

**Remediation and Redevelopment Division  
Program Redesign 2009**

**Background Document:**

**Draft Proposed Immediate Response Activity Screening Levels: Acute Indoor Air Screening Levels (AIASLs); Acute Soil Gas Screening Levels – sub-slab and Deep (ASGSLs); Excavation Worker Screening Levels (EWSLs); Groundwater Sump Screening Levels (GW<sub>sump</sub>SLs); Flammability and Explosivity Screening Levels (FESLs)**

September 24, 2009

The Immediate Response Activity Screening Levels (IRASLs) are intended to assist in identifying those conditions that may present an immediate or imminent threat to the public health, safety, or welfare, or the environment, as a result of a release. The screening levels are developed for air, soil gas, and groundwater and represent an acceptable exposure limit that is not expected to cause adverse health effects after a single or short-term exposure to an individual hazardous substance. An acute exposure is generally defined as a single or repeated exposure over a 24-hour period. Acute toxicity is defined as the ability of a hazardous substance to cause harmful, non-cancer effects in an organism through a single or short-term exposure. The acute screening levels may not protect sensitive populations, such as children or pregnant women, with unique or increased exposures via a specific pathway.

The IRASLs are intended to facilitate self-implementation of response actions to address known or suspected conditions that may present an immediate threat to human health. The absence of an IRASL for a specific hazardous substance and/or pathway should not be interpreted to mean the absence of toxicity or physical hazard from that hazardous substance or exposure pathway.

All of the screening levels are based on inhalation exposures except for the Flammability and Explosivity Screening Levels (FESLs). Acute inhalation toxicity endpoints were evaluated by the department for development of the acute inhalation-based screening levels. The department selected the Minimal Risk Levels (MRLs) developed by the Agency for Toxic Substances and Disease Registry as the basis for the AIASLs, the ASGSLs, and the EWSLs. These values are preemptive in nature and provide an estimate of a daily human exposure to a hazardous substance that is unlikely to cause an adverse non-cancer health effect over a specified duration of exposure [acute (1-14 days), intermediate (15-364 days) and chronic (365 days or more)]. The methodology used to develop the MRLs is similar to that of the United States Environmental Protection Agency's (U.S. EPA) methodology for deriving reference doses (RfDs) and reference concentrations (RfCs), which represent daily doses over chronic or sub-chronic durations of exposure that are not expected to cause

adverse health effects. MRLs undergo a rigorous internal and external review process.

The IRASLs are:

1) **Acute Indoor Air Screening Levels (AIASLs):**

The intent of the AIASLs is to assist in the evaluation of acute inhalation toxicity in the indoor air of an occupied structure and determine the need for an immediate response action. The AIASLs should be compared to indoor air data collected over 1-24 hour periods (averaging times).

The AIASL is equivalent to the acute MRL and is applicable to both residential and non-residential land uses. MRLs have been developed for a limited number of priority hazardous substances which includes 45 of the hazardous substances included in the list of cleanup criteria.

$$\text{AIASL (ug/m}^3\text{)} = \text{Acute or Intermediate MRL}$$

Only one exceedance of an AIASL initiates an accelerated evaluation/mitigation process. Immediate response obligations include: initiation of a response within 48 hours of discovery; mitigation of the acute inhalation hazard; and subsequent obligations may apply. Indoor air monitoring is generally not required; however, monitoring of indoor air may supplement an evaluation when discovery/inquiry demonstrates an exceedance of an Acute Soil Gas Screening Level.

2) **Acute Soil Gas Screening Levels (ASGSLs):**

The ASGSLs are intended to assist in the evaluation of acute inhalation toxicity in indoor air and to determine the need for an immediate response. Two separate screening levels are developed, one for sub-slab and one for deep (5 feet and greater) samples; they apply to both residential and nonresidential land uses.

The ASGSLs are calculated from the AIASLs which are equivalent to the acute or intermediate MRLs for 45 priority hazardous substances. The calculations are consistent with the calculations for the chronic soil gas criteria (SGC)(see the draft Background Document for the Vapor Intrusion Criteria and Screening Levels). The deep ASGSLs are based on an attenuation coefficient of 0.002; the sub-slab ASGSLs are based on an attenuation coefficient of 0.02. The ASGSLs are calculated by dividing the AIASL by the attenuation coefficient. See below:

$$\text{ASGSL (sub-slab; ug/m}^3\text{)} = \text{AIASL}/0.02$$

$$\text{ASGSL (deep; ug/m}^3\text{)} = \text{AIASL}/0.002$$

Concentrations exceeding a ASGSL in deep or sub-slab soil gas do not necessarily indicate an actual acute inhalation exposure indoors, but indicate that an evaluation and an accelerated mitigation process must be initiated. An evaluation of soil gas may be supplemented with indoor air monitoring data which are compared to the AIASLs. An evaluation or exposure assessment may include development of a conceptual site model to identify potential sources, receptors and migration pathways. Response actions may include, but are not limited to: source removal; mitigation to address threatened receptors; presumptive remedies; and further evaluation of indoor air quality with a comparison of indoor air data to the AIASLs. Subsequent obligations may be necessary.

