

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Distribution **Date:** October 27, 2009

From: Shannon Ethridge, M.S.
Toxicology Division, Chief Engineer's Office

Subject: Health Effects Review of Ambient Air Monitoring Data Collected
by Wolf Eagle Environmental Engineers and Consultants for DISH, TX

SUMMARY

- The highest potential 1-hour maximum benzene concentration is below the health effects level observed in short-term animal and human studies; however, it is possible that adverse health effects could occur from exposure to this concentration. It was not possible to determine if residents were exposed to this concentration of benzene based on the information provided.
- The Toxicology Division (TD) is concerned that the monitored concentrations of benzene at several of the sampling locations could pose a long-term health risk to residents in the area if the concentrations are representative of normal and prolonged ambient conditions.
- Several monitored and potential 1-hour maximum concentrations of target compounds and tentatively identified compounds (TICs) could have resulted in odorous conditions. Persistent or recurrent exposure to levels which significantly exceed the odor threshold may cause odor-related effects such as headache and nausea. This is consistent with citizen reports of odors in the area.
- The TD strongly recommends additional sampling in the area.

BACKGROUND

Ambient air monitoring analysis was conducted by Wolf Eagle Environmental Engineers and Consultants (Wolf Eagle) for the town of DISH, Texas. The report is available at the following website: <http://www.townofdish.com/>. Air monitoring was conducted to characterize the ambient air quality adjacent to several natural gas compression stations on town property and adjacent to town boundaries. The TD was requested to complete a health effects review of the air monitoring results. For the purposes of this evaluation, the TD assumed that sample collection and data analysis met appropriate quality assurance/quality control requirements.

According to the Wolf Eagle report, a total of seven 24-hour canister samples were collected beginning at 12:12 pm on August 17, 2009. All canister locations were on or near residential property. Canisters were placed on residential property located at 9217 Chisum, 9213 Chisum, 9203 Chisum, Burgess property, and Guthries property. The canister sample Airfield 1:29 was placed at the southeast corner of an airfield adjacent to a residential area. The canister sample Airfield 1:32 was placed at the southwest corner of an airfield adjacent to a residential area. Please refer to the Wolf Eagle report for a map showing canister locations.

Wolf Eagle obtained meteorological data from the Denton Municipal Airport and reported the wind direction during the time of the sampling event to be out of the southeast at an average wind speed of 9 miles per hour with gusts up to 20 miles per hour. Wind roses generated from meteorological data obtained from the Denton Airport South CAMS 56 site for the sampling period are presented in Figure 1.

Samples were analyzed for 40 target volatile organic compounds (VOCs) as well as TICs, fixed gases, and NOx. TICs are observed measurements in the sample for which the gas chromatograph-mass spectrometer (GC/MS) was not specifically calibrated; however, the tentative identification of a compound can be made by comparing the mass spectrum from the environmental sample to a computerized library of mass spectra. The comparison of the sample spectra and that of the library are scored for their similarity to the mass spectrum of a particular TIC and the tentative identification is made based on the most similar spectra. This is a commonly used technique; however, the absolute identity of a TIC is uncertain. Quantifying TICs is also less accurate than for target compounds because the true relative response factor is not known, since the instrument was not calibrated for the TIC. It is important to note these uncertainties when evaluating TICs.

Air samples collected over a 24-hour period are designed to provide representative long-term average concentrations when samples are collected at a minimum of every sixth day for an entire year. In this case, sampling was conducted for one 24-hour period; therefore, the sampling results would not be considered representative of a long-term average. The TD evaluated the reported concentrations for each target analyte and TIC for potential short-term odor, health, and vegetative concerns by comparing the measured chemical concentrations to appropriate short-term comparison values. Additionally, the TD evaluated the potential 1-hour maximum concentrations of all reported chemicals for each target analyte and TIC for potential short-term odor, health, and vegetative concerns by comparing the potential 1-hour maximum chemical concentrations to appropriate short-term comparison values. To determine the potential 1-hour maximum concentrations of all reported chemicals, the reported 24-hour concentration was multiplied by 24. This calculation conservatively assumes that the chemical had a maximum concentration for one hour and was not detected for the remaining 23 hours. This may or may not represent actual conditions.

