ESTIMATION OF DAILY WATER CONSUMPTION: UPDATE TO THE DEFAULT VALUES FOR THE INTEGRATED EXPOSURE UPTAKE BIOKINETIC MODEL FOR LEAD IN U.S. CHILDREN

OVERVIEW

Since 1994, the Office of Land and Emergency Management (OLEM), formerly known as the Office of Solid Waste and Emergency Response (OSWER), has recommended the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK model) as a risk assessment tool to support environmental cleanup decisions at current and future anticipated residential sites (U.S. EPA, 1994a,b). The IEUBK model predicts blood lead levels (PbB) in young children (birth to 7 years of age[1]) exposed to lead from several sources of exposure and routes. The IEUBK model uses more than 100 input parameters that are initially set to default values. Of these, there are 46 parameters that may be input, or modified, by the user; the remainder are internal variables that are unavailable for modification (U.S. EPA, 1994a).

The IEUBK model uses empirical data from numerous scientific studies of lead uptake and biokinetics, contact and intake rates of children with contaminated media, and data on the presence and behavior of environmental lead to predict a plausible distribution centered on the geometric mean (GM) of PbB for a hypothetical child or population of children (EPA, 2020).[2] The relative variability of PbB concentrations around the GM is defined as the geometric standard deviation (GSD). The GSD encompasses biological and behavioral differences, measurement variability from repeat sampling, variability as a result of sample locations, and analytical variability.[3] From this distribution, the IEUBK model estimates the risk (*i.e.,* probability) that a child's or a population of children's PbB concentration will not exceed a certain PbB level (U.S. EPA, 1998, 1994a; White et al., 1998).

The default values for the *Water Consumption* variable in the IEUBK model (v. 1.1, build 11) represent age-specific central tendency estimates for children (birth to 7 years of age) of water consumption rates in the absence of exposures at the site being assessed. The IEUBK model (v. 1.1, build 11) default consumption rates were derived from the water (and water-based foods) consumption values from the U.S. Department of Agriculture's 1977-78 Nationwide Food Consumption Survey (NFCS; USDA, 1984) and the Department of Health and Human Services 1976-80 National Health and Nutrition Examination Survey (NHANES; U.S. DHHS, 1983) as reported in the Exposure Factors Handbook (U.S. EPA, 1989). Of the approximately 6,300 foods obtained from the NFCS and NHANES surveys, a representative list of commonly consumed water-based foods (water, coffee, tea, reconstituted juices, and reconstituted soups) was paired with the daily water intake information from the NFCS and used to predict total water consumption in the United States (U.S. EPA, 1989; Pennington, 1983).

[1] To better align the CDC recommendation and the risk predictions for lead exposure at Superfund sites, the TRW Lead Committee recommends that the default age range in IEUBK model be modified to match the 1-5 year age range (12-72 months).

[2] The GM represents the central tendency estimate (*e.g.,* mean, 50th percentile) of PbB concentration of children from a hypothetical population (Hogan et al., 1998). If an arithmetic mean (or average) is used, the model provides a central point estimate for risk of an elevated PbB level. By definition a central tendency estimate is equally likely to over- or under-estimate the lead-intake at a contaminated site. Upper confidence limits (UCLs) can be used in the IEUBK model; however, the IEUBK model results could be interpreted as a more conservative estimate of the risk of an elevated PbB level. See U.S. EPA (1994a) for further information.

[3] The IEUBK model uses a log-normal probability distribution to characterize this variability (U.S. EPA, 1994a). The biokinetic component of the IEUBK model output provides a central estimate of PbB concentration, which is used to provide the geometric standard deviation (GSD). In the IEUBK model, the GSD is not intended to reflect variability in PbB concentrations where different individuals are exposed to different media concentrations of lead. The recommended default value for GSD (1.6) was derived from empirical studies with young children where both blood and environmental lead concentrations were measured (White et al., 1998).

The purpose of this document is to present the data currently available and provide a technical basis for updating the water consumption age-specific variables in the IEUBK model. The age-specific variables recommended herein were derived using: 1) a more representative methodology for estimating water consumption, and 2) more recent daily average water consumption rates, than those used for the IEUBK model (v. 1.1, build 11) water consumption values. The recommended estimates for the water consumption variable in the IEUBK model are based on the 1994-1996 and 1998 Continuing Survey of Food Intakes by Individuals (CSFII; USDA, 2000) as analyzed and published by Kahn and Stralka (2009). Linear interpolation was used to estimate water consumption rates for the IEUBK model age groups, from consumption rates reported by Kahn and Stralka (all water sources, consumers only, 2009). Table 1 presents the water consumption default value for IEUBK model (v. 1.1, build 11) and the recommended water consumption default value for IEUBK model (v. 2).

