

Dioxins - Guidance for Air

The following guidance was developed by the Minnesota Department of Health (MDH) at the request of the Minnesota Pollution Control Agency (MPCA).

For more information, see:

- Facts about Dioxins
(<https://www.health.state.mn.us/communities/environment/risk/chemhazard/dioxins.html>)
- Guidance for Dioxins
(<https://www.health.state.mn.us/communities/environment/risk/docs/guidance/dioxinmemo1.pdf>)

Development of an Inhalation Benchmark for Dioxin-Like Compounds

March 16, 2004

The Minnesota Department of Health (MDH) prepared this guidance regarding the methodology to develop an inhalation benchmark value for dioxin.

As stated in MDH's March 17, 2003 Memorandum to the MPCA and the August 2001 Statement of Need and Reasonableness (SONAR) for the Health Risk Values (HRVs), ingestion not inhalation is the primary exposure route of concern for dioxins. For compounds emitted to air for which ingestion is the primary route of exposure MDH develops multimedia HRVs rather than a HRV based on an air concentration. A multimedia HRV represents the total daily dose of a compound that results from an emission to ambient air, at or below which adverse health effects are unlikely. Multimedia HRVs are expressed in units of micrograms of the compound per kilogram of body weight per day ($\mu\text{g}/\text{kg}\text{-day}$).

Following discussions with MPCA staff, MDH understands that under the Air Emissions Risk Analysis (AERA) guidance currently utilized by MPCA, an inhalation benchmark value is needed in order to assess multimedia impacts resulting from dioxin emissions. Toxicological data from inhalation studies is not available for the dioxins; however, as stated in the March 17, 2003 Memorandum, MDH staff acknowledge that although the recommended oral slope factor is based on liver tumors, route-to-route extrapolation is acceptable. In order to extrapolate an inhalation unit risk factor from the oral slope factor, an absorption adjustment factor, inhalation rate, and body weight are necessary. These parameter values are influenced by the physical form of dioxins (e.g., particulate or vapor-phase) and the individual or population under evaluation.

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The document submitted with your December 31, 2003 request includes the following calculation:

$$\frac{1.4 \times 10^6}{(\text{mg TCDD TEQ/kg/d})} \times \frac{13\text{m}^3}{70 \text{ kg body weight}} \times \frac{\text{mg}}{1000\mu\text{g}} = \frac{260}{\mu\text{g/m}^3}$$

Where:

$1.4 \times 10^6/(\text{mg TCDD TEQ/kg/day})$ = the oral slope factor recommended in the MDH's March 17, 2003 Memorandum

13 m^3 = assumed daily inhalation rate

70 kg body weight = assumed body weight

The MPCA did not utilize an absorption adjustment factor in the calculation. Ideally, sufficient toxicokinetic information to address route of administration differences would be available; however, this information is not available for dioxin at this time. Given the paucity of data on the absorption of inhaled dioxin and the absence of information regarding the physical form of dioxin in emissions, MDH concurs with MPCA that such an adjustment not be made at this point.

To develop a generic inhalation screening value, MPCA also utilized an inhalation rate of $13 \text{ m}^3/\text{day}$ and a body weight of 70 kg. The standard default values currently utilized by MDH to calculate equivalent doses are $20 \text{ m}^3/\text{day}$ and 70 kg body weight. MDH recommends utilization of these default values at this time.

MDH re-evaluates and revises its risk assessment methods and procedures as more data become available, therefore the recommended default values could change in the future.

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