TCEQ Interoffice Memorandum

То:	Melanie Edwards, Regional Director, R14
From:	Lisa Westbrook, MS ${\cal L}{\cal W}$ Toxicology, Risk Assessment, and Research Division, Office of the Executive Director
Date:	May 16, 2025
Subject:	Health Effects Review of 2023 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 respective TCEQ 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 24-hour and annual average concentrations of metals and VOCs reported at canister monitoring sites, with the exception of the annual average concentrations of benzaldehyde at the Oak Park Elementary School monitoring site and ethylene dichloride and vinyl chloride at the Point Comfort Plant monitoring site, were below their respective TCEQ AMCVs. Exposure to all 24-hour and annual average VOC and metal concentrations would not be expected to result in long-term adverse health effects or vegetation effects.
 - The long-term concentration of benzaldehyde at the Oak Park Elementary School monitoring site exceeded the long-term (i.e., lifetime) AMCV up to 4.8 times.
 - The long-term concentration of ethylene dichloride (EDC) at the Point Comfort Plant monitoring site exceeded the long-term AMCV up to 1.01 times.
 - The long-term concentration of vinyl chloride (VC) at the Point Comfort Plant monitoring site was at the long-term AMCV.
- Reported concentrations of hydrogen sulfide (H₂S) were below the numerical value of the 30-minute state standard for residential areas.

Background

The primary purpose of this memorandum is to convey the Toxicology, Risk Assessment, and Research Division's (TD's) evaluation of ambient air toxics sampling conducted at ambient air monitoring sites in Region 14, Corpus Christi during 2023. The TCEQ Monitoring Division reported the data for the TCEQ-operated monitoring sites evaluated in this memorandum; other data were received from the industry sponsored ambient air networks: Cheniere Energy and Gulf Coast Growth Ventures (GCGV), Valero, and Formosa, in San Patrico, Nueces, and

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Calhoun Counties, respectively.

The TCEQ Toxicology, Risk Assessment, and Research Division (TD) evaluated ambient air sampling data for VOCs from 24-hour canister samples and 1-hour autoGC samples, 24-hour speciated metals samples from filters designed to collect particulate matter with an aerodynamic diameter of 2.5 micrometers or less (PM_{2.5}), and 30-minute rolling averages of hydrogen sulfide (H₂S) samples from monitoring sites in TCEQ Region 14, Corpus Christi (see Table 1 for the specific monitored compounds at each of the sites). Except for lead, data for criteria pollutants (i.e., compounds having a National Ambient Air Quality Standard) were not evaluated for this memorandum. For a complete list of all chemicals evaluated, please see List 1, List 2, and List 3 in Attachment A.

One-hour autoGC VOC data were evaluated for potential acute health, odor, and vegetation concerns, as were any 24-hour canister samples (e.g., VOCs, metals). 30-minute H₂S data was accessed to evaluate state standards. Twenty-four-hour air samples (canister) collected every 2nd, 6th or 12th day or once a month on a yearly basis are designed to provide representative long-term average concentrations. In order to be able to evaluate 24-hour monitoring data more fully, the TCEQ has developed 24-hour AMCVs for specific chemicals. As such, 24-hour samples were compared to the available TCEQ 24-hour AMCVs for the following:

- 1,3-butadiene
- 2,2-dimethylbutane
- 2,3-dimethylbutane
- 2-methylpentane
- 3-methylpentane
- aluminum
- arsenic
- benzene
- cadmium
- carbon tetrachloride

- chromium
- cobalt
- ethylene dibromide
- ethylene dichloride
- manganese
- molybdenum
- nickel
- n-hexane
- vanadium

However, because short-term or peak concentrations may be significantly different than 24hour sample concentrations, daily concentrations have limited use in evaluating the potential for acute health effects, unlike the shorter-term data reviewed herein (e.g., 1-hour autoGC data, 30-minute H₂S data). The annual averages from 1-hour autoGC and 24-hour samples (VOCs and metals) were evaluated for potential chronic health and vegetation concerns. Measured chemical concentrations were compared to appropriate comparison values (e.g., the National Ambient Air Quality Standards (NAAQS) value for lead, TCEQ health-, odor-, and vegetation-based AMCVs). More information about AMCVs is available online at: https://www.tceq.texas.gov/toxicology/amcv/about.

