03	a
Dichloropropene	26952-23-8	2.44E+02	a	7.90E+02	a,b
Dieldrin	60-57-1	2.00E-03		2.00E-03	
Diethyl mercaptosuccinate s-ester with O,O-	121-75-5	1.00E-01		1.00E-01	
Diethyl mercaptosuccinate, O,O-	121-75-5	1.00E-01		1.00E-01	
O,O-Diethyl Mercaptosuccinate	121-75-5	1.00E-01		1.00E-01	
Di-2-Ethylhexyl Phthalate	117-81-7	3.60E+02	d	3.60E+02	d
Di(2-Ethylhexyl)Orthophthalate	117-81-7	3.60E+02	d	3.60E+02	d
Di(2-Ethylhexyl)Phthalate	117-81-7	3.60E+02	d	3.60E+02	d
Dimethyl Dithiophosphate	121-75-5	1.00E-01		1.00E-01	
2,4-Dimethyl Phenol	105-67-9	2.12E+03	a,b	NA	
2,4-Dimethylphenol	105-67-9	2.12E+03	a,b	NA	
4,6-Dimethylphenol	105-67-9	2.12E+03	a,b	NA	
Dinitotoluene	121-14-2	2.30E+02	a	NA	
Dinitrotoluene (total)	25321-14-6	NA		3.70E+02	a
Dinitrotoluene Mixture	25321-14-6	NA		3.70E+02	a
2,4-Dinitrotoluene	121-14-2	2.30E+02	a	NA	
2,4-Dinitrotoluol	121-14-2	2.30E+02	a	NA	
Dioctyl phthalate	117-81-7	3.60E+02	d	3.60E+02	d
1,2-Diphenyl hydrazine	122-66-7	2.70E+02	a,b	NA	
1,2-Diphenylhydrazine	122-66-7	2.70E+02	a,b	NA	
DTE	72-54-8	6.00E-01	a,b	3.60E+00	a,b
EDC	107-06-2	2.00E+04	a	1.13E+05	a,b
Endocide	115-29-7	5.60E-02		9.00E-03	
Endosol	115-29-7	5.60E-02		9.00E-03	
Endosulfan	115-29-7	5.60E-02		9.00E-03	
Endosulfan alpha	959-98-8	5.60E-02		9.00E-03	
Endosulfan beta	33213-65-9	5.60E-02		9.00E-03	
Endosulfan I	959-98-8	5.60E-02		9.00E-03	
alpha-Endosulfan	959-98-8	5.60E-02		9.00E-03	
beta-Endosulfan	33213-65-9	5.60E-02		9.00E-03	
Endrin	72-20-8	2.00E-03		2.00E-03	
Ethane, 1,2-dichloro-	107-06-2	2.00E+04	a	1.13E+05	a,b
Ethyl benzene	100-41-4	3.20E+04	a,b	4.30E+02	a,b
Ethylbenzene	100-41-4	3.20E+04	a,b	4.30E+02	a,b
Ethylbenzol	100-41-4	3.20E+04	a,b	4.30E+02	a,b
Ethylene dichloride	107-06-2	2.00E+04	a	1.13E+05	a,b
1,2-Ethylene Dichloride	107-06-2	2.00E+04	a	1.13E+05	a,b
Ethylene tetrachloride	127-18-4	8.40E+02	a	4.50E+02	a

RELATIVE RISK COMPARISON VALUES
Ambient Water Quality

Analyte	CAS Number	Fresh LeL ug/L	Foot	Marine ER-L ug/L	Foot
Ethylene, tetrachloro-	127-18-4	8.40E+02	a	4.50E+02	a
2-Ethylhexyl Phthalate	117-81-7	3.60E+02	d	3.60E+02	d
Fluoranthene	206-44-0	3.98E+03	a,b	1.60E+01	a
Free cyanide	57-12-5	5.20E+00		1.00E+00	
Guthion	86-50-0	1.00E-02		1.00E-02	
Haloethers (total)	RRSE-023	1.22E+02	a	NA	
Halomethanes (total)	RRSE-024	1.10E+04	a,b	6.40E+03	a
HCH (gamma) Lindane	58-89-9	8.00E-02		1.60E-01	b
HCH -technical	58-89-9	8.00E-02		1.60E-01	b
Heptachlor	76-44-8	4.00E-03		4.00E-03	
Heptachlor Epoxide	1024-57-3	4.00E-03		4.00E-03	
Hexachloro-5-norbornene-2,3-dimethanol cyclic sulfite	115-29-7	5.60E-02		9.00E-03	
Hexachlorobenzene	118-74-1	3.68E+00	d	NA	
Hexachlorobicyclo(2.2.1)-2-heptene-5,6-bisoxymethylene sulfite	115-29-7	5.60E-02		9.00E-03	
Hexachlorobutadiene	87-68-3	9.30E+00	a	3.20E+01	a,b
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH), Gamma - Lindane	58-89-9	8.00E-02		1.60E-01	b
Hexachlorocyclohexane (Lindane)	58-89-9	8.00E-02		1.60E-01	b
Hexachlorocyclopentadiene	77-47-4	5.20E+00	a	7.00E+00	a,b
Hexachloroethane	67-72-1	5.40E+02	a	9.40E+02	a,b
Hexachloropentadiene	77-47-4	5.20E+00	a	7.00E+00	a,b
Hydrazobenzene	122-66-7	2.70E+02	a,b	NA	
Hydrazodibenzene	122-66-7	2.70E+02	a,b	NA	
Hydrogen Sulfide	7783-06-4	2.00E+00		2.00E+00	
Hydroxybenzene	108-95-2	2.56E+03	a	5.80E+03	a,b
1-Hydroxy-2,4-dimethylbenzene	105-67-9	2.12E+03	a,b	NA	
Iron	7439-89-6	1.00E+03		NA	
Isophorone	78-59-1	1.17E+05	a,b	1.29E+04	a,b
Lead	7439-92-1	3.20E+00	c	8.50E+00	
Lindane	58-89-9	8.00E-02		1.60E-01	b
Malathion	121-75-5	1.00E-01		1.00E-01	
Mercaptosuccinic acid diethyl ester	121-75-5	1.00E-01		1.00E-01	
Mercury	7439-97-6	1.20E-02		2.50E-02	
Methoxychlor	72-43-5	3.00E-02		3.00E-02	
Methyl Benzene	108-88-3	1.75E+04	a,b	5.00E+03	a
Methyl-4-chlorophenol	59-50-7	3.00E+01	a,b	NA	
Methylbenzene	108-88-3	1.75E+04	a,b	5.00E+03	a
4-Methyl-3-Chlorophenol	59-50-7	3.00E+01	a,b	NA	
1-Methyl-2,4-Dinitrobenzene	121-14-2	2.30E+02	a	NA	
Mirex	2385-85-5	1.00E-03		1.00E-03	
Monohydroxybenzene	108-95-2	2.56E+03	a	5.80E+03	a,b
N,N'-Bianiline	122-66-7	2.70E+02	a,b	NA	
N,N'-Diphenylhydrazine	122-66-7	2.70E+02	a,b	NA	
Naphthalene	91-20-3	6.20E+02	a	2.35E+03	a,b
1,2-(1,8-naphthylene)-Benzene	206-44-0	3.98E+03	a,b	1.60E+01	a
Nickel	7440-02-0	1.60E+02	c	8.30E+00	
Nickel (Soluble Salts)	7440-02-0	1.60E+02	c	8.30E+00	
Nitrobenzene	98-95-3	2.70E+04	a,b	6.68E+03	a,b
Nitrophenols (total)	RRSE-025	1.50E+02	a	4.85E+03	a,b
Nitrosamines	35576-91-1	5.85E+03	a,b	3.30E+06	a,b

RELATIVE RISK COMPARISON VALUES
Ambient Water Quality

Analyte	CAS Number	Fresh LeL ug/L	Foot	Marine ER-L ug/L	Foot
5-Norbornene-2,3-dimethanol, 1,4,5,6,7,7-hexachloro-,cyclicsulfite	115-29-7	5.60E-02		9.00E-03	
O,O-Dimethyl phosphorodithioate	121-75-5	1.00E-01		1.00E-01	
O,O-Dimethyl thiophosphate	121-75-5	1.00E-01		1.00E-01	
Oxybenzene	108-95-2	2.56E+03	a	5.80E+03	a,b
Parathion	56-38-2	1.30E-02		NA	
PCB	1336-36-3	1.40E-02		3.00E-02	
PCBs	1336-36-3	1.40E-02		3.00E-02	
PCE	127-18-4	8.40E+02	a	4.50E+02	a
Pentachloroethane	76-01-7	1.10E+03	a	2.81E+02	a
Pentachlorophenol	87-86-5	1.30E+01	e	7.90E+00	
Pentachlorophenyl chloride	118-74-1	3.68E+00	d	NA	
PERC	127-18-4	8.40E+02	a	4.50E+02	a
Perchlorobenzene	118-74-1	3.68E+00	d	NA	
Perchloroethylene (PCE)	127-18-4	8.40E+02	a	4.50E+02	a
Phenanthrene	85-01-8	6.30E+00	d	4.60E+00	d
Phenol	108-95-2	2.56E+03	a,b	5.80E+03	a,b
Phenol,2,4-dichloro-	120-83-2	5.70E+03	a	NA	
Phenylethane	100-41-4	3.20E+04	a,b	4.30E+02	a,b
Phenylmethane	108-88-3	1.75E+04	a,b	5.00E+03	a
Phosphorus	7723-14-0	NA		1.00E-01	
Phthalate Esters	RRSE-027	3.00E+00	a	3.40E+00	a
Phthalic acid, bis(2-ethylhexyl) ester	117-81-7	3.60E+02	d	3.60E+02	d
Polychlorinated Biphenyls (PCBs)	1336-36-3	1.40E-02		3.00E-02	
Polychlorobiphenyl	1336-36-3	1.40E-02		3.00E-02	
Polynuclear Aromatic Hydrocarbons	RRSE-028	NA		3.00E+02	a,b
2-Propenal	107-02-8	2.10E+01	a	5.50E+01	a,b
Propenenitrile	107-13-1	2.60E+03	a	NA	
2-Propenenitrile	107-13-1	2.60E+03	a	NA	
Propylene aldehyde	107-02-8	2.10E+01	a	5.50E+01	a,b
Selenium	7782-49-2	5.00E+00		7.10E+01	
Silver	7440-22-4	1.20E-01		9.20E-01	d
Succinic acid	121-75-5	1.00E-01		1.00E-01	
Sulfide-Hydrogen Sulfide	7783-06-4	2.00E+00		2.00E+00	
TCDD	1746-01-6	1.00E-05	a	NA	
2,3,7,8-TCDD (Dioxin)	1746-01-6	1.00E-05	a	NA	
2,3,7,8-Tetrachlorobenzo-1,4- Dioxin	1746-01-6	1.00E-05	a	NA	
2,3,7,8-Tetrachlorobenzo-p-Dioxin	1746-01-6	1.00E-05	a	NA	
2,3,7,8-Tetrachlorodibenzo(be) (1,4)Dioxin	1746-01-6	1.00E-05	a	NA	
1,1,2,2-Tetrachloroethane	79-34-5	2.40E+03	a	9.02E+03	a,b
Tetrachloroethanes	25322-20-7	9.32E+03	a,b	NA	
Tetrachloroethylene (PCE)	127-18-4	8.40E+02	a	4.50E+02	a
1,1,2,2,-Tetrachloroethylene	127-18-4	8.40E+02	a	4.50E+02	a
2,3,5,6-Tetrachlorophenol	935-95-5	NA		4.40E+02	a,b
Thallium	7440-28-0	4.00E+01	a	2.13E+03	a,b
Toluene	108-88-3	1.75E+04	a,b	5.00E+03	a
Toluene,2,4-dinitro-	121-14-2	2.30E+02	a	NA	
Toluol	108-88-3	1.75E+04	a,b	5.00E+03	a
Toxaphene	8001-35-2	2.00E-04		2.00E-04	
Trichlorinated Ethanes	25323-89-1	1.80E+04	a,b	NA	
1,1,1-Trichloroethane	71-55-6	NA		3.12E+04	a,b
1,1,2-Trichloroethane	79-00-5	9.40E+03	a	NA	

RELATIVE RISK COMPARISON VALUES
Ambient Water Quality

Analyte	CAS Number	Fresh LeL ug/L	Foot	Marine ER-L ug/L	Foot
Trichloroethylene (TCE)	79-01-6	2.19E+04	a	2.00E+03	a,b
2,4,5-Trichlorophenol	95-95-4	6.30E+01	d	1.10E+01	d
2,4,6-Trichlorophenol	88-06-2	9.70E+02	a	NA	
Vinyl cyanide	107-13-1	2.60E+03	a	NA	
2,4-Xylenol	105-67-9	2.12E+03	a,b	NA	
m-Xylenol	105-67-9	2.12E+03	a,b	NA	
Zinc	7440-66-6	1.10E+02	c	8.60E+01	

Notes -

[a] - Insufficient data to develop criteria. Value presented is the Lowest Observed Effect Level (LOEL).
[b] - No chronic exposure values available; value presented based on available acute toxicity levels.
[c] - Hardness dependent criteria; 100 mg/L $CaCO_3$ used.
[d] - Value presented is a proposed criterion.
[e] - pH dependent criterion; pH = 7.8 used.

APPENDIX B-3

RELATIVE RISK COMPARISON VALUES

MARINE AND AQUATIC SEDIMENTS

The Relative Risk Comparison Values presented should be used to rank marine, estuarine, and fresh water sediments that may impact potential ecological receptors in these habitats. (Concerns regarding human exposures to contaminated sediments should be addressed using the data presented in Appendix B-1) These Comparison Values represent relatively conservative screening values and are not to be considered as "clean-up goals." Concentrations greater than the Comparison Value generally indicates the need for a more extensive, site-specific assessment. The National Oceanic and Atmospheric Administration [NOAA] values apply to marine and estuarine environments, while the data, obtained from the Ontario Ministry of Environment and Energy, have been widely used within DOD to assess fresh water systems.

Please note that synonyms have been added to Appendix B-3 to facilitate its use. In instances where no Chemical Abstract System (CAS) number was available, a unique identifier has been assigned to the analyte for database function purposes.

The Relative Risk Comparison Values will be formally updated as part of future Primer revisions to address new data issued from EPA or other sources. The Relative Risk Comparison Values will be posted on the Internet through the U.S. Army Center for Health Promotion and Preventative Medicine home page.

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RELATIVE RISK COMPARISON VALUES
Marine and Aquatic Sediment

Analyte	CAS Number	Marine ER-L (mg/kg) [a]	Freshwater LEL (mg/kg) [b]
Acenaphthene	83-32-9	1.50E-01	NA
Acenaphthylene	207-08-9	NA	2.40E-01
Aldrin	309-00-2	NA	2.00E-03
Anthracene	120-12-7	8.50E-02	2.20E-01
Anthracin	120-12-7	8.50E-02	2.20E-01
Antimony	7440-36-0	2.00E+00	NA
Arochlor 1016	12674-11-2	NA	7.00E-03
Arochlor 1248	RRSE-030	NA	3.00E-02
Arochlor 1254	11097-69-1	NA	6.00E-02
Arochlor 1260	RRSE-031	NA	5.00E-03
Aroclor	1336-36-3	5.00E-02	7.00E-02
Aroclor 1016	12674-11-2	NA	7.00E-03
Arsenic	7440-38-2	3.30E+01	6.00E+00
1,2-Benzacenaphthene	206-44-0	6.00E-01	7.50E-01
Benzene,1,2-(1,8-naphthylene)-	206-44-0	6.00E-01	7.50E-01
Benzo(a)Anthracene	56-55-3	2.30E-01	3.20E-01
Benzo(a)Pyrene	50-32-8	4.00E-01	3.70E-01
Benzo(def)Phenanthrene	129-00-0	3.50E-01	4.90E-01
Benzo(g,h,i)Perylene	198-55-0	NA	1.70E-01
Benzo(jk)Fluorene	206-44-0	6.00E-01	7.50E-01
Benzo(k)Fluoranthene	207-08-9	NA	2.40E-01
11,12-Benzofluoranthene	207-08-9	NA	2.40E-01
8,9-Benzofluoranthene	207-08-9	NA	2.40E-01
beta-Pyrene	129-00-0	3.50E-01	4.90E-01
BHC	608-73-1	NA	3.00E-03
alpha-BHC	319-84-6	NA	6.00E-03
beta-BHC	319-85-7	NA	5.00E-03
2,3,1',8'-Binaphthylene	207-08-9	NA	2.40E-01
Biphenyl, polychloro-	1336-36-3	5.00E-02	7.00E-02
Cadmium	7440-43-9	5.00E+00	6.00E-01
Carbazole	86-74-8	4.00E-01	3.40E-01
Chlordane	57-74-9	5.00E-04	7.00E-03
Chlordane, alpha- (2)	57-74-9	5.00E-04	7.00E-03
Chlordane, gamma-	57-74-9	5.00E-04	7.00E-03
Chlorinated Biphenyl	1336-36-3	5.00E-02	7.00E-02
Chromium	7440-47-3	8.00E+01	2.60E+01
Chrysene	218-01-9	6.00E-02	6.00E-02
Copper	7440-50-8	7.00E+01	1.60E+01
1,8-Cyclopenta(de)naphthalene	207-08-9	NA	2.40E-01
DDD	6088-51-3	1.00E-03	8.00E-03
4,4-DDD	6088-51-3	1.00E-03	8.00E-03
DDE	72-55-9	2.00E-03	5.00E-03
4,4-DDE	72-55-9	2.00E-03	5.00E-03
DDT	50-29-3	2.00E-03	8.00E-03
4,4-DDT	50-29-3	2.00E-03	8.00E-03
Dibenzo(a,h)Anthracene	218-01-9	6.00E-02	6.00E-02
Dibenzo(b,jk)fluorene	207-08-9	NA	2.40E-01
1,2,5,6-Dibenzonaphthalene	218-01-9	6.00E-02	6.00E-02
Dieldrin	60-57-1	2.00E-05	2.00E-03
Endrin	72-20-8	2.00E-05	3.00E-03
Fluoranthene	206-44-0	6.00E-01	7.50E-01
Fluorene	86-73-7	3.50E-02	1.90E-01

RELATIVE RISK COMPARISON VALUES
Marine and Aquatic Sediment

Analyte	CAS Number	Marine ER-L (mg/kg) [a]	Freshwater LEL (mg/kg) [b]
gamma-BHC	58-89-9	NA	3.00E-03
HCB	RRSE-032	NA	2.00E-02
HCH (alpha)	319-84-6	NA	6.00E-03
HCH (beta)	319-85-7	NA	5.00E-03
HCH (gamma) Lindane	58-89-9	NA	3.00E-03
HCH -technical	58-89-9	NA	3.00E-03
Heptachlor Epoxide	1024-57-3	NA	5.00E-03
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH) - Technical	608-73-1	NA	3.00E-03
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH), Alpha	319-84-6	NA	6.00E-03
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH), Beta	319-85-7	NA	5.00E-03
1,2,3,4,5,6-Hexachlorocyclo-hexane (HCH), Gamma - Lindane	58-89-9	NA	3.00E-03
Indeno(1,2,3-cd)Pyrene	86-73-7	NA	2.00E-01
Iron	7439-89-6	NA	2.00E+04
Lead	7439-92-1	3.50E+01	3.10E+01
Lindane	58-89-9	NA	3.00E-03
Manganese	7439-96-5	NA	4.60E+02
Mercury	7439-97-6	1.50E-01	2.00E-01
2-Methylnapthalene	91-57-6	6.50E-02	NA
Mirex	2385-85-5	NA	7.00E-03
Naphthalene	91-20-3	3.40E-01	NA
Nickel	7440-02-0	3.00E+01	1.60E+01
PAHs (total)	RRSE-033	4.00E+00	4.00E+00
Paranaphthalate	120-12-7	8.50E-02	2.20E-01
PCB	1336-36-3	5.00E-02	7.00E-02
PCB 1016	12674-11-2	NA	7.00E-03
PCBs	1336-36-3	5.00E-02	7.00E-02
Phenanthrene	85-01-8	2.25E-01	5.60E-01
Polychlorinated Biphenyls (PCBs)	1336-36-3	5.00E-02	7.00E-02
Polychlorobiphenyl	1336-36-3	5.00E-02	7.00E-02
Pyrene	129-00-0	3.50E-01	4.90E-01
Silver	7440-22-4	1.00E+00	NA
Total Kjeldahl Nitrogen	RRSE-034	NA	5.50E+02
Total Organic Carbon (%)	RRSE-035	NA	1.00E+00
Total Phosphorus	RRSE-036	NA	6.00E+02
Zinc	7440-66-6	1.20E+02	1.20E+02

RELATIVE RISK COMPARISON VALUES
Marine and Aquatic Sediment

Notes -

[a] - Obtained from: Long, Edward R. and Lee G. Morgan, NOAA Technical Memorandum NOS OMA 52, ***The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program*** , August 1990.

ER-L - Environmental Response-Low, which represents a no-effects level (i.e., response noted in less than 5% of the observations)

[b] - Obtained from: Persaud, D., R. Jaagumagi, and A Hayton, Ontario Ministry of Environment and Energy, ***Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*** , August 1993.

LEL - Lowest Effect Level, which indicates a level of contamination which has an effect on less than 5% of the sediment-dwelling organisms observed

APPENDIX C

Regulatory Agreement and

Site Type Codes Used in DERA and BRAC Programs

Note: These codes are included here for informational purposes and will be kept consistent with codes used in the Restoration Management Information System/Defense Site Environmental Restoration Tracking System (RMIS/DSERTS). Actual codes for each DoD installation and formerly used defense site reside in the Cost-to-Complete estimates database. Codes in this database will be cross-walked with relative risk site evaluation information to obtain actual Regulatory Agreement and RMIS/DSERTS Site Type Codes.

