

## 2 Description of Relative Risk Site Evaluation Framework

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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

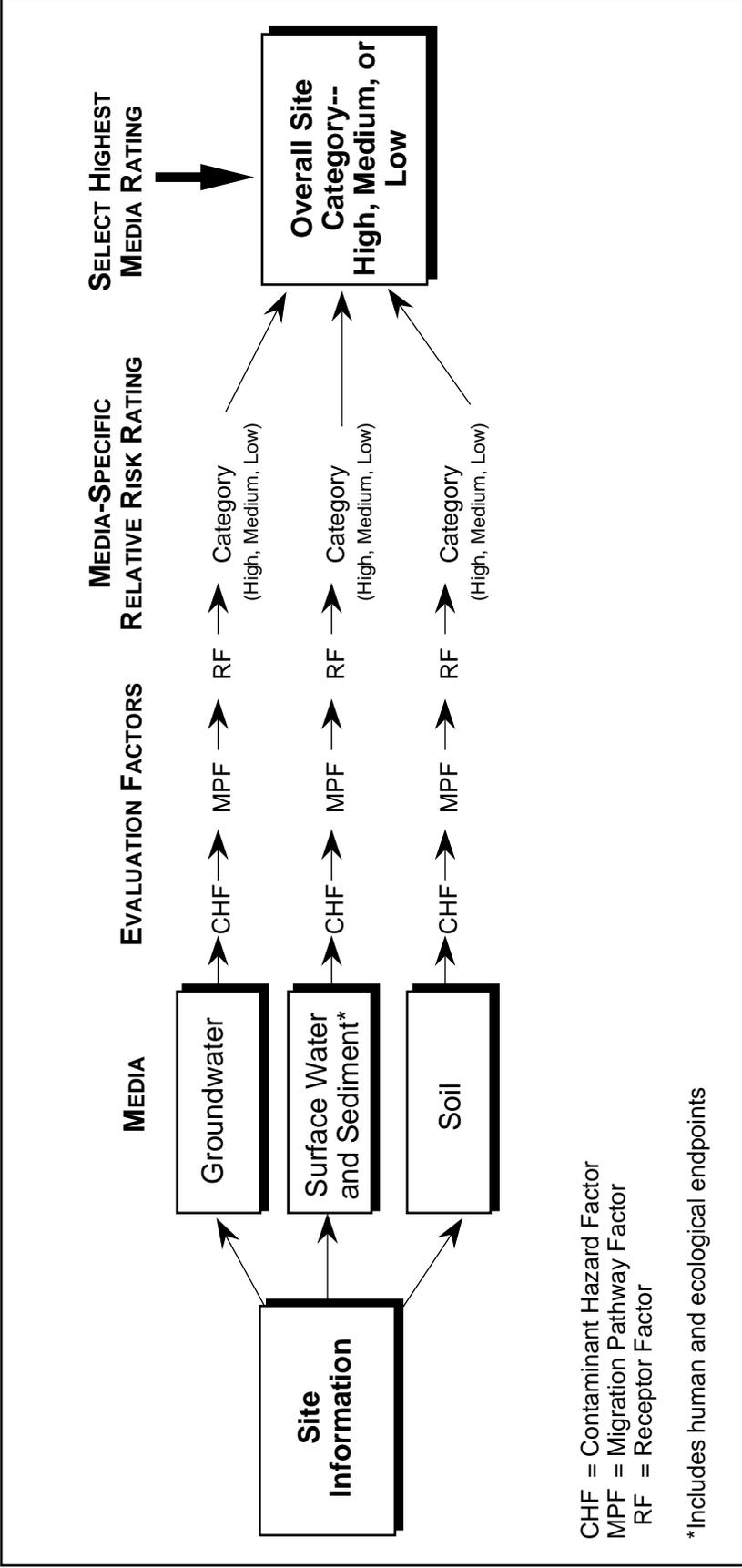


Figure 2. Flow Diagram of the Relative Risk Site Evaluation Framework

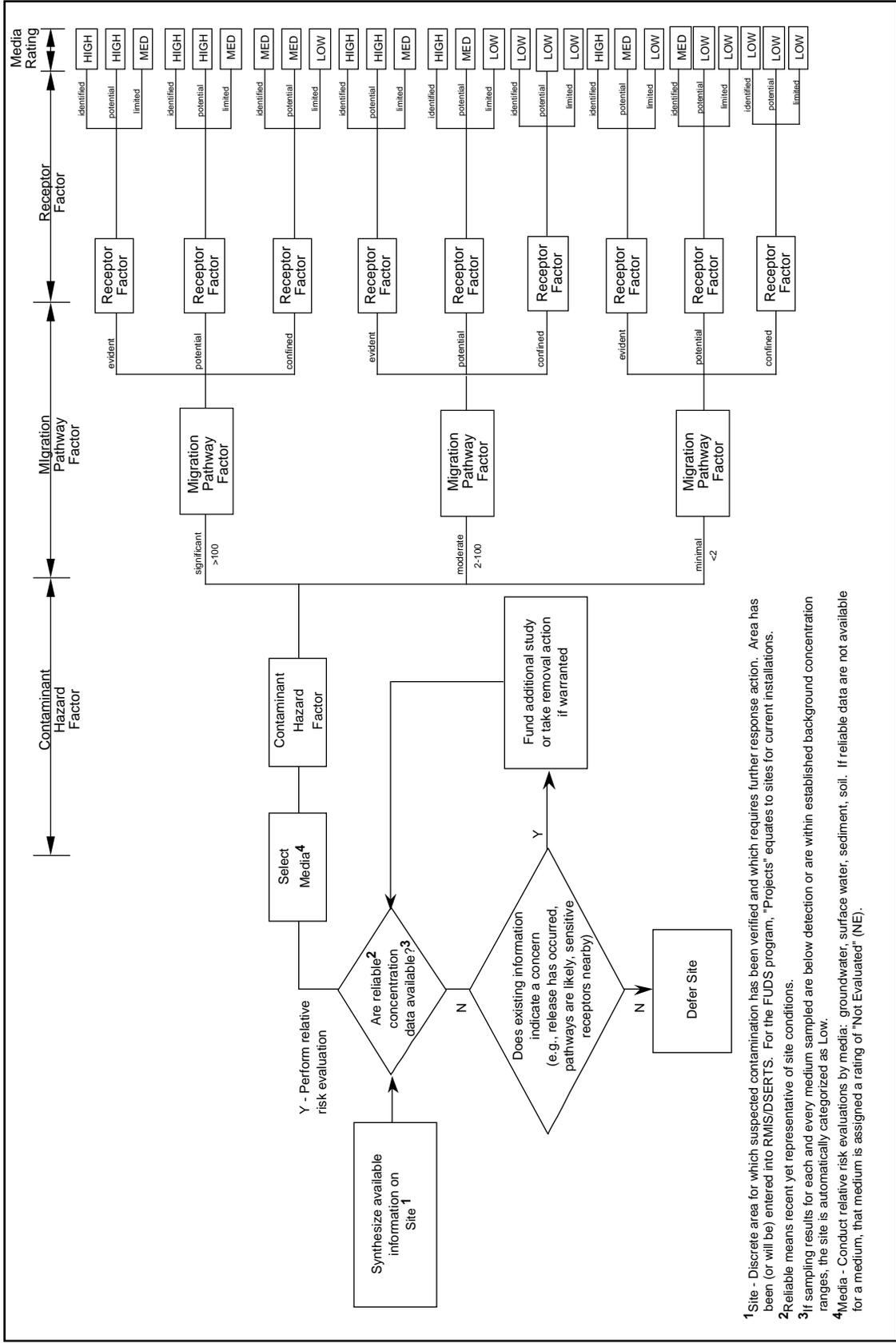


Figure 3. Relative Risk Site Evaluation Framework: Decision Flowchart

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 RMS/DSERTS. For the FUDS program, "Projects" equates to sites for current installations.  
 2 Reliable means recent yet 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).

