MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

December 4, 2000

TO: Tetranitromethane File (CAS #509-14-8)

FROM: Gary Butterfield, Toxics Unit, Air Quality Division (AQD)

SUBJECT: Screening Levels for Tetranitromethane

Tetranitromethane is an oily, yellow liquid with a vapor pressure of 8 mmHg. Tetranitromethane is an explosive, and is also used to make rocket propellants. It makes a very strong explosive when combined with hydrocarbons. One of the nitro groups of tetranitromethane is readily lost in chemical reactions. Tetranitromethane has been used to make tetranitrotoluene (TNT). Some munitions and TNT explosive workers have been exposed to tetranitromethane due to its presence as an impurity/contaminant in TNT.

The Chemical Abstracts Service (CAS) and National Library of Medicine (NLM) on-line literature search was conducted on August 2, 2000. Not many toxicity studies were located during the literature review. Standard secondary toxicity references (National Toxicology Program (NTP), United States Environmental Protection Agency Integrated Risk Information System (IRIS), American Conference of Governmental Industrial Hygienists (ACGIH), International Agency for Research on Cancer (IARC), National Institute for Occupational Safety and Health (NIOSH), etc., were also searched for toxicity information. The majority of references referred back to the 1990 NTP study; apparently not a lot of other toxicity studies have been conducted with this chemical. There are some positive mutagenicity studies that were found by the literature searches. There are a few acute studies available evaluating tetranitromethane. An unpublished acute toxicity study reported by Kinkead et aI (1977) determined the 4-hour lethal concentration 50% of 17.5 parts per million (ppm) in rats and 54 ppm in mice, and lethal dose 50% of 130 milligrams per kilogram (mg/kg) in rats and 375 mg/kg in mice, for tetranitromethane and several other nitro compounds. Only a couple of studies were found with exposure duration long enough to possibly use the inhalation reference concentration (RfC) methodology to calculate a screening level. The NTP 13-week study was not well documented in the 2-year study report. Few details were given on pathology findings from the 13-week NTP study, making use of this study questionable for calculating a screening level based on the scant details available from the report. Further complicating the use of this study was the results of the 2-year NTP study which showed significantly increased incidences of lung tumors as well as non-neoplastic respiratory effects at 0.5 ppm. The lowest dose tested in mice. This dose level is near

the lowest dose (0.2 ppm) in the 13-week study. In the study reported by Horn (1954), acute and 6 month study results are covered. In the 6-month study, a single group of 19 rats and 2 dogs were exposed to 6.35 ppm for 6 hours a day, 5 days per week. There was an additional group of control animals. There was high mortality observed in the exposed rat group and there were no effects observed in the dogs. This 6-month study is of limited value for calculating a screening level due to few animals per dose group, only one dose level, and the frank adverse effect of mortality in 58 percent of the exposed rats.

The occupational exposure limit (OELs) from NIOSH, United States Occupational Satety and Health Administration (OSHA), and ACGIH do exist for tetranitromethane. The ACGIH threshold limit value (TLV) of 0.005 ppm was the lowest and the most recently updated OEL, and considers the potential carcinogenic effects as well as the irritant effects of this chemical. The NIOSH and OSHA OELs are older and only consider irritant effects when setting the recommended exposure level (REL) or permissible exposure limit (PEL). For the initial threshold screening level (ITSL) screening level development, the ACGIH TLV value provides the best basis for screening level development. It is the most recently developed OEL, and considers the latest toxicity information. The ITSL is most appropriately based on the ACGIH TLV of 0.005 ppm [or 40 micrograms per cubic meter ($\mu g/m^3$)]. According to R232(c), determining the ITSL from the OEL the ITSL is equivalent to 1/100th the OEL. Therefore, the ITSL is being established as 0.4 $\mu g/m^3$ with an 8-hour averaging time.

The 1990 NTP 2-year inhalation study found high incidences of lung tumors in both sexes of rats and mice. This NTP study provides the basis for the calculation of the IRSL and secondary risk screening level (SRSL), based on the male mice alveolar and bronchiolar adenoma and carcinomas. The mice were exposed to 0, 0.5 or 2 ppm [0, 4 or 16 milligrams per cubic meter (mg/m^3)] for 6 hours a day, 5 days a week for 2 years. The average daily dose is 0, 0.71 and 2.9 mg/rn3. The adenoma and carcinoma tumor incidence was observed to be 12/50 in controls, 27/47 in the low dose and 47/48 in the high dose. These incidence rates are based on the number of animals surviving until the first tumor was observed. Animals that died before this date were excluded from determination of these rates. This information resulted in a slope factor of 1.5E-2 $\mu g/m^3$ from Global82. This slope factor will generate an IRSL of 6.6E-5 $\mu g/m^3$ and a SRSL of 6.6E-4 $\mu g/m^3$.

References:

ACGIH. 1996. Documentation of the TLVs and BEIs. 6th Ed.

Horn. 1954. Inhalation toxicology of tetranitromethane. Arch. Ind. Hyg. Occup. Med. 10:213-222.

Kinkead et al. 1977. Toxic hazards evaluation of five atmospheric pollutants from army ammunition plants. NTIS # 0TS0557145.

National Toxicology Program. 1990. Toxicology and carcinogenesis studies of tetranitromethane in F344 rats and B6C3F1 mice. NTP Tech Rep No 386.

GB:DB
cc: Catherine Simon, AQD Mary Lee Hultin, AQD Sheila Biais, AQD