MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: 1,2-Dichloroethane File (CAS # 107-06-2)

FROM: Doreen Lehner, Toxics Unit, Air Quality Division

SUBJECT: Screening Level for 1,2-Dichloroethane (CAS # 107-06-2)

DATE: April 13, 2015

The initial risk screening level (IRSL) for 1,2-dichloroethane (CAS # 107-06-2) is 0.04 µg/m^3 and the SRSL is 0.4 µg/m^3 based on an annual averaging time. The IRSL was established in 1986 and was determined from a potency based on National Cancer Institute (NCI, 1978) as calculated in EPA IRIS (1991), where male rats that were gavaged had in increased incidence of hemangiosarcomas.

1,2-Dichloroethane, also known as ethylene dichloride, EDC, ethane dichloride, Dutch liquid, and Freon 150, is a chlorinated hydrocarbon. It is a highly flammable, colorless, oily organic liquid with a sweet, chloroform-like odor and a molecular weight of 98.96 g/mol. 1,2-Dichloro-ethane is used: to produce vinyl chloride monomer, which is the major precursor for PVC production; in the production of rubber and synthetic textile fibers; as an intermediate for other organic chemical compounds; as a solvent for resins and fats in photography, photocopying, cosmetics, and drugs; as a fumigant for grains and orchards; and as a precursor in the production of 1,1,1-trichloroethane (EPA, 2013; Wikipedia 2015).

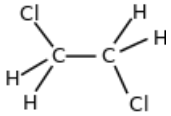

Figure 1. Structure of 1,2-dichloroethane.

The EPA derived a quantitative estimate of carcinogenic risk from inhalation exposure with an inhalation unit risk of 2.6x10^{-5} per µg/m^3 using dose-response data from an NCI (1978) bioassay of 1,2-dichloroethane in rats and mice. “1,2-Dicholoroethane in corn oil was administered by gavage to groups of 50 each male and female Osborne-Mendel rats and B6C3F1 mice. Treatment was for 78 weeks followed by an additional observation period of 12-13 weeks for mice or 32 weeks for low-dose rats. TWA dosages were 47 and 95 mg/kg/day for rats, 97 and 195 mg/kg/day for male mice and 149 and 299 mg/kg/day for female mice. All high-dose male rats died after 23 weeks of observation; the last high-dose female died after 15 weeks. Male rats had significantly increased incidence of forestomach squamous-cell carcinomas and circulatory system hemangiosarcomas. Female rats and mice were observed to have significant increases in mammary adenocarcinoma incidence. Mice of both sexes developed alveolar/bronchiolar

adenomas, females developed endometrial stromal polyps and sarcomas, and males developed hepatocellular carcinomas (NCI, 1978)" (EPA, 1991).

"Inhalation exposure of Wistar, Sprague-Dawley rats and Swiss mice did not result in increased tumor incidence (Spencer et al., 1951; Maltoni et al., 1980)" (EPA, 1991). "Reitz et al. (1982) found the major urinary metabolites in rats of ingested and inhaled 1,2-dichloroethane to be identical and generated in the same relative amounts" (EPA, 1991).

The NCI (1978) gavage study tumor type used for unit risk determination was male Osborne-Mendel rat hemangiosarcomas. "Equivalent human dose was calculated using an assumed 70-kg human weight and the reported terminal rat weight of 0.5 kg. Metabolism of 1,2-dichloro-ethane after oral exposure is dose-dependent" (EPA, 1991). "Because of the high mortality rate in the high-dose rats, a time-to-event analysis was used to quantitate the risk estimate. It was assumed that rats with hemangiosarcomas were killed by the tumors. The 95% upper bound of the risk was calculated using 90 weeks to approximate the lifetime risk" (EPA, 1991). "The inhalation unit risk was calculated from oral data assuming 100% absorption and metabolism at the low dose" (EPA, 1991) and a linearized multistage procedure using extra risk.

Administered Dose (mg/kg/day)	Human Equivalent Dose (mg/kg/day)	Tumor Incidence
0	0	0/40
47	4.46	9/48
95	8.23	7/27

The calculated inhalation unit risk is 2.6×10^{-5}. Rule 231(1) was used to develop the IRSL, using the inhalation unit risk value derived by the EPA for 1,2-dichlorobenzene. The equation is below:

$$IRSL = \frac{1 \times 10^{-6}}{Unit\ Risk} = \frac{1 \times 10^{-6}}{2.6 \times 10^{-5}} = 0.038461538\ {}^{\mu g}/_{m^3}$$

Rule 231(4) states that the averaging time for IRSLs and SRSLs is an annual averaging time. The initial risk screening level (IRSL) for 1,2-dichloroethane (CAS # 107-06-2) is 0.04 µg/m^3 and the SRSL is 0.4 µg/m^3 based on an annual averaging time.

References:

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