All data collected at TCEQ monitors are analyzed by the TCEQ laboratory and should meet a 75% data completeness objective. At industry sponsored monitors, data are collected by a

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third-party contractor and should also meet a 75% data completeness objective. Thus, only long-term data that met the 75% completeness objective were evaluated in this memorandum.

Site Name and Location	EPA Site ID	Network	County	Monitored Compounds
<u>Corpus Christi</u> <u>Hillcrest</u> 1802 Nueces Bay Blvd	48-355-0029	TCEQ	Nueces	VOCs (every 6 th -day 24-hr canister)
Corpus Christi Palm 1511 Palm Drive	48-355-0083	TCEQ	Nueces	VOCs (autoGC)
<u>Dona Park</u> 5707 Up River Rd	48-355-0034	TCEQ	Nueces	VOCs (every 6 th -day 24-hr canister) & PM _{2.5} Metals
<u>Corpus Christi</u> <u>Huisache</u> 3810 Huisache St	48-355-0032	TCEQ	Nueces	VOCs (every 6 th -day 24-hr canister) & H ₂ S
Oak Park Elementary School (27.79940, -97.43255)	N/A	Valero	Nueces	VOCs (every 6 th -day for first quarter and every 12 th -day thereafter 24-hr canister) ^a
Point Comfort Plant Site (28.68161, -96.55162)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 2 nd -day 24-hr canister)
Point Comfort City Hall Site (28.67776, -96.55440)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 6 th -day 24-hr canister)
Point Comfort Training Center Site (28.67806, -96.55776)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 6 th -day 24-hr canister)
Point Comfort Park Site (28.68183, -96.56072)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 6 th -day 24-hr canister)

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

Site Name and Location	EPA Site ID	Network	County	Monitored Compounds
Point Comfort North Site (28.71832, -96.55507)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (once a month 24- hr canister)
Gregory Fresnos Site Stephen F. Austin Elementary; 401 Fresnos St. Gregory	N/A	Gregory- Portland ^b	San Patricio	VOCs (AutoGC)
Portland Buddy Ganem Site Gregory Portland High School; 307 Buddy Ganem St.	N/A	Gregory- Portland ^b	San Patricio	VOCs (AutoGC), EtO ^c (every 6 th -day 24-hr canister)
Portland Broadway Site Old East Cliff Elementary; 175 Broadway Blvd.	N/A	Gregory- Portland ^b	San Patricio	VOCs (AutoGC), EtO ^c (every 6 th -day 24-hr canister)

^a Sample schedule changed seasonally to account for changes in seasonal weather patterns and to make monitoring at this location more economical for the industry sponsored monitor.

^b Gregory-Portland – Cheniere Energy and GCGV

^c Reported concentrations of EtO are semi-quantitative and experimental

Abbreviations: H_2S – hydrogen sulfide; $PM_{2.5}$ – particulate matter of 2.5 micrometers or less in diameter; VOC – volatile organic compound; EtO – ethylene oxide

Evaluation

Short-Term Data (30-minute, Hourly, and 24-hour)

VOCs and Metals

The reported hourly average concentrations of the targeted VOCs measured were either not detected or were below their respective short-term AMCVs. Similarly, all available 24-hour VOC canister and metals concentrations were below their respective 24-hour AMCVs. Therefore, acute adverse health or vegetation effects and odors are not expected to occur as a result of short-term exposure to the reported levels of these chemicals.

Hydrogen Sulfide (H₂S)

All reported 30-minute rolling averages at the Corpus Christi Huisache site were below the level of the state 30-minute H₂S standard (80 ppb).

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Long-Term Data (Annual Averages)

VOCs

The TD compared the calculated annual average concentrations for each target VOC to their respective long-term (i.e., lifetime) AMCVs to evaluate the potential for chronic health and vegetation effects. Annual average concentrations of all the targeted VOCs, except for benzaldehyde at the Oak Park Elementary School site and ethylene dichloride and vinyl chloride at the Point Comfort Plant monitoring site, were below their respective long-term AMCVs. Exposure to the annual average VOC concentrations would not be expected to result in long-term adverse health or vegetation effects. Discussions of the reported annual concentrations for benzaldehyde at the Oak Park Elementary School, and ethylene dichloride and vinyl chloride at the Point Comfort Plant monitoring site are provided below.

