

# Texas Commission on Environmental Quality

## INTEROFFICE MEMORANDUM

**To:** Michael E. Honeycutt, Ph.D.  
Director, Toxicology Division  
Chief Engineer's Office

**Date:** February 8, 2010

**From:** Joseph T. Haney, Jr., M.S.<sup>1/8</sup>  
Toxicology Division  
Chief Engineer's Office

**Subject:** Conservativeness of TCEQ's Current Effects Screening Levels (ESLs) for Carbon Disulfide and Air Samples in Areas of Oil & Gas Exploration

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### *Executive Summary*

TCEQ's long- and short-term ESLs for carbon disulfide are very conservative (i.e., health protective). The long-term ESL is over 200 times lower than the long-term, health-protective value used by the United States Environmental Protection Agency, and is 32-300 times more conservative than the health-protective comparison values used by some other agencies (e.g., California Environmental Protection Agency (CalEPA), Health Canada). The short-term ESL for carbon disulfide is conservative as well. For example, TCEQ's short-term ESL is 200 times lower than the short-term, health-protective comparison value derived by CalEPA. Consequently, exposure to the levels of carbon disulfide (5.86 – 103 ppb 24-hour; 0.06 – 20 ppb instantaneous) monitored to date in areas of oil & gas exploration (e.g., Barnett Shale, Dish, City of Westworth Village) would clearly not be expected to cause adverse health effects.

### *Background*

This memorandum discusses the inherent conservativeness (i.e., health-protectiveness) of TCEQ's current long- and short-term ESLs for carbon disulfide (CAS# 75-15-0) and some air sampling results collected in areas of oil & gas exploration. The current ESLs are based on the generally conservative method of deriving health-protective air screening values historically used by TCEQ as well as some other states. However, in 2006 TCEQ adopted an updated ESL derivation process which incorporates the latest scientific methods and was peer reviewed by a panel of renowned external scientific experts, and at some point in the future updated ESLs will be derived for carbon disulfide under that process ([http://www.tceq.state.tx.us/comm\\_exec/forms\\_pubs/pubs/rg/rg-442.html/at\\_download/file](http://www.tceq.state.tx.us/comm_exec/forms_pubs/pubs/rg/rg-442.html/at_download/file)). ESLs do not represent air concentration thresholds for adverse health effects, but rather generally represent conservative screening values below which adverse health effects would clearly not be expected. Consequently, due to the inherent conservativeness of the ESLs, exceedances of the long- and/or short-term ESLs for carbon disulfide should not necessarily be interpreted as indicating a human health concern, but rather that further evaluation is warranted to determine whether the exceedances represent a human health concern based on available scientific literature on the toxicity and levels of carbon disulfide associated with adverse health effects. Additional discussion regarding the

conservativeness of the long- and short-term ESLs for carbon disulfide is provided below to aide in the further evaluation of ESL exceedances.

**Long-Term ESL**

The long-term ESL for carbon disulfide of 1 ppb is conservative as evidenced by a review of other agencies' long-term comparison values for carbon disulfide derived using standard scientific, human health hazard assessment methodologies, as well as known effects levels. Table 1 presents long-term, health-protective air concentration comparison values derived by four other agencies. While these values differ in regard to their inherent level of conservativeness, the discussion of which is beyond the scope of this memorandum, they are all considered health-protective values for public exposure and demonstrate the greater conservativeness of TCEQ's long-term ESL. However, the greater conservativeness of TCEQ's long-term ESL should not be construed as conferring a greater degree of health protection because if adverse health effects do not occur as a result of exposure to any of these health-protective levels, they may be viewed as being associated with an equal level of human health protection.

The long-term ESL for carbon disulfide of 1 ppb is 32-300 times more conservative than the health-protective comparison values used by these other agencies. Additionally, the long-term ESL (1 ppb) is approximately 4,000-5,000 times lower than the no-observed-adverse-effect-levels (NOAELs) or no-observed-effect-levels (NOELs) identified by these agencies (NOAELs/NOELs of about 4,100-5,100 ppb). Consequently, based on these health-protective values, along with public exposure, the magnitude of a long-term ESL exceedance for carbon disulfide based on comparison to a representative long-term concentration would have to be several orders of magnitude for a potential public health concern to exist.

**Table 1: Long-Term, Health-Protective Air Concentrations from Other Agencies**

Agency	Long-Term Comparison Value Name	Long-Term Comparison Value (ppb) <sup>a</sup>	Point-of-Departure <sub>HEC</sub> (ppb) <sup>b</sup>	Total Uncertainty Factor	Critical Study and Effect
ATSDR	Chronic Minimal Risk Level (MRL)	300	7,600 LOAEL [NOAEL (median) of 4,100 ppb]	30	Johnson et al. 1983 Nervous system/minimal decrease in nerve conduction velocity
CalEPA	Chronic Reference Exposure Level (REL)	300	2,540 BMCL <sub>05</sub>	10	See above
USEPA	Reference Concentration (RfC)	224	6,304 BMC <sub>10</sub> [NOAEL]	30	See above

			(mean) of 5,100 ppb]		
Health Canada	Tolerable Concentration (TC)	32	1,600 BMCL <sub>05</sub>  [NOEL of 4,160 ppb]	50	See above

ATSDR = Agency for Toxic Substances and Disease Registry; CalEPA = California Environmental Protection Agency; USEPA = United States Environmental Protection Agency; LOAEL = lowest-observed-adverse-effect-level; BMC<sub>10</sub> = benchmark concentration at the 10% response level; BMCL<sub>05</sub> = benchmark concentration lower bound at the 5% response level.

