Quarterly Report of Air Quality Monitoring April 1 to June 30, 2020 at the Gregory - Portland Community Air Monitoring Stations

Prepared by

Vincent M. Torres, PE
Project Manager

David W. Sullivan, Ph.D.
Data Analyst and Quality Assurance Manager

Center for Energy & Environmental Resources
The University of Texas at Austin
Austin, Texas

TEXAS
The University of Texas at Austin

July 14, 2020

Contents

Executive Summary

The Gregory Fresnos Community Air Monitoring Station began continuous monitoring operations October 1, 2019. Two additional air-monitoring stations in Portland, TX on Buddy Ganem Dr. on the campus of the Gregory-Portland High School and on Broadway on the campus of the old East Cliff Elementary School began operations on January 1, 2020.

During the past three and a half months a large-scale slowdown has occurred in general activity and the world economy owing to the COVID 19 pandemic. This has had minimal impact on the project's monitoring operations. The equipment 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. Project managers at The University of Texas at Austin (UT Austin) have been working from home with no loss of effectiveness.

On four occasions beginning late March 2020, very high instrument readings of NOx and modestly high readings of other species have occurred at the Gregory Fresnos station. These readings have been diagnosed by site operators as likely chemical interferents, and the instrument responses are not actual reflections of target species concentrations. As a result, these data have been invalidated and do not appear on the data website, but the raw data are stored in the project's offline database and data archive.

As is generally the case in South Texas in the spring months, fires in southern Mexico and Central America were responsible for several days with elevated concentrations of $PM_{2.5}$ measured at all project stations and also at $PM_{2.5}$ instruments in Corpus Christi and the Lower Rio Grande Valley operated by the Texas Commission on Environmental Quality (TCEQ).

A new public website to provide information about air quality and monitoring data from the three stations was designed and developed by UT Austin with advice from a focus group composed of Gregory-Portland community representatives. The website (https://gpair.ceer.utexas.edu), under the management of UT Austin, has been fully functional, accessible to the public, and actively populated with data and other project-related information since early April.

1.0 Introduction

The University of Texas at Austin is jointly funded by Cheniere Energy and Gulf Coast Growth Ventures (GCGV) to independently review and perform analyses of the air monitoring data obtained at the three Gregory-Portland community air monitoring stations. This report focuses primarily on these stations' air monitoring data for the period April 1 to late-June 2020. UT Austin 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 for the Period April 1 through June 30, 2020

The international COVID 19 pandemic has caused a large-scale slowdown in a wide range of activities over the past quarter. While this has had little impact on the project's monitoring operations, it may have had some effect on activities in the community, which could have effects on air quality.

Project activities during the reporting period have focused on maintenance and operation of the three community air monitoring stations, analysis of the data from all three stations, and maintenance of the public website for reporting of the data from the three stations. The UT Austin project team appointed a focus group composed of community representatives to provide advice on the detailed design and development of the public website to make it user friendly and helpful for the community. The focus group members are listed in Table 1. The website (https://gpair.ceer.utexas.edu) has been fully functional and accessible to the general public since early April. The website is managed and maintained by UT Austin.

Table 1. Public Website Design & Development Focus Group Members and Affiliation

Name	Position
Troy Bethel	City Council, Portland
Randy Cain	City Council, Ingleside on the Bay
Brandi Dickey	Gregory-Portland ISD
Amelia Flores	Parks & Recreation Board, Gregory
Ron Jorgensen	Portland Resident and Regional Health Awareness Board
Bob Lacy	HOA Officer, Portland
Rudy Rivera	Gregory Resident
Kristina Zambrano	City Council, Gregory

The remainder of this report focuses on the data collected since the beginning of the project, with a specific focus on the data collected during the most recent annual quarter (April – June 2020).

3.0 Air Monitoring Station Locations & Information

Currently, there are three air monitoring stations in the Gregory-Portland area in operation: the Gregory Fresnos (GF) Community Air Monitoring Station at 401 Fresnos Street, Gregory, Texas at the Stephen F. Austin, Elementary School Campus and two sites operated by AECOM, at two Gregory-Portland Independent School District (GPISD) properties in Portland, TX. The two GCGV stations are named Portland Buddy Ganem (located at the Gregory Portland High School campus) and Portland Broadway (located on the Old East Cliff Elementary School property). The parameters measured at the three stations are summarized in Table 2. The locations of the three stations are 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.

Table 2. 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 6^{th} 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 401 Fresnos St., Gregory, TX	Yes	No	Yes	Yes	Yes	Yes
Portland Buddy Ganem GP High School Portland, TX	Yes	Yes	No	No	Yes	Yes. + precipitation
Portland Broadway Old East Cliff Elementary School Portland, TX.	Yes	Yes	No	No	Yes	Only WS, WD

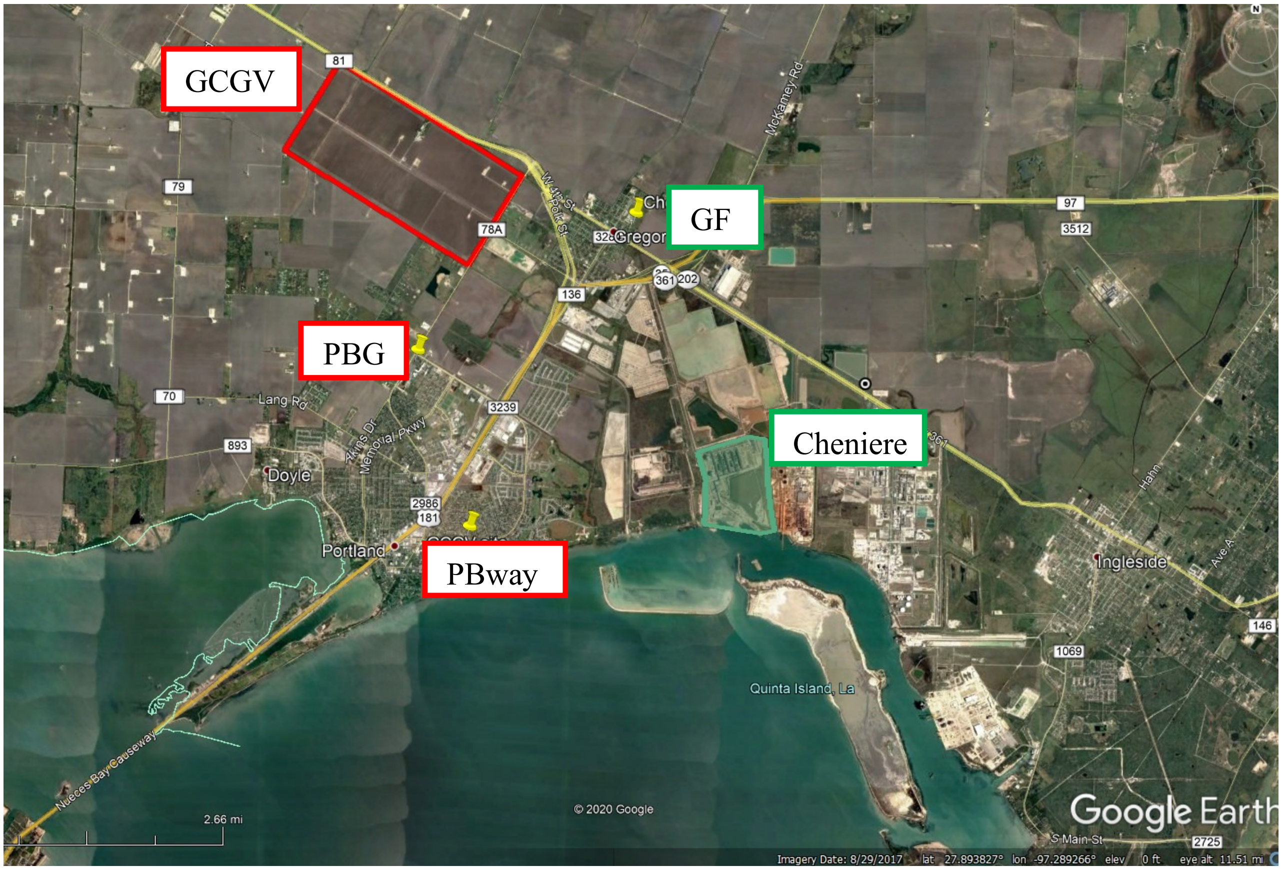

Figure 1. Location of Gregory-Fresnos Community Air Monitoring Station (GF), and two GCGV stations on GPISD sites in Portland on Buddy Ganem (PBG) and on Broadway (PBway) and two industrial facilities

4.0 Summary of Data

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, especially particulate matter. Temperature inversions such as those experienced at night 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 large 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. 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., are 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.

Please note that the measurement data in this report are quality assured site data made available at different 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. Hence, the data available at the time the analyses were performed for this report will not all have the same date ranges for this quarter.

Gregory Fresnos Hydrocarbon Data

Figure 2 shows the time series for the hourly concentrations of benzene at the Gregory-Fresnos (GF) station. The figure shows benzene hourly average concentrations for each hour from October 1, 2019 through April 30, 2020. Figure 3 shows the hourly time series for 1,3-butadiene, and Figure 4 shows the hourly time series for iso-propylbenzene. Iso-propylbenzene has a relatively low odor threshold and is shown in part because the odor threshold had been crossed at a Corpus Christi monitoring station in the past. Benzene and 1,3-butadiene 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) or Effects Screening Levels (ESL). Note that a straight line or a gap in a time series graph represents missing data.

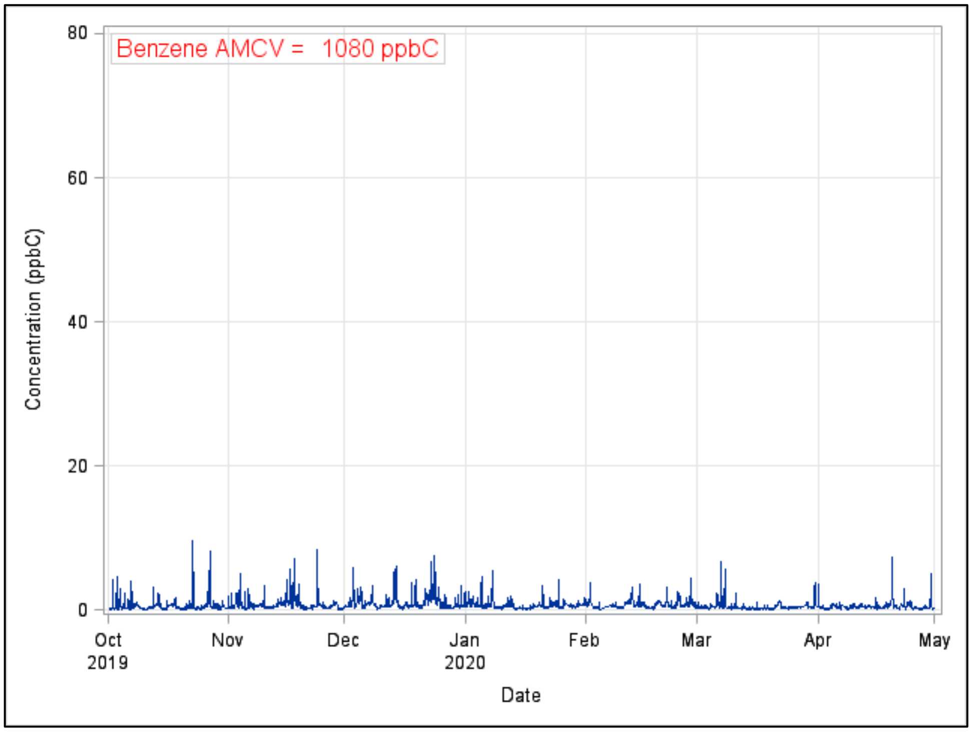

Figure 2. Hourly benzene concentrations at GF station, Oct. 1, 2019 – Apr. 30, 2020, ppbC units

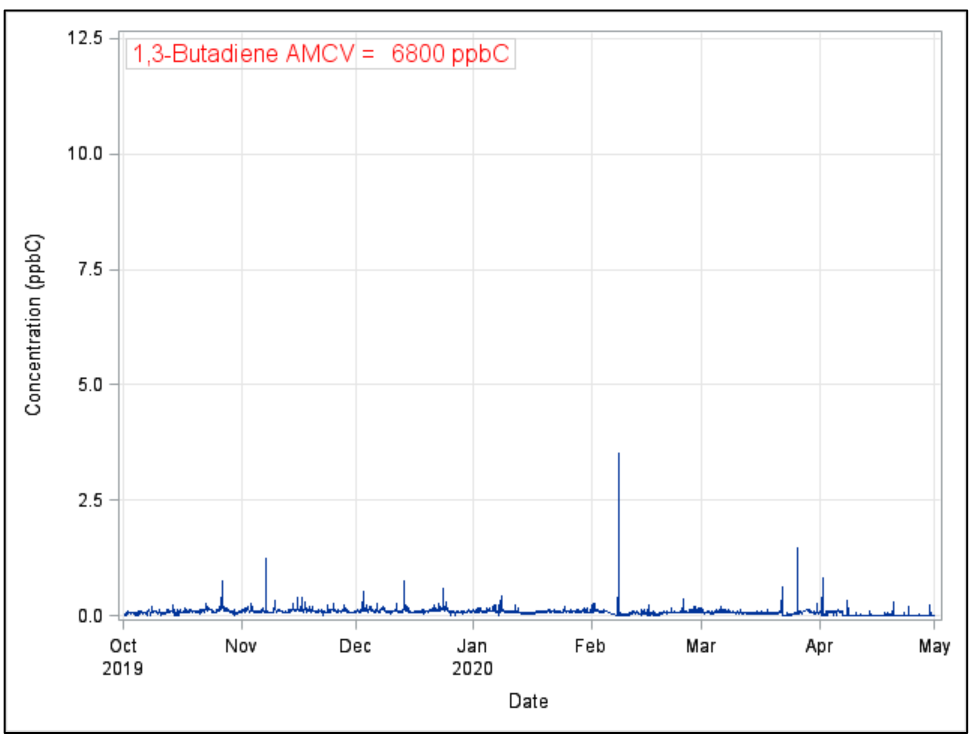

Figure 3. Hourly 1,3-butadiene concentrations at GF station, Oct. 1, 2019 – Apr. 30, 2020, ppbC units

