TCEQ Interoffice Memorandum

To: Susan Clewis, Regional Director

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Toxicology Division, Office of the Executive Director

Date: September 2, 2016

Subject: Health Effects Review of 2015 Ambient Air Network Monitoring Data in Region 14, Corpus Christi

Conclusions

- All hourly and annual average concentrations of volatile organic compounds (VOCs) reported at automated gas chromatograph (autoGC) monitoring sites were below their short-term and long-term air monitoring comparison values (AMCVs) and would not be expected to cause acute or chronic adverse health effects, vegetation effects, or odor concerns.
- All reported 30-minute rolling averages of hydrogen sulfide (H_2S) at the six reporting monitoring sites (See Table 1) did not exceed the 30-minute state H_2S standard.
- All 24-hour and annual average concentrations of VOCs reported at Region 14 canister samples, with the exception of annual concentrations of ethylene dichloride (EDC) in Point Comfort, were below their respective TCEQ AMCVs and would not be expected to cause acute or chronic adverse health effects, vegetation effects, or odor concerns.
- Annual average EDC concentrations are above our recently updated long-term AMCV. The Toxicology Division (TD) recommends further investigations to reduce ambient EDC concentrations in Point Comfort.
- All 24-hour annual average concentrations of speciated metals reported at Region 14 monitoring sites were below their respective comparison values and would not be expected to cause chronic adverse health effects or vegetation effects.

Background

The primary purpose of this memorandum is to convey the TD's evaluation of ambient air toxics sampling conducted at monitoring sites in Region 14, Corpus Christi during 2015. The TCEQ Monitoring Division reported the data for the TCEQ-operated monitoring sites evaluated in this memorandum, other data were received from the Corpus Christi Air Quality Project (CCAQP), or industry (e.g., Flint Hill Resources, Corpus Christi; Formosa Plastics Corporation, Point Comfort).

The TCEQ evaluated results of ambient air sampling for VOCs, metals from particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$), and H_2S from 20 monitoring sites in TCEQ Region 14, Corpus Christi. VOC data were collected from 24-hour every sixth-day canister samples, 1-hour automated gas chromatographs (autoGC), and 20-minute event-triggered canister samples. Metals data were collected from filters from 24-hour $PM_{2.5}$ samplers. Finally, 5-minute concentrations were collected from H_2S analyzers. Please note that data for criteria pollutants (i.e., compounds having a National Ambient Air Quality Standard) were not evaluated for this memorandum.

Table 1 lists the sampling locations and provides links to more information on the TCEQ and CCAQP sites. Lists of target analytes at these monitoring locations are also included in Attachment A. Figure 1 is a map indicating the specific locations of the TCEQ, CCAQP, and CCNET air monitoring sites in Corpus Christi, Texas. Figure 2 is a map indicating the specific locations of the Formosa Plastic Corporation air monitoring sites in Point Comfort, Texas. For additional information on event-triggered VOC canister sampling data from the CCAQP network, please see http://www.utexas.edu/research/ceer/ccaqp/canister_data.htm.

Measured chemical concentrations were compared to appropriate comparison values (e.g., TCEQ health-, odor-, and vegetation-based AMCVs or the state H_2S standard) to evaluate the potential for adverse health or welfare effects. For the short-term health and welfare evaluations, the TD compared the hourly measured concentrations of the VOCs collected from autoGC sites to their respective short-term AMCVs. In addition, 5-minute H_2S concentrations were averaged to calculate rolling 30-minute concentrations that were compared to the state regulatory standards of 80 ppb (non-industrial areas) and 120 ppb (industrial areas). Because short-term or peak concentrations may be significantly different than 24-hour sample concentrations, 24-hour concentrations have limited use in evaluating the potential for acute health effects. In order to be able to evaluate 24-hour monitoring data collected every sixth-day more fully, TCEQ has developed 24-hour AMCVs for specific chemicals. As such, 24-hour samples were compared to the available TCEQ 24-hour AMCVs for benzene, 1,3-butadiene, and EDC. Finally, the annual averages of 1-hour autoGC and 24-hour samples (VOCs and metals) were compared to their respective long-term AMCVs to evaluate the potential for chronic health and vegetation effects. More information about AMCVs is available online at: https://www.tceq.texas.gov/toxicology/AirToxics.html#list.

All data collected at TCEQ monitors were analyzed by the TCEQ laboratory and met a 75% data completeness objective, including the CCAQP autoGC data.

