



TCEQ Interoffice Memorandum

To: Susan Clewis, Regional Director

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Toxicology Division, Office of the Executive Director

Date: November 29, 2017

Subject: Health Effects Review of 2016 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 (H₂S) at the six reporting monitoring sites (See Table 1) did not exceed the 30-minute state H₂S standard.
- All 24-hour and annual average concentrations of VOCs reported at Region 14 canister sites, with the exception an annual concentration of ethylene dichloride (EDC) from a site 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.
- An annual average EDC concentration at one of five monitoring sites was above the long-term AMCV. This downward trend is an improvement from 2015, and the Toxicology Division (TD) continues to support efforts aimed at reducing ambient EDC concentrations in Point Comfort.
- All 24-hour and annual average concentrations of speciated metals from particulate matter with an aerodynamic diameter of 2.5 micrometers or less (PM_{2.5}) reported at Region 14 monitoring sites were below their respective comparison values and would not be expected to cause acute or chronic adverse health effects or vegetation effects.

Background

The primary purpose of this memorandum is to convey the Toxicology Division's (TD's) evaluation of ambient air toxics sampling conducted at monitoring sites in Region 14, Corpus Christi during 2016. 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), and regulated entities (e.g., Corpus Christi Industrial Monitoring Network Group (CCNET) made up of CITGO, Valero, and Flint Hill Resources, Corpus Christi; Formosa Plastics Corporation, Point Comfort).

The TD evaluated results of ambient air sampling for VOCs, metals from PM_{2.5}, and H₂S from 20 monitoring sites in TCEQ Region 14, Corpus Christi (see Table 1). 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 H₂S analyzers. Except for lead, data for criteria pollutants (i.e., compounds having a National Ambient Air Quality Standard) were not evaluated for this memorandum.

Attachment A contains a list of the target analytes evaluated for this review. Table 1 lists the sampling locations and provides links to more information on the TCEQ and CCAQP sites. 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 H₂S 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 H₂S 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) found in 30 Texas Administrative Code §§ 112.31 and 112.32. Individual 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
- benzene
- cadmium
- chromium
- cobalt
- ethylene dichloride
- n-hexane

Reported annual averages from 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 from monitoring sites intended to measure annual averages are expected to meet a 75% data completeness objective to ensure that data are representative of ambient conditions throughout the year. Due to its deactivation in May 2016, target analytes from the Oak Park autoGC did not meet the 75% data completeness objective. In addition, 1,2,3-trimethylbenzene and 2,4-dimethylpentane from the Corpus Christi Palm autoGC and acetylene from the Solar Estates autoGC did not meet the 75% data completeness objective. These data were excluded from this evaluation for the potential for long-term health effects.

Evaluation

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

VOCs

The reported hourly average concentrations of each of the 46 VOCs measured at the Oak Park (January-May), Solar Estates (January-December), and Corpus Christi Palm (January-December) autoGC monitoring sites, as well as benzene from the benzene-only CCNET Corpus Christi Huisache autoGC monitoring site (January-December), were either not detected or were below their respective short-term and 24-hour AMCVs. Similarly, all 24-hour VOC canister concentrations from CCAQP, TCEQ, CCNET, and Formosa Plastics Corporation sponsored monitoring networks were below their respective 24-hour AMCVs. In addition, there were only four 20-minute event-triggered VOC canister samples collected in 2016 from two of the four active CCAQP event-triggered canister sites (Dona Park CAMS 635 and Port Grain Elevator). Three event-triggered canister sites (Port Grain Elevator, J.I. Hailey, and FHR Easement) were deactivated on May 23, 2016. Having said that, all 2016 reported 20-minute event-triggered VOC concentrations were below TCEQ's respective acute 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 each of the six H₂S monitors were below the state 30-minute H₂S standards for industrial and non-industrial properties. Five of the six H₂S monitors were deactivated in May 2016 (see Table 1).

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 Solar Estates CCAQP autoGC monitoring site, as well as the annual average benzene concentration at the CCNET Corpus Christi Huisache monitoring site, were below their respective long-term AMCVs. Although the deactivation of the Oak Park autoGC monitor precluded evaluation of 2016 annual averages, samples collected from the preceding 12 months (from June 2015 through May 2016) did meet the 75% data completeness objective and annual average concentrations of all analytes were below their respective long-term AMCVs. Therefore, adverse health effects would also not be expected to occur at the Oak Park monitoring site prior to its deactivation.

