TABLE C-3-2

AVERAGE DAILY DOSE TO THE EXPOSED INFANT

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Description

This equation calculates the average daily dose for an infant exposed to contaminated breast milk. Uncertainty associated with this equation includes the following:

The most significant uncertainty associated with this equation is the selection of a value for averaging time (*AT*). As stated in U.S. EPA (1994a), "Little agreement exists regarding the appropriate choice of an averaging time for less than lifetime exposures. This is especially true for cases where exposure is occurring in a particularly sensitive developmental period."

Use of an averaging time (*AT*) of 1 year is appropriate for assessing noncarcinogenic effects. However, use of this value may overestimate a lifetime average appropriate for assessing carcinogenic risk by almost two orders of magnitude (70/1).

Equation

$$ADD_{infant} = \frac{C_{milkfat} \cdot f_3 \cdot f_4 \cdot IR_{milk} \cdot ED}{BW_{infant} \cdot AT}$$

Variable	Description	Units	Value
ADD_{infant}	Average daily dose for infant exposed to contaminated breast milk	pg COPC/kg BW-day	
$C_{milkfat}$	Concentration of COPC in milk fat of breast milk for a specific exposure scenario	pg COPC/kg milkfat	**Varies** This variable is COPC- and site-specific, and is calculated by using the equation in Table C-3-1. The following uncertainty is associated with this variable: The most significant uncertainties associated with the calculation of this variable are those associated with the variable *m* and the estimate of $C_{milkfat}$. Uncertainties associated with *m* represent a sum of the various uncertainties associated with each of the potential exposure pathways (see the equation in Table C-1-6).
f_3	Fraction of mother's breast milk that is fat	unitless	**0.04** This variable is COPC- and site-specific. U.S. EPA OSW recommends the use of this default value, consistent with U.S. EPA (1994a) and U.S. EPA (1994b). As cited in U.S. EPA (1994a), the source of this variable value is Smith (1987). The uncertainty associated with this value is assumed to be minimal.
f_4	Fraction of ingested COPC that is absorbed	unitless	**0.9** This variable is COPC- and site-specific. U.S. EPA OSW recommends the use of this default value, consistent with U.S. EPA (1994a),and U.S. EPA (1994b). As cited in U.S. EPA (1994a), the source of this variable value is Smith (1987). The uncertainty associated with this value is assumed to be minimal.

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AVERAGE DAILY DOSE TO THE EXPOSED INFANT

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Variable	Description	Units	Value
IR_{milk}	Ingestion rate of breast milk by the infant	kg/day	**0.8** This variable is COPC- and site-specific. U.S. EPA OSW recommends the use of this default value, consistent with U.S. EPA (1994a) and U.S. EPA (1994b). As cited in U.S. EPA (1994a), the source of this variable value is Smith (1987). The following uncertainty is associated with this variable: As reported in U.S. EPA (1994a), Smith (1987) reports that breast milk ingestion for 7- to 8-month-old infants ranged from 677 to 922 mL/day. Assuming a density of breast milk of slightly more than 1.0, the recommended value is about the midpoint of the reported ingestion rate, converted from milliliters per day to kilograms per day. Based on the reported ingestion range, the ingestion rate could vary by about 12 percent from the recommended value. This possible variance is not considered especially significant.
ED	Exposure duration	yr	**1.0** This variable is COPC- and site-specific. U.S. EPA OSW recommends the use of this default value, consistent with U.S. EPA (1994a) and U.S. EPA (1994b). The following uncertainty is associated with this variable: Some infants may nurse for more or less than the recommended 1 year. However, the average uncertainty associated with this variable value is not expected to be large.
BW_{infant}	Body weight of infant	kg	**10** U.S. EPA OSW recommends the use of this default value. As cited in U.S. EPA (1994a), this value is based on information presented by the National Center for Health Statistics (1987). The following uncertainty is associated with this variable: As reported in U.S. EPA (1994a), the National Center for Health Statistics (1987) reported mean body weights of 6- to 11-month-old and 1 year-old infants of 9.1 and 11.3 kilograms, respectively. Based on this information and an assumed 1-year ED, the uncertainty associated with this variable value is expected to be minimal.
AT	Averaging time	yr	**1** This variable is COPC- and site-specific. U.S. EPA OSW recommends the use of this default value, consistent with U.S. EPA (1994a) and U.S. EPA (1994b). The following uncertainty is associated with this variable: The uncertainty associated with this variable value is significant, as stated in U.S. EPA (1994a): "Little agreement exists regarding the appropriate choice of an averaging time for less than lifetime exposures. This is especially true for cases where exposure is occurring in a particularly sensitive developmental period." Use of an averaging time of 1 year is appropriate for assessing noncarcinogenic effects. However, use of this value may overestimate a lifetime average, appropriate for assessing carcinogenic risk, by almost two orders of magnitude (70/1).

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AVERAGE DAILY DOSE TO THE EXPOSED INFANT

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REFERENCES AND DISCUSSION

National Center for Health Statistics. 1987.

  Cited in U.S. EPA (1994a) as the source of the recommended BW_{infant} value of 10 kilograms. However, that document does not provide a complete reference for this document.

Smith., A.H. 1987. "Infant Exposure Assessment for Breast Milk Dioxins and Furans Derived from Waste Incineration Emissions." *Risk Analysis*. 7(3) 347-353.

  This document is cited by U.S. EPA (1994a) as the source of the recommended values for the variables in the equation in Table C-3-2.

U.S. EPA. 1994a. *Estimating Exposure to Dioxin-Like Compounds. Review Draft.* Office of Research and Development. EPA/600/6-88/0055Cc. Washington ,D.C. June.

  This document is cited as the original source of the fraction of fat in breast milk, fraction of ingested COPC that is absorbed, ingestion rate of breast milk, exposure duration, and body weight of infant.

U.S. EPA. 1994b. *Revised Draft Guidance for Performing Screening Level Risk Analyses at Combustion Facilities Burning Hazardous Wastes. Attachment C, Draft Exposure Assessment Guidance for RCRA Hazardous Waste Combustion Facilities.* Office of Emergency and Remedial Response. Office of Solid Waste. December 14.

  This document recommends the use of the equation in Table C-3-2 and values for the variables in this equation: f_3 (0.04), f_4 (0.9), IR_{milk} (0.8 kg/day), *ED* (1 year), BW_{infant} (10 kg) , and *AT* (1 year).