Evaluation

Short-Term (Hourly, 24-hour, and Event-Triggered) Data

VOCs

The reported hourly average concentrations of each of the 46 VOCs reviewed from CCAQP (Oak Park and Solar Estates) and the TCEQ (Corpus Christi Palm) autoGC monitoring sites, as well as benzene from the benzene-only CCNET (Corpus Christi Huisache) autoGC monitoring site, were below their respective short-term health- and odor-based AMCVs. Similarly, all 24-hour canister VOC concentrations were below respective 24-hour health- and odor-based AMCVs. The reported 24-hour benzene, 1,3-butadiene, and EDC concentrations from CCAQP, TCEQ, CCNET, and Formosa Plastics Corporation sponsored monitoring networks were below their respective 24-hour AMCVs. The reported 20-minute VOC concentrations from CCAQP event-triggered canisters were also below TCEQ's respective acute AMCVs. Therefore, acute adverse health or vegetation effects and odor nuisances are not expected to occur as a result of short-term exposure to the reported levels of these chemicals.

Hydrogen Sulfide (H_2S)

All reported 30-minute rolling averages at each of the six H_2S monitors were below the state 30-minute H_2S standards for industrial and non-industrial properties.

Long-Term Data

VOCs

The TD compared the calculated annual average concentrations for each targeted VOC to their respective long-term AMCVs to evaluate the potential for chronic health and vegetation effects. Annual average concentrations of 46 VOCs at the Oak Park and Solar Estates CCAQP autoGC monitoring sites and the Corpus Christi Palm TCEQ autoGC monitoring site, as well as the annual average benzene concentration at the CCNET Corpus Christi Huisache monitoring site, were reported to be below their respective long-term AMCVs. The reported annual average concentrations of the 84 VOCs evaluated at the TCEQ canister monitoring sites (i.e., Corpus Christi Huisache, Corpus Christi Hillcrest, and Dona Park) were also below their respective long-term AMCVs. The reported annual average concentrations of the 17 VOCs evaluated at FHR monitoring sites were below their respective long-term AMCVs. With the exception of EDC, all reported annual average concentrations at the five Formosa Plastics Corporation monitoring sites were below their respective long-term AMCVs. Exposure to VOC concentrations below their respective long-term AMCVs would not be expected to result in long-term adverse health or vegetation effects. Further discussion about the reported annual EDC concentrations that exceeded the long-term AMCV is provided below.

Ethylene dichloride (EDC)
Formosa Plastics Corporation in Point Comfort runs an ambient air monitoring network targeting five VOCs (ethylene, 1,3-butadiene, benzene, vinyl chloride, and EDC). Reported

annual EDC averages at four of the five Formosa monitoring sites exceeded the long-term AMCV (see Figure 2 & 3). Several 24-hour EDC values ranging from 0.71 to 42 ppb at the PC Plant Site in the fourth quarter of 2015 helped to drive the reported annual average concentrations over both the previous and current long-term AMCVs of 1 and 0.71 ppb, respectively. Despite available 2016 first and second quarter data reporting a narrower range of 24-hour EDC values (0.71 to 12 ppb) that supports lower six-month averages, to-date rolling annual averages at four of the five Formosa monitoring sites remain above the long-term AMCV. In response to these elevated EDC concentrations, the TCEQ has launched an investigation to determine whether the 2015 and available 2016 reported concentrations warrant recommending this area of Point Comfort for the Air Pollutant Watch List (APWL). This has included gathering and evaluating information requested from the Formosa facility in Point Comfort on sources and activities that could have potentially contributed to reported EDC concentrations.

Metals

All annual average $PM_{2.5}$ metals concentrations collected at the Corpus Christi Dona Park monitoring site were below their respective comparison values. Exposure to these reported concentrations would not be expected to result in long-term adverse health effects.

If you have any questions regarding the content of this review, please do not hesitate to contact Darrell McCant by phone at (512) 239-4477 or via email at Darrell.McCant@tceq.texas.gov or Lindsey Jones by phone at (512) 239-1784 or via email at Lindsey.Jones@tceq.texas.gov.

