Quarterly Report of Air Quality Monitoring October 1, 2020 to December 31, 2020 at the Gregory – Portland Community Air Monitoring Stations

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Executive Summary

There are three air monitoring stations in the Gregory-Portland area in operation. 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 near the intersection of Buddy Ganem Dr. and Wildcat Dr. on the campus of the Gregory-Portland High School and on Broadway Blvd. on the campus of the old East Cliff Elementary School began operations on January 1, 2020.

A large-scale slowdown in the world economy owing to the COVID 19 pandemic has been underway since early 2020, but this has had minimal impact on air monitoring operations. The instruments in the stations operate automatically and can be accessed remotely. Station operators are locally based and need only travel a short distance to conduct standard operations and maintenance. The University of Texas at Austin (UT Austin) personnel have been working from home with no loss of effectiveness.

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).

Since monitoring began, some measured pollutant concentrations have exceeded the concentration levels of National Ambient Air Quality Standards (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).

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 (GCGV) as part of their separate 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 and has managed the stations since continuous monitoring operations began on January 1, 2020.

2.0 Summary of Activities October 1, 2020 through December 31, 2020

The international COVID 19 pandemic has caused a large-scale slowdown in a wide range of activities over recent months. While this has had no impact on air monitoring operations, it may have had some effect on activities in the community, which could have effects on air quality. For example, across Texas, the TCEQ recorded 267 monitor-days with daily maximum 8-hours average ozone at 71 parts per billion or above in 2019, 502 monitor-days in 2018, and 254 monitor-days in 2017, but only 195 monitor-days in 2020. In nearby Corpus Christi, 34 out of 46 (74 percent) of hydrocarbon species measured at the TCEQ Palm station in the Hillcrest neighborhood were lower in average concentrations from April through December 2020 as compared with April through December 2019. Year-to-year differences can be caused by combinations of human activity and weather. However, published research is appearing that suggests lower pollution concentrations in many parts of the world in 2020 was owing to reduced emissions associated with activity changes brought on by responses to the pandemic[1].

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).

This report focuses on the data collected at the three air monitoring stations during the period October 1 through December 31, 2020.

3.0 Air Monitoring Station Locations & Information

Currently, there are three air monitoring stations in the Gregory-Portland area in operation, one station operated by UT in Gregory, TX and two operated by AECOM in Portland, TX.

The locations of the three stations and parameters measured are summarized in Table 1. The locations of the three stations are also shown in Figure 1. Also outlined in Figure 1 are the locations of the Cheniere liquefied natural gas facility under expansion and the under-construction GCGV ethane-cracker facility.

[1] See https://cen.acs.org/environment/atmospheric-chemistry/COVID-19-lockdowns-had-strange-effects-on-air-pollution-across-the-globe/98/i37
https://www.nature.com/articles/s41893-020-0581-y
https://www.sciencedirect.com/science/article/pii/S0048969720350506

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

Air Monitoring Station Name & Address	Volatile Organic Compounds (VOCs) 46 compounds	Ethylene oxide (EO) 24 hr canister every 6th day	Nitrogen Oxides (NOx, NO, & NO2)	Sulfur Dioxide (SO_2)	Particulate Matter (PM) Mass, particles < 2.5 micron diameter	Wind Speed (WS), Wind Direction (WD), Ambient Temperature (T), Relative Humidity (RH), & Barometric Pressure (BP)
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	Yes	No	No	Yes	Yes. + precipitation
Portland Broadway 175 Broadway Blvd. Old East Cliff Elementary School Portland, TX	Yes	Yes	No	No	Yes	Only WS, WD

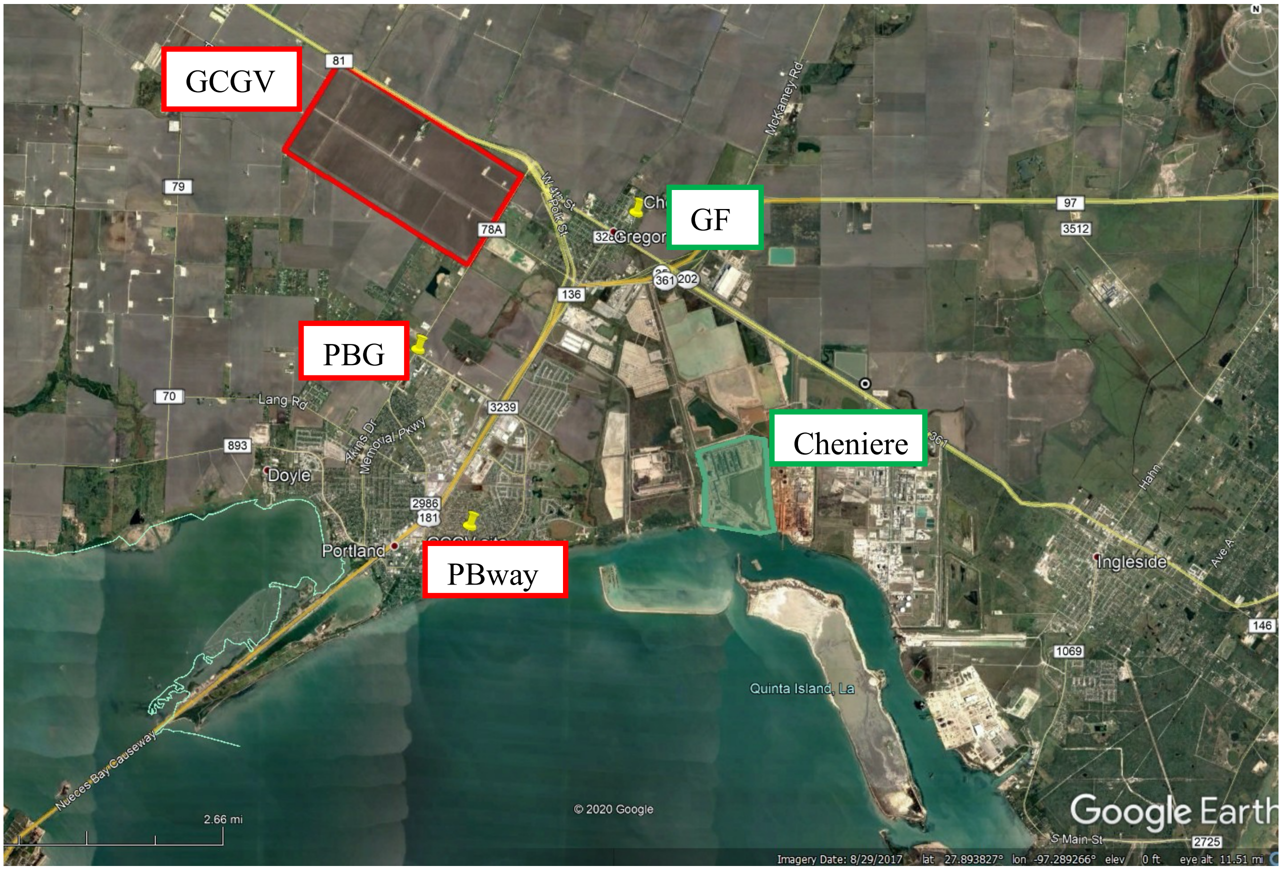

Figure 1. Location of Gregory-Fresnos Community Air Monitoring Station (GF), and two Portland community stations on GPISD campuses on Buddy Ganem (PBG) and on Broadway (PBway) and two industrial facilities

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 a source or the availability of dust to become airborne. Another is the weather. Regarding weather, rain can reduce concentrations of several pollutants, in particular, 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 a 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 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. 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 or not 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.

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, PM 2.5 & Met measurements – weekly; auto GC VOC measurements – within 90 days of the measurement; and EO canister data – within 60 days of the date the sample was collected. Although all of these measurements, except EO, are made in near-real time, the nature of the complexity in quality assuring the 46 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 EO data are collected at the station and then sent to a laboratory where EO concentration 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 EO data were available thought October 31, 2020 and all other data were available through December 27, 2020.

4.1 Gregory Fresnos Station Hydrocarbon Data

Figure 2 shows the time series for hourly concentrations of benzene at the Gregory-Fresnos (GF) station. The figure shows benzene hourly average concentrations for each hour from January 1, 2020 through October 31, 2020. 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 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 January 2021). 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. When data are missing, the reason(s) for the missing data are provided in the section with the available data.

Table 2 lists all 46 hydrocarbon species measured and reported by the auto-GCs, with the peak one-hour concentration, maximum 24-hour day concentration, and annual average concentration (up to Oct. 31) for each species. Note that total sum of target species (TNMTC) and total sum of hydrocarbons (target species plus non-target species and unknown species) (TNMHC) are included in the table. Time series graphs of other hydrocarbon species are also available upon request and any graphs can be made with time-scale (x-axis) or concentration-scale (y-axis) adjustments. Also, concentrations can be averaged by day, month, or other time period upon request. To make a request, contact Dr. Dave Sullivan at sullivan231@mail.utexas.edu or 512-471-7805.

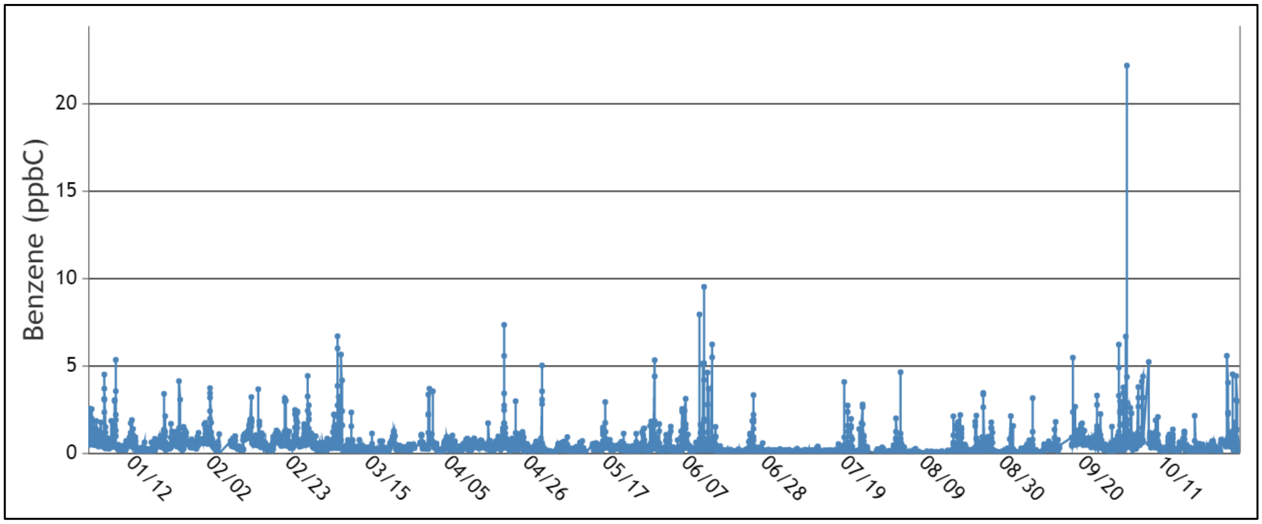

Figure 2. Hourly benzene concentrations at GF station, Jan. 1 – Oct. 31, 2020, ppbC units

Table 2. Gregory-Fresnos Auto-GC statistics for 2020 (through Oct. 31)

Species	Num. Samples	Peak 1-hr ppbC	Peak 24-hr ppbC	Mean ppbC
TNMTC	5,953	2,259.30	279.22	44.639
TNMHC	5,877	2,316.50	289.25	51.981
Ethane	6,117	767.82	84.19	12.032
Ethylene	6,117	14.14	2.45	0.674
Propane	6,117	564.20	67.22	9.451
Propylene	5,957	6.14	1.90	0.476
Isobutane	6,046	361.32	36.16	3.698
n-Butane	6,043	223.61	37.69	5.634
Acetylene	5,147	11.68	1.45	0.344
trans-2-Butene	5,979	4.20	0.47	0.101
1-Butene	6,046	3.54	0.56	0.232
cis-2-Butene	6,042	1.72	0.45	0.059
Cyclopentane	6,045	5.91	0.90	0.167
Isopentane	6,045	136.60	17.40	2.805
n-Pentane	6,116	403.64	81.91	3.333
1,3-Butadiene	6,100	3.52	0.39	0.057
trans-2-Pentene	6,100	2.26	0.33	0.031
1-Pentene	6,017	67.35	3.11	0.066
cis-2-Pentene	6,100	0.98	0.27	0.014
2,2-Dimethylbutane	5,259	19.17	1.75	0.154
Isoprene	5,909	2.99	0.75	0.110
n-Hexane	6,062	38.82	5.75	0.861
Methylcyclopentane	6,090	18.63	2.69	0.404
2,4-Dimethylpentane	6,089	3.83	0.45	0.014
Benzene	6,090	22.17	5.23	0.433
Cyclohexane	6,089	26.32	4.79	0.413
2-Methylhexane	6,090	8.22	1.61	0.132
2,3-Dimethylpentane	6,084	4.34	0.77	0.054
3-Methylhexane	6,090	8.94	1.47	0.176
2,2,4-Trimethylpentane	6,080	6.86	1.53	0.222
n-Heptane	6,086	16.62	2.62	0.282
Methylcyclohexane	6,077	30.42	5.02	0.465
2,3,4-Trimethylpentane	6,090	1.95	0.28	0.028
Toluene	6,090	18.60	4.05	0.521
2-Methylheptane	6,081	5.03	0.57	0.068
3-Methylheptane	6,089	2.72	0.58	0.053
n-Octane	6,079	7.02	1.24	0.145
Ethyl Benzene	6,090	1.89	0.44	0.060
p-Xylene + m-Xylene	6,090	7.04	1.34	0.308
Styrene	5,920	1.44	0.25	0.023
o-Xylene	5,812	1.73	0.39	0.081
n-Nonane	6,089	2.75	0.35	0.081
Isopropyl Benzene - Cumene	6,077	1.80	0.20	0.009
n-Propylbenzene	6,088	1.43	0.49	0.052
1,3,5-Trimethylbenzene	5,838	0.97	0.16	0.026
1,2,4-Trimethylbenzene	5,670	2.53	0.95	0.171
n-Decane	5,843	4.15	0.56	0.175
1,2,3-Trimethylbenzene	5,251	5.00	1.26	0.135

4.2 Portland Buddy Ganem and Portland Broadway Stations Hydrocarbon Data

Figure 3 shows the time series for hourly concentrations of benzene at the Portland Buddy Ganem (PBG) station. The figure shows benzene hourly average concentrations for each hour from January 1 through October 31, 2020.

Figure 4 shows the time series for the hourly concentrations of benzene at the Portland Broadway (PBway) station. The figure also shows benzene hourly average concentrations for each hour from January 1 through October 31, 2020.

As was the case at the Gregory Fresnos station, concentrations to date are much lower than TCEQ AMCVs or ESLs. Table 3 lists all 46 hydrocarbon species measured and reported by the Portland Buddy Ganem (PGB) auto-GC and Table 4 lists all 46 hydrocarbon species measured and reported by the Portland Broadway (PBway) auto-GC with the peak one hour concentration, maximum 24-hour day concentration, and annual average concentration for each species through Oct. 31, 2020. Time series graphs of other hydrocarbon species are also available upon request, and any graphs can be made with time-scale (x-axis) or concentration-scale (y-axis) adjustments. In addition, concentrations can be averaged by day, week, or month upon request.

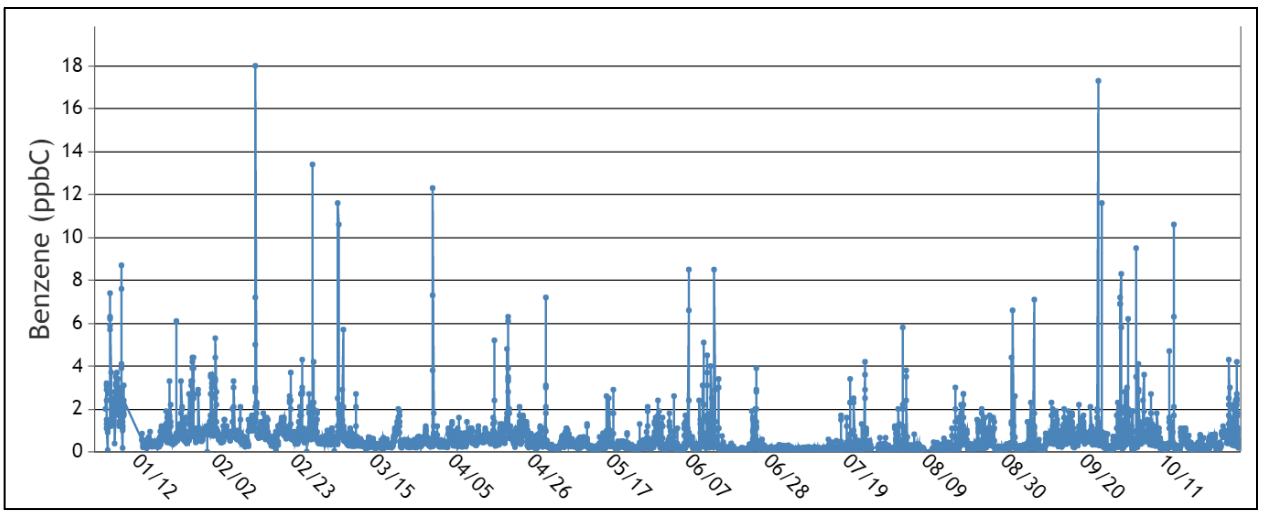

Figure 3. Hourly benzene concentrations at PBG station, Jan. 1 – Oct. 31, 2020, ppbC units

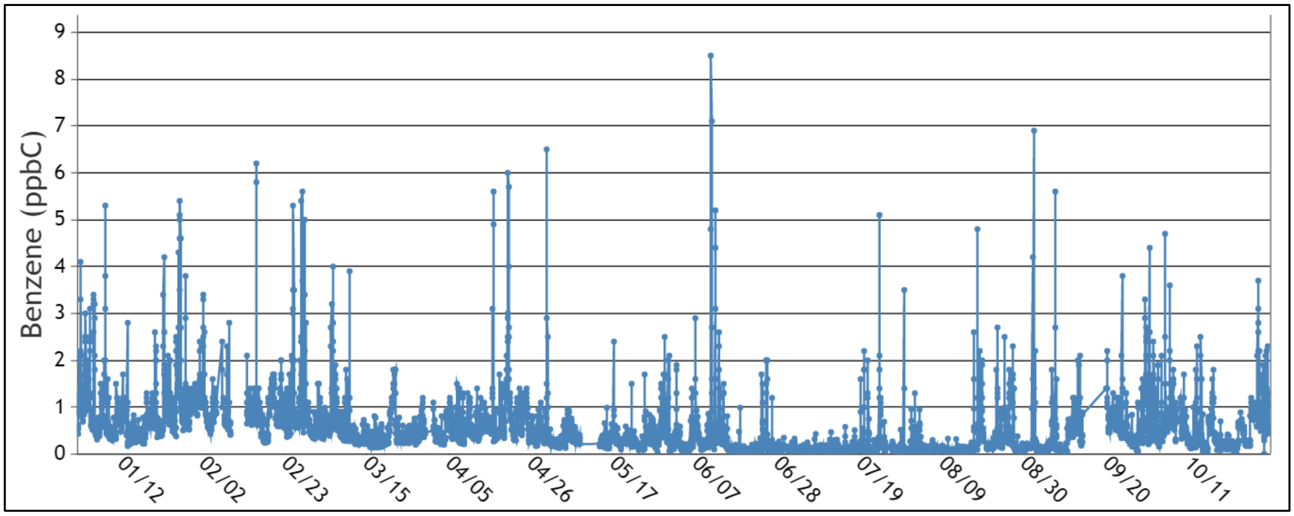

Figure 4. Hourly benzene concentrations at PBway station, Jan. 1 – Oct. 31, 2020, ppbC units

Table 3. PGB Auto-GC statistics for 2020 (through Oct. 31)

Species	Num. Samples	Peak 1-hr ppbC	Peak 24-hr ppbC	Mean ppbC
TNMTC	6,360	1867.21	256.07	47.511
TNMHC	6,360	1960.73	272.79	57.204
Ethane	6,400	603.00	79.15	12.934
Ethylene	6,400	18.50	3.62	0.758
Propane	6,400	441.00	71.71	10.600
Propylene	6,400	6.90	2.09	0.551
Isobutane	6,400	200.00	21.54	3.616
n-Butane	6,400	185.00	44.46	5.904
Acetylene	6,400	9.20	1.31	0.483
trans-2-Butene	6,130	1.10	0.15	0.056
1-Butene	6,400	4.50	0.98	0.302
cis-2-Butene	6,187	2.30	2.00	0.061
Cyclopentane	6,400	4.60	1.07	0.152
Isopentane	6,400	101.00	16.04	2.999
n-Pentane	6,400	68.70	14.99	2.120
1,3-Butadiene	6,400	2.30	1.17	0.066
trans-2-Pentene	6,400	2.00	0.14	0.020
1-Pentene	6,398	4.20	0.35	0.068
cis-2-Pentene	6,398	2.20	0.15	0.009
2,2-Dimethylbutane	6,400	4.30	0.53	0.126
Isoprene	690	2.40	0.83	0.313
n-Hexane	6,400	31.50	4.98	0.813
Methylcyclopentane	6,399	14.50	2.32	0.514
2,4-Dimethylpentane	6,399	8.00	0.60	0.056
Benzene	6,235	18.00	2.94	0.607
Cyclohexane	6,399	28.50	3.34	0.510
2-Methylhexane	6,400	10.30	1.11	0.178
2,3-Dimethylpentane	6,400	6.70	0.73	0.105
3-Methylhexane	6,400	12.50	1.44	0.282
2,2,4-Trimethylpentane	6,400	13.40	1.13	0.293
n-Heptane	6,400	24.10	2.70	0.379
Methylcyclohexane	6,400	36.60	3.97	0.608
2,3,4-Trimethylpentane	6,400	4.70	0.33	0.053
Toluene	6,400	29.00	4.61	0.638
2-Methylheptane	6,400	5.10	0.50	0.080
3-Methylheptane	6,400	5.50	0.44	0.066
n-Octane	6,400	27.50	1.60	0.188
Ethyl Benzene	6,400	6.40	0.45	0.077
p-Xylene + m-Xylene	6,400	21.30	1.39	0.294
Styrene	6,400	2.70	0.18	0.019
o-Xylene	6,400	7.50	0.44	0.064
n-Nonane	6,400	86.60	4.46	0.098
Isopropyl Benzene - Cumene	6,400	3.80	0.20	0.007
n-Propylbenzene	6,400	17.90	0.92	0.016
1,3,5-Trimethylbenzene	6,214	8.60	0.46	0.027
1,2,4-Trimethylbenzene	6,214	71.00	3.73	0.094
n-Decane	6,214	218.00	11.56	0.388
1,2,3-Trimethylbenzene	Species not analyzed			

Table 4. PBway Auto-GC statistics for 2020 (through Oct. 31)

Species	Num. Samples	Peak 1-hr ppbC	Peak 24-hr ppbC	Mean ppbC
TNMTC	6,035	952.34	262.33	52.355
TNMHC	6,035	902.67	244.96	46.023
Ethane	5,991	171.00	69.62	13.406
Ethylene	5,991	22.50	3.13	0.829
Propane	5,946	285.00	65.72	8.873
Propylene	5,955	8.20	2.49	1.303
Isobutane	5,991	75.00	20.55	2.947
n-Butane	5,991	216.00	41.56	5.27
Acetylene	5,789	4.10	1.63	0.609
trans-2-Butene	5,991	3.30	0.64	0.177
1-Butene	5,991	71.70	6.56	0.389
cis-2-Butene	5,989	0.80	0.26	0.071
Cyclopentane	5,991	15.20	2.72	0.162
Isopentane	5,991	69.10	15.90	2.723
n-Pentane	5,991	74.30	15.29	2.07
1,3-Butadiene	5,991	14.20	0.74	0.084
trans-2-Pentene	5,991	4.10	0.45	0.043
1-Pentene	5,990	6.80	0.69	0.082
cis-2-Pentene	5,988	4.40	0.91	0.018
2,2-Dimethylbutane	5,991	3.80	0.70	0.111
Isoprene	5,329	8.20	2.24	0.775
n-Hexane	5,991	20.00	4.51	0.845
Methylcyclopentane	5,991	37.20	2.28	0.372
2,4-Dimethylpentane	5,991	4.80	0.45	0.023
Benzene	5,991	8.50	2.20	0.543
Cyclohexane	5,991	10.90	2.06	0.365
2-Methylhexane	5,991	26.40	2.24	0.181
2,3-Dimethylpentane	5,991	13.10	1.13	0.078
3-Methylhexane	5,991	37.00	3.11	0.275
2,2,4-Trimethylpentane	5,991	32.00	3.26	0.435
n-Heptane	5,991	16.30	2.06	0.317
Methylcyclohexane	5,991	11.10	2.23	0.396
2,3,4-Trimethylpentane	5,991	10.30	0.97	0.06
Toluene	5,991	72.20	7.97	0.723
2-Methylheptane	5,991	5.10	0.89	0.085
3-Methylheptane	5,990	3.80	0.81	0.083
n-Octane	5,991	9.00	1.55	0.157
Ethyl Benzene	5,989	6.60	0.81	0.098
p-Xylene + m-Xylene	5,991	18.70	3.25	0.361
Styrene	5,991	0.94	0.18	0.024
o-Xylene	5,991	5.30	0.93	0.066
n-Nonane	5,991	6.80	0.84	0.067
Isopropyl Benzene - Cumene	5,991	1.90	0.12	0.008
n-Propylbenzene	5,991	2.50	0.22	0.015
1,3,5-Trimethylbenzene	5,991	3.80	0.46	0.024
1,2,4-Trimethylbenzene	5,991	10.20	1.19	0.092
n-Decane	5,991	6.00	1.25	0.376
1,2,3-Trimethylbenzene	Species not analyzed			

4.4 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). Some National Ambient Air Quality Standards (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) concentration each year must be less than 35 micrograms per cubic meter ($\mu g/m^3$). The annual average, calculated by first averaging 24-hour averages by quarter and then averaging the four quarters, is averaged with the two previous years' annual averages, and must be less than 12 $\mu g/m^3$. 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, and averaging it with the similar statistic from the previous two years.

No concentrations at levels that violate the National Ambient Air Quality Standards (NAAQS) have been seen at the GF station. Several recorded PM2.5 1-hour values exceeded the level of the 24-hour NAAQS, 35 $\mu g/m^3$, 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 violates the 24-hour NAAQS, or unless the overall annual average, averaged over three years, exceeds the level of the annual NAAQS (12 $\mu g/m^3$).

Figure 5 shows the hourly average time series for PM2.5 at the GF station from Oct. 1 through Dec. 27, 2020. The average concentration for 2020 was 9.0 $\mu g/m^3$ compared with the primary one-year NAAQS value (annual mean averaged over three years) of 12 $\mu g/m^3$.

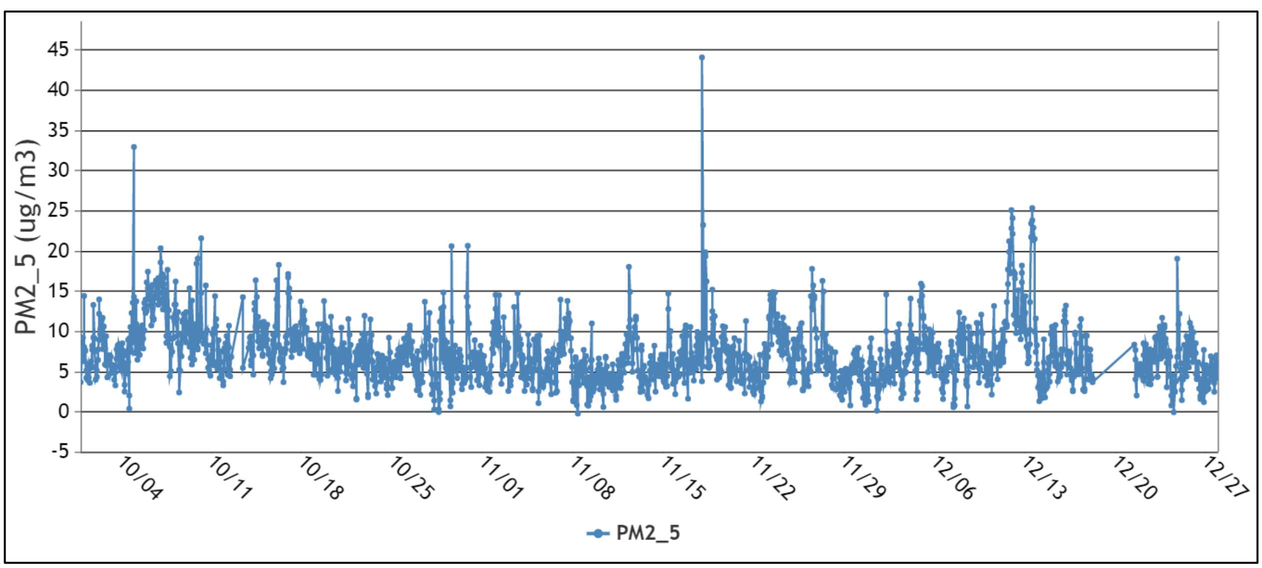

Figure 5. Hourly average PM2.5 at GF, $\mu g/m^3$, Oct. 1, 2020 – Dec. 27, 2020

Figure 6 shows the hourly average time series for NO_2 at the Gregory Fresnos station from Oct. 1 through Dec. 27, 2020. The National Ambient Air Quality Standard (NAAQS) for NO_2 is for the values to average less than 53 ppb in a calendar year. Over 2020, the annual average NO_2 concentration at the Gregory Fresnos station was 6 ppb. The NOx instrument was out of service for three and a half weeks in late November into late December 2020. The routine quality assurance calibrations for this instrument were unstable and unacceptable in late November so the instrument was removed and sent to the manufacturer for assessment. It was repaired and returned to service in late December after standard on-site calibrations showed stable operation within acceptable limits.

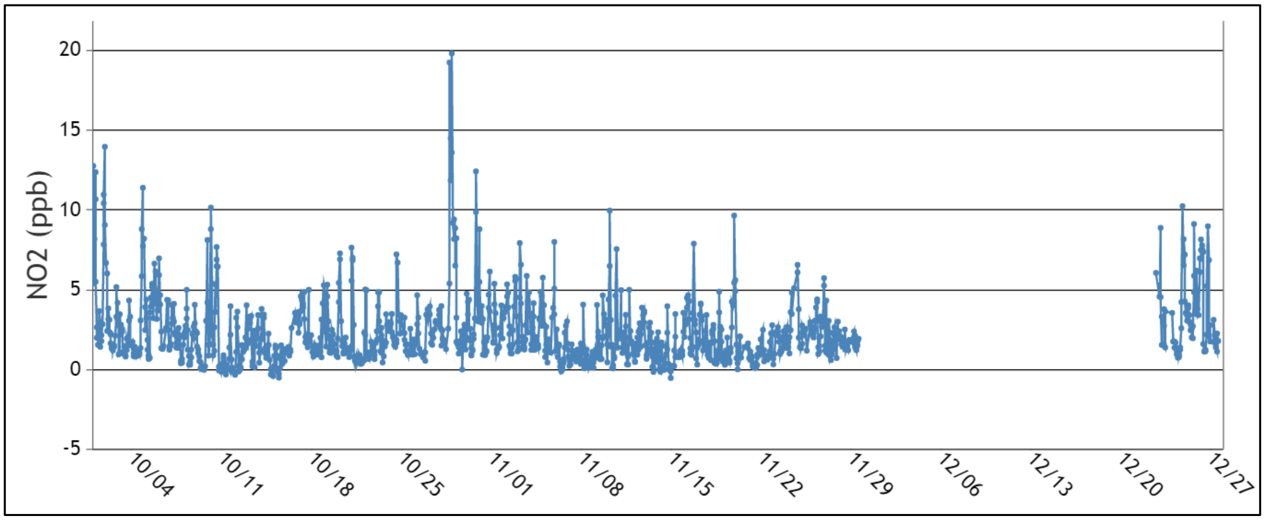

Figure 6. Hourly NO_2 at GF, ppb units, Oct. 1, 2020 – Dec. 27, 2020

Figure 7 shows the hourly average time series for SO_2 from Oct. 1 through Dec. 27, 2020. The average concentration of SO2 measured to date is less than 1 part per billion (ppb) and the maximum one-hour concentration during the fourth quarter of 2020 was 4.8 ppb on Dec. 5 at 6 p.m. CST. This was within an hour of two Corpus Christi stations also recording concentrations greater than zero, suggesting SO_2 may have been transported into the area. Winds around this time were northerly. The NAAQS for SO_2 is the 99th percentile of daily one-hour maximum averaged over three years being less than 75 ppb. Because SO_2 is rarely found in ambient air, and the instruments are calibrated to accurately measure high concentrations that are a risk to public health, the concentrations close to 0.0 tend to fluctuate around 0, as illustrated in the graph. 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.

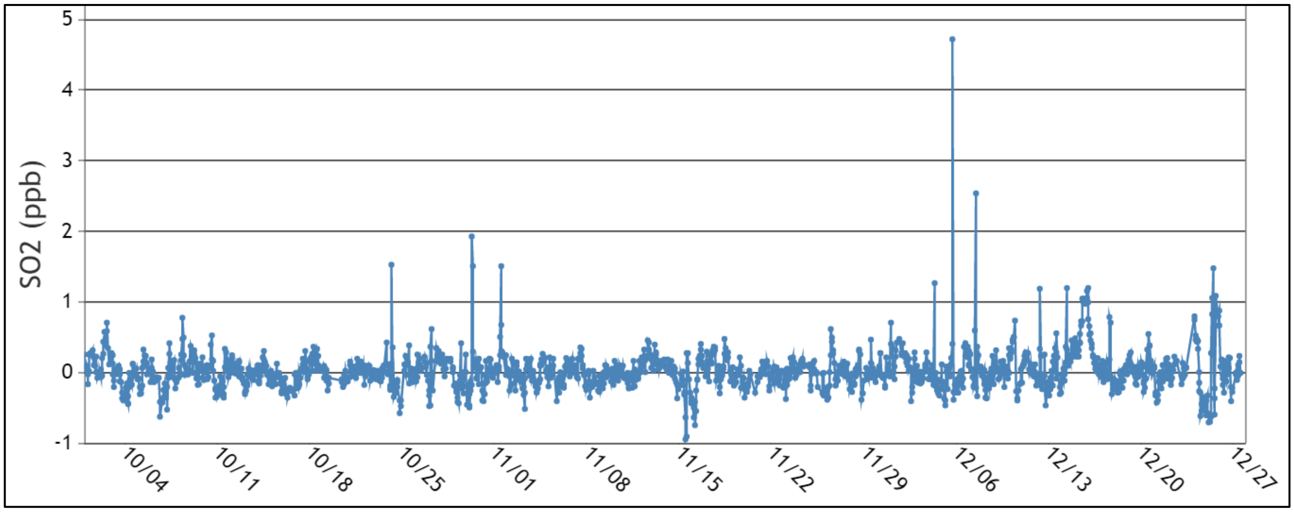

Figure 7. Hourly average SO_2 at GF, ppb units, Oct. 1, 2020 – Dec. 27, 2020

4.5 Portland Buddy Ganem and Portland Broadway Stations Criteria Pollutant Data

Fine particulate matter (PM2.5) is the only NAAQS-regulated pollutant measured at the PBG and PBway stations. Concentrations that exceed the NAAQS 24-hour average value have been seen at the two stations, but no violations of the standard have occurred. Figure 8 shows the recent 24-hour averaged concentrations of PM2.5 at the PBG site and Figure 9 shows the same for the PBway site. The average concentration to date at PBG in 2020 was 6.6 $\mu g/m^3$ and was 8.8 $\mu g/m^3$ at PBway, as compared to the NAAQS Annual Average of 12 $\mu g/m^3$.

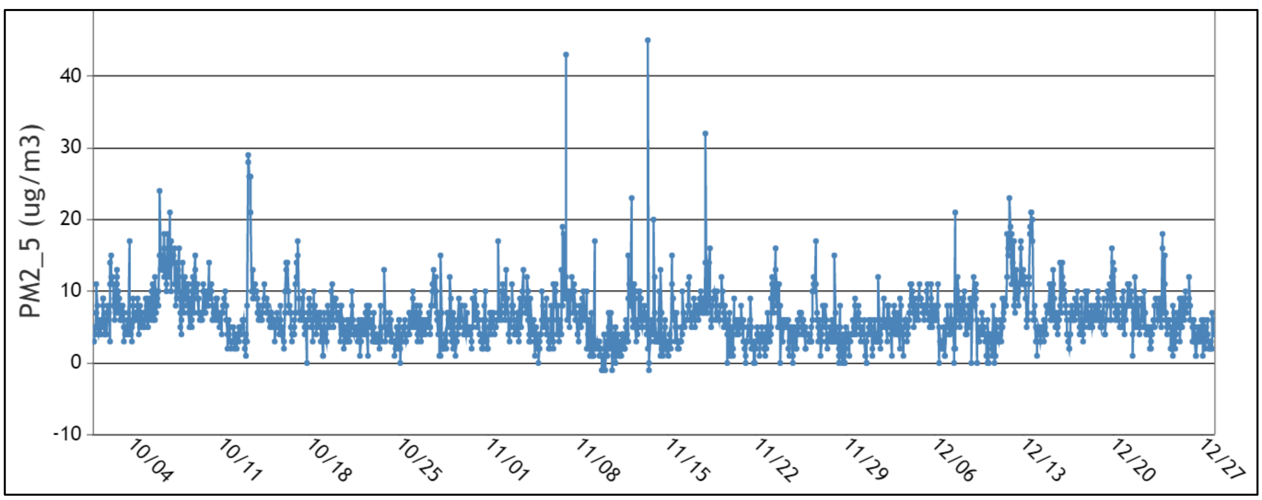

Figure 8. Hourly average PM2.5 at PBG, $\mu g/m^3$, Oct. 1, 2020 – Dec. 27, 2020

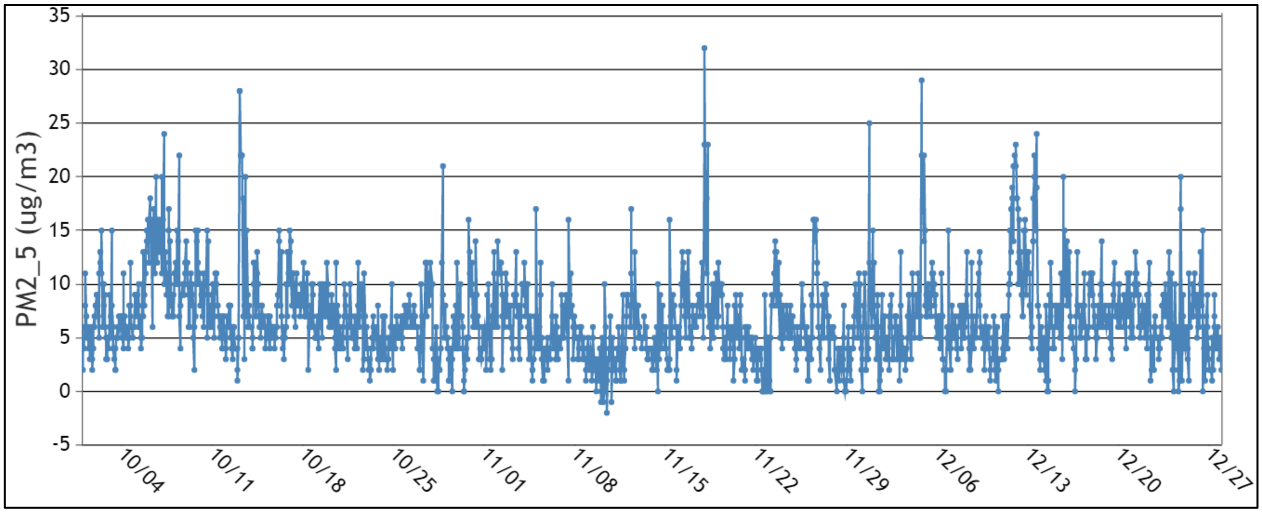

Figure 9. Hourly average PM2.5 at PBway, μg/m³, Oct. 1, 2020 – Dec. 27, 2020

6.1 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-term or short-term AMCVs. 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 & Address	Volatile Organic Compounds (VOCs) 46 compounds	Ethylene oxide (EO) 24 hr canister every 6th day	Nitrogen Oxides (NOx, NO, & NO_2)	Sulfur Dioxide (SO_2)	Particulate Matter (PM) Mass, particles < 2. 5 micron diameter	Wind Speed (WS), Wind Direction (WD), Ambient Temperature (T), Relative Humidity (RH), & Barometric Pressure (BP)
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	Yes	No	No	Yes	Yes. + precipitation
Portland Broadway 175 Broadway Blvd. Old East Cliff Elementary School Portland, TX	Yes	Yes	No	No	Yes	Only WS, WD

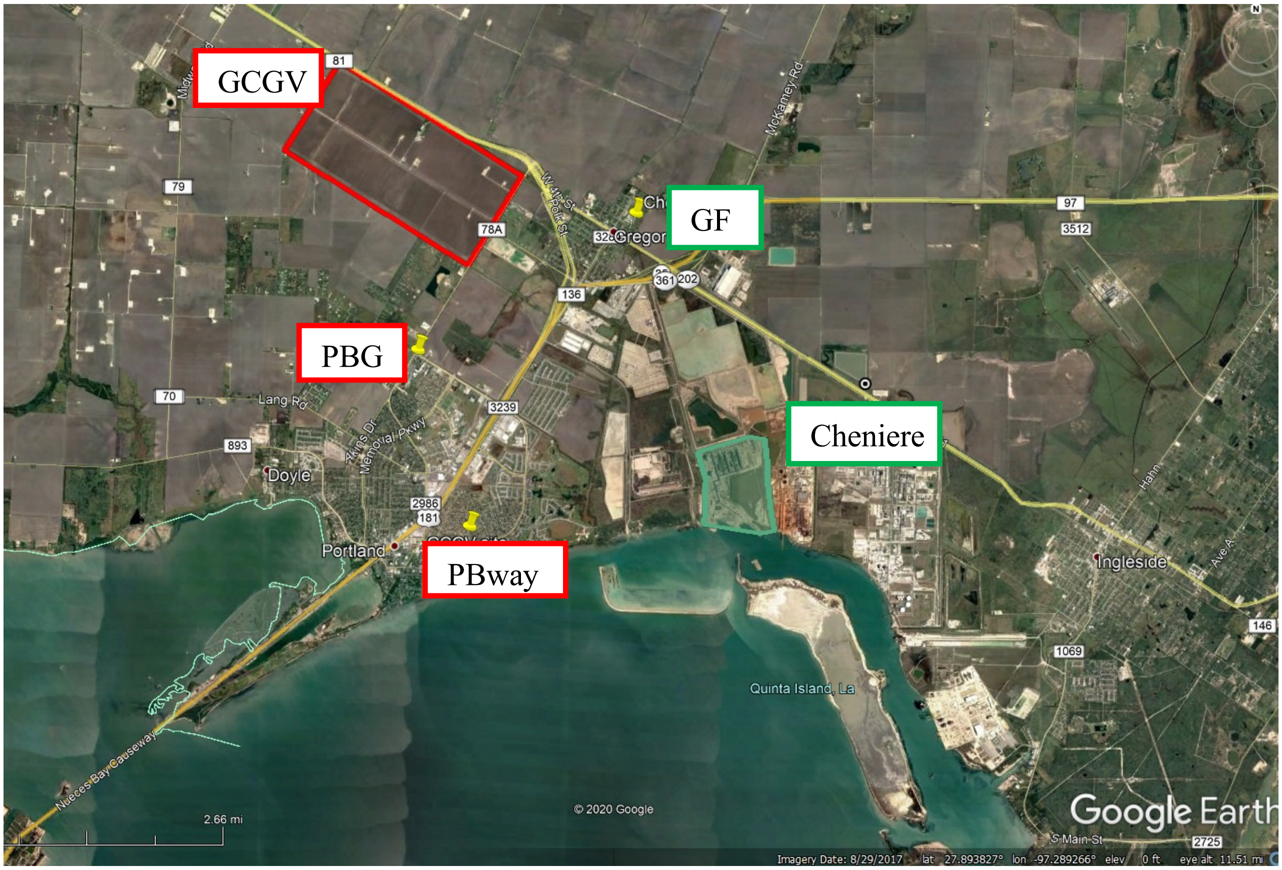

Figure 10. Location of Gregory-Fresnos Community Air Monitoring Station (GF), and two Portland community stations on GPISD campuses on Buddy Ganem Dr. (PBG) and on Broadway Ave. (PBway) and two industrial facilities

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 (pp<u>mV</u>) or ppb-volume (pp<u>bV</u>) 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 air samples when an independent sensor detects that *elevated* (see below) levels of hydrocarbons (TNMHC) are present. 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. Two valuable online documents ("Fact Sheet" and "Uses of ESLs and AMCVs Document") that explain AMCVs are at http://www.tceq.texas.gov/toxicology/AirToxics.html (accessed January 2021). The following text is an excerpt from the TCEQ "Fact Sheet" document:

Effects Screening Levels are chemical-specific air concentrations set to protect human health and welfare. Short-term ESLs are based on data concerning acute health effects, the potential for odors to be a nuisance, and effects on vegetation, while long-term ESLs are based on data concerning chronic health and vegetation effects. Health-based ESLs are set below levels where health effects would occur whereas welfare-based ESLs (odor and vegetation) are set based on effect threshold concentrations. The ESLs are screening levels, **not ambient air standards.**

Originally, the same long- and short-term ESLs were used for both air permitting and air monitoring.

There are significant differences between performing health effect reviews of air permits using ESLs, and the various forms of ambient air monitoring data. The Toxicology Division is using the term “air monitoring comparison values” (AMCVs) in evaluations of air monitoring data in order to make more meaningful comparisons. “AMCVs” is a collective term and refers to all odor-, vegetative-, and health-based values used in reviewing air monitoring data. Similar to ESLs, AMCVs are chemical-specific air concentrations set to protect human health and welfare. Different terminology is appropriate because air *permitting* and air *monitoring* programs are different.

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 ($PM_{2.5}$) 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 2021)

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 99^{th} 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.