

# Texas Commission on Environmental Quality

## INTEROFFICE MEMORANDUM

**To:** Richard Hyde, P.E., Director  
Air Permits Division

**Date:** October 24, 2008

**Thru:** Michael Honeycutt, Ph.D., Manager  
Toxicology Section, Chief Engineer's Office

**From:** Gulan Sun, Ph.D. *G.S.*  
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**Subject:** Interim Carbonyl Sulfide Effects Screening Levels

### Conclusions

Effective immediately, the Toxicology Section (TS) recommends that the following values be used as interim Effects Screening Levels (ESLs) for carbonyl sulfide (CAS Reg. No. 463-58-1) until this chemical undergoes formal ESL development under RG-442 (TCEQ 2006). These interim ESLs are 16.9 and 3.3 times higher than the previous carbonyl sulfide ESLs published on September 15, 2008 ESLs List for short-term and long-term, respectively.

Short-term*	135 $\mu\text{g}/\text{m}^3$	55 ppbv
Long-term	2.6 $\mu\text{g}/\text{m}^3$	1.1 ppbv

\* odor-based

### Background

The previous interim short-term and long-term health-based ESLs for carbonyl sulfide were 8  $\mu\text{g}/\text{m}^3$  (3 ppbv) and 0.8  $\mu\text{g}/\text{m}^3$  (0.3 ppbv), respectively. Those ESL values were derived in early 1990's based on limited toxicological information and were conservative. Briefly, the short-term ESL for carbonyl sulfide was derived by comparing the 50% lethality data of a structure similar chemical, i.e., phosgene, with established inhalation referenced values to that of carbonyl sulfide. The long-term ESL was set at one tenth of the derived short-term ESL.

Eastman Chemical Company (Eastman) requested that TCEQ review its proposed interim short- and long-term ESLs for carbonyl sulfide. The proposed ESLs were developed by an independent toxicologist, Dr. Thomas Dydek, according to the TCEQ guidelines (TCEQ 2006). The TS has reviewed Dr. Dydek's evaluation (Dydek 2008) and determined that it met TCEQ guidelines.

## **Evaluation**

### **Short-term ESL**

Carbonyl sulfide is considered a category 3 gas and causes systemic adverse effect of neurotoxicity upon short-term exposure. The proposed short-term interim ESL was based on a no-observed-adverse-effect level (NOAEL) of 300 ppm for clinical signs and brain pathology in rats exposed to carbonyl sulfide for 6 hours (Morgan et al. 2004). The NOAEL identified from this study was used as the point of departure (POD). The POD was then adjusted by appropriate dosimetry adjustment factor and exposure duration to obtain a human equivalent POD (POD<sub>HEC</sub>, 540 ppm). The short-term reference value (ReV) of 1.8 ppm was calculated by applying a cumulative of uncertainty factor (UF) of 300 (a UF<sub>H</sub> of 10 for human variation, a UF<sub>A</sub> of 10 for interspecies extrapolation, and a UF<sub>D</sub> of 3 for uncertainty associated with an incomplete database) to the POD<sub>HEC</sub> of 540 ppm. The short-term ESL of 0.54 ppm (540 ppbv or 1330 µg/m<sup>3</sup>) was set according to the ESL guidance based on the ReV of 1.8 ppm multiplied by a hazard quotient (HQ) of 0.3.

### **Odor-based ESL**

Carbonyl sulfide is a colorless, flammable gas with a typical sulfur odor. An odor threshold of 135 µg/m<sup>3</sup> reported by Nagata, et al. (2003) was selected for odor-based ESL. The odor threshold met the criteria accepted by US EPA (TCEQ 2006). Since the odor-based ESL is lower than health-based short-term ESL of 1330 µg/m<sup>3</sup>, the odor-based ESL of 135 µg/m<sup>3</sup> or 55 ppb was selected as short-term ESL for carbonyl sulfide.

### **Long-term ESL**

The proposed short-term interim ESL was based on an animal fertility study by Reyna and Ribelin (1987). Male rats were exposed to 0, 10, 60 or 182 ppm of carbonyl sulfide 6 hours/day, 5 days/week over a 13-week period. Only 12 of 24 females mated with males exposed with 182 ppm became pregnant, compared with 20 of 24 females in the 0, 10, and 60 ppm groups. A lowest observed adverse effect level (LOAEL) of 182 ppm and a NOAEL of 60 ppm were identified from this study. The NOAEL of 60 ppm was selected as the POD for the derivation of long-term ESL.

The POD was then adjusted by appropriate dosimetry adjustment factor and exposure duration to the POD<sub>HEC</sub> (10.8 ppm). The long-term ReV of 0.0036 ppm (3.6 ppb) was calculated by applying a cumulative of uncertainty factor (UF) of 3000 (a UF<sub>H</sub> of 10, a UF<sub>A</sub> of 10, a UF<sub>sub</sub> of 10 for extrapolating from subchronic to chronic exposure, and a UF<sub>D</sub> of 3) to the POD<sub>HEC</sub> of 10.8 ppm. The long-term ESL of 1.1 ppb (2.6 µg/m<sup>3</sup>) was set according to the ESL guidance (TCEQ 2006) based on the ReV of 3.6 ppb multiplied by a HQ of 0.3.

If you have any questions regarding this evaluation, please do not hesitate to call me at 512-239-1336 or email me at [gsun@tceq.state.tx.us](mailto:gsun@tceq.state.tx.us).

**References**

Dydek, T., 2008. An evaluation of the effects screening levels for Carbonyl Sulfide using the new TCEQ ESL setting procedure, Dydek Toxicology Consulting.

Morgan, D. L., Little, P. B., Herr, D. W., et al. 2004. Neurotoxicity of carbonyl sulfide in F344 rats following inhalation exposure for up to 12 weeks. Toxicology and Applied Pharmacology. 200: 131-145.

Nagata, Y., 2003. Measurement of odor threshold by triangle odor bag method. Odor Measurement Review. Japan Ministry of the Environment, 118-127.

Reyna, M. S. and Ribelin, W. E. 1987. One-generation reproduction studies of male albino rats, female albino rats, and previously exposed male Sprague-Dawley rats to carbonyl sulfide by inhalation. Monsanto Technical Laboratory, submitted by E. I. DuPont de Nemours & Co. OTS 0555041

Texas Commission on Environmental Quality (TCEQ). 2006. Guidelines to develop effects screening levels, reference values, and unit risk factors. Chief Engineer's Office. RG-442.