Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Frank Espino, Director
Tony Walker, Air Section Manager
TCEQ Region 4-Dallas/Fort Worth

Date: January 9, 2006

From: Neeraja K. Erraguntla, Ph.D.
Toxicology Section, Chief Engineer's Office

Subject: Health Effects Review of 2004 Ambient Air Network Monitoring Sites in Region 4-Dallas/Fort Worth

Conclusions

- All reported 96 VOCs and metals annual average concentrations at all of the 15 sites, except nickel at the Dallas-Morrell site were below their long-term ESLs and were not a health concern.
- Annual nickel levels at the Dallas-Morrell site have historically exceeded the long-term nickel ESLs and did so again in 2004. Metallic nickel is likely the major form of nickel detected at the site due to emissions from Dal Chrome Co., Inc. However, the presence of other nickel species in the particulate matter samples and other nickel sources in the area cannot be precluded. It should be further emphasized that nickel levels will continue to be monitored and assessed at the Dallas-Morrell site in the future and TS advises reductions in nickel concentrations to levels less than or equal 0.06 $\mu g/m^3$.

Background

This memorandum conveys the Toxicology Section's (TS) evaluation of ambient air sampling conducted at monitoring network sites in Region 4-Dallas/FortWorth during 2004. We reviewed annual summary results for 24- and/or 1-hour Volatile Organic Compounds (VOCs) including carbonyls. Table 1 contains information regarding the 15 sites located in Texas Commission on Environmental Quality (TCEQ) Region 4-Dallas/Fort Worth. We evaluated the reported VOCs expressed in parts per billion by volume (ppb_v) for their potential to cause short-term adverse health effects, odorous conditions, and vegetative damage. We also evaluated annual average VOC concentrations for chronic health effects. In addition, we reviewed summary results for metals from 24-hour $PM_{2.5}$, PM_{10}, and Total Soluble Particulates (TSP) filter samples collected every third or sixth day. Metal concentrations were reported in micrograms per cubic meter ($\mu g/m^3$). The measured chemical concentrations were compared to TCEQ's health based Effects Screening Levels (ESLs).

An ESL is a guideline concentration which is protective of the general public including sensitive members of the population, such as the elderly, children, and persons with pre-existing health conditions. Health-based ESLs are guideline comparisons levels set well below levels at which adverse health effects have been reported in the scientific literature. If an air concentration of a pollutant is below the ESL, we do not expect adverse health effects to occur. If an air concentration of a pollutant is above the health–based ESL, it is not indicative that adverse effects will necessarily occur, but rather that further evaluation may be warranted.

It should be noted that 24-hour air samples are designed to provide representative long-term average concentrations. Therefore, annual averages from 24-hour samples were evaluated for potential chronic health concerns. Twenty-four hour samples do not show short-term peak concentrations, and therefore, have limited use in evaluating potential for acute health effects or odors. One-hour air samples are designed to provide representative short-term concentrations and have utility in evaluating potential acute health and odor concerns.

TS's evaluation may include the estimation of cancer risk. This is accomplished by using EPA's unit risk factors to calculate *upper-bound* excess lifetime cancer risk that is estimated to result from *continuous lifetime exposure* to the 2004 monitored average concentration. However, due to many factors (e.g., population mobility and daily activity patterns, differences in distance and direction from the sources monitored, variability in area emissions, differences in distance and direction from the sources(s) monitored, variability in area emissions, differences in indoor and outdoor concentrations), *the 2004 monitored average concentration at a particular site is not expected to be representative of actual lifetime exposure levels for surrounding communities*. As a result, the risk estimates presented should not be construed to be actual upper-bound excess lifetime cancer risk for the surrounding communities.

These cancer risk estimates are only to allow comparison of potential relative risk, based on the unlikely assumption that the 2004 monitored average concentration is representative of actual lifetime exposure levels. Upper-bound means the true risk may be lower but is unlikely to be higher than the estimate. Excess lifetime cancer risk means the additional or extra risk of developing cancer due to exposure to a toxic substance over the lifetime of an individual. The highest excess cancer risk considered to be acceptable is generally between 1in 10,000 and 1 in 1,000,000 (or 1E-04 to 1E-06) [1]. The target risk goal of TCEQ is 1 excess cancer in 100,000 (1E-05) for individual chemicals and 1 excess cancer in 10, 000 (1E-04) for cumulative risk. This memorandum evaluated air monitoring data on a chemical-by-chemical basis.