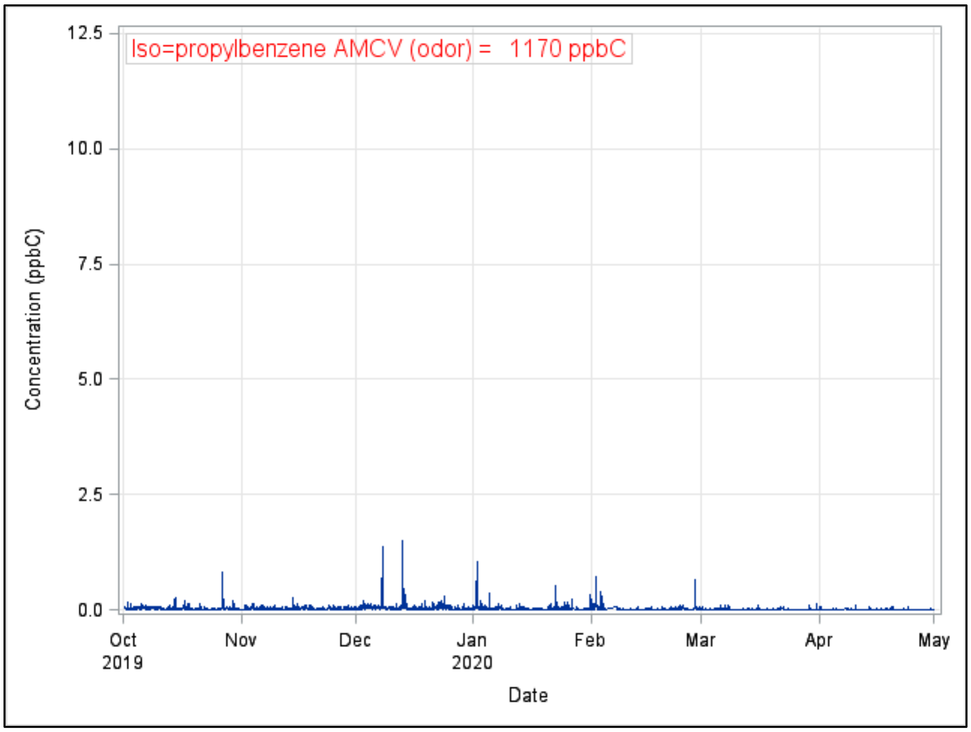

Figure 4. Hourly iso-propylbenzene concentrations at GF station, Oct. 1, 2019 – Apr. 30, 2020, ppbC units

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, or week, or month, upon request.

Portland Buddy Ganem and Portland Broadway Hydrocarbon Data

Figure 5 shows the time series for the 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 April 30, 2020. Some benzene data were invalidated January 1 to 4 and January 9 to 13, and on January 16 due to failed internal QC for the daily blank recoveries. In the benzene graph, a straight line replaces the January 9 – 13 invalidated data. Figure 6 shows the hourly time series for 1,3-butadiene, and Figure 7 shows the hourly time series for iso-propylbenzene.

Figure 8 shows the time series for the hourly concentrations of benzene at the Portland Broadway (PBway) station. The figure shows benzene hourly average concentrations for each hour from January 1 through April 30, 2020. Figure 9 shows the hourly time series for 1,3-butadiene, and Figure 10 shows the hourly time series for iso-propylbenzene.

As was the case at the Gregory Fresnos station, concentrations to date are much lower than TCEQ AMCVs or ESLs.

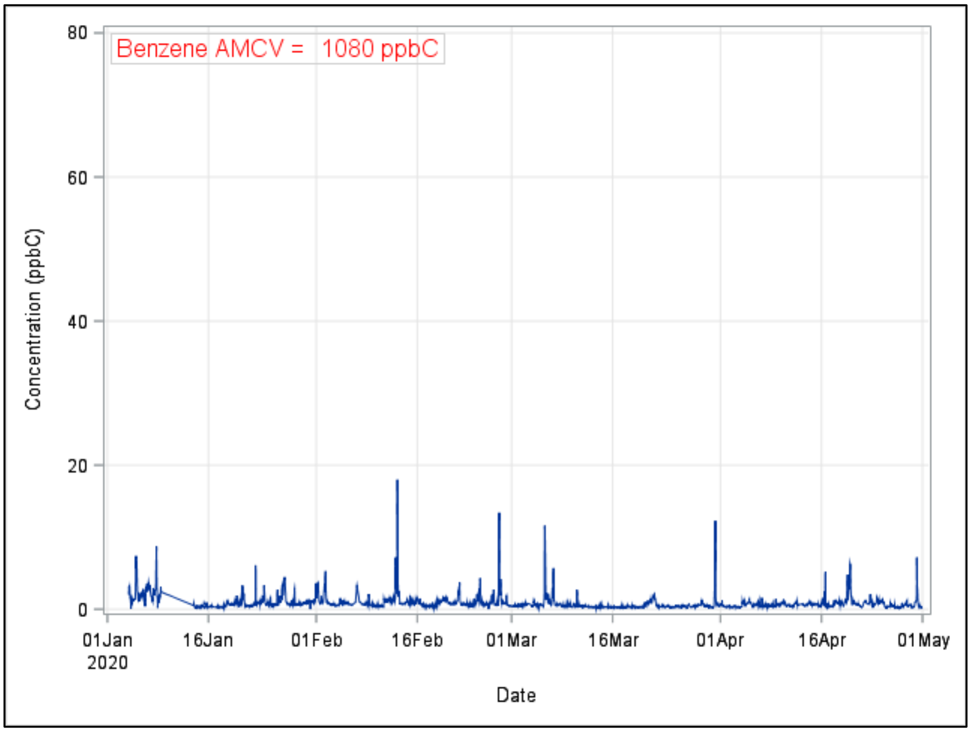

Figure 5. Hourly benzene concentrations at PBG station, Jan. 1 – Apr. 30, 2020, ppbC units

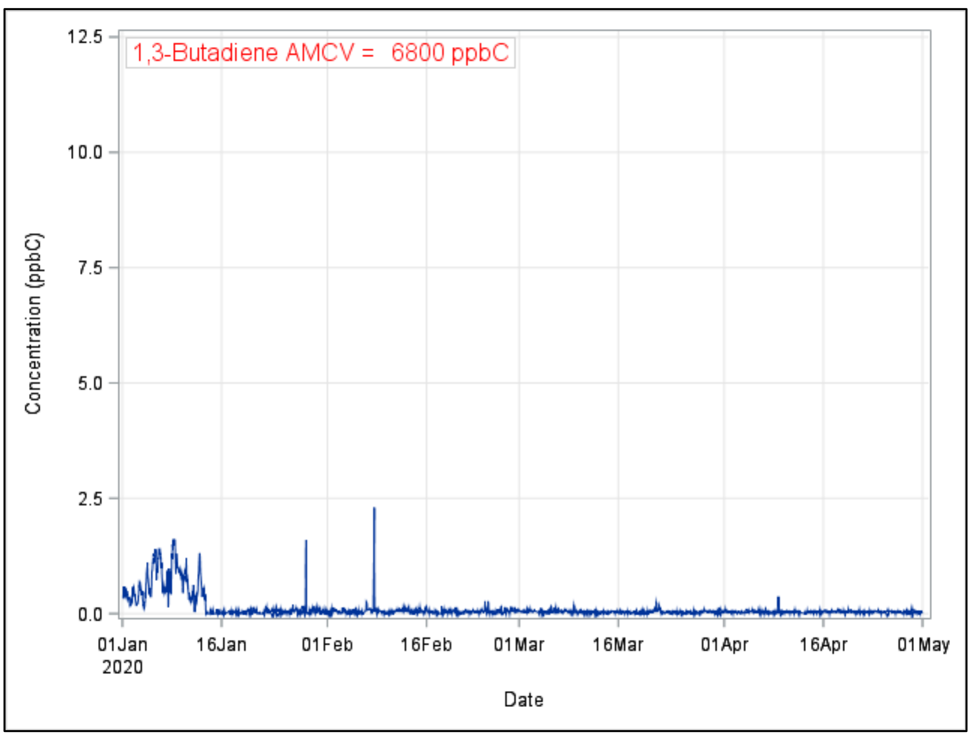

Figure 6. Hourly 1,3-butadiene concentrations at PBG station, Jan. 1 – Apr. 30, 2020, ppbC units

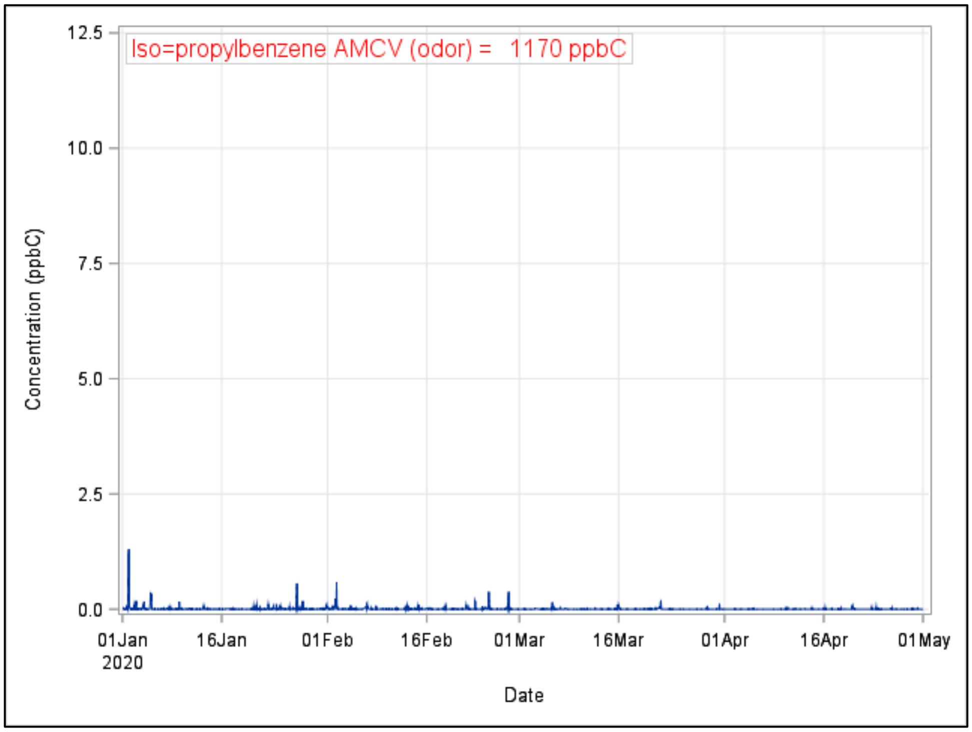

Figure 7. Hourly iso-propylbenzene concentrations at PBG station, Jan. 1 – Apr. 30, 2020, ppbC units

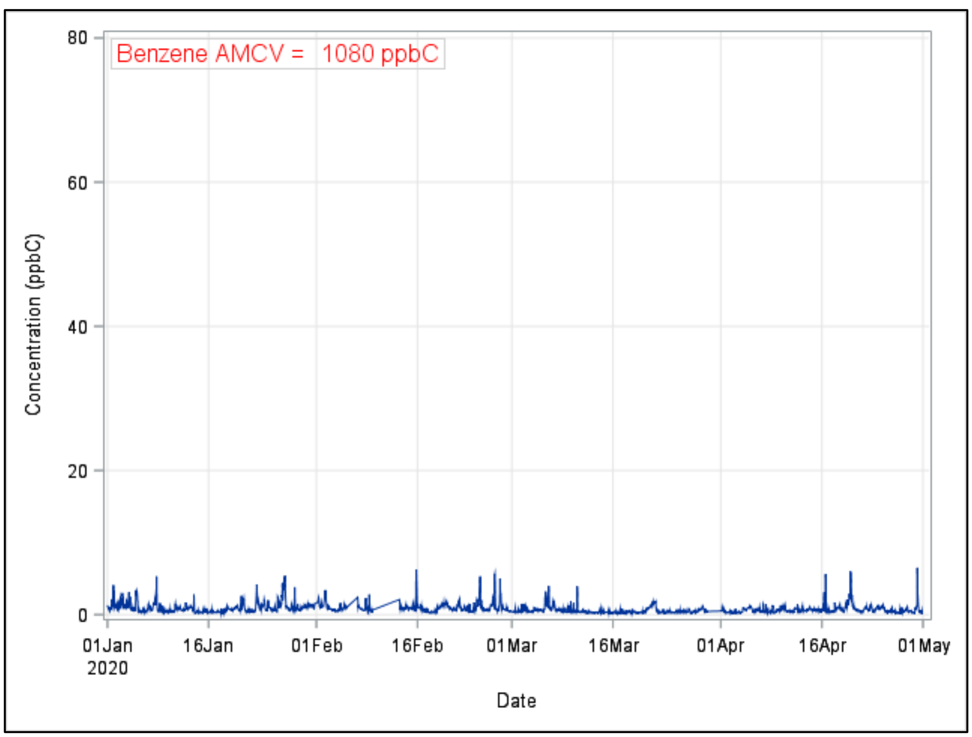

Figure 8. Hourly benzene concentrations at PBway station, Jan. 1 – Apr. 30, 2020, ppbC units

