TABLE C-1-7

INDIVIDUAL CANCER RISK: CARCINOGENS

Description

This equation calculates the individual cancer risk from indirect exposure to carcinogenic COPCs. The exposure duration varies for different scenarios. Uncertainties associated with this equation include the following:

(1) Default factors for exposure frequency and exposure duration are assumed to represent the highest exposure that is reasonably expected to occur at a site and, in practice, is estimated by combining upper-bound (90th to 95th percentile) values for these exposure parameters, but not all parameters. This assumption may over- or underestimate the *Cancer Risk*$_i$.

(2) Slope factors are used to estimate an upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen, and are accompanied by the weight of evidence classification to indicate the strength of the evidence that the agent is a human carcinogen. This classification has the potential to over- or underestimate *Cancer Risk*$_i$.

(3) Risk at low exposure levels is difficult to measure directly either by animal experiments or by epidemiological studies. The development of a cancer slope factor generally entails applying a model to the available data set and using the model to extrapolate from the relatively high doses administered to experimental animals (or the exposures noted in epidemiological studies) to lower exposure levels expected for human contact in the environment. This approach may under- or overestimate *Oral CSF*.

Equation

$$Cancer\ Risk_i = \frac{I \cdot ED \cdot EF \cdot CSF}{AT \cdot 365}$$

Variable	Description	Units	Value
Cancer Risk$_i$	Individual lifetime cancer risk through indirect exposure to COPC carcinogen *i*	unitless	

TABLE C-1-7

INDIVIDUAL CANCER RISK: CARCINOGENS

Variable	Description	Units	Value
I_i	Daily intake of COPC *i* from animal tissue *j*	mg COPC/kg BW-day	**Varies** This variable is COPC- and site-specific, and is calculated by using the equation in Table C-1-6. The value for this variable will vary for each exposure pathway and each exposure scenario location. The following uncertainty is associated with this variable: This variable is COPC- and site-specific. See the equation in Table C-1-6 regarding the calculation of and uncertainities associated with this variable.
ED	Exposure duration	yr	**6, 30, or 40** This variable is exposure scenario-specific: Exposure Scenario — ED Subsistence Farmer — 40 (U.S. EPA 1994) Subsistence Farmer Child — 6 (U.S. EPA 1989) Subsistence Fisher — 30 (U.S. EPA 1994) Subsistence Fisher Child — 6 (U.S. EPA 1989) Adult Resident — 30 (U.S. EPA 1989) Child Resident — 6 (U.S. EPA 1989) The following uncertainty is associated with this variable: This exposure duration is a single value that represents the highest exposure that is reasonably expected to occur at a site. This assumption may overestimate *ED*.

TABLE C-1-7

INDIVIDUAL CANCER RISK: CARCINOGENS

Variable	Description	Units	Value
EF	Exposure frequency	days/yr	**350** This variable is site-specific. U.S. EPA OSW recommends the use of this default value in the absence of site-specific information, consistent with U.S. EPA (1991). The following uncertainty is associated with this variable: This exposure frequency is a single value that represents the most frequent exposure that is reasonably expected to occur at a site, assuming 2 weeks of vacation or travel. This assumption may overestimate *EF*.
AT	Averaging time	yr	**70** This variable is site-specific. U.S. EPA OSW recommends the use of this default value in the absence of site-specific information, consistent with U.S. EPA (1989). The following uncertainty is associated with this variable: The recommendation for averaging time may not accurately represent site-specific time; specifically, this single value may under- or overestimate the length of time of exposure.
365	Units conversion factor	day/yr	
Oral CSF	Oral Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$	**Varies** This variable is COPC-specific, and should be determined from the COPC tables in Appendix A-3. Uncertainties associated with this variable include the following: (1) Slope factors are used to estimate an upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen; and are accompanied by the weight of evidence classification to indicate the strength of the evidence that the agent is a human carcinogen. (2) Risk at low exposure levels is difficult to measure directly either by animal experiments or by epidemiological studies. The development of a cancer slope factor generally entails applying a model to the available data set and using the model to extrapolate from the relatively high doses administered to experimental animals (or the exposures noted in epidemiological studies) to the lower exposure levels expected for human contact in the environment. This approach may under- or overestimate *Oral CSF*.

TABLE C-1-7

INDIVIDUAL CANCER RISK: CARCINOGENS

REFERENCES AND DISCUSSION

U.S. EPA. 1989. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A).* Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/002. December.

This document is cited as the reference source document of the exposure duration for adult and child residents. This document is also cited as the reference source document for the averaging time for carcinogens.

U.S. EPA. 1991. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors.* Office of Solid Waste and Emergency Response. OSWER Directive 9285.6-03. Washington, D.C.

This document is cited as the reference source document of the exposure frequency.

U.S. EPA. 1994. *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*. April 15.

This document is cited as the reference source document of the exposure duration for the subsistence fisher and subsistence farmer.