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APPENDIX C

CODES FOR REGULATORY AGREEMENTS

Code	Enforcement Agreement	Comments*
A	Federal Facility Agreement at NPL and proposed NPL installations	Yes
B	Interagency Agreement (2 and 3 party) at non-NPL installations	Yes
C	RCRA Permits with Corrective Action Requirements	Yes
D	RCRA Corrective Action Orders (Issued by EPA or a state)	Yes
E	Consent Order under state law	Yes
F	Memorandum of Understanding commitments	Yes
G	Memorandum of Agreement commitments	Yes
H	Notice of Violation requirements	Yes
I	Requirements related to Agency for Toxic Substances Disease Registry (e.g., response to health advisory)	No
J	Requirements related to Natural Resource Trustee claim (e.g., damage claim)	No
K	Court-ordered requirements (in cases of litigation)	Yes
L	Imminent threats	No
M	Consent decrees (usually for third-party sites)	Yes
N	Unilateral orders (usually for third-party sites)	Yes
O	Preliminary Assessments for installations listed on the Docket	No
P	Long-Term Operation/Monitoring for in-place cleanup systems for installations without agreements	No
Q	State laws and regulations requiring response within a specified period	No
R	Congressional/owner concerns	No, except for FUDS
S	Building demolition/debris removal	No, except for FUDS
T	Ordnance and explosive waste, RAC 1-2	No, except for FUDS
U	Ordnance and explosive waste, RAC 3-4	No, except for FUDS
Z	No agreements	No
Blank	Manpower/workyears	No

* "Yes" in the comments column indicates a regulatory agreement for purposes of relative risk evaluation. "No" indicates that the agreement type is not considered a regulatory agreement for relative risk evaluation, with exceptions as noted.

CODES FOR RMIS/DSERTS SITE TYPES

Code	Site Type
TA	Aboveground Storage Tank
DB	Building Demolition/Debris Removal
AB	Burn Area
DC	Chemical Disposal
CB	Contaminated Buildings
CF	Contaminated Fill
CG	Contaminated Groundwater
CS	Contaminated Sediments
CD	Contaminated Soil Piles
DT	Dip Tank
DP	Disposal Pit/Dry Well
DD	Drainage Ditch
XE	Explosive Ordnance Disposal Area
AT	Fire/Crash Training Area
FR	Firing Range
IN	Incinerator
ID	Industrial Discharge
LF	Landfill
FL	Leach Field
MY	Maintenance Yard
WM	Mixed Waste Area
OW	Oil/Water Separator
OS	Optical Shop
PS	Pesticide Shop
PR	Pistol Range
SP	Plating Shop
PL	POL (Petroleum/Oil/Lubricants) Lines
WR	Radioactive Waste Area
EP	Sewage Effluent Settling Ponds
ST	Sewage Treatment Plant
SR	Small Arms Range
SO	Soil Contamination After Tank Removal
SS	Spill Site Area
SA	Storage Area
SD	Storm Drain
DA	Surface Disposal Area
SI	Surface Impoundment/Lagoon
RS	Surface Runoff
TU	Underground Storage Tanks
TT	Underground Tank Farm
XU	Unexploded Munitions/Ordnance Area
RW	Washrack
WL	Waste Lines
WT	Waste Treatment Plant
ZZ	Other

APPENDIX D

Examples of Completed Relative Risk Site Evaluation Worksheets

Army Landfill (Page D-3)

Navy Fire Training Area (Page D-6)

Air Force Landfill (Page D-13)

Note: Primer users are encouraged to read through the following example site evaluations. They illustrate the type/nature of documentation to be included on worksheets, and provide example language that should be included as **rationale** for MPF and RF factor ratings.

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RELATIVE RISK SITE EVALUATION WORKSHEET

SITE[1] BACKGROUND INFORMATION

Installation/Property Name for FUDS: Example Army Base

Date Entered/Updated (day, month, year): 15 June 1994

Location (City/County State): North City, Washington

Media Evaluated (GW, SW, Sediment, Soil, Sed. Eco., Soil Eco.): GW

Site (Name/DSERTS ID)/Project (Name/Project No.) for FUDS: Landfill 5, ABCDEFGHIJKL

Phase of Execution (SI, RI, FS, EE/CA, IRA, RD/RA, or equiv. RCRA Stage): RD

Point of Contact (Name/Phone): J. Johnson

Agreement Status (enter appropriate DERP Site code): A

SITE SUMMARY

(Include only the key elements of information used to conduct the relative risk site evaluation. Attach map view of site if desired.)

Brief Site Description (include site type, materials disposed of, dates of operation, and other relevant information): *60 acre landfill operated from 1967 through 1990. Materials disposed of include some 77,000 tons of mixed municipal solid waste, 188,000 cubic yards of demolition waste , and dewatered sludge from a nearby sewage treatment plant. Landfill materials were buried in trenches and covered in accordance with State standards. Groundwater is contaminated with volatile organic compounds; surface water sampling revealed no contamination; soil sampling was deemed unnecessary because the landfill cap precludes direct exposure to subsurface soils.*

Brief Description of Pathways (Groundwater, Soil, Surface Water [Human], Surface Water [Ecological], Sediment [Human], Sediment [Ecological]): *Site is underlain by a series of glacial and interglacial deposits. The uppermost aquifer, in which the groundwater contamination is found, consists of sand, gravel and glacial till. It is separated from the lower, confined, sand and gravel aquifer by fine sands and silty clays.*

Brief Description of Receptors (Human and Ecological): *Groundwater from the upper aquifer is used as the water supply for the nearby town. All water supply wells are upgradient from the site, with the nearest water supply 4,000 feet upgradient. Groundwater in the immediate vicinity of the site and downgradient from the site is not used for domestic or agricultural purposes. Local Tribes conduct salmon fishing in Suqua Creek and in the Bay. Several base employees work adjacent to the west edge of the landfill, but no one resides or works in the landfill area.*

[1]The term *Site* is defined as a discrete area for which suspected contamination has been verified and requires further response action. A *Site* by definition has been, or will be, entered into RMIS/DSERTS. For the FUDS Program, "projects" equates to sites for current installations.

GROUNDWATER

CONTAMINANT HAZARD FACTOR[1] (CHF)

Contaminant		Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[2]
1,1-Dichloroethylene	ca	6.8	4.6	1.48
1,2-Dichloroethylene(cis)	nc	3.3	61	0.05
Vinyl Chloride	ca	3.2	2.0	1.60
Toluene	nc	16.0	720	0.02
Manganese	nc	10,700	180	59.44
			Total	**62.59**

1 Evaluate for human contaminants only
2 Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)___

Moderate (if Total 2-100) X

Minimal (if Total <2)___

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the groundwater is moving or has moved away from the source area

Potential - Contamination in the groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates that the potential for contaminant migration from the source via the groundwater is limited (due to geological structures or physical controls)

(Place an "X" next to one below)

Evident___

Potential X

Confined___

Brief Rationale for Selection: *Monitoring well data show very localized contaminant migration not extending beyond the source boundary. GW gradient is nearly flat.*

RECEPTOR FACTOR (RF)

Identified - There is a threatened water supply downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer)

Potential - There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture, (equivalent to Class I, IIA, or IIB aquifer)

Limited - There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only)

(Place an "X" next to one below)

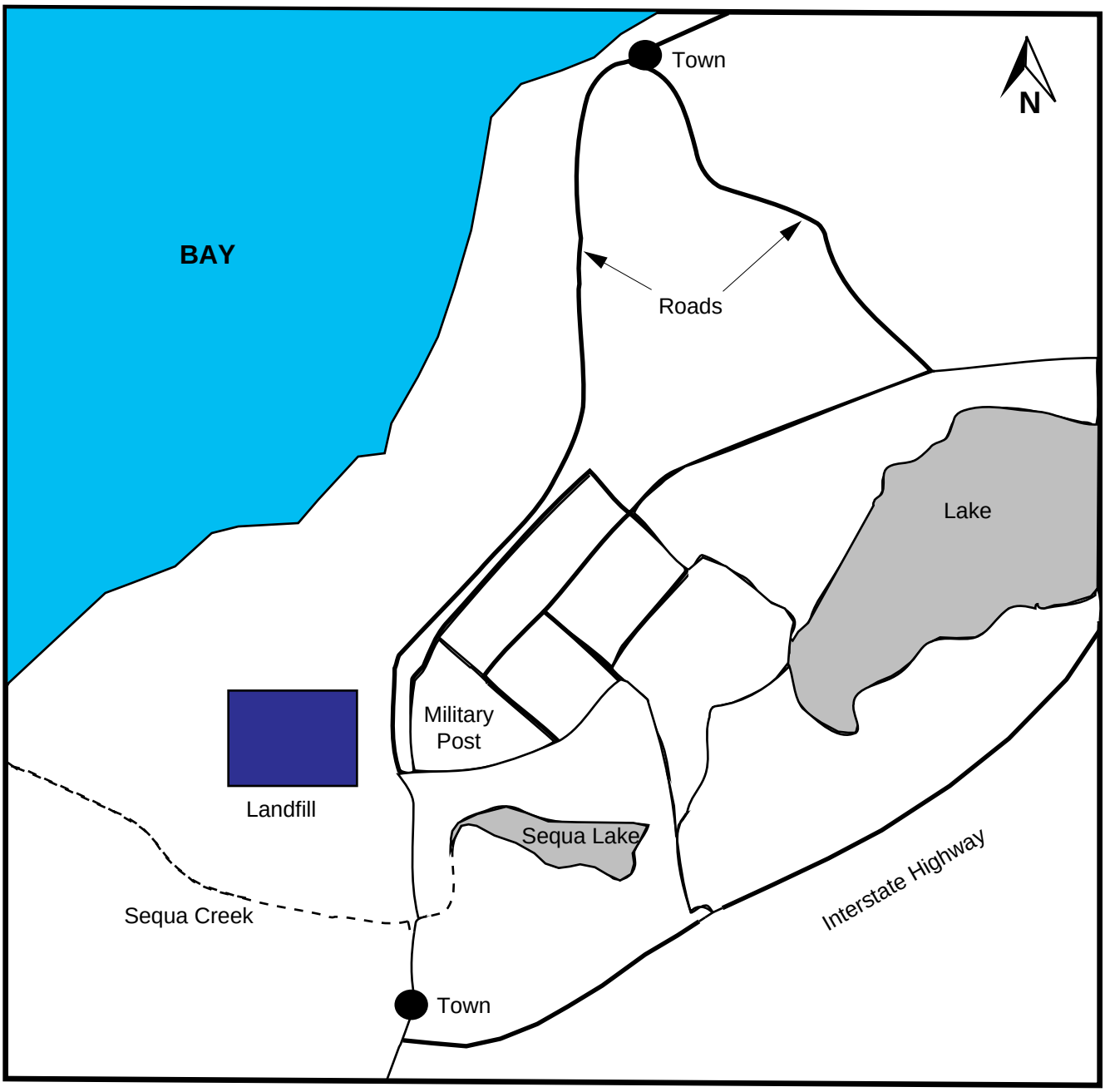
Identified___

Potential X

Limited___

Brief Rationale for Selection: *Groundwater downgradient of site is not currently used, but water is potentially usable.*

Groundwater Category (High, Medium, Low) Medium



Example 1. Map View of Landfill and Vicinity at Example Army Base

RELATIVE RISK SITE EVALUATION WORKSHEET

SITE[1] BACKGROUND INFORMATION

Installation/Property Name for FUDS: Example Navy Base
Location (City/County State): South City, New Jersey
Site (Name/DSERTS ID)/Project (Name/Project No.) for FUDS: Site 00014
Point of Contact (Name/Phone): P. Jackson
Date Entered/Updated (day, month, year): 15 June 1994
Media Evaluated (GW, SW, Sediment, Soil, Sed. Eco., Soil Eco.): ALL
Phase of Execution (SI, RI, FS, EE/CA, IRA, RD/RA, or equiv. RCRA Stage): RD
Agreement Status (enter appropriate DERP Site code): A

SITE SUMMARY

(Include only the key elements of information used to conduct the relative risk site evaluation. Attach map view of site if desired.)

Brief Site Description (include site type, materials disposed of, dates of operation, and other relevant information): *1.5 acre fire fighting training area which was in use 1965-1978. Waste oils, fuels and solvents were released. The fire training area is surrounded by a fence and access is restricted. Contamination was found in groundwater, soils, surface water and sediment.*

Brief Description of Pathways (Groundwater, Soil, Surface Water [Human], Surface Water [Ecological], Sediment [Human], Sediment [Ecological]): *The site is underlain by 150 feet of sand in which a groundwater plume has been identified several hundred yards downgradient of the site. Surface drainage from the site leads to a large lake. Contaminants have been identified in both surface water and sediments in the lake. The soils in the fire training area are contaminated within the fenced-in area.*

Brief Description of Receptors (Human and Ecological): *Groundwater is used for both drinking and livestock watering points downgradient from the site. The lake downstream from the site is used for recreation and is bordered by a State Wildlife Refuge. The site is in a remote area of the base, access is restricted, and there is no evidence of human activity on the site.*

[1]The term *Site* is defined as a discrete area for which suspected contamination has been verified and requires further response action. A *Site* by definition has been, or will be, entered into RMIS/DSERTS. For the FUDS Program, "projects" equates to sites for current installations.

GROUNDWATER

CONTAMINANT HAZARD FACTOR[1] (CHF)

Contaminant		Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[2]
Benzene	ca	130	39	3.3
1,1 dichloroethlyene	ca	2400	4.6	521.7
Vinyl Chloride	ca	2000	2.0	1000.0
Lead	nc	86	4.0	21.5
			Total	**1546.5**

1 Evaluate for human contaminants only
2 Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100) X

Moderate (if Total 2-100)___

Minimal (if Total <2)___

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the groundwater is moving or has moved away from the source area

Potential - Contamination in the groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates that the potential for contaminant migration from the source via the groundwater is limited (due to geological structures or physical controls)

(Place an "X" next to one below)

Evident X

Potential___

Confined___

Brief Rationale for Selection: *Monitoring data indicate presence of groundwater plume several hundred yards downgradient of source area*

RECEPTOR FACTOR (RF)

Identified - There is a threatened water supply downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer)

Potential - There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture, (equivalent to Class I, IIA, or IIB aquifer)

Limited - There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only)

(Place an "X" next to one below)

Identified X

Potential___

Limited___

Brief Rationale for Selection: *A municipal wellfield is located approximately 1/3 mile downgradient*

Groundwater Category (High, Medium, Low): High

SURFACE WATER/HUMAN ENDPOINT

CONTAMINANT HAZARD FACTOR [1] (CHF)

Contaminant		Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[1]
Lead	nc	82	4.0	20.5
4-4'-DDE	ca	0.17	20	<.1
4-methylphenol	nc	2	180	<.1

1 Ratio = Max. Concentration/Comparison Value

20.5

(Place an "X" next to one below)

Significant (if Total >100) __

Moderate (if Total 2-100) X

Minimal (if Total <2)___

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident X

Potential___

Confined___

Brief Rationale for Selection: *Contamination was found in surface water several hundred yards downstream of the site.*

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified X

Potential___

Limited___

Brief Rationale for Selection: *A recreational lake is located downstream of the site.*

Surface Water/Human Endpoint Category High

(High, Medium, Low)

SEDIMENT/HUMAN ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant	Max. Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio[1]
4-4'-DDE ca	270	130	2.1
		Total	2.1

[1]Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)_____

Moderate (if Total 2-100)__X___

Minimal (if Total <2)_____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident _____

Potential __X__

Confined _____

Brief Rationale for Selection: *Contamination in sediment is limited to areas immediately downstream of the site and is not extensive.*

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified _____

Potential __X__

Limited _____

Brief Rationale for Selection: *A recreational lake is located downstream of the site; there is a potential for humans to access the area of sediment contamination, but this would be unlikely since recreational activities are significantly downstream.*

Sediment/Human Endpoint Category Medium

(High, Medium, Low)

SURFACE WATER/ECOLOGICAL ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant		Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[1]
Lead	nc	82	3.2	25.6
4-4'-DDE	ca	0.17	Not Evaluated	-
4-methylphenol	nc	2	Not Evaluated	-
			Total	25.6

[1]Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)_____

Moderate (if Total 2-100)___X__

Minimal (if Total <2)_____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident __X___

Potential _____

Confined _____

Brief Rationale for Selection: *Contamination was found in surface water several hundred yards downstream of the site.*

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified ___X__

Potential _____

Limited _____

Brief Rationale for Selection: *A State Wildlife Refuge is located downstream of the site.*

Surface Water/Ecological Endpoint Category High

(High, Medium, Low)

SEDIMENT/ECOLOGICAL ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant	Max. Concentration	units	Comparison Value	unit	Ratio[1]
4-4'-DDE ca	0.270	mg/kg	.005	mg/kg	54 g
				Total	54

[1]Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)_____

Moderate (if Total 2-100)__X__

Minimal (if Total <2)_____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident _____

Potential __X__

Confined _____

Brief Rationale for Selection: *Contamination in sediment is limted to areas immediately downstream of the site and is not extensive.*

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contaminant has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contaminant has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contaminant has moved or can move

(Place an "X" next to one below)

Identified __X__

Potential _____

Limited _____

Brief Rationale for Selection: *A State Wildlife Refuge is located downstream of the site.*

Sediment/Ecological Endpoint Category High

(High, Medium, Low)

SOIL*

Contaminant Hazard Factor[1] (CHF)

Contaminant		Max. Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio[2]
Lead	nc	254	400	0.64
4-4' DDD	ca	230	190	1.21
Xylenes		53	990	0.05
Chloroform	ca	4	53	0.08
			Total	**1.98**

1 Evaluate for human contaminants only
2 Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)___

Moderate (if Total 2-100)___

Minimal (if Total <2) X

Migration Pathway Factor (MPF)

Evident - Analytical data or observable evidence that contamination is present at, is moving toward, or has moved to a point of exposure

Potential - contamination has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Low possibility for contamination to be present at or migrate to a point of exposure

(Place an "X" next to one below)

Evident)___

Potential X

Confined___

Brief Rationale for Selection: *No direct evidence of confinement of soil*

Receptor Factor (RF)

Identified - Receptors identified that have access to contaminated soil

Potential - Potential for receptors to have access to contaminated soil

Limited - Little or no potential for receptors to have access to contaminated soil

(Place an "X" next to one below)

Identified___

Potential___

Limited X

Brief Rationale for Selection: *Restricted area in remote portion of base*

Soil Category (High, Medium, Low) Low

* Soil samples should be from a depth of 0–6 inches. If samples are not available from the 0–6 inch interval, results from depths up to, but not exceeding, 24 inches can be used.

RELATIVE RISK SITE EVALUATION WORKSHEET

SITE[1] BACKGROUND INFORMATION

Installation/Property Name for FUDS: Example Air Force Base
Location (City/County State): Middle City, Georgia
Site (Name/DSERTS ID)/Project (Name/Project No.) for FUDS: Landfill 4, BCCDDEEFHHIJ
Point of Contact (Name/Phone): R. Hammond
Date Entered/Updated (day, month, year): 15 June 1994
Media Evaluated (GW, SW, Sediment, Soil, Sed. Eco, Soil Eco): ALL
Phase of Execution (SI, RI, FS, EE/CA, IRA, RD/RA, or equiv. RCRA Stage): RD
Agreement Status (Enter appropriate DERP Site code): A

SITE SUMMARY

(Include only the key elements of information used to conduct the relative risk site evaluation. Attach map view of site if desired.)

Brief Site Description (include site type, materials disposed of, dates of operation, and other relevant information): *45 acre landfill and associated 1.5 acre sludge lagoon operated from 1962-1978. Materials disposed of include general refuse, wastewater treatment plant sludge, electroplating wastes, organic solvents from cleaning operations, and pesticides. Volatile organic compounds and metals detected in groundwater and surface soil/sludge samples; lower levels of metals also detected in surface water and sediment samples in adjacent drainage ditch.*

Brief Description of Pathways (Groundwater, Soil, Surface Water [Human], Surface Water [Ecological], Sediment [Human], Sediment [Ecological]): *Site has a vegetative cover. Underlain by alluvial aquifer and deeper gravelly and silty sand aquifer, both of which reveal contaminant migration (e.g., TCE and lead) northeast and east of contamination sources. A mounded water table has been established within the landfill due to infiltration. Runoff from landfill flows to drainage ditch that is part of an operating and compliant non-point-source runoff collection system at the base. Drainage ditch flows to settling basin. Overflow from settling basin drains to wetlands and creek to the east. Drainage ditch sediments and local areas of standing water along the ditch upgradient of the settling basin have been impacted from contaminant migration. Samples show no surface water or sediment contamination beyond settling basin.*

Brief Description of Receptors (Human and Ecological): *Groundwater in the vicinity of the site is Class IIIA and is not used for domestic or agricultural purposes. Access to the site is restricted by a locked gate and fence at the landfill entrance. Humans could have access to the drainage ditch area, though access to this areas is limited by wetlands. A portion of the drainage ditch beyond the settling pond leads through critical habitat for an endangered species to a creek which is also part of the critical habitat.*

[1]The term *Site* is defined as a discrete area for which suspected contamination has been verified and requires further response action. A *Site* by definition has been, or will be, entered into RMIS/DSERTS. For the FUDS Program, "projects" equates to sites for current installations.

