

**Appendix B**  
**Development of Risk-Based Depth**  
**Criteria**

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## Approach to Developing Risk-Based Human Health Criteria

### *Protection of Future Site Users from Potential Vapour Inhalation*

The approach to developing site specific risk-based criteria is based on the Johnson and Ettinger (J&E) (1991) one-dimensional analytical model to determine theoretical values that would apply to soil at depth based on a potential to generate vapours at levels that would pose a risk to future site users.

Johnson and Ettinger (J&E) (1991) provides a screening-level model that incorporates both convective and diffusive mechanisms for estimating the transport of contaminant vapours emanating from either subsurface soils or groundwater into indoor spaces located directly above the source of contamination.

A users guide to the Johnson and Ettinger (J&E) (1991) model has been developed by the US EPA (2004).

### *Calculating Risk-Based Criteria*

To calculate risk-based criteria, the model is run using a populated spreadsheet that requires variable input based on site and soil conditions.

Specific contaminant compounds of concern at the Site were selected based on whether the compounds are considered to have sufficient volatility and toxicity to pose a risk to human health. Table 1 of the users guide lists 114 chemicals that may be found at hazardous waste sites and indicates whether the chemical is sufficiently toxic and volatile to result in a potentially unacceptable indoor inhalation risk.

The contaminants selected were based on the contaminants of concern at the Site, which included those identified in the table.

Benzene	o-xylene	Benzo(b)fluoranthene
Toluene	p-xylene	Chrysene
Ethylbenzene	Naphthalene	Fluorene
m-xylene	Acenaphthene	Pyrene

The chemical properties of these compounds drive the calculations. The soil conditions are based on a set of variables for particular soil types. The soil type selected was based on the expectation that backfill material will consist of a sandy clay material. The following properties were used to populate each spreadsheet for individual compounds:

- Depth of floor base – 15cm (i.e. concrete slab on ground).
- Depth of risk based interval – 250cm, 400cm or 800cm (i.e. depth to which criteria apply).
- Soil temperature – 15°C.
- Soil type – Sandy Clay.
- Soil bulk density – 1.63g/cm<sup>3</sup> (model default).
- Soil porosity – 0.385 unitless (model default).
- Soil water-filled porosity – 0.197cm<sup>3</sup>/cm<sup>3</sup> (model default).

The remainder of the variable inputs are model defaults. The results tab on the calculation spreadsheet provides a final indoor exposure soil concentration (in µg/kg). This value was used as the risk-based soil criteria value. The results spreadsheet for each compound is provided at the rear of this appendix.