MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

To: File for Dipropylene glycol monopropyl ether (CAS # 29911-27-1)

From: Doreen Lehner, Air Quality Division, Toxics Unit

Subject: Screening Level Derivation

Date: October 3, 2017

The initial threshold screening level (ITSL) for dipropylene glycol monopropyl ether (CAS # 29911-27-1) is 180 µg/m^3 based on an annual averaging time.

Dipropylene glycol monopropyl ether [DPnP] (CAS # 29911-27-1), also known as 1-(1-methyl-2-propoxyethoxy)2-propanol, is a water soluble, colorless liquid with an ether-like odor and has a molecular weight of 176.25 g/mol. DPnP is used: as a solvent and coalescent for water-borne latex coatings; “a component of cleaning formulations and of household and personal care products from which occupational and consumer exposure is likely” (CalARB, 2010).

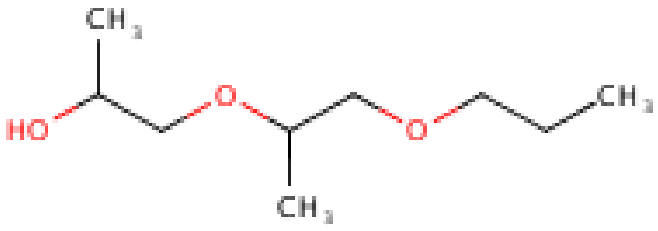

Figure 1. Structure of dipropylene glycol monopropyl ether.

ITSL Derivation:

Male and female Fischer 344 rats (10/sex/dose level) were exposed to either 0, 50, 150, or 500 mg/kg-day of propylene glycol n-propyl ether for 90 days in drinking water. “Drinking water solutions were prepared weekly. The amount of test material administered was adjusted weekly based on the most recent body weights and water consumption data” (ECHA, 2017). “Rats were observed for clinical signs of toxicity prior to the start of the study and twice daily thereafter. A detailed clinical observation was conducted pre-exposure and weekly during the study. Functional testing (sensory evaluation, rectal temperature, grip performance, and motor activity) was conducted predosing and during the last week of the study. Body weights and feed and water consumption were measured during the pre-exposure period and once per week during the study. Ophthalmological examinations were conducted by a veterinarian prior to treatment and at termination. Urinalyses were conducted on urine collected (16 hours in metabolism cages) one week prior to termination” (ECHA, 2017). At termination, blood was collected from the orbital sinuses of anesthetized animals. The blood was used for standard hematology, clinical chemistry, and prothrombin time analysis. A complete necropsy was performed on all animals.

The rats at the highest dose level of 500 mg/kg bw showed an “increased absolute and relative liver weight in males (16%), decreased water consumption in females (10% reduction), decreased urine volume in males (3.9 ±0.6 ml vs. 4.6 ±0.7 ml in control) and females (3.8 ±3.7 ml vs. 5.3 ±3.5 ml in control), increased urine specific gravity for females (1.079 ±0.022 vs. 1.059 ±0.018), and increased cholesterol in males (by 17%)” (ECHA, 2017) were related to treatment. At 500 mg/kg, three males had an increase in the size of the liver and one male and one female showed hemolyzed blood in the lumen of the stomach. Lower levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were found in both males and females. Higher relative kidney and adrenal weights were observed in males and females, and higher absolute and relative kidney weights of males were also found at 500 mg/kg bw. The authors of the study stated that these changes were not considered to be treatment-related or toxicologically relevant (ECHA, 2017).

The rats at the 150 mg/kg bw level showed “lower ALT in males and females and higher absolute and relative thymus weight of males” (ECHA, 2017). The authors of the study stated that these changes were not considered to be biologically significant. “One male had hemolyzed blood in the lumen of the stomach” (ECHA, 2017). The rats at the 50 mg/kg by level showed no effect of treatment compared to controls. Due to the increased thymus weight in male rats the 150 mg/kg bw dose level is the lowest observable adverse effect level (LOAEL) for the study and the 50 mg/kg bw level is the no observable adverse effect level (NOAEL) for this study.

A 90-day study is the minimum length of study needed to develop a reference dose (RfD). EPA (1993) uses the following equation to determine and RfD from a NOAEL:

$$RfD\left({}^{mg}/_{\frac{kg}{day}}\right) = \frac{NOAEL\ {}^{mg}/_{kg/day}}{UF_H \times UF_A \times UF_S}$$

Where:

UF = The uncertainty factor used to account for differences between the available data and the possible effects in the human population, usually expressed as factors of 10.

UF_H = 10 to account for variation in sensitivity among individuals of the human population.

UF_A = 10 to account for extrapolation from animal data to humans.

UF_S = 10 to account for the extrapolation from less than chronic NOAELs to chronic NOAELs.

The NOAEL from the 90-day oral rat drinking study of 50 mg/kg bw is used in the above equation:

$$RfD = \frac{50\ {}^{mg}/_{kg/day}}{10 \times 10 \times 10} = 0.05\ {}^{mg}/_{kg/day}$$

Rule 232(1)(b) uses an oral RfD to determine an ITSL using the following equation:

$$ITSL = oral\ RfD \times \frac{70\ kg}{20\ m^3}$$

Where 70 kg is the default body weight of an average human and 20 m^3 is ventilation rate per day for an average human. Using the oral RfD, determined as 0.05 mg/kg/day above, the ITSL was calculated below:

$$ITSL = 50\ {}^{mg}/_{kg/day} \times \frac{70\ kg}{20\ m^3} = 0.175\ {}^{mg}/_{m^3} = 175\ {}^{\mu g}/_{m^3} \approx 180\ {}^{\mu g}/_{m^3}$$

According to Rule 232(2)(b), the averaging time is annual. Therefore, the ITSL for dipropylene glycol monopropyl ether is 180 µg/m^3 based on an annual averaging time.

References:

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

CalARB. 2010. Draft Interim REL, Dipropylene Glycol n-Propyl Ether (CAS 29911-27-1). California Air Resources Board. Available online at: https://www.arb.ca.gov/consprod/regact/2010ra/dpnp29911271.pdf

ECHA. 2017. European Chemicals Agency. Registration file for 1-(1-methyl-2-propoxyethoxy) propan-2-ol CAS Number 29911-27-1). Accessed on 9/21/2017. Available online at: https://echa.europa.eu/registration-dossier/-/registered-dossier/5828/7/6/2

EPA. 1993. Reference Dose (RfD): Description and Use in Health Risk Assessments. Background Document 1A. March 15, 1993. Available online at: https://www.epa.gov/iris/reference-dose-rfd-description-and-use-health-risk-assessments

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