<sup>a</sup> Comparison values only given in  $\mu\text{g}/\text{m}^3$  were converted to ppb using  $1 \mu\text{g}/\text{m}^3 = 0.32 \text{ ppb}$ .

<sup>b</sup> Human equivalent concentration point-of-departure (POD<sub>HEC</sub>) values only given in  $\mu\text{g}/\text{m}^3$  were converted to ppb using  $1 \mu\text{g}/\text{m}^3 = 0.32 \text{ ppb}$ .

### ***Short-Term ESL***

The short-term (e.g., 1-hour) ESL for carbon disulfide of 10 ppb is conservative as well. The California Environmental Protection Agency (CalEPA) has derived an acute (6-hour) Reference Exposure Level (acute REL) of 2,000 ppb using standard scientific, human health hazard assessment methodologies. Additionally, the United States Environmental Protection Agency (USEPA) has developed a sample screening level of 2,240 ppb for use in their school monitoring initiative ([www.epa.gov/schoolair/pdfs/UsesOfHealthEffectsInfoinEvalSampleResults.pdf](http://www.epa.gov/schoolair/pdfs/UsesOfHealthEffectsInfoinEvalSampleResults.pdf)). These CalEPA and USEPA values are health-protective for public exposure and demonstrate the greater conservativeness of TCEQ's short-term ESL. However, the greater conservativeness of TCEQ's short-term ESL should not be construed as conferring a greater degree of health protection because if adverse health effects do not occur as a result of exposure to any of these health-protective levels, they may be viewed as being associated with an equal level of human health protection.

The short-term ESL for carbon disulfide of 10 ppb is about 200 times more conservative than these health-protective comparison values used by CalEPA and USEPA. Additionally, the short-term ESL (10 ppb) is 20,000 times lower than the critical NOAEL identified by CalEPA for derivation of the acute REL (NOAEL of 200,000 ppb for fetal body weight reduction in rats; the lowest-observed-adverse-effect-level (LOAEL) was 400,000 ppb). Consequently, based on this information, the magnitude of a short-term ESL exceedance for carbon disulfide based on comparison to a monitored short-term concentration to which the public was exposed would have to be several orders of magnitude for a potential public health concern to exist.

### ***Air Sampling Results in Areas of Soil & Gas Exploration***

Carbon disulfide was detected as a tentatively identified compound (TIC) in some air samples collected in areas of oil & gas exploration (e.g., Barnett Shale, Dish, City of Westworth Village). These sampling efforts have been the subject of previous Toxicology Division memoranda wherein results were evaluated from a health effects perspective. Although there are uncertainties in the identification and quantification of TICs, Table 2 presents a summary of those data.

**Table 2: Summary of Air Sampling Results for Carbon Disulfide**

<b>Date</b>	<b>General Area of Sample Location</b>	<b>Sample Duration</b>	<b>Detected Concentration (ppb)</b>
May 25, 2009	City of Westworth Village	24-hours	5.86 – 15.1
June 27, 2009	City of Westworth Village	24-hours	9.53
August 17, 2009	Dish	24-hours	7.33 - 103
October 10-15, 2009	Barnett Shale Formation Area	instantaneous	0.06-20

In evaluating these sample results, Toxicology Division memoranda have concluded that exposure to the reported concentrations would not be expected to cause adverse health effects. The memorandum addressing samples collected in Dish, Tx may be found at [http://www.tceq.state.tx.us/assets/public/implementation/barnett\\_shale/healthEffectsReview.pdf](http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/healthEffectsReview.pdf). The memorandum for the Barnett Shale Formation Area may be found at [http://www.tceq.state.tx.us/assets/public/implementation/barnett\\_shale/2010.01.27-healthEffects-BarnettShale.pdf](http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/2010.01.27-healthEffects-BarnettShale.pdf). The other memorandum (City of Westworth Village) is not currently available on the internet.

Based on the information presented above regarding TCEQ's long- and short-term ESLs and the derivation of health-protective values by other agencies, these reported levels are clearly not of health concern. Even if the highest sample result (103 ppb) were to be representative of long-term exposure, this level is well below the upper end of the range of long-term regulatory levels considered health protective by TCEQ and other agencies (300 ppb). Additionally, these results are well below both the lowest effect levels (e.g., LOAELs) and no effect levels (e.g., NOAELs/NOELs) from the key studies used to derive these health-protective regulatory values.

Recent significant health concerns expressed outside of the agency regarding these reported carbon disulfide levels appear unwarranted and may distract focus and resources away from other chemicals which likely represent more of a potential health concern based on reported data and available scientific literature (e.g., benzene).

Please call me at (512) 239-5691 if you have any questions regarding this evaluation.

cc: Toxicology Division (via e-mail), Board