GROUNDWATER

CONTAMINANT HAZARD FACTOR[1] (CHF)

Contaminant		Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[2]
1,2-Dichloroethylene (cis)	nc	19,000	61	311
TCE	ca	21,000	160	131
Vinyl Chloride	ca	6,700	2	3350
Cr	nc	2,700	180	15
Pb	nc	5,240	4	1310
			Total	**5117**

1 Evaluate for human contaminants only
2 Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100) X

Moderate (if Total 2-100)___

Minimal (if Total <2)___

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the groundwater is moving or has moved away from the source area

Potential - Contamination in the groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates that the potential for contaminant migration from the source via the groundwater is limited (due to geological structures or physical controls)

(Place an "X" next to one below)

Evident X

Potential___

Confined___

Brief Rationale for Selection: *Monitoring well data revealed downgradient plume well beyond source; see map view and cross section*

RECEPTOR FACTOR (RF)

Identified - There is a threatened water supply downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer)

Potential - There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture, (equivalent to Class I, IIA, or IIB aquifer)

Limited - There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only)

(Place an "X" next to one below)

Identified___

Potential___

Limited X

Brief Rationale for Selection: *Groundwater is Class IIIA and is not considered a potential source of water for drinking or agricultural purposes*

Groundwater Category (High, Medium, Low) Medium

SURFACE WATER/HUMAN ENDPOINT

CONTAMINANT HAZARD FACTOR [1] (CHF)

Contaminant			Max. Concentration	Comparison Value	Ratio[1]
Cr	VI	nc	1,390	180	8
Pb		nc	1,400	4	350
Cd		nc	128	18	7
1 Ratio = Max. Concentration/Comparison Value					**365**

(Place an "X" next to one below)

Significant (if Total >100) X

Moderate (if Total 2-100)___

Minimal (if Total <2)___

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident___

Potential___

Confined X

Brief Rationale for Selection: *Metals detected in surface water samples in drainage ditch directly adjacent to landfill. The ditch is part of an operating and compliant non-point source runoff collection system at the base. Samples show no contamination in surface water beyond the settling pond.*

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified ___

Potential X

Limited___

Brief Rationale for Selection: *Humans could have access to the drainage ditch area, though access to this areas is limited by wetlands.*

Surface Water/Human Endpoint Category Medium

(High, Medium, Low)

SEDIMENT/HUMAN ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant		Max. Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio[1]
Cr VI	ca	880	3000	.29
Pb	nc	385	400	0.96
Cd	nc	10	38	0.26
			Total	1.51

[1]Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)_____

Moderate (if Total 2-100)__ ___

Minimal (if Total <2)__X___

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident _____

Potential _____

Confined __X___

Brief Rationale for Selection: *Metals detected in sediment samples in drainage directly adjacent to landfill. The ditch is part of an operating and compliant nonpoint source runoff collection system at the base. Samples show no contamination in sediments beyond the settling pond.*

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified ___

Potential __X__

Limited _____

Brief Rationale for Selection: *Humans could have access to the drainage ditch area, though access to this areas is limited by wetlands.*

Sediment/Human Endpoint Category (High, Medium, Low) Low

SURFACE WATER/ECOLOGICAL ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant		Max. Concentration (ug/l)	Comparison Value (ug/l)	Ratio[1]
Cr VI	nc	1,390	11	126.4
Pb	nc	1,400	3.2	437.5
Cd	nc	128	1.1	116.4
			Total	680.3

[1]Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)__X___

Moderate (if Total 2-100)_____

Minimal (if Total <2)_____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident _____

Potential _____

Confined __X___

Brief Rationale for Selection: *Metals detected in surface water samples in drainage ditch directly adjacent to landfill. The ditch is part of an operating and compliant non-point source runoff collection system at the base. Samples show no contamination in surface water beyond the settling pond.*

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contamination has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

(Place an "X" next to one below)

Identified __X___

Potential _____

Limited _____

Brief Rationale for Selection: *Overflow from settling pond flows to critical habitat for an endangered species*

Surface Water/Ecological Endpoint Category Medium

(High, Medium, Low)

SEDIMENT/ECOLOGICAL ENDPOINT

CONTAMINANT HAZARD FACTOR (CHF)

Contaminant		Max. Concentration	units	Comparison Value	units	Ratio[1]
Cr VI	nc	880	mg/kg	26.0	mg/kg	33.8
Pb	nc	385	mg/kg	31.0	mg/kg	12.4
Cd	nc	10	mg/kg	0.6	mg/kg	16.7
					Total	62.9

[1]Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)_____

Moderate (if Total 2-100)__X__

Minimal (if Total <2)_____

MIGRATION PATHWAY FACTOR (MPF)

Evident - Analytical data or observable evidence indicates that contamination in the media is present at, moving toward, or has moved to a point of exposure

Potential - Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Information indicates a low potential for contaminant migration from the source to a potential point of exposure (could be due to presence of geological structures or physical controls)

(Place an "X" next to one below)

Evident _____

Potential _____

Confined __X__

Brief Rationale for Selection: *Metals detected in sediment samples in drainage directly adjacent to landfill. The ditch is part of an operating and compliant nonpoint source runoff collection system at the base. Samples show no contamination in sediments beyond the settling pond.*

RECEPTOR FACTOR (RF)

Identified - Receptors identified that have access to surface water or sediment to which contaminant has moved or can move

Potential - Potential for receptors to have access to surface water or sediment to which contaminant has moved or can move

Limited - Little or no potential for receptors to have access to surface water or sediment to which contaminant has moved or can move

(Place an "X" next to one below)

Identified __X__

Potential _____

Limited _____

Brief Rationale for Selection: *Overflow from settling pond flows to critical habitat for an endangered species*

Sediment/Ecological Endpoint Category Low

(High, Medium, Low)

SOIL*

Contaminant Hazard Factor [1] (CHF)

Contaminant		Max. Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio[2]
Cr	nc	153	3000	0.05
Pb	nc	122	400	0.3
			Total	**0.35**

1 Evaluate for human contaminants only
2 Ratio = Max. Concentration/Comparison Value

(Place an "X" next to one below)

Significant (if Total >100)___

Moderate (if Total 2-100)___

Minimal (if Total <2) X

Migration Pathway Factor (MPF)

Evident - Analytical data or observable evidence that contamination is present at, is moving toward, or has moved to a point of exposure

Potential - contamination has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined

Confined - Low possibility for contamination to be present at or migrate to a point of exposure

(Place an "X" next to one below)

Evident) X

Potential___

Confined___

Brief Rationale for Selection: *Metals have been detected in surface soil/sludge samples outside landfill perimeter*

Receptor Factor (RF)

Identified - Receptors identified that have access to contaminated soil

Potential - Potential for receptors to have access to contaminated soil

Limited - Little or no potential for receptors to have access to contaminated soil

(Place an "X" next to one below)

Identified___

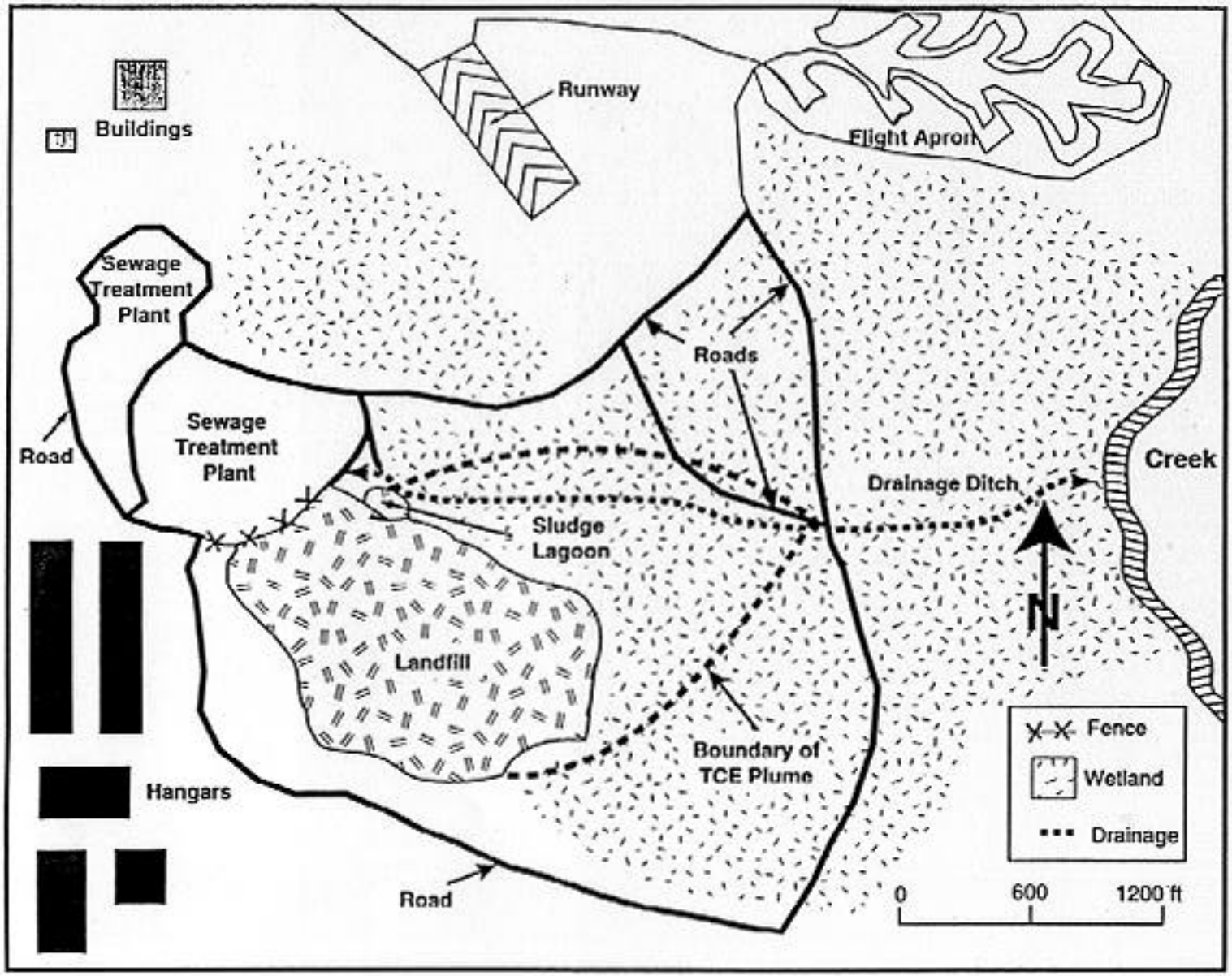
Potential X

Limited___

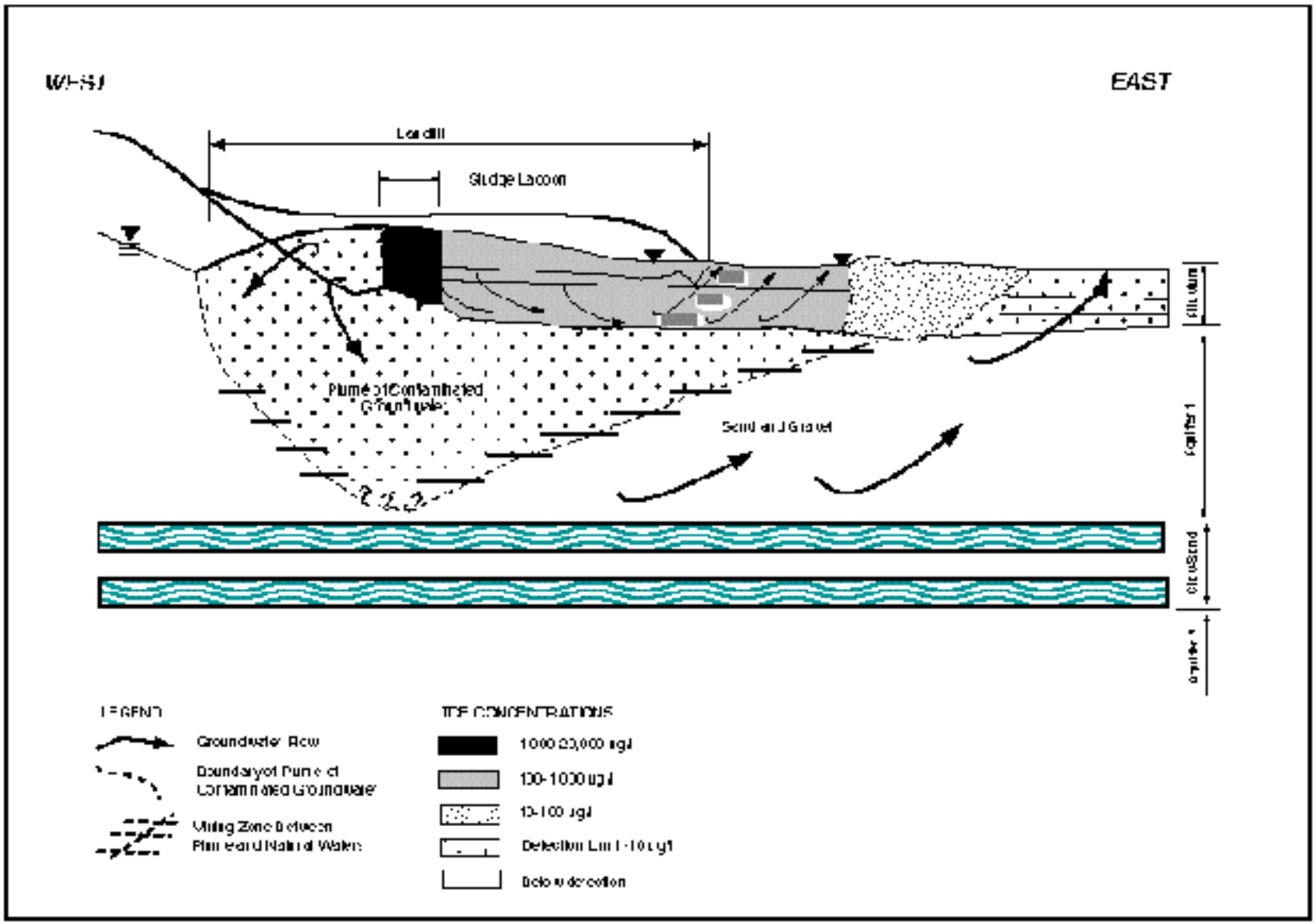
Brief Rationale for Selection: *Human receptors could have access to contaminated soil beyond the fenced area*

Soil Category (High, Medium, Low) Medium

* Soil samples should be from a depth of 0–6 inches. If samples are not available from the 0–6 inch interval, results from depths up to, but not exceeding, 24 inches can be used.



Example 3. Map View of Landfill and Sludge Lagoon Site at Example Air Force Base



Example 3. Cross Section View of Landfill and Sludge Lagoon Site Showing at Example Air Force Base

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APPENDIX E

Relative Risk Site Evaluation Concept Fact Sheet

Relative Risk Question-and-Answer Fact Sheet

Briefing Charts for Presentation/Training

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Office of the Deputy Under Secretary of Defense
(Environmental Security)

Defense Environmental Cleanup Program Fact Sheet

The Relative Risk Site Evaluation Concept

Introduction

The Department of Defense (DoD) considers environmental restoration as an integral part of its daily mission activities. At installations around the country, environmental restoration activities are underway to address contamination resulting from past DoD operations. Environmental analysis and cleanup activities address a wide variety of sites contaminated with fuels, solvents, chemicals, heavy metals, and common industrial materials.

Given the large number of sites to be addressed and limitations on money and people to work on these sites each year, DoD believes that a risk-based approach should be applied to work sequencing at active military installations, Base Realignment and Closure (BRAC) installations, and formerly used defense properties using relative risk as a key factor. The relative risk site evaluation framework described in this fact sheet provides a means of helping accomplish this objective.

The framework for evaluating site relative risk was published in September 1994, in the *Relative Risk Site Evaluation Primer (Interim Edition)* which contained instructions for performing relative risk site evaluations at sites across DoD. A revised edition of the Primer was issued in June 1996.

Definition of Relative Risk Site Evaluation

The relative risk site evaluation framework is a methodology used by all DoD Components to evaluate the relative risk posed by a site in relation to other sites. It is a tool used across all of DoD to group sites into high, medium, and low categories based on an evaluation of site information using three factors: the contaminant hazard factor (CHF), the migration pathway factor (MPF), and the receptor factor (RF). Factors are based on a quantitative evaluation of contaminants and a qualitative evaluation of pathways and human and ecological receptors in the four media most likely to result in significant exposure¾ groundwater, surface water, sediment, and surface soils. A representation of this evaluation concept is presented in Figures 1 and 2. Figure 1 also depicts possible opportunities for stakeholder input into the technical evaluation.

The relative risk site evaluation framework is a qualitative and easy to understand method–ology for evaluating the relative risks posed by sites and should not be equated with more formal risk assessments conducted to assess baseline risks posed by sites. It is a tool to assist in sequencing environmental restoration work (i.e., known requirements such as remedial investigation or cleanup actions) to be done by a DoD Component. It is designed to handle the broad range of sites that exist at DoD installations and the broad range of data available. The grouping of sites into high,

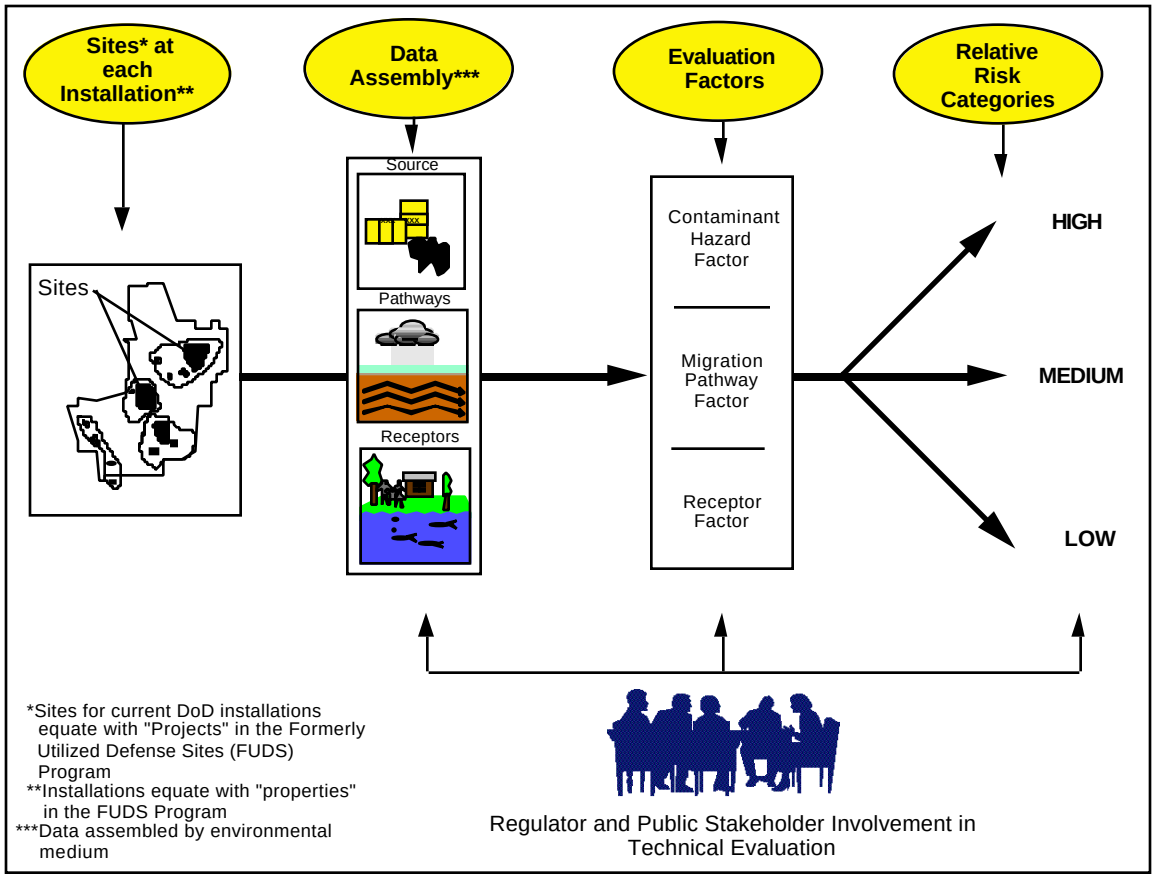


Figure 1. Relative Risk Site Evaluation Concept Summary

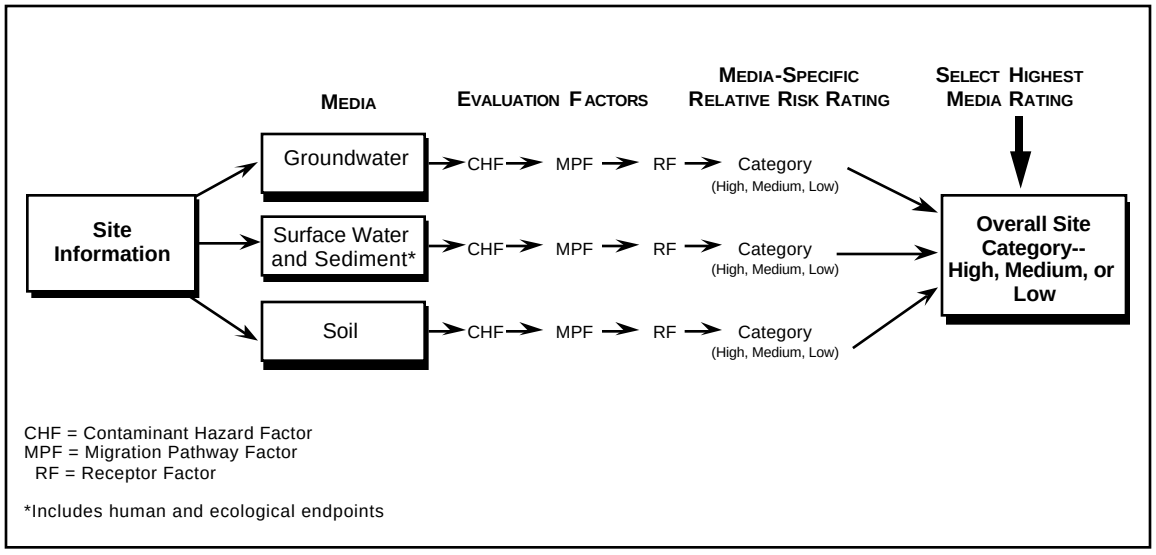


Figure 2. Flow Diagram of the Relative Risk Site Evaluation Framework

medium, or low relative risk categories **is not** a substitute for either a baseline risk assessment or health assessment; **it is not** a means of placing sites into a Response Complete/No Further Action category; and **it is not** a tool for justifying a particular type of action (e.g., the selection of a remedy).

Use of the relative risk site evaluation framework is restricted to environmental restoration sites and does not extend to unexploded ordnance (UXO) removal, building demolition/debris removal (BD/DR), potentially responsible party (PRP) activities, or compliance activities.

Relative Risk and Funding Decisions

Relative risk is not the sole factor in determining the sequence of environmental restoration work, but it is an important consideration in the priority setting process. It should be factored into all priority setting decisions, and should be discussed with regulators and public stakeholders in the environmental restoration process.

The actual funding priority for a site is identified after relative risk information is combined with other important risk management considerations (e.g., the statutory and regulatory status of a particular installation or site, public stakeholder concerns, program execution considerations, and economic factors). These additional risk management considerations can result in a decision to fund work at a site that is not classified as a high relative risk. DoD Components have each developed guidelines for combining relative risk and risk management considerations as part of their planning, programming, and budgeting process.

The relative risk site evaluation framework does not address the question of whether work is necessary at a site; it only provides information for use in helping to determine the general sequence in which sites will be addressed. At the DoD headquarters level, it also provides a framework for planning, programming, and budgeting requirements, a topic discussed below.

Requirements for Relative Risk Site Evaluations

Relative risk site evaluations are required for all sites at active military installations, BRAC installations, and formerly used defense properties that have future funding requirements that are not classified as (1) having "all remedies in place," (2) "response complete," (3) lacking sufficient information, or (4) abandoned ordnance. These four situations are discussed in the following four paragraphs.

Relative risk site evaluations are not required (NR) for sites classified as having all remedies in place (RIP) even though they may be in remedial action operation (RAO) or long-term monitoring (LTM). A RIP determination requires that remedial action construction is complete for a site.

Relative risk site evaluations are not required (NR) for sites classified as response complete (RC). Sites classified as RC are those where a DoD Component deems that no further action (NFA) is required with the possible exception of LTM. An RC determination requires that one of the following apply: (1) there is no evidence that contaminants were released at the site, (2) no contaminants were detected at the site other than at background concentrations, (3) contaminants attributable to the site are below action levels used for risk screening, (4) the results of a baseline risk assessment demonstrate that cumulative risks posed by the site are below established thresholds, or (5) removal and/or remedial action operations (RAOs) at a site have been implemented, completed, and are the final action for the site. Only LTM remains.