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). The annual average EDC concentration from one of the five monitoring locations, an onsite monitor in the Formosa network, exceeded the long-term AMCV (see Figure 2 & 3). This is an improvement from 2015, where several 24-hour EDC values helped to drive the reported annual average concentrations at four of the five monitors above the long-term EDC AMCV of 0.71 ppb. Since 2015 the TCEQ has closely watched Formosa's monitoring network and has been in contact with Formosa representatives, meeting quarterly to discuss the company's EDC emission reduction strategies. As a result, 2016 and available 2017 monitoring data reflect a narrower range of 24-hour EDC values (0.71 to 15 ppb) and indicate a downward trend at all five Formosa monitoring sites. The TD continues to support all efforts aimed at reducing ambient EDC concentrations in Point Comfort.

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 ₂ S |
| 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 ₂ S |
| 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 ₂ S |
| J.I Hailey Site* 2702B East Navigation Blvd | 48-355-0037 | CCAQP | Nueces | VOCs (20-min event-triggered canister); 5-min H ₂ S |
| 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 ₂ S |

| Site Name and Location | EPA Site ID | Network | County | Monitored Compounds |
|---|-------------|------------------------------------|---------|--|
| Point Comfort Park Site (28.68183, -96.56072) | N/A | Formosa Plastics Corporation | Calhoun | VOCs (every 6th-day 24-hr canister) |
| 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 ₂ S |
| Tuloso-Midway Middle School (KH01) (27.83317, -97.55750) | N/A | FHR | Nueces | VOCs (every 6 th and/or 12 th -day 24-hr canister) |
| Tuloso-Midway Elementary School (KH02) (27.82167, -97.52500) | N/A | FHR | Nueces | VOCs (every 6 th and/or 12 th -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 (60-min event- triggered canister) |

*20-min event-triggered canister or autoGC deactivated May 23, 2016; Solar Estates H₂S deactivated May 24, 2016

Abbreviations:

CCAQP – Corpus Christi Air Quality Project

CCNET – Corpus Christi Industrial Monitoring Network Air Quality Program

FHR – Flint Hills Resources

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H₂S – 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 (Methylene Chloride) | N-Propylbenzene |
| 2,2-Dimethylbutane (Neohexane) | Ethane | N-Undecane |
| 2,3,4-Trimethylpentane | Ethylbenzene ² | O-Ethyltoluene |
| 2,3-Dimethylbutane | Ethylene ^{1,2} | O-Xylene ² |
| 2,3-Dimethylpentane | Ethylene Dibromide (1,2-Dibromoethane) | P-Diethylbenzene |
| 2,4-Dimethylpentane | Ethylene Dichloride (1,2-Dichloroethane) ¹ | P-Ethyltoluene |
| 2-Chloropentane | Isobutane | Propane |
| 2-Methyl-2-Butene | Isopentane (2-Methylbutane) | Propylene ² |
| 2-Methylheptane | Isoprene | Styrene ² |
| 2-Methylhexane | Isopropylbenzene (Cumene) | Tetrachloroethylene ² |
| 2-Methylpentane (Isohexane) | M-Diethylbenzene | Toluene ² |
| 3-Methyl-1-Butene | M-Ethyltoluene | Trans-1,3-Dichloropropene |
| 3-Methylheptane | M/P-Xylene ² | Trans-2-Butene |
| 3-Methylhexane | | 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}) | Vanadium (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