Table 1. Comparison of age-specific water consumption rates for use in the IEUBK model

	Age Category (months)							
Source	**0<12**	**12<24**	**24<36**	**36<48**	**48<60**	**60<72**	**72<84**	**Basis for Age-Specific Value**
IEUBK Model Default[a]	0.2	0.5	0.52	0.53	0.55	0.58	0.59	Methodology U.S. EPA, 1989 U.S. EPA, 1984 Pennington, 1983 Data Source 1976-1980 NHANES (U.S. DHHS, 1983) 1977-1978 NFCS (USDA, 1984)
Updated Water Consumption Rates[b]	0.40	0.43	0.51	0.54	0.57	0.60	0.63	Methodology Kahn and Stralka, 2009 (All Water Sources, Consumers Only) Data Source 1994-1996 & 1998 CSFII (USDA, 2000)

[a]IEUBK model (v. 1.1, build 11).
[b]IEUBK model (v. 2). Linear interpolation of the known Kahn and Stralka (2009) data points were performed in Microsoft Office Excel 2007®.

The intended audience for this document is risk assessors who are familiar with using the IEUBK model. For further background information on both this variable and the use of the IEUBK model in Superfund lead risk assessment, refer to U.S. EPA (1994a) or the Technical Review Workgroup for Lead (TRW) website (https://www.epa.gov/superfund/lead-superfund-sites-guidance).

INTRODUCTION

The IEUBK model default values represent national averages or other central tendency values derived from empirical data in the open literature. Default values include: a) lead concentrations in exposure media (*e.g.*, diet representative of national food sources); b) contact and intake rates (*e.g.,* soil/dust ingestion); and c) exposure durations (White et al., 1998). The representativeness of IEUBK model output is wholly dependent on the representativeness of the data (often assessed in terms of: completeness, comparability, precision, and accuracy [U.S. EPA, 1994a]).

Representative site-specific data are essential for developing a risk assessment (as well as cleanup goals) that reflect the current or potential future conditions. The most common type of site-specific data is media-specific lead concentration information (air, water, soil, dust). Until recently, an inexpensive, EPA validated method[4] (U.S. EPA 2017) to estimate site-specific bioavailability of lead in soil or dust was not available. Receptor data (*e.g.*, age, body weight, breathing rate, soil ingestion rate) does not typically vary due to site-specific factors.

To promote defensible and reproducible site investigations and decision making, while maintaining flexibility needed to respond to different site conditions, EPA recommends the Data Quality Objectives process (U.S. EPA, 2006). Data Quality Objectives provide a structured approach to collecting environmental data that will be sufficient to support decision-making: http://www.epa.gov/QUALITY/dqos.html.

The IEUBK model (v. 1.1, build 11) default water consumption rates are based on NHANES data (1976-1980). The NHANES is a continuous survey that is designed to assess the health and nutritional status of children and adults in the U.S. (http://www.cdc.gov/nchs/nhanes.htm). U.S. CDC releases data from the NHANES in 2-year increments as one dataset, and recommends using four or more years of data (*i.e.*, two or more datasets) when estimating parameters for demographic sub-domains (U.S. CDC, 2006).

The dietary component of the NHANES survey [*i.e.*, What We Eat in America (WWEIA)] is conducted as a partnership between USDA and the U.S. DHHS. The WWEIA includes two 24-hour dietary recall interviews to query all foods and portion sizes consumed during the prior 24 hours. Although the recall is limited to foods consumed for a single day, it provides very detailed and reliable data (*e.g.*, brand names for bottled water, time the water was consumed and some information on water sources).[5] The second most commonly used dietary survey instrument is the food frequency questionnaire (FFQ), which typically collects information about food consumption over a much longer period of time (*e.g.*, the year preceding the date of the interview). However, the FFQ typically collects only data on consumption frequency. Information about the quantity of food consumption, which is required to estimate dietary intake rates, is not collected.

