TABLE C-2-2

INHALATION HAZARD QUOTIENT FOR COPCS: NONCARCINOGENS

Description

This equation calculates the *HQ* for inhalation exposures to COPCs that have noncancer health effects. Uncertainties associated with this equation include the following:

(1) COPC-specific reference concentrations (*RfC*) are unlikely to underestimate a COPC's potential for causing adverse health effects.
(2) Most of the uncertainties associated with the variables in the equation in Table B-5-1 (used to calculate C_a), specifically those associated with the variables *Q*, *Cyv*, and *Cyp*, are site-specific.
(3) The uncertainties associated with the remaining variables in the equation in Table C-2-2, *IR*, *ET*, *EF*, *ED*, *BW*, and *AT* are not expected to be significant.

Equation

$$HQ_{inh(i)} = \frac{ADI}{RfD}$$

$$ADI = \frac{C_a \cdot IR \cdot ET \cdot EF \cdot ED \cdot 0.001\ mg/\mu g}{BW \cdot AT \cdot 365}$$

$$RfD = \frac{RfC \cdot 20\ m^3/day}{70\ kg}$$

Variable	Description	Units	Value
$HQ_{inh(i)}$	Hazard quotient for direct inhalation of COPC noncarcinogen *i*	unitless	
ADI	Average daily COPC intake via inhalation	mg COPC/ kg-day	
C_a	Total COPC air concentration	µg/m^3	**Varies** This variable is COPC- and site-specific, and is calculated by using the equation in Table B-5-1.

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Variable	Description	Units	Value
RfD	Reference Dose	mg/kg-day	**Varies** This variable is COPC-specific, and should be determined from the COPC tables in Appendix A-3. The following uncertainty is associated with this variable: A chronic RfD is an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure (from 7 years to a lifetime) to a compound. COPC-specific RfDs are unlikely to underestimate a chemical's potential for causing adverse health effects.
RfC	Reference concentration	mg/m^3	**Varies** This variable is COPC-specific, and should be determined from the COPC tables in Appendix A-3. The following uncertainty is associated with this variable: COPC *RfC*s are generally estimated by applying a series of uncertainty factors to the results of studies conducted on laboratory animals. The application of uncertainty factors follows the underlying assumption that humans are, or may be, as sensitive or more sensitive to the harmful effects of COPCs than the laboratory animals that were tested. *RfC*s are designed to ensure that the general public, including sensitive subpopulations, will not experience adverse health effects as a result of exposure to a COPC at its *RfC*. As a result, COPC-specific *RfC*s are unlikely to underestimate a COPC's potential for causing adverse health effects.
IR	Inhalation rate	m^3/hr	**0.30 or 0.63** This variable is site-specific. U.S. EPA OSW recommends using default values of 0.63 (adults) and 0.30 (children) in the absence of site-specific information. The recommended adult value is consistent with U.S. EPA (1991) and U.S. EPA (1994c). The recommended child value is greater than the inhalation rate proposed in U.S. EPA (1994b)— 0.18 m^3/hr based simply on the adult inhalation rate multiplied by the ratio of child to adult body weight (15 kg/70 kg)—but is consistent with U.S. EPA (1997). Uncertainty associated with this variable includes: The recommended inhalation rates do not consider individual respiratory or activity differences. Therefore, based on the individual and the activities that individual is engaged in, the recommended inhalation rates may under-or overestimate the actual rates. However, the degree of under-or overestimation is not expected to be significant.

