

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: File for Chlorine Dioxide (CAS# 10049-04-4)
FROM: Keisha Williams, Air Quality Division (AQD)
DATE: October 12, 2015
SUBJECT: Screening Level for Chlorine Dioxide

The initial threshold screening level (ITSL) for chlorine dioxide (CAS#10049-04-4) is 0.2 µg/m³ with an annual averaging time. This ITSL is based on the United States Environmental Protection Agency's (USEPA's) reference concentration (RfC) for chlorine dioxide and was adopted by the MDEQ AQD on October 12, 2000 (USEPA, 2000).

The ITSL was originally established with an averaging time set at 24 hours per AQD Rules 232 (2). It is being changed at this time to annual, as allowed per Rule 229 (2), because the EPA derivation of the RfC accounted for chronic exposure.

The RfC for chlorine dioxide is based on critical effects of "vascular congestion and peribronchial edema" in rats that were exposed for 5 hours/day, 5 days/week for 2 months to 0 or 1ppm chlorine dioxide (USEPA, 2000). A no observable adverse effect level (NOAEL) was not identified in this study. The lowest observable adverse effect level (LOAEL) of 1ppm was used to derive the RfC as follows:

$$RfC = \frac{LOAEL_{Human\ Equivalent\ Concentration}}{uncertainty\ factors}$$

Where

-the temperature and atmospheric pressure are assumed to be 25°C and 760 mm Hg, and the molecular weight is 67.46 grams/mole so that 1.0 ppm x 67.46/24.45=2.76 mg/m³

- $LOAEL_{Human\ Equivalent\ Concentration} = LOAEL_{adjusted\ for\ time} \times dosimetric\ adjustment\ factor$

$$-LOAEL_{adjusted\ for\ time} = 2.76 \frac{mg}{m^3} \times \frac{5\ hours}{24\ hours} \times \frac{5\ days}{7\ days} = 0.41 \frac{mg}{m^3}$$

- $dosimetric\ adjustment\ factor = regional\ gas\ dose\ ratio_{thoracic\ effects}$

$$-regional\ gas\ dose\ ratio_{thoracic\ effects} = \frac{\left(\frac{rat\ minute\ volume}{thoracic\ surface\ area\ in\ rat}\right)}{\left(\frac{human\ minute\ volume}{thoracic\ surface\ area\ in\ human}\right)}$$

-Rat minute volume=0.17 m³

-Human minute volume=20 m³

-Thoracic surface area in rat=3,461.6 cm²

-Thoracic surface area in humans=640,581 cm²

$$-LOAEL_{Human\ Equivalent\ Concentration} = 0.41 \frac{mg}{m^3} \times \frac{\frac{0.17\ m^3}{3,461.6\ cm^2}}{\frac{20\ m^3}{640,581\ cm^2}} = 0.64 \frac{mg}{m^3}$$

Uncertainty factors are 10 for subchronic to chronic duration extrapolation, 10 for LOAEL to NOAEL extrapolation and database deficiencies, 10 for intraspecies variability, and 3 for interspecies extrapolation

$$RfC = \frac{0.64 \frac{mg}{m^3}}{10 \times 10 \times 10 \times 3} = 2.13 \times 10^{-4} \frac{mg}{m^3}$$
$$\approx 2 \times 10^{-4} \frac{mg}{m^3}$$

$$ITSL = 2 \times 10^{-4} \frac{mg}{m^3} \times \frac{1000\ \mu g}{mg} = 0.2 \frac{\mu g}{m^3}$$

References:

Act 451 of 1994, Natural Resources and Environmental Protection Act and Air Pollution Control Rules, Michigan Department of Environmental Quality.

USEPA. 2000. Chemical Assessment Summary: Chlorine dioxide; CASRN 10049-04-4. Integrated Risk Information System, US Environmental Protection Agency, Accessed on October 5, 2015. http://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nمبر=496