Benzaldehyde

During 2023, the Oak Park Elementary School site exceeded the benzaldehyde long-term (i.e., lifetime) AMCV of 2.1 ppb with an annual average of 10 ppb, which is almost 5 times higher than the AMCV. Benzaldehyde was first reported as an analyte at this site in 2022 and the annual average for that year was 4.5 ppb, which was 2 times higher than the AMCV.

The Oak Park Elementary School site has a canister sampler that collects 24-hour samples every 6th day for the first quarter (January – March) and every 12th day for the reminder of the year (April – December). Due to the seasonality of this sampler, the first quarter has a higher number of samples than the second through fourth quarter of data. In order to have a representative annual average, each quarter was averaged and then multiplied by 0.25 to give it a 25% representative weight for the year. The four temporally-weighted averages were then summed to obtain the representative annual average.

Benzaldehyde is a colorless-to-yellowish liquid with a bitter almond odor. It is used as a food additive and in perfumes. The odor threshold for benzaldehyde is reported as 42 ppb¹. Exposure to, or inhalation of, sufficiently high air concentrations may irritate the eyes, nose, and throat. The long-term AMCV for benzaldehyde is based on an occupational 8-hour time weighted average (TWA) workplace environmental exposure limit (WEEL) developed by the American Industrial Hygiene Association (AIHA). The WEEL is set at a concentration where there is a strong odor without irritation (2,100 ppb); exposures to benzaldehyde concentrations at or below the WEEL prevent respiratory tract and eye irritation in worker populations. The TCEQ very conservatively reduced the benzaldehyde occupational value by a factor of one thousand to derive the long-term value for use in air permit applications (2.1 ppb). In 2019, the Research Institute for Fragrance Materials² published a review that examined the safety of

¹ Source: New Jersy Department of Health and Senior Services Benzaldehyde Hazard Summary (<u>https://nj.gov/health/eoh/rtkweb/documents/fs/0196.pdf</u>)

² Api, et al. 2019. RIFM fragrance ingredient safety assessment, benzaldehyde, CAS Registry Number 100-52-7. Food and Chemical Toxicology. 134:2. DOI: 110878.

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benzaldehyde. In that scientific publication, a lowest observed adverse effect level (LOAEL) of 500,000 ppb was identified in rats for nasal and ocular irritation. Utilization of this LOAEL and applying the maximum uncertainty factors (i.e., total UF of 3,000; TCEQ 2015³) yields a calculated safe level of 167 ppb (e.g., 500,000 ppb / total UF of 3,000 = 167 ppb), which is 16.5 times higher than the calculated annual average of 10 ppb. This information provides context to demonstrate that the TCEQ's benzaldehyde AMCV (2.1 ppb) is very conservative, so exposure to a 10 ppb annual average concentration that exceeds the AMCV would not be expected to cause any adverse health effects.

Ethylene dichloride (EDC)

During 2023, the Plant site in the Formosa Point Comfort Network reported an annual average of EDC (0.73 ppb) that slightly exceeded the EDC long-term (i.e., life-time) AMCV of 0.72 ppb (by 1.01 times). The highest EDC concentration measured in 2023 was 17.9 ppb measured on 9/30/2023. This value is approximately 2.5 times higher than the next highest concentration measured in 2023 (6.83 ppb). The facility had an incident on 9/29/2023 that resulted in EDC and VC emissions. The elevated level of EDC measured on 9/30/2023 could potentially have been affected by this emission event. While this high concentration contributed to the slight exceedance of the long-term AMCV, it is indicative of an overall increase in EDC concentrations observed since 2022. However, because of Formosa's proximity to residential areas and the increase of EDC since 2022, the TD continues to encourage efforts to mitigate ambient EDC concentrations in Point Comfort, TX, so that the annual average is below the long-term health-based AMCV.

Vinyl chloride (VC)

During 2023, the Plant site in the Formosa Point Comfort Network reported an annual average of VC (0.47 ppb) that was equal to the VC long-term (i.e., life-time) AMCV of 0.47 ppb. The highest VC concentration measured in 2023 was 25.5 ppb measured on 9/30/2023. This value is approximately 4.2 times higher than the next highest VC concentration (6.02 ppb). The facility had an incident on 9/29/2023 that resulted in EDC and VC emissions. The elevated level of VC measured on 9/30/2023 could potentially have been affected by this emission event. It is noted that the annual average is at the value of the AMCV, and we would not expect adverse health effects as a result of exposure to this concentration. However, the TD encourages efforts to mitigate ambient VC concentrations in Point Comfort, TX, so that the annual average does not go above the long-term health-based AMCV.

