Memorandum

From: Aimee Reynolds

Date: 4/9/2017

Re: Screening Levels for Lead in Soil

The United States Environmental Protection Agency (EPA) has not developed standard estimates representing a dose-response assessment for lead, because a clear threshold for some of the more sensitive effects in humans from exposure to lead has not been identified (ATSDR 2007). Rather, exposure to lead is typically evaluated in terms of the increase in blood lead (PbB) concentrations following exposure. The United States Department of Health and Human Services' Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) have designated, and the EPA has adopted, 10 micrograms per deciliter (µg/dL) as a PbB concentration of concern to protect sensitive populations (e.g., neonates, infants, and children). This blood lead level of concern is the basis of EPA Regional Screening Levels (RSLs) of 400 and 800 mg/kg for a typical residential and commercial/industrial exposure, respectively. The EPA's stated goal for lead is that children have no more than a 5 percent probability of exceeding a PbB concentration of 10 µg/dL (USEPA, 2013b). As such, this level is assumed to also provide protection for adults.

In 2012, the CDC released an updated reference level for blood lead of 5 µg/dL (https://www.cdc.gov/nceh/lead/acclpp/blood_lead_levels.htm); however, EPA has not yet formally adopted it for use in risk assessment. EPA has indicated that until the lead guidance is updated, risk assessments should include evaluations for both 10 µg/dL and 5 µg/dL blood lead endpoints. The Montana Department of Environmental Quality (DEQ) requires that lead concentrations in soil be evaluated based upon lead concentrations that are not likely to result in more than a 5 percent probability of exceeding a PbB concentration of 5 µg/L.

For residential exposure the concern is for an exposed child during ages 0 to 7 years. This evaluation is facilitated through use of the EPA's Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) (EPA 2012, 2002, 1994). Default estimates are used for the statistical measures of blood lead, including the target 95th percentile blood lead concentration in fetus, fetal/maternal blood-lead ratio (Rfetal/maternal), biokinetic slope factor, geometric standard deviation on the population mean blood lead concentration (GSDi), and baseline blood lead concentration. Default values are also used for exposure parameters such as the lead absorption fraction and the averaging time. With the IEUBK, concern is for an exposed child during ages 0 to 7 years. The residential soil

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screening level calculated using EPA default exposure assumptions and a target PbB of 5 µg/dL is 153 mg/kg.

For adult workers exposed to lead, the comparison of PbB levels to the health-protective goal is facilitated through use of the EPA's Adult Lead Methodology (USEPA 2003a,b,c; 2007a,b; 2009) and Adult Lead Model (ALM). With the ALM, concern is for a fetus that may be carried by an exposed pregnant female, with the assumption that the results apply to both exposed females and males. The ALM calculates 95th percentile blood-lead concentrations by applying a geometric standard deviation to a central tendency estimate (CTE) calculated from the user specified input parameters. The commercial/industrial soil screening level calculated using EPA default exposure assumptions and a target PbB of 5 µg/dL is 669 mg/kg. However, construction workers are also potentially exposed to surface soil and the default soil ingestion rate for this type of exposure is higher than that of the commercial/industrial workers. The construction soil screening level calculated using EPA default exposure assumptions and a target PbB of 5 µg/dL is 505 mg/kg. Therefore, 505 mg/kg should be used as the screening level for commercial/industrial exposure areas and should also be used to screen subsurface soil.

The lead models may be accessed at: https://www.epa.gov/superfund/lead-superfund-sites-software-and-users-manuals. The model output for the DEQ screening levels is attached.

Please note that lead concentrations must also be screened for leaching to groundwater. The Montana-specific background concentration of lead in soils is 29.8 mg/kg, which is well below the screening levels (DEQ 2013). Site-specific background may also be considered. In addition, DEQ will consider site-specific bioavailability for lead based upon the EPA's *Guidance for Evaluating the Oral Bioavailability of Metals in Soils for Use in Human Health Risk Assessment* (EPA, 2007c). Site-specific blood lead levels will not be used to adjust cleanup levels based upon EPA Technical Review Workgroup for Lead guidance (EPA 2017). Finally, based upon EPA's Updated Scientific Considerations for Lead in Soil Cleanups (EPA 2016), DEQ will not consider adjustment of site-specific exposure parameters without The Office of Superfund Remediation and Technology Innovation and the Technical Review Workgroup for Lead approval.

References:

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EPA. 2007c. *Guidance for Evaluating the Oral Bioavailability of Metals in Soils for Use in Human Health Risk Assessment.* OSWER 9285.7-80. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. May.

EPA. 2009. *Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameter.* OSWER 9200.2-82. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. June 2009 – Update to the ALM.

EPA. 2016. Updated Scientific Consideration for Lead in Soil Cleanups. Office of Solid Waste and Emergency Response. December.

EPA. 2017. *Frequent Questions from Risk Assessors on the Integrated Exposure Uptake Biokinetic (IEUBK) Model.* Available online at: http://www.epa.gov/superfund/lead/ieubkfaq.htm. U.S. Environmental Protection Agency.

Regional Wizard

When calculating PRG, specify the age group for the receptor population (typically 0-84 months or 6-84 months). Users must then specify cutoff, GSD and percent exceedence.

The defaults shown will calculate a soil PRG that meets the EPA risk reduction goal for the media exposures set by the user.

Depending on the values enter, calculating PRG may take a few moments.

Consult the IEUBK guidance for more detailed information.

Find Soil Pb Concentration

Find

Cancel

Help?

Select Age Group for Graph: 0 to 84 months

Parameter Change

Change Cutoff: 5 µg/dl

Change GSD (Geometric Standard Deviation): 1.6

Probability of Exceeding the Cutoff (PC): 5 %

Please note

Depending on the values enter, calculating PRG may take a few moments.

Soil and/or Dust Concentration: 153 PPM

TRW Homepage: http://www.epa.gov/superfund/health/contaminants/lead/index.htm

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Calculations of Preliminary Remediation Goals (PRGs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09 **EDIT RED CELLS**

Commercial/Industrial Worker at 5 ug/dL using Montana-specific EF and AT

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
$PbB_{fetal,\ 0.95}$	95th percentile PbB in fetus	ug/dL	5
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days/yr	187
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days/yr	270
PRG		**ppm**	**669**

Calculations of Preliminary Remediation Goals (PRGs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09 **EDIT RED CELLS**

Construction Worker or Excavation at 5 ug/dL using Montana-specific EF and AT

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
$PbB_{fetal,\ 0.95}$	95th percentile PbB in fetus	ug/dL	5
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days/yr	124
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days/yr	270
PRG		**ppm**	**505**