EVALUATION

A total of seven 24-hour canister samples were collected beginning at 12:12 pm on August 17, 2009, and analyzed for 40 target VOCs as well as TICs, fixed gases, and NOx.

Target compound analysis

Of the 40 target VOCs analyzed, m&p xylenes were monitored at concentrations that could have caused odorous conditions. Of the 40 target VOCs, benzene, ethylbenzene, styrene, toluene, 1,2,4-trimethylbenzene, m&p xylenes, and o-xylenes had potential 1-hour maximum concentrations that exceeded TCEQ short-term applicable comparison levels.

Benzene

None of the monitored concentrations of benzene exceeded the short-term health-based comparison level of 180 parts per billion (ppb). Three potential 1-hour maximum concentrations of benzene exceeded the short-term health-based comparison value of 180 ppb: 257 ppb (Chisum 9213), 295 ppb (Chisum 9203), and 1865 ppb (Airfield 1:29). Actual monitored concentrations were 10.7 ppb, 12.3 ppb, and 77.7 ppb, respectively. Three subacute animal studies as reviewed in ATSDR (2005) and TCEQ (2007) reported adverse hematological effects after inhalation exposure to approximately 10,000 ppb benzene. All other reported health effects from short-term benzene exposure occur at higher concentrations (ATSDR 2005). The highest potential 1-hour maximum concentration of 1865 ppb is below 10,000 ppb; however, it is possible that adverse health effects could occur from exposure to this concentration given differences between animals and humans and possible sensitive humans. It was not possible to determine if residents were actually exposed to this concentration of benzene based on the information provided in the report. In addition, the TD is concerned that the monitored concentrations of benzene at several of the sampling locations could pose a long-term health risk to residents if representative of normal and prolonged ambient conditions.

Ethylbenzene

None of the monitored concentrations of ethylbenzene exceeded the short-term odor-based comparison level of 170 ppb. Two potential 1-hour maximum concentrations of ethylbenzene exceeded the short-term odor-based

comparison level of 170 ppb: 331 ppb (Chisum 9203) and 516 ppb (Airfield 1:29). These potential 1-hour maximum concentrations of ethylbenzene could have resulted in odorous conditions.

Styrene

None of the monitored concentrations of styrene exceeded the short-term odor-based screening level of 25 ppb. One potential 1-hour maximum concentration of styrene exceeded the short-term odor-based comparison level of 25 ppb: 31 (Airfield 1:29). This potential 1-hour maximum concentration of styrene could have resulted in odorous conditions.

Toluene

None of the monitored concentrations of toluene exceeded the short-term odor-based screening level of 170 ppb. Three potential 1-hour maximum concentrations of toluene exceeded the short-term odor-based comparison value of 170 ppb: 809 ppb (Chisum 9213), 1481 ppb (Chisum 9203), and 3336 ppb (Airfield 1:29). These potential 1-hour maximum concentrations of toluene could have resulted in odorous conditions.

1,2,4-Trimethylbenzene

None of the monitored concentrations of 1,2,4-trimethylbenzene exceeded the short-term health-based screening level of 250 ppb. Three potential 1-hour maximum concentrations of 1,2,4-trimethylbenzene exceeded the short-term health-based comparison value of 250 ppb: 461 ppb (Chisum 9213), 1450 ppb (Chisum 9203), and 1130 ppb (Airfield 1:29). These potential 1-hour maximum concentrations are much lower than those reported to cause health effects in humans and animals (ACGIH 2001) and would be unlikely to cause adverse health effects.

m&p xylenes

Two of the monitored concentrations of m&p xylenes exceeded the short-term odor-based comparison value of 41 ppb: 46 ppb (Chisum 9203) and 84 ppb (Airfield 1:29). Four potential 1-hour maximum concentrations of m&p xylenes exceeded the short-term odor-based comparison value of 41 ppb: 554 ppb (Chisum 9213), 1109 ppb (Chisum 9203), 2028 ppb (Airfield 1:29), and 45 (Burgess). These concentrations of 1,2,4-trimethylbenzene could have resulted in odorous conditions. The potential 1-hour maximum concentration of 2028 was slightly above the short-term health-based comparison value of 1700 ppb and would be unlikely to cause adverse health effects.

o xylenes

None of the monitored concentrations of o xylenes exceeded the short-term odor-based comparison value of 41 ppb. Three potential 1-hour maximum concentrations of o xylenes exceeded the short-term odor-based comparison value of 41 ppb: 252 ppb (Chisum 9213), 394 ppb (Chisum 9203), and 954 ppb (Airfield 1:29). These potential 1-hour maximum concentrations of o xylenes could have resulted in odorous conditions.