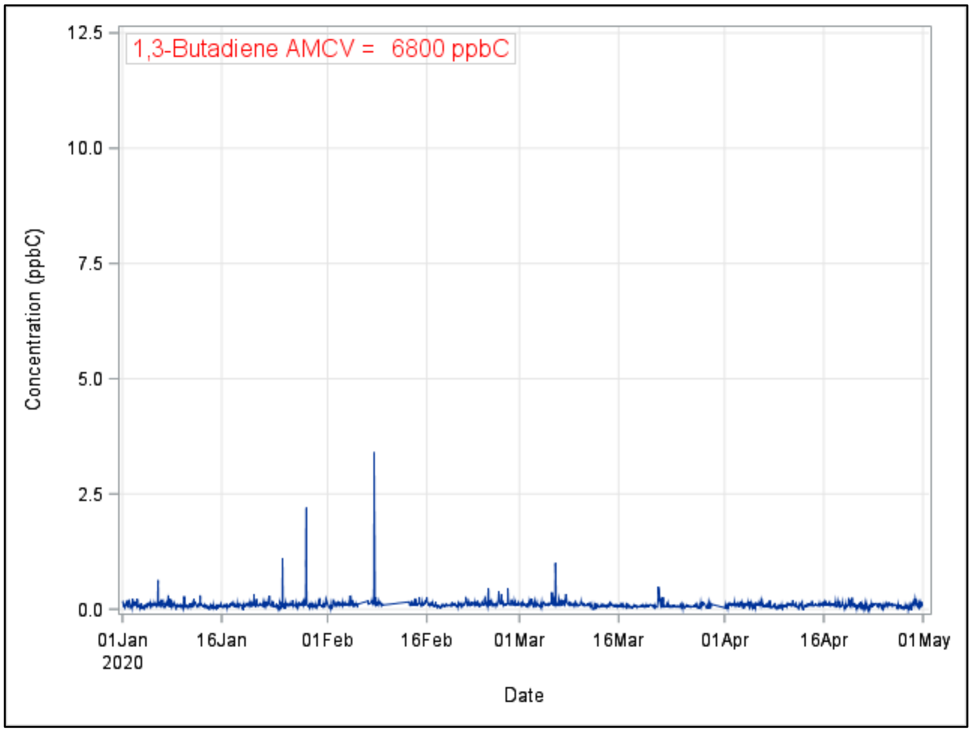

Figure 9. Hourly 1,3-butadiene concentrations at PBway station, Jan. 1 – Apr. 30, 2020, ppbC units

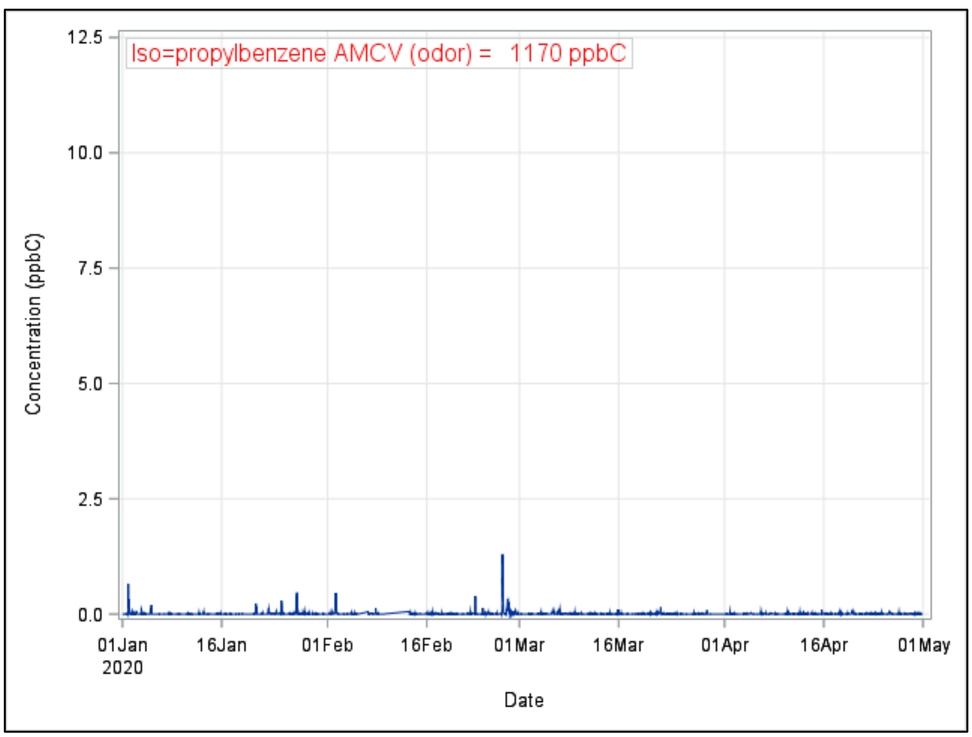

Figure 10. Hourly iso-propylbenzene concentrations at PBway station, Jan. 1 – Apr. 30, 2020, ppbC units

Portland Buddy Ganem and Portland Broadway Ethylene Oxide Data
In May 2020, the TCEQ concluded a study into the toxicity of ethylene oxide (EO), a chemical used in manufacturing processes and as a sterilizing agent in laboratories and medical facilities. Both the PBG and PBway stations measure EO concentration in 24-hour canister samples, obtained on an every 6th day basis. The TCEQ determined the long-term health threshold for exposure to EO to be 4.8 ppbC (2.4 ppbV), and concentrations at both stations are well below this level. Time series of EO concentrations that have been reported to date appear in the figures below.

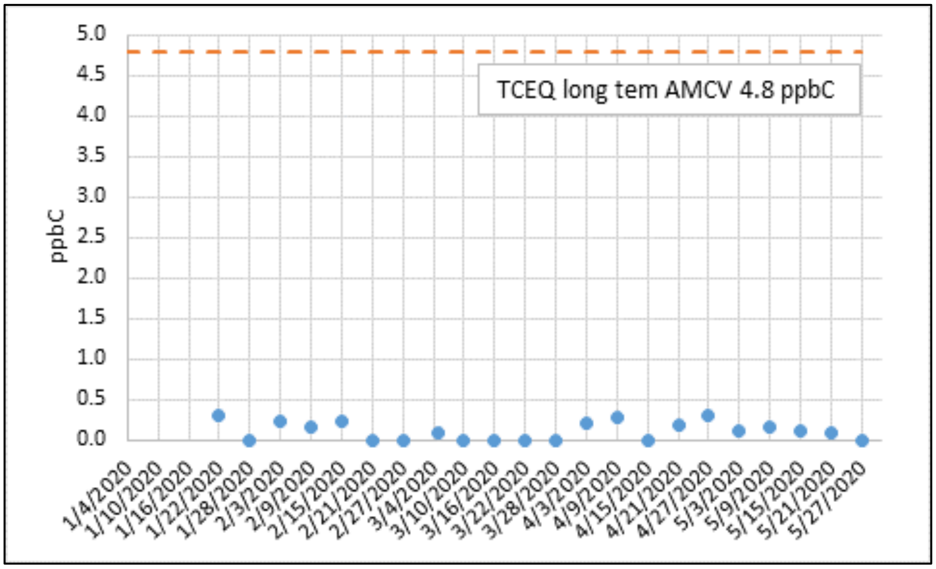

Figure 11. Canister 24-hour ethylene oxide concentrations at PBG station, Jan. 1 – May. 31, 2020, ppbC units

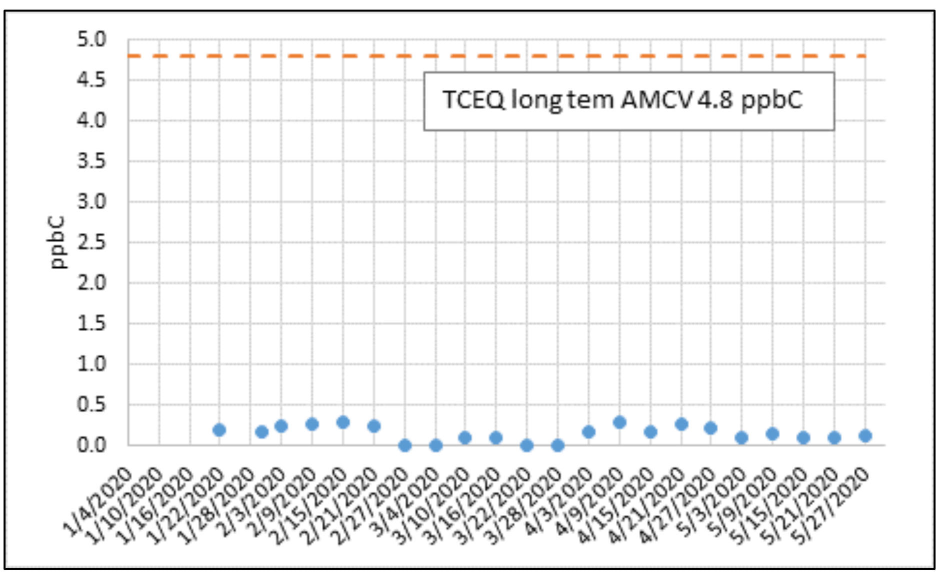

Figure 12. Canister 24-hour ethylene oxide concentrations at PBway station, Jan. 1 – May. 31, 2020, ppbC units

Gregory Fresnos Criteria Pollutant Data

Sulfur dioxide (SO_2), fine particulate matter ($PM_{2.5}$), and nitrogen dioxide (NO_2) are three pollutants measured at the GF site that are regulated by the U.S. Environmental Protection Agency (EPA). No concentrations near the National Ambient Air Quality Standards (NAAQS) have been seen at the GF station, with the exception of one short period of elevated $PM_{2.5}$ likely associated with parking lot maintenance adjacent to the site in early December. This was not enough to cause concern for exceeding the NAAQS, however.

Figure 13 shows the hourly average time series for $PM_{2.5}$ at the GF station. The average concentration since October 2019 is 7.9 micrograms per cubic meter (μg/m^3), and the average in 2020 through June 21 is 8.4 μg/m^3 compared with the primary one-year NAAQS value (annual mean over three years) of 12 μg/m^3. The instrument underwent maintenance in mid-February 2020, resulting in two weeks of data loss, shown as a straight line in the graph.

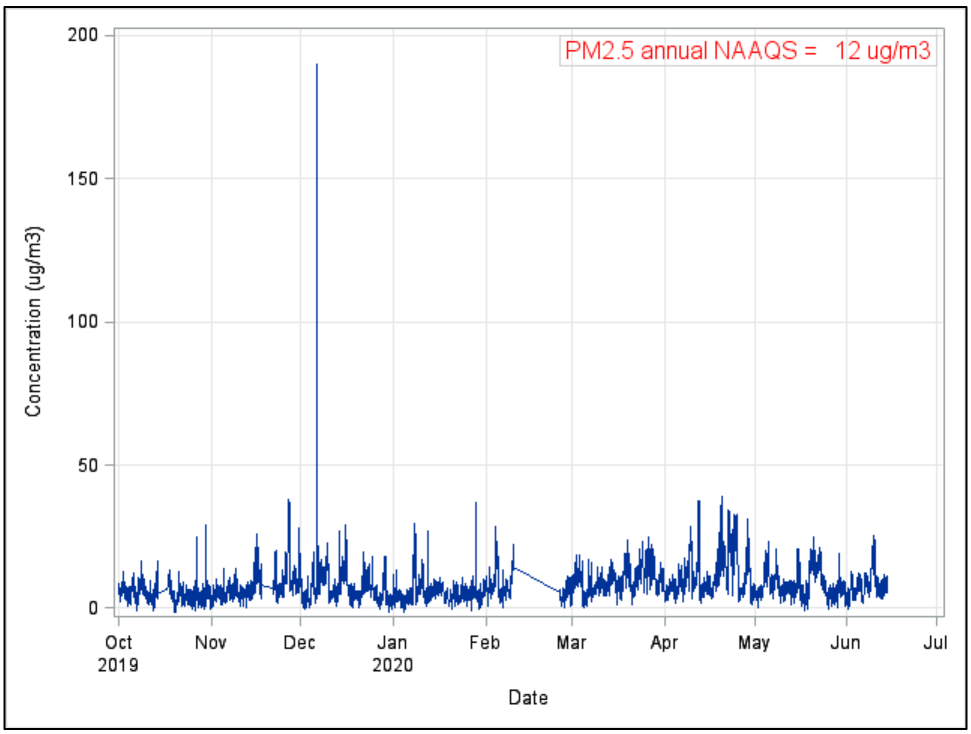

Figure 13. Hourly average $PM_{2.5}$ at GF, micro-grams/cubic meter units, Oct. 17, 2019 – June 14, 2020

Figure 14 shows the hourly average time series for NO_2. The average concertation of NO_2 measured to date is 6.8 parts per billion (ppb) and the average in 2020 through mid-June is 8.0 ppb compared to the primary NAAQS (annual average) of 53 ppb. There was a change out of equipment in mid-February that caused a few days data loss. During the early morning hours on April 20, 2020, elevated concentrations of NO, NO_2, NOx were measured, believed to have been associated with a natural gas leak based on the coincident auto-GC hydrocarbon measurements. Figure 15 shows the coincident elevated NO_2 concentration and the alkanes generally associated with natural gas. The 6 alkanes shown represented 94 percent of total hydrocarbon mass at 3:00 CST. Winds were from the northeast at less than 3 miles per hour. Figure 16 shows the NO_2 concentrations to mid-June on a scale more typical of the measured concentration ranges.