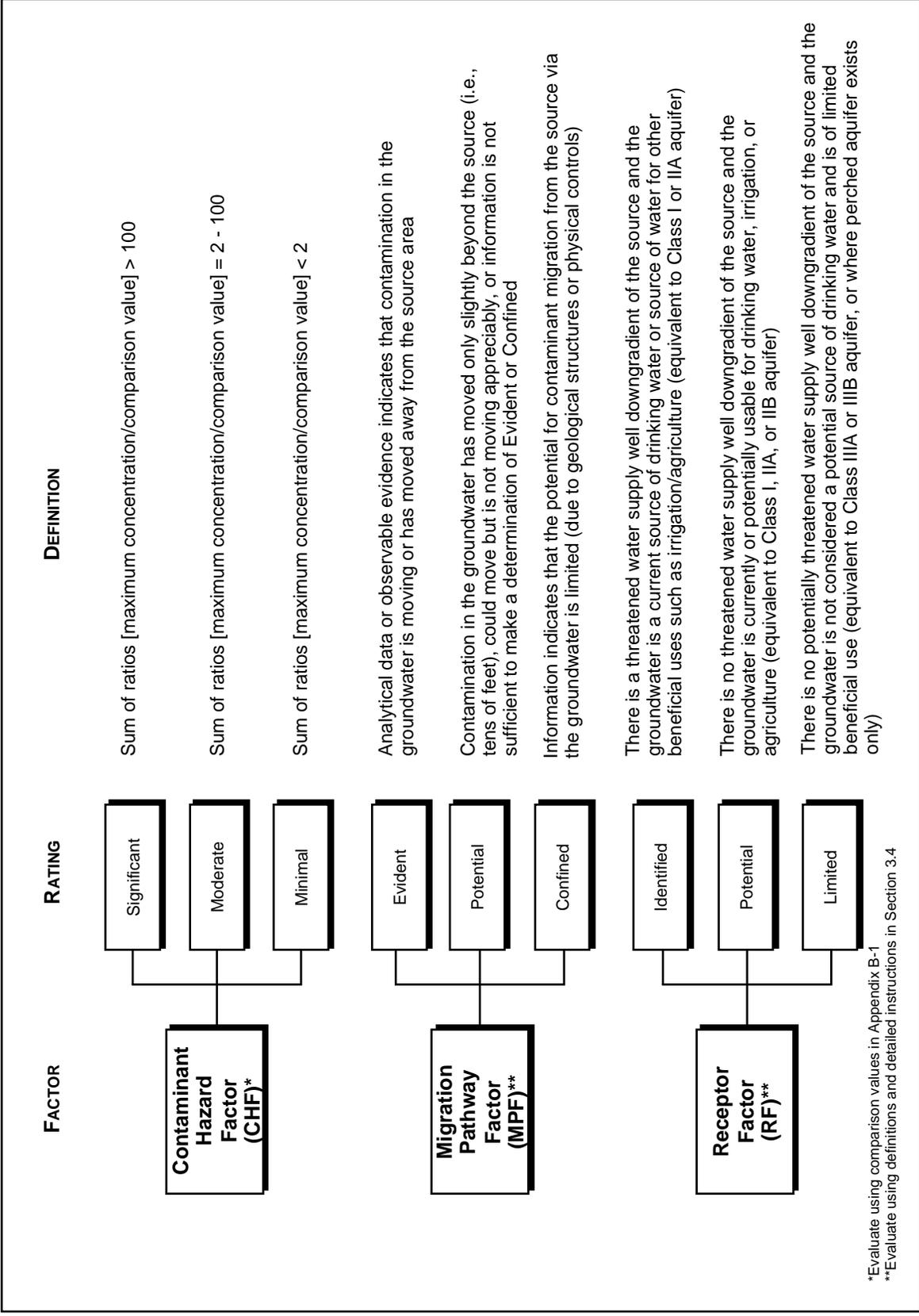


Figure 4. Relative Risk Site Evaluation Factor Information