Lead was monitored in Region 4- Dallas/Fort Worth. However it was not evaluated in this memorandum since it is a criteria pollutant with a corresponding National Ambient Air Quality Standard (NAAQS).

Evaluation

Except for formaldehyde and methyl ethyl ketone/methacrolein at the Dallas-Hinton and Fort Worth-Northwest sites and nickel at the Dallas-Morrell site, all reported VOCs and metals annual average concentrations were below their long-term ESLs. In addition, 24-and 1-hour concentrations for all reported VOCs and 24-hour concentrations for all reported metals were below levels that would cause acute health effects or odor related health effects. However, it should be noted that because 24-hour composite samples do not provide information about shorter-term and peak concentration, potential for acute health effects and odors could not be fully evaluated.

[1] 40 CFR Ch.1, 300.430, 7-1-98 Edition.

Table 1: Monitoring Site Information for Region 4

County	City and Site Location	EPA Site ID	Monitored Compounds
Collin	Frisco, 6931 Ash St.	48-085-0007	Metals
Collin	Frisco, 5th St.	48-085-0003	Metals
Collin	Frisco, GNB Property	48-085-0009	Metals
Dallas	Dallas, 1415 Hinton St.	48-113-0069	VOCs, Carbonyl, Metals
Dallas	Dallas, 3004 N. Westmoreland	48-113-0057	VOCs, Metals
Dallas	Dallas, 3049 Morrell St	48-113-0018	Metals
Dallas	Dallas, 717 South Akard Street	48-113-0050	Metals
Denton	Denton, Denton Municipal Air port	48-121-0034	VOCs
Ellis	Midlothian, 1241 East Wyatt Road	48-139-0017*	Metals
Ellis	Midlothian, 2725 Old Fort Worth Road	48-139-0016	VOCs
Ellis	Midlothian, 4252 Waterworks	48-139-0015	Metals, VOCs
Kaufman	Kaufman, 3790 South Houston St.	48-257-0005	Metals, VOCs
Tarrant	Fort Worth, 3317 Ross Avenue	48-439-1002	VOCs, Carbonyl
Tarrant	Grapevine, 4100 Fairway Dr.	48-439-3009	VOCs
Hunt	Greenville, 824 Sayle St	48-231-1006	VOCs

* It should be noted that PM_{10} data at the Midlothian-East Wyatt Road site facility was incomplete and did not meet the TCEQ's goal for data completeness of 75 % data return. In addition select VOCs at particular monitoring sites did not meet the TCEQ's goal for data completeness of 75 % data return. Formaldehyde, methyl ethyl ketone/methacrolein and nickel are discussed below.

Formaldehyde

Dallas–Hinton and Fort Worth–Northwest

The annual average formaldehyde concentrations at the Dallas-Hinton (3.25 ppb_v) and at Fort Worth-Northwest sites (3.12 ppb_v) exceeded the long term ESL of 1.2 ppb_v. Assuming continuous lifetime exposure to the measured levels and using the current EPA unit risk factor, cancer risk estimates were 5 excess cancers in 100,000 at both the Dallas-Hinton and the Fort Worth-Northwest sites. However, the current EPA formaldehyde unit risk factor, which was promulgated in 1991 based on rat data from a 1987 study, does not represent the available science in the peer-reviewed literature and is generally believed to substantially overestimate risk. EPA is currently reviewing this risk factor in light of significant new data and analyses. Use of a new risk factor [2] (published in 2004) that incorporates more recent toxicological

[2] 4.77E-7 risk per 0.010 ppm in R.Connolly, et al., 2004. Human Respiratory Tract Cancer Risks of Inhaled Formaldehyde: Dose Response Predictions Derived from Biologically-Motivated Computational Modeling of a Combined Rodent and Human Dataset. Toxicological Sciences 82:1, 279-296.

