

**MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY**

**INTEROFFICE COMMUNICATION**

October 17, 1995

TO: File for Nitrogen Trifluoride (7783-54-2)  
FROM: Marco Bianchi  
SUBJECT: Initial Threshold Screening Level

The initial threshold screening level (ITSL) for nitrogen trifluoride is 290  $\mu\text{g}/\text{m}^3$  based on an 8 hr. averaging time.

The following references or databases were searched to identify data to determine the ITSL: IRIS, HEAST, NTP Management Status Report, RTECS, EPB-CCD, EPB library, CAS-online, NLM-online, IARC, NIOSH Pocket Guide, and ACGIH Guide.

Nitrogen trifluoride is a compound having a moderately acute inhalation toxicity causing anoxic deaths due to methemoglobinemia. Acute inhalation also results in slight histologic changes in the liver and kidneys of some rats and enlargement and darkening of the spleen. Serum glutamic oxaloacetic transaminase (SGOT) levels in the rats were essentially unaffected after acute inhalation. Exposure to nonlethal doses of nitrogen trifluoride induces methemoglobinemia, a condition which resolves spontaneously in those with normal activity of erythrocytic methemoglobin reductase. Cyanosis occurs when 15% or greater of the total hemoglobin is converted to methemoglobin.

RTECS lists LC50 values for a 1-hour exposure to rats, monkeys and dogs at 6700 ppm, 7500 ppm, and 9600 ppm, respectively. The ACGIH stated that estimation of approximate LC50 values at 15 and 30 minutes showed that the dog was the most sensitive species. Dogs surviving exposure at 9600 ppm for 60 minutes exhibited Heinz body-induced hemolysis, anemia, decreased hematocrit, decreased hemoglobin, reduced red blood cell count, and clinical signs consistent with histotoxic anoxia as a result of methemoglobin formation. Rats inhaling 1000 ppm nitrogen trifluoride for 4 hours caused a substantial increase in circulating methemoglobin; however, inhaling 3000 ppm for 10 minutes failed to show such an effect. When rats inhaled 2500 ppm nitrogen trifluoride for 4 hours, deaths were commonplace.

In a study by Torkelson et al., (1962) Rabbits receiving nine intraperitoneal injections of 10 ml of nitrogen trifluoride gas in 29 days showed enlarged spleens, pathologic changes in the liver, and myocardial degeneration. Considerable difference in species response was noted. Inhalation of nitrogen trifluoride by rats at 100 ppm 7 hours/day, 5 days/week for 19 weeks resulted in mild to moderate

pathologic changes in liver and kidneys, which included cloudy swelling of the parenchymal cells and some round cell infiltration and proliferation of the bile duct epithelium in the portal areas. In the livers of female rats some lobular necrosis was observed. In the kidney of both sexes, interstitial and slight tubular nephritis were seen. There was no evidence of fluorosis in the teeth or bones, although the characteristics of renal injury suggested fluoride toxicosis. Prolonged inhalation exposure at 100 ppm, however, failed to cause significant effects on the spleen or on hematologic parameters, as might have been predicted from acute studies. Torkelson et al., concluded that data from this study was not adequate to suggest a threshold limit safe for repeated 7-8 hour exposures, but do indicate that such a level is well below 100 ppm.

The ACGIH, OSHA and NIOSH have concurred in setting an occupational exposure level (OEL) for nitrogen trifluoride at 10 ppm (29 mg/m<sup>3</sup>). They base this occupational exposure level on the Torkelson study, using one-tenth the concentration to provide a margin of safety for liver and kidney pathology. In addition to the 10-fold safety factor applied by these occupational health agencies, the AQD also employs an additional 100-fold safety factor when deriving an ITSL based on an OEL. Therefore, the OEL of 29 mg/m<sup>3</sup> seems appropriate to derive an ITSL for this compound.

The ITSL was derived as follows:

$$\text{ACGIH TLV} = 29 \text{ mg/m}^3$$

$$29 \text{ mg/m}^3 \div 100 = 0.29 \text{ mg/m}^3$$

$$0.29 \frac{\text{mg}}{\text{m}^3} \times \frac{1000 \frac{\mu\text{g}}{\text{m}^3}}{1 \frac{\text{mg}}{\text{m}^3}} = 290 \frac{\mu\text{g}}{\text{m}^3}$$

**The ITSL for nitrogen trifluoride = 290 µg/m<sup>3</sup> based on 8 hr. averaging.**

#### References:

ACGIH. 1994. Documentation of the TLVs and BETs.

Torkelson et al., 1962. Preliminary toxicologic studies on nitrogen trifluoride. *Tox. Appl. Pharmacol.* 4:770-781.

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