MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

November 16, 2000

TO: File for 4-phenylcyclohexene (4994-16-5)

FROM: Marco Bianchi, Toxics Unit, Air Quality Division

SUBJECT: Initial Threshold Screening Level

The Initial Threshold Screening Level (ITSL) for 4-phenylcyclohexene (PCH) is 33 $\mu g/m^3$ based on an annual averaging time. The following references or databases were searched to identify data to determine the ITSL/IRSL: IRIS-online, HEAST, NTP Management Status Report-online, RTECS, EPB-CCD, EPB library, CAS-online, NLM-online, IARC-online, NIOSH Pocket Guide, and ACGIH Guide.

Recent reports have suggested that the installation of new carpet may sometimes result in health complaints such as headache, eye irritation and nausea (Van Ert et al, 1987). These reports have also suggested that PCH, a by-product formed in trace amounts during the polymerization of styrene-butadiene latex used in carpet manufacturing may contribute to these health complaints. Air concentrations of PCH ranging from 0.3 to 26 ppb have been measured in some buildings following installation of new carpeting.

A review of the above databases resulted in the finding of an acute lethality study, and a 2-week inhalation/neurotoxicity study both conducted by the Dow Chemical Company. In the acute lethality study, 5 male and 5 female Fischer 344 rats were exposed for 6 hrs to 16 or 60 ppm PCH. Results included porphryn staining around the eyes of the low dose group while the high dose group exhibited no clinical signs. At necropsy, 14 days after exposure to the test material there were no exposure-related effects observed in animals of either dose group. In the 2-week inhalation/neurotoxicity study, groups of 20 Swiss-Webster mice/sex/dose were exposed to actual concentrations of 0, 7, 18 or 71 ppm (near-saturated atmosphere) of PCH vapor, 6 hr/day for 9 consecutive days. Data was collected on a wide variety of clinical, neurological and histopathological parameters including functional observational battery (FOB), motor activity, and extensive neurohistopathology. According to the study investigators, all animals survived exposures to PCH. There were no treatment-related effects that could be related from exposure to PCH based on in-life parameters, functional observation batteries, motor activity, gross pathological or histopathological examination of an extensive set of organs and tissues. However, there were adverse effects not associated with exposure to PCH. It appears that certain sub-strains of Swiss-Webster mice suffer from an apparent congenital eye condition in which there is a bilateral absence of both rods and cones. Additionally, vacuoles were noted in the neural tissue of some test animals. But, according to the study investigators, these lesions were considered spontaneous events based on the low incidence, the lack of a similar observation in other animals at any exposure level or animals exposed to lower dose levels, and the failure to correlate the observation with any definitive cellular degenerative change or loss.

In a 2-week follow-up study using the same sub-strain of Swiss-Webster mice, 20 animals/sex/group were exposed to 0 and 62 ppm PCH. Sporadic incidences of vacuoles were observed in the same neural tissue types or same dose groups, but these incidences were less than in the original study. According to the study investigators, the no-observable-adverse-effect-level (NOAEL) for this study was 71 ppm or (459.6 mg/m^3). Although the optical and neuropathological condition of this particular sub-strain of Swiss-Webster mice was odd, the

data interpretations seemed consistent with the results. Therefore, the NOAEL for this study is 460 mg/m^3.

The ITSL was derived as follows:

NOAEL = 460 mg/m^3
35 = uncertainty factor; to account for using a NOAEL for a 7-day exposure period to estimate a NOAEL for a lifetime study.
100 = uncertainty factor; to account for specie differences and human population sensitivities.

$$\text{ITSL} = \frac{\text{NOAEL}}{35 \times 100} \times \frac{\text{hours exposed/day}}{24 \text{ hrs/day}}$$

$$\text{ITSL} = \frac{460 \text{mg/m}^3}{35 \times 100} \times \frac{6 \text{hrs/day}}{24 \text{ hrs/day}} = 0.0328 \text{ mg/m}^3$$

Conversion of mg/m^3 to µg/m^3

$$\text{ITSL} = 0.0328 \text{ mg/m}^3 \times \frac{1000 \text{ µg}}{1 \text{ mg}} = 32.8 \text{ µg/m}^3$$

The ITSL for 4-phenylcyclohexene = 33 µg/m^3 based an annual averaging.

Reference:

1. Van Ert, MD. 1987. Identification and characterization of 4-phenylcyclohexene – an emission product from new carpeting. Unpublished report of Department of Pharmacology and Toxicology, College of Pharmacy, University of Arizona.

2. Nitschke, KD. et al. 1989. 4-phenylcyclohexene: acute inhalation toxicity study in fischer 344 rats. The Dow Chemical Company; Study ID: DD-000969-003. pgs 1-29.

3. Beekman, MJ. et al. 1996. 4-Phenylcyclohexene: 2-week inhalation toxicity and neurotoxicity studies in swiss-webster mice. Food and Chemical Toxicology. 34:873-881.

MB:ST
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