for Groundwater

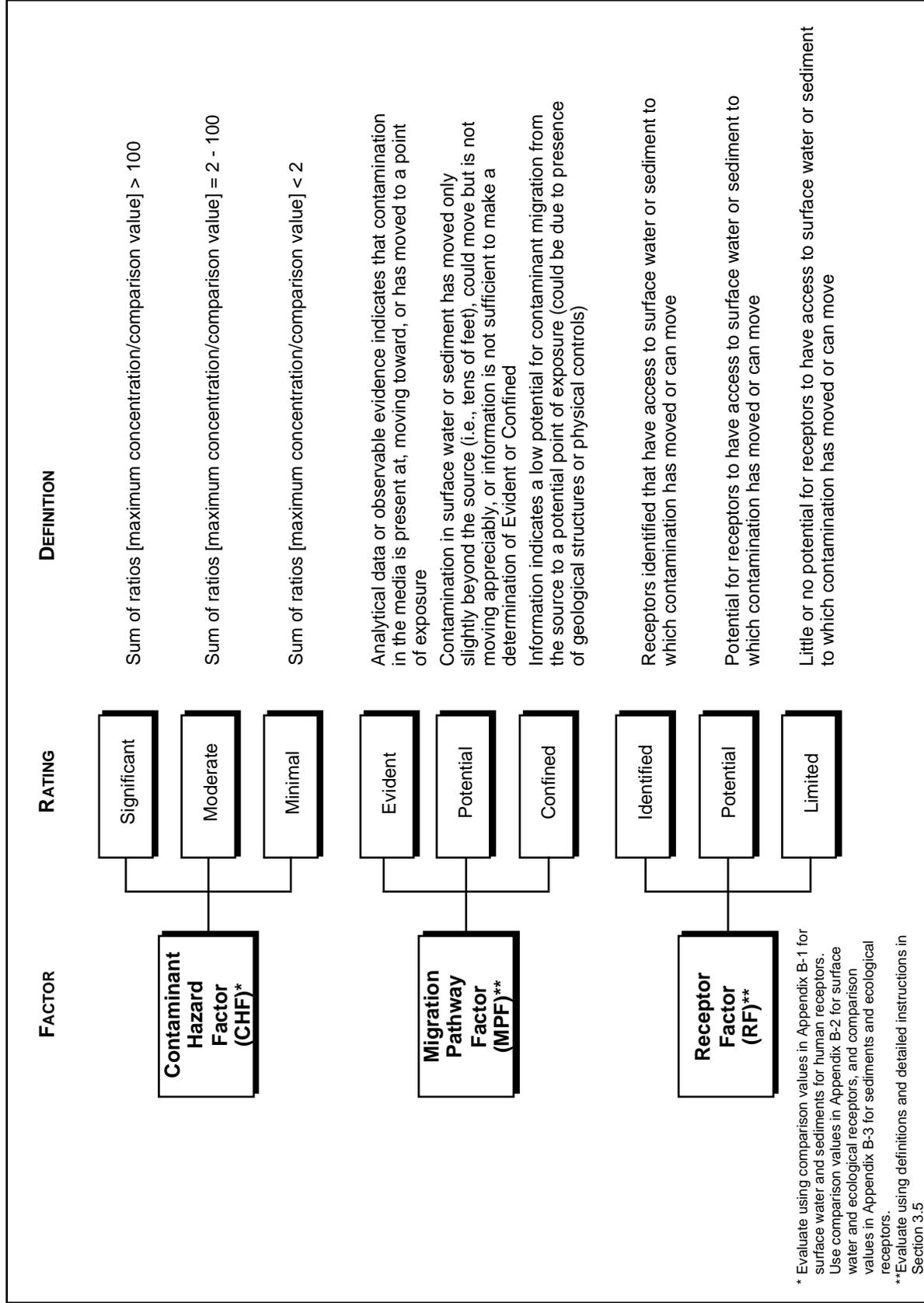
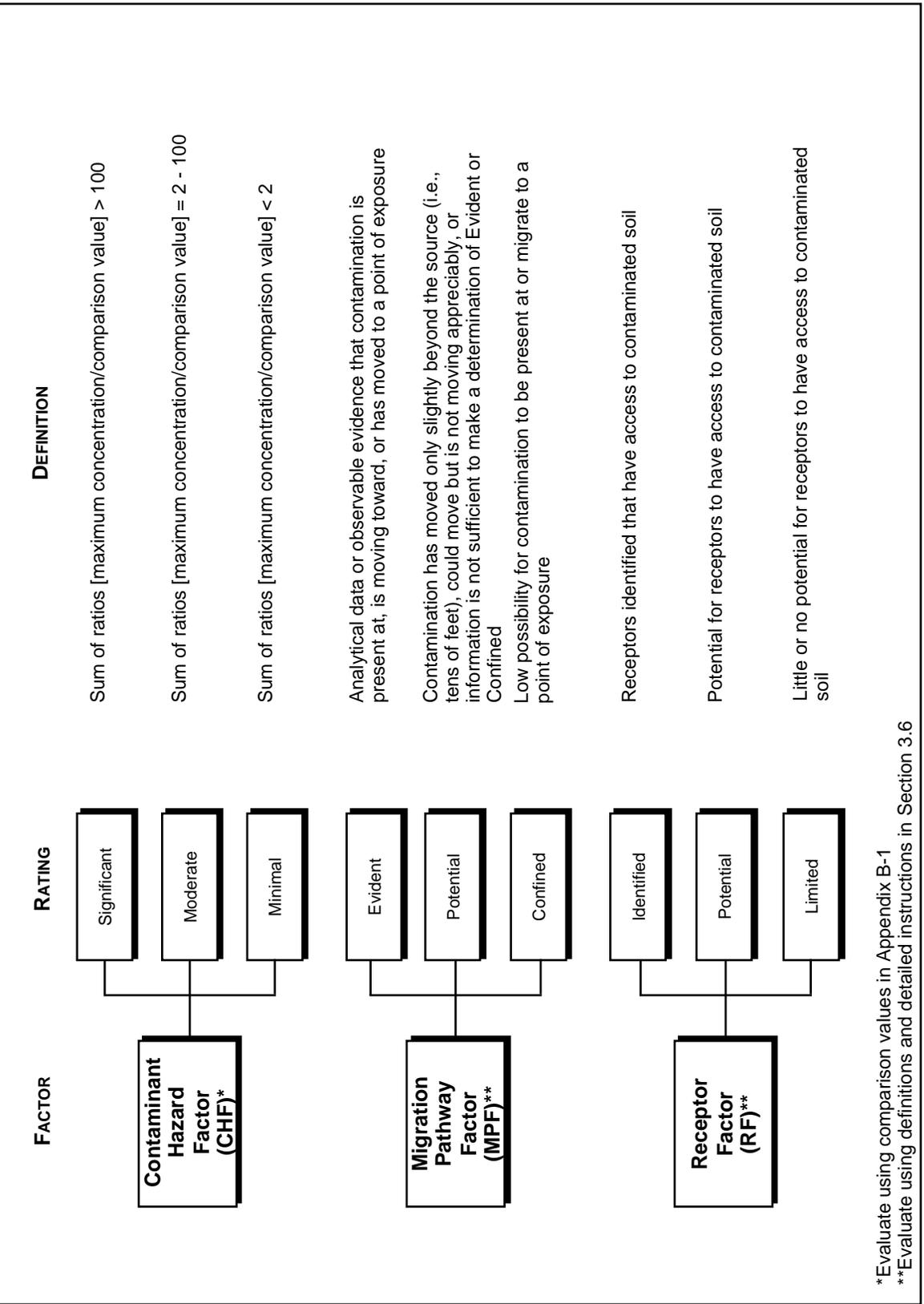


