TCEQ Interoffice Memorandum

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From: Gulan Sun, Ph.D. GS.
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Date: March 16, 2011

Subject: Health Effects Review of 2009 Ambient Air Network Monitoring Data in Region 4, Dallas/Fort Worth

Conclusions

- All hourly average concentrations of the 46 volatile organic compounds (VOCs) reported at Texas Commission on Environmental Quality (TCEQ) Region 4-Dallas/Fort Worth automated gas chromatograph (autoGC) monitoring sites were below their short-term air monitoring comparison values (AMCVs), and would not be expected to cause short-term adverse health effects, vegetative effects, or odor concerns.

- Except for nickel (measured as Total Suspended Particulate (TSP) at the Dallas-Morrell site), annual average concentrations of the 46 VOCs from 1-hour autoGC, 84 VOCs from 24-hour canisters, 17 carbonyls, 14 metals (measured as particulate matter with an aerodynamic diameter 2.5 microns or less, $PM_{2.5}$) and two metals (measured as TSP) reported at TCEQ Region 4-Dallas/Fort Worth monitoring sites were below their TCEQ long-term AMCVs and would not be expected to cause chronic adverse health effects and vegetative effects.

- The 2009 annual average nickel TSP concentration of 0.15 $\mu g/m^3$ exceeded the interim long-term AMCV of 0.015 $\mu g/m^3$ and the proposed TCEQ long-term AMCV of 0.059 $\mu g/m^3$ for respirable nickel particles (i.e., particulate matter less than 10 µm in size, or PM_{10}). However, nickel TSP incorporates all particle size fractions, including those that are larger than 10 µm, and comparing nickel TSP data to the AMCV for respirable nickel particles may be overly conservative. The preliminary analysis from a special one-year monitoring study from April 2009 to May 2010 indicated that the estimated annual nickel $PM_{2.5}$ concentrations appear to have been below the proposed TCEQ long-term AMCV of 0.059 $\mu g/m^3$ since 1996. The final health effects evaluation of nickel at the Morrell site will be made available after the one-year special study is fully reviewed and the proposed nickel AMCV is finalized. Nickel at the Morrell site currently remains on TCEQ's APWL with listing number APWL0401.

- Air quality impacted by Barnett Shale activities is currently under investigation. Detailed information is available on the TCEQ's Barnett Shale Web page at: http://www.tceq.state.tx.us/goto/barnettshale.

Background

The Toxicology Division (TD) has reviewed ambient air sampling data collected from ten network monitoring sites in TCEQ Region 4, Dallas/Fort Worth. Table 1 lists the sampling locations and provides a link to more information on the sites. The TD reviewed air monitoring summary results for VOCs and carbonyls from one-hour and 24-hour samples collected continuously and/or every sixth day respectively. TD also reviewed summary results of metals from 24-hour filter samples (either as $PM_{2.5}$ or TSP) collected every third or sixth day. For a complete list of all chemicals evaluated, please see Lists 1 through 4 in Attachment A.

The TCEQ Field Operations Support Division reported the data for all chemicals evaluated in this memorandum. All data (84 VOCs (canister), 46 VOCs (autoGC), 17 carbonyls, 14 metals ($PM_{2.5}$), and two metals (TSP)) highlighted in this evaluation met TCEQ's data completeness objective of 75 percent data return.

One-hour autoGC VOC samples were compared to TCEQ's short-term AMCVs. Twenty-four-hour air samples collected every third or sixth day for a year are designed to provide representative long-term average concentrations. Short-term or peak concentrations are not captured by 24-hour samples; therefore, daily maximum concentrations have limited use in evaluating the potential for acute health effects. The TD evaluated the reported annual average concentrations from 1-hour autoGC and 24-hour samples for each target analyte for potential chronic health and vegetation concerns by comparing measured chemical concentrations to long-term AMCVs. More information about AMCVs is available online at: http://www.tceq.state.tx.us/implementation/tox/AirToxics.html#amcv.