Relative risk site evaluations should be based on the information currently available on contaminants, migration pathways, and receptors. Sites lacking sufficient information for the conduct of a

relative risk site evaluation should be given a "Not Evaluated" designation and should then be programmed for additional study, a removal action if warranted, or other appropriate response action, including deferral, before they are evaluated.

Sites comprised solely of abandoned ordnance are not subject to the relative risk site evaluation described in this Primer. Such sites should be evaluated using a separate risk procedure, which is discussed in the management guidance cited above (Office of the Under Secretary of Defense [Environmental Security], 1994).

Implementation of the Relative Risk Site Evaluation Framework

DoD's goal is to conduct relative risk site evaluations at the field level with the involvement of the regulators and public stakeholders (see Figure 1). The technical evaluation of sites using the evaluation framework can serve as a basis for discussion and negotiation with regulators and public stakeholders. In particular, regulators and public stakeholders can help identify receptors, and can make judgments about the extent of contaminant migration in various environmental media at a site. Where they exist, Restoration Advisory Boards (RABs) are an excellent forum for obtaining public stakeholder input on these aspects of site relative risk. Other opportunities for public stakeholder involvement may also be appropriate. Regulators and public stakeholders should always be given the opportunity to participate in the development and review of relative risk site evaluation data before the data is used in planning and programming.

Management Uses of Relative Risk Information

DoD and DoD Components are using the relative risk site evaluation framework as a tool to help sequence work at sites and as a headquarters program management tool. As a program management tool, the framework is being used by DoD and DoD Components to periodically identify the distribution of sites in each of three relative risk categories—high, medium, and low. A series of discrete relative risk site evaluations provides headquarters program managers with a macro-level view of changes in relative risk distributions within DoD over time.

The relative risk site evaluation framework and resulting data also provide DoD with a basis for establishing goals and performance measures for the environmental restoration program. In this regard, DoD has established goals for all DoD Components to reduce relative risk at sites in Defense Environmental Restoration Account (DERA) and BRAC programs or to have remedial systems in place where necessary for these sites, within the context of legal agreements. DoD and DoD Components are tracking progress towards these relative risk reduction goals as one of several program measures of merit (MOMs) at the headquarters level. Another MOM tracks the number of sites where cleanup action has been taken and relative risk has been reduced in one or more media. Resultant information is used to provide the necessary feedback to develop and adjust program requirements and budget projections, as well as to assess whether established goals reflect fiscal reality.

For More Information

At the Installation, contact

At DoD Headquarters, contact the Office of the Deputy Under Secretary of Defense (Environmental Security - Cleanup) at 703/697-7475.

Office of the Deputy Under Secretary of Defense
(Environmental Security)

Defense Environmental Cleanup Program Fact Sheet

Relative Risk Site Evaluation Questions & Answers

Q.1 *How is relative risk information being used by the Department of Defense (DoD) and military services at the field and headquarters levels?*

A. Field activities within the DoD use relative risk information as one means of representing the status of their environmental restoration program to DoD, regulators, and local stakeholders. Information on site relative risk is used by each military installation or formerly used defense site, in conjunction with other risk management considerations, to help sequence work at sites in light of available resources within DoD.

Headquarters environmental restoration program offices within each military service collect relative risk information from each field activity to identify to Congress, regulators, and other stakeholders the distribution of sites in each of three relative risk categories− high, medium, and low. A series of discrete relative risk site evaluations provides headquarters program managers with a macro-level view of changes in relative risk distributions within DoD over time. In the event of budget cuts or recessions, Headquarters Program Offices will consider the relative risk of sites along with other risk management considerations in the resultant deferral of projects. In general, low relative risk sites will be deferred before medium relative risk sites, and medium relative risk sites will be deferred before high relative risk sites. At the installation or field level, specific work program adjustments will be made considering relative risk and other risk management concerns in the event that budget cuts or recessions occur.

Relative risk information will also be used to provide DoD with a basis for establishing goals and performance measures for the environmental restoration program. In this regard, DoD has established goals for all DoD Components to reduce relative risk at sites or to have remedial systems in place where necessary for these sites, within the context of legal agreements. Military services and DoD will track changes in relative risk towards these relative risk reduction goals as a measure of merit (MOM). Relative risk will not be used to set cleanup standards, nor will it be used as a basis for making remedial action decisions, remedy selection decisions, or no further action decisions.

Q.2 *How are other risk management considerations taken into account for priority setting?*

A. Relative risk is not the sole factor in determining the sequence of environmental restoration work, but it is an important consideration in the priority setting process. It should be

factored into all priority setting decisions, and should be discussed with regulators and public stakeholders in the environmental restoration process.

The actual funding priority for a site is identified after relative risk information is combined with other important risk management considerations (e.g., the statutory and regulatory status of a particular installation or site, public stakeholder concerns, program execution considerations, and economic factors). These additional risk management considerations can result in a decision to fund work at a site that is not classified as a high relative risk. Military services have each developed guidelines for combining relative risk and risk management considerations as part of their planning, programming, and budgeting process.

Q.3 *What is the role of the community in evaluating relative risk at sites?*

A. Community members of Restoration Advisory Boards and other members of the public participate in the technical evaluation of relative risk at a variety of levels depending on their desire for involvement. At some installations and formerly used defense sites, community members have received relative risk training and participate directly in the evaluation of relative risk factors for each environmental medium at a site. At other installations and formerly used defense sites, community members review and provide input into relative risk evaluations prepared by installation personnel. DoD intends to increase community input into relative risk evaluations at all installations and formerly used defense sites where there is sufficient interest. To increase community awareness of and access to guidance on performing relative risk site evaluations, DoD has placed the *Relative Risk Site Evaluation Primer* on the DoD Environmental Restoration Electronic Bulletin Board, a World Wide Web site at http://www.dtic.dla.mil/envirodod/envdocs.html.

Q.4 *What is the role of regulatory agencies in evaluating relative risk at sites?*

A. State and federal regulatory agency personnel are key participants in the relative risk evaluation process. Their involvement in this process largely depends on their degree of involvement in an environmental restoration program at a particular installation or formerly used defense site. At some installations or formerly used defense sites, regulatory agency personnel have received relative risk training and participate directly in the evaluation of relative risk factors for each environmental medium at a site. Discussions with regulatory agency personnel on relative risk at these training sessions and at project team meetings at installations have proven helpful in increasing regulatory acceptance of relative risk. DoD seeks to increase regulatory involvement in relative risk evaluations at all appropriate installations and formerly used defense sites.

Q.5 *How often will field activities need to conduct relative risk site evaluations?*

A. Relative risk at sites should be evaluated whenever important new information about a site becomes available. DoD will collect information on site relative risk from the military services on a semi-annual basis, once in the middle of the fiscal year and once at year end.

Q.6 *Will progress in the environmental restoration program be measured on the basis of Relative Risk?*

A. Yes, for the following reasons. Progress at sites in DERP has traditionally been measured by reporting on the response status of sites at the field and headquarters level (e.g., number of sites with responses complete). While these traditional measures of progress are still important measures, DoD planning guidance for Fiscal Years (FYs) 1998-2002 establishes goals for all military services to reduce relative risk at sites. The planning guidance specifically requires (1) military services to implement actions that lower relative risk for all high relative risk within specific time frames or have remedial systems in place where necessary for these sites, (2) implement actions that lower relative risk of all medium relative risk sites within a specific time frame or have remedial systems in place where necessary for those sites, and (3) implement actions that result in "response complete" for all relative risk sites within a set time frame.

Q.7 *Does relative risk site evaluation apply to sites at Base Realignment and Closure (BRAC) installations?*

A. Yes. DoD planning guidance requires that available restoration funds at BRAC installations be used to implement actions to lower relative risk for all high relative risk sites within specific time frames or have remedial systems in place where necessary for these sites.

Q.8 *What is the relationship between the Relative Risk Site Evaluation Framework and risk assessment?*

A. Relative risk evaluation and risk assessment share a common conceptual framework, but have significant differences in purpose and methodology. First and foremost, relative risk evaluation is not a substitute for a risk assessment. It is a screening-level evaluation of site information at a point in time based on three factors: the contaminant hazard factor (CHF), the migration hazard factor (MPF), and the receptor factor. In terms of hazard assessment, the relative risk framework uses maximum (worst-case) contaminant data, while risk assessment uses average and/or reasonable maximum concentrations of contaminants. For exposure assessment, the relative risk framework relies on a qualitative evaluation of fate and transport of contaminants away from a source, while risk assessment emphasizes quantitative predictions of contaminant fate and transport. In terms of toxicity assessment, both relative risk and risk assessment use similar data. The relative risk framework uses concentration standards *derived from* preliminary remediation goals that are calculated using the same toxicity data used in risk assessment. In terms of results, relative risk information is used at the field level to help sequence work at sites. Risk assessment results are typically used to determine whether or not additional response actions are warranted at a site.

Q.9 *Why were the Environmental Protection Agency (EPA) preliminary remediation goals (PRGs) multiplied by 100 for carcinogens?*

A. PRGs are concentrations of contaminants in a specific medium that have been estimated to (1) cause 1 excess cancer occurrence per 1,000,000 people over the course of a 70-year life-time or (2) cause non-cancer adverse effects (e.g., birth defects, neurological problems). These values have been calculated through the use of toxicity data found in EPA databases and by using conservative assumptions (e.g., a person will obtain all water for drinking and showering over a 30-year period

from the same source). The methods used by EPA for calculating "safe" doses for cancer-versus-noncancer effects differ dramatically. Noncancer effects have thresholds (levels of exposure that do not cause toxicity), while cancer effects are not assumed to have a threshold. The differing assumptions for noncancer and cancer effects mean that respective toxicities are handled differently when setting acceptable exposures. For cancer-inducing agents, mathematical formulas are used to determine acceptable exposure levels. For noncancer toxicants, a "reference dose" that is related to the threshold is used. Threshold doses are generally much higher than are doses that cause 1 in 1,000,000 cancer occurrences.

In Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30, dated 22 April 1991, the *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, EPA states that action is generally not warranted if reasonable maximum contaminant exposures at a site are less than the reference dose or cause fewer than 1 in 10,000 excess cancer occurrences. This is consistent with the remedial action threshold for carcinogens defined in the Preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (55 Federal Register 8716, March 8, 1990). This means that EPA has made the reference dose equivalent to 1 in 10,000 cancer occurrences for screening purposes. Because PRGs are reference doses and concentrations of contaminants that result in 1 in 1,000,000 cancer occurrences, the PRGs for cancer agents are 100 times smaller than the equivalence set by OSWER Directive 9355.0-30. Multiplying the cancer PRGs by 100 restores the equivalence for purposes of relative risk evaluation.

Q.10 *What is the relationship between Maximum Contaminant Levels (MCLs) and concentration standards in Appendix B-1?*

A. MCLs, established by EPA under the Safe Drinking Water Act, apply to water supplies used for human consumption. Under the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA), MCLs are often considered applicable or relevant and appropriate requirements for groundwater response actions. Some MCLs are risk-based, while others are technology-based. When compared to concentration standards in Appendix B-1, results are mixed. For noncancer toxicants, concentration standards in Appendix B-1 are generally equivalent to or lower than MCLs. For cancer-causing agents, concentration standards in Appendix B-1 (equivalent to 1 in 10,000 excess cancer occurrences) are in some cases above MCLs and in others below MCLs depending in part on whether the MCL is risk-based or technology-based.

Q.11 *Why is the threshold for the CHF rating of "significant" set at 100?*

A. The relative risk site evaluation framework is a programmatic tool used to categorize sites that have requirements for future work into three broad bands called "high," "medium," and "low." In order to place the CHF in the appropriate perspective, it is important to note that neither the intent nor the application of relative risk evaluation is to classify risk in an absolute sense that defines what remedial action is required. Decisions regarding future work are made

separately on the basis of a remedial investigation, baseline risk assessment, and evaluation of the acceptability of the calculated risk. As stated in response to Question 16, a low overall site rating is not equivalent to a no further action decision. Thus, the descriptors used in the relative risk evaluation process such as "significant," "moderate," and "minimal," as applied to the CHF ratios, and "high," "medium," or "low," as applied to the overall site rating, must be considered relative terms to be used only in the relative rating of the sites under consideration. If there is insufficient data to categorize a site, it is identified as "Not Evaluated."

The threshold values for the CHF descriptors were chosen as 2 and 100 such that when the site CHF was combined with the other site rating factors, an approximately equal distribution of sites among the three overall categories of "high," "medium," and "low" would result. This was determined by testing the framework with various values of CHF thresholds at thousands of DoD sites. Each of the three site-rating factors, which are based on the three elements of the conceptual site model used in a baseline risk assessment, are intended to have a balanced and appropriate impact on the final overall site rating. The balanced weighting of the three factors is illustrated (see Figure 7 in the Primer) by the fact that a "moderate" CHF will result in a "high" overall site rating if an "identified" receptor exists and the MPF is either "evident" or "potential." Even with a "potential" receptor, a "high" overall rating will result if an "evident" pathway exists for a site with a "moderate" CHF. (Also see Question 13.)

Q.12 *Does the Relative Risk Site Evaluation Framework consider wetlands as an ecological receptor?*

A. Wetlands, in the broad sense of the definition, are present at a large number of DoD sites. As a result, maximum resolution of sites on the basis of relative risk to human health and ecological receptors is obtained by considering wetlands as ecological receptors when they are part of sensitive environments such as critical habitats, marine sanctuaries, spawning areas, and other such environments listed in Table 2 of the Primer.

Q.13 *What is the rationale for the assignment of ratings to the 27 combinations of the three factors used in the Relative Risk Site Evaluation Framework?*

A. The bottom line answer is that for relative risk site evaluation to be a useful programmatic tool, it had to result in placing a significant distribution of the evaluated sites into each of the three broad categories of "high," medium," and "low." The thresholds for each category were established by evaluating data from all the services to ensure that there would be a distribution of sites into each category. The choices of categories for the 27 possible combinations of the three different site characterization factors (depicted in Figures 3 and 7 of the Primer) are based on a balanced consideration of the three factors as they describe the degree of completion of exposure of receptors to contaminants. The logic of the assigned categories is perhaps best understood by considering the combinations depicted in Figure 7 of the Primer in light of the exposure scenarios represented by each of the 27 possibilities.

With a significant CHF, which represents a concentration of contaminant that is two orders of magnitude above the concentration standard (see Appendix B of the Primer), any combination of evident or potential migration pathway with an identified or potential receptor is assigned to be in the high category. Any potential for exposure to contaminants at this high relative concentration will receive highest priority. Only if either the migration pathway is confined (no migration to a point of exposure) or the receptors are limited (little or no receptor access to site) is the site placed in a medium category. If both migration is unlikely and receptor access is unlikely, the site is assigned a low rating. In this case, the contaminant, though present at high concentrations, will not be exposed to receptors and can await cleanup while other sites with a more certain scenario for exposure are addressed.

Sites with a moderate CHF, where concentrations of contaminants exceed concentration standards by factors of 2 to 100, also receive high ratings if migration is evident and receptors are identified, if migration is evident and receptors are potential, or if migration is potential and receptors are identified. These situations all represent likely exposure scenarios to concentrations of contaminant that exceed the concentration standards by more than a factor of 2. If both the migration and the receptors are potential, exposure is less likely and a medium rating is assigned. If migration is evident, even if the receptor is judged to be limited, a medium rating is also assigned to allow for the existence of an unanticipated receptor. In the case of confined migration (no migration to a point of exposure), all receptor possibilities are assigned a low rating because exposure is unlikely. The combination of potential migration and limited receptors is also assigned a low rating.

With a low CHF, where measured concentrations are less than twice the concentration standard, only sites with both evident migration and identified receptors are assigned a high rating. A high probability of exposure, even to this relatively low concentration, received the highest priority. Evident migration with potential receptors or potential migration with identified receptors both receive a medium rating because of the likelihood of exposure, albeit to a relatively lower concentration of contaminant. All other possibilities with this relatively lower concentration of contaminant receive a low rating.

Q.14 *What happened to the Defense Priority Model (DPM)?*

A. In 9 November 1993, testifying before the Senate Committee on Energy and Natural Resources, Sherri Goodman, Deputy Under Secretary of Defense (Environmental Security) stated the following: "...concerns have been raised about the use of DPM for determining program priorities and DoD has decided not to use the model on a DoD-wide basis."

Q.15 *How does the Relative Risk Site Evaluation Framework relate to the Hazard Ranking System (HRS)?*

A. Both the HRS and evaluation framework are screening tools that can be used to evaluate relative risks at waste sites. The HRS is an EPA regulation (40 Code of Federal Regulations 300, Appendix A) used to place sites or aggregates of sites on the National Priorities List (NPL) if scores are above 28.5. Although the HRS has the capability to differentiate among the

relative risk of sites, it is more frequently applied to identify candidate installations for the NPL. The relative risk framework is a tool used to group sites in high, medium, and low relative risk categories to help sequence work at installations or former defense sites given the available resources. The HRS evaluates groundwater, surface water, soil, and air pathways and considers human and ecological receptors (called targets). Each pathway in the HRS is evaluated using three factor categories (likelihood of release, waste characteristics, and targets) each of which is subdivided into a number of factors tied to site-related information. The relative risk framework evaluates groundwater, surface water, and surface soils and considers human and ecological receptors. Both the HRS and relative risk use toxicity data from EPA databases for assessing contaminants; however, only the HRS takes waste quantity into account. The HRS assigns a single score to a site between 0 and 100 from a one-time ranking that becomes permanent. The relative risk framework assigns a site a high, medium, or low rating at a point in time, but allows for re-evaluation of a site when important new information becomes available. HRS ranking is detailed, time-intensive, and requires significant support documentation. In addition, HRS evaluations are typically not specific to sites when applied to military installations. HRS evaluations are based on an aggregation of sites across an installation. Relative risk evaluation is simpler and more transparent than HRS evaluation, is applied site by site, but is subject to more judgment.

Q.16 *Will "low" relative risk sites be addressed or will they be deferred indefinitely?*

A. A low relative risk site is not equivalent to a no further action site. Appropriate response actions will be programmed for all low relative risk sites as dictated by available resources and other risk management considerations.

Q.17 *Does the Relative Risk Site Evaluation Framework apply to ordnance and explosive wastes?*

A. The relative risk evaluation framework applies specifically to hazardous, petroleum, and radioactive waste sites in the environmental restoration program. A separate methodology has been developed for grouping ordnance and explosive waste sites into high, medium, and low categories. This methodology is based on safety concerns, and results are tracked separately from other sites.

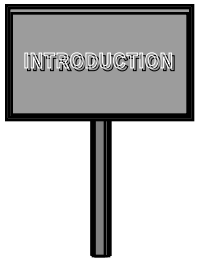
Q.18 *When are relative risk site evaluations not performed?*

A. Relative risk site evaluations are not required at sites classified as (1) having "all remedies in place," (2) "response complete," (3) lacking sufficient information, or (4) abandoned ordnance. These four situations are discussed in section 1.4 of the Primer.

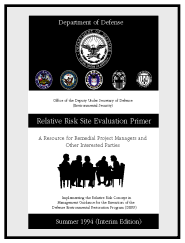
Relative Risk Site Evaluation within the Department of Defense Cleanup Program

Outline

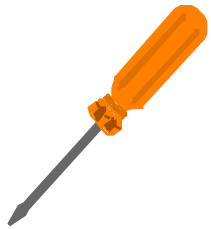
- Introduction
  - Origins of relative risk
  - Work group composition and products



- Description of framework
  - What it is and is not
  - Media and factors
  - Documentation
  - Example/benefits



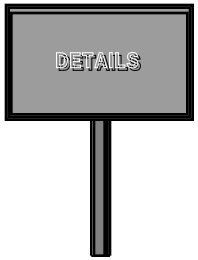
- Use of relative risk in program management



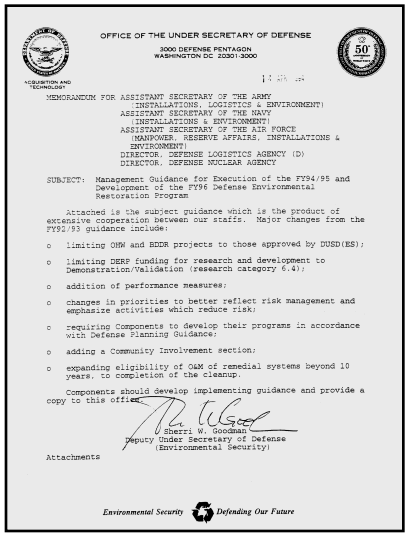
- Implementation

- Workgroup recommendations

- Detailed descriptions of each relative risk factor



Origin of Relative Risk within DoD



OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON DC 20301-3000

ACQUISITION AND TECHNOLOGY

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY
(INSTALLATIONS, LOGISTICS & ENVIRONMENT)
ASSISTANT SECRETARY OF THE NAVY
(INSTALLATIONS & ENVIRONMENT)
ASSISTANT SECRETARY OF THE AIR FORCE
(MANPOWER, RESERVE AFFAIRS, INSTALLATIONS & ENVIRONMENT)
DIRECTOR, DEFENSE LOGISTICS AGENCY (D)
DIRECTOR, DEFENSE NUCLEAR AGENCY

SUBJECT: Management Guidance for Execution of the FY94/95 and Development of the FY96 Defense Environmental Restoration Program

Attached is the subject guidance which is the product of extensive cooperation between our staffs. Major changes from the FY92/93 guidance include:

- limiting OMW and BDDR projects to those approved by DUSD(ES);
- limiting DERP funding for research and development to Demonstration/Validation (research category 6.4);
- addition of performance measures;
- changes in priorities to better reflect risk management and emphasize activities which reduce risk;
- requiring Components to develop their programs in accordance with Defense Planning Guidance;
- adding a Community Involvement section;
- expanding eligibility of O&M of remedial systems beyond 10 years, to completion of the cleanup.

Components should develop implementing guidance and provide a copy to this office.