Table 1: Air Monitoring Sites in Region 14, Corpus Christi

Site Name and Location	EPA Site ID	Network	County	Monitored Compounds
Corpus Christi Hillcrest 1802 Nueces Bay Blvd	48-355-0029	TCEQ	Nueces	VOCs (every 6th-day 24-hr canister)
Corpus Christi Huisache 3810 Huisache St	48-355-0032	TCEQ/CCNET	Nueces	VOCs (every 6th-day 24-hr canister);VOC (autoGC, benzene only); 5-min H_2S
Dona Park 5707 Up River Rd	48-355-0034	TCEQ/CCAQP	Nueces	VOCs (every 6th-day 24-hr canister); Metals (every 6th-day 24-hr $PM_{2.5}$); VOCs (20-min event-triggered canister); 5-min H_2S
Corpus Christi Palm 1511 Palm Drive	48-355-0083	TCEQ	Nueces	VOCs (autoGC)
Crossley Elementary School (CC01) (27.80118, -97.41633)	N/A	CCNET	Nueces	VOCs (split schedule 24-hr canister)
FHR Easement 8401B Up River Road	48-355-0039	CCAQP	Nueces	VOCs (20-min event-triggered canister); 5-min H_2S
J.I Hailey Site 2702B East Navigation Blvd	48-355-0037	CCAQP	Nueces	VOCs (20-min event-triggered canister); 5-min H_2S
Oak Park 842 Erwin St	48-355-0035	CCAQP	Nueces	VOCs (autoGC)
Oak Park Elementary School (CC02) (27.79940, -97.43255)	N/A	CCNET	Nueces	VOCs (split schedule 24-hr canister)
Port Grain Elevator 2001B East Navigation Blvd	48-355-0036	CCAQP	Nueces	VOCs (20-min event-triggered canister); 5-min H_2S
Point Comfort Park Site (28.68183, -96.56072)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 6th-day 24-hr canister)

Site Name and Location	EPA Site ID	Network	County	Monitored Compounds
Point Comfort City Hall Site (28.67776, -96.55440)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 6th-day 24-hr canister)
Point Comfort School Site (28.67806, -96.55776)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 6th-day 24-hr canister)
Point Comfort Plant Site (28.68161, -96.55162)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 2nd-day 24-hr canister)
Point Comfort North Site (28.71832, -96.55507)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (once a month)
Solar Estates 9122 Leopard St	48-355-0041	CCAQP	Nueces	VOCs (autoGC); 5-min H_2S
Tuloso-Midway Middle School (KH01) (27.83317, -97.55750)	N/A	FHR	Nueces	VOCs (every 6th and/or 12th-day 24-hr canister)
Tuloso-Midway Elementary School (KH02) (27.82167, -97.52500)	N/A	FHR	Nueces	VOCs (every 6th and/or 12th-day 24-hr canister)
Up River Road (CC03) (27.80883, -97.47533)	N/A	CCNET	Nueces	VOCs (every 6th and/or 12th-day 24-hr canister)
Williams Park 2518 Dempsey Rd	48-355-1024	TCEQ	Nueces	VOCs (20-min event-triggered canister)

Abbreviations:
CCAQP – Corpus Christi Air Quality Project
CCNET – Corpus Christi Industrial Monitoring Network Air Quality Program
FHR – Flint Hills Resources
H_2S – hydrogen sulfide
$PM_{2.5}$ – particulate matter of 2.5 micrometers or less in diameter
TCEQ – Texas Commission on Environmental Quality
VOC – volatile organic compound

Attachment A

List 1. Target VOC Analytes at TCEQ and/or Industrial Canister Sites (Formosa Plastics Corporation and CCNET)

1,1,2,2-Tetrachloroethane	Carbon Tetrachloride	Methyl Chloroform (1,1,1-Trichloroethane)
1,1,2-Trichloroethane	Chlorobenzene	Methylcyclohexane
1,1-Dichloroethane	Chloroform	Methylcyclopentane
1,1-Dichloroethylene	Chloromethane (Methyl Chloride)[2]	Methyl t-Butylether[2]
1,2,3-Trimethylbenzene	Cis-1,3-Dichloropropene	Naphthalene[2]
1,2,4-Trimethylbenzene[2]	Cis-2-Butene	N-Butane
1,2-Dichloropropane	Cis-2-Hexene	N-Decane
1,3,5-Trimethylbenzene	Cis-2-Pentene	N-Heptane
1,3-Butadiene [1,2]	Cyclohexane[2]	N-Hexane[2]
1-Butene	Cyclopentane	N-Nonane
1-Hexene+2-Methyl-1-Pentene	Cyclopentene	N-Octane
1-Pentene	Dichlorodifluoromethane	N-Pentane
2,2,4-Trimethylpentane	Dichloromethane	N-Propylbenzene
2,2-Dimethylbutane (Neohexane)	(Methylene Chloride)	N-Undecane
2,3,4-Trimethylpentane	Ethane	O-Ethyltoluene
2,3-Dimethylbutane	Ethylbenzene [2]	O-Xylene[2]
2,3-Dimethylpentane	Ethylene[1,2]	P-Diethylbenzene
2,4-Dimethylpentane	Ethylene Dibromide (1,2-Dibromoethane)	P-Ethyltoluene
2-Chloropentane	Ethylene Dichloride (1,2-Dichloroethane) [1]	Propane
2-Methyl-2-Butene	Isobutane	Propylene[2]
2-Methylheptane	Isopentane (2-Methylbutane)	Styrene[2]
2-Methylhexane	Isoprene	Tetrachloroethylene[2]
2-Methylpentane (Isohexane)	Isopropylbenzene (Cumene)	Toluene[2]
3-Methyl-1-Butene	M-Diethylbenzene	Trans-1,3-Dichloropropene
3-Methylheptane	M-Ethyltoluene	Trans-2-Butene
3-Methylhexane	M/P Xylene[2]	Trans-2-Hexene
3-Methylpentane		Trans-2-Pentene
4-Methyl-1-Pentene		Trichloroethylene[2]
Acetylene		Trichlorofluoromethane
Benzene[1,2]		Vinyl Chloride[1]
Bromomethane		

