# Human Health Risk Assessment Screening Tool for Atypical Risk Exposure Scenarios

## Introduction

This risk assessment screening tool is intended to help regulators review risk assessments that do not fit typical residential or commercial/industrial scenarios. These atypical situations, selected with States feedback, include exposures from trespassing, recreating, or short-term work assignments, etc. This tool helps reviewers determine if the variables used are within reasonable ranges and what variables have the highest impact on the ultimate outcome of a risk assessment. This tool uses 50$^{th}$ percentile exposure factor rates from the EPA's Exposure Factors Handbook (EFH). Users of the EFH should employ the exposure metric most appropriate for their specific situation.

## Human Health Risk Assessment Overview

A **Human Health Risk Assessment (HHRA)** determines if site contaminants are of concern to human health and the environment. The HHRA uses environmental data to estimate the nature, magnitude, and probability of adverse health effects on those exposed to the contaminated media (e.g., soil, soil vapor, groundwater, surface water), now and in the future. Regulators use the HHRA to determine allowable property use, and to help assess whether the cleanup strategy ensures safe end use.

### There are four steps to the HHRA process:

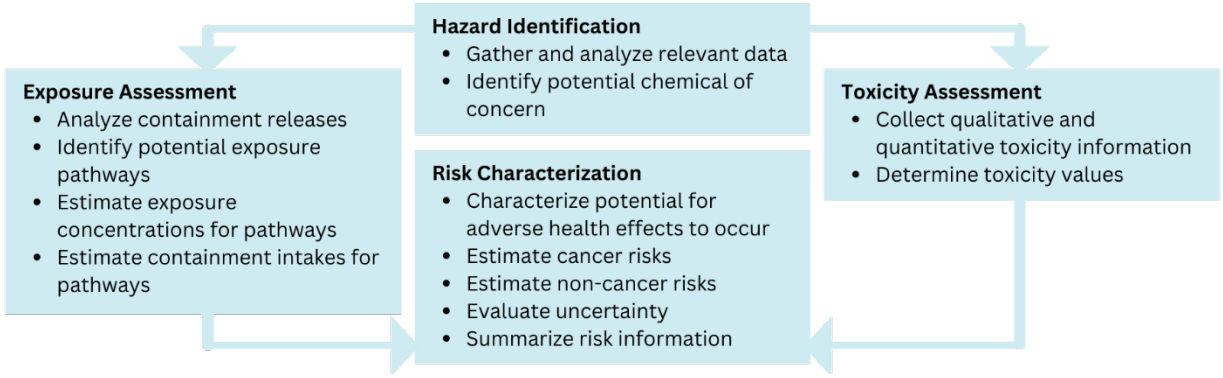
1. **Hazard Identification:** Site data determines what chemicals are present and whether they have harmful health effects (cancer and non-cancer) for those in contact with the site.
2. **Exposure Assessment:** Exposures for current and potential future populations consider the site's contaminants; the contaminated media; exposure pathways such as ingestion, inhalation, or absorption through the skin; and estimated contaminant concentrations (intake rates). One focus of this tool is the variables for the exposure assessment.
3. **Toxicity Assessment:** This incorporates chemical toxicity information into the HHRA. This information is typically available on the U.S. Environmental Protection Agency website.
4. **Risk Characterization:** This step combines results from previous steps to give cumulative cancer and non-cancer hazards for exposed humans. The risk characterization indicates whether site contaminants pose unacceptable risks to people and the environment that require remediation of contaminated media. Risk management decisions are developed based on the results of cumulative cancer risk and non-cancer hazard estimates for the site.

### An Uncertainty Analysis is used within the risk assessment to reflect:

**(a)** the sources and degrees of uncertainty associated with the data collected at the site.

**(b)** exposure assumption and toxicity information used to estimate cancer risks and non-cancer hazards to populations.

**(c)** assumptions and input variables associated with the assessment models employed.




## HHRA Screening Tool

These tables demonstrate how changes in exposure factors affect the risk characterization. Modifying an exposure factor could lower or raise the cancer and non-cancer risk estimate. The magnitude of impact on the HHRA from changing exposure factors was qualitatively rated as Very High, High, or Moderate.