Sherri W. Goodman
Deputy Under Secretary of Defense
(Environmental Security)

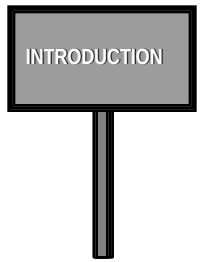
Attachments

Environmental Security *Defending Our Future*

- **Relative Risk guidelines specified in 14 April 1994 DERP Management Guidance**
  - **Proposed risk management concept for building FY96 program**
  - **For interim and remedial action projects Components will indicate “the number of sites, the current relative risk and expected risk reduction the project will achieve” (p. 16)**
  - **To measure performance, Components will report on the number of sites where relative risk has been reduced (p. 6)**

Work Group Objectives

- **Prepare a method or procedure to group sites into high, medium, and low relative risk categories based upon the risk management concept in Management Guidance (May 1994)**
  - **Review methods used by Components**
  - **Develop a common methodology using consistent definitions**
- **Establish a peer review process to monitor and improve relative risk evaluation (August 1994)**
  - **Develop a consistent data format**
  - **Review and comment on relative risk data collected by Components**

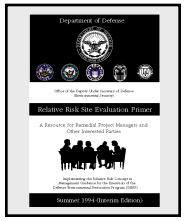


Work Group Participants

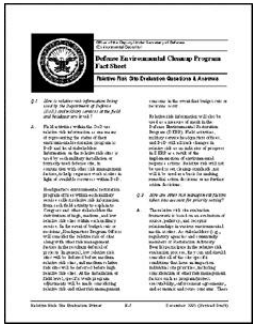
- **DoD**
- **Army**
  - 3 **Army Environmental Center**
  - 3 **Army Center for Health Promotion and Preventive Medicine**
- **Navy**
  - 3 **Chief of Naval Operations**
  - 3 **HQ Navy Facilities Engineering Command**
- **Air Force**
  - 3 **HQ Air Force Environmental Restoration Program Directorate**
  - 3 **Office of the Deputy Assistant Secretary of the Air Force**
  - 3 **Air Force Institute of Technology**
- **FUDS**
  - 3 **HQ and HTRW Center of Expertise U.S. Army Corps of Engineers (COE)**
- **Defense Logistics Agency**
- **HQ Environmental Protection Agency**

Work Group Products

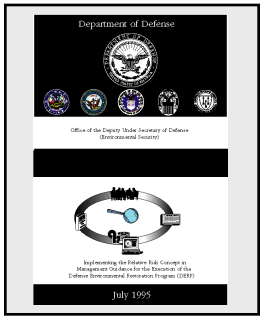
- **Produced the *DoD Relative Risk Site Evaluation Primer***



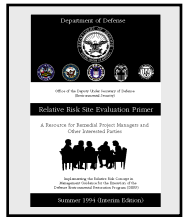
- **Developed *DoD Question and Answer Fact Sheet* and response to EPA comments**



- **Produced a draft *Interservice Relative Risk Site Evaluation Peer Review Report***



What is Relative Risk Evaluation?



Definition **The grouping of sites in the Defense Environmental Restoration Program into High, Medium, and Low categories based on an evaluation of site information using three factors: the contaminant hazard, the migration pathway, and the receptors**

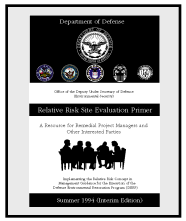
It is

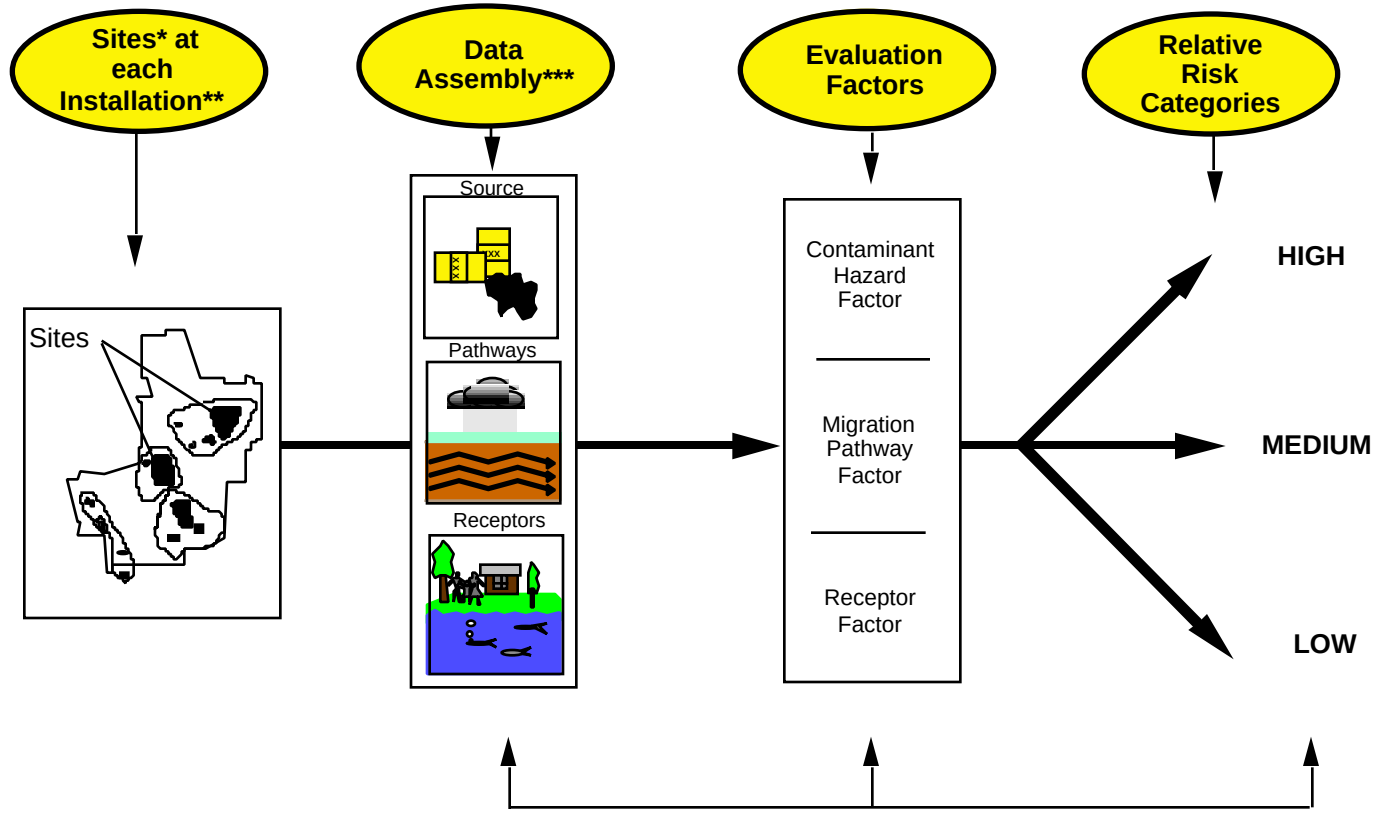
- **A common methodology for evaluating the relative risk posed by a site**
- **A screening tool**
- **An evolutionary instrument**
- **A framework for dialogue with stakeholders**

It isn't

- **A way to avoid our legal agreements**
- **A means of reducing our financial obligations**
- **An abdication of our cleanup responsibilities**
- **An absolute assessment of risk**
- **A substitute for a health assessment**
- **A remedy selection tool**

Relative Risk Site Evaluation Concept Summary





*Sites for current DoD installations equate with "Projects" in the Formerly Utilized Defense Sites (FUDS) Program

**Installations equate with "properties" in the FUDS Program

***Data assembled by environmental medium

Regulator and Public Stakeholder Involvement in Technical Evaluations

Site Evaluation Framework is a Method for Placing Sites into Relative Risk Categories

It evaluates source, pathway, and receptor relationships in:

Groundwater (human endpoint)

Surface water (human and ecological endpoints)

Sediment (human and ecological endpoints)

Surface soils (human endpoint)

Based on:

Contaminant Hazard Factor (CHF)

How high are contaminant concentrations relative to standards?

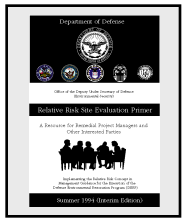
Migration Pathway Factor (MPF)

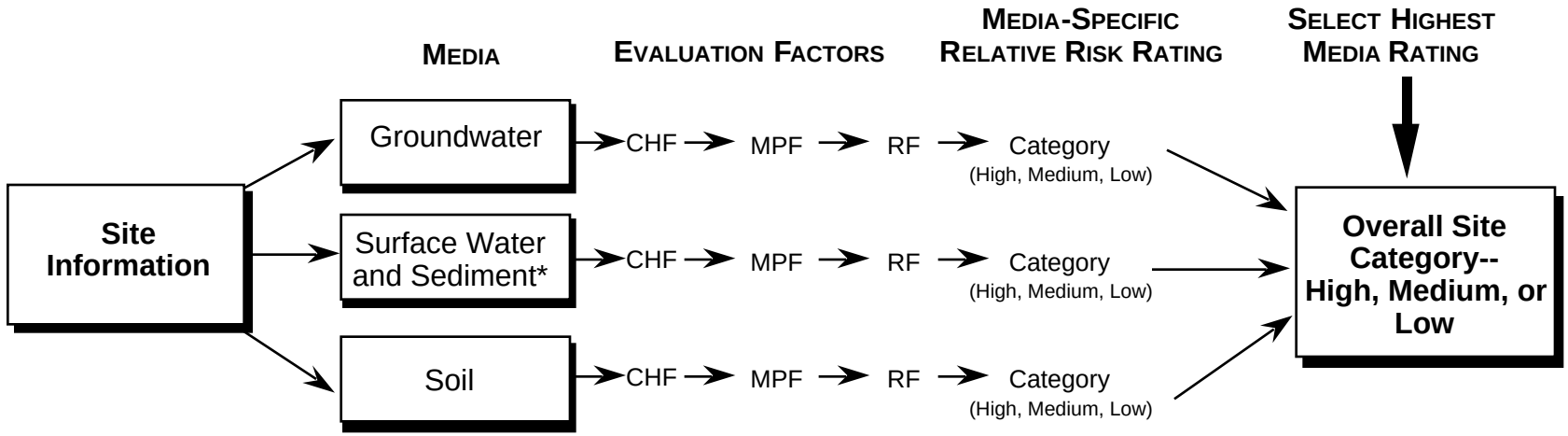
Is the contamination moving or likely to move?

Receptor Factor (RF)

Are there humans or sensitive environments affected or potentially affected by the contamination?

Structure of Relative Risk Evaluation Framework

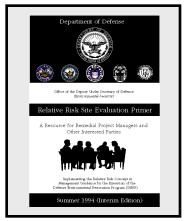




CHF = Contaminant Hazard Factor
MPF = Migration Pathway Factor
RF = Receptor Factor

*Includes human and ecological endpoints

Relative Risk Site Evaluation Matrix



CHF = SIGNIFICANT

MPF	Identified	Potential	Limited
Evident	H	H	M
Potential	H	H	M
Confined	M	M	L

RF

CHF = MODERATE

MPF	Identified	Potential	Limited
Evident	H	H	M
Potential	H	M	L
Confined	L	L	L

RF

CHF = MINIMAL

MPF	Identified	Potential	Limited
Evident	H	M	L
Potential	M	L	L
Confined	L	L	L

RF

CHF	=	Contaminant Hazard Factor
MPF	=	Migration Pathway Factor
RF	=	Receptor Factor
H	=	High
M	=	Medium
L	=	Low

How is Relative Risk Evaluated?

Documentation

The *Relative Risk Site Evaluation Primer* is the primary source for direction

The *Relative Risk Evaluation Worksheet* in the Primer is used to record pertinent information on each site that is evaluated

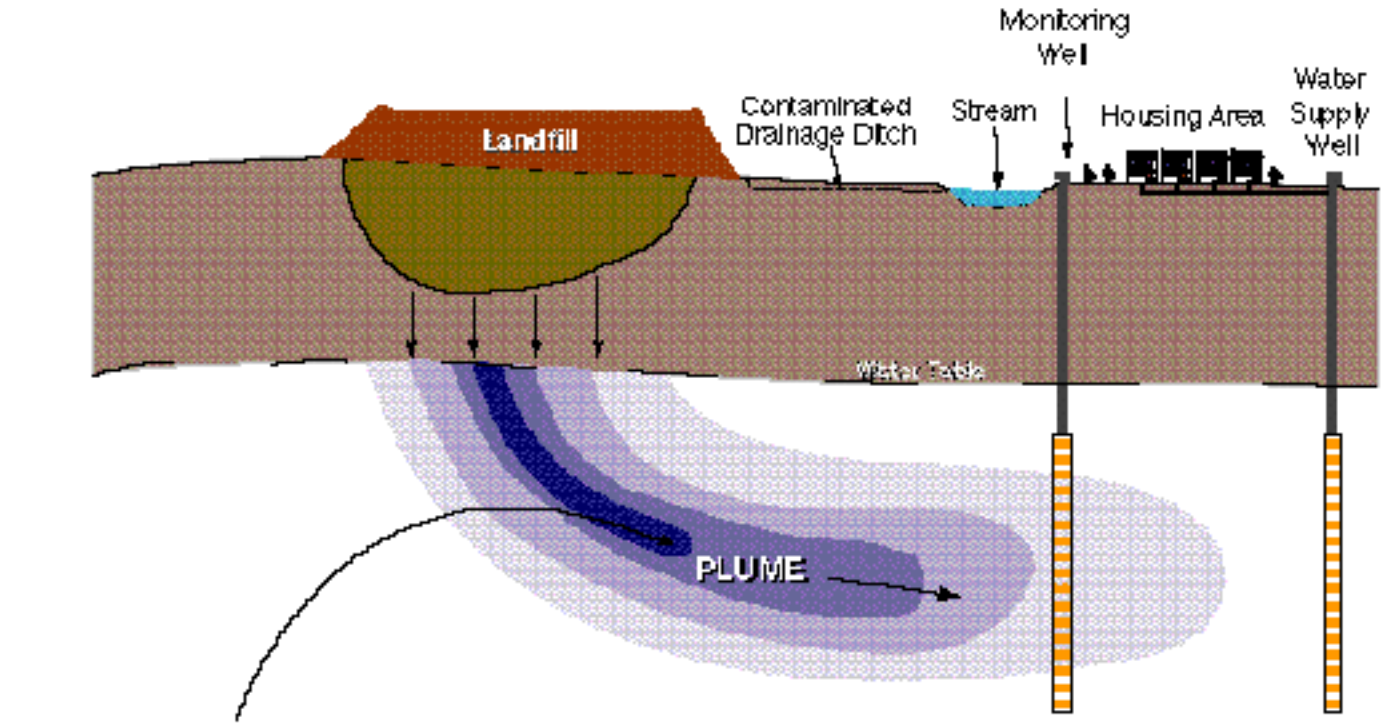
Instructions in the *Primer* show how to fill out the *Relative Risk Evaluation Worksheet*

A stand-alone/executable computer program has been developed for conducting relative risk evaluations consistent with the *Primer*

Regulatory agency and public stakeholder input is obtained on site evaluations, where possible

Relative Risk Evaluation Example

High Relative Risk (Human) – Groundwater/Surface Water



Benefits

Benefits

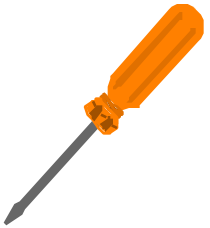
The framework provides a common approach among DoD components for categorizing sites by relative risk

The most urgent sites are identified so that resources can be focused on higher relative risk projects first

The rating serves as a basis for dialogue with stakeholders on sequencing work at installations

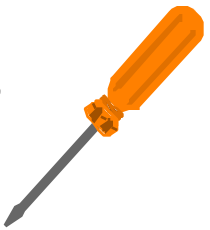
Periodic ratings serve as an indicator of progress in reducing relative risk

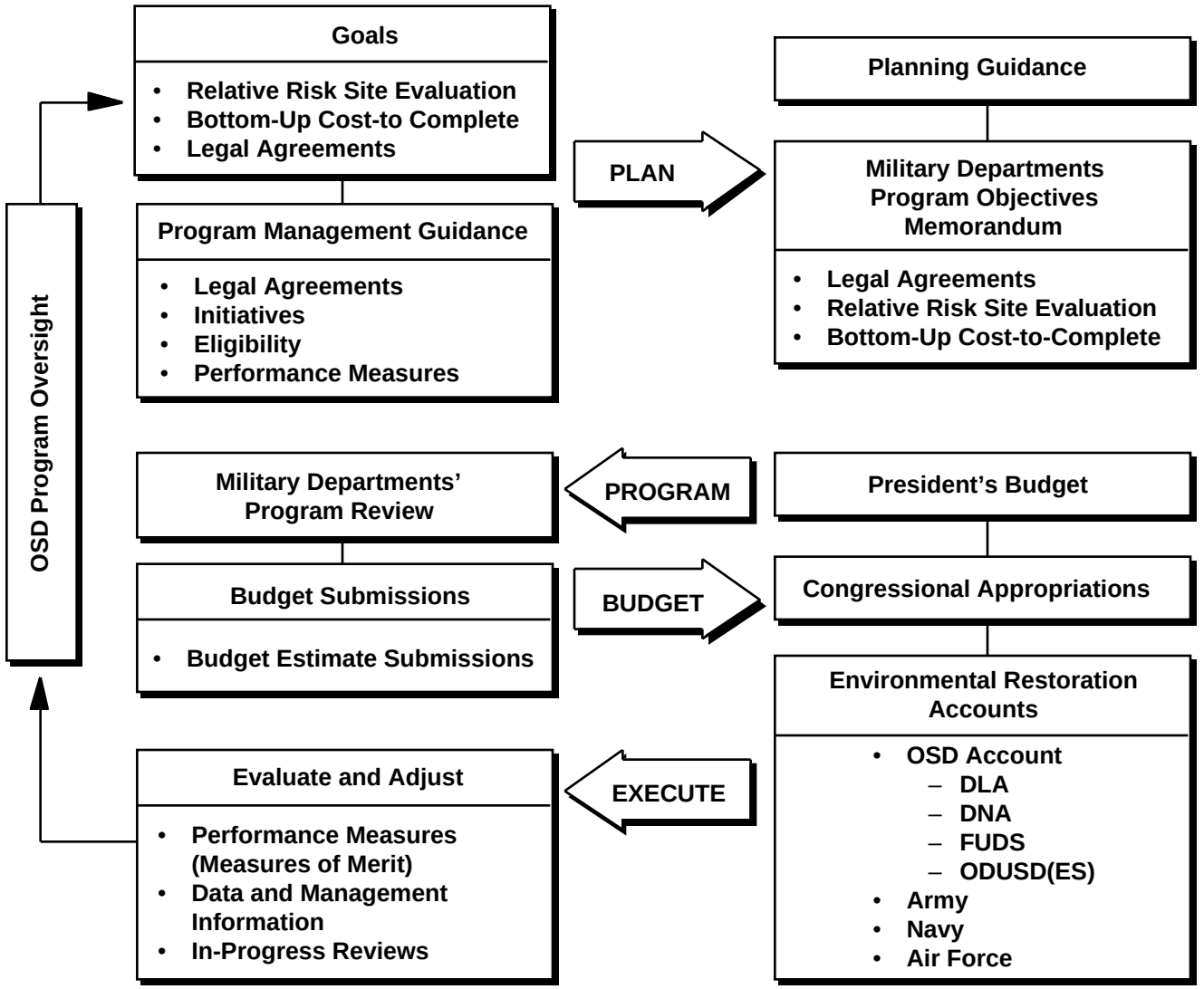
Use of Relative Risk Information



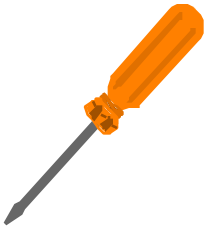
- A factor in sequencing environmental restoration work (known requirements)
  - Framework for discussions with stakeholders
  - One factor in priority setting
- A program-level management tool
  - Used to identify the distribution of sites in each of three relative risk categories for military departments within DoD
  - Used as a measure of merit (MOM) at the HQ level to measure and report progress toward achievement of cleanup goals

DERP Planning, Programming, Budgeting, and Execution





Requirements from Defense Planning Guidance



- Complete relative risk evaluations at every Defense Environmental Restoration Account (DERA) and Base Realignment and Closure (BRAC) site
- Implement actions to reduce relative risk at sites in DERA and BRAC programs, or have remedial systems in place where necessary for these sites, within specified time frames and within the context of legal agreements

Measures of Merit

- Relative risk reduction
  - High
  - Medium
  - Low
  - Not evaluated
  - Not required
- Progress at sites
  - Analysis
  - Cleanup
  - Response complete/NFA
- Milestones accomplished
  - Work underway
  - Actions taken
  - Remedy in place
  - Response complete/NFA

Relative Risk Implementation at DoD Level

- Communication on a variety of levels
  - Presentations to EPA staff and management
  - Presentations to states at DSMOA conferences
  - Placement of Primer on world wide web at http://www.dtic.dla.mil/envirodod/envdocs.html
- Training
  - Service-specific training
  - DoD training
- Performance
  - Initial evaluations September 1994 - July 1995
  - Accelerated data collection to meet the constraints for building the FY 96 program

Relative Risk Implementation at DoD Level (Concluded)

- **Data management**
  - **Data managed by services**
  - **Automated relative risk site evaluation worksheet**
  - **DoD has assembled an integrated database for peer review purposes and incorporated relative risk information into its program management database**

Overview of the Draft Peer Review Report

- ***Requirement*—Established by Relative Risk Work Group on 1 February 1995**
- ***Scope*—Active and former defense properties**
- ***Primary Objective*—To document work group efforts to develop the Relative Risk Site Evaluation Framework (i.e., Primer) and provide an internal DoD review of each Component's relative risk data and implementation procedures**

Selected Findings and Recommendations

- Offer and provide relative risk training to environmental project managers and other stakeholders in the program using similar training materials
- Increase community input in relative risk evaluations through Restoration Advisory Boards and other means
- Establish a common relative risk data reporting structure to ensure consistency in service data submissions to DoD
- Improve the quality of data reported for the contaminant hazard factor by requiring quality assurance/quality control checks of relative risk data when it is computerized
- Add military-unique compounds to the list of contaminants that can be evaluated and identify concentration standards for these compounds

Contaminant Hazard Factor (CHF)

- **Comparison of maximum project contaminant concentrations in each medium to Relative Risk concentration comparison values**

$$\text{CHF} = \sum \frac{[\text{maximum concentration of A}]}{\text{Comparison Value for A}}$$

- **Three tiers**
  - **Significant = CHF > 100**
  - **Moderate = CHF of 2 - 100**
  - **Minimal = CHF < 2**

Standards for CHF Calculation

- **Human health**
  - **Carcinogens = concentration that presents a 1 in 10,000 risk of increased cancer incidence**
  - **Non-carcinogens = the reference dose (equivalent to Hazard Quotient of 1)**
- **Ecological**
  - **Ambient Water Quality Criteria (AWQC) or EPA Lowest Observed Effects Levels in the absence of AWQC**
  - **Sediment screening criteria from National Oceanic and Atmospheric Administration (NOAA) and Ontario Ministry of Environment and Energy**