TIC analysis

A total of 28 TICs were identified in at least one canister sample. Six TICs were reported in more than one canister including carbonyl sulfide, carbon disulfide, dimethyl disulfide, methyl ethyl disulfide, trimethyl benzene, and diethyl benzene. Of the 28 total reported TICs, six had potential 1-hour maximum concentrations that exceeded short-term odor-based comparison levels: carbonyl sulfide, dimethyl pyridine, dimethyl disulfide, methyl ethyl disulfide, and naphthalene. It is possible that these concentrations could have resulted in odorous conditions. An additional 17 TICs had at least one potential 1-hour maximum concentration that exceeded short-term health-based screening levels: 2-methyl butane, 2,4-dimethylpentane, 2,3-dimethylpentane, carbon disulfide, propyl benzene, methyl pyridine, ethyl methyl ethyl disulfide, ethyl methyl benzene, trimethyl benzene, diethyl benzene, methyl-methyl ethyl benzene, tetramethyl benzene, undecane, 1-methyl propenyl benzene, dodecane, 1-methylene-1H-indene, and 2-methyl propenyl benzene. Given the uncertainties in identification and quantification of these compounds and the method used to determine potential 1-hour maximum concentrations, it is not possible to accurately draw conclusions about the potential for adverse health effects.

Fixed gases and NOx

Fixed gases and NOx were either not detected or detected below levels of health concern in all canister samples.