Figure 5. Relative Risk Site Evaluation Factor Information for Surface Water and Sediment



\*Evaluate using comparison values in Appendix B-1

\*\*Evaluate using definitions and detailed instructions in Section 3.6

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\***

<p><b>Class I Groundwater**</b></p>	<p>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.</p>	<p>If water supply wells in Class I groundwater are threatened, the receptor factor is <i>Identified</i>.</p> <p>If water supply wells in Class I groundwater are not threatened the receptor factor is <i>Potential</i>.</p>
<p><b>Class II Groundwater</b></p>	<p>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.</p>	<p>If water supply wells in Class IIA groundwater are threatened, the receptor factor is <i>Identified</i>.</p> <p>If water supply wells in Class IIA groundwater are not threatened, the receptor factor is <i>Potential</i>.</p> <p>If groundwater is Class IIB, the receptor factor is <i>Potential</i>.</p>
<p><b>Class III Groundwater</b></p>	<p>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.</p> <p>Class IIIA includes groundwater that is interconnected to surface water or adjacent groundwater that potentially could be used for drinking water.</p> <p>Class IIIB includes groundwater that has no interconnection to surface water or adjacent aquifers.</p>	<p>If groundwater is Class III, the receptor factor is <i>Limited</i>.</p>

\* 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)

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| <ul style="list-style-type: none"> <li>✓ Critical habitat<sup>a</sup> for federal designated endangered or threatened species</li> <li>✓ Marine Sanctuary</li> <li>✓ National Park</li> <li>✓ Designated Federal Wilderness Area</li> <li>✓ Areas identified under Coastal Zone Management Act<sup>b</sup></li> <li>✓ Sensitive areas identified under National Estuary Program<sup>c</sup> or Near Coastal Waters Program<sup>d</sup></li> <li>✓ Critical areas identified under the Clean Lakes Program<sup>e</sup></li> <li>✓ National Seashore Recreational Area</li> <li>✓ National Lakeshore Recreational Area</li> <li>✓ Habitat known to be used by federal designated or proposed endangered or threatened species</li> <li>✓ National Preserve</li> <li>✓ National or State Wildlife Refuge</li> <li>✓ Unit of Coastal Barrier Resources System</li> <li>✓ Coastal Barrier (undeveloped)</li> <li>✓ Federal land designated for protection of natural ecosystems</li> <li>✓ Administratively Proposed Federal Wilderness Area</li> <li>✓ Spawning areas critical for the maintenance of fish or shellfish species within river, lake, or coastal tidal waters<sup>f</sup></li> <li>✓ 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</li> <li>✓ Terrestrial areas utilized for breeding by large or dense aggregations of animals<sup>g</sup></li> <li>✓ National river reach designated as Recreational</li> </ul> |
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<sup>a</sup> Critical habitat as defined in 50 CFR 424.02

<sup>b</sup> Areas identified in State Coastal Zone Management plans as requiring protection because of ecological value

<sup>c</sup> 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)

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

<sup>e</sup> 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)

<sup>f</sup> Limited to areas described as being used for intense or concentrated spawning by a given species

<sup>g</sup> 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.