Table 1. Monitoring Sites Located in TCEQ Region 4

City and Site Location	County	EPA Site ID	Monitored Compounds
Dallas, 1415 Hinton Street	Dallas	48-113-0069	VOCs[a], Carbonyl, Metals ($PM_{2.5}$)
Dallas, 3049 Morrell Street[c]	Dallas	48-113-0018	Metals (TSP)
Dallas, 717 South Akard Street	Dallas	48-113-0050	Metals ($PM_{2.5}$)
Denton, Denton Municipal Airport	Denton	48-121-0034	VOCs[b]
Midlothian, 2725 Old Fort Worth Road	Ellis	48-139-0016	VOCs[b], Metals ($PM_{2.5}$)
Italy, 900 Farm to Market Road 667	Ellis	48-139-1044	VOCs[b]

City and Site Location	County	EPA Site ID	Monitored Compounds
Kaufman, 3790 South Houston Street	Kaufman	48-257-0005	VOCs[b,]
Fort Worth (Northwest), 3317 Ross Avenue	Tarrant	48-439-1002	VOCs[a], Carbonyl
Grapevine, 4100 Fairway Drive	Tarrant	48-439-3009	VOCs[b]
Greenville, 824 Sayle Street	Hunt	48-231-1006	VOCs[b]

[a]24-hour Canister and One-hour AutoGC.
[b]24-hour Canister only.
[c]A link is not available for this site.

Evaluation

VOCs

Short-Term Data

All but one of the hourly average concentrations of the 46 VOCs reported at the two autoGC sites were below their respective short-term AMCVs. Therefore, acute adverse health effects, odor nuisances, or vegetative effects would not be expected to occur as a result of exposure to the reported levels of these chemicals at the Fort Worth (Northwest) and Dallas-Hinton monitoring sites.

One reported hourly average concentration of 4.02 parts per billion by volume (ppb_v) for n-propylbenzene exceeded its odor AMCV of 3.8 ppb_v at the Dallas-Hinton monitoring site. Because the detected concentration of n-propylbenzene was not of high intensity, the frequency of the slightly elevated concentration was low (only one exceedance out of 7450 hourly average concentrations), and historical monitoring at the site indicates no other exceedances of the n-propylbenzene AMCV in the last three years, therefore, health or welfare concerns related to this chemical would not be expected to occur.

Long-Term Data

The 2009 annual average concentrations of the 46 VOCs evaluated at the two autoGC sites and the 84 VOCs reported at each of the eight 24-hour canister monitoring sites were well below their respective long-term AMCVs. Exposure to the reported annual average concentrations would not be expected to cause chronic adverse health or vegetative effects.

Carbonyls

The 2009 annual average concentrations of the 17 carbonyls reported at the Fort Worth (Northwest) and Dallas-Hinton sites were below their respective long-term AMCVs. Exposure to the reported annual average concentrations would not be expected to cause chronic adverse health and vegetative effects.

Metals

At the three sites reporting $PM_{2.5}$ metals data, annual average concentrations of all 14 metals were well below their respective long-term AMCVs. Exposures to the reported levels of these metals would not be expected to cause chronic adverse health and vegetative effects.

At the Dallas-Morrell site, only nickel and chromium measured as TSP were reported. The annual average concentration of chromium TSP was below its long-term health AMCV. Exposure to the reported annual concentration of chromium TSP would not be expected to cause chronic adverse health effects. The annual average concentration of nickel TSP was above the long-term AMCV, and is discussed below.

Nickel TSP at Dallas-Morrell Site

The 2009 annual average nickel TSP concentration of 0.15 $\mu g/m^3$ exceeded the interim long-term AMCV of 0.015 $\mu g/m^3$ and the proposed TCEQ long-term AMCV of 0.059 $\mu g/m^3$ for respirable nickel particles (i.e., particulate matter less than 10 μm in size, or PM_{10}). Elevated annual nickel TSP levels have been detected at the Morrell site since 1987 (Figure 1). Beginning in 1995, the annual average nickel TSP concentrations decreased and have stabilized in the range of 0.1 to 0.3 $\mu g/m^3$ from 1998 through 2009. The reductions in annual nickel levels first observed in 1995 are attributed to actions taken by Dal Chrome Co. Inc., which is an automotive chrome bumper recycling facility located upwind from the Morrell site.