U.S. EPA (2011, 2010, 2009, 2008, 2007, 2004) identified the Kahn and Stralka (2009) analysis which was based on CSFII. CFSII is a nationwide food survey that was conducted by the U.S. Department of Agriculture's Agricultural Research Service (from 1985-1998). The CSFII was designed to collect a representative sample of the type and amount of foods consumed in the U.S. The 1994-1996 and 1998 surveys consisted of two, in-home, 24-hour dietary recall interviews that recorded all foods and water consumed during the day preceding the interview. The interviews were implemented at least three days apart to reduce dependence between the two recalls (USDA, 2000). Self-reported body weights were also provided which support population and subpopulation (*e.g.*, age-specific groups) estimates of water

[4] Method 1340 *In Vitro* Bioaccessibility Assay for Lead in Soils, https://www.epa.gov/hw-sw846
[5] The types of information available for water consumption varies between NHANES survey years.

consumption rates (U.S. EPA, 2009). Data from the 1989-1991 CSFII were analyzed and ultimately not recommended for use in the Exposure Factors Handbook (U.S. EPA, 1997). U.S. EPA (2011, 2009, 2008, 2007, 2004) and Kahn and Stralka (2009) provided childhood estimates of water consumption based on the 1994-1996 and 1998 CSFII (USDA, 2000).

Kahn and Stralka (2009) and U.S. EPA (2004) provide an analysis of the strengths of using the 1994-1996 and 1998 CSFII data to estimate water consumption. Briefly, the principal advantages of this survey are:

(1) survey design to obtain a representative sample of the non-institutionalized United States population that over-sampled children and low income groups;
(2) sample weights that facilitated proper analysis of the data and accounted for non-response; and
(3) sufficient number of individuals sampled (more than 20,000) to allow categorization within narrowly defined age categories. The sample size for children younger than 11 years of age (from 4,339 in the initial 1994-96 survey to 9,643 children in the combined 1994-96 and 1998 surveys) enabled water consumption estimates to be categorized into the finer age categories recommended by U.S. EPA (2005)[6]. The over-sampling of children enhanced the precision and accuracy of the estimates for the child population subsets.

TECHNICAL ANALYSIS

The TRW identified and evaluated information on age-specific childhood water consumption rates from six sources (U.S. EPA, 2011, 2007, 2004, 1997; Kahn and Stralka, 2009; World Health Organization (WHO), 2005). Table 2 shows the results of these analyses. The U.S. EPA 1997 and WHO 2005 reports did not meet the criteria which enables water consumption estimates to be categorized into the finer age categories recommended by U.S. EPA (2005).

Linear interpolation was used with data provided from each of the remaining studies to estimate age-specific consumption rates for use in the IEUBK model (Table 3).[7] Age-specific water consumption rates were calculated using the following general equation:

$$y = [y_1 + (x - x_1)] * [(y_2 - y_1) / (x_2 - x_1)]$$

Where:

y = water consumption rate at age x *x* = age (1 and 2 are specific ages in the study)

An impact analysis of the recommended data was performed using the IEUBK model (v. 2).

[6]Age Ranges recommended by U.S. EPA, 2005: <1 month, 1 to <3 months, 3 to <6 months, 6 to <12 months, 1 to <2 years of age, 2 to <3 years, 3 to <6 years, 6 to <11 years, 11 to <16 years, 16 to <18 years, and 18 to <21 years of age, 21 years and older, 65 years and older, and all ages.

[7] Linear interpolation is a method that has been used by U.S. EPA (2010, 2007) to estimate an unknown value that lies between two data points. Further information on calculating linear interpolation with Microsoft Excel is available online at: http://www.blueleafsoftware.com/Products/Dagra/LinearInterpolationExcel.php#HowItWorks