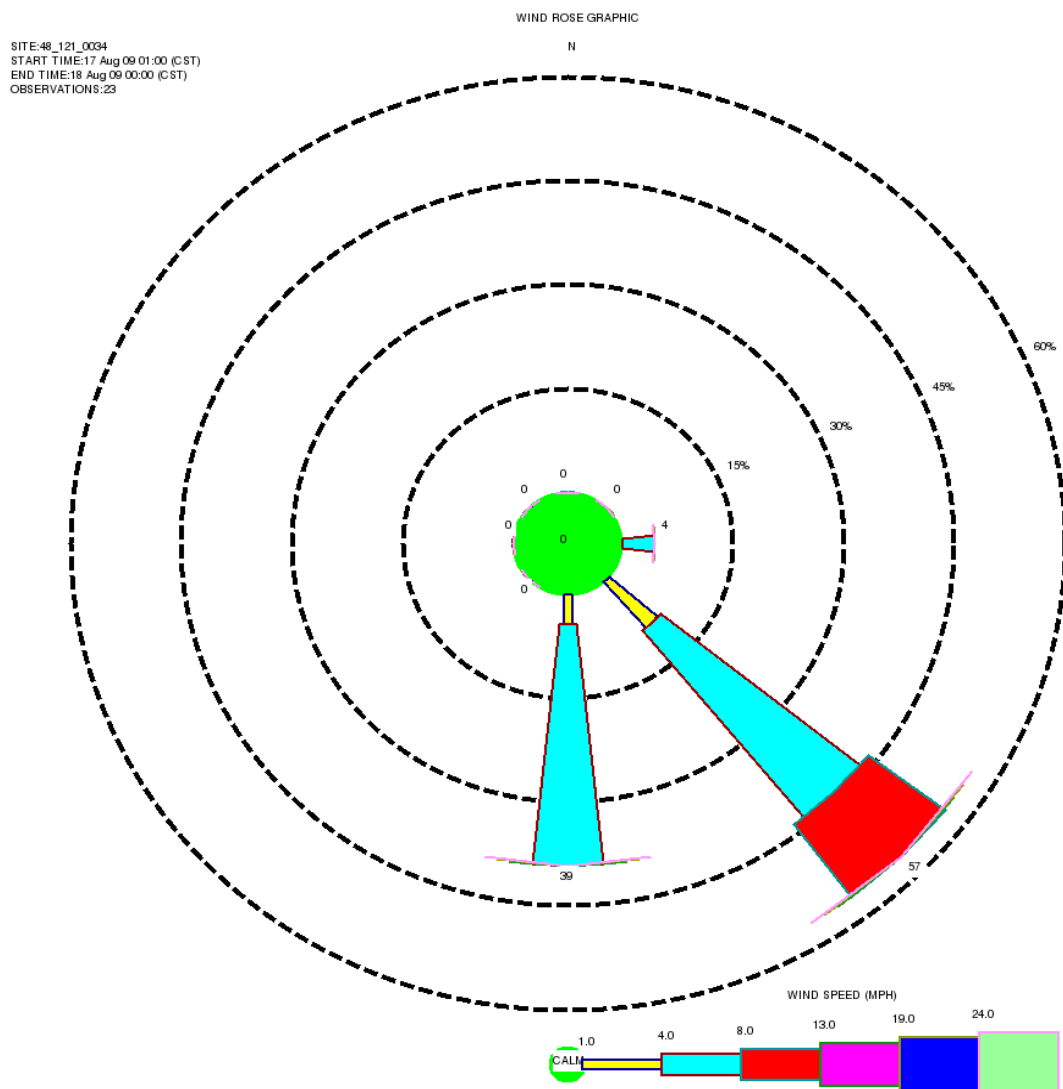
Additional Concerns

The community has expressed concerns about exposure to carbon disulfide. Carbon disulfide was reported as a TIC in three of the seven canister samples: 103 ppb (Chisum 9203), 97.6 ppb (Airfield 1:29), and 7.33 ppb (Airfield 1:32). Two of the three reported concentrations exceeded the TCEQ short-term health-based comparison value of 10 ppb. All potential 1-hour maximum concentrations exceeded the short-term health-based comparison value of 10 ppb: 2472 ppb (Chisum 9203), 2342 ppb (Airfield 1:29), and 176 ppb (Airfield 1:32). One animal study reports adverse liver effects after 8 hours of inhalation exposure to 20,000 ppb in rats (Freundt et al. 1974 in ATSDR 1996). All other reported health effects from short-term animal studies occur at higher concentrations. Human studies report that adverse health effects can occur after long-term exposure (1 year or more) to 1,000 – 3,000 ppb and above (ATSDR 1996, ACGIH 2006). All monitored and potential 1-hour maximum concentrations were well below short-term and long-term health effect levels. Given the uncertainties in identification and quantification of carbon disulfide and the method used to determine potential 1-hour maximum concentrations, it is not possible to accurately draw conclusions about the potential for adverse health effects. The TD recommends additional sampling in the area using methodology that would more precisely identify and quantify carbon disulfide.

CONCLUSIONS

The highest potential 1-hour maximum benzene concentration is below the lowest concentration that has been shown to cause health effects in short-term human and animal studies; however, it is possible that adverse health effects could occur from exposure to this concentration. In addition, the TD is concerned that the monitored concentrations of benzene at several of the sampling locations could pose a long-term health risk to residents in the area if the concentrations are representative of normal ambient conditions. Several monitored and potential 1-hour maximum concentrations of target compounds and TICs could have resulted in odorous conditions. Persistent or recurrent exposure to levels which significantly exceed the odor threshold may cause odor-related effects such as headache and nausea. This is consistent with citizen reports of odors in the area. The TD strongly recommends additional air sampling in the area.

Figure 1. Wind rose graphic developed from meteorological data obtained from the Denton Airport South CAMS 56 site located in Denton, Texas (EPA site 48-121-0034).



If you have any questions about this evaluation, please call me at (512) 239-1822 or email me at sethridg@tceq.state.tx.us.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological profile for benzene. U.S. Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ATSDR). 1996. Toxicological profile for carbon disulfide. U.S. Department of Health and Human Services.

American Conference of Industrial Hygienists (ACGIH). 2006. Documentation for the Threshold Limit Value for Carbon Disulfide.

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Texas Commission on Environmental Quality (TCEQ). 2007. Development support document for benzene.