research affecting formaldehyde carcinogenicity (e.g., anatomical differences between rat and human nasal passages, regional dosimetry throughout the human respiratory tract, mode of action information) results in *de minimus* risk estimates of 1.5 in 10 million and 1 in 10 million for lifetime exposures to formaldehyde levels at the Dallas-Hinton and Fort Worth-Northwest sites respectively. The new risk factor is considered more scientifically defensible as it utilizes more recently available mechanistic and dosimetric science on the dose-response for portal of entry (i.e., respiratory tract) cancers due to formaldehyde exposure.

Methyl Ethyl Ketone/Methacrolein
Dallas-Hinton and Fort Worth-Northwest

The reported methyl ethyl ketone/methacrolein annual average concentrations at the Dallas-Hinton (0.17 ppb_v) and Fort Worth-Northwest sites (0.15 ppb_v) were slightly above the methacrolein long-term ESL of 0.13 ppb_v and would not be expected to cause long-term health effects. The reported high concentration (11.84 ppb_v) at the Fort Worth-Northwest site exceeded the short-term ESL (1.3 ppb_v) by 9 times and would not be expected to cause short-term health effects.

Nickel
Dallas-Morrell

The 2004 annual average nickel concentration (0.33 $\mu g/m^3$) exceeded the long-term ESL (0.015 $\mu g/m^3$) by 22 times. TS is aware of elevated annual nickel levels being detected at the Morrell site since 1987. From 1987 to 1994, the annual nickel concentrations ranged from approximately 0.6 to 0.9 $\mu g/m^3$, with typical values ranging between 0.8 to 0.9 $\mu g/m^3$. Beginning in 1995, the annual nickel levels decreased and since 1997 have stabilized in the range of 0.1 to 0.3 $\mu g/m^3$ (Figure 1). Dal Chrome Co., Inc. (Dal Chrome) is likely the major contributor to the elevated nickel measurements in Dallas County. However, it should be noted that other potential sources may exist in the vicinity of the site and contribute to the observed measurements. The reduction in annual nickel levels first observed in 1995 are attributed to actions taken by Dal Chrome, a known source of nickel upwind from the Morrell site.

Historically, EPA has documented that considerable uncertainty exists in regards to the carcinogenicity of the various forms of nickel. The 1999 National-Scale Air Toxics Assessment (NATA)[3] report characterizes total nickel emissions into two categories: the soluble nickel species (35 %) and the insoluble nickel species (65%) based on studies on nickel speciation from the large nickel-emitting sources (e.g., oil combustion and coal combustion). In addition, the 1999 NATA report assumed that all insoluble nickel is crystalline and reported a unit risk estimate based on evidence of the *carcinogenic effects of insoluble nickel compounds in crystalline form*.

The 2004 annual nickel concentration for the Morrell site is reported as total nickel which is potentially comprised of a variety of different nickel species. Based on the process operations occurring at Dal Chrome, metallic nickel is likely to be the main nickel species emitted from the facility and metallic nickel alone is non-carcinogenic. However, emissions of other nickel species can not be precluded. Therefore, in assessing the nickel levels detected at the Morrell site, it is assumed that a mixture of species is potentially present, with metallic nickel being a predominant form.

Assuming continuous lifetime exposure to the measured nickel levels and using the current unit risk estimate proposed in the 1999 NATA[3] report, the calculated theoretical excess cancer risk estimate at the Morrell site in Dallas was calculated to be 5 excess cancers in 100,000 which exceeds the TCEQ's target risk range of 1 excess cancer in 100,000 (1E-05) for individual chemicals. However, the calculated theoretical risk range is within the USEPA's acceptable risk range of 1 excess cancer in 1,000,000 to 1 excess cancer in 10,000 (1E-06 to 1E-04). TS believes that even assuming all nickel compounds to be carcinogenic the calculated theoretical risk estimates are likely to be conservative in protecting the general public from a theoretical excess cancer risk from nickel exposure. It should be further emphasized that nickel levels will continue to be monitored and assessed at the Morrell site in the future and TS advises reductions in nickel concentrations to be reduced to levels less than or equal to 0.06 $\mu g/m^3$ to reflect TCEQ's theoretical excess cancer risk goal of 1E-05 for individual chemicals.