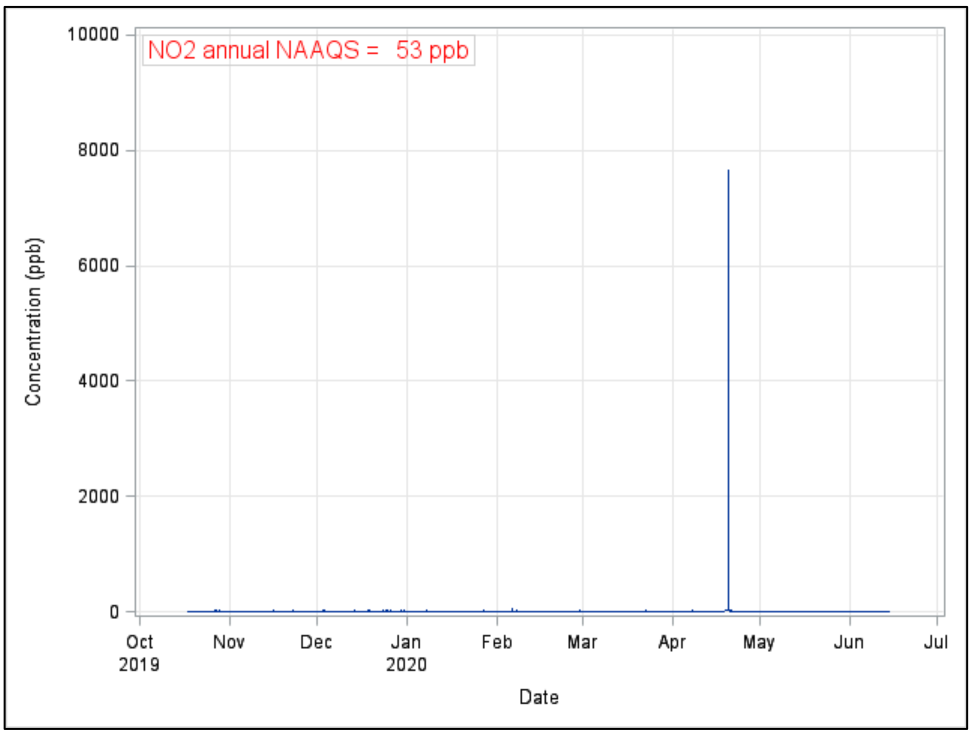

Figure 14. Hourly NO_2 at GF, ppb units, Oct. 17, 2019 – June 14, 2020

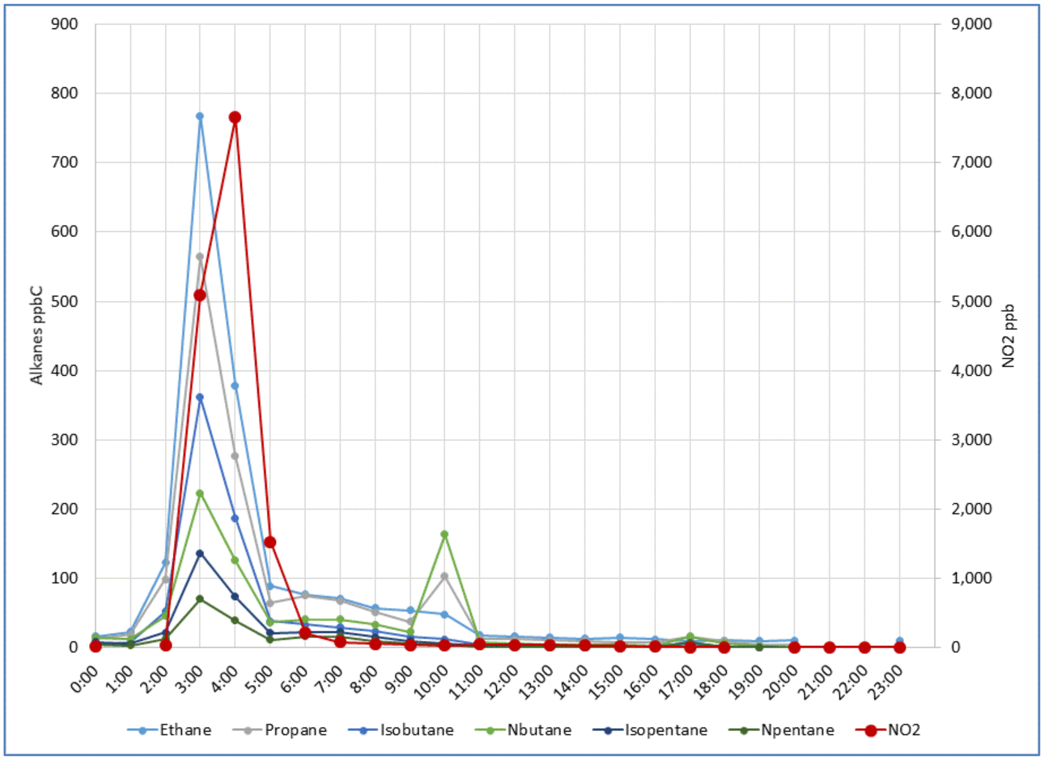

Figure 15. Hourly NO_2 (red) and low-molecular weight alkane species on April 20, 2020, suspected natural gas leak

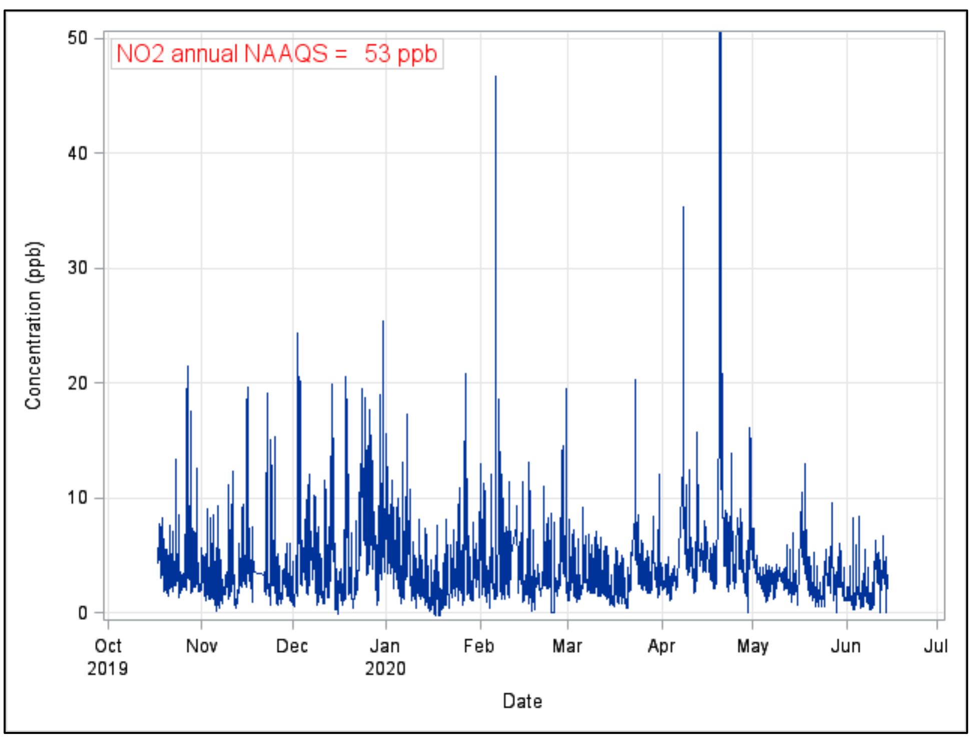

Figure 16. Hourly NO_2 at GF, ppb units, Oct. 17, 2019 – June 14, 2020, smaller y=axis scale

Figure 17 shows the hourly average time series for SO_2. The average concentration of SO_2 measured to date is less than 1 part per billion (ppb) and the maximum one-hour concentration has been 3 ppb compared to the primary NAAQS value (99th percentile of daily one-hour maximum averaged over three years) of 75 ppb. There was a change out of equipment in mid-February that caused a few days data loss.

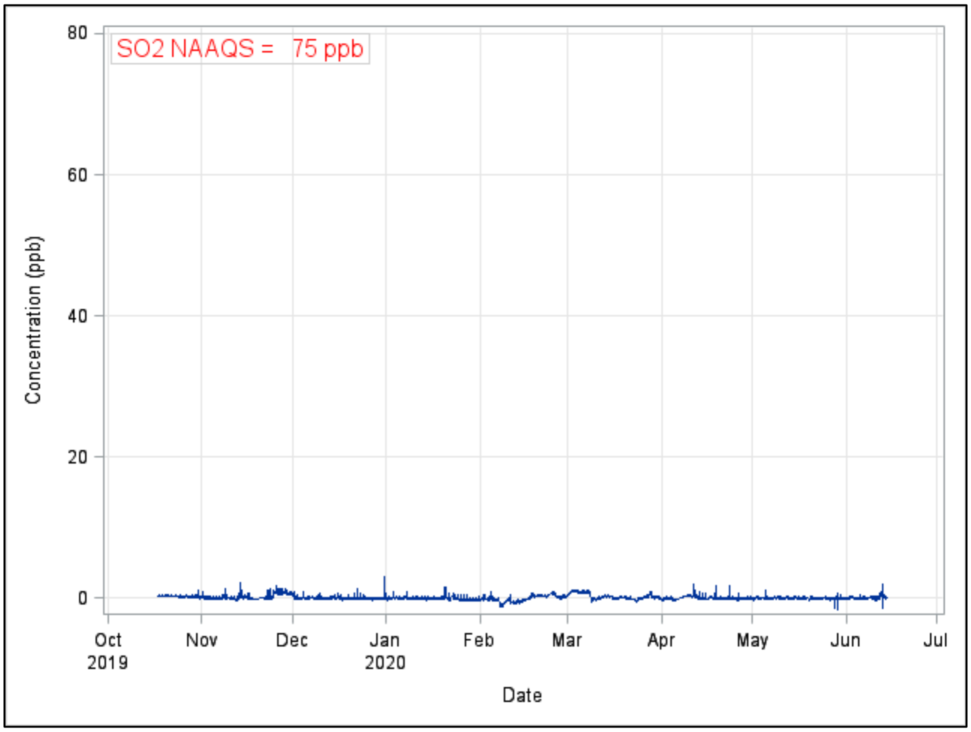

Figure 17. Hourly average SO_2 at GF, ppb units, Oct. 17, 2019 – June 14, 2020

Portland Buddy Ganem and Portland Broadway Criteria Pollutant Data

Fine particulate matter ($PM_{2.5}$) is the only NAAQS-regulated pollutant measured at the PBG and PBway sites. No concentrations near the NAAQS have been seen at the two stations. Figure 18 shows the 24-hour averaged concentrations of $PM_{2.5}$ at the PBG site and Figure 19 shows the same for the PBway site. The average concentration to date at PBG in 2020 is 5.9 $\mu g/m^3$ and is 7.9 $\mu g/m^3$ at PBway, as compared to the primary NAAQS (annual average) of 12 $\mu g/m^3$.

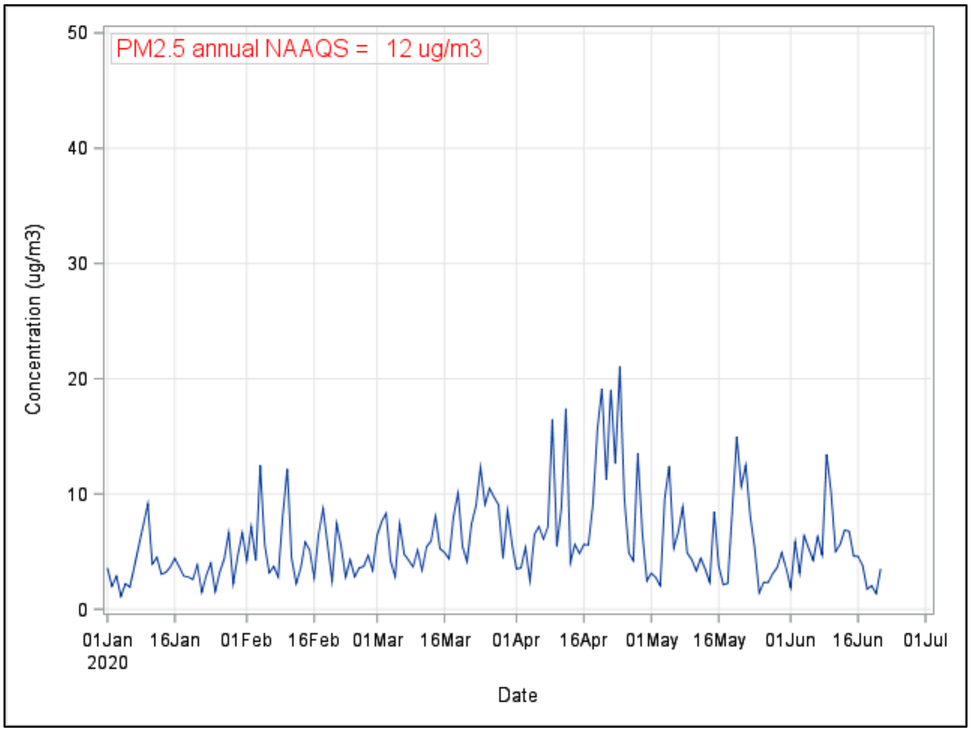

Figure 18 Daily average $PM_{2.5}$ at PBG, micro-grams/cubic meter units, Jan. 1 – June 21, 2020