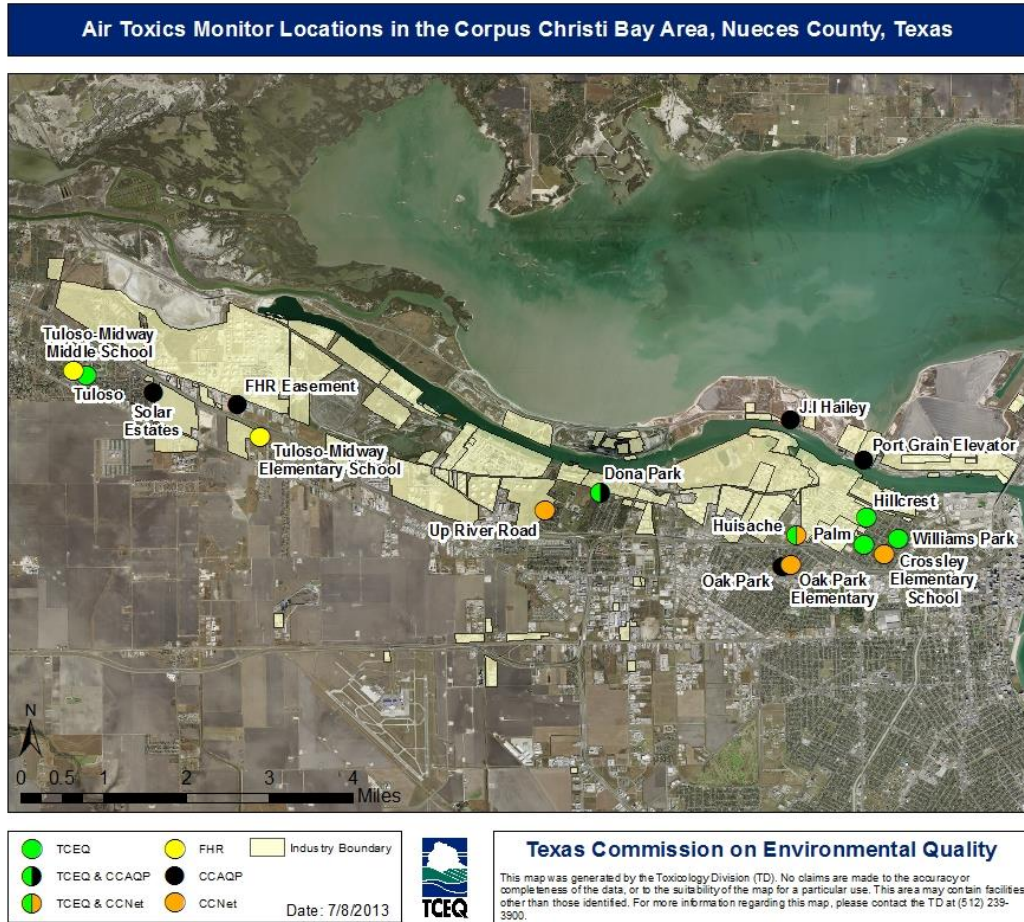


Figure 2: Industry-Sponsored Air Toxics Monitoring Locations in Point Comfort, Calhoun County, Texas

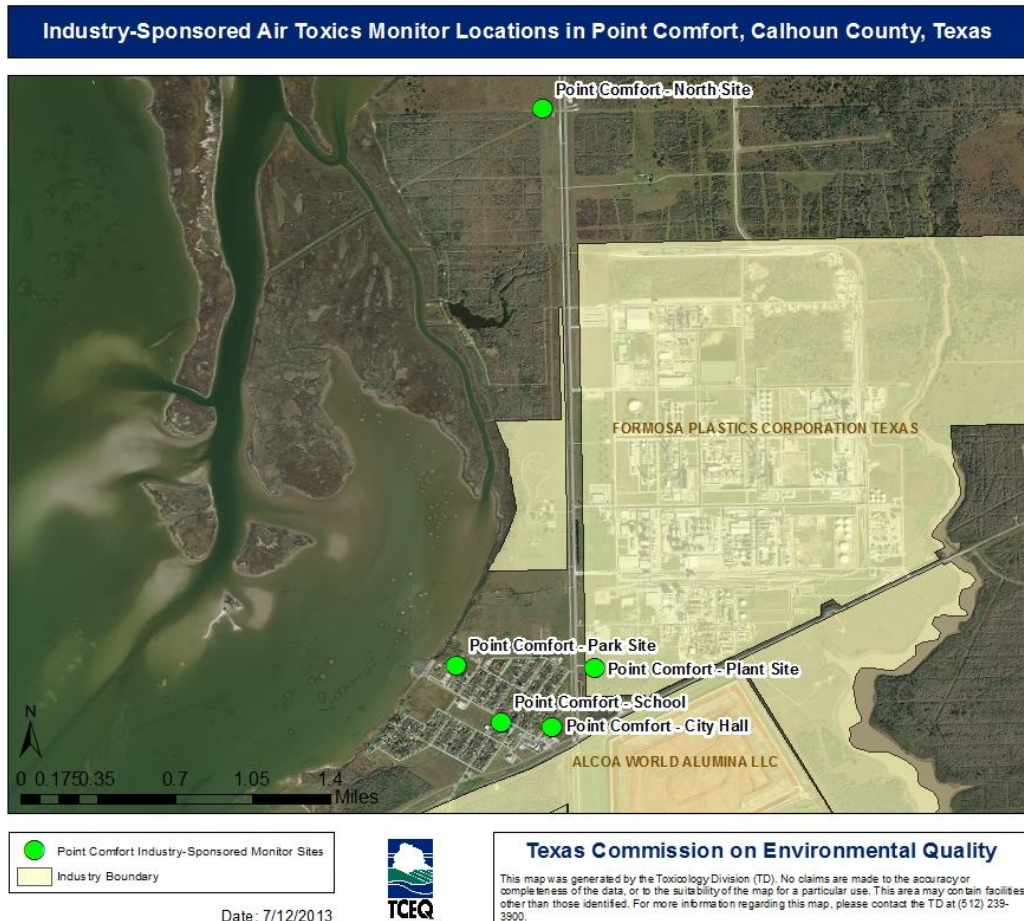


Figure 3: 2009 – 2016 Annual Average EDC Concentrations at Formosa Plastics Corporation, Point Comfort, TX (24-hour canister)