In addition to cancer, other health concerns from long-term exposure to nickel include effects to the respiratory systems and blood. However it is unclear at this time if these effects are a relevant concern for the monitored annual nickel concentrations. As additional information on the toxicity of nickel becomes available, reassessment and clarification of chronic non-cancer health effects can and will be made.

If you have any questions about this evaluation, please call me at (512)-239-2492 or email me at nerragun@tceq.state.tx.us

cc (via email): Casso, Ruben – EPA Region 6

[3] Health Effects Information Used In Cancer and Non-Cancer Risk Characterization for the 1999 National-Scale Assessment

Appendix 1
Table 1: List of Target Analytes for Community Air Toxics Monitoring Network

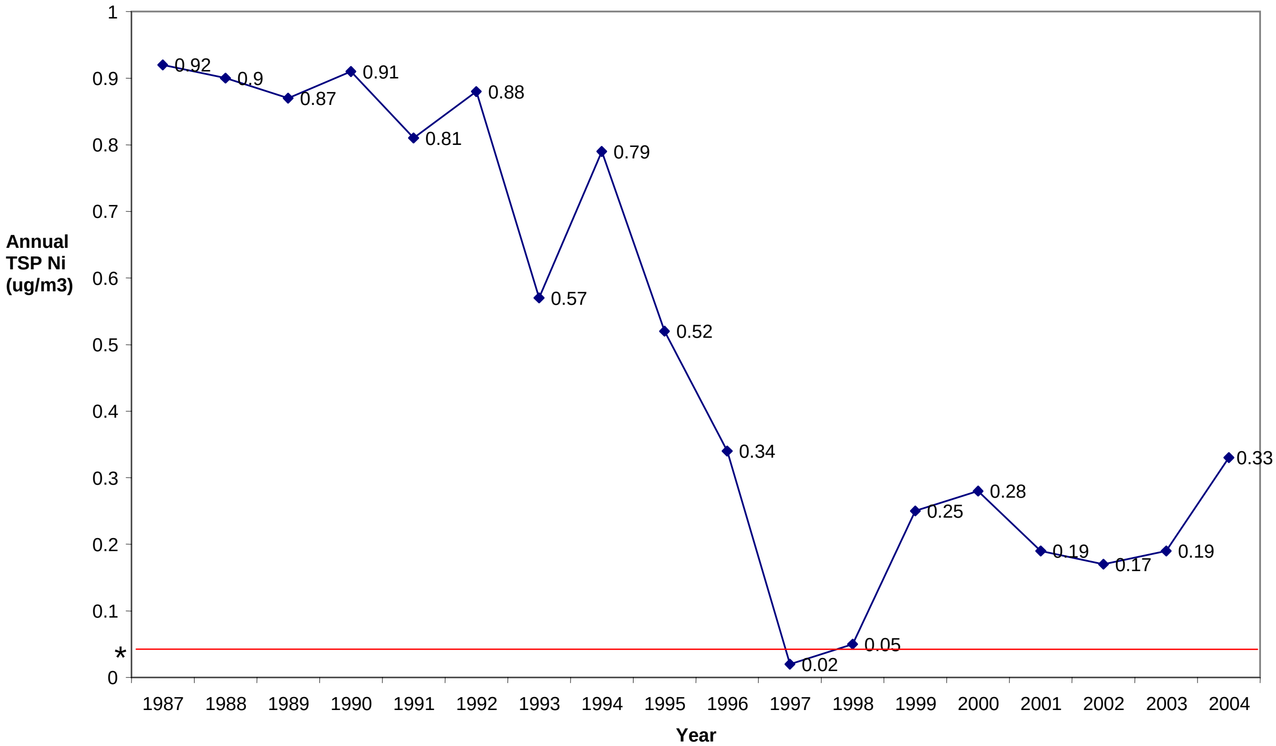
CATMN VOCs		Metals
1,1,1-Trichloroethane	Ethyl Benzene	Aluminum ($PM_{2.5}$, PM_{10})
1,1,2,2-tetrachloroethane	Ethylene	Antimony ($PM_{2.5}$, PM_{10})
1,1,2-Trichloroethane	Isobutane	Arsenic ($PM_{2.5}$, PM_{10})
1,1-Dichloroethylene	Isopentane	Barium ($PM_{2.5}$, PM_{10})
1,2,3-Trimethylbenzene	Isoprene	Beryllium (PM_{10})
1,2,4-Trimethylbenzene	Isopropylbenzene	Cadmium ($PM_{2.5}$, PM_{10})
1,2-Dibromoethane	Methyl Butyl Ketone (MBK)	Chromium ($PM_{2.5}$, PM_{10})
1,2-Dichloroethane	Methyl t-Butyl ether	Cobalt ($PM_{2.5}$, PM_{10})
1,2-Dichloropropane	Methylcyclohexane	Copper ($PM_{2.5}$, PM_{10})