Appendix B-1: Comparison Values (For Human Endpoints)

- Apply to water and soil media
- Used in conjunction with potential or actual human exposures
- Derived from EPA Region IX Preliminary Remediation Goals (PRGs) with exception of military materials and radionuclides
- Military Materials standards are taken from Army and Oak Ridge National Lab Studies
- Radionuclide standards (“benchmarks”) are taken from EPA’s Superfund Chemical Data Matrix (SCDM) maintained as part of the Hazard Ranking System

Appendix B-2: Comparison Values (Ecological Endpoint)

- Apply to surface water medium
- Used in conjunction with potential or actual ecological exposures
- Based on Aquatic Water Quality Criteria or the Lowest Observed Effects Level
- Fresh water and marine (use appropriate column)

Appendix B-3: Comparison Values (Ecological Endpoint)

- Apply to sediment medium
- Used in conjunction with potential or actual ecological exposures
- Based on NOAA Sediment Screening Values and values from the Ontario Ministry of Environment and Energy
- Values used represent concentrations that produced response effects in less than 5% of the observations

Mechanics of the CHF Calculation

Contaminants		**Calculation*****	**Rating**
Carcinogen A: Carcinogen B: Non-carcinogen C:	$[A]^*_{max}$ $[B]_{max}$ $[C]_{max}$	$\frac{[A]^*_{max}}{Std^{**}} + \frac{[B]_{max}}{Std^{**}} + \frac{[C]_{max}}{Std^{***}} = X_1$	>100 = Significant CHF 2-100 = Moderate CHF <2 = Minimal CHF
Ecological D:	$[D]_{max}$	$\frac{[D]_{max}}{Std^{****}} = X_2$	

$[A]^*$ - Maximum concentration in medium
Std** - Comparison value based on 10^{-4} human cancer incidence
Std*** - Comparison value based on reference dose for humans
Std**** - Comparison value for ecological receptors where available

*****Use comparison values in Appendix B

Note: Contaminants posing a threat to ecological receptors (i.e., ecological contaminants) must be evaluated separately from those posing a threat to human receptors

Mechanics of the CHF Calculation—Example*

Contaminant**	Maximum Concentration (ug/l)	Standard (ug/l)
1,1-Dichloroethylene [carcinogen]	6.8	4.6
1,2-Dichloroethylene (z) [non-carcinogen]	3.3	61.0
Vinyl Chloride [carcinogen]	3.2	2.0
Toluene [non-carcinogen]	16.0	720.0
Manganese [non-carcinogen]	10,700.0	180.0

Calculation

$$\frac{6.8}{4.6} + \frac{3.3}{61} + \frac{3.2}{2.0} + \frac{16.0}{720} + \frac{10{,}700}{180} = 62.59$$

>100	=	Significant
2-100	=	Moderate
<2	=	Minimal

*From Appendix A of Primer
**Groundwater Medium

Mechanics of the CHF Calculation for Substances with both Carcinogenic and Non-Carcinogenic Effects

Contaminants		**Calculation*****	**Rating**
Carcinogen A:	$[A]^*_{max}$	$\frac{[A]^*_{max}}{Std^{**}} + \frac{[B]_{max}}{Std^{**}} + \frac{[C]_{max}}{Std^{***}} + \frac{[E]_{max}}{Std^{**}} + \frac{[E]_{max}}{Std^{***}} = X_1$	>100 = Significant CHF
Carcinogen B:	$[B]_{max}$		2-100 = Moderate CHF
Non-carcinogen C:	$[C]_{max}$		<2 = Minimal CHF
Carcinogen/ Non-carcinogen E:	$[E]_{max}$		
Ecological D:	$[D]_{max}$	$\frac{[D]_{max}}{Std^{****}} = X_2$	

[A]* - Maximum concentration in medium
Std** - Comparison value based on 10^{-4} human cancer incidence
Std*** - Comparison value based on reference dose for humans
Std**** - Comparison value for ecological receptors where available

*****Use comparison values in Appendix B

Note: Contaminants posing a threat to ecological receptors (i.e., ecological contaminants) must be evaluated separately from those posing a threat to human receptors

Mechanics of the CHF Calculation—Example 2*

Contaminant[2]	Maximum Concentration (ug/l)	Standard (ug/l)
Cr** [non-carcinogen]	1,390 ug/l	180 ug/l
Pb** [non-carcinogen]	1,400 ug/l	4 ug/l
Cd** [non-carcinogen]	128 ug/l	18 ug/l
Cr***	880 ppm	26 ppm
Pb***	385 ppm	31 ppm
Cd***	10 ppm	0.6 ppm

$$\frac{1{,}390}{180} + \frac{1{,}400}{4} + \frac{128}{18} = 365 = \text{Significant}$$

$$\frac{880}{26} + \frac{385}{31} + \frac{10}{0.6} = 62.9 = \text{Moderate}$$

*From Appendix A of Primer
**Surface water medium, human exposure
***Sediment, ecological exposure

Mechanics of Surface Water/ Sediment Evaluation

- **Summary of Relative Risk Site Evaluation possibilities**

Medium / Receptor Endpoint	Surface Water	Sediment
Human	CHF = Sum of Ratios using Appendix B-1 (water); MPF; RF	CHF = Sum of Ratios using Appendix B-1 (soil); MPF; RF
Ecological	CHF = Sum of Ratios using Appendix B-2 (fresh or marine); MPF; RF	CHF = Sum of Ratios using Appendix B-3; MPF; RF

- **Evaluate separately; take the highest rating**

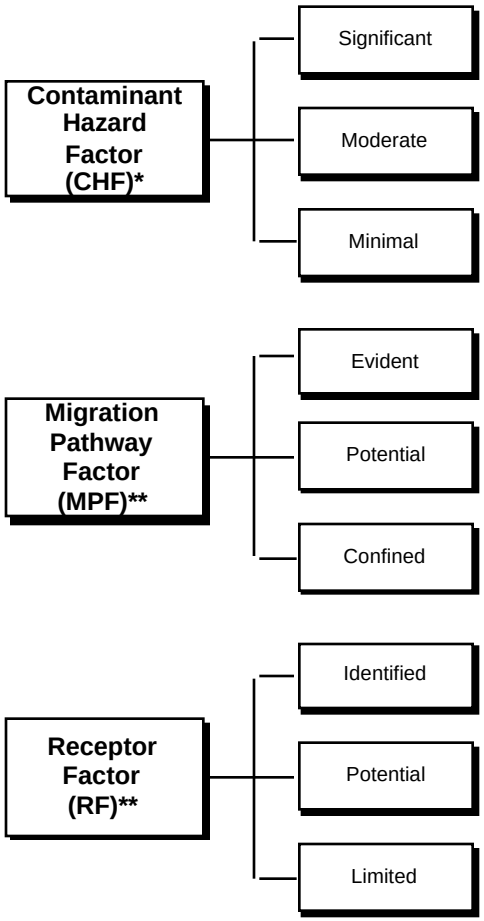
Migration Pathway Factor (MPF)

- Each media pathway evaluated (groundwater, surface water/ sediment, soil)
- Three tiers
  - *Evident*: Contamination is present at, is moving toward, or has moved to a point of exposure
  - *Potential*: Contamination has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information not sufficient to make determination of Evident or Confined
  - *Confined*: Potential for contaminant migration from source is limited due to geological structures or physical controls
- Opportunity for technical input from regulators and community

Receptor Factor

- **Receptors (human or sensitive ecological species/ environments) evaluated for each media**
- **Three tiers**
  - ***Identified*: Receptors are threatened or have access to potentially contaminated media**
  - ***Potential*: Receptors are not threatened but have potential access to media of concern**
  - ***Limited*: Receptors are not threatened or have little or no access to potentially contaminated media**
- **Opportunity for technical input from regulators and community**

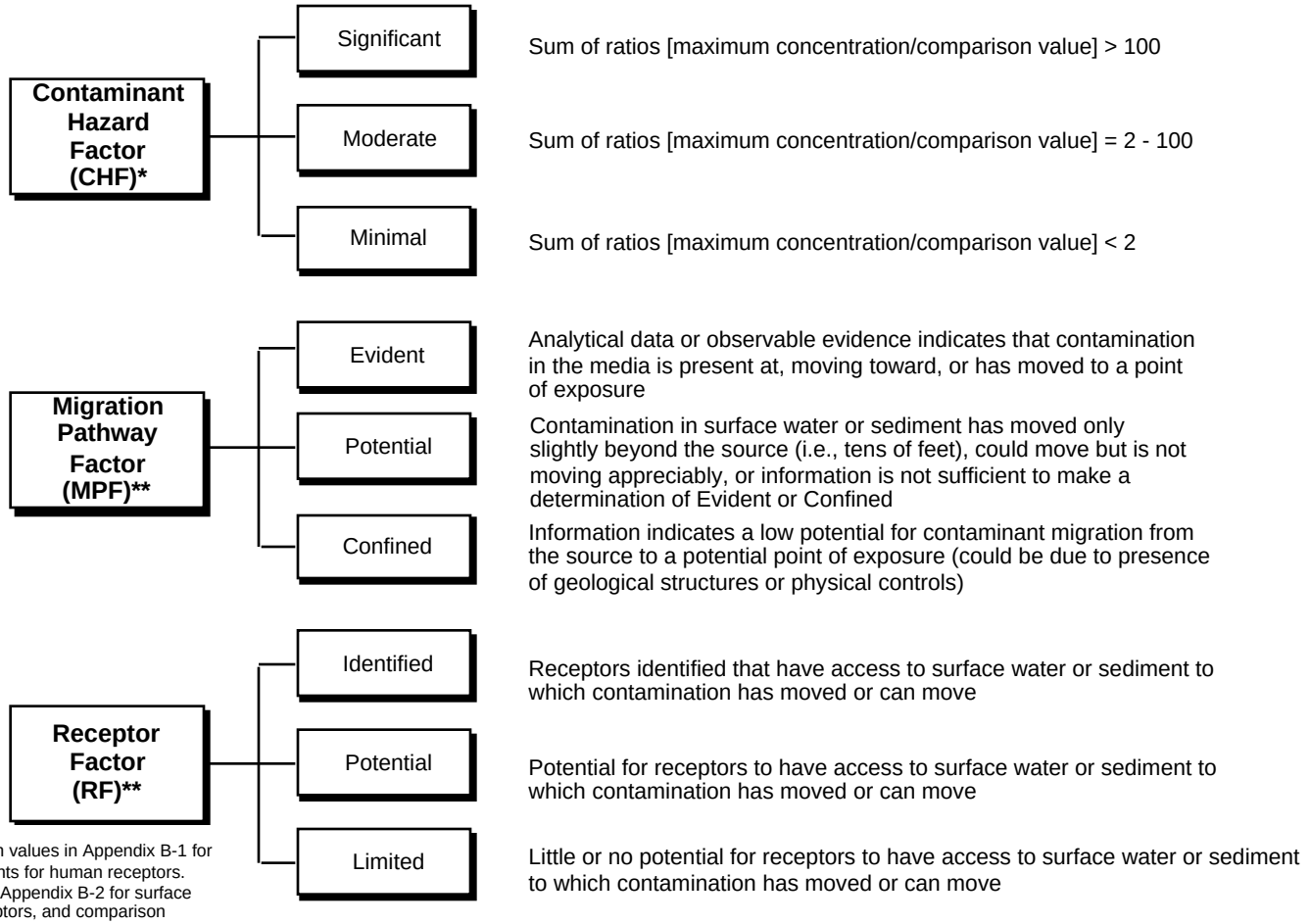
Site Evaluation Factor Information for Groundwater



Factor	Rating	Definition
Contaminant Hazard Factor (CHF)*	Significant	Sum of ratios [maximum concentration/comparison value] > 100
	Moderate	Sum of ratios [maximum concentration/comparison value] = 2 - 100
	Minimal	Sum of ratios [maximum concentration/comparison value] < 2
Migration Pathway Factor (MPF)**	Evident	Analytical data or observable evidence indicates that contamination in the groundwater is moving or has moved away from the source area
	Potential	Contamination in the groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined
	Confined	Information indicates that the potential for contaminant migration from the source via the groundwater is limited (due to geological structures or physical controls)
Receptor Factor (RF)**	Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer)
	Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer)
	Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only)

*Evaluate using comparison values in Appendix B-1
**Evaluate using definitions and detailed instructions in Section 3.4

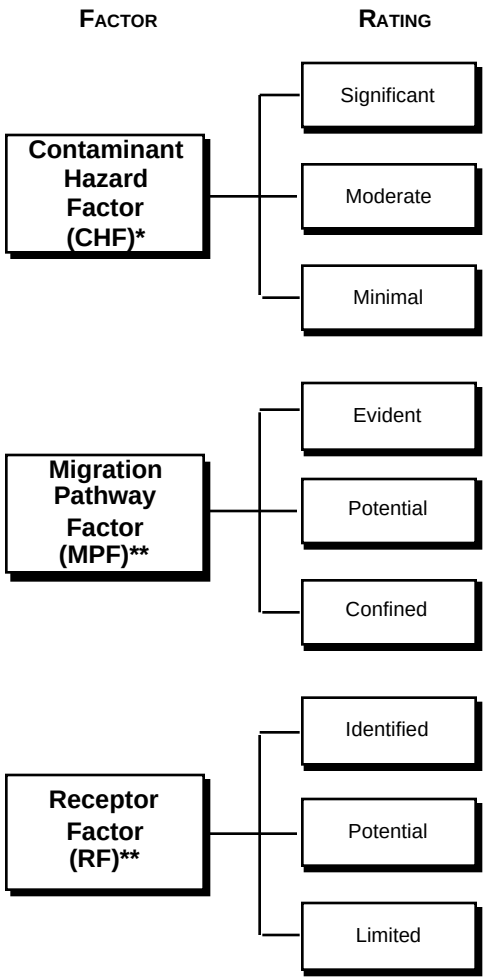
Site Evaluation Factor Information for Surface Water/Sediment



* Evaluate using comparison values in Appendix B-1 for surface water and sediments for human receptors. Use comparison values in Appendix B-2 for surface water and ecological receptors, and comparison values in Appendix B-3 for sediments and ecological receptors.

**Evaluate using definitions and detailed instructions in Section 3.5

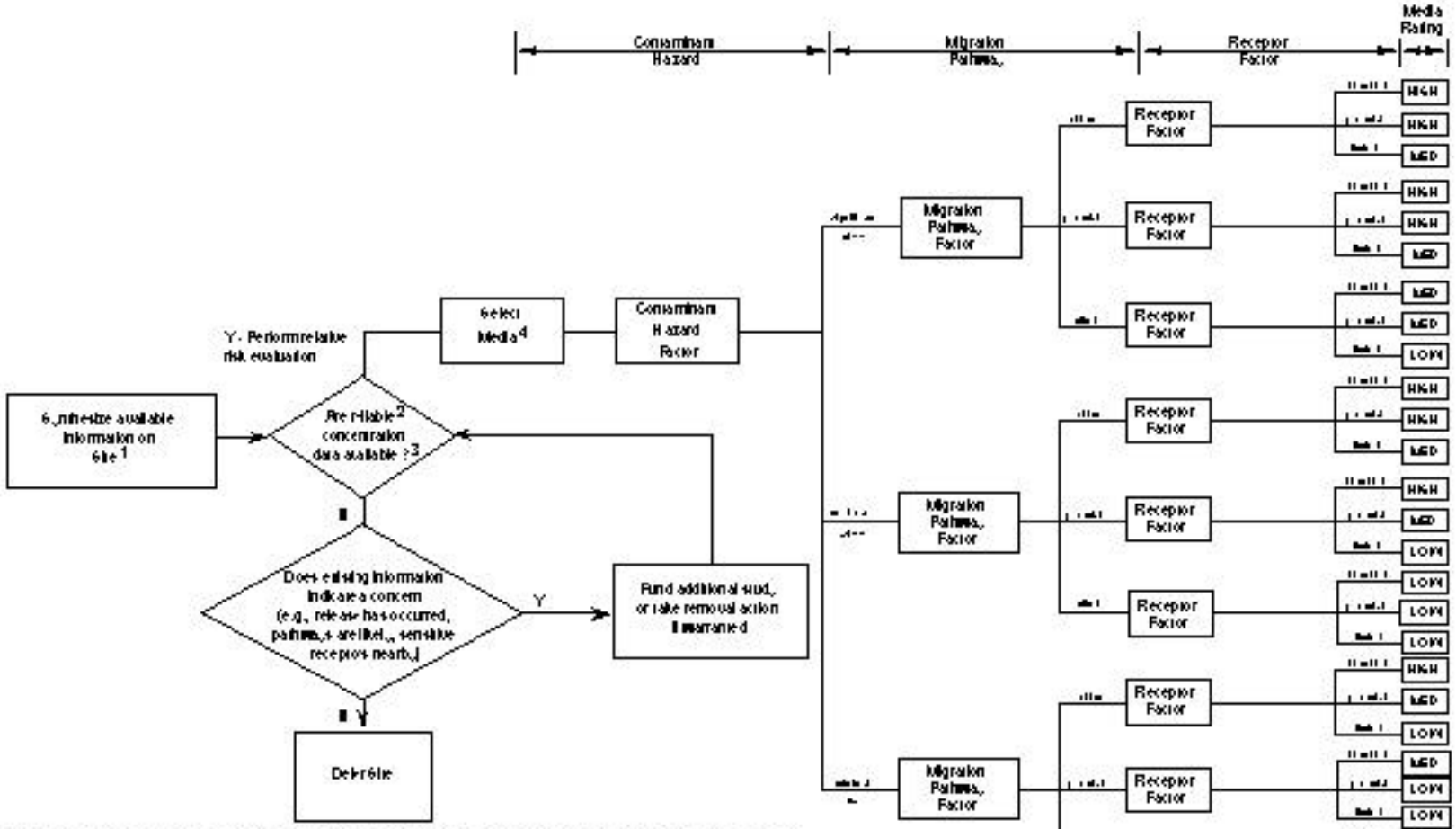
Site Evaluation Factor Information for Soils



DEFINITION
Sum of ratios [maximum concentration/comparison value] > 100
Sum of ratios [maximum concentration/comparison value] = 2 - 100
Sum of ratios [maximum concentration/comparison value] < 2
Analytical data or observable evidence that contamination is present at, is moving toward, or has moved to a point of exposure
Contamination has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined
Low possibility for contamination to be present at or migrate to a point of exposure
Receptors identified that have access to contaminated soil
Potential for receptors to have access to contaminated soil
Little or no potential for receptors to have access to contaminated soil

*Evaluate using comparison values in Appendix B-1
**Evaluate using definitions and detailed instructions in Section 3-6

Risk-Based Site Evaluation Framework: Decision Flowchart



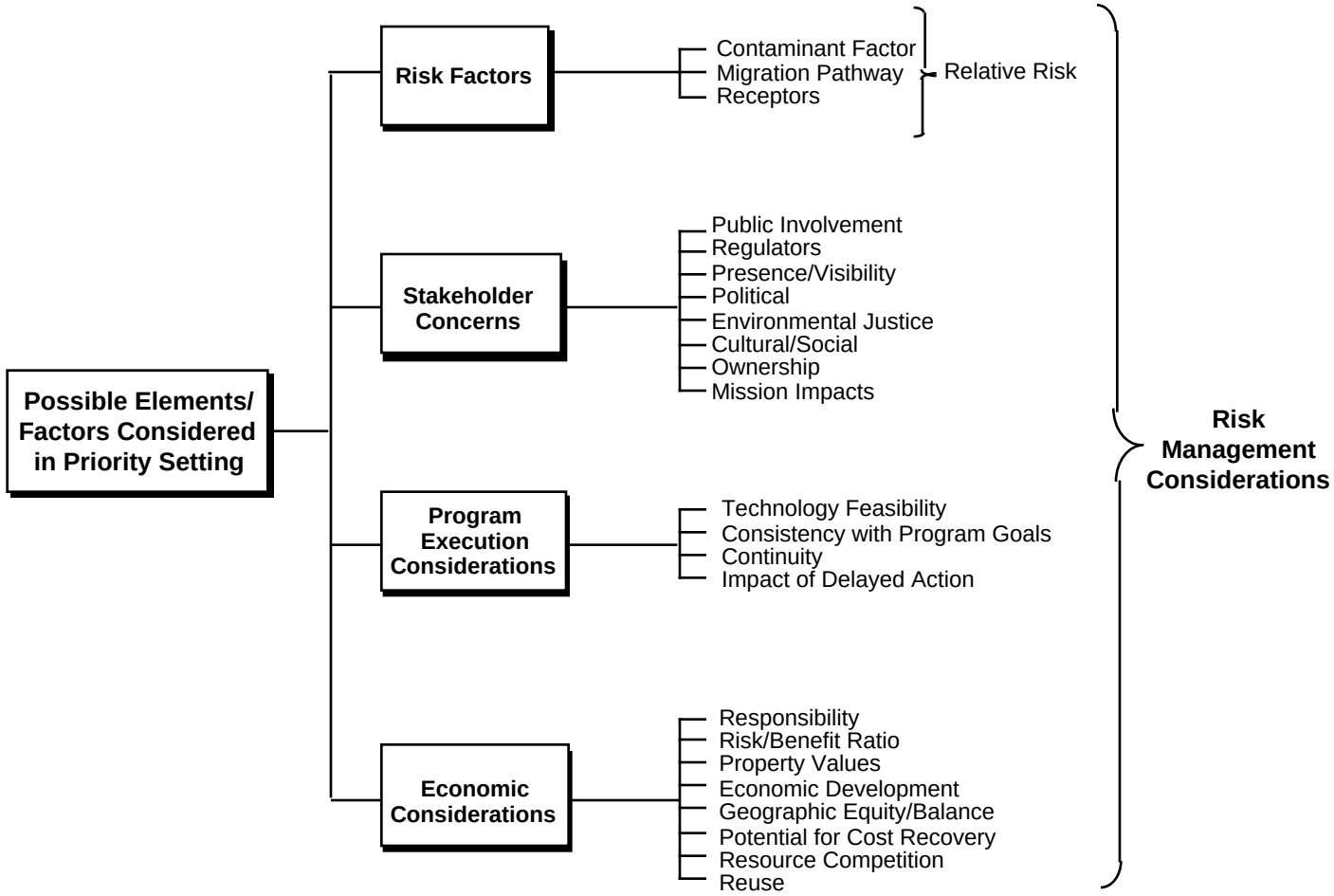
[1] Site - Discrete area for which suspected contamination has been verified and which requires further response action. Area has been (or will be) entered into FUDS Data Entry Form 6. For the FUDS program, "Projects" equates to sites for current investigations.

[2] Reliable means recent, or representative of site conditions.