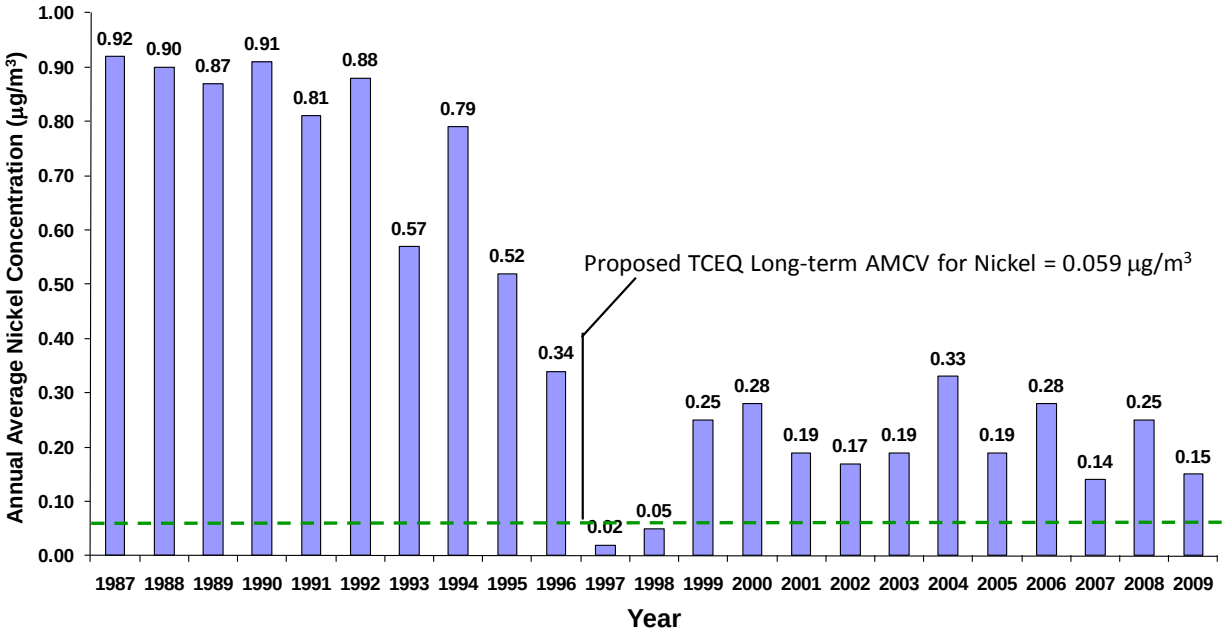

Figure 1. Annual Average Nickel TSP Concentrations at Dallas-Morrell Site from 1987 to 2009

However, nickel TSP incorporates all particle size fractions, including those that are larger than 10 µm. Comparing nickel TSP data to the AMCV for respirable nickel particles may be overly conservative. Available animal and human inhalation nickel and nickel compound studies have demonstrated that the serious adverse health effects (non-carcinogenic and carcinogenic) were related to the smaller fractions, specifically $PM_{2.5}$ and smaller, which are taken deep into the lungs.

In order to address the issue of particle size at the Morrell site, a special one-year monitoring study was conducted from April 2009 to May 2010 at the Dallas-Morrell site. As mentioned above, only TSP samples have historically been collected at this site. During the special one-year monitoring study, however, a new monitor capable of collecting inhalable $PM_{2.5}$ was co-located with the TSP monitor and had been set to the same sampling schedule. The study, in part, identified the percentage of inhalable $PM_{2.5}$ out of TSP. The purpose of identifying the percentage of inhalable $PM_{2.5}$ out of TSP is to allow TD to estimate the more toxicologically relevant nickel PM fraction for risk assessment of nickel exposure, specifically, nickel $PM_{2.5}$. Using the percentage of $PM_{2.5}$ found in TSP collected at the Dallas-Morrell site in the one-year special monitoring study, the TD could estimate the annual nickel concentrations in $PM_{2.5}$ from the historical TSP data. Though the final evaluation of the one-year special study is not available, the preliminary analysis indicated that the estimated annual nickel $PM_{2.5}$ concentrations appear to have been below the proposed TCEQ long-term AMCV of 0.059 µg/m^3 since 1996. The final health effects evaluation of nickel at Morrell site will be made available after the one-year special study is fully reviewed and the proposed nickel AMCV is finalized. Nickel at Morrell site currently remains on TCEQ's APWL with listing number APWL0401.

More detailed information regarding nickel at APWL0401 is available online at: http://www.tceq.texas.gov/implementation/tox/AirPollutantMain/APWL.html.

Investigations of Air Quality Impacted by Barnett Shale Activities

In response to concerns about Barnett Shale oil and gas operations, the TCEQ has performed extensive mobile monitoring and is in the process of significantly expanding the network of stationary samplers that measure VOCs. In addition, as of December 17, 2009, the agency has implemented a 12-hour response time for all complaints received concerning oil and gas facilities in the 24-county Barnett Shale area. The Dallas/Fort Worth regional staff conducts weekly reconnaissance investigations in the Fort Worth area and in DISH, Texas. The regional office also conducts monitoring, as time and resources permit, at the request of the public and other interested parties. Detailed information is available on the TCEQ's Barnett Shale Web page at: http://www.tceq.state.tx.us/goto/barnettshale.