**3) Excavation Worker Screening Levels (EWSLs):**

The EWSLs assist in the evaluation of acute inhalation toxicity from volatile hazardous substances during excavation or utility work. They are equivalent to the acute MRLs available for 45 priority hazardous substances and should be compared to soil gas data from a depth of 5 feet or greater ( $\text{ug}/\text{m}^3$  or ppbv). The EWSLs and the AIASLs are equivalent. The EWSLs apply to both land uses. Since the EWSLs are lower than the ASGSLs, if soil gas concentrations exceed a deep or sub-slab ASGSL, the EWSL will also be exceeded.

$$\text{EWSL } (\text{ug}/\text{m}^3) = \text{Acute or Intermediate MRL}$$

The EWSLs are not intended to precede or preclude excavation work. An immediate response is not necessary unless current conditions or the conceptual site model indicates current or on-going excavation work. If excavation work is being conducted at the site, remedial obligations include: immediate notice to excavation/utility workers; and mitigation of acute inhalation hazards. If inquiry shows an exceedance of the EWSL in soil gas, a contingency to ensure protection is required as part of the response action if the owner/operator/lessor engages in excavation activities. Obligations include a notice to potentially affected parties. Subsequent obligations may also apply.

**4) Groundwater Sump Screening Levels ( $\text{GW}_{\text{sump}}\text{SLs}$ ):**

When a  $\text{GW}_{\text{sump}}\text{SL}$  is exceeded in sump water, immediate measures are required to presumptively mitigate potential volatilization to indoor air. The  $\text{GW}_{\text{sump}}\text{SLs}$  are derived via the following equation:

$$\text{GW}_{\text{sump}}\text{SL } (\text{ug}/\text{L}) = \frac{\text{IAC}}{\text{HLC}' \times \text{TAF}}$$

where,

IAC	=	Indoor Air Criterion (see the draft Background Document for the Vapor Intrusion Criteria and Screening Levels)
HLC'	=	Dimensionless Henry's law Constant
TAF	=	Temperature adjustment factor = 0.5 (unitless)

The HLC' is calculated as follows:

$$\text{HLC}' = \frac{\text{HLC} \times \text{CF}}{\text{R} \times \text{T}}$$

where,

HLC'	Dimensionless Henry's Law Constant	= chemical-specific, unitless
HLC	Henry's Law Constant	= chemical-specific, atm-m <sup>3</sup> /mol
CF	Conversion Factor	= 1000 L/m <sup>3</sup>
R	Ideal Gas Constant	= 8.206E-02 atm-L/mol-K
T	Groundwater Temperature	= 283.15 K (273.15 K + 10°C)

A response action is required when hazardous substances are detected in the sump water of an occupied building. Although the GW<sub>sump</sub>SLs are derived from the IAC, which address chronic, long-term exposures, the GW<sub>sump</sub>SLs are not intended to represent a precise estimate of risk since the presence of volatile hazardous substances in sump water in an occupied building is of significant concern. Upon exceedance of a GW<sub>sump</sub>SL, capping or venting of the sump must be initiated within 48 hours. Subsequent obligations may also be necessary.

#### 5) **Fire and Explosion Screening Levels (FESLs):**

The FESLs are a screening tool for evaluating the fire and explosion hazards of contaminated groundwater. Concentrations exceeding the FESLs in groundwater indicate the need for a more detailed evaluation to ensure protection against fire and explosion hazards. FESLs are applicable to situations where excavation work is being conducted and groundwater has the potential to be intercepted and seep into the excavation. They are also applicable to groundwater which has collected in a sump, an indoor trench, drain or basin.

The FESLs are not new screening levels. The methodology for the existing promulgated FESLs will be maintained. FESLs are available only for those hazardous substances with a reported Lower Explosive Limit (LEL) from the National Institute for Occupational Safety and Health or the American Conference of Governmental Industrial Hygienists

Upon identification of a FESL exceedance, an immediate response is required. Appropriate response actions include: 1) an exposure assessment including initiation of a conceptual site model to identify potential sources, receptors, and migration pathways; 2) source removal; 3) activity and use limitations preventing subsurface work. Subsequent obligations may also apply. Specific requirements to address the presence of methane can be found in the draft Methane Technical Support Document.

Response actions or presumptive remedies to address threatened receptors may also be undertaken. These include but are not limited to: 1) development of a new or modification to an existing Health and Safety Plan for active or operating facilities to address potential fire and explosion risks during excavation activities; 2) notification of a potential threat to easement holders, utility workers or those conducting an excavation; 3) venting of a sump (capping alone is not an option as this may facilitate the accumulation of flammable or explosive vapors at the sump); 4) a presumptive mitigation of vapors beneath a structure; 5) a soil gas evaluation where the soil gas data is compared to 20% of the LEL.