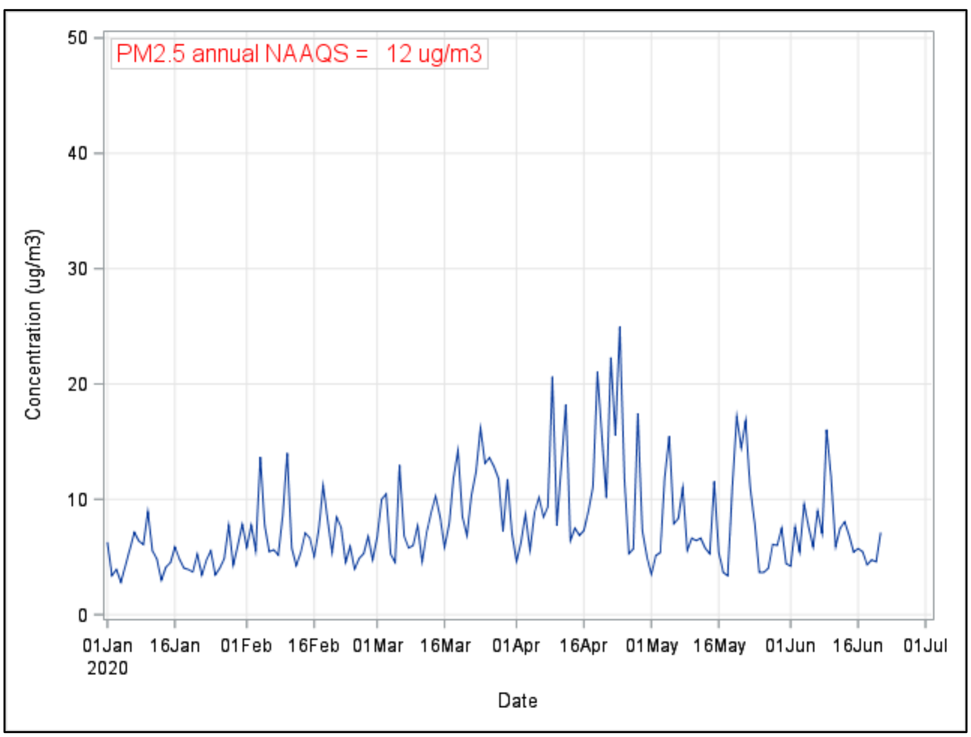

Figure 19. Daily average $PM_{2.5}$ at PBway, micro-grams/cubic meter units, Jan. 1 – June 21, 2020

5.0 Analysis of Data

Possible Interferent Affecting Gregory Fresnos Monitoring Station in San Patricio County, Texas

This section focuses on four air quality episodes in 2020 to date at the Gregory Fresnos monitoring station on Gregory Portland Independent School District property in Gregory, TX. During each episode station instruments readings indicated very high oxides of nitrogen (NOx) concentrations with instrument readings of other species at unusually high levels. No other monitoring sites in the area reported unusual readings. A brief description of the episodes follows.

The clearest demonstration that an unknown source was affecting the station instrument measurements was in the NOx, nitrogen dioxide (NO_2), and nitric oxide (NO) instrument readings. On four occasions, NOx and NO_2 appeared to rise rapidly (in 10 – 20 minutes) to near the maximum level of the instrument and crop/attenuate at that top value indicated. That value was near 16,500 parts per billion (ppb) for the March 22 and April 6-7 episodes, and increased to 18,400 ppb for the April 18-19 episode and to 20,000 ppb for the May 16 episode. See Figure 20 showing the frequency of the episodes between mid-March and mid-May 2020. Dates and the approximate durations of the episodes are as follows, all using Central Standard Time (CST):

- Sun. March 22, 3:15 – 9:45 CST (Figure 21)
- Mon. April 6, 21:45 – Tue. Apr. 7, 7:10 CST (Figure 22)
- Sat. April 18, 22:25 – Sun. April 19, 3:05 CST (Figure 23)
- Sat. May 16, 1:05 – 3:30 CST (Figure 24)

During these episodes, NO readings also rose, but only to a range of 200 to 800 ppb. The April 18-19 episode was interrupted by a weekly quality assurance span check of the NOx instrument. After the span check finished, instrument readings started to rise again, but then declined. The April 6-7 and May 16 episodes were interrupted by the shorter daily span-Z checks, and the elevated NOx readings immediately returned to high readings after each check.

After each episode, NOx instrument readings declined steadily for several hours, suggesting that the unknown source was still affecting the instrument but to a lessening degree over time. All the NOx data for March 22, April 7, April 19, and May 16 have been deleted from the valid data set database and are not included in earlier graphs in this report. (Raw data are all preserved in a separate data folder and data archive.)

On three of the four occasions, sulfur dioxide (SO_2) instrument readings also rose and fell during these periods, but at a slower rate and to more modest levels. See Figure 25, Figure 26, Figure 27, and Figure 28. Note that the SO_2 instrument did not respond on the April 18-19 episode (Figure 27). The SO_2 data collected in this project tend to show instrument drift at low concentrations, and one notable feature was that the nature of the drift changed after each of the three episodes.

Fine particulate matter ($PM_{2.5}$) instrument readings did not appear to be affected during the episodes. These data are shown in the graphs Figure 25, Figure 26, Figure 27, and Figure 28.

For the March 22 event, the hydrocarbon concentrations measured by the automated gas chromatograph (auto-GC) for n-Pentane and several seven to ten carbon (C7 – C10) species rose coincident with the NOx concentrations (Figure 29). The auto-GC hydrocarbons are measured on an hourly timescale, whereas the NOx and SO_2 measurements are on a five-minute timescale. The site operations contractor, Carol Meyer, invalidated the C7 – C10 results, based on a conclusion that the instrument was seeing an interferent. There was a significant difference in total nonmethane target compounds (TNMTC = sum of identified species) and total nonmethane hydrocarbon compounds (TNMHC = identified + unidentified species), suggesting other species were present. On April 7 (Figure 30), the auto-GC behaved as on March 22. Unfortunately, the timing of this episode overlapped with the hours the auto-GC runs its nighttime quality assurance blank and standard samples. The auto-GC did not appear to respond at all on the April 18-19 episode (Figure 31). On May 16 (Figure 32), the shortest episode to date happened during the two-hour quality assurance runs. However, one species, n-Pentane, appeared to respond on the first hour of the May 16 event. N-Pentane also responded to the March 22 and April 6-7 events, and was not invalidated, as Carol Meyer determined these measurements were valid.

For several of the hours during these events, winds were light and variable. Mean wind speeds during all 284 five-minute period (23+ hours) of events was only 2.9 miles per hour. Figure 33, Figure 34, Figure 35, and Figure 36 show the time series graphs for five-minute timescale wind speed and direction. There are two different wind direction y-axis scales used – one from 0 to 360 degrees and one from -90 to 270 degrees. The scale for a graph was selected to best show the directionality during the episode.

With the light and variable nature of the winds during much of the episode durations, all of the winds have been pooled to try to extract the gross directionality associated with the episodes. Figure 37 and Figure 38 are two wind roses made based on wind direction only, the former for the episode five-minute wind directions and the latter uses all five-minute values from the overnight periods preceding and following the episodes and previous or succeeding day. The Figure 37 wind rose uses 284 “episode” wind direction values and points southeast. The Figure 38 wind rose uses the five-minute values between 21:45 CST and midnight and between midnight and 9:45 CT on March 21, 22, April 6, 7, 18, 19, May 15, 16, for which there are 1,160 wind direction values. The Figure 38 wind rose with all 1,160 late night-morning winds points both southeast and northeast.

Based on wind directionality, there are industrial sources upwind. Figure 39 shows an aerial view of the Gregory Fresnos station and the area to the southeast. One ray in this figure points in the most common direction using 10 degree wind bins, that being 140 degrees. Another ray is at 125 degrees, which is the extreme lower value in the 130 degree wind direction bin, which is the second most frequent wind direction bin in Figure 37. Another ray is at 155 degrees, which is the extreme higher value in the 150 degree wind direction bin, which is the third most frequent wind direction bin in Figure 37.

An examination of the Texas Commission on Environmental Quality Air Emission Event Report Database (https://www2.tceq.texas.gov/oce/eer/ accessed June 2020) showed that over the period from March through May, one facility in San Patricio County reported an emission event that was largely coincident with one of the episodes at the Gregory Fresnos station, and the reporting facility was in the general upwind direction from the station. Details for this coincidental event are at https://www2.tceq.texas.gov/oce/eer/index.cfm?fuseaction=main.getDetails&target=333549. The reported event includes SO_2, NOx, n-Pentane, and other hydrocarbon species.

Our contractor Carol Meyer opined that we may be seeing an oxygenated hydrocarbon. She is a national expert in the operation of the auto-GC installed at the station. UT Austin contacted the TCEQ Regional Staff to identify potential sources and interferents. This investigation into the assignable cause for the high instrument readings described herein is still underway but has been hampered by the COVID 19 restrictions.

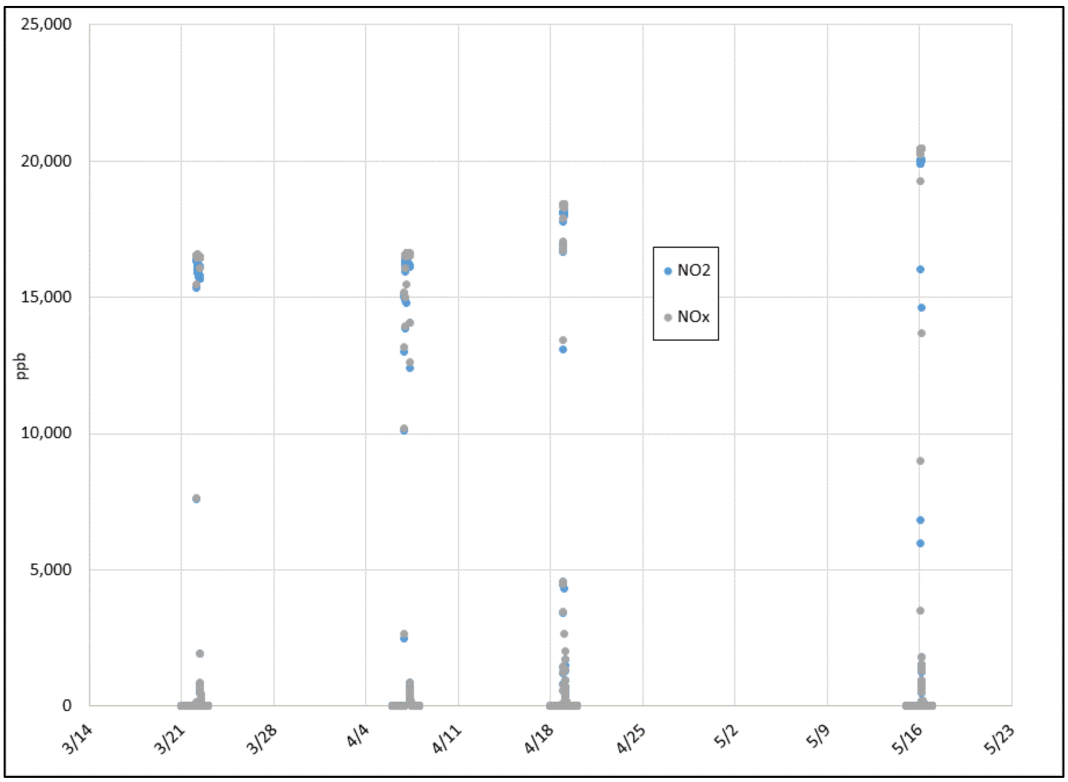

Figure 20. Spacing of four high concentration episodes at Gregory Fresnos (GF) station

