TCEQ Interoffice Memorandum

To: Susan Clewis, Regional Director, R14

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Toxicology, Risk Assessment, and Research Division
Office of the Executive Director

Date: May 12, 2021

Subject: Health Effects Review of 2017 through 2019 Ambient Air Network Monitoring Data in Region 14, Corpus Christi

Conclusions

- All hourly and three-year 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.

- With exception of an annual average of vinyl chloride, all 24-hour and annual average concentrations for all chemicals and metals from 24-hour measurements in 2017 through 2019 were below their respective TCEQ AMCVs. However, all 3-year average concentrations were below their respective TCEQ AMCVs, which is a more appropriate comparison as the long-term AMCV is a lifetime comparison value.

    - At the Point Comfort Plant Site, the 2018 annual average of vinyl chloride slightly exceeded the AMCV. However, the three-year average was below the long-term AMCV is a lifetime value.

- All reported 30-minute rolling averages of hydrogen sulfide (H_2S) at the three monitoring sites (See Table 1) did not exceed the 30-minute state H_2S standard.

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 monitoring sites in Region 14, Corpus Christi, during 2017 through 2019. 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, Flint Hill Resources, Corpus Christi; and Formosa, Point Comfort). During the 2017 through 2019 evaluation period, monitors at several long-term monitoring sites were either

shutdown, discontinued, and/or experienced deactivation of certain parameters at a given location (see Table 1).

The TD evaluated ambient air sampling data for volatile organic compounds (VOCs), metals from filters designed to collect particulate matter with an aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$), and hydrogen sulfide (H_2S) from 15 monitoring sites in TCEQ Region 14, Corpus Christi (see Table 1), that were available from 2017 through 2019. VOC data were collected for 24-hour every sixth- and/or every 12th-day canister samples, and 1-hour autoGC samples. Metals data were collected from filters from 24-hour $PM_{2.5}$ samplers. Finally, 30-minute H_2S concentrations were collected from H_2S analyzers. 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 Lists 1 through 3 in Attachment A. Maps indicating the specific locations of the TCEQ, CCAQP, and CCNET air monitoring sites in Corpus Christi, Texas and the Formosa air monitoring sites in Point Comfort, Texas are shown in Figure 1 and Figure 2, respectively.

One-hour autoGC VOC, 24-hour samples (e.g., VOCs, metals), and 30-minute H_2S data were evaluated for potential acute health (e.g., irritation), odor, and vegetation effects. Twenty-four-hour air samples collected every 6th or 12th day 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
- benzene
- cadmium
- chromium
- cobalt
- ethylene dibromide
- ethylene dichloride
- manganese
- n-hexane

However, because short-term or peak concentrations may be significantly different than 24-hour 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 H_2S data). The three-year 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, TCEQ health-, odor-, and vegetation-based AMCVs). More information about AMCVs is available online at: https://www.tceq.texas.gov/toxicology/AirToxics.html#list.

All data collected at TCEQ monitors are analyzed by the TCEQ laboratory and should meet a 75% data completeness objective. At industry sponsored monitors such as CCAQP, CCNET, and Formosa Plastics Corporations, data are collected by a 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.

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

Site Name and Location	EPA Site ID	Network	County	Monitored Compounds	Date of Site Deactivation
Corpus Christi Hillcrest 1802 Nueces Bay Blvd	48-355-0029	TCEQ	Nueces	VOCs (every 6th-day 24-hr canister)	--
Corpus Christi Palm 1511 Palm Drive	48-355-0083	TCEQ	Nueces	VOCs (autoGC)	--
Dona Park 5707 Up River Rd	48-355-0034	TCEQ/CCAQP	Nueces	VOCs (TCEQ & Co-located CCAQP) & $PM_{2.5}$ Metals (every 6th-day 24-hr)/ 5-min H_2S	CCAQP: Co-located VOCs & H_2S - May 2017
Solar Estates 9122 Leopard St	48-355-0041	CCAQP	Nueces	VOCs (autoGC); 5-min H_2S	May 2017
Corpus Christi Huisache 3810 Huisache St	48-355-0032	TCEQ/CCNET	Nueces	VOCs (every 6th-day 24-hr canister), 5-min H_2S/ VOC(autoGC, benzene only)	June 2019 (autoGC benzene only)
Crossley Elementary School (CC01)	N/A	CCNET	Nueces	VOCs (every 6^{th} and/or 12^{th}-day 24-hr canister)	June 2019