**Table 1: Time and Weight Variables**

| EXPOSURE Factors | Definition | Typical Unit | Avg Range | Magnitude of Impact |
|---|---|---|---|---|
| Time Indoors | Average time spent indoors | Minutes/ Day | 1278-1440 (Child)<br>1142-1244 (Adult) | Very High |
| Time Outdoors | Average time spent outdoors | Minutes/ Day | 0-107(Child)<br>132-298 (Adult | Very High |
| Time Swimming | Average time exposed during swimming. Depending on the area, the time spent can vary significantly seasonally and should be factored in accordingly. | Minutes/ Month | 96-137 (Child)<br>40-151 (Adult) | Very High |
| Body Weight | Body weight for the general population and various demographic groups. | kg | 4.8-18.6 (Child)<br>18.6-83.6 (Adult) | Very High |
| Age of Subject | Often subjects are divided into child or adult, but more specific age ranges may be defined and should be assessed accordingly. | Years | 0-6 (Child)<br>6-70+ (Adult) | Very High |

**Table 2: Ingestion Variables**

| EXPOSURE Factors | Definition | Typical Unit | Avg Range | Magnitude of Impact |
|---|---|---|---|---|
| Total Food Intake | Total food consumption for the general population and various demographic groups; information on the composition of the diet is also provided | g/kg per Day | 79-91 (Child)<br>29-47 (Adult) | Very High |
| Incidental Ingestion | Unintentional intake of small amounts of soil or water, particularly associated with children's hand to mouth activity. | g/kg per Day<br>ml/kg per Day | | Very High |
| Ingestion of Water | Drinking water consumption and data on intake of select liquids for the general population and various demographic groups | mL per Day | 184-362 (Child)<br>414-1379 (Adult) | Very High |
| Intake of Fruits & Vegetables | Total fruit consumption as well as intake of individual fruits for the general population and various demographic groups. | g/kg per Day | 4.6-7.8 (Child)<br>0.9-2.3 (Adult) | Very High |
| Intake of Fruits & Vegetables | Total vegetable consumption as well as intake of individual vegetables for the general population and various demographic groups. | g/kg per Day | 5.0-6.7(Child)<br>2.3-3.7 (Adult) | Very High |
| Intake of Meats | Meat consumption for the general population | g/kg per Day | 1.2-3.9 (Child)<br>1.4-2.8 (Adult) | Very High |
| Finfish/ Shellfish Consumption | General Population, Finfish, Freshwater | g/kg per Day | 0.03-0.22 (Child)<br>0.1-0.2 (Adult) | Very High |
| Finfish/ Shellfish Consumption | General Population, Shellfish, Freshwater | g/kg per Day | 0-0.05 (Child)<br>0.03-0.08 (Adult) | Very High |
| Finfish/ Shellfish Consumption | General Population, Total Finfish/Shellfish, Freshwater | g/kg per Day | 0.04-0.26 (Child)<br>0.13-0.25(Adult) | Very High |
| Finfish/ Shellfish Consumption | Recreation Population, Marine Fish (Atlantic) | g/kg per Day | 2.5 (Child)<br>2.5-5.6 (Adult) | Very High |
| Finfish/ Shellfish Consumption | Recreation Population, Marine Fish (Gulf) | g/kg per Day | 3.2 (Child)<br>3.3-7.2 (Adult) | Very High |
| Finfish/ Shellfish Consumption | Recreation Population, Marine Fish (Pacific) | g/kg per Day | 0.9 (Child)<br>0.9-2.0 (Adult) | Very High |
| Human Milk Intake | Data on human milk consumption for infants | mL/ Day | | Very High |

**Table 3: Inhalation Variables**

| EXPOSURE Factors | Definition | Typical Unit | Avg Range | Magnitude of Impact |
|---|---|---|---|---|
| Respiration/ Inhalation Rate | Long-term average daily inhalation rates. Short-term inhalation rates can vary significantly and should be assessed for activity-specific scenarios. | $m^3$/ Day | 3.5-10.1 (Child)<br>10.1-16.3 (Adult) | High |
| Soil/Dust Inhalation Rate | Soil and dust ingestion for adults and children. Often particles are trapped in an individual's mucous and swallowed. | mg/ Day | 60-100 (Child)<br>50-100 (Adult) | High |

**Table 4: Absorption Variables**

| EXPOSURE Factors | Definition | Typical Unit | Avg Range | Magnitude of Impact |
|---|---|---|---|---|
| Surface Area of Exposed Skin | Skin surface area available for contact | $cm^2$ | 0.29-0.76 (Child)<br>1.08-2.15 (Adult) | Moderate |
| Adherence Factor | Amount of solid that adheres to the skin per unit surface area | $mg/cm^2$ | | Moderate |

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