



Exposure Dose Guidance for Body Weight

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Purpose

Based on the availability of updated exposure parameters, many from the 2011 Exposure Factors Handbook (EFH) published by the U.S. Environmental Protection Agency (EPA), it is necessary that assumptions used in calculating doses in our public health evaluations be updated to reflect the best available science. This update includes body weight recommendations for additional special groups that can be considered as part of the PHA process.

This exposure dose guidance (EDG) for body weight provides health assessors with updated guidance on appropriate body weights to use in public health evaluations.

Background After a chemical release into the environment, health assessors have to evaluate all human exposure pathways. Most quantitative exposure pathway calculations use a value for body weight.

Default body weights in ATSDR’s previous 2005 Public Health Assessment Guidance Manual (PHAGM) were 70 kg for adults, 16 kg for children aged 1 to 6 years, and 10 kg for infants (ATSDR 2005). ATSDR’s 2016 body weight EDG was created to update these body weights for standard age groups (see Table 1). This 2023 EDG update includes additional body weights for special age groups (see Tables 2 and 3) and adds to available standard body weights listed in the current PHAGM (ATSDR, 2022).

Definitions To discuss body weight values, these definitions are important to know:
Central Tendency Exposure (CTE): CTE refers to persons who have average or typical intake factors. CTE calculations use mean body weight.

Reasonable Maximum Exposure (RME): RME refers to persons at the upper end of the exposure distribution (approximately the 95th percentile). The RME scenario assesses exposures that are higher than average but still within a realistic exposure range. RME calculations also use mean body weight.

Central Tendency and Reasonable Maximum Dose Estimates (CTE/RME) Exposure doses are calculated for CTE and RME exposure scenarios. When feasible, you can present the results as a range of doses for the target population. The EPA’s EFH is the primary source for body weights for children and adults (EPA 2011). Use mean body weights from Tables 1, 2, and 3 for both the CTE and RME evaluations. NOTE: Upper body weights, such as the 95th percentile, yield a lower dose than the mean body weight does and should not be used.

Discussion in the public health implications section of the document should include your explanation for estimates for both children and adults. For example, if the risk of harmful effects is only for children with high intake rates (RME), your discussion should describe the risk of harm for these children and explain that children with typical intake rates (CTE) are not at risk. Likewise, if the risk of harmful effects is for both groups, your explanation should reflect both scenarios.

When evaluating noncancer endpoints, estimate doses for the most highly exposed group (usually birth < 1 year) or for the most sensitive group. If the estimated dose for this group exceeds the health guideline (e.g., MRL, RfD), then estimate and evaluate doses for other groups. Remember that when evaluating cancer risk, you should use site-specific information to identify the age ranges for which you need cancer risk estimates.

Body Weights Summary

Table 1 shows recommended body weights for ATSDR’s standard age groups. Use an 80-kg default value to evaluate adults. For children, a variety of body weights are used depending upon their age, which ranges from 7.8 kg to 71.6 kg. Body weights for infants are presented in Table 2 and body weights for special age groups are presented in Table 3.

Use the default body weights in this guidance when calculating contaminant exposure doses. If you modify body weights using site- or situation-specific information, explain the basis of those modifications in your documents.

Table 1. ATSDR-Recommended Body Weights in Health Evaluations^{1,2}

Age Group	Mean Body Weight (in kg)
Birth to < 1 year	7.8
1 to < 2 years	11.4
2 to < 6 years	17.4
6 to < 11 years	31.8
11 to < 16 years	56.8
16 to < 21 years	71.6
Adult ³ ≥ 21 years	80
Pregnant Women ⁴	73
Breastfeeding Women ⁵	73

¹ Body weights for children to 21 years of age are from the EFH (2011), Table 8–1. The values are based on NHANES 1999–2006 data. All body weights (BW) are in units of kg and are time-weighted averages (TWA).

² The recommended body weights are based on NHANES data that incorporate nationally representative information and include various racial and ethnic groups. For communities comprised of distinct racial and ethnic groups, you can change body weight to reflect values consistent with the specific group (e.g., white, black, Mexican American). Tables 8-17 through 8-21 in EPA’s Exposure Factor Handbook have values for these populations (EFH 2011).

³ Adult values were obtained from Table 8-25 (EFH 2011). The values are based on NHANES IV data (Portier et al. 2007).

⁴ Body weight for pregnant women reflect the Table 8-29 50th percentile weights for all three trimesters (EFH 2011). The values are based on the NHANES 1999–2006 data.

⁵ Body weight for breastfeeding women is 73 kg, which reflects the body weight for women of childbearing age (68 kg: TWA of 50th percentile body weight for females from 15 to < 45 years of age: see table 8-5 in EFH 2011) plus an additional 5 kg that is retained during lactation (Janney et al. 1997; Moya et al. 2014).

TWA calculation for Body Weight (Birth to < 1 year)

$$\frac{[(0 \text{ to } < 1\text{mo} \times 1\text{mo}) + (1 \text{ to } < 3\text{mo} \times 2\text{mo}) + (3 \text{ to } < 6\text{mo} \times 3\text{mo}) + (6 \text{ to } < 12\text{mo} \times 6\text{mo})]}{12\text{mo}} =$$

$$\frac{[(4.8\text{kg} \times 1\text{mo}) + (5.9\text{kg} \times 2\text{mo}) + (7.4\text{kg} \times 3\text{mo}) + (9.2\text{kg} \times 6\text{mo})]}{12\text{mo}} = 7.8\text{kg}$$

TWA calculation for Body Weight (2 to < 6 years)

$$\frac{[(2 \text{ to } < 3\text{yr} \times 1\text{yr}) + (3 \text{ to } < 6\text{yr} \times 3\text{yr})]}{4\text{yr}} =$$

$$\frac{[(13.8\text{kg} \times 1\text{yr}) + (18.6\text{kg} \times 3\text{yr})]}{4\text{yr}} = 17.4\text{kg}$$

Table 2. Body weight for infants¹

Age Interval	Body Weight (in kg)
Birth to < 1 month	4.8
1 to < 3 months	5.9
3 to < 6 months	7.4
6 to < 12 months	9.2

¹US EPA, 2011 EFH, Chapter 8, Table 8-1

Table 3. Body Weight for Special Groups¹

Age Range	Special Group	Body Weight (in kg)
3 to < 5 years	Pre-Kindergarten	17.2
5 to < 6 years	Kindergarten	20.6
6 to < 11 years	1st–5 th grade	31.8
11 to < 14 years	6 th –8 th grade	50.6
14 to < 16 years	9 th –10 th grade	63.7
16 to < 18 years	11 th –12 th grade	67.3
14 to < 18 years	9 th –12 th grade	65.5
18 ≤ 67 years	Full-, part-time worker/educator	80.6

¹US EPA, 2011 EFH, Chapter 8, Table 8-24

Impact Using the best available science to update the body weights to calculate exposure doses will improve the consistency of exposure-dose estimates in public health evaluations.

References

[ATSDR] Agency for Toxic Substances and Disease Registry. 2022. Public health assessment guidance manual. Atlanta: US Department of Health and Human Services. Available from: <https://www.atsdr.cdc.gov/pha-guidance/index.html> [accessed 2022 August 11].

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