Metals

All annual average PM_{2.5} metals concentrations collected at the Corpus Christi Dona Park monitoring site were below their respective long-term 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

³ TCEQ 2015 Guidelines to develop toxicity factors. RG-442

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contact Lisa Westbrook (512-239-1160) or Lisa.Westbrook@tceq.texas.gov.

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Attachment A

List 1. Target VOC Analytes at Canister Sites

Benzene 1,2 1.1.2.2-Tetrachloroethane 1,1,1-Trichloroethane² Bromomethane 1,1,2-Trichloroethane Butyraldehyde² 1,1-Dichloroethane² Carbon Tetrachloride² 1,2-Dichloroethane² Chlorobenzene 1,1-Dichloroethylene² Chloroform 1,2,3-Trimethylbenzene Chloromethane (Methyl 1,2,4-Trimethylbenzene² Chloride)² Cis-1,3-Dichloropropene² 1,2-Dichloropropane 1,3,5-Trimethylbenzene Cis-2-Butene 1,3-Butadiene ^{1,2} Cis-2-Hexene 1-Butanol² Cis-2-Pentene 1-Butene Cyclohexane² 1-Hexene+2-Methyl-1-Pentene Cyclopentane Cyclopentene 1-Pentene 2,2,4-Trimethylpentane Dichlorodifluoromethane 2,2-Dimethylbutane (Neohexane) Dichloromethane 2,3,4-Trimethylpentane (Methylene Chloride) Ethane 2,3-Dimethylbutane Ethylbenzene² 2,3-Dimethylpentane Ethylene 1,2 2,4-Dimethylpentane 2-Chloropentane Ethylene Dibromide (1,2-2-Methyl-2-Butene Dibromoethane) Ethylene Dichloride (1,2-2-Methylheptane 2-Methylhexane Dichloroethane)¹ 2-Methylpentane (Isohexane) Ethylene Oxide³ 3-Methyl-1-Butene Isobutane 3-Methylheptane Isopentane (2-3-Methylhexane Methylbutane) 3-Methylpentane Isoprene 4-Methyl-1-Pentene Isopropylbenzene (Cumene) Acetylene M-Diethylbenzene Benzaldehyde² M-Ethyltoluene

M/P-Xylene² Methyl Chloroform (1,1,1-Trichloroethane) Methylcyclohexane Methylcyclopentane Methyl tert-Butyl ether² Naphthalene² N-Butane N-Decane N-Heptane N-Hexane² N-Nonane N-Octane N-Pentane N-Propylbenzene³ N-Undecane O-Ethyltoluene O-Xylene² P-Diethylbenzene P-Ethyltoluene Propane Propylene² Styrene² Tetrachloroethylene² Toluene² Trans-1,3-Dichloropropene² Trans-2-Butene Trans-2-Hexene Trans-2-Pentene Trichloroethylene² Trichlorofluoromethane Vinyl Chloride ¹

¹ Formosa Plastics Corporation

² Valero

³ Gregory-Portland (Portland-Buddy Ganem & -Broadway sites only)

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List 1. 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})	Vanadium (PM _{2.5})
		Zinc (PM _{2.5})

List 2. Target Analytes at AutoGC Sites

1-Butene	Benzene	N-Heptane
1-Pentene	Cis-2-Butene	N-Hexane
1,2,3-Trimethylbenzene	Cis-2-Pentene	N-Nonane
1,2,4-Trimethylbenzene	Cyclohexane	N-Octane
1,3-Butadiene	Cyclopentane	N-Pentane
1,3,5-Trimethylbenzene	Ethane	N-Propylbenzene
2-Methylheptane	Ethyl Benzene	O-Xylene
2-Methylhexane	Ethylene	P-Xylene + M-Xylene
2,2-Dimethylbutane	Isobutane	Propane
2,2,4-Trimethylpentane	Isopentane	Propylene
2,3-Dimethylpentane	Isoprene	Styrene
2,3,4-Trimethylpentane	Isopropyl Benzene – Cumene	Trans-2-Butene
2,4-Dimethylpentane	Methylcyclohexane	Trans-2-Pentene
3-Methylheptane	Methylcyclopentane	Toluene
3-Methylhexane	N-Butane	
Acetylene	N-Decane	