

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION

July 6, 1995

TO: File for Carbonyl Sulfide (463-58-1)

FROM: Marco Bianchi

SUBJECT: Initial Threshold Screening Level

The initial threshold screening level (ITSL) for carbonyl sulfide is 9  $\mu\text{g}/\text{m}^3$  based on an annual averaging time.

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

Carbonyl sulfide was previously reviewed by AQO staff in February 1993. According to the review document, carbonyl sulfide is thought to elicit a toxic response due to decomposition to H<sub>2</sub>S in the lungs and blood via hydrolysis. However, no animal data was available to establish a screening level.

The current review of carbonyl sulfide found only two TSCA studies submitted by Monsanto Agricultural Company, but data obtained from these studies are supportive to establish a screening level. The first study is an acute inhalation toxicity study exposing Sprague-Dawley rats to carbonyl sulfide. In this study, six groups of six male and six female rats per group were singly exposed to atmospheres of carbon oxysulfide gas between 804 and 1,189 ppm for 4 hours by whole body inhalation. One additional exposure (control) was performed using house-conditioned air only. These rats were observed for a 14-day post-exposure period then sacrificed- Results showed hypoactivity, lacrimation, breathing difficulties, cyanosis, bleeding from the nose, convulsions, tremors, and behavioral abnormalities. Animals surviving longer than 24 hours post-exposure exhibited comparatively few gross signs of toxicity. The most prominent of which, circling, was demonstrated by approximately 50% of the 1062 ppm dose group survivors during the first four days post-exposure. The authors concluded that the gross signs of toxicity demonstrated during and after carbonyl sulfide exposure suggest nervous system dysfunction and lower respiratory system irritation. CNS symptoms are most likely the result of the decomposition of carbonyl sulfide to carbon dioxide and hydrogen sulfide. The latter substance causes sulfmethemoglobinemia which inhibits the cytochrome oxidase system causing cytotoxic anoxia. The lowest LC<sub>50</sub> (95% confidence) was determined to be 1070 ppm (2,675  $\text{mg}/\text{m}^3$ ) for females.

As a follow-up to the LC<sub>50</sub> study, a two week inhalation study was conducted by exposing rats to carbonyl sulfide to further note CNS dysfunction and increases in methemoglobin concentrations. Groups of 10

male and 10 female Sprague-Dawley rats were exposed to target concentrations of 0, 50, 150, 250, and 450 ppm carbonyl sulfide, 6 hr/day, 5 days/wk for a total of 11 exposure days. Toxic effects were monitored by observing gross signs of toxicity, body weight, hematology and gross pathological changes in the test animals. Results showed carbonyl sulfide toxicity for the high dose group, but only after at least six days of exposure. Females of the high exposure level weighed statistically less than controls after the second week of exposure. Signs of CNS dysfunction, ataxia, head-tilting, circling, tremors, and convulsions were observed in 50% of the high dose group. Females in the mid and mid-high groups had depressed red cell counts which along with a slight depression in mean corpuscular volume, resulted in statistically significant changes in the derived measurements of hematocrit, mean corpuscular hemoglobin and mean corpuscular hematocrit. The authors noted that a viral infection occurred in the study animals including controls, but that it did not appear to have affected the test animals' responses to exposure.

The authors concluded that a no exposure-related effect occurred animals receiving eleven, six hour exposures to 51 ppm (127.5 mg/m<sup>3</sup>) carbonyl sulfide. This value will be used to derive an ITSL.

The ITSL was derived as follows:

$$\begin{aligned} \text{ITSL} &= \text{NOAEL}/(35 \times 100) \times \text{hours exposed per day}/(24 \text{ hours per day}) \\ &= 127.5 \text{ mg/m}^3/(35 \times 100) \times (6 \text{ hours})/(24 \text{ hours}) = 0.009 \text{ mg/m}^3 \\ &= 0.009 \text{ mg/m}^3 \times 1000 = 9 \text{ ug/m}^3 \end{aligned}$$

**The ITSL for carbonyl sulfide = 9 ug/m<sup>3</sup> based on annual averaging.**

References:

Monsanto Agricultural Company. 1990. TSCA 8(e) submission. Acute Inhalation Toxicity of Carbon Oxysulfide to Sprague-Dawley Rats, ML-82-213. OTS0540051.

Monsanto Agricultural Company. 1992. TSCA 8(e) submission. Two week Study of COS Administered By Inhalation to Rats, ML-83-029. OTS0534820.

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