Table 2. Comparison of age-specific water consumption rates

Variable	Age Range (months)	Constant Water Consumption (L/day)[c]	Basis for Age-Specific Value	
IEUBK Default[a]	0 < 12 12 < 24 24 < 36 36 < 48 48 < 60 60 < 72 72 < 84	0.20 0.50 0.52 0.53 0.55 0.58 0.59	Analysis Methodology U.S. EPA, 1989 U.S. EPA, 1984 Pennington, 1983	Data Source 1977-1978 NFCS (USDA, 1984) 1976-1980 NHANES (U.S. DHHS, 1983)
IEUBK Updated Values	0 < 12 12 < 24 24 < 36 36 < 48 48 < 60 60 < 72 72 < 84	0.40 0.43 0.51 0.54 0.57 0.60 0.63	Analysis Methodology Kahn and Stralka (2009) All Water Sources, Consumers Only using linear interpolation to arrive at age-specific values	Data Source 1994-1996, 1998 CSFII (USDA, 2000)
IEUBK v. 2; Kahn and Stralka, 2009[b]	0 < 1 1 < 3 3 < 6 6 < 12 12 < 24 24 < 36 36 < 72 72 < 132	0.511 0.555 0.629 0.567 0.366 0.439 0.518 0.603	Analysis Methodology All Water Sources, Consumers Only	Data Source 1994-1996, 1998 CSFII (USDA, 2000)
U.S. EPA, 2011	0 < 1 1 < 3 3 < 6 6 < 12 12 < 24 24 < 36 36 < 72 72 < 132	0.470 0.552 0.556 0.467 0.308 0.356 0.417 0.480	Analysis Methodology Kahn and Stralka, 2009 U.S. EPA, 2009 U.S. EPA, 2008 (Community Water Sources, Consumers Only)	Data Source 1994-1996, 1998 CSFII (USDA, 2000)
	0 < 1 1 < 3 3 < 6 6 < 12 12 < 24 24 < 36 36 < 72 72 < 132	0.184 0.227 0.362 0.360 0.271 0.317 0.380 0.447	Analysis Methodology Kahn and Stralka 2009 U.S. EPA, 2009 U.S. EPA, 2008 (Community Water Sources, All Individuals)	Data Source 1994-1996, 1998 CSFII (USDA, 2000)
U.S. EPA, 2007	6 < 12 12 < 24 24 < 36 36 < 48 48 < 60 60 < 72 72 < 84	0.34 0.31 0.31 0.33 0.36 0.39 0.42	Analysis Methodology U.S. EPA, 2002 U.S. EPA, 2000 (Community Water Sources, All Individuals)	Data Source 1994-1996, 1998 CSFII (USDA, 2000)
WHO, 2005	0 < 6 7 < 12 12 < 36 36 < 96	0.7 0.8 1.3 1.7	Analysis Methodology IOM, 2005	Data Source IOM, 2005
U.S. EPA, 2004	0 < 5 6 < 11 12 < 36	0.296 0.360 0.311	Analysis Methodology U.S. EPA, 2002 U.S. EPA, 2000	Data Source 1994-1996, 1998 CSFII (USDA, 2000)

	48 < 72 72 < 156	0.406 0.453	(Community Water Sources, All Individuals)	
U.S. EPA, 1997	0 < 12 0 < 36 36 < 60 12 < 120	0.302 0.61 0.87 0.736	Analysis Methodology Roseberry and Burmaster, 1992 Ershow and Cantor, 1989 CMNHW, 1981	Data Source 1977-1978 NFCS (USDA, 1984) CMNHW, 1981

[a] IEUBK model (v. 1.1, build 11)
[b] IEUBK model (v. 2). Values were the basis of the updated IEUBK model updates. See Table 3 and text for more information.
[c] Values presented as reported.

Table 3. Water consumption rates considered for the IEUBK model

Source	Age (months)						
	0 < 12	**12 < 24**	**24 < 36**	**36 < 48**	**48 < 60**	**60 < 72**	**72 < 84**
IEUBK Default[a]	0.2	0.5	0.52	0.53	0.55	0.58	0.59
Updated Water Consumption Rates[b]	0.40	0.43	0.51	0.54	0.57	0.60	0.63
U.S. EPA, 2011[c]	0.33	0.35	0.41	0.44	0.46	0.48	0.50
U.S. EPA, 2011[d]	0.29	0.31	0.37	0.40	0.42	0.45	0.47
U.S. EPA, 2007	0.34	0.31	0.31	0.33	0.36	0.39	0.42
U.S. EPA, 2004	0.36	0.34	0.31	0.34	0.37	0.40	0.42

[a] IEUBK Model (v. 1.1, build 11)
[b] IEUBK model (v. 2). Kahn and Stralka, 2009; all water sources, consumers only (age-specific values based on linear interpolation)
[c] Kahn and Stralka, 2009*;* community water sources, consumers only
[d] Kahn and Stralka, 2009*;* community water sources, all individuals

The TRW evaluated water consumption rate using the methodology previously used for the default water consumption default rates (v 1.1, build 11), and compared that with the most recent NHANES data. Information on dietary intakes, including water consumption, was extracted from the NHANES WWEIA data files (U.S. CDC, 2010a,b). Data from the two most recent 2-year cycles (2003-04 & 2005-06)[8] were used, in accordance with U.S. CDC recommendations (U.S. CDC, 2006). A comparison of the sample sizes available from the 2003-04 and 2005-06 WWEIA and the 1994-96 & 1998 CSFII survey data is provided in Table 4.

[8]The 2003-04 & 2005-06 dietary data were the most recent available data at the time this research was initiated.