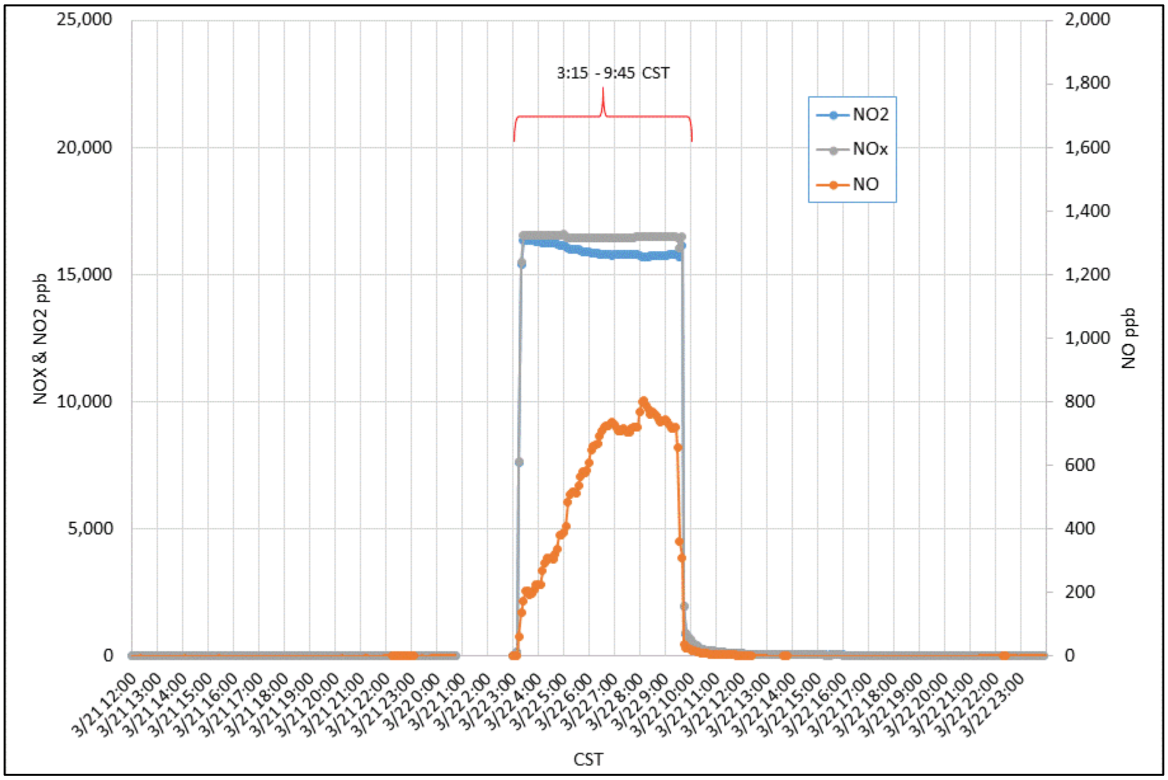

Figure 21. Sunday March 22 NO, NO_2, NOx at the GF station

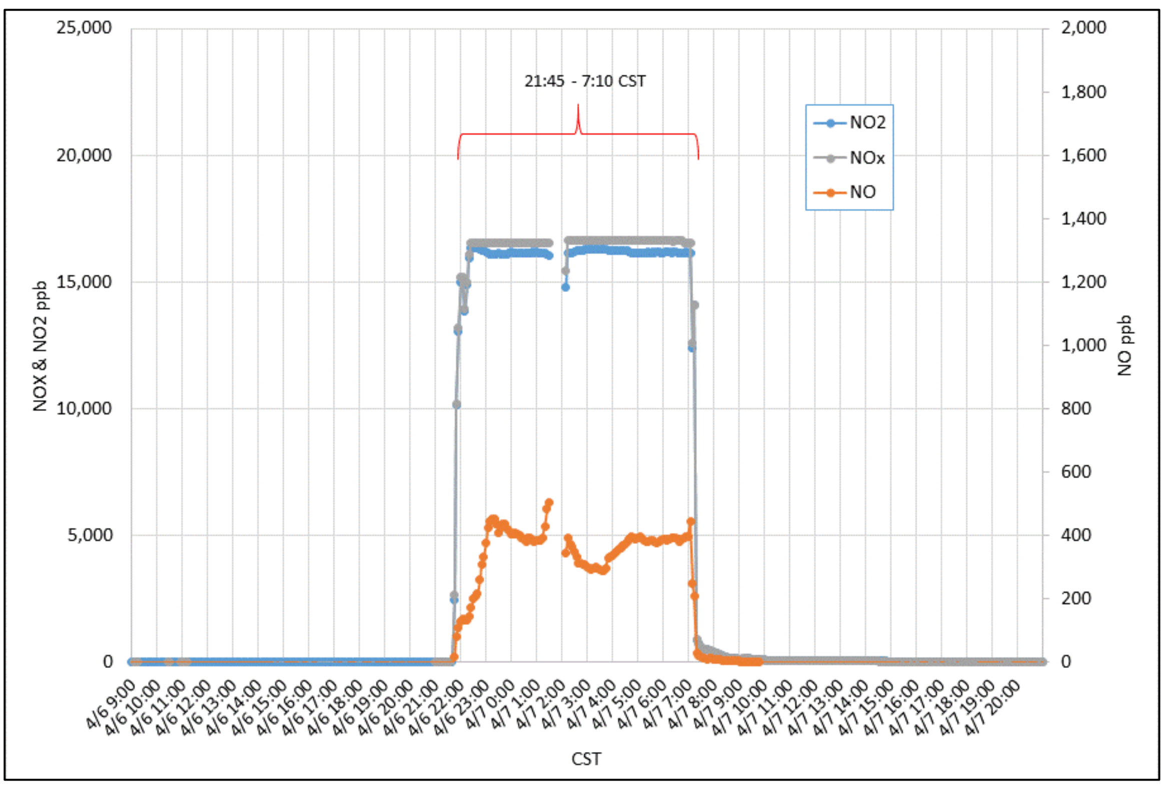

Figure 22. Monday-Tuesday April 6-7 NO, NO_2, NOx at the GF station

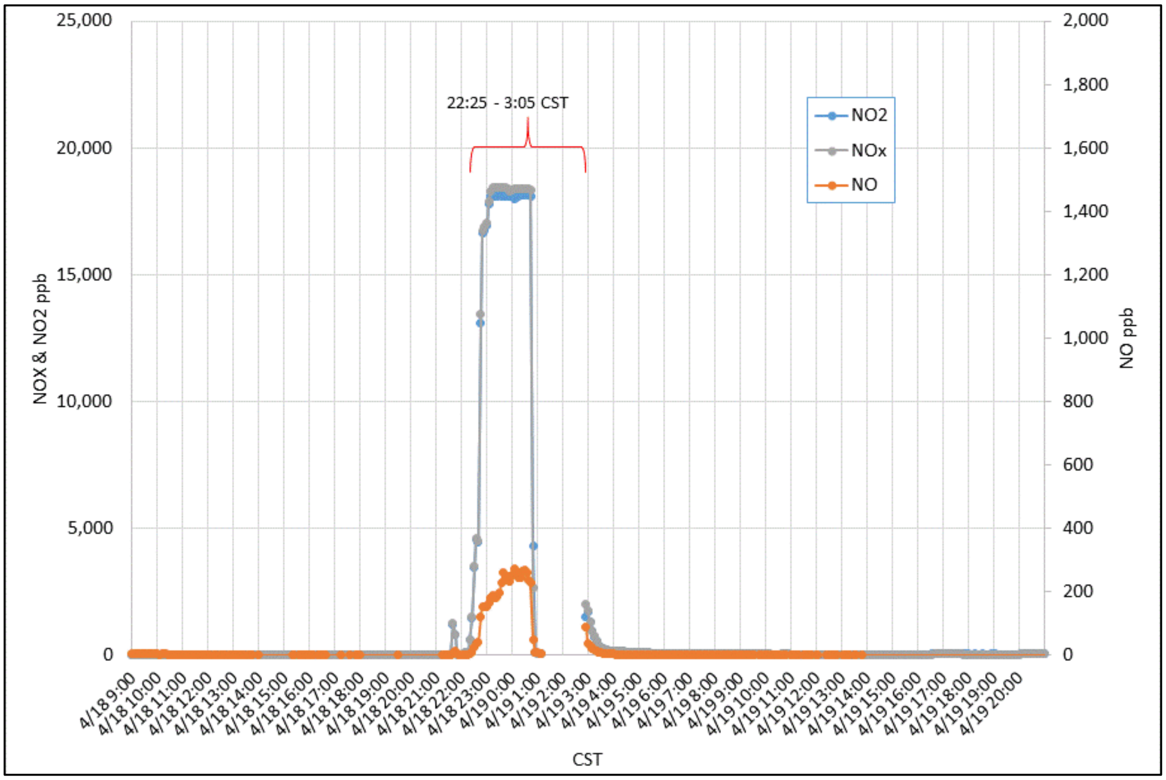

Figure 23. Saturday-Sunday April 18-19 NO, NO_2, NOx at the GF station

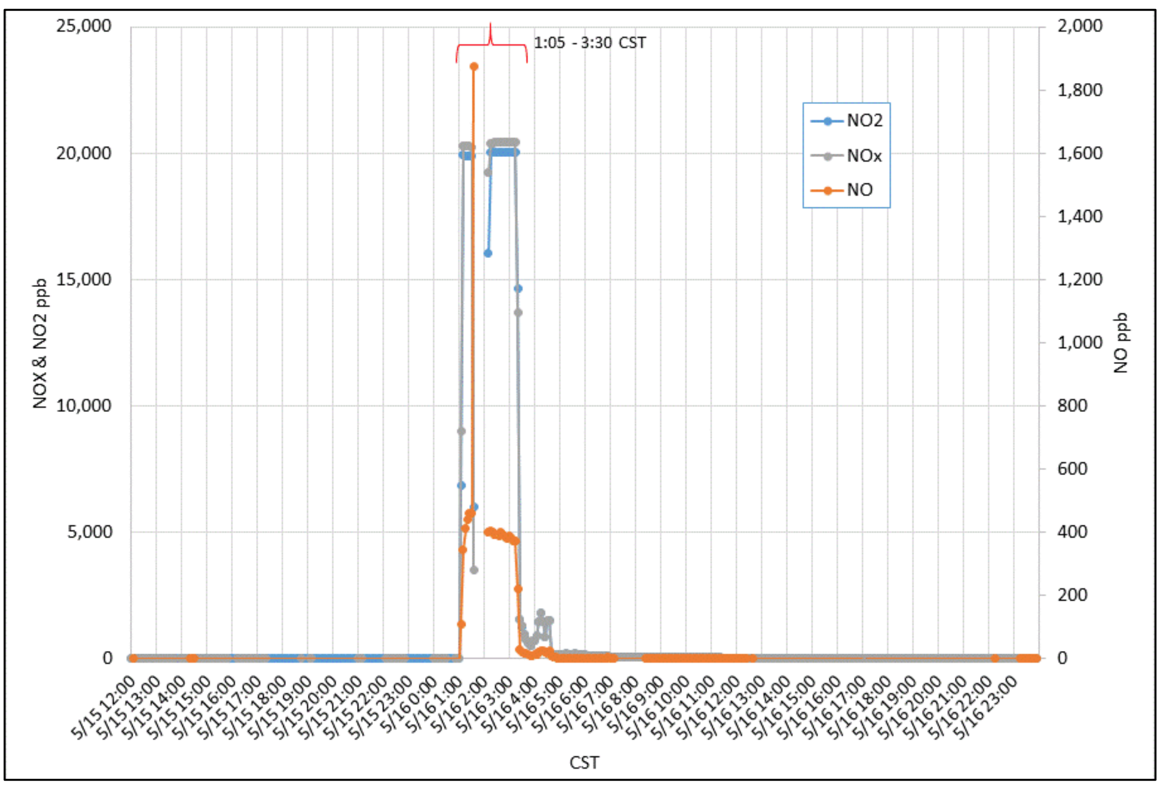

Figure 24. Saturday May 16 NO, NO_2, NOx at the GF station

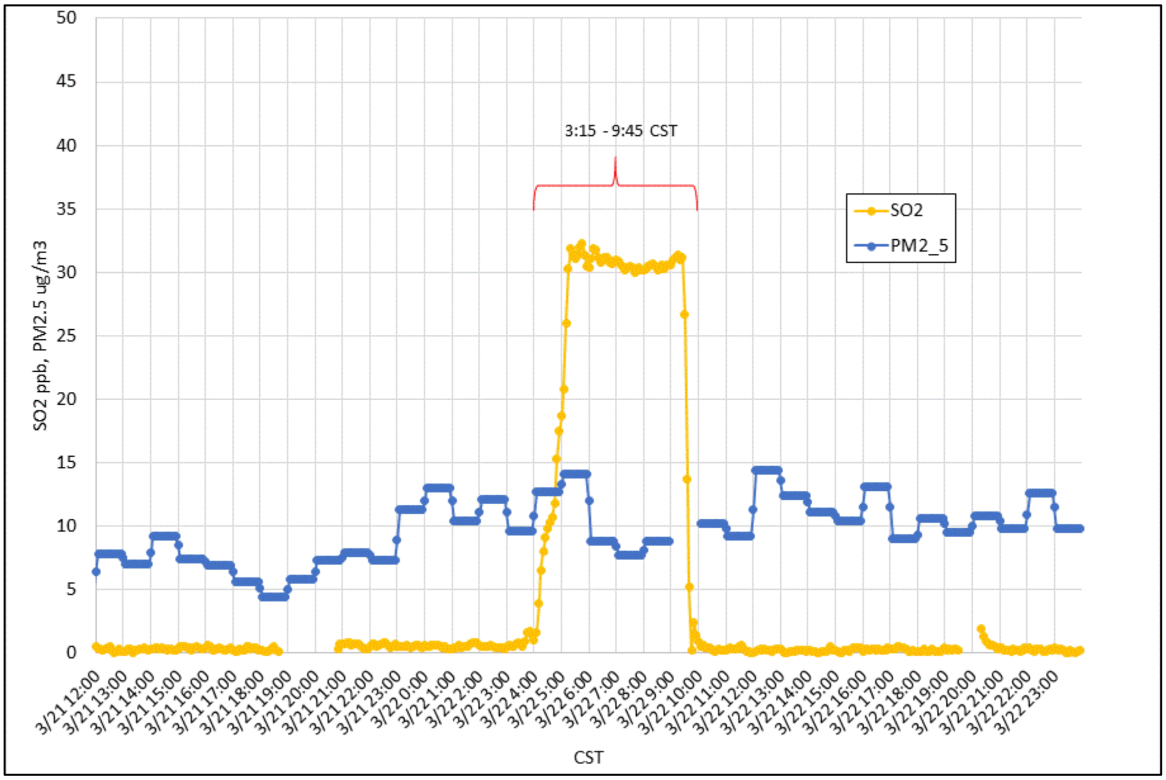