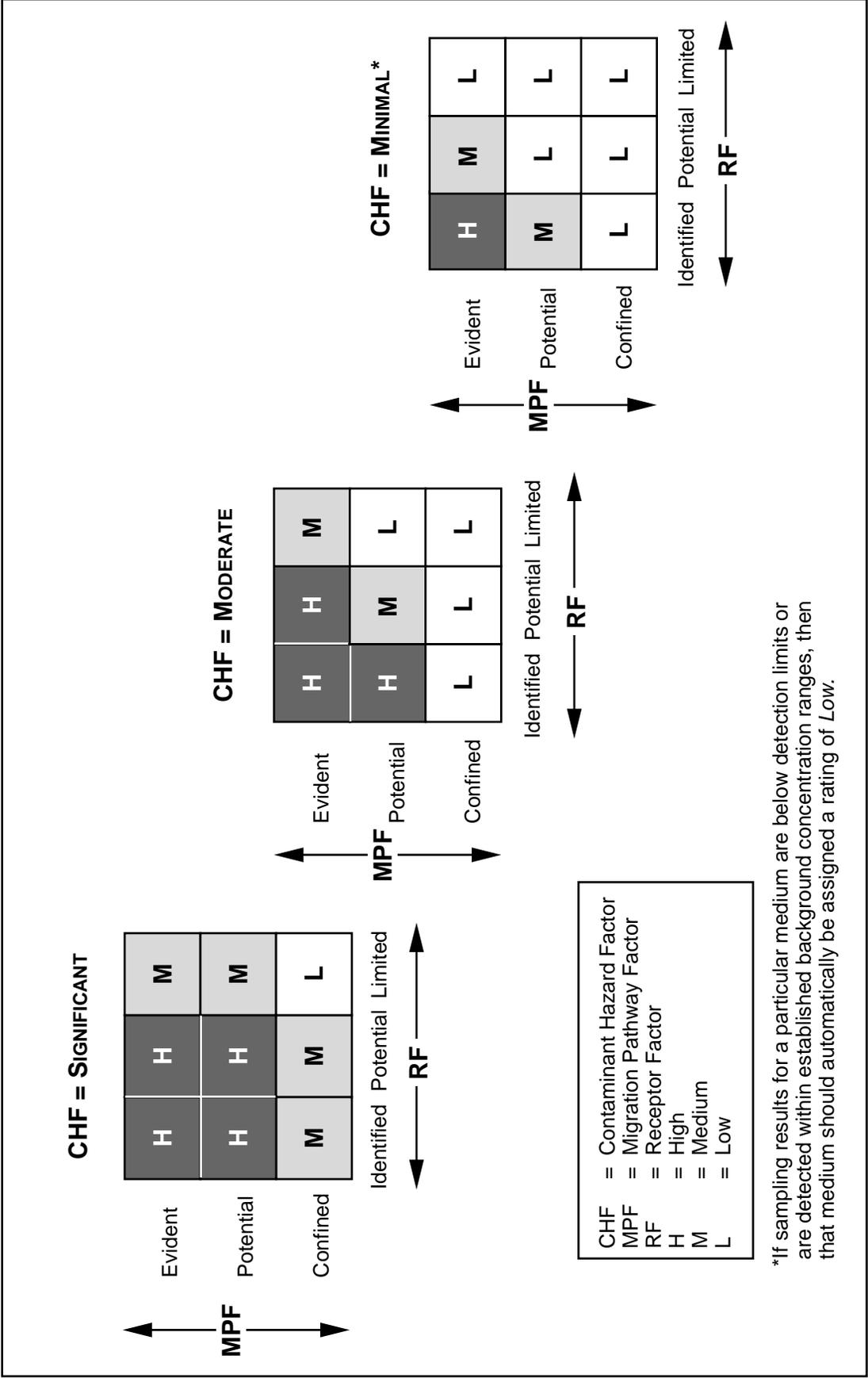


Figure 7. Relative Risk Site Evaluation Matrix

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