Table 4. Sample size comparison (number of participants) by age range for the CSFII as compared to NHANES (WWEIA) 2003-2004 and 2005-2006. The number of survey participants is shown in parentheses

CSFII 1994-96 & 1998[a]	NHANES (WWEIA) 2003-2006 (IEUBK Age groups)[b]
< 1 (58)	0 < 12 months (820)
1 < 3 (178)	
3 < 6 (363)	
6 < 12 (667)	
12 < 24 (1017)	12 < 24 months (559)
24 < 36 (1051)	24 < 36 months (510)
36 < 72 (4350)	36 < 48 months (308)
	48 < 60 months (363)
	60 < 72 months (304)
72 < 132 (1659)	72 < 84 months (331)
	≥84 months (13,299)

[a] Source: Kahn and Stralka, 2009; Table 1. Consumers only, Total Water.
[b] Sample sizes correspond to individuals with two days of complete and reliable dietary recall data (CDC, 2010a, b).

<u>UNCERTAINTY</u>

Estimating long-term average daily water consumption rates from short-term 24-hour dietary recalls requires an assumption that the 24-hour recalls provide an unbiased estimate of population intake (*e.g.*, Dodd et al, 2006; Tooze et al., 2006). Even if the recalls are considered unbiased, uncertainty remains about using a limited number of short-term, cross-sectional data ('snapshots in time') to estimate long-term daily water consumption rates (*e.g.*, Dodd et al., 2006; Tooze et al., 2006). While the 1994-1996 and 1998 CSFII collects survey data over two days, this fact does not necessarily depict "usual intakes" (U.S. EPA, 2004).

As described by U.S. EPA (2004), the 1994-1996 and 1998 multistage survey design does not support interval estimates for many of the subpopulations reported[9]. The survey design also does not support individuals who live in hot climates, who consume large amounts of water because of physical activity, and individuals with medical conditions necessitating increased water intake (U.S. EPA, 2004).

Based on the evaluation of the 2003-2004 and 2005-2006 NHANES WWEIA data (U.S. CDC, 2010a,b), the biggest difference between the types and amount of water consumed currently and the types and amount of water consumed at the time of the CSFII 1994-96 and 1998 surveys may be found in bottled water. However, if the concern is exposure to lead in drinking water derived from the site, bottled water may not be a concern (*i.e.*, the community water consumption rates recommended in this report <u>do not</u> include bottled water).

<u>RECOMMENDATIONS FOR THE IEUBK MODEL</u>

The primary limitation of the default water consumption rates in the IEUBK model (v. 1.1, build 11) is the representativeness of the survey data used to estimate water consumption. With approximately 20,000 and 30,000 participants in the 1976-1980 NHANES (U.S. DHHS, 1983) and the 1977-1978 NFCS (USDA, 1984), respectively, the default values in the IEUBK model (v.

[9] The CSFII 1994-96 and 1998 does not identify subpopulations (income level, ethnicity), while the NHANES survey does.

1.1, build 11) are considered sufficient for most young people, but do not reflect changes in the consumption of direct (*e.g.*, soft drinks, bottled water) and indirect sources of water over the last three decades.

U.S. EPA (2011, 2010, 2009, 2008) identified Kahn and Stralka (2009) as a potential source for alternative water consumption values for children in the United States. Kahn and Stralka (2009) derived mean and percentile estimates of age-specific, daily average water consumption rates from the 1994-96 and 1998 CSFII (USDA, 2000). They calculated both indirect and direct water consumption for two water source categories: *"All Water Sources"* including water from all supply sources (*e.g.*, municipal tap, private well, bottled, other sources) and "*Community Water*" including tap water from a community or municipal water supply[10]. Kahn and Stralka (2009) further divided these two categories into two subcategories: *"All Individuals,"* including all participants (whether or not they ingested any water from the specified source during the 2-day survey) and *"Consumers Only,"* which excludes those who did not drink community water during the survey.

The Exposure Factors Handbook (EFH) (U.S. EPA, 2011) recommended consumption rates are based on the analysis of the 1994-1996 and 1998 CSFII performed by Kahn and Stralka (2009). More specifically, the EFH recommended the consumption rates estimated for direct and indirect "*Community Water*" sources (ml/person/day) for "*All Individuals*" and "*Consumers Only*".