[3] If sampling results for each and every medium sampled are below detection or are within established background concentration ranges, the site is automatically categorized as Low.

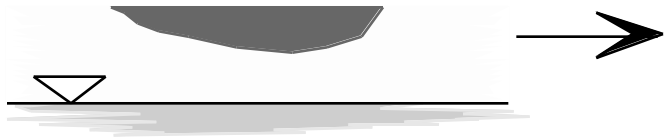
[4] Media - Conduct relative risk evaluations by media: groundwater, surface water, sediment, soil. If reliable data are not available for a medium, that medium is assigned a rating of "Not Evaluated" (NE).

Considerations in a Priority Setting



Relative Risk Site Evaluation—Issue Clarification

1. **No reliable analytical data for a site**

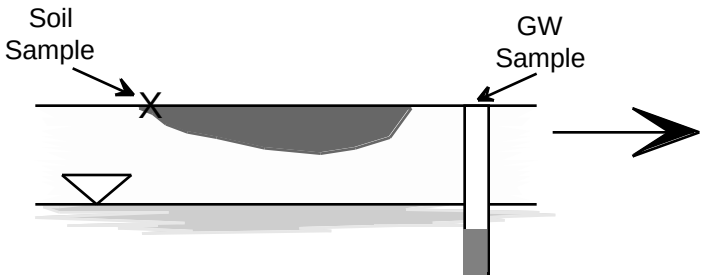


Site categorized as Not Evaluated (NE)

2. **Site in Remedies in Place (RIP) or in Response Complete (RC) status**

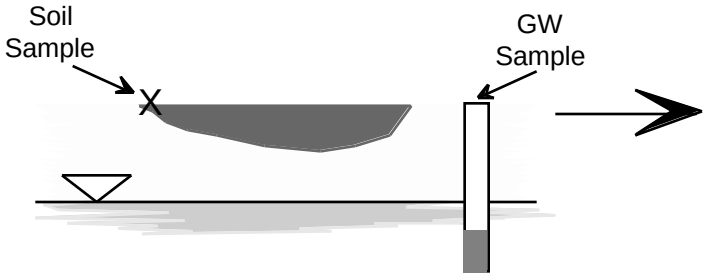
Do not perform relative risk site evaluation. They are Not Required (NR).

3. **Analytical data within established background levels**



Evaluated as *Low* in Primer

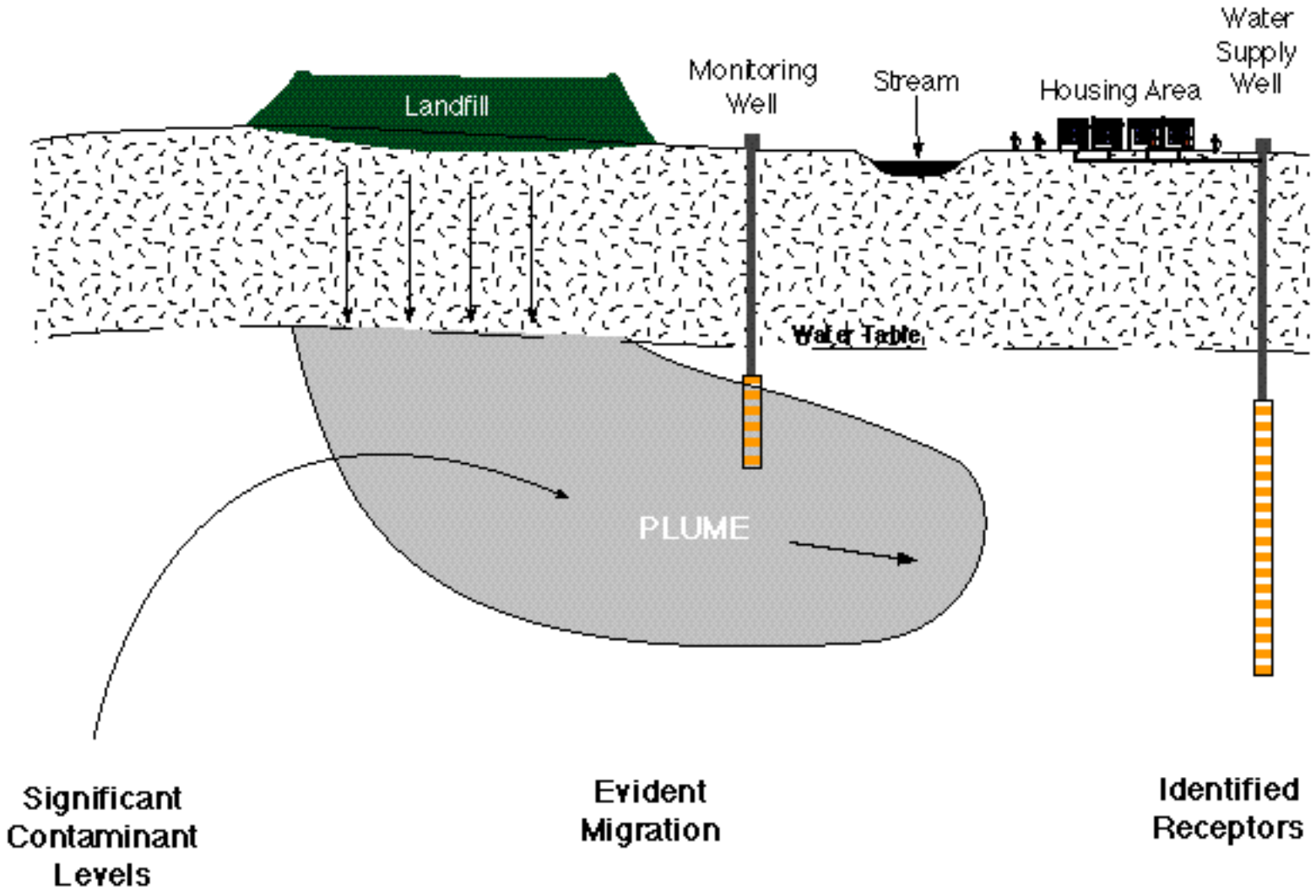
4. **Analytical results are below method detection limit**