Site Name and Location	EPA Site ID	Network	County	Monitored Compounds	Date of Site Deactivation
(27.80118, -97.41633)					
Up River Road (CC03) (27.80883, -97.47533)	N/A	CCNET	Nueces	VOCs (every 6th and/or 12th-day 24-hr canister)	June 2019
Oak Park Elementary School (CC02) (27.79940, -97.43255)	N/A	CCNET	Nueces	VOCs (every 6th and/or 12th-day 24-hr canister)	--
Tuloso-Midway Middle School (KH01) (27.83317, -97.55750)	N/A	FHR	Nueces	VOCs (every 6th and/or 12th-day 24-hr canister)	December 2018
Tuloso-Midway Elementary School (KH02) (27.82167, -97.52500)	N/A	FHR	Nueces	VOCs (every 6th and/or 12th-day 24-hr canister)	December 2018
Point Comfort Plant Site (28.68161, -96.55162)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 2nd-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)	--

Site Name and Location	EPA Site ID	Network	County	Monitored Compounds	Date of Site Deactivation
Point Comfort Park Site (28.68183, -96.56072)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (every 6th-day 24-hr canister)	--
Point Comfort North Site (28.71832, -96.55507)	N/A	Formosa Plastics Corporation	Calhoun	VOCs (once a month)	--

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

Evaluation

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

VOCs

The reported hourly average concentrations of each of the 46 VOCs measured at the Solar Estates (January-May 2017) and Corpus Christi Palm (2017 to 2019) autoGC monitoring sites, as well as benzene from the benzene-only CCNET Corpus Christi Huisache autoGC monitoring site (January-December 2017 to 2018), were either not detected or were below their respective short-term AMCVs. Similarly, all available 24-hour VOC canister concentrations from TCEQ, CCAQP, CCNET, and Formosa-sponsored monitoring networks 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 (H_2S)

All reported 30-minute rolling averages at the three active H_2S monitors (Huisache, Dona Park, and Solar Estates) in 2017 and the single active H_2S monitor (Huisache) in 2018 and 2019 were below the level of the state 30-minute H_2S standards for industrial and non-industrial properties. The Dona Park and Solar Estates H_2S monitors were deactivated on May 31, 2017 (see Table 1).

Long-Term Data

VOCs

The TD compared the calculated three-year average concentrations for each target VOC to their respective long-term AMCVs to evaluate the potential for chronic health and vegetation effects. Each three-year average concentration for the targeted VOCs evaluated at the TCEQ and industry-sponsored canister monitoring sites were below their respective long-term AMCVs. Exposure to all annual average and three-year average VOC concentrations, including vinyl chloride, would not be expected to result in long-term adverse health or vegetation effects. A brief discussion of reported annual vinyl chloride and historical ethylene dichloride (EDC) concentrations are provided below.

Vinyl Chloride

Historically, Formosa has operated an ambient air monitoring network in Point Comfort targeting five VOCs (ethylene, 1,3-butadiene, benzene, vinyl chloride, and EDC) and over the years TD has been collaborating with Formosa representatives to reduce VOC emissions. During the three-year evaluation, the 2018 vinyl chloride annual average concentration at the Point Comfort Plant Site was 0.60 ppb, which is 1.28 times greater than the long-term AMCV of 0.47 ppb. However, the long-term AMCV is designed to protect an individual over a lifetime of exposure (e.g., 70 years). A minimum of 1-years' worth of data is ordinarily used for comparison to this long-term AMCV, but longer-term data are even more appropriate for comparison to a lifetime AMCV. Since this evaluation covers three years' worth of data, a three-year average, which provides more information for the long-term, can be calculated. The three-year vinyl chloride average is 0.40 ppb, which is lower than the long-term, health-based AMCV. Also, the 2019 annual vinyl chloride concentration (0.25 ppb) at the Point Comfort Plant Site represents an approximately 58% decrease which may reflect the beginning of a downward trend (see Figure 3). In addition, the TD continues to support all efforts aimed at reducing ambient vinyl chloride concentrations in Point Comfort.

Ethylene dichloride (EDC)

Annual EDC concentrations have exceeded the long-term AMCV historically, thus currently and over the years, TD has been collaborating with Formosa representatives to reduce EDC emissions (see Figure 4). During 2017 to 2019, none of the annual average EDC concentrations from the five monitoring locations in the Formosa network exceeded the long-term AMCV (see Figures 2 & 4). This is an improvement from 2016, where several elevated 24-hour EDC values contributed to an annual average concentration at one of the five monitors above the long-term EDC AMCV of 0.72 ppb. The TD continues to support all efforts aimed at reducing ambient EDC concentrations in Point Comfort.

Metals

All 2017, 2018, and 2019 annual average and three-year combined 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 Lalita Shrestha by phone at (512) 239-0561 or via email at Lalita.Shrestha@tceq.texas.gov .

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

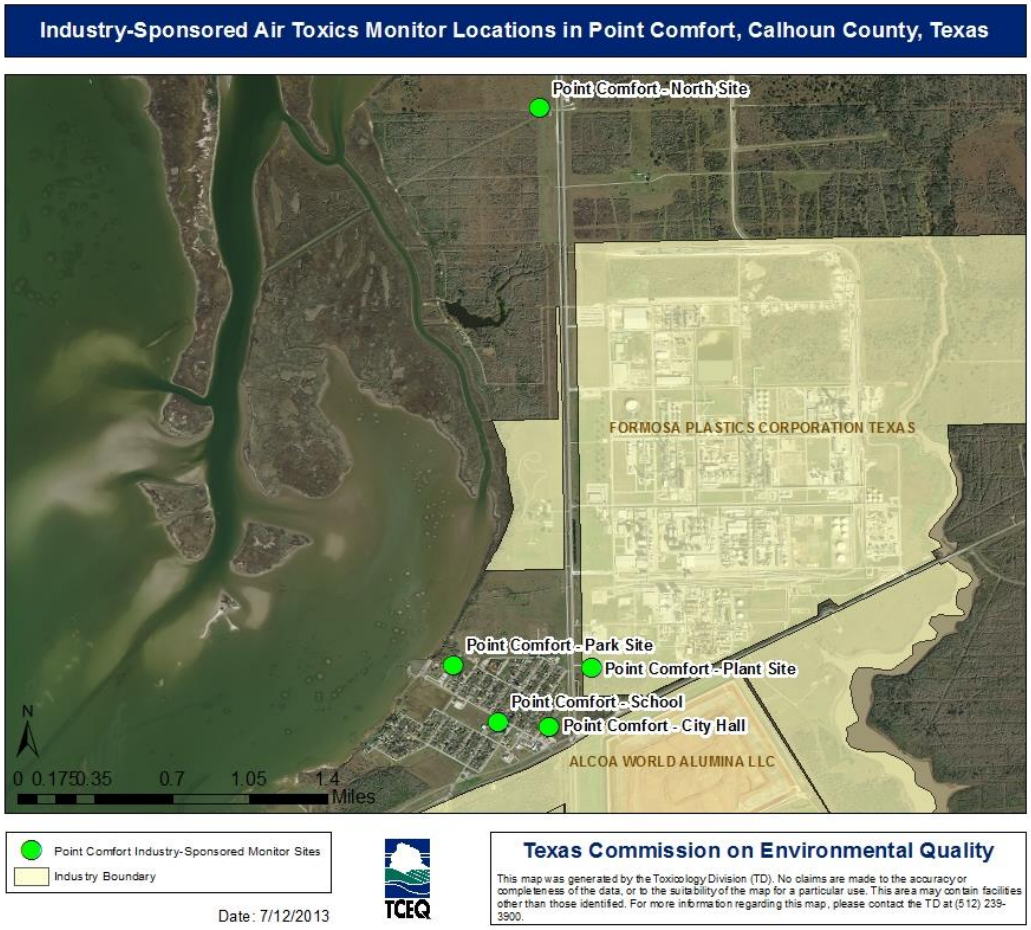


Figure 3: 2015 – 2019 Annual Average Vinyl Chloride Concentrations at Formosa Plastics Corporation, Point Comfort, TX (24-hour canister)

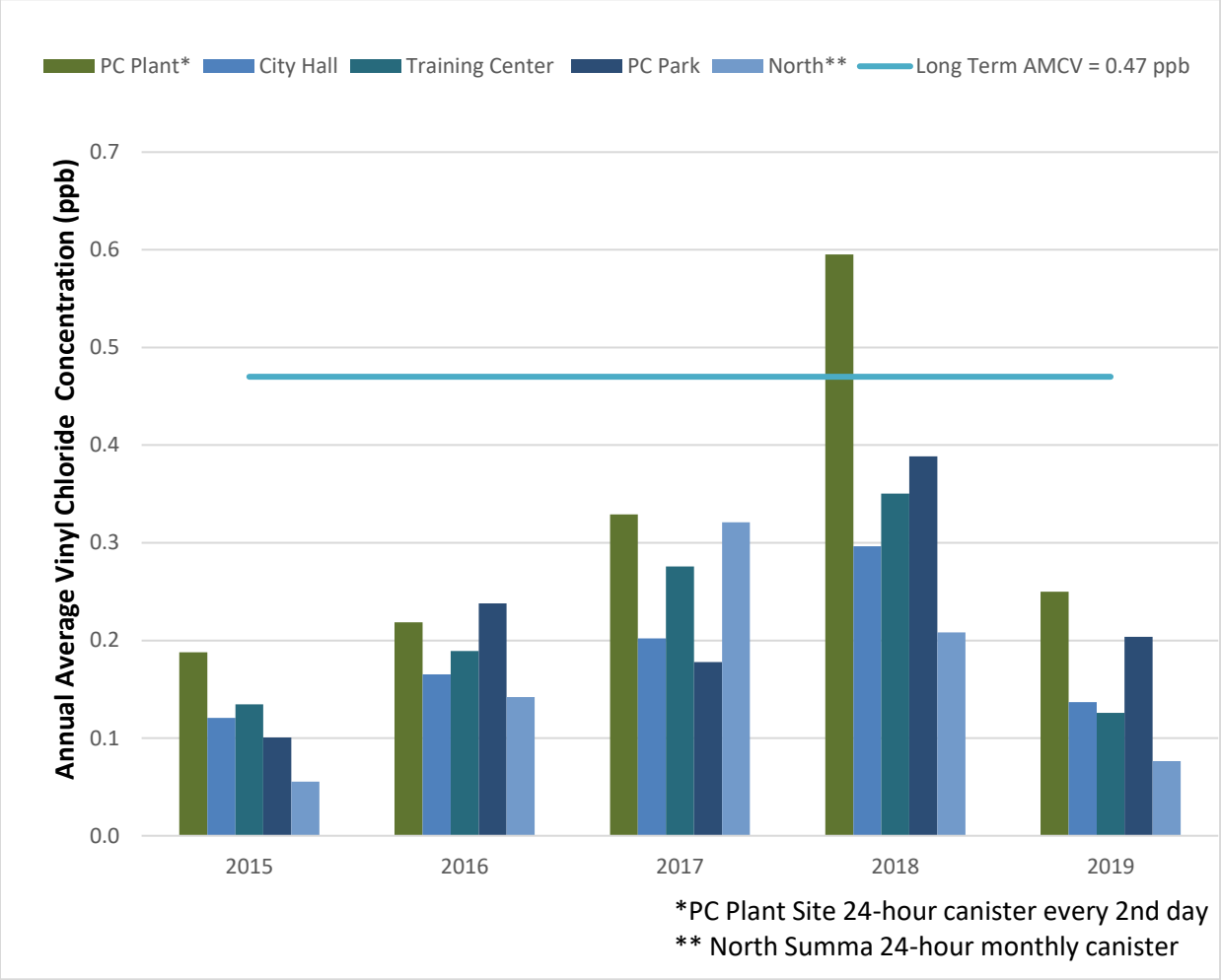
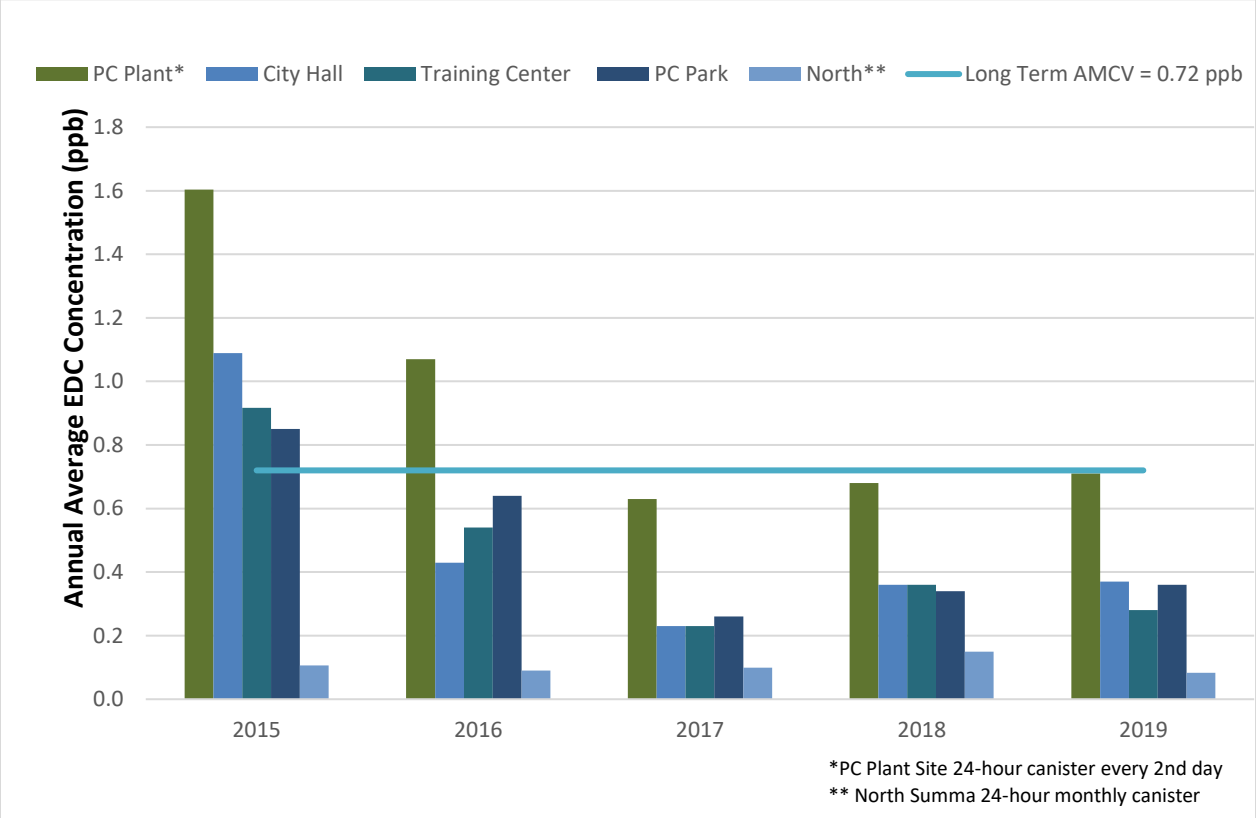


Figure 4: 2015 – 2019 Annual Average EDC Concentrations at Formosa Plastics Corporation, Point Comfort, TX (24-hour canister)



Attachment A

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

1,1,2,2-Tetrachloroethane

1,1,2-Trichloroethane

1,1-Dichloroethane

1,1-Dichloroethylene

1,2,3-Trimethylbenzene

1,2,4-Trimethylbenzene[2]

1,2-Dichloropropane

1,3,5-Trimethylbenzene

1,3-Butadiene [1,2]

1-Butene

1-Hexene+2-Methyl-1-Pentene

1-Pentene

2,2,4-Trimethylpentane

2,2-Dimethylbutane (Neohexane)

2,3,4-Trimethylpentane

2,3-Dimethylbutane

2,3-Dimethylpentane

2,4-Dimethylpentane

2-Chloropentane

2-Methyl-2-Butene

2-Methylheptane

2-Methylhexane

2-Methylpentane (Isohexane)

3-Methyl-1-Butene

3-Methylheptane

3-Methylhexane

3-Methylpentane

4-Methyl-1-Pentene

Acetylene

Benzene[1,2]

Bromomethane

Carbon Tetrachloride

Chlorobenzene

Chloroform

Chloromethane (Methyl Chloride)[2]

Cis-1,3-Dichloropropene

Cis-2-Butene

Cis-2-Hexene

Cis-2-Pentene

Cyclohexane[2]

Cyclopentane

Cyclopentene

Dichlorodifluoromethane

Dichloromethane (Methylene Chloride)

Ethane

Ethylbenzene [2]

Ethylene[1,2]

Ethylene Dibromide (1,2-Dibromoethane)

Ethylene Dichloride (1,2-Dichloroethane) [1]

Isobutane

Isopentane (2-Methylbutane)

Isoprene

Isopropylbenzene (Cumene)

M-Diethylbenzene

M-Ethyltoluene

M/P-Xylene[2]

Methyl Chloroform (1,1,1-Trichloroethane)

Methylcyclohexane

Methylcyclopentane

Methyl t-Butylether[2]

Naphthalene[2]	N-Undecane	Toluene[2]
N-Butane	O-Ethyltoluene	Trans-1,3-Dichloropropene
N-Decane	O-Xylene[2]	Trans-2-Butene
N-Heptane	P-Diethylbenzene	Trans-2-Hexene
N-Hexane[2]	P-Ethyltoluene	Trans-2-Pentene
N-Nonane	Propane	Trichloroethylene[2]
N-Octane	Propylene[2]	Trichlorofluoromethane
N-Pentane	Styrene[2]	Vinyl Chloride[1]
N-Propylbenzene	Tetrachloroethylene[2]	

[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 ($PM_{2.5}$)	
Arsenic ($PM_{2.5}$)	Copper ($PM_{2.5}$)	Nickel ($PM_{2.5}$)
Barium ($PM_{2.5}$)	Lead ($PM_{2.5}$)	Selenium ($PM_{2.5}$)
Cadmium ($PM_{2.5}$)	Manganese ($PM_{2.5}$)	Tin ($PM_{2.5}$)
		Vanadium ($PM_{2.5}$)
		Zinc ($PM_{2.5}$)

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

1-Butene	1,3-Butadiene	2-Methyl-2-butene[3]
1-Pentene	1,3,5-Trimethylbenzene	2-Methylpentane[3]
1,2,3-Trimethylbenzene[1]	2-Methylheptane	2,2-Dimethylbutane
1,2,4-Trimethylbenzene	2-Methylhexane	2,2,4-Trimethylpentane

2,3-Dimethylbutane	Cyclopentane	N-Hexane
2,3-Dimethylpentane[3]	Cyclopentene[3]	N-Nonane
2,3,4-Trimethylpentane	Ethane	N-Octane
2,4-Dimethylpentane	Ethyl Benzene	N-Pentane
3-Methylheptane	Ethylene	N-Propylbenzene
3-Methylhexane	Isobutane	O-Xylene
3-Methylpentane[3]	Isopentane	P-Xylene + M-Xylene
4-Methyl-1-pentene[3]	Isoprene	Propane
Acetylene	Isopropyl Benzene – Cumene	Propylene
Benzene[1,2]	Methylcyclohexane	Styrene
C-2-Butene	Methylcyclopentane	T-2-Butene
C-2-Hexene[3]	N-Butane	T-2-Pentene[3]
C-2-Pentene	N-Decane[1]	Toluene
Cyclohexane	N-Heptane	

[1] AutoGCs only

[2] Only Target Analyte at the CCNET - Huisache autoGC

[3] Only in CCAQP Event-Triggered Canisters