TABLE C-2-2

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Variable	Description	Units	Value
ET	Exposure time	hrs/day	**24** This variable is site-specific. U.S. EPA OSW recommends the use of this default value in the absence of site-specific data. Uncertainty associated with this variable includes: The recommended *ET* value assumes that an individual remains at a specific location 24 hours per day. In reality this is likely to be true only for a minority of the population including young children, their caregivers, and elderly or other individual who are sick. Therefore, this recommended value contributes to a degree of overestimation for much of the population. However, it must be noted that though an individual may not always be at a single location, that individual may continue to be exposed to combustion emissions at an alternate location.
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 data. This value is based on U.S. EPA (1991) and is consistent with U.S. EPA (1994b). Uncertainties associated with this variable include: (1) This exposure frequency is a single value that represents the most frequent exposure that is reasonably expected to occur at a site with two weeks of vacation. This recommended value may overestimate *EF* for individuals who are away from their home for more than two weeks each year. On the other had, some individuals such as subsistence farmers, may remain at their home (or farm) for more than 350 days per year. In either case, the degree of over- or underestimation is not expected to be significant in most cases.
ED	Exposure duration	yr	**6, 30, or 40** This variable is site-specific. Consistent with U.S. EPA (1994b) and NC DEHNR (1997), U.S. EPA OSW recommends the use of the following default values. Exposure Scenario — *ED* Subsistence Farmer — 40 (U.S. EPA 1994c) Subsistence Farmer Child — 6 (U.S. EPA 1989) Subsistence Fisher — 30 (U.S. EPA 1994c) Subsistence Fisher Child — 6 (U.S. EPA 1989) Adult Resident — 30 (U.S. EPA 1989) Child Resident — 6 (U.S. EPA 1989) Uncertainty associated with this variable includes: These exposure durations are single values that represent the highest exposure that is reasonably expected to occur at a site. These values may overestimate *ED* for some individuals.

TABLE C-2-2

INHALATION HAZARD QUOTIENT FOR COPCS: NONCARCINOGENS

Variable	Description	Units	Value
BW	Body weight	kg	**15 or 70** This variable is site-specific. U.S. EPA OSW recommends using default values of 70 (adults) and 15 (children). These default values are consistent with U.S. EPA (1991; 1994c). Uncertainty associated with this variable includes: These body weights represent the average weight of an adult and child. However, depending on the site, the body weights may be higher or lower. These default values may overestimate or underestimate actual body weights. However, the degree of under- or overestimation is not expected to be significant.
365	Units conversion factor	day/yr	
AT	Averaging time	yr	**6, 30, or 40** This variable is site-specific and related to *ED*. Specifically, the *AT* for noncarcinogens is numerically the same as the *ED*. This default value is consistent with U.S. EPA (1989), U.S. EPA (1991), and U.S. EPA (1994c). Uncertainty associated with this variable includes: The recommendation for averaging time may not accurately represent site-specific time; specifically this single value may under- or overestimate the length of an average adult lifetime.

TABLE C-2-2

INHALATION HAZARD QUOTIENT FOR COPCS: NONCARCINOGENS

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. U.S. EPA assumes that the recommended exposure duration for the child resident may also reasonably be applied to the subsistence farmer child and to the subsistence fisher child.

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 body weight variables.

U.S. EPA. 1994a. IRIS. *Database on the TOXNET.*

This document is U.S. EPA's primary source of *RfC*s and other toxicity factors. This document is updated periodically and should be reviewed prior to preparing a risk assessment.

U.S. EPA. 1994b. *Estimating Exposure to Dioxin-like Components - Volume III: Site-Specific Assessment Procedure*. Review Draft. Office of Research and Development. Washington D.C. EPA/600/6-88/005Cc. June.

This document is cited by U.S. EPA (1994b) as the same document for the recommended default exposure duration (*ED*) values for the subsistence farmer and subsistence fisher. The *ED* value of 40 years recommended for both the subsistence farmer and the subsistence fisher is based on the assumption that "farmers live in one location longer than the general population".

U.S. EPA. 1994c. *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 following:

- An adult inhalation rate of 20 m^3/day (0.83 m^3/hr).
- An exposure frequency of 350 days per year
- Receptor-specific exposure duration values as presented in U.S. EPA (1994a)—subsistence fisher (40 years) and subsistence farmer (40 years) and U.S. EPA (1989)—adult resident (30 years) and child resident (6 years)
- Adult and child body weights of 70 kg and 15 kg, respectively

U.S. EPA. 1995. *Health Effects Assessment Summary Tables*. Annual Update. OHEA-ECAO-CIN-909. Environmental Criteria and Assessment Office. Office of Research and Development. Cincinnati, Ohio.

This document is U.S. EPA's secondary source of *RfC*s and other toxicity factors. This document is updated periodically and should be reviewed prior to preparing a risk assessment.

U.S. EPA. 1997. *Exposure Factors Handbook.* Office of Research and Development. EPA/600/P-95/002F. August.

This document recommends an "average" child inhalation of 7.17 m^3/day (0.30 m^3/hr), and recommends an "average" adult inhalation rate of 15.2 m^3/day (0.63 m^3/hr).