

Technical Update: Dealing with Lead in Soil in Human Health Risk Assessments under O. Reg. 153/04

March 2024

The purpose of this guidance is to provide an update to risk assessment (RA) practitioners (e.g., QPs) on what the Ministry considers to be best available science and clarify Ministry expectations when dealing with lead (Pb) contamination in soil at contaminated sites under the brownfields program (O. Reg. 153/04). Although this guidance includes recommendations regarding the use of updated information in RA, it should not be considered as in-depth or stand-alone guidance on how to assess Pb exposures in the Human Health Risk Assessment (HHRA).

HHRA Considerations when Pb is identified as a soil COC

Previous RA program guidance for Pb was to use the generic Table 2/3 soil site condition standard of 120 µg/g for R/P/I property use when determining whether risk management measures were required to address soil exposure at R/P/I sites. The Ministry’s Technical Assessment and Standards Development Branch (TASDB) has recently made TRV selections for Pb and these should now be used in HHRAs when assessing Pb exposures, where possible. TASDB’s TRV selections, which include receptor-specific Risk Specific Doses (RSDs) and related exposure parameters (RAFs and SAFs) are summarized in the table below.

Table A: Summary of TRV selections and related exposure parameters for Pb:

Receptor Category	Relevant RSD	Estimated RAF _{ORAL} for Soil Pb	Estimated RAF _{DERMAL} for Soil Pb	SAF
infant	5.0 x 10 ⁻⁴ mg/kg/d EFSA (2013) child-specific RSD	60%	0.4%	20%
toddler		60%		50%*
child (4 to <12 y)		35%		20%
teen (12 to <20 y)		45%		80%
adult	6.3 x 10 ⁻⁴ mg/kg/d EFSA (2013) adult-specific RSD	60%	1%	80%
pregnant woman		100%		

* For the toddler, the SAF of 50% is contingent on the soil ingestion rate of 200 mg/d considered representative of an upper estimate of ingestion of soil and house dust combined. The use of an alternative soil ingestion rate for only soil (no house dust) would require a revision of the SAF to 20%.

The above table was extracted from the Ministry's 2024 Lead in Soil document (Part II); refer to the original table for a list of relevant acronyms, abbreviations and references.

Updated Human Health Component Values for Pb in Soil

Ministry component values are often used in RAs for secondary screening purposes. In the HHRA, the S1, S2 and S3 components are the most relevant when assessing Pb exposures in soil. Ministry component values have been updated with consideration to the new TRV selections and are listed in the following table:

Table B: Updated Ministry human health component values for soil ($\mu\text{g/g}$):

Parameter	S1	S2	S3
Lead (Pb)	45	420	420

The updated S1 component value was calculated for a toddler receptor following the methodology and exposure parameters listed in the Ministry's 2011 Rationale document, and using the Table A parameters for the toddler (i.e., RSD, RAFs and SAF listed for toddler receptor).

Updated S2 and S3 component values were calculated for an adult female receptor and following the methodology and exposure parameters listed in the Ministry's 2011 Rationale document for chemicals with developmental toxicity (see Section 2.7.7 and Tables 2.26 – 2.29 of the 2011 Rationale document), but with the following modifications specific to Pb:

- using Table A parameters for the pregnant woman (i.e., RSD, RAFs and SAF listed for pregnant woman receptor); and
- using an exposure frequency of 5 days/week.

Note that the selected adult-specific RSD is not a developmental TRV per se, however it is considered to be protective of developmental effects associated with Pb exposure (i.e., protective of the fetus from neurodevelopmental effects). The critical window for in utero Pb exposures to cause neurodevelopmental effects in the fetus is longer than one week; therefore, averaging or prorating intermittent exposures occurring over the week is acceptable, e.g., for exposures expected 5 days/week. However, the entire 9-month gestational period may occur during the spring, summer, and fall; therefore, averaging or prorating exposures by assuming negligible soil contact during the winter (e.g., prorating exposures for 39 weeks/year) is not advised.

In the HHRA, risks for a typical brownfield site are expected to be driven by the toddler receptor (for R/P/I sites) or the pregnant woman receptor (for I/C/C sites); reporting risks for each individual receptor category (as listed in Table A, above) is not necessary. Pb assessments can be further refined and site-specific risk-based concentrations developed using the methodology generally described above. Deviations from this methodology can be made, however these will be subject to detailed review by the Ministry and are generally not expected to be needed for typical brownfield sites under O. Reg. 153/04.

Guidance Regarding Use of the Approved Model in MGRAs

The Pb TRV selections (RSDs) and supporting selections (RAFs, SAFs) cannot currently be entered directly into the “TRVs” worksheet of the approved model by QPs, as other coding updates are first required to properly account for these updates. The Ministry will revise the approved model to enable use of the new TRVs for Pb when the model is next updated. In the interim, QPs can continue to use the current (2016) version of the approved model without any further TRV modifications for Pb when submitting MGRAs.

References

Ontario Ministry of the Environment, Conservation and Parks, Technical Assessment and Standards Development Branch. March 2024. Lead in Soil – Part I: Toxicity Reference Values Selected for Children and Adults.

Ontario Ministry of the Environment, Conservation and Parks, Technical Assessment and Standards Development Branch. March 2024. Lead in Soil – Part II: Relative Absorption Factors and Source Allocation Factors for Use with Selected Toxicity Reference Values.

Ontario Ministry of the Environment and Climate Change, Standards Development Branch. November 1, 2016. Modified Generic Risk Assessment “Approved Model”. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Ffiles.ontario.ca%2F2016_modified_generic_risk_assessment_model.xlsx&wdOrigin=BROWSELINK

Ontario Ministry of the Environment, Standards Development Branch. April 15, 2011. Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario.