Quarterly Report on Air Quality Monitoring January 1 to March 31, 2025, at the Gregory – Portland Community Air Monitoring Stations

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Contents

Executive Summary

There are three continuous air quality monitoring stations operating in the Gregory-Portland area. The Gregory Fresnos Community Air Monitoring Station on Fresnos St. began continuous monitoring operations October 1, 2019. Two additional air-monitoring stations in Portland, TX, one near the intersection of Buddy Ganem Dr. and Wildcat Dr. on the campus of the Gregory-Portland High School and the other on Broadway Blvd. on the campus of the old East Cliff Elementary School, began operations on January 1, 2020. The U.S. Environmental Protection Agency (EPA) generally uses three years of data collection to assess attainment with the National Ambient Air Quality Standards (NAAQS). This project has now collected and validated data for more than five years at all three stations.

Since monitoring began, some measured pollutant concentrations have exceeded the concentration levels of NAAQS; however, these values have not been sustained long enough or measured frequently enough to violate a NAAQS. Furthermore, measured hydrocarbon concentrations have not exceeded the levels of concern published by the Texas Commission on Environmental Quality (TCEQ).

The public website developed as the community's source for information about the community air monitors continues to provide information about air quality and monitoring data from the three air monitoring stations (https://gpair.ceer.utexas.edu accessed April 2025).

UT Austin would be happy to answer any questions or conduct additional analysis at the community's or sponsors' requests. Contact Vincent Torres at vmtorres@mail.utexas.edu for information on the website or Dave Sullivan at sullivan231@mail.utexas.edu with questions about the monitoring data and analyses in this report.

1.0 Introduction

This report is jointly funded by Cheniere Energy and Gulf Coast Growth Ventures LLC (GCGV) as part of their separate Gregory-Portland community air-monitoring programs. This report includes reviews and analyses conducted by The University of Texas at Austin (UT) of the air monitoring data obtained at the three stations since their continuous monitoring operations began. UT established the Gregory Fresnos (GF) station for Cheniere Energy and has managed the station since continuous monitoring operations began on October 1, 2019. AECOM, an engineering company, established the Portland Buddy Ganem (PBG) and Portland Broadway (PBway) stations for GCGV on January 1, 2020, and managed the stations up through 2024. Recently, Orsat, LLC, the company that manages auto-GC instruments for the TCEQ and manages the UT Gregory-Fresnos station, has taken over operations at the two GCGV stations.

The primary emphasis in this report is the examination of data collected and validated for the period January 1 to March 31, 2025, with some comparisons to earlier data.

2.0 Summary of Activities January 1 through March 31, 2025

The data completeness acceptable minimum for regulatory monitoring of criteria air pollutants is 75 percent. These three non-regulatory air monitoring stations have generally reported quality assured data at a greater than 75% data completeness.

As was noted in recent quarterly reports, the GCGV ethane-cracking and derivatives facility has been fully operational since January 2022. Operations at the GCGV facility and the Cheniere Energy facility do not appear to have affected the level of pollutants measured at project stations.

Commercial instruments to continuously measure and provide hourly average ambient concentrations of EtO have only been approved by the EPA and come on the market in the past few years. For the past year, the PBG station operator has been becoming familiar with the proper operation and maintenance of a new instrument (Aroma) to be able to continuously measure EtO over the course of every day alongside the every sixth-day canister sample method currently used to measure EtO at the PBG station. While the new instrument has comparable accuracy to the canister method, it is not possible to make a direct comparison the measurement of the two systems, i.e., a comparison of the sixth-day average to continuous hourly values. UT Austin data analysts have developed an approach to indirectly compare measurements from the two systems that will be used beginning this year until the canister system is no longer needed. A comparison of the continuous measurements to the canister measurements appears later in this report.

In 2024, the United States Environmental Protection Agency (EPA) changed their annual average PM2.5 standard from its previous level of 12.0 micro-grams per cubic meter ($\mu g/m^3$) to 9.0 $\mu g/m^3$. Currently, the three-year average concentrations at all three stations have been lower than the 9.0 $\mu g/m^3$ level mentioned above.

3.0 Air Monitoring Station Locations & Information

As noted earlier in this report, there are three air monitoring stations in the Gregory-Portland area in operation, one station operated by Orsat for UT in Gregory, TX and two operated by Orsat for GCGV in Portland, TX. The locations of the three stations and parameters measured are summarized in Table 1. The locations of the three stations are shown in satellite view in Figure

1[1]. Also shown in Figure 1 are the locations of the Cheniere liquefied natural gas facility and the GCGV ethane-cracking and derivatives facility.

Table 1. Gregory-Portland Community Air Monitoring Stations and Parameters Measured

Air Monitoring Station Name and Street Address	Volatile Organic Compounds (VOCs)[1]	Ethylene oxide (EtO)[1]	Nitrogen Oxides (NOx, NO, & NO2)[1]	Sulfur Dioxide (SO_2)[1]	Particulate Matter (PM) Mass, particles < 2.5 micron diameter [1]	Wind Speed (WS), Wind Direction (WD), Ambient Temperature (T), Relative Humidity (RH), & Barometric Pressure (BP)[1]
Gregory Fresnos Stephen Austin Elementary 401 Fresnos St. Gregory, TX	Yes	No	Yes	Yes	Yes	Yes
Portland Buddy Ganem 307 Buddy Ganem St. GP High School Portland, TX	Yes	24-hr canister every 6 th day & a continuous analyzer	No	No	Yes	Yes+ precipitation
Portland Broadway 175 Broadway Blvd. Old East Cliff Elementary School Portland, TX	Yes	24-hr canister every 6 th day	No	No	Yes	Only WS, WD

[1] All instruments operate continuously to provide hourly average measurements except as noted in the table.

[1] This image date is June 2023.

Figure 1. Location of Gregory-Fresnos Community Air Monitoring Station, and two Portland community stations on GPISD campuses on Buddy Ganem and on Broadway and the Cheniere Energy (green outline) and GCGV (red outline) industrial facilities

4.0 Summary of Measurement Data

As described in each report, the reader is reminded that pollutant concentrations are affected by several factors. One, of course, is the emission of a gas or smoke from an emission source or the availability of dust to become airborne. Another is the weather. Regarding weather, rain can reduce concentrations of several pollutants, especially particulate matter. The "mixing height" is the lower level of the atmosphere wherein gases and particles mix vertically. Temperature inversions such as those experienced at night have low mixing heights and can lead to air pollutants emitted near the surface being trapped at lower altitudes, thus allowing concentrations to increase. The converse is midday periods when the mixing height of the lower atmosphere rises, and air pollutants are diluted in a larger volume of air. The wind plays a significant role in moving air pollutants from an emission source to other locations. For this reason, a large majority of air monitoring stations operated by the TCEQ and all three Gregory-Portland stations measure wind speed and wind direction. Under high wind speeds, many gas pollutants are dispersed and diluted; however, under high-speed winds, dust on the surface can be picked up and transported, leading to higher particulate concentrations. Higher speed winds passing over the roof of a storage tank can lower the atmospheric pressure on that roof, leading to vapors being drawn out of the tank and into the air. However, in general, low speed winds often lead to higher concentrations of pollutants. Figure 2 shows how higher concentrations of NO_2 and propane at the GF station are associated with low-speed winds, with lower concentrations under higher speed winds. Winds can be thought of as being local – near the surface – and regional – at higher altitudes. The local wind direction affects pollutant concentrations in terms of whether a pollution source is in the upwind direction, or along the local upwind path of the air if wind directions are changing. Similarly, but on a larger scale, the regional wind direction affects pollutant concentrations in terms of whether or not a source such as another major city, a large power plant, a forest fire, etc., is along the regional upwind path of the air. In the graphs that follow, some short-term concentration measurements are significantly higher than the balance of the data. In some cases, this is likely the combination of emission and meteorological (Met) factors, and in other cases, normal emissions can result in unusually high concentrations owing to a source being nearby under low wind speeds or air stagnation.

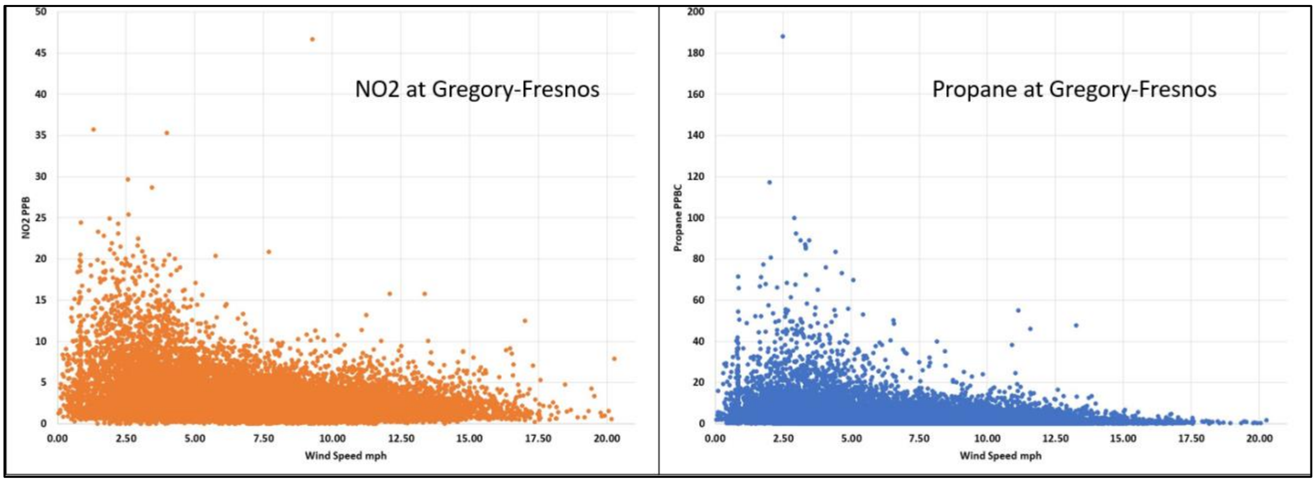

Figure 2. Effect of wind speed on primary pollutants

Please note that the measurement data in this report are quality assured station data made available at different submission frequencies:

- NOx, NO, & NO_2, SO_2, PM2.5 & Met measurements – weekly;
- Auto-GC VOC measurements – generally within 60 days of the measurement; and
- EtO canister data – generally within 60 days of the date the sample was collected.

Although all these measurements, except EtO, are made in near-real time, the nature of the complexity in quality assuring the auto-GC target hydrocarbons among the thousands of different organic compounds that exist in the air leads to a lengthy delay in releasing the quality assured target species data. Air samples for EtO data are collected at the station and then sent to a laboratory where EtO concentrations are then derived upon analysis of the air samples. Hence, the data available at the time this report was written will not all have the same date ranges. For this report, auto-GC and EtO data are available through February 28, 2025, and all other data were available through March 31, 2025.

4.1 Gregory Fresnos Station Hydrocarbon Data

Figure 3 shows the time series graph for hourly concentrations of benzene at the Gregory-Fresnos (GF) station in 2024 and early 2025. The graph shows benzene hourly average concentrations for each hour from January 1, 2024, through February 28, 2025 (14 months). Benzene concentrations in the air can be of health concern but to date their concentrations have been much lower than TCEQ Air Monitoring Comparison Values (AMCV) of 1,080 ppbC for a single one-hour value or 8.4 ppbC for an annual hourly average concentration. Other AMCVs for auto-GC hydrocarbons can be found at https://www.tceq.texas.gov/cgi-bin/compliance/monops/agc_amcvs.pl (accessed April 2025). Note that a straight line or a gap in a time series graph represents missing data. Data may be missing owing to equipment failure, planned equipment or site maintenance, or external factors such as power loss or severe weather.

Table 2 lists all target hydrocarbon species measured and reported by the GF auto-GC, with the peak one-hour concentration, maximum 24-hour day concentration, and the January through December 2024 average hourly concentration for each species. Note that the total sum of the target species (TNMTC) and the total sum of the hydrocarbons (target species plus non-target species and unknown species) (TNMHC) are included in the table. In addition, the TCEQ's Air Monitoring Comparison Values (AMCV) are shown in the table. From the TCEQ's Air Monitoring Comparison Values website[2]:

> "AMCVs are used to evaluate the potential for effects to occur as a result of exposure to concentrations of constituents in the air. AMCVs are based on data concerning health effects, odor, and vegetation effects. They are not ambient air standards. If predicted or measured airborne levels of a constituent do not exceed the comparison level, adverse health or welfare effects would not be expected to result. If ambient levels of constituents in air exceed the comparison levels, it does not necessarily indicate a problem, but rather triggers a more in-depth review. If you have any questions about the potential for health, odor, or vegetation effects from exposure to reported concentrations of any of these compounds, please contact the Toxicology Division by telephone at (512) 239-3900 or by email at tox@tceq.texas.gov."

Data completeness for auto-GCs is based on the planned collection of 22 hours per day – as two hours per day are reserved for quality assurance activities. The GF station has collected data on the individual hydrocarbon compounds with 83 to 88 percent data completeness of the planned collection hours for 2024.

Time series graphs of other hydrocarbon species are also available upon request and any graphs can be made with timescale (x-axis) or concentration-scale (y-axis) adjustments. Also, concentrations can be averaged by day, month, or other time period upon request. A user can also make graphs of data on the project website at https://gpair.ceer.utexas.edu/custom-data-request.php (accessed April 2025). To make a request, contact Dr. Dave Sullivan at sullivan231@mail.utexas.edu or call 512-914-4710.

[2] https://www.tceq.texas.gov/cgi-bin/compliance/monops/agc_amcvs.pl accessed April 2025.

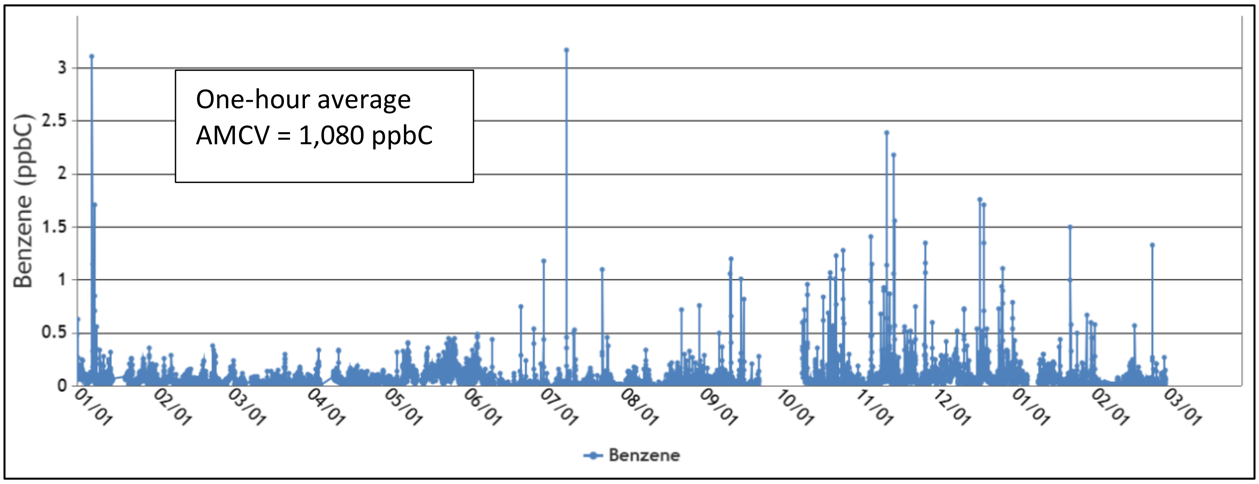

Figure 3. Hourly benzene concentrations at GF station, Jan. 1, 2024 – Feb. 28, 2025, ppbC units

Table 2. Gregory-Fresnos Auto-GC statistics for Jan. – Dec. 2024

Species	Num. Samples	Peak 1-hr ppbC	Peak 24-hr ppbC	Short-term AMCV	Mean ppbC	Long-term AMCV
TNMHC	7,060	2,248.95	486.57	N/A	62.60	N/A
TNMTC	7,060	3,553.83	460.01	N/A	59.95	N/A
Ethane	7,060	810.68	167.21	N/A	17.34	N/A
Ethylene	7,060	377.16	17.54	1,000,000	0.95	10,600
Propane	7,060	588.15	109.00	N/A	12.51	N/A
Propylene	7,060	901.42	41.95	N/A	1.28	N/A
Isobutane	7,060	238.45	41.01	132,000	4.55	40,000
n-Butane	7,060	516.52	54.53	368,000	7.37	40,000
Acetylene	6,985	450.54	20.81	50,000	0.72	5,000
trans-2-Butene	7,060	462.34	21.14	60,000	0.24	2,800
1-Butene	7,060	6.14	0.88	108,000	0.21	9,200
cis-2-Butene	7,060	22.83	1.80	60,000	0.09	2,800
Cyclopentane	7,060	67.74	3.62	29,500	0.21	2,950
Isopentane	7,060	218.96	22.39	340,000	3.58	40,500
n-Pentane	7,060	260.7	23.31	340,000	2.91	40,500
1,3-Butadiene	7,060	210.38	12.29	6,800	0.18	36
trans-2-Pentene	7,060	156.8	7.15	60,000	0.06	2,800
1-Pentene	7,060	14.71	1.04	60,000	0.06	2,800
cis-2-Pentene	7,060	3.33	0.41	60,000	0.03	2,800
2,2-Dimethylbutane	7,060	6.95	1.09	32,400	0.17	1,140
Isoprene	7,056	13.31	0.79	7,000	0.10	700
n-Hexane	7,059	93.45	8.20	32,400	1.15	1,140
Methylcyclopentane	7,060	59.59	4.18	4,500	0.54	450
2,4-Dimethylpentane	7,060	77.75	3.53	58,100	0.05	15,400
Benzene	7,060	36.42	2.02	1,080	0.43	8.4
Cyclohexane	7,060	45.83	4.15	6,000	0.57	600
2-Methylhexane	7,060	34.23	2.18	58,100	0.18	15,400
2,3-Dimethylpentane	7,060	41.98	2.00	58,100	0.09	15,400
3-Methylhexane	7,060	14.68	1.37	58,100	0.23	15,400
2,2,4-Trimethylpentane	7,060	16.08	1.49	32,800	0.25	3,040
n-Heptane	7,059	30.47	2.29	58,100	0.35	15,400
Methylcyclohexane	7,060	48.69	3.69	28,000	0.55	2,800
2,3,4-Trimethylpentane	7,060	25.22	1.24	32,800	0.05	3,040
Toluene	7,060	94.72	7.79	28,000	0.57	7,700
2-Methylheptane	7,060	12.15	0.68	32,800	0.09	3,040
3-Methylheptane	7,060	9.92	0.51	32,800	0.07	3,040
n-Octane	7,060	15.78	0.90	32,800	0.17	3,040
Ethyl Benzene	7,060	5.82	0.83	160,000	0.07	3,520
p-Xylene + m-Xylene	7,060	9.9	1.39	13,600	0.24	1,120
Styrene	7,060	2.12	0.31	41,600	0.01	880
o-Xylene	7,060	3.19	0.47	13,600	0.07	1,120
n-Nonane	7,060	7.59	0.51	27,000	0.07	2,520
Isopropyl Benzene -	7,060	1.71	0.08	4,590	0.01	459
n-Propylbenzene	7,060	1.29	0.23	4,590	0.02	459
1,3,5-Trimethylbenzene	6,708	1.48	0.12	27,000	0.02	333
1,2,4-Trimethylbenzene	6,684	2.6	0.66	27,000	0.21	333
n-Decane	6,708	6.16	0.57	10,000	0.08	1,900
1,2,3-Trimethylbenzene	6,708	1.79	0.33	27,000	0.04	333

4.2 Portland Buddy Ganem & Portland Broadway Stations Hydrocarbon Data

Figure 4 shows the time series graph for hourly concentrations of benzene at the Portland Buddy Ganem (PBG) station, and Figure 5 shows the time series graph for the hourly concentrations of benzene at the Portland Broadway (PBway) station. Both graphs show benzene hourly average concentrations for each hour from January 1, 2024, through February 28, 2025.

As was the case at the Gregory Fresnos station, hydrocarbon concentrations to date are much lower than the TCEQ AMCVs. Table 3 lists the target hydrocarbon species measured and reported by the Portland Buddy Ganem (PBG) auto-GC and Table 4 lists the target hydrocarbon species measured and reported by the Portland Broadway (PBway) auto-GC with the peak one-hour concentration, maximum 24-hour day concentration, and average hourly concentration for each species for January through December 2024. Also shown in the two tables are the TCEQ's AMCVs.

Based on the 22 hours per day planned ambient measurements, the PBG station has collected data with 86 to 90 percent data completeness based on planned collection hours for 2024, the only exception being Acetylene at 57 percent. Acetylene is a particularly difficult compound to measure. The PBway station has between 91 and 94 percent data completeness of the planned collection hours over 2024, except for a lower 40 percent data completeness for Acetylene, and 81 percent for Cis-2-pentene.

Time series graphs of other hydrocarbon species are also available upon request, and any graphs can be made with timescale (x-axis) or concentration-scale (y-axis) adjustments. In addition, concentrations can be averaged by day, week, or month upon request. As mentioned earlier in the report, a user can also make graphs on the project website.

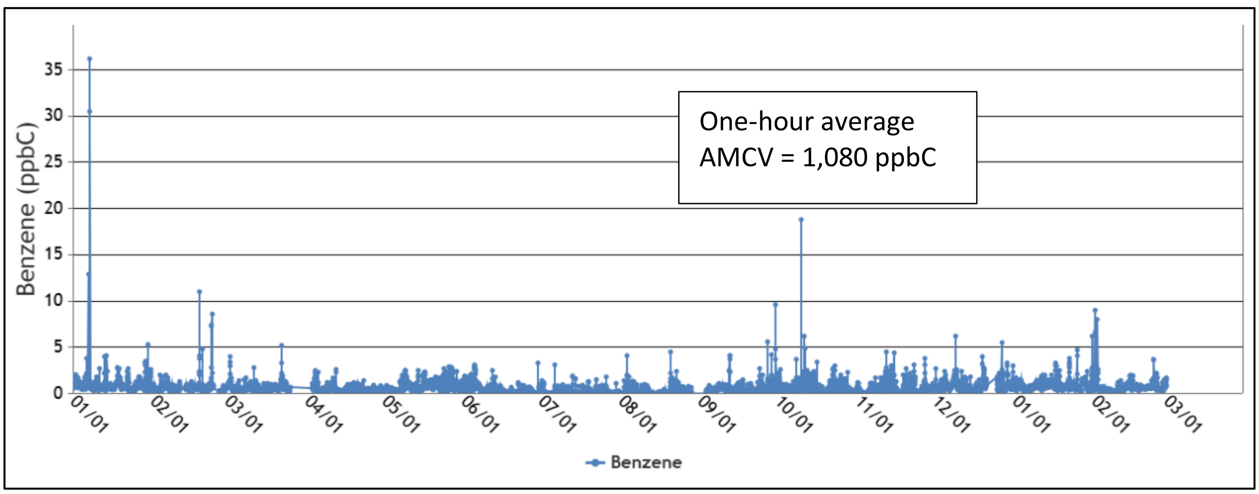

Figure 4. Hourly benzene concentrations at PBG station, Jan. 1, 2024 – Feb. 28, 2025, ppbC units

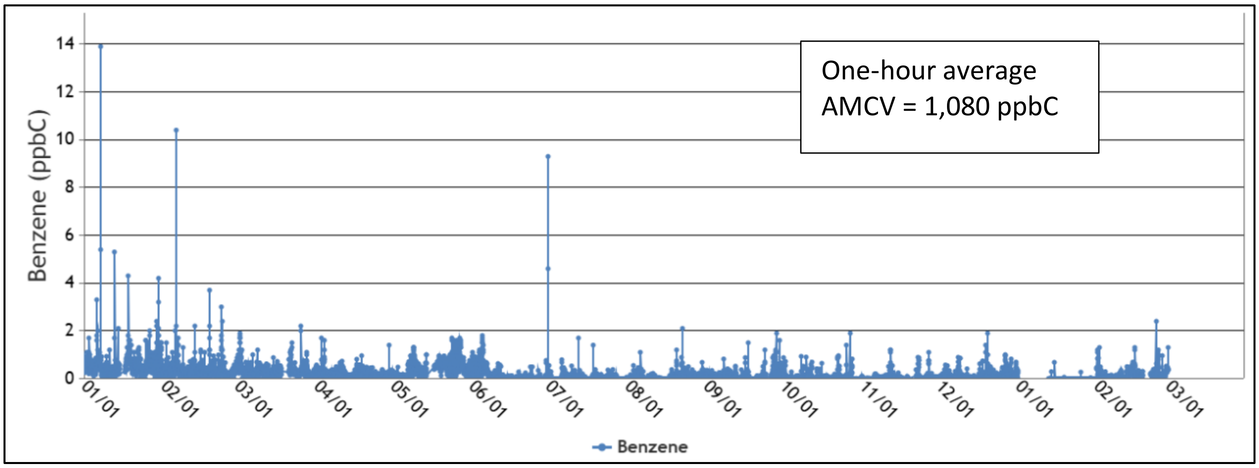

Figure 5. Hourly benzene concentrations at PBway station, Jan. 1, 2024 – Feb. 28, 2025, ppbC units

Table 3. PBG Auto-GC statistics for Jan. – Dec. 2024

Species	Num. Samples	Peak 1-hr ppbC	Peak 24-hr ppbC	Short-term AMCV	Mean ppbC	Long-term AMCV
TNMHC	7,167	2,310.57	279.62	N/A	55.73	N/A
TNMTC	7,167	2,260.86	265.02	N/A	51.81	N/A
Ethane	7,167	2,157.00	141.88	N/A	16.84	N/A
Ethylene	7,167	88.50	6.01	1,000,000	1.17	10,600
Propane	7,167	291.00	55.62	N/A	10.42	N/A
Propylene	7,167	13.60	2.01	N/A	1.07	N/A
Isobutane	7,167	156.00	25.25	132,000	3.14	40,000
n-Butane	7,167	258.00	34.07	368,000	6.14	40,000
Acetylene	4,615	9.60	1.31	50,000	0.44	5,000
trans-2-Butene	7,165	3.10	0.37	60,000	0.09	2,800
1-Butene	7,125	3.70	0.47	108,000	0.22	9,200
cis-2-Butene	7,167	0.83	0.11	60,000	0.05	2,800
Cyclopentane	7,167	21.00	2.06	29,500	0.18	2,950
Isopentane	7,167	143.00	15.70	340,000	3.11	40,500
n-Pentane	7,167	207.00	20.65	340,000	2.54	40,500
1,3-Butadiene	7,166	11.80	0.64	6,800	0.05	36
trans-2-Pentene	7,061	2.60	0.21	60,000	0.02	2,800
1-Pentene	7,066	1.40	0.13	60,000	0.05	2,800
cis-2-Pentene	7,066	2.40	0.15	60,000	0.01	2,800
2,2-Dimethylbutane	7,066	4.60	0.51	32,400	0.07	1,140
Isoprene	7,066	2.90	0.78	7,000	0.20	700
n-Hexane	7,235	120.00	11.21	32,400	0.78	1,140
Methylcyclopentane	7,235	57.70	5.40	4,500	0.33	450
2,4-Dimethylpentane	7,235	9.90	0.88	58,100	0.01	15,400
Benzene	7,232	36.20	4.05	1,080	0.56	8.4
Cyclohexane	7,235	93.40	8.79	6,000	0.49	600
2-Methylhexane	7,235	22.00	2.13	58,100	0.17	15,400
2,3-Dimethylpentane	7,235	12.60	1.20	58,100	0.08	15,400
3-Methylhexane	7,234	35.60	3.37	58,100	0.24	15,400
2,2,4-Trimethylpentane	7,235	31.90	3.18	32,800	0.32	3,040
n-Heptane	7,227	66.20	6.38	58,100	0.38	15,400
Methylcyclohexane	7,235	119.00	11.25	28,000	0.58	2,800
2,3,4-Trimethylpentane	7,233	8.10	0.55	32,800	0.05	3,040
Toluene	7,235	58.60	5.36	28,000	0.77	7,700
2-Methylheptane	7,200	17.60	1.59	32,800	0.06	3,040
3-Methylheptane	7,200	13.20	0.81	32,800	0.05	3,040
n-Octane	7,200	30.50	2.90	32,800	0.22	3,040
Ethyl Benzene	7,200	12.00	1.06	160,000	0.10	3,520
p-Xylene + m-Xylene	7,200	58.60	4.78	13,600	0.35	1,120
Styrene	7,184	1.80	0.27	41,600	0.02	880
o-Xylene	7,184	20.80	1.51	13,600	0.08	1,120
n-Nonane	7,184	8.80	0.72	27,000	0.10	2,520
Isopropyl Benzene -	7,184	3.70	0.25	4,590	0.01	459
n-Propylbenzene	7,216	4.90	0.32	4,590	0.03	459
1,3,5-Trimethylbenzene	6,931	10.20	0.64	27,000	0.03	333
1,2,4-Trimethylbenzene	6,949	20.70	1.31	27,000	0.09	333
n-Decane	6,949	3.50	0.58	10,000	0.18	1,900
1,2,3-Trimethylbenzene	6,949	4.50	0.31	27,000	0.04	333

Table 4. PBway Auto-GC statistics for Jan. – Dec. 2024

Species	Num. Samples	Peak 1-hr ppbC	Peak 24-hr ppbC	Short-term AMCV	Mean ppbC	Long-term AMCV
TNMHC	7,364	2,906.38	290.81	N/A	44.50	N/A
TNMTC	7,364	2,747.68	277.36	N/A	41.42	N/A
Ethane	7,466	621.00	89.11	N/A	12.24	N/A
Ethylene	7,509	30.20	4.26	1,000,000	0.79	10,600
Propane	7,557	200.00	49.46	N/A	8.66	N/A
Propylene	7,385	16.20	3.11	N/A	1.00	N/A
Isobutane	7,557	431.00	31.33	132,000	2.87	40,000
n-Butane	7,557	1,084.00	74.64	368,000	5.89	40,000
Acetylene	3,188	20.10	2.23	50,000	0.35	5,000
trans-2-Butene	7,547	31.10	2.08	60,000	0.15	2,800
1-Butene	7,554	11.90	0.77	108,000	0.25	9,200
cis-2-Butene	7,557	12.20	0.77	60,000	0.07	2,800
Cyclopentane	7,557	8.70	1.39	29,500	0.42	2,950
Isopentane	7,557	523.00	34.17	340,000	3.01	40,500
n-Pentane	7,557	150.00	15.11	340,000	2.26	40,500
1,3-Butadiene	7,557	92.20	4.39	6,800	0.08	36
trans-2-Pentene	7,557	23.80	1.12	60,000	0.03	2,800
1-Pentene	7,555	24.30	1.22	60,000	0.06	2,800
cis-2-Pentene	6,562	8.40	0.38	60,000	0.01	2,800
2,2-Dimethylbutane	7,557	7.50	0.89	32,400	0.09	1,140
Isoprene	7,556	5.60	1.79	7,000	0.48	700
n-Hexane	7,502	57.60	4.80	32,400	0.44	1,140
Methylcyclopentane	7,502	27.00	2.07	4,500	0.22	450
2,4-Dimethylpentane	7,502	8.70	0.45	58,100	0.00	15,400
Benzene	7,502	13.90	1.39	1,080	0.21	8.4
Cyclohexane	7,502	36.80	2.89	6,000	0.31	600
2-Methylhexane	7,502	8.50	0.57	58,100	0.04	15,400
2,3-Dimethylpentane	7,502	7.60	0.43	58,100	0.02	15,400
3-Methylhexane	7,502	12.50	0.92	58,100	0.08	15,400
2,2,4-Trimethylpentane	7,502	22.70	1.68	32,800	0.18	3,040
n-Heptane	7,501	21.60	1.50	58,100	0.12	15,400
Methylcyclohexane	7,502	39.00	3.00	28,000	0.35	2,800
2,3,4-Trimethylpentane	7,502	5.30	0.40	32,800	0.03	3,040
Toluene	7,502	114.00	9.86	28,000	0.44	7,700
2-Methylheptane	7,501	3.60	0.29	32,800	0.02	3,040
3-Methylheptane	7,501	2.40	0.18	32,800	0.01	3,040
n-Octane	7,502	7.40	0.76	32,800	0.07	3,040
Ethyl Benzene	7,502	2.50	0.17	160,000	0.01	3,520
p-Xylene + m-Xylene	7,502	11.30	1.32	13,600	0.18	1,120
Styrene	7,502	0.73	0.26	41,600	0.01	880
o-Xylene	7,502	3.90	0.29	13,600	0.03	1,120
n-Nonane	7,502	17.50	0.87	27,000	0.04	2,520
Isopropyl Benzene -	7,502	2.20	0.11	4,590	0.00	459
n-Propylbenzene	7,501	2.00	0.15	4,590	0.01	459
1,3,5-Trimethylbenzene	7,501	4.50	0.22	27,000	0.01	333
1,2,4-Trimethylbenzene	7,500	5.90	0.69	27,000	0.12	333
n-Decane	7,502	30.90	1.54	10,000	0.05	1,900
1,2,3-Trimethylbenzene	7,501	1.10	0.19	27,000	0.02	333

4.3 Ethylene Oxide Measurements

As was noted earlier in this report, the GCGV ethane-cracking and derivatives facility began operating in late 2021 through early 2022. As shown in Figure 6 through Figure 9, the levels of EtO measured at the two GCGV stations have remained low, with no discernable trends. Note that values of 0.0 ppbC were recorded from the laboratory as non-detects. The TCEQ effects screening level (ESL) and Air Monitoring Comparative Value (AMCV) for chronic exposure to EtO is 2.4 ppbV or 4.8 ppbC. The terms AMCV and ESL are defined in Appendix A.2. (https://www.tceq.texas.gov/downloads/toxicology/dsd/final/eto.pdf, accessed April 2025). It is notable that there has been no change in concentrations over the past three years while the GCGV industrial facility has been in operation. In fact, there has been an increased frequency of non-detects over time.

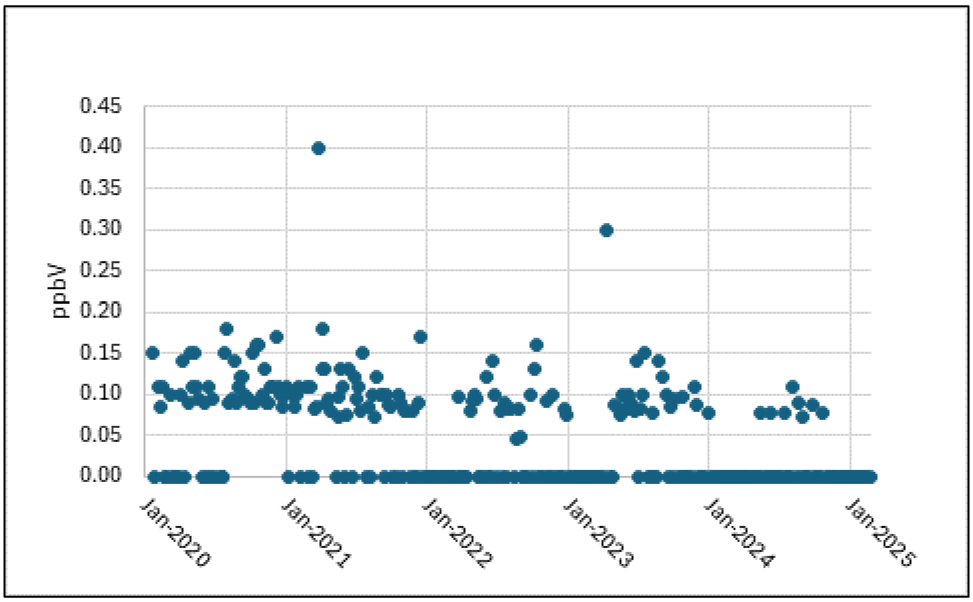

Figure 6. PBG EtO concentrations, every 6th day samples Jan. 2020 through Feb. 2025

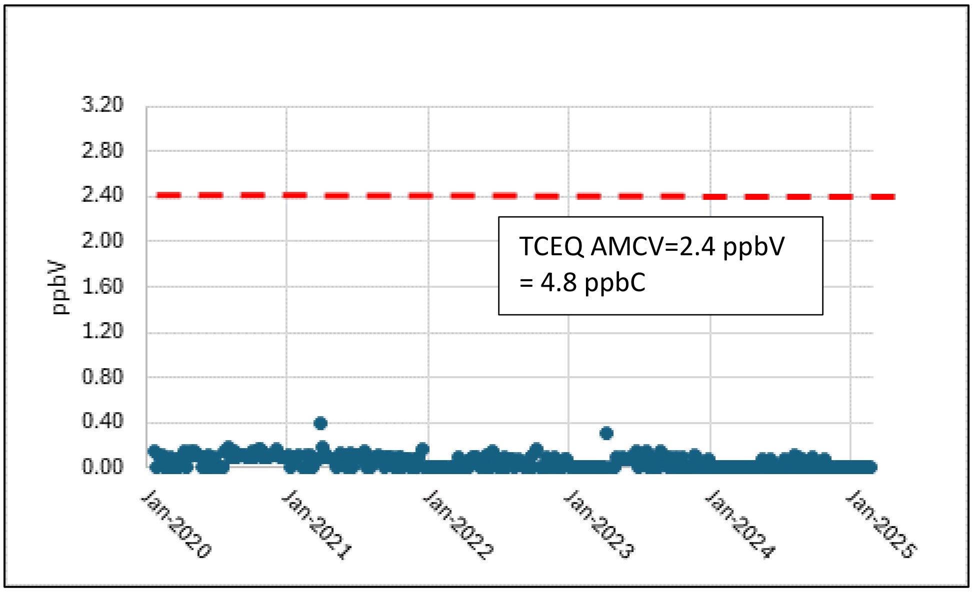

Figure 7. PBG EtO concentrations, every 6th day samples Jan. 2020 through Feb. 2025 in comparison to TCEQ Air Monitoring Comparative Value

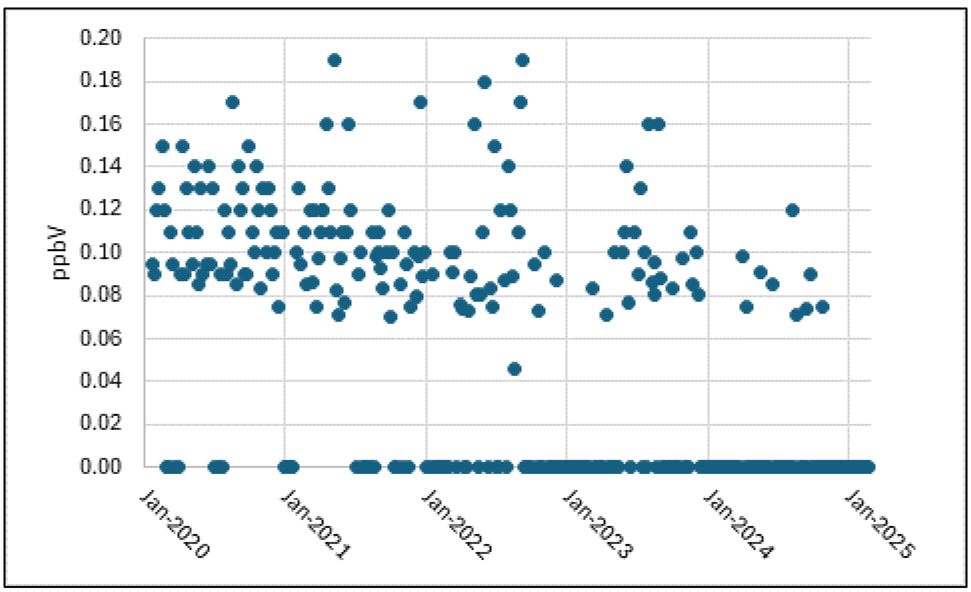

Figure 8. PBway EtO concentrations, every 6th day samples Jan. 2020 through Feb. 2025

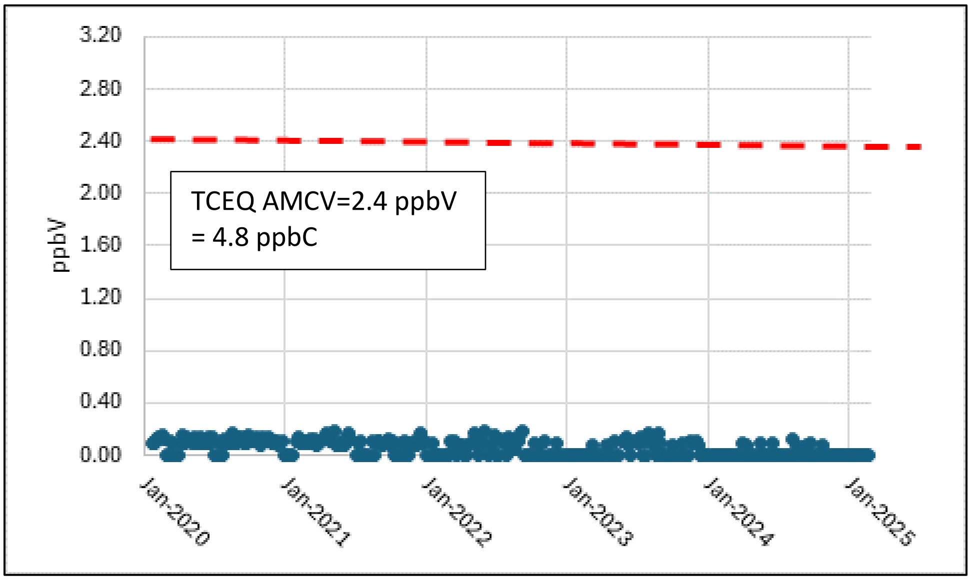

Figure 9. PBway EtO concentrations, every 6th day samples Jan. 2020 through Feb. 2025 in comparison to TCEQ Air Monitoring Comparative Value

4.4 Comparing Hydrocarbon Data between Stations

Figure 10 shows a bar graph comparison between the average concentrations for 2024 for the hydrocarbons measured by auto-GC, including TNMTC and TNMHC, at the three stations. The graph shows relatively close correlation among the three stations, although the Portland Buddy Gamen (PBG) is trending higher than the other two stations. A close examination of PBG benzene concentrations compared to the other two stations was presented in the October 2023 Quarterly Report, and it was shown that wind speed had a big effect on the concentrations, and adjusting for it made the difference between PBG and the other stations smaller.

Figure 11 is a similar graph excluding TNMTC and TNMHC. This second graph allows for a better comparison of the similarity among the stations. The most common nonmethane hydrocarbons in the atmosphere in urban areas are ethane and propane, followed by other alkane species such as butanes and pentanes. These species have low chemical reactivities and thus can persist in the air longer than more reactive species. Some ethane and propane are likely transported into the region from nearby oil and gas extraction fields.

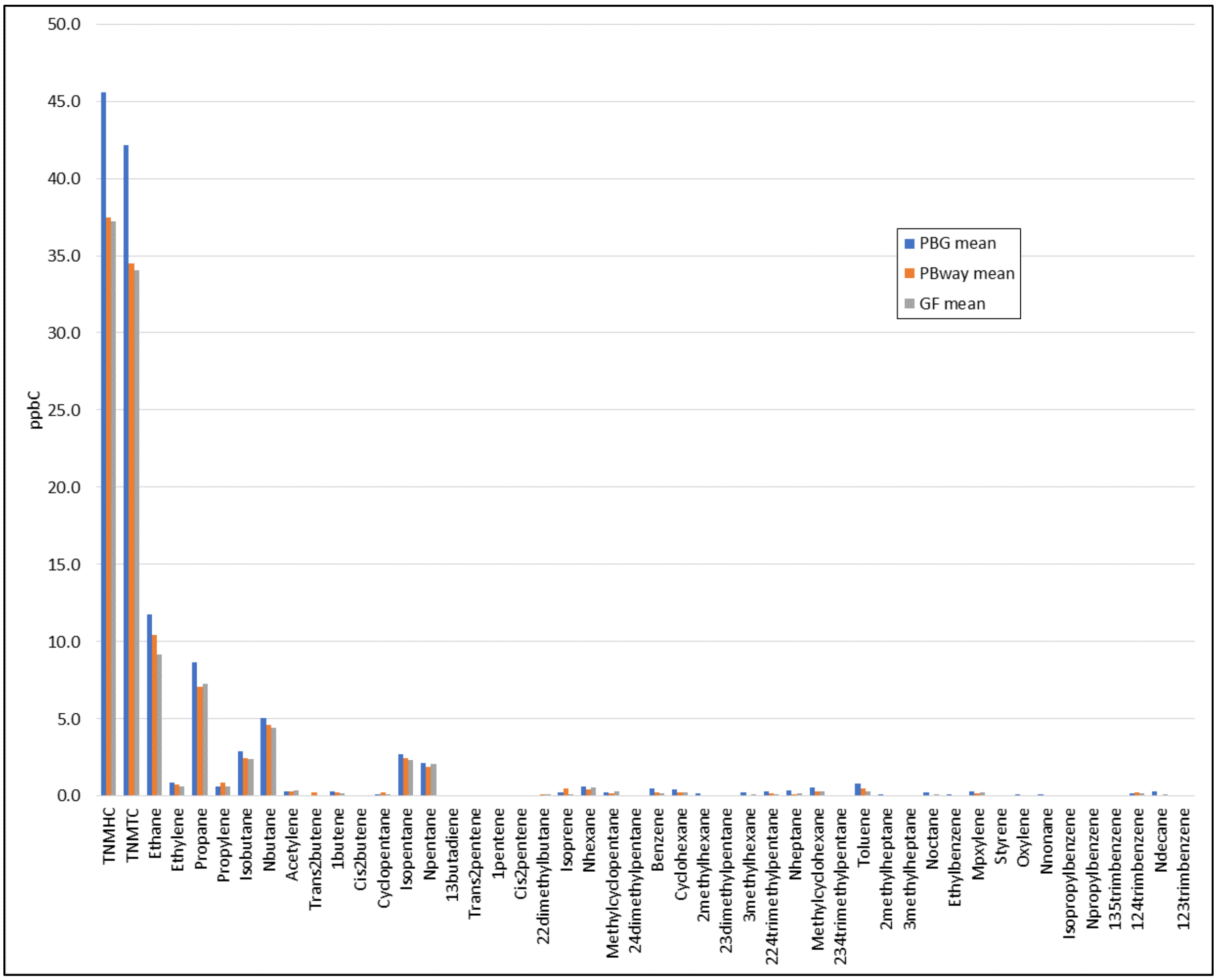

Figure 10. January through December 2024, mean concentrations of TNMTC, TNMHC, and hydrocarbon species at three stations.

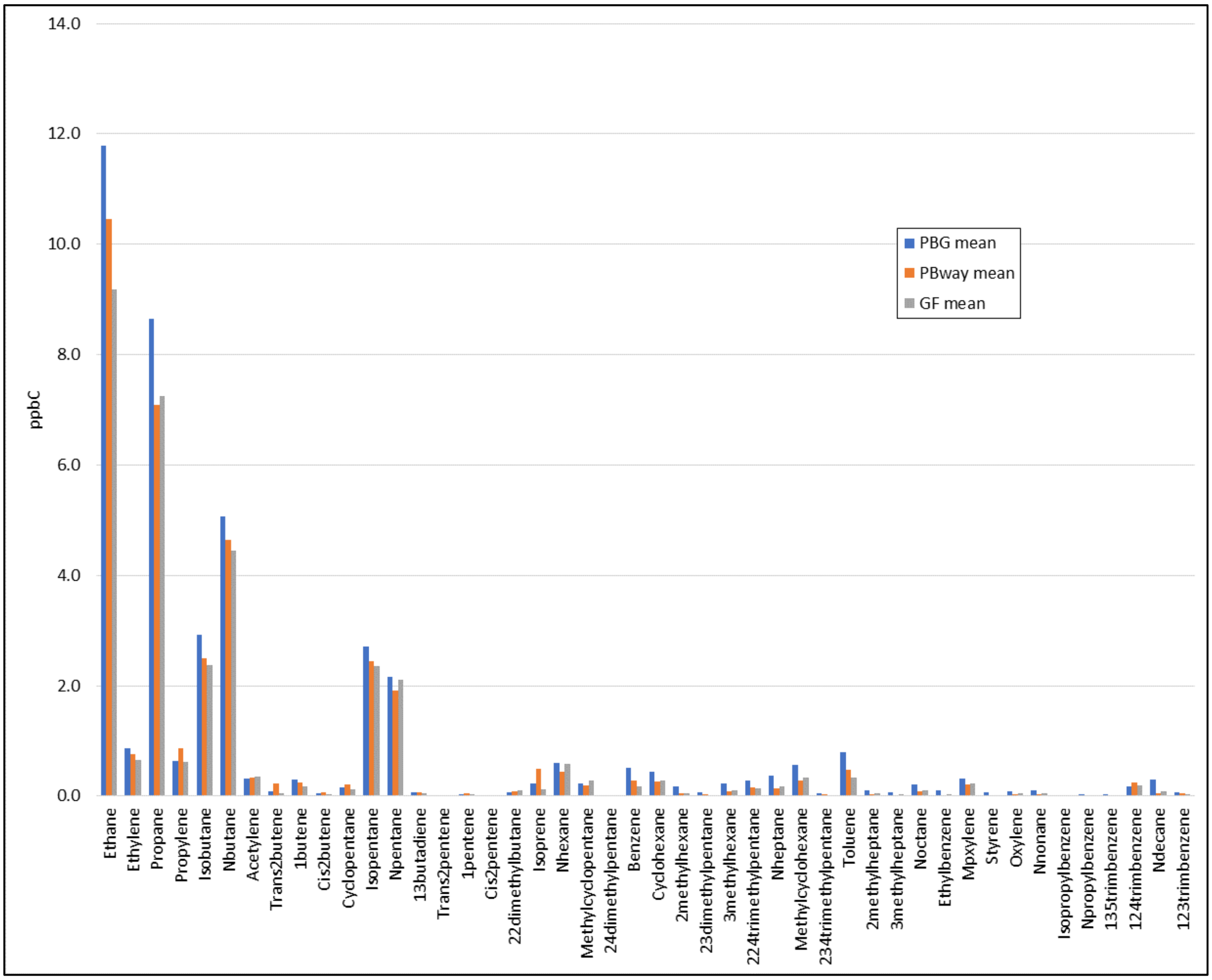

Figure 11. January through December 2024, mean concentrations of hydrocarbon species at three air monitoring stations.

4.5 Gregory Fresnos Station Criteria Pollutant Data

Sulfur dioxide (SO_2), fine particulate matter (PM2.5), and nitrogen dioxide (NO_2) are three pollutants measured at the GF site that are regulated by the U.S. Environmental Protection Agency (EPA). These pollutants, along with ozone, lead, combined coarse and fine particulate matter (PM10), and carbon monoxide are referred to as "criteria pollutants" and are governed by National Ambient Air Quality Standards (NAAQS). Some NAAQS are based on annual average concentrations, and some are based on the frequency with which very high concentrations are measured. The rationale is that different pollutants affect human health in different ways.

- PM2.5 has both an annual average NAAQS and 24-hour NAAQS. For the PM2.5 24-hour NAAQS, the three-year average of the 98th percentile 24-hour (midnight to midnight, using standard time) concentration each year must be less than 35 micrograms per cubic meter ($\mu g/m^3$). The annual average, averaged over three years, is calculated by first averaging 24-hour averages by quarter and then averaging the four quarters, must be less than 9 $\mu g/m^3$.
- The NAAQS for NO_2 is for the one-hour values to average less than 53 ppb in a calendar year and for the three-year average of the 98th percentile daily maximum values to be less than 100 ppb.

- SO_2 has a 1-hour NAAQS, based on ranking the daily maximum one-hour values for each day in a year, selecting the 99th percentile daily maximum values, and then calculating a three-year average, which must be less than 75 ppb.

No concentrations at levels that violate the NAAQS have been seen at the GF station. Several recorded PM2.5 one-hour values exceeded the level of the 24-hour NAAQS (35 μg/m^3), but as noted above, the NAAQS is not violated unless the 98th percentile of 24-hour averaged concentrations in a year, averaged over three years exceeds the 24-hour NAAQS (35 μg/m^3) level, or unless the overall annual average, averaged over three years, exceeds the level of the annual NAAQS (9μg/m^3).

Figure 12 shows the 24-hour averaged daily PM2.5 concentrations since the start of monitoring in October 2019. This graph is provided to illustrate the roughly seasonal pattern of PM2.5, with higher concentrations in the summers associated with transported dust from Northern Africa. The average concentration for 2024 was 8.4 μg/m^3. Table 5 lists the annual mean PM2.5 concentration from each of the past five years and the most recent three-year average for the GF station.

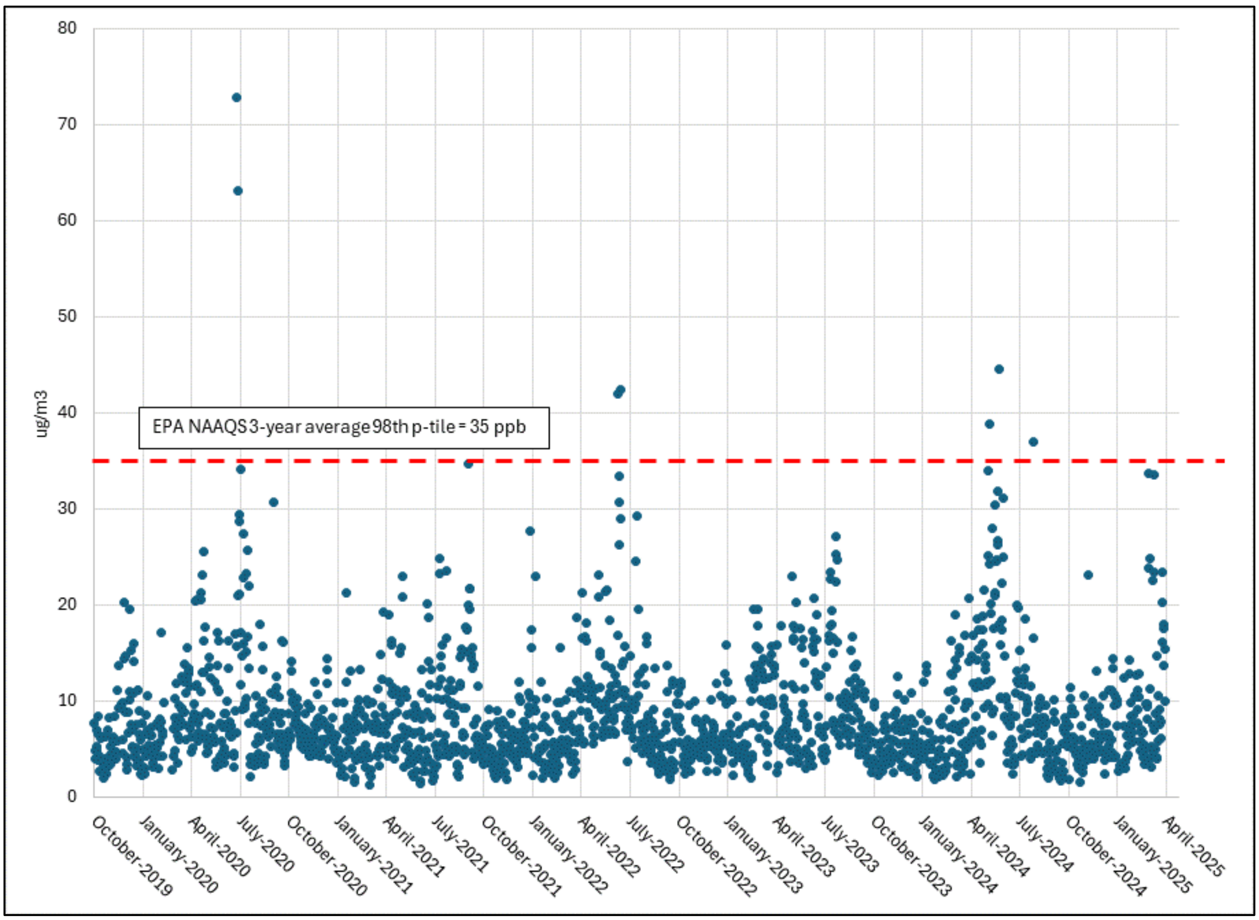

Figure 12. Averaged 24-Hour PM2.5 at GF, Oct. 1, 2019 – Mar. 31, 2025, with EPA NAAQS Value

Table 5. GF PM2.5 annual means and three-year averages showing NAAQS compliance.

Year	Annual Mean, μg/cm^3	NAAQS 3-Year Annual Average Value, μg/cm^3	Annual 98th Percentile Value, μg/cm^3	NAAQS 3-Year 98th Percentile Average Value, μg/cm^3
2020	8.9		27.4	
2021	7.7		21.7	
2022	8.2		24.3	
2023	8.4		20.9	
2024	8.7		28.0	
2022-2024 3-year average	8.4	9.0	24.4	35.0

Figure 13 shows the hourly average time series graph for daily maximum NO_2 at the Gregory Fresnos station from October 1, 2019, through March 31, 2025. The figure also shows the 24-hour 98th p-tile 100 ppb NAAQS level. The figure shows measured concentrations have been well below the level of the NAAQS. In addition, one can see the periodicity of concentrations, which tend to be higher during winter months owing to longer nights with lower mixing heights and less overall air movement. Table 6 lists for the past five years the NO_2 annual 98th percentile and the annual averages showing NAAQS compliance with these standards by large margins.

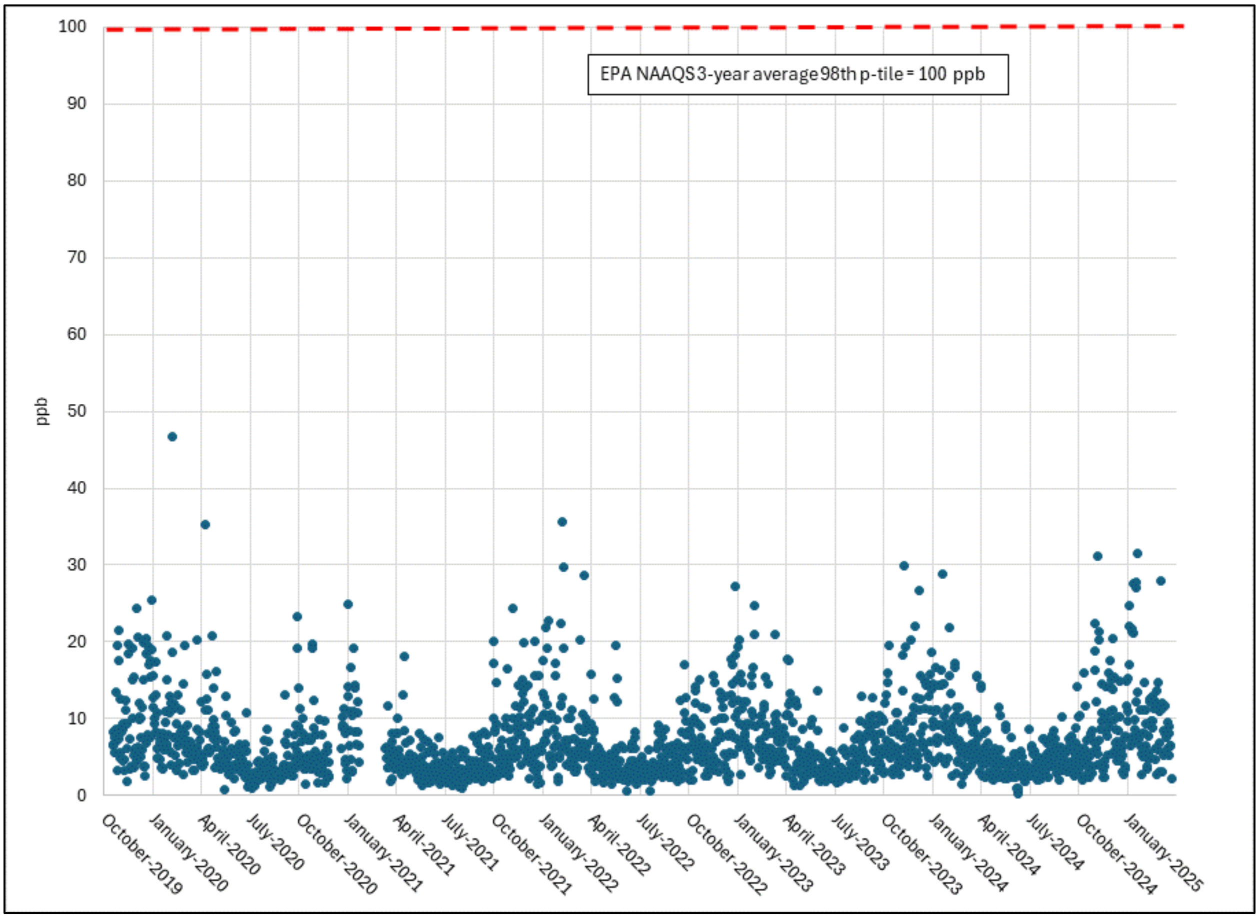

Figure 13. Daily maximum NO_2 at GF, ppb units, Oct. 1, 2019 – Mar. 31, 2025, with EPA NAAQS Value

Table 6. GF NO_2 annual 98th p-tile values, three-year mean showing NAAQS compliance.

Year	Annual Average Values, ppb	NAAQS Annual Average Value, ppb	Annual 98th percentile ppb	NAAQS 3-Year 98th Percentile Average Value, ppb
2020	2.7	53	19.4	
2021	2.4		18.5	
2022	2.7		19.7	
2023	3.0		20.6	
2024	2.8		18.8	
3-year Average for 2022-2024 Period			19.7	100

SO_2 is rarely found in ambient air, and the SO_2 instruments are calibrated to accurately measure high concentrations that are a risk to public health. As a result, the large majority of SO_2 concentrations measurements are close to 0.0. Many instruments measuring low concentrations will produce time series with much scatter near 0.0 owing to the nature of carrying out the chemical or electrical reaction that is associated with the measurement and converting that to a number representing the concentration. When an instrument has been calibrated to accurately measure high concentrations to safeguard public health, generally at low concentrations near zero there can be high relative error. The time series graph for SO_2 since Oct. 2019 at the GF station is shown in Figure 14. The graph is scaled to illustrate how low the concentrations have been compared to the 75-ppb level of the NAAQS. Table 7 lists the annual 99th percentile values of daily maximum SO_2 for the past five complete years, again showing compliance between the level of the NAAQS and measured concentrations by more than 70 ppb.

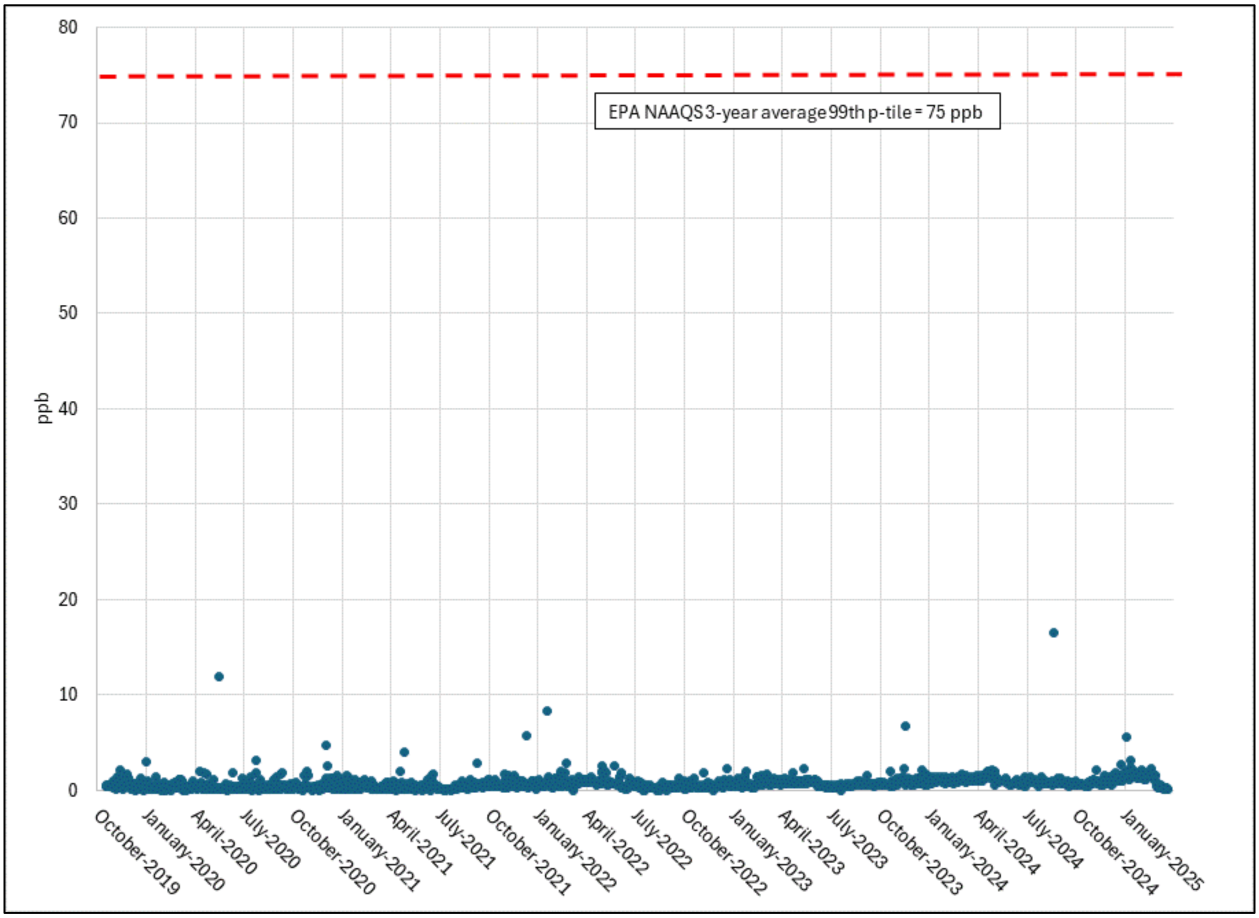

Figure 14. Daily maximum SO_2 at GF, Oct. 1, 2019 – Mar. 31, 2025, with EPA NAAQS Value

Table 7. GF SO_2 annual 99th percentile values of daily maximums three-year average showing NAAQS compliance.

Year	Annual 99th percentile ppb	NAAQS 99th Percentile Average Value, ppb
2020	2.5	
2021	2.0	
2022	2.3	
2023	1.9	
2024	2.0	
3-year Avg. 2022 - 2024	2.1	75

4.6 Portland Buddy Ganem & Portland Broadway Stations Criteria Pollutant Data

Fine particulate matter (PM2.5) is the only NAAQS-regulated pollutant measured at the PBG and PBway stations. Figure 15 shows the 24-hour average concentrations at the PBG site from Jan. 2020 through Mar. 2025, and Figure 16 shows the same time series for the PBway site. The 3-year average concentration PBG is 8.1 μg/m^3 and is also 8.1 μg/m^3 at PBway. Table 8 and Table 9 summarize the average annual PM2.5 concentrations for the PBG and PBway stations and the three-year average annual concentrations. The year 2024 was the first year a station – PBG – averaged over 9 μg/m^3 in one year, but the 3-year value is what matters. It is also the case that the Clean Air Act (Section 179b) specifically calls for excluding pollutant concentrations coming from outside the United States boundaries in assessing NAAQS compliance, and research at The University of Texas at Austin has shown that up to a half a micro-gram per cubic meter of annual PM2.5 averages in East Texas may be caused by a combination of North African dust transported across the Atlantic Ocean, and agricultural smoke from foliage and crop burning in Central America and Southern Mexico. As an example of the out of the U.S. transport of PM2.5, all three stations exceeded the 35 μg/m^3 24-hour NAAQS on the same two dates, June 12, 2022, and June 16, 2022, owing to the transported North African dust. Across the State of Texas, with 66 regulatory PM2.5 monitors, 22 stations had elevated PM2.5 on June 12, 2022, and 48 stations had elevated PM2.5 on June 16, 2022. Among TCEQ regions, all parts of the state had some elevated concentrations between June 12 and June 16, 2022.

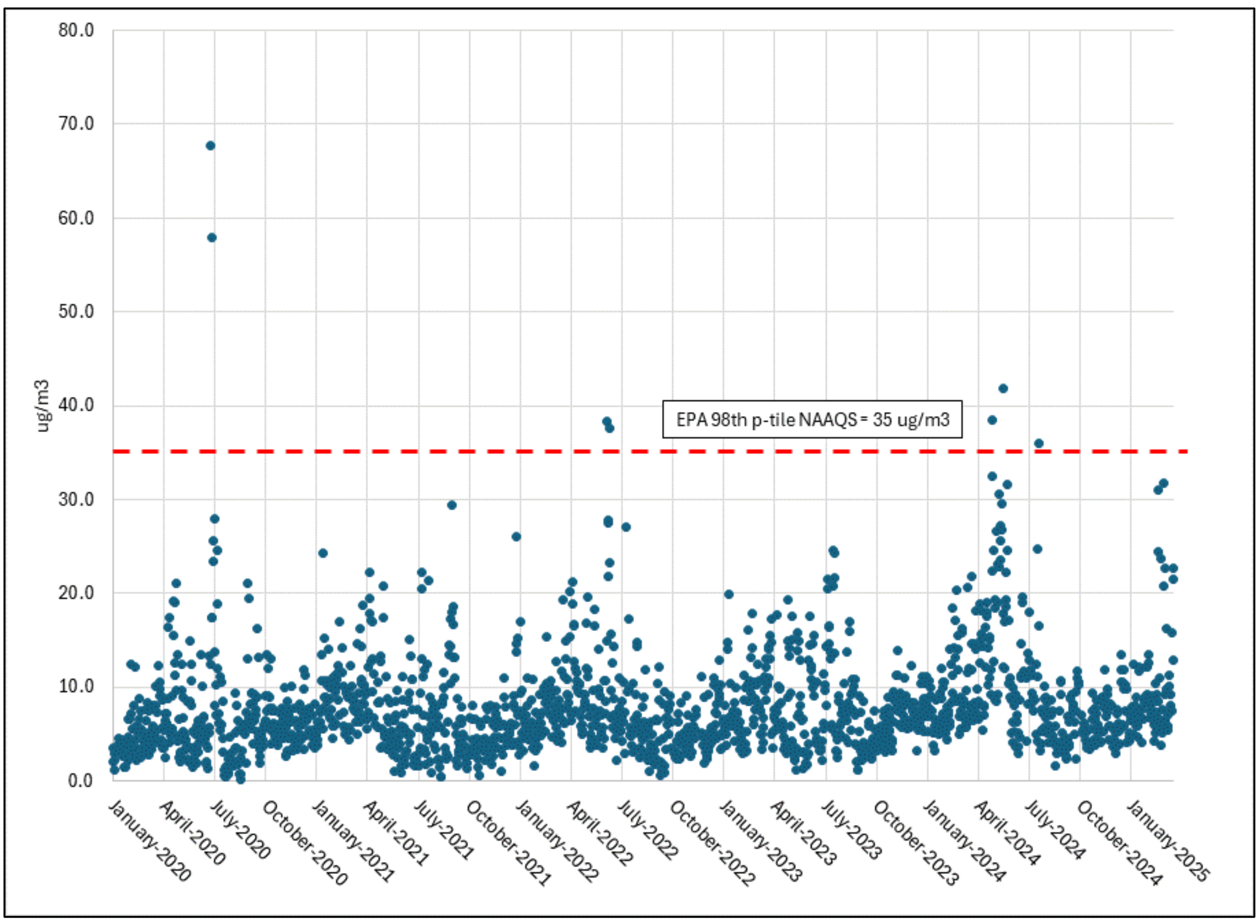

Figure 15. Mean 24-Hour PM2.5 at PBG, Jan. 1, 2020 – Mar. 31, 2025, NAAQS scale.

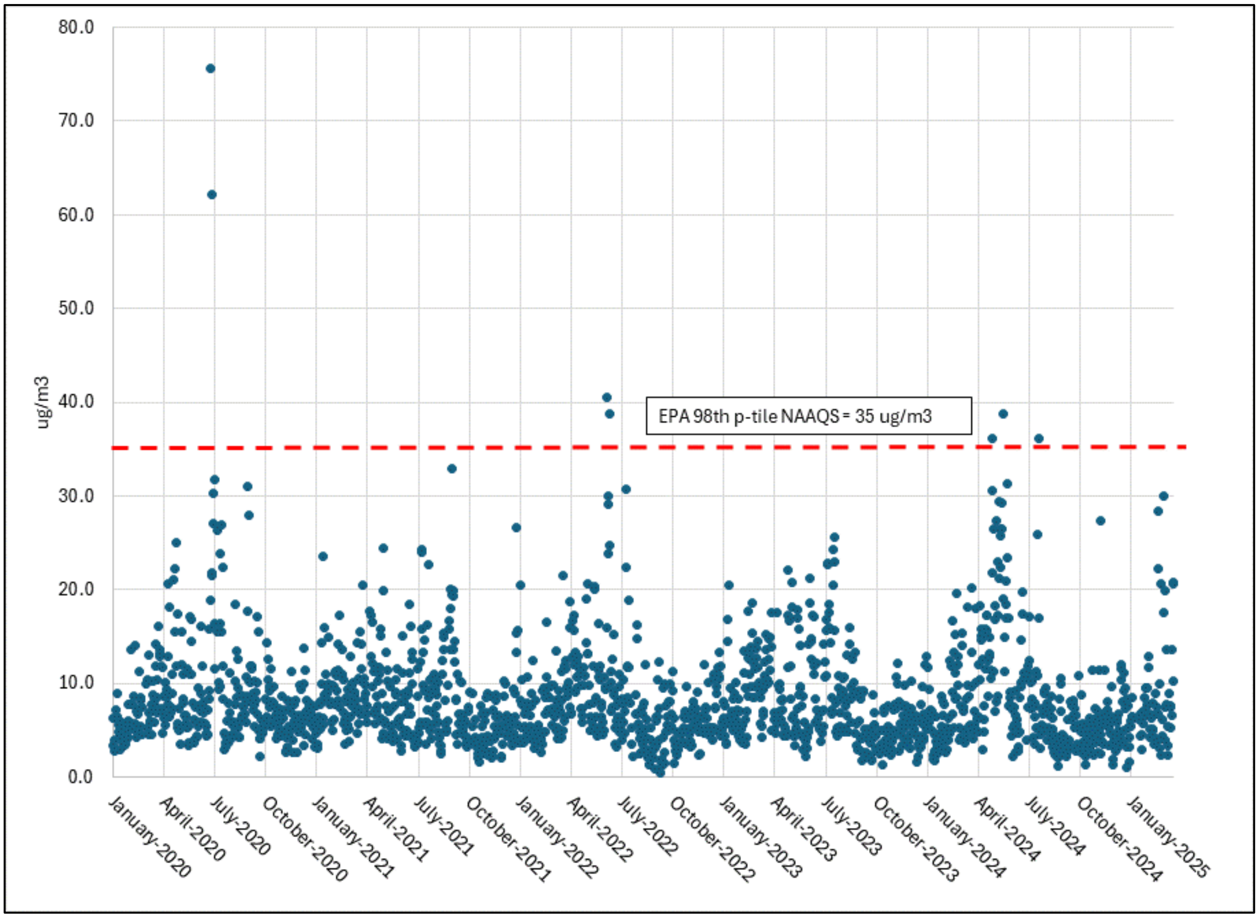

Figure 16. Mean 24-Hr PM2.5 at PBway, Jan. 1, 2020 – Mar. 31, 2025, with NAAQS value.

Table 8. PBG PM2.5 annual means and 3-year averages showing NAAQS compliance.

Year	Annual Mean, µg/cm^3	NAAQS 3-Year Annual Average Value, µg/cm^3	Annual 98th Percentile Value, µg/cm^3	NAAQS 3-Year 98th Percentile Average Value, µg/cm^3
2020	6.6		20.8	
2021	7.2		20.5	
2022	7.4		21.3	
2023	7.6		19.3	
2024	9.5		27.4	
3-year Avg. 2022-2024	8.1	9.0	22.7	35.0

Table 9. PBway PM2.5 annual means and 3-year averages showing NAAQS compliance.

Year	Annual Mean, µg/cm³	NAAQS 3-Year Annual Average Value, µg/cm³	Annual 98th Percentile Value, µg/cm³	NAAQS 3-Year 98th Percentile Average Value, µg/cm³
2020	8.7		26.9	
2021	8.2		20.5	
2022	7.8		22.5	
2023	8.1		20.7	
2024	8.3		27.4	
3-year Avg. 2022-2024	8.1	9.0	23.5	35.0

5.0 Data Analysis

As was noted earlier in this report, GCGV began operating a continuous EtO analyzer in early 2024 at PBG alongside the canister sampling. One would expect that with two different methods of taking measurements of the same chemical in the atmosphere, there would be some agreement between the methods. However, as has been pointed out, concentrations have been very low, with the large majority of canister samples being non-detects. The measurements for EtO are made in parts per billion "volume" (ppbV) for the continuous analyzer, which is a count of molecules of the compound to molecules in the air, as opposed to a count of carbon atoms in the molecule in ppbC. So ppbV units are used in this section of the report. In 2024, 52 of 61 can samples at PBG and also 52 of 61 samples at PBway were non-detects. The lowest reported value by canister sampler has been 0.045 ppbV, while the continuous EtO analyzer has a method detection limit of 0.010 ppbV although it has reported concentrations as low as 0.0001 ppbV. Over the course of the operation of the continuous analyzer, there have been eight canister samples that were "detects", and a side-by-side comparison of the canister concentration and the continuous analyzer 24-hour average value for the same 24-hour period is shown in Table 10. The table shows that reported concentrations from canisters are from 2 to 7 times the concentrations from the analyzer. However, all of the concentrations are quite low. The graph in Figure 17 does show a positive slope, however the regression is not robust enough to be called "statistically significant".

Table 10. Comparison of canister and continuous EtO analyzer

Date	Continuous EtO Average of 24 1-hour measurements (ppbV)	EtO Sixth day cans 24-hour sample (ppbV)
5/18/2024	0.032	0.076
6/11/2024	0.019	0.077
7/17/2024	0.009	0.076
8/10/2024	0.030	0.110
8/22/2024	0.043	0.090
9/3/2024	0.011	0.073
9/27/2024	0.020	0.088
10/27/2024	0.043	0.076

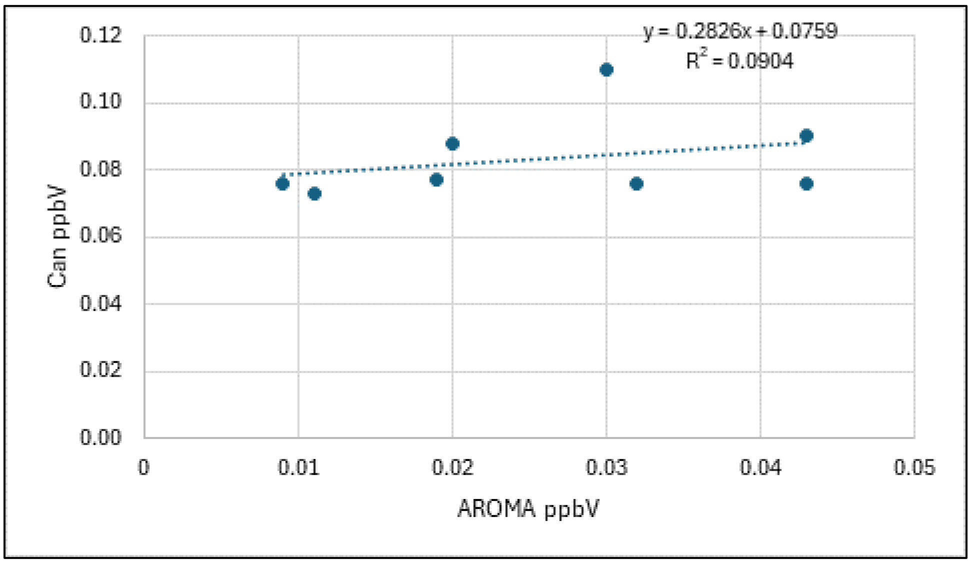

Figure 17. EtO Concentrations from canister samples (y-axis) compared to the continuous analyzer (x-axis)

6.0 Conclusions

The air monitoring to date has been very successful. Although some concentrations have occasionally exceeded the concentration levels of the NAAQS, to date, the NAAQS have not been violated. Furthermore, measured hydrocarbon concentrations have not exceeded TCEQ long- or short-term AMCVs. To date, operations at the GCGV facility and the Cheniere Energy facility do not appear to have affected the level of pollutants measured at project stations. UT Austin would be happy to answer any questions or conduct additional analysis at the community's or sponsors' requests.

Appendices

A.1 Air Monitoring Station Locations & Information

Table A-1. Gregory-Portland Community Air Monitoring Stations and Parameters Measured

Air Monitoring Station Name and Street Address	Volatile Organic Compounds (VOCs)[1]	Ethylene oxide (EtO)[1]	Nitrogen Oxides (NOx, NO, & NO2)[1]	Sulfur Dioxide (SO_2)[1]	Particulate Matter (PM) Mass, particles < 2.5 micron diameter[1]	Wind Speed (WS), Wind Direction (WD), Ambient Temperature (T), Relative Humidity (RH), & Barometric Pressure (BP)[1]
Gregory Fresnos Stephen Austin Elementary 401 Fresnos St. Gregory, TX	Yes	No	Yes	Yes	Yes	Yes
Portland Buddy Ganem 307 Buddy Ganem St. GP High School Portland, TX	Yes	24-hr canister every 6 th day	No	No	Yes	Yes + precipitation
Portland Broadway 175 Broadway Blvd. Old East Cliff Elementary School Portland, TX	Yes	24-hr canister every 6 th day	No	No	Yes	Only WS, WD

[1] All instruments operate continuously to provide hourly average measurements except as noted in the table.

Figure 18. Location of Gregory-Fresnos Community Air Monitoring Station (GF, pin G), and two Portland community stations on GPISD campuses on Buddy Ganem (PBG, pin 1) and on Broadway (PBway, pin 2) and the Cheniere Energy and GCGV industrial facilities

A.2 Glossary of Terms and Terminology

Pollutant concentrations – Concentrations of most gaseous pollutants are expressed in units denoting their "mixing ratio" in air, i.e., the ratio of the number molecules of the pollutant to the total number of molecules per unit volume of air. Because concentrations for all gases other than molecular oxygen, nitrogen, and argon are very low, the mixing ratios are usually scaled to express a concentration in terms of "parts per million" (ppm) or "parts per billion" (ppb).

Sometimes the units are explicitly expressed as ppm-volume (ppmV) or ppb-volume (ppbV) where 1 ppmV indicates that one molecule in one million molecules of ambient air is the compound of interest and 1 ppbV indicates that one molecule in one billion molecules of ambient air is the compound of interest. In general, air pollution standards and health effects screening levels are expressed in ppmV or ppbV units. Because hydrocarbon species may have a chemical reactivity related to the number of carbon atoms in the molecule, mixing ratios for these species are often expressed in ppb-carbon (ppbV times the number of carbon atoms in the molecule), to reflect the ratio of carbon atoms in that species to the total number of molecules in the volume. This is relevant to our measurement of auto-GC species and TNMHC, which are reported in ppbC units. For the purpose of relating hydrocarbons to health effects, this report notes hydrocarbon concentrations in converted ppbV units. However, because TNMHC is a composite of all species with different numbers of carbons, it cannot be converted to ppbV. Pollutant concentration measurements are time-stamped based on the start time of the sample, in Central Standard Time (CST), with sample duration noted.

Auto-GC – The automated gas chromatograph collects a sample for 40 minutes, and then automatically analyzes the sample for a target list of 46 hydrocarbon species. These include benzene and 1,3-butadiene, which are air toxics, various species that have relatively low odor thresholds, and a range of gasoline and vehicle exhaust components.

Total non-methane hydrocarbons (TNMHC) – TNMHC represent a large fraction of the total volatile organic compounds released into the air by human and natural processes. TNMHC is an unspeciated total of all hydrocarbons, and individual species must be resolved by other means, such as with canisters or auto-GCs.

Canister – Electro-polished stainless-steel canisters are filled with 24-hour air samples on a regular every sixth-day schedule, or when an independent sensor detects that *elevated* (see below) levels of hydrocarbons (TNMHC or a specific chemical species) are present. Event-triggered samples are taken for a set time period to capture the chemical make-up of the air.

Air Monitoring Comparison Values (AMCV) – The TCEQ uses AMCVs in assessing ambient data. A TCEQ Website that explain AMCVs is at https://www.tceq.texas.gov/toxicology/amcv/about (accessed April 2025). The following text is an excerpt from the Website:

> **AMCVs** and **ESLs** are screening levels for ambient air set to protect human health and welfare.
>
> **AMCVs** are screening levels used in TCEQ's evaluation of ambient air monitoring data to assess the potential for measured concentrations of specific chemicals to cause health

or welfare effects. Health-based AMCVs are safe levels at which exposure is unlikely to result in adverse health effects. Long-term AMCVs are similar to the USEPA's inhalation reference concentrations.

ESLs are screening levels used in the TCEQ's air permitting process to establish maximum emission rates that are written into enforceable air permits. Health-based ESLs are set 70 percent lower than the safe level, or AMCV. This additional buffer allows TCEQ to take into account exposure to chemicals from multiple sources in air permit reviews. A more detailed discussion of the differences can be found in Attachment C of the **Uses of ESLs and AMCVs Document**, or the **Fact Sheet** (which discusses the health-based values used to review air permits and air monitoring data)..

Rationale for Differences between ESLs and AMCVs – A very specific difference between the permitting program and monitoring program is that permits are applied to one company or facility at a time, whereas monitors may collect data on emissions from several companies or facilities or other source types (e.g., motor vehicles). Thus, the protective ESL for permitting is set lower than the AMCV in anticipation that more than one permitted emission source may contribute to monitored concentrations.

National Ambient Air Quality Standards (NAAQS) – U.S. Environmental Protection Agency (EPA) has established a set of standards for several air pollutions described in the Federal Clean Air Act. NAAQS are defined in terms of *levels* of concentrations and particular *forms*. For example, the NAAQS for particulate matter with size at or less than microns (PM2.5) has a *level* of 12 micrograms per cubic meter averaged over 24- hours, and a *form* of the annual average based on four quarterly averages, averaged over three years. Individual concentrations measured above the level of the NAAQS are called *exceedances*. The number calculated from a monitoring site's data to compare to the level of the standard is called the site's *design value*, and the highest design value in the area for a year is the regional design value used to assess overall NAAQS compliance. A monitor or a region that does not comply with a NAAQS is said to be *noncompliant*. At some point after a monitor or region has been in noncompliance, the U.S. EPA may choose to label the region as *nonattainment*. A nonattainment designation triggers requirements under the Federal Clean Air Act for the development of a plan to bring the region back into compliance. A more detailed description of NAAQS can be found on the EPA's Website at https://www.epa.gov/criteria-air-pollutants#self (accessed January 2023)

One species measured by this project and regulated by a NAAQS is sulfur dioxide (SO_2). EPA set the SO_2 NAAQS to include a level of 75 ppb averaged over one hour, with a form of the three-year average of the annual 99th percentiles of the daily maximum one- hour averages. If measurements are taken for a full year at a monitor, then the 99th percentile would be the fourth highest daily one hour maximum. There is also a secondary SO_2 standard of 500 ppb over three hours, not to be exceeded more than once in any one year.

Elevated Concentrations – In the event that measured pollutant concentrations are above a set threshold they are referred to as "elevated concentrations." The values for these thresholds are summarized by pollutant below. As a precursor to reviewing the data, the reader should understand the term "*statistical significance*." In the event that a concentration is higher than one would typically measure over, say, the course of a week, then one might conclude that a specific transient assignable cause may have been a single upwind pollution source, because experience shows the probability of such a measurement occurring under normal operating conditions is small. Such an event may be labeled "statistically significant" at level 0.01, meaning the observed event is rare enough that it is not expected to happen more often than once in 100 trials. This does not necessarily imply the failure to meet a health-based standard. A discussion of "elevated concentrations" and "statistical significance" by pollutant type follows:

- For SO_2, any measured concentration greater than the level of the NAAQS, which is 75 ppb over one hour, is considered "elevated." Note that the concentrations of SO2 need not persist long enough to constitute an exceedance of the standard to be regarded as elevated. In addition, any closely spaced values that are statistically significantly (at 0.01 level) greater than the long-run average concentration for a period of one hour or more will be considered "elevated" because of their unusual appearance, as opposed to possible health consequence. The rationale for doing so is that unusually high concentrations at a monitor may suggest the existence of unmonitored concentrations closer to the source area that are potentially above the state's standards.
- For TNMHC, any measured concentration greater than the threshold of 2000 ppbC is considered "elevated."
- For benzene and other air toxics in canister samples or auto-GC measurements, any concentration above the AMCV is considered "elevated." Note that 40-minute auto-GC measurements are compared with the short-term AMCV.
- Some hydrocarbon species measured by the auto-GC generally appear in the air in very low concentrations close to the method detection level. Similar to the case above with SO_2, any values that are statistically significant (at 0.01 level) greater than the long-run average concentration at a given time or annual quarter will be considered "elevated" because of their unusual appearance, as opposed to possible health consequence. The rationale for doing so is that unusually high concentrations at a monitor may suggest an unusual emission event in the area upwind of the monitoring site.