[1] Formosa Plastics Corporation Target Analytes
[2] CCNET & FHR Target Analytes (Methyl t-Butylether and Naphthalene are CCNET only)

List 2. Target Metal Analytes

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

List 3. Target Analytes at AutoGC and CCAQP Event-Triggered Sites

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

[1] AutoGCs only
[2] Only Target Analyte at the CCNET - Huisache autoGC
[3] Only in CCAQP Event-Triggered Canisters

Figure 1: Air Monitor Locations in the Corpus Christi Bay Area, Nueces County, Texas

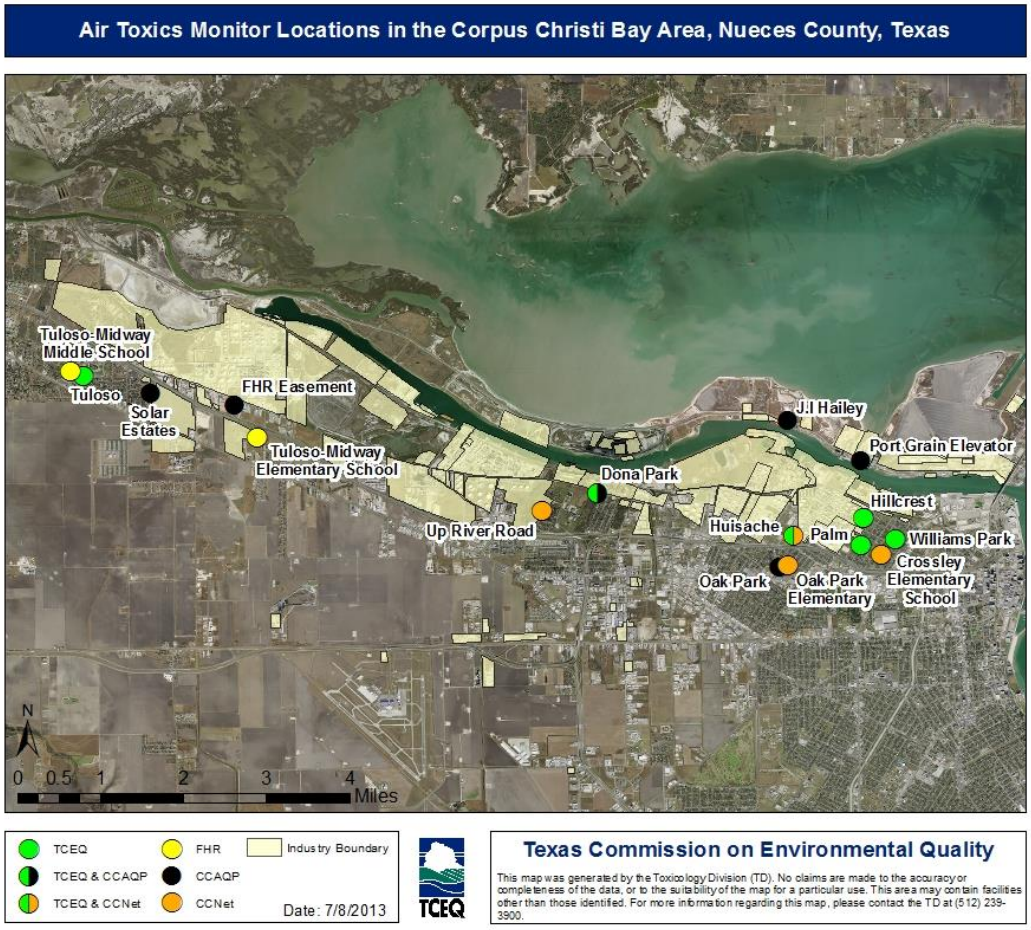

Figure 2: Industry-Sponsored Air Toxics Monitoring Locations in Point Comfort, Calhoun County, Texas

Figure 3: 2008 – 1&2Q 2016 Annual Average EDC Concentrations at Formosa Plastics Corporation, Point Comfort, TX (24-hour canister)