Evaluated as *Low* in Primer

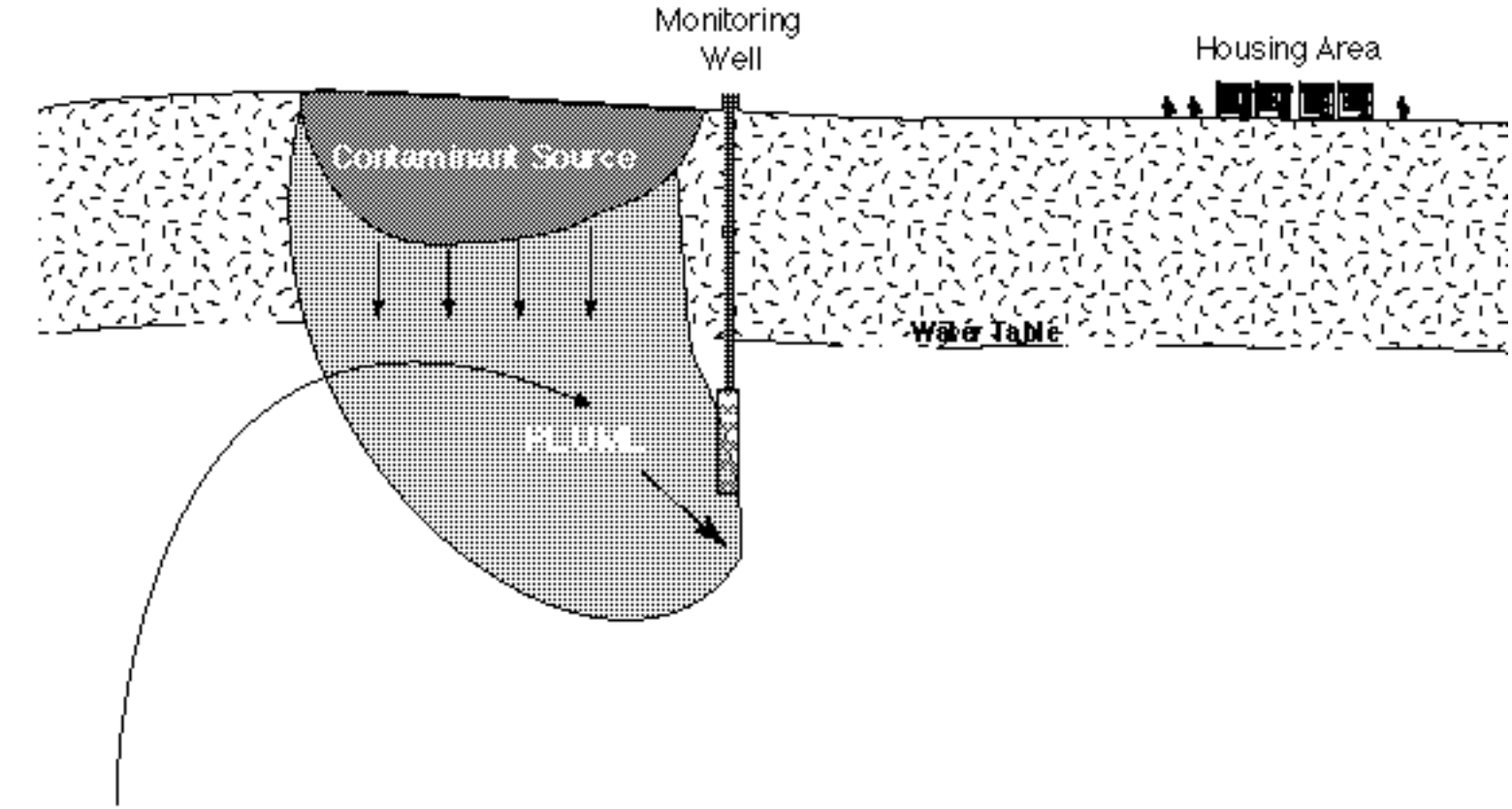
Relative Risk Site Evaluation Scenarios

High Relative Risk—Groundwater



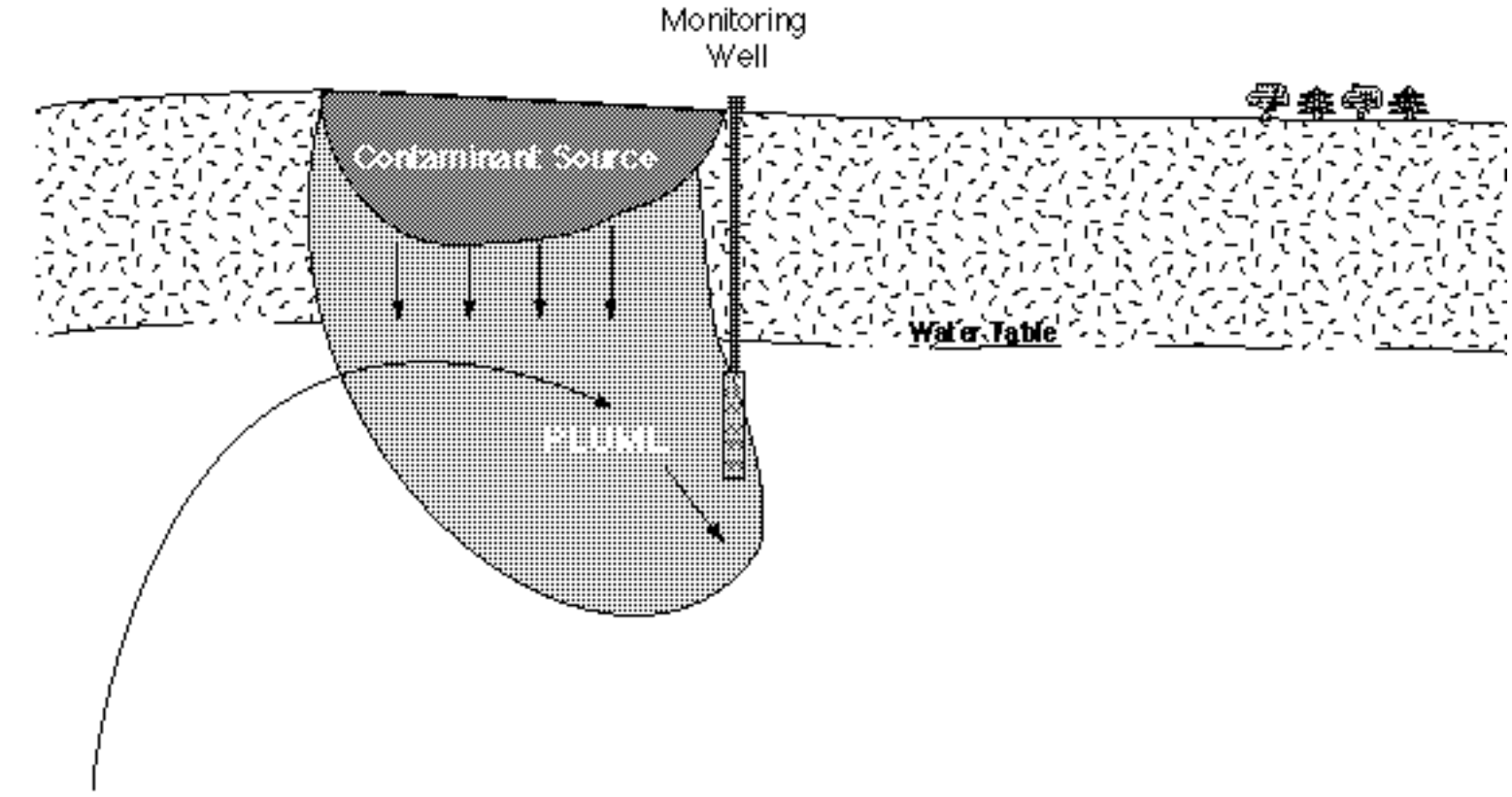
Relative Risk Site Evaluation Scenarios

Medium Relative Risk—Groundwater



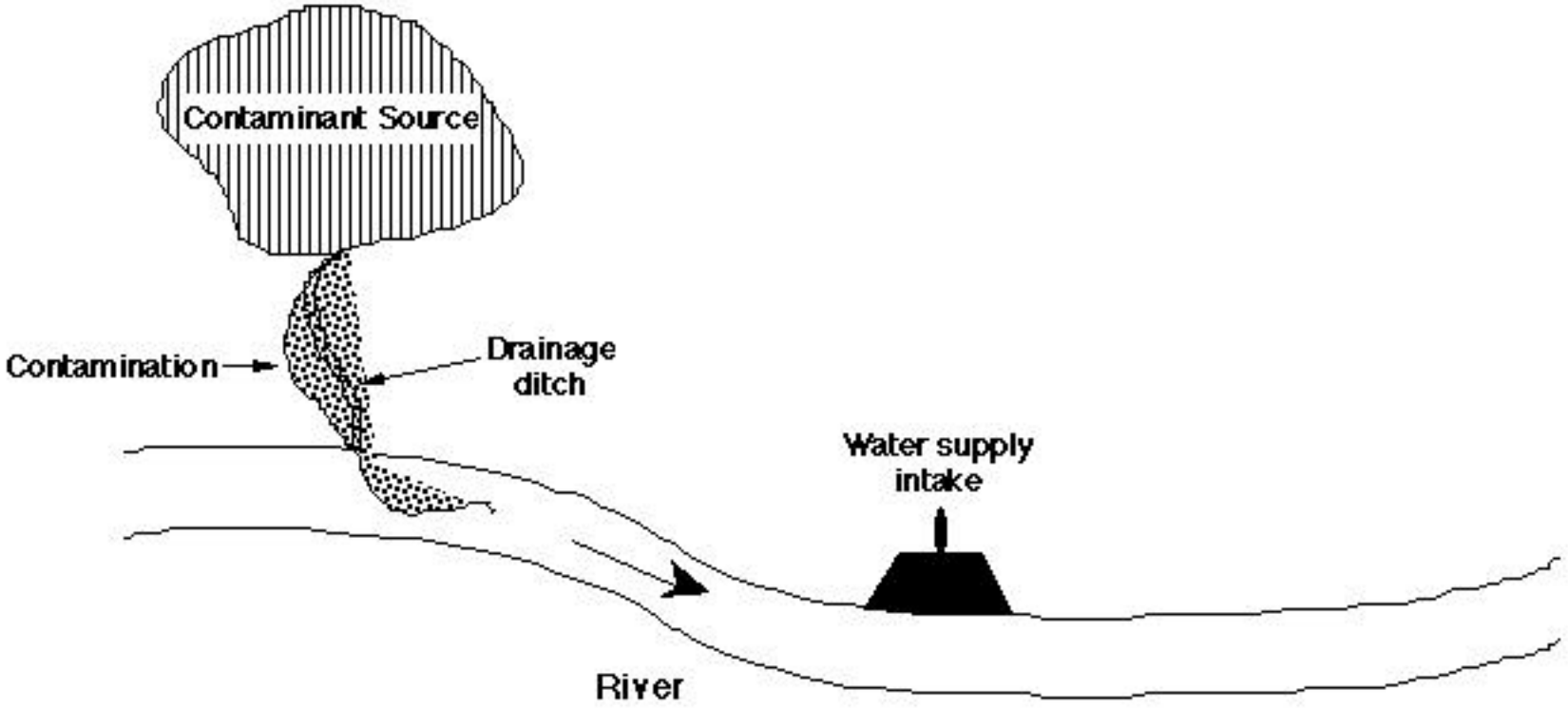
Relative Risk Site Evaluation Scenarios

Low Relative Risk—Groundwater



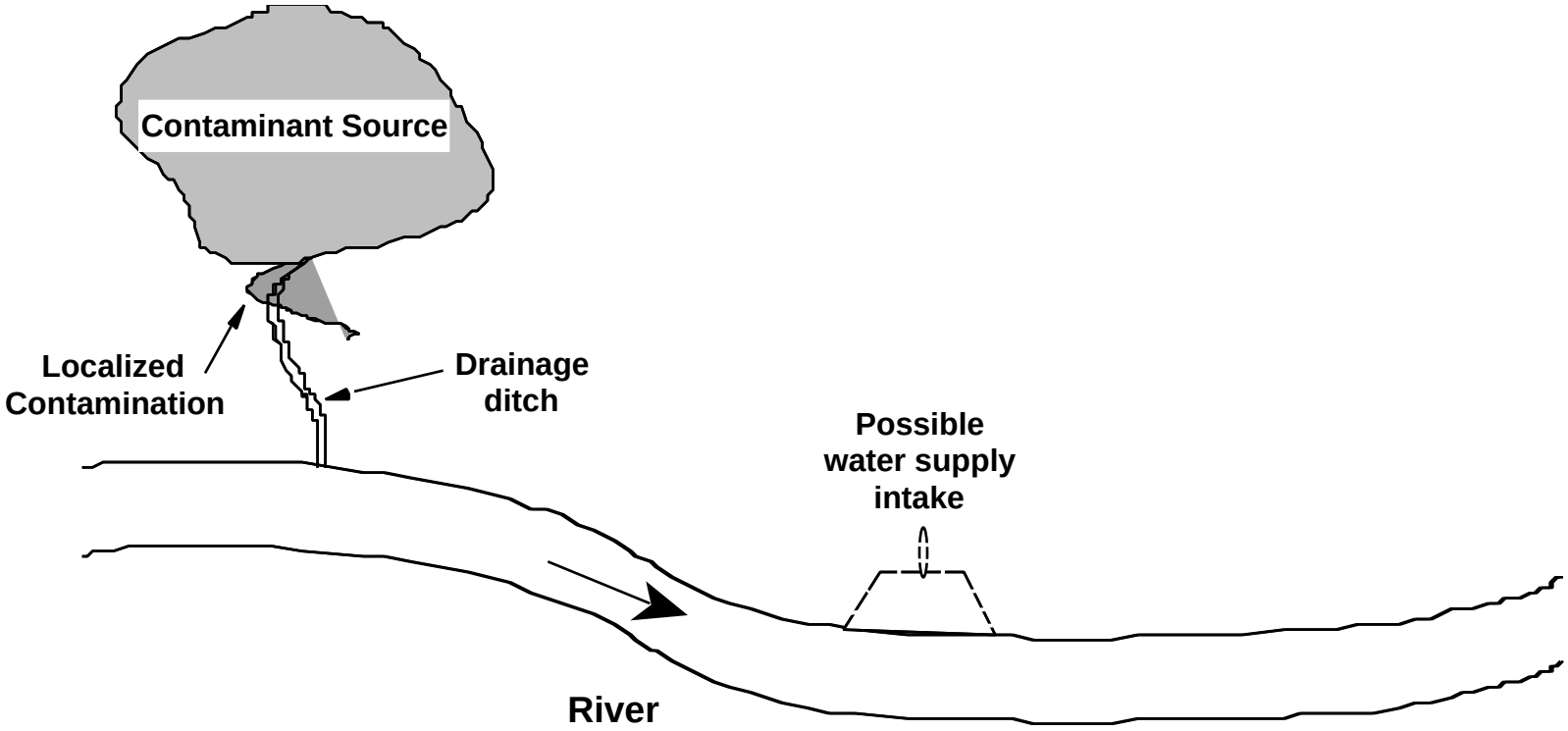
Relative Risk Site Evaluation Scenarios

High Relative Risk (Human)—Surface Water or Sediment



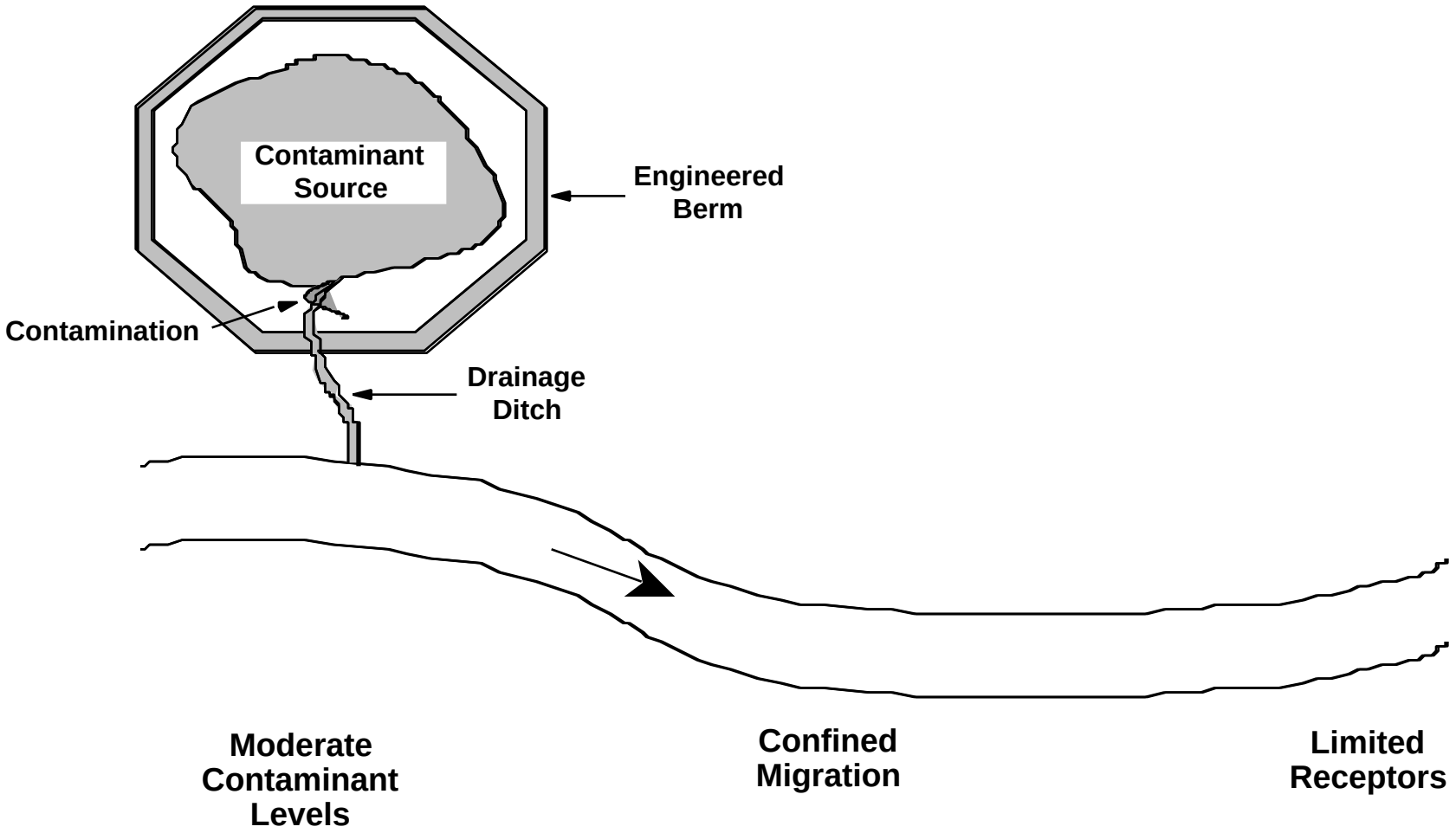
Relative Risk Site Evaluation Scenarios

Medium Relative Risk (Human)—Surface Water or Sediment



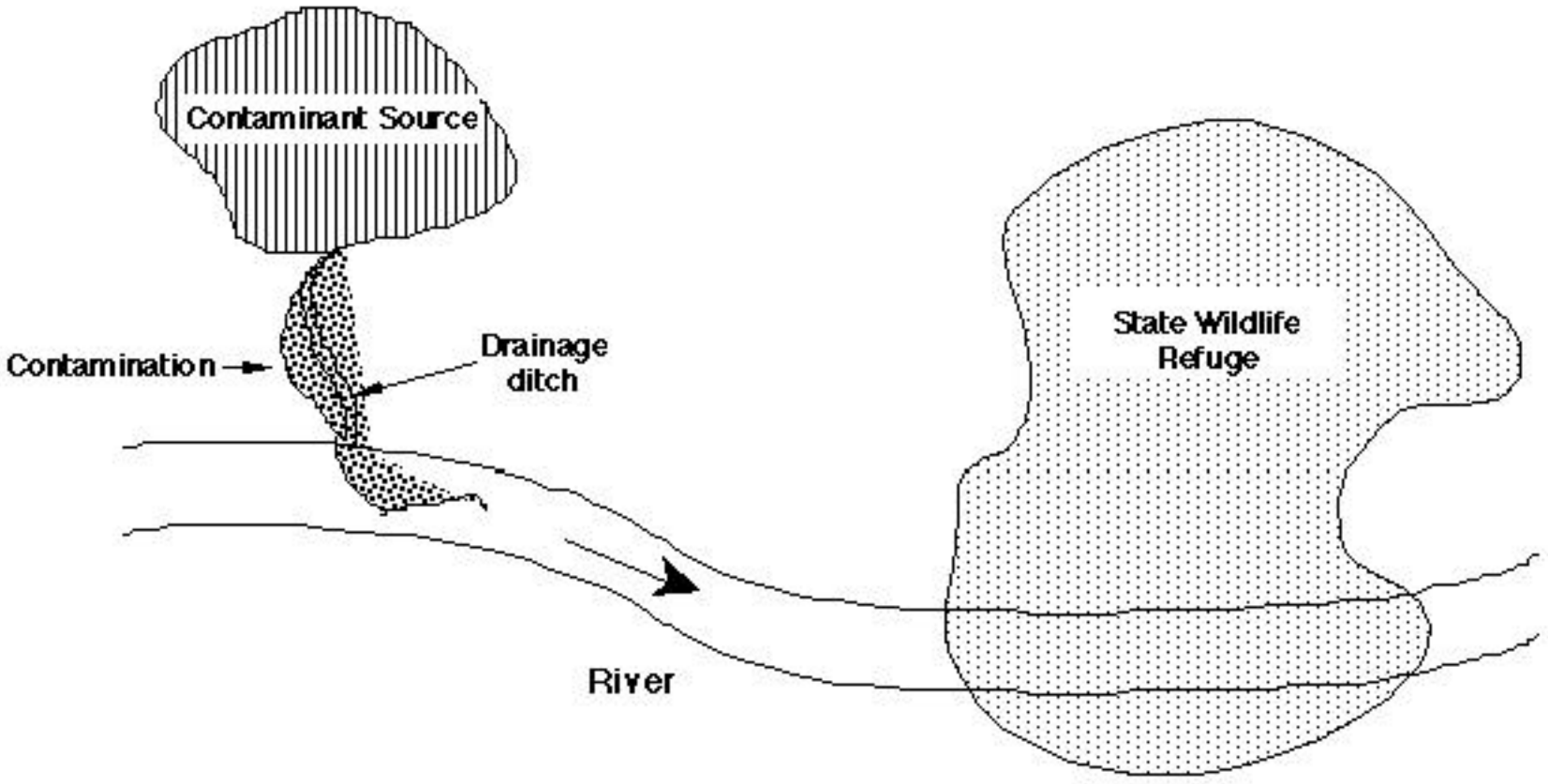
Relative Risk Site Evaluation Scenarios

Low Relative Risk (Human)—Surface Water or Sediment



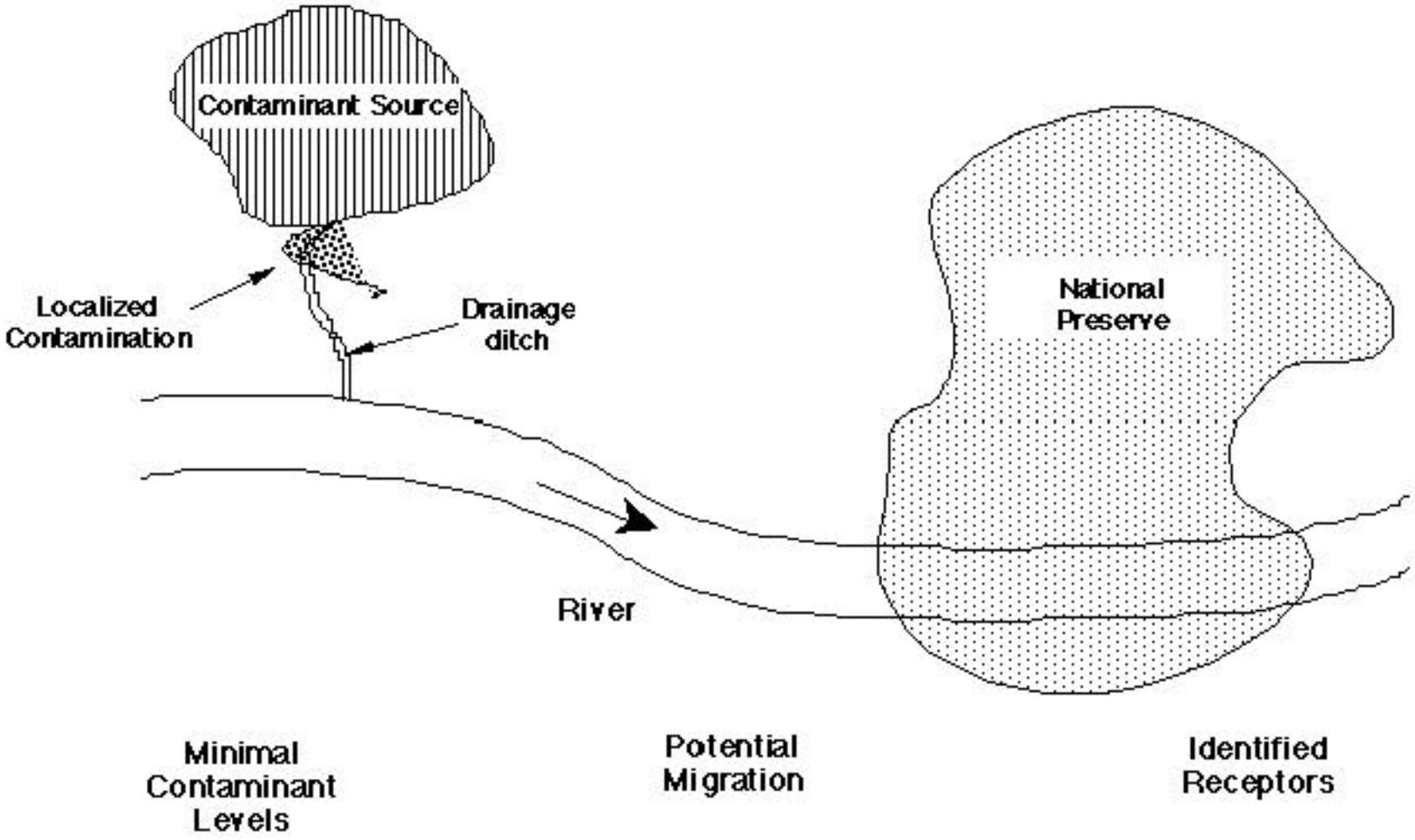
Relative Risk Site Evaluation Scenarios

High Relative Risk (Ecological)—Surface Water or Sediment



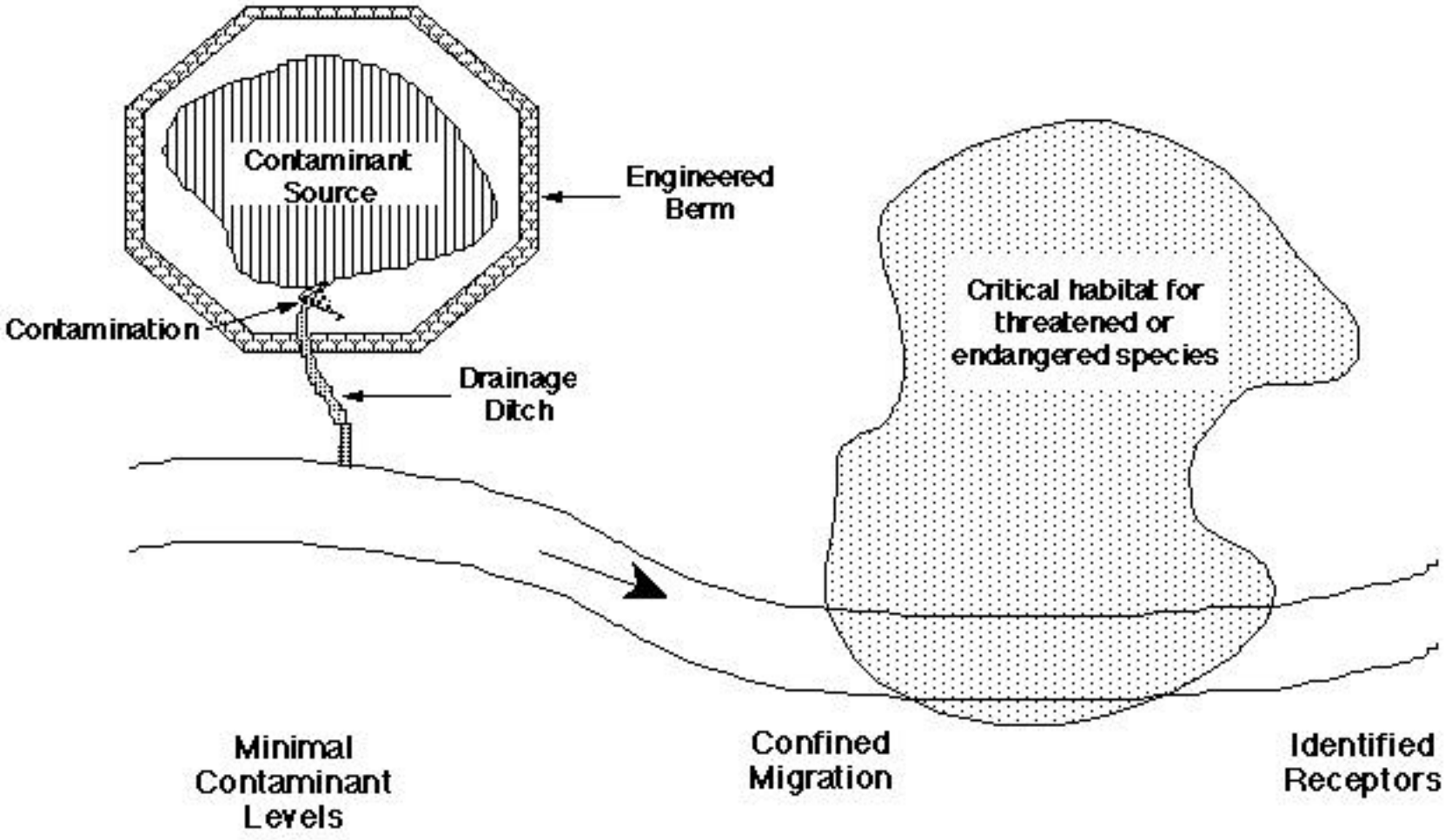
Relative Risk Site Evaluation Scenarios

Medium Relative Risk (Ecological)—Surface Water or Sediment



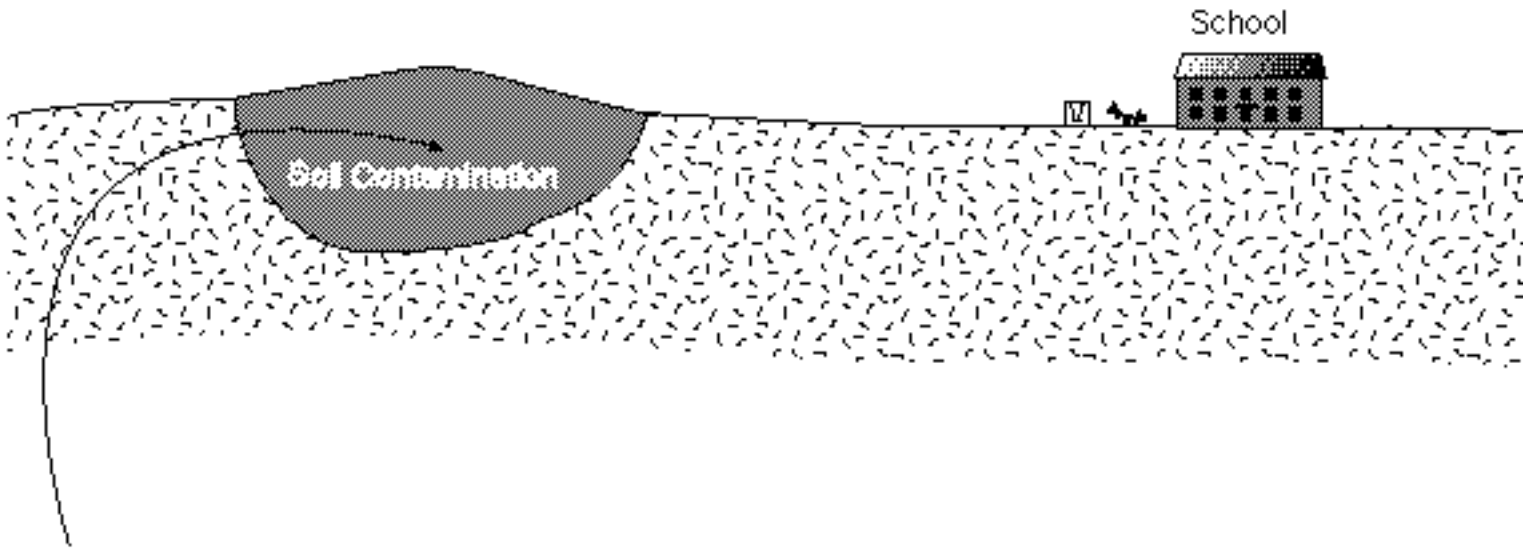
Relative Risk Site Evaluation Scenarios

Low Relative Risk (Ecological)—Surface Water or Sediment



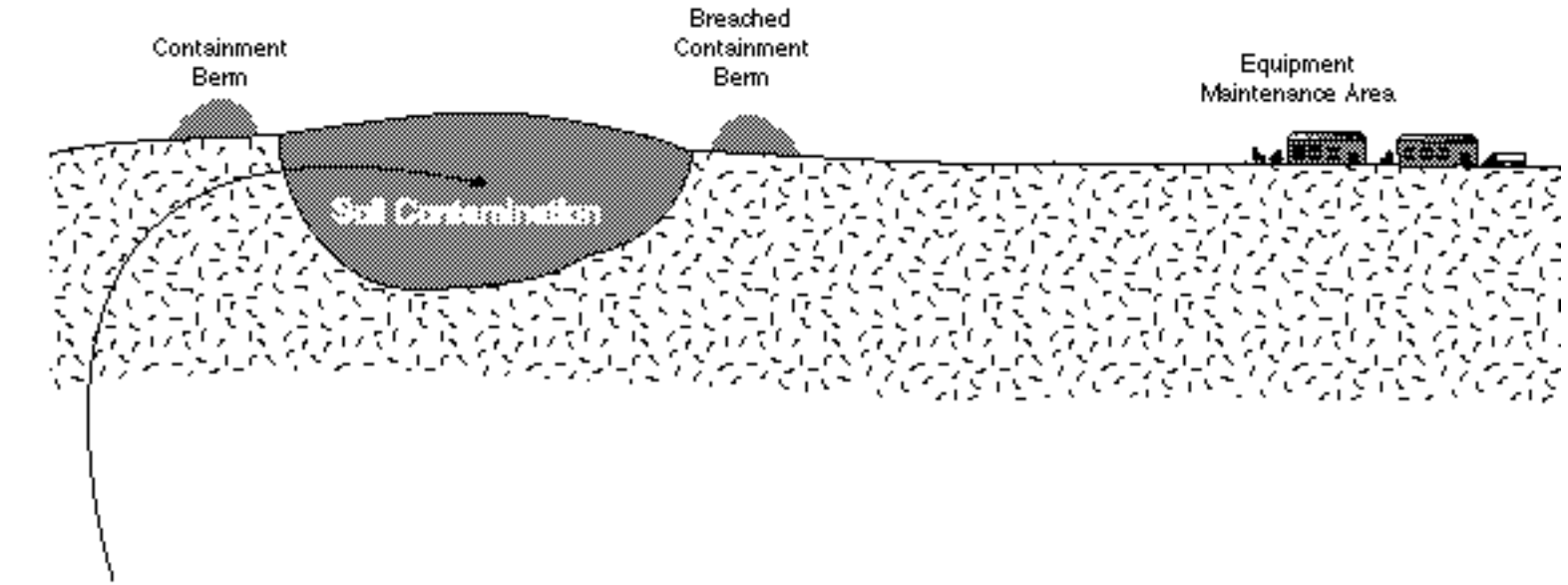
Relative Risk Site Evaluation Scenarios

High Relative Risk—Soil



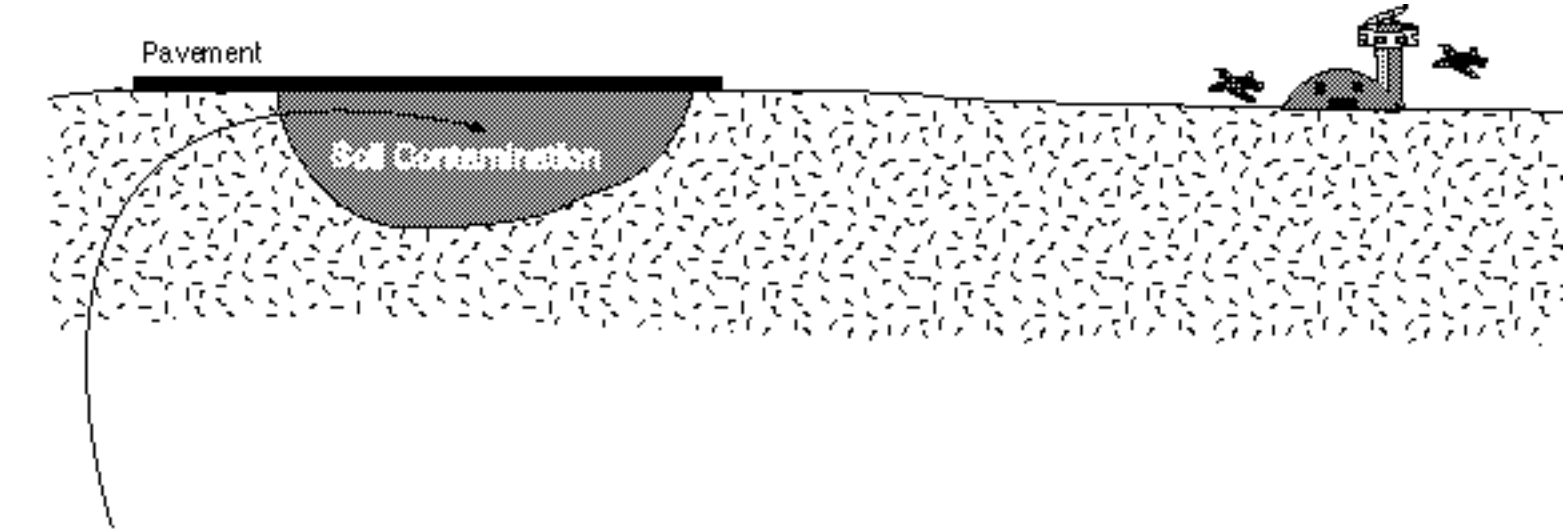
Relative Risk Site Evaluation Scenarios

Medium Relative Risk—Soil



Relative Risk Site Evaluation Scenarios

Low Relative Risk—Soil



Moderate Contaminant Levels

Confined Migration

Limited Receptors