1,3,5-Trimethylbenzene	Methylcyclopentane	Lead ($PM_{2.5}$, TSP)
1,3-Butadiene	Methylene Chloride	Magnesium (PM_{10})
1-Butene	Methylisobutylketone	Manganese($PM_{2.5}$, PM_{10})
1-Hexene+2-methyl-1-pentene	Propane	Mercury ($PM_{2.5}$)
1-Pentene	Propylene	Molybdenum ($PM_{2.5}$, PM_{10})
2,2,4-Trimethylpentane	Styrene	Nickel ($PM_{2.5}$, PM_{10}, TSP)
2,2-Dimethylbutane - Neohexane	Tetrachloroethylene - Perchloroethylene	Selenium ($PM_{2.5}$, PM_{10})
2,3,4-Trimethylpentane	Toluene	Tin ($PM_{2.5}$, PM_{10})
2,3-Dimethylbutane	Trichloroethylene	Zinc ($PM_{2.5}$, PM_{10})
2,3-Dimethylpentane	Trichlorofluoromethane	
2,4-Dimethylpentane	Vinyl Chloride	
2-Butanone	c-2-Butene	
2-Chloropentane	c-2-Hexene	
2-Methyl-2-Butene	c-2-Pentene	
2-Methylheptane	dichlorodifluoromethane	
2-Methylhexane	isobutyraldehyde	
2-Methylpentane - Isohexane	m-Diethylbenzene	
2-methyl-3-hexanone	m-Ethyltoluene	
3-Methyl-1-Butene	methyl chloride	
3-Methylheptane	n-Butane	
3-Methylhexane	n-Decane	
3-Methylpentane	n-Heptane	
3-hexanone	n-Hexane	
3-pentanone	n-Nonane	
4-Methyl-1-Pentene	n-Octane	
Acetylene	n-Pentane	
Benzene	n-Propyl Acetate	
Bromomethane	n-Propylbenzene	
Butyl Acetate	n-Undecane	
Butyraldehyde	o-Ethyltoluene	
CIS 1,3-dichloropropylene	o-Xylene	
Carbon Tetrachloride	p-Diethylbenzene	
Chlorobenzene	p-Ethyltoluene	
Chloroform	p-Xylene + m-Xylene	
Chloroprene	t-2-Butene	
Cyclohexane	t-2-Hexene	
Cyclopentane	t-2-Pentene	
Cyclopentene	trans-1-3-dichloropropylene	
Ethane		
Ethyl Acetate		