Figure 25. Sunday March 22 SO_2 and $PM_{2.5}$ at the GF station

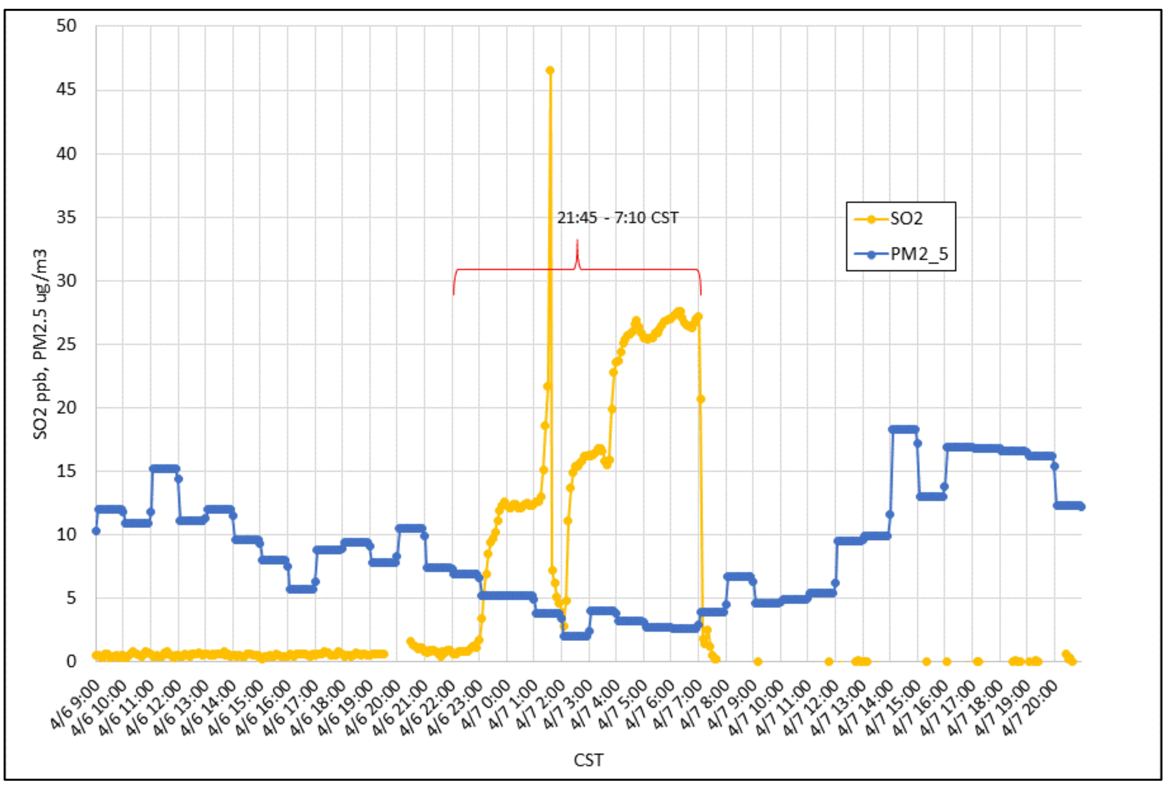

Figure 26. Monday-Tuesday April 6-7 SO_2 and $PM_{2.5}$ at the GF station

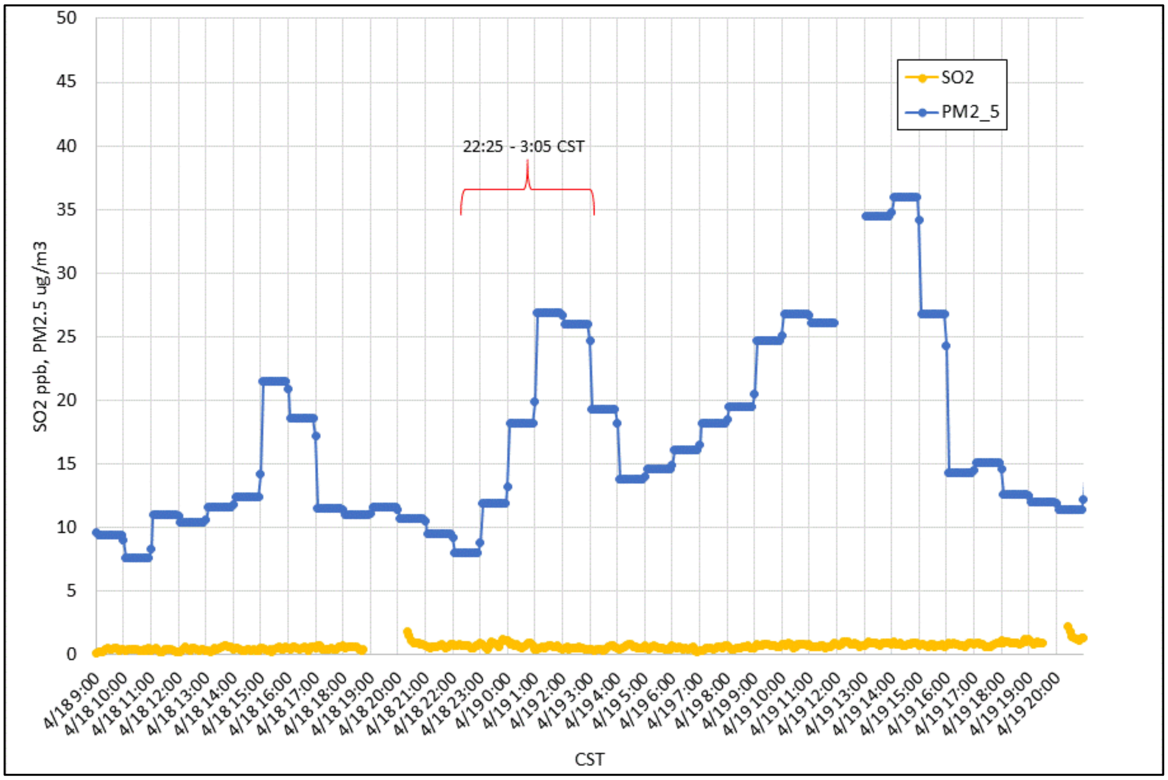

Figure 27. Monday-Tuesday April 18-19 SO_2 and $PM_{2.5}$ at the GF station

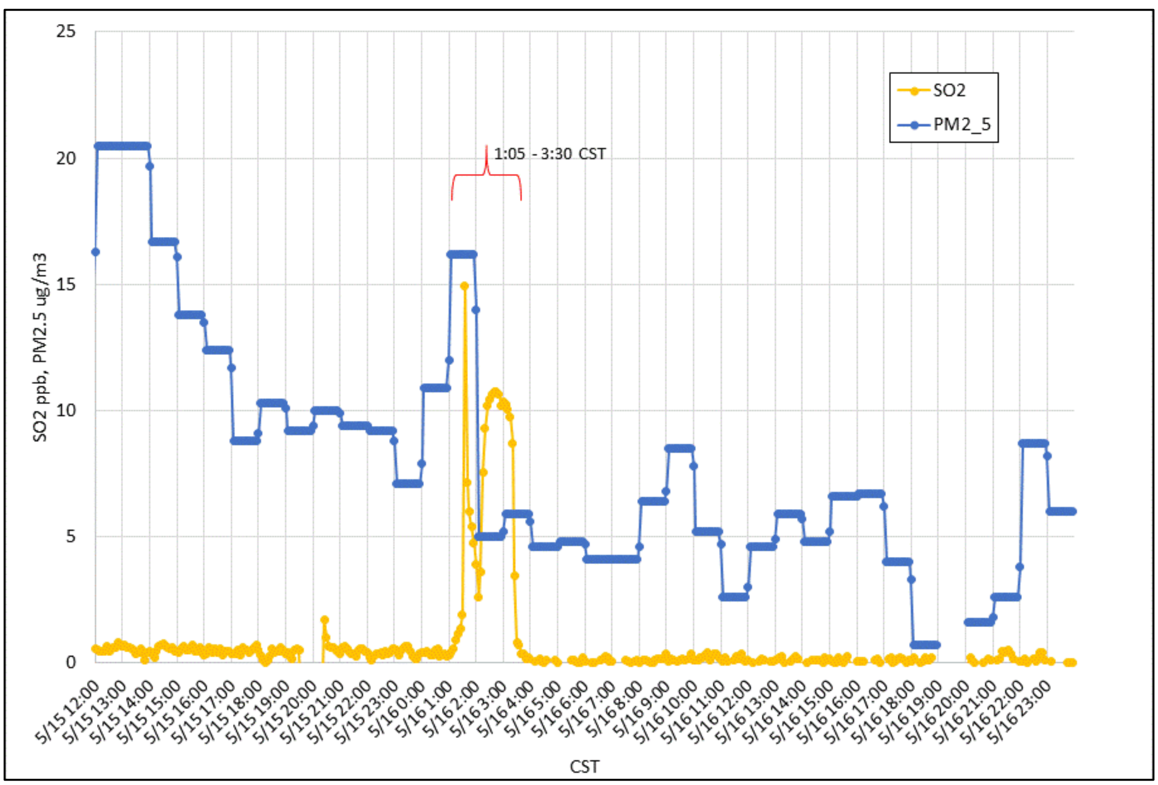

Figure 28. Saturday May 16 SO_2 and $PM_{2.5}$ at the GF station

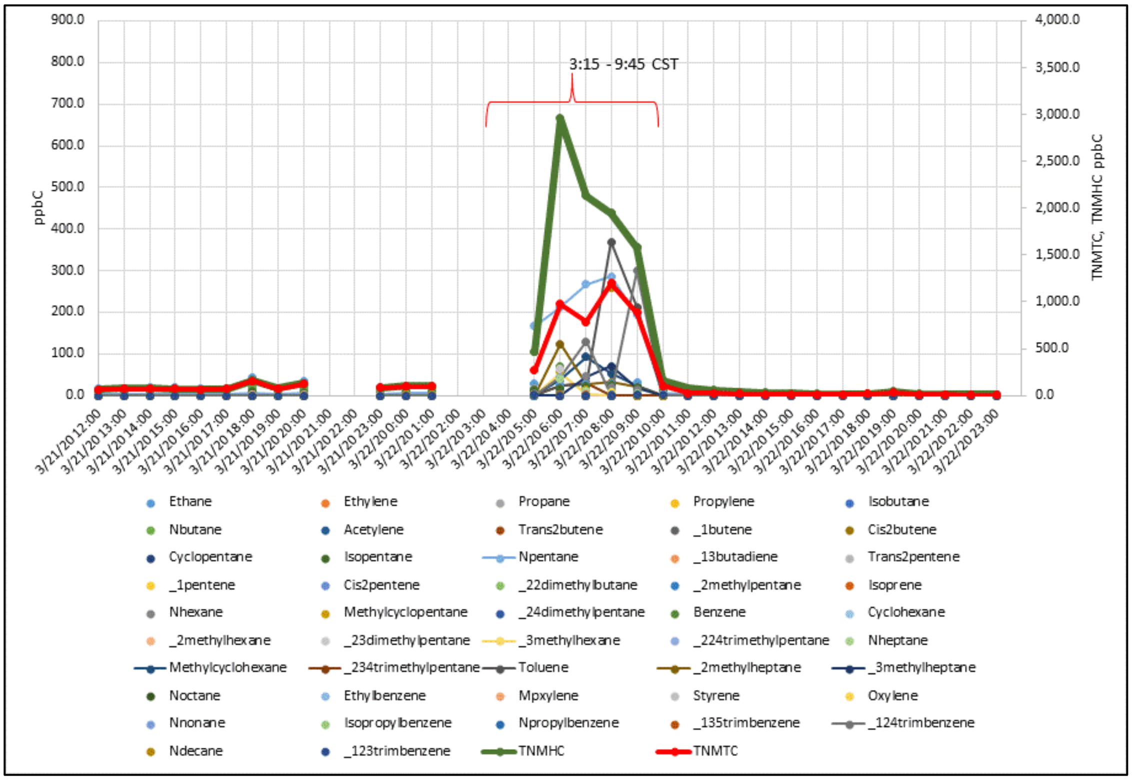

Figure 29. Sunday March 22 Auto-GC data at the GF station