The TRW also recommends the analysis of the 1994-1996 and 1998 CSFII performed by Kahn and Stralka (2009); however, the TRW recommends using the estimated direct and indirect total water consumption for "*All Water Sources*" for "*Consumers Only*". The grouping of "*All Water Sources*" takes into account the full use of the water resource. Families that choose to use groundwater or community water for mixing formulas, juice, or soup, and that choose not to drink bottled water will still be protected with these values. Also, estimates for *"Consumers Only"* are often the primary focus in analyses of risk due to ingestion of water that may be contaminated (Kahn and Stralka, 2009). The TRW elected to use the consumption rate estimates by Kahn and Stralka (2009) over the 2003-04 and 2005-06 NHANES WWEIA because the 1994-1996 and 1998 CSFII database: a) included more survey participants; b) received a high level of peer review (U.S. EPA, 2011, 2010); and c) the sources of uncertainty were minimal (U.S. EPA, 2009).

The TRW does not believe there is sufficient information for all lead exposure and biokinetic variables, nor is there necessarily a need, to model sex-specific information for typical Superfund site-specific risk assessments. Based on this analysis, the updated age-specific variables are considered appropriate for all applications in the IEUBK model (v. 2) where current and future residential scenarios are being assessed.

The recommended values are based on national averages; however, these values may not necessarily represent subpopulations of children that may have higher exposure (*e.g.*, due to cultural practices, diets heavy in canned foods prepared using water, or those who live in hot

[10]As described by Kahn and Stralka (2009), "direct water is water that survey respondents reported drinking directly as a beverage. Indirect water is defined as water added to foods or beverages during final preparation at home or by local food service establishments such as school cafeterias and restaurants. CSFII recipe files served as the basis for determining the percentage of indirect water contained per 100 g of each food consumed by participants. This percentage was then multiplied by the amount of food consumed by the survey respondents to determine the amount of indirect water ingested." Kahn and Stralka (2009) as noted that indirect water does not include intrinsic (i.e., the water naturally found in foods such as fruits and vegetables) and commercial water added to foods and beverages by the manufacturer prior to distribution.

climates). The IEUBK model will continue to allow for input of site-specific water consumption information to replace the recommended updated values with site-specific information where appropriate.

IMPACT ON THE IEUBK MODEL PREDICTIONS

When applying the recommended water consumption rates, along with the other IEUBK model (v 2) default parameter values, the GM PbB for children (0-7 years of age) decreases from 2.7 µg Pb/dL to 2.3 µg/dL and the PRGs increase (Table 5).

Table 5. Effects of changes to the IEUBK model variables with a focus on the water consumption rate variable.

Source	Age Range (months)							GM (µg/dL)	P_{10} (%)	PRG for 5% NTE 5 µg/dL	PRG for 5% NTE 10 µg/dL
	0 < 12	12 < 24	24 < 36	36 < 48	48 < 60	60 < 72	72 < 84				
IEUBK Model Default Value[a]											
Consumption Rate (L/day)	0.2	0.5	0.52	0.53	0.55	0.58	0.59	2.7	0.3	153	418
Lead Uptake from Water (µg/day)	0.375	0.929	0.976	1.004	1.059	1.123	1.146				
Calculated Total Lead Uptake (µg/day)	5.586	8.368	8.593	8.651	7.045	6.720	6.592				
Calculated Blood Lead Concentration (µg/dL)	3.0	3.5	3.2	3.0	2.5	2.1	1.9				
Updated IEUBK Model Default Value[b]											
Consumption Rate (L/day)	0.40	0.43	0.51	0.54	0.57	0.60	0.63	2.3	0.09	200	605
Lead Uptake from Water (µg/day)	0.169	0.182	0.219	0.234	0.248	0.263	0.276				
Calculated Total Lead Uptake (µg/day)	5.626	7.172	6.102	6.056	6.424	5.926	6.064				
Calculated Blood Lead Concentration (µg/dL)	3.0	3.0	2.4	2.1	2.1	1.9	1.7				

GM: Geometric mean blood lead concentration (µg/dL); NTE: Not to Exceed; P10: Probability (%) of the predicted GM blood lead concentration ≤ 10 µg/dL; PRG: preliminary remediation goal; NTE: not to exceed. The GM, P10 and PRGs are for the 0-84 month age range. To better align the CDC recommendation and the risk predictions for lead exposure at Superfund sites, the TRW Lead Committee recommends that the default age range in IEUBK model be modified to match the 1-5 year age range (12-72 months).

[a] IEUBK Model (v. 1.1, build 11)

[b] IEUBK Model (v. 2) with updated water consumption values based on Kahn and Stralka, 2009, all water sources, consumers only.

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