MultiCan VOCs		**Carbonyls**
1,1,1-Trichloroethane	Isopentane	2,5-Dimethylbenzaldehyde
1,1,2,2-tetrachloroethane	Isoprene	Acetaldehyde
1,1,2-Trichloroethane	Isopropylbenzene	Acetone
1,1-Dichloroethylene	Methyl Butyl Ketone (MBK)	Acrolein
1,2,3-Trimethylbenzene	Methyl t-Butyl ether	Benzaldehyde
1,2,4-Trimethylbenzene	Methylcyclohexane	Butylaldehyde
1,2-Dibromoethane	Methylcyclopentane	Crotonaldehyde - 2-Butenal
1,2-Dichloroethane	Methylene Chloride	Formaldehyde
1,2-Dichloropropane	Methylisobutylketone	Heptaldehyde
1,3,5-Trimethylbenzene	Propane	Hexanaldehyde
1,3-Butadiene	Propylene	Isovaleraldehyde
1-Butene	Styrene	m-Tolualdehyde
1-Hexene+2-methyl-1-pentene	Tetrachloroethylene - Perchloroethylene	MEK/Methacrolein
1-Pentene	Toluene	o-Tolualdehyde
2,2,4-Trimethylpentane	Trichloroethylene	p-Tolualdehyde
2,2-Dimethylbutane - Neohexane	Trichlorofluoromethane	Propanal - Propionaldehyde
2,3,4-Trimethylpentane	Vinyl Chloride	Valeraldehyde
2,3-Dimethylbutane	c-2-Butene	
2,3-Dimethylpentane	c-2-Hexene	
2,4-Dimethylpentane	c-2-Pentene	
2-Butanone	Dichlorodifluoromethane	
2-Chloropentane	Isobutyraldehyde	
2-Methyl-2-Butene	m-Diethylbenzene	
2-Methylheptane	m-Ethyltoluene	
2-Methylhexane	Methyl chloride	
2-Methylpentane - Isohexane	n-Butane	
2-methyl-3-hexanone	n-Decane	
3-Methyl-1-Butene	n-Heptane	
3-Methylheptane	n-Hexane	
3-Methylhexane	n-Nonane	
3-Methylpentane	n-Octane	
3-hexanone	n-Pentane	
3-pentanone	n-Propyl Acetate	
4-Methyl-1-Pentene	n-Propylbenzene	
Acetylene	n-Undecane	
Benzene	o-Ethyltoluene	
Bromomethane	o-Xylene	
Butyl Acetate	p-Diethylbenzene	
Butyraldehyde	p-Ethyltoluene	
CIS 1,3-dichloropropylene	p-Xylene + m-Xylene	
Carbon Tetrachloride	t-2-Butene	
Chlorobenzene	t-2-Hexene	
Chloroform	t-2-Pentene	
Chloroprene	trans-1-3-dichloropropylene	
Cyclohexane		
Cyclopentane		
Cyclopentene		
Ethane		
Ethyl Acetate		
Ethyl Benzene		
Ethylene		
Isobutane		

Auto-GC VOCs	
1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene 1,3-Butadiene 1-Butene 1-Hexene 1-Pentene 2,2,4-Trimethylpentane 2,2-Dimethylbutane 2,3,4-Trimethylpentane 2,3-Dimethylbutane 2,3-Dimethylpentane 2,4-Dimethylpentane 2-Methyl-1-Pentene 2-Methyl-2-Butene 2-Methylheptane 2-Methylhexane 2-Methylpentane 3-Methyl-1-Butene 3-Methyl-1-Butene+Cyclopentene 3-Methylheptane 3-Methylhexane 3-Methylpentane 4-Methyl-1-Pentene Acetylene Benzene Cyclohexane Cyclopentane Cyclopentene Ethane Ethyl Benzene Ethylene Isobutane Isobutene Isopentane Isoprene Isopropyl Benzene - Cumene Methylcyclohexane Methylcyclopentane Propane Propylene Styrene Toluene a-Pinene b-Pinene c-2-Butene c-2-Hexene c-2-Pentene m-Diethylbenzene m-Ethyltoluene n-Butane	n-Decane n-Heptane n-Hexane n-Nonane n-Octane n-Pentane n-Propylbenzene n-Undecane o-Ethyltoluene o-Xylene p-Diethylbenzene p-Ethyltoluene p-Xylene + m-Xylene t-2-Butene t-2-Hexene t-2-Pentene

Appendix 2

Figure 1 - 2004 Annual TSP Ni (ug/m3) at 3049 Morrell St. in Dallas



*0.06 µg/m3 reflects TCEQ's theoretical excess cancer risk goal of 1 excess in 100,000