If you have any questions regarding the contents of this review, please do not hesitate to contact me at (512) 239-1336 or via email at gulan.sun@tceq.texas.gov.

cc (via email):
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Attachment A

List 1. Target VOC Analytes in Canister Samples

1,1,1-Trichloroethane	3-Methylhexane	Methylcyclopentane
1,1,2,2-Tetrachloroethane	3-Methylpentane	Methylene Chloride
1,1,2-Trichloroethane	4-Methyl-1-Pentene	m-Ethyltoluene
1,1-Dichloroethane	Acetylene	n-Butane
1,1-Dichloroethylene	Benzene	n-Decane
1,2,3-Trimethylbenzene	Bromomethane	n-Heptane
1,2,4-Trimethylbenzene	c-1,3-Dichloropropylene	n-Hexane
1,2-Dibromoethane	c-2-Butene	n-Nonane
1,2-Dichloroethane	c-2-Hexene	n-Octane
1,2-Dichloropropane	c-2-Pentene	n-Pentane
1,3,5-Trimethylbenzene	Carbon Tetrachloride	n-Propylbenzene
1,3-Butadiene	Chlorobenzene	n-Undecane
1-Butene	Chloroform	o-Ethyltoluene
1-Hexene + 2-Methyl-1-Pentene	Cyclohexane	o-Xylene
1-Pentene	Cyclopentane	p-Diethylbenzene
2,2,4-Trimethylpentane	Cyclopentene	p-Ethyltoluene
2,2-Dimethylbutane - Neohexane	Dichlorodifluoromethane	Propane
2,3,4-Trimethylpentane	Ethane	Propylene
2,3-Dimethylbutane	Ethyl Benzene	Styrene
2,3-Dimethylpentane	Ethylene	t-1,3-Dichloropropylene
2,4-Dimethylpentane	Isobutane	t-2-Butene
2-Chloropentane	Isopentane	t-2-Hexene
2-Methyl-2-Butene	Isoprene	t-2-Pentene
2-Methylheptane	Isopropylbenzene	Tetrachloroethylene
2-Methylhexane	m & p-Xylene	Toluene
2-Methylpentane - Isohexane	m-Diethylbenzene	Trichloroethylene
3-Methyl-1-Butene	Methyl Chloride	Trichlorofluoromethane
3-Methylheptane	Methylcyclohexane	Vinyl Chloride

List 2. Target Carbonyl Analytes

2,5-Dimethylbenzaldehyde	Formaldehyde	o-Tolualdehyde
Acetaldehyde	Heptaldehyde	Propanal - Propionaldehyde
Acetone	Hexanaldehyde	p-Tolualdehyde
Acrolein	Isovaleraldehyde	Valeraldehyde
Benzaldehyde	Methyl Ethyl Ketone	
Butyraldehyde	(MEK)/Methacrolein	
Crotonaldehyde - 2-Butenal	m-Tolualdehyde	

List 3. Target Metal Analytes

Aluminum ($PM_{2.5}$)	Chromium ($PM_{2.5}$, TSP)	Nickel ($PM_{2.5}$, TSP)
Antimony ($PM_{2.5}$)	Cobalt ($PM_{2.5}$)	Selenium ($PM_{2.5}$)
Arsenic ($PM_{2.5}$)	Copper ($PM_{2.5}$)	Tin ($PM_{2.5}$)
Barium ($PM_{2.5}$)	Manganese($PM_{2.5}$)	Zinc ($PM_{2.5}$)
Cadmium ($PM_{2.5}$)	Molybdenum ($PM_{2.5}$)	

List 4. Target VOC Analytes in AutoGC

1-Butene	Benzene	n-Decane
1-Pentene	c-2-Butene	n-Heptane
1,2,3-Trimethylbenzene	c-2-Pentene	n-Hexane
1,2,4-Trimethylbenzene	Cyclohexane	n-Nonane
1,3-Butadiene	Cyclopentane	n-Octane
1,3,5-Trimethylbenzene	Ethane	n-Pentane
2-Methylheptane	Ethyl Benzene	n-Propylbenzene
2-Methylhexane	Ethylene	o-Xylene
2,2-Dimethylbutane	Isobutane	p-Xylene + m-Xylene
2,2,4-Trimethylpentane	Isopentane	Propane
2,3-Dimethylpentane	Isoprene	Propylene
2,3,4-Trimethylpentane	Isopropyl Benzene - Cumene	Styrene
2,4-Dimethylpentane	Methylcyclohexane	t-2-Butene
3-Methylheptane	Methylcyclopentane	t-2-Pentene
3-Methylhexane	n-Butane	Toluene
Acetylene		