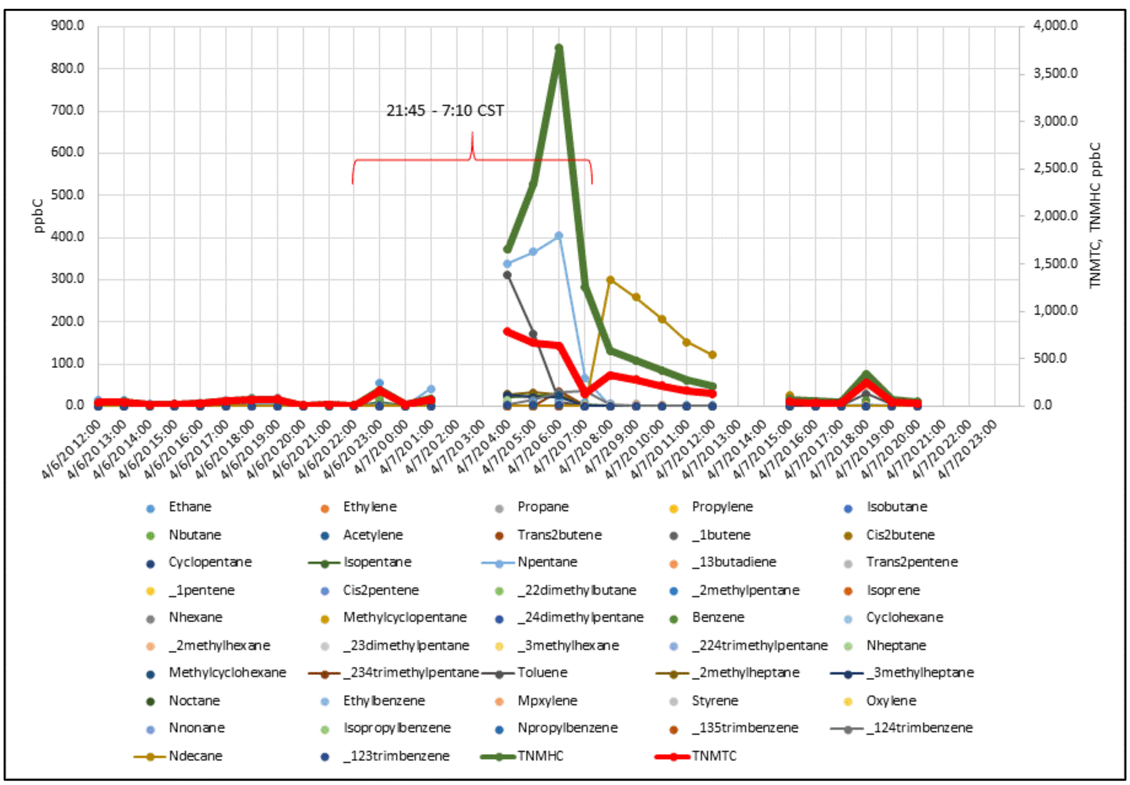

Figure 30. Monday-Tuesday April 6-7 Auto-GC data at the GF station

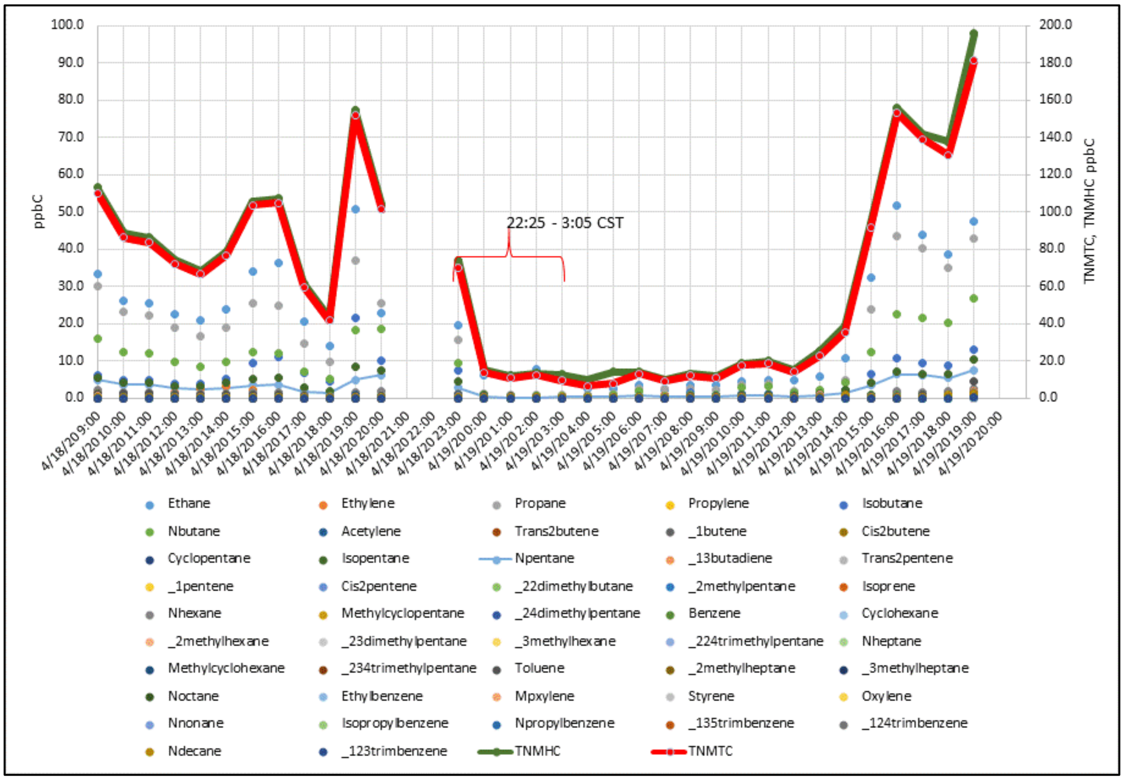

Figure 31. Saturday-Sunday April 18-19 Auto-GC data at the GF station

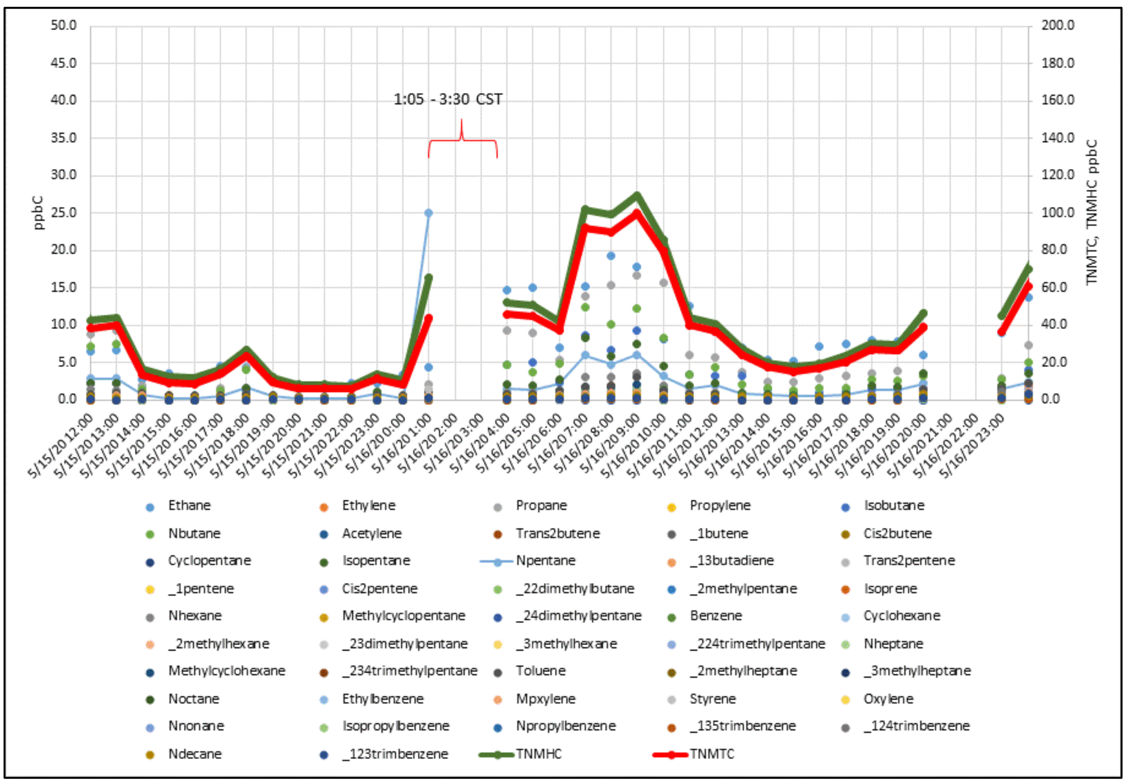

Figure 32. Saturday May 16 Auto-GC data at the GF station

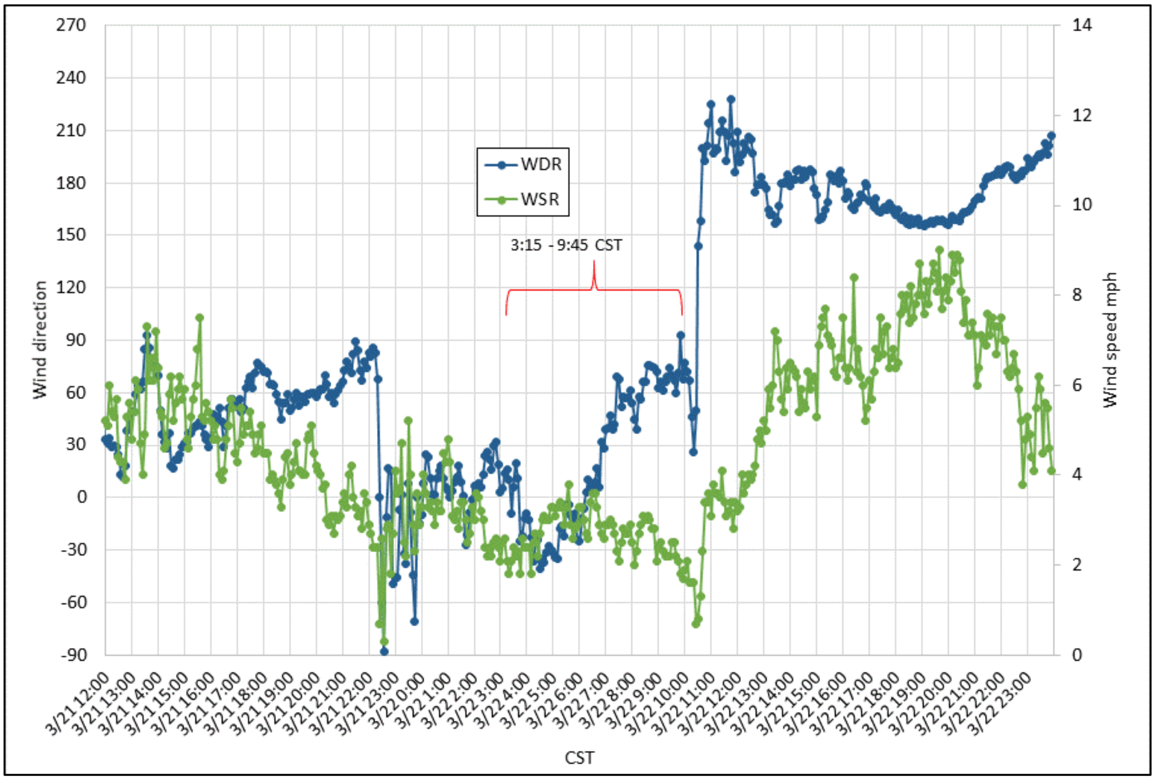

Figure 33. Sunday March 22 Winds at the GF station

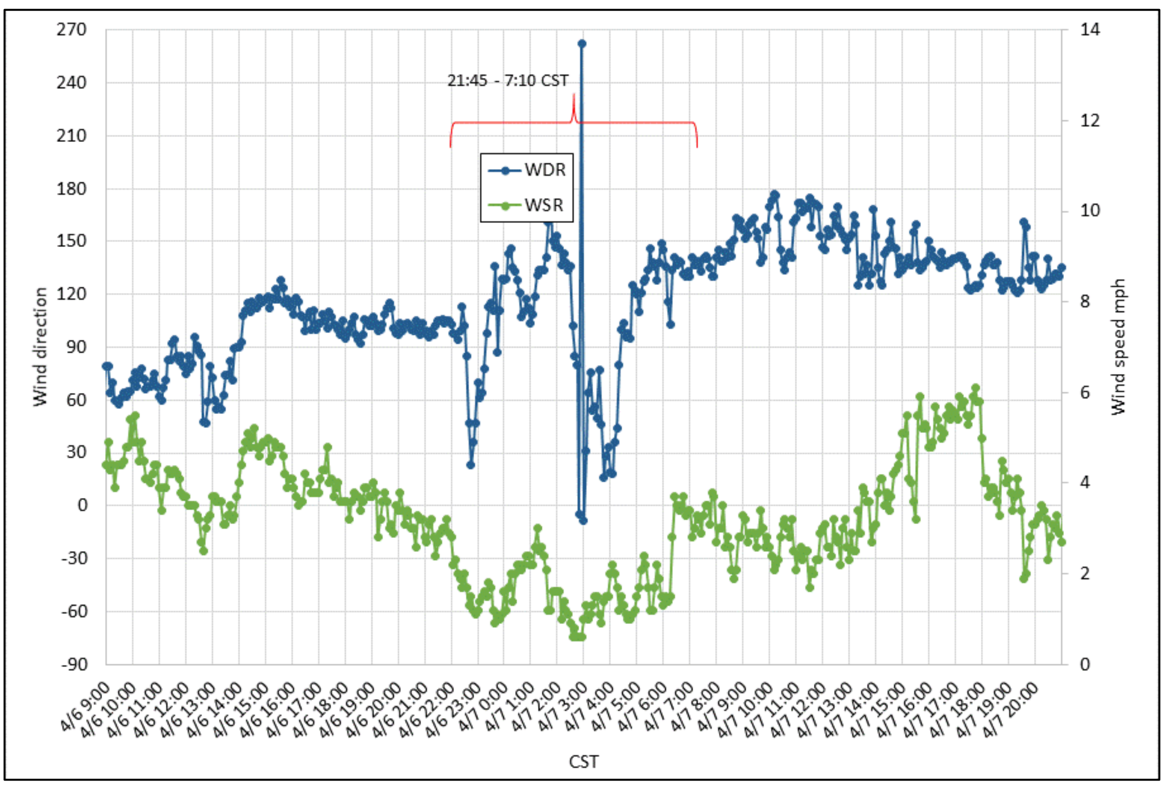

Figure 34. Monday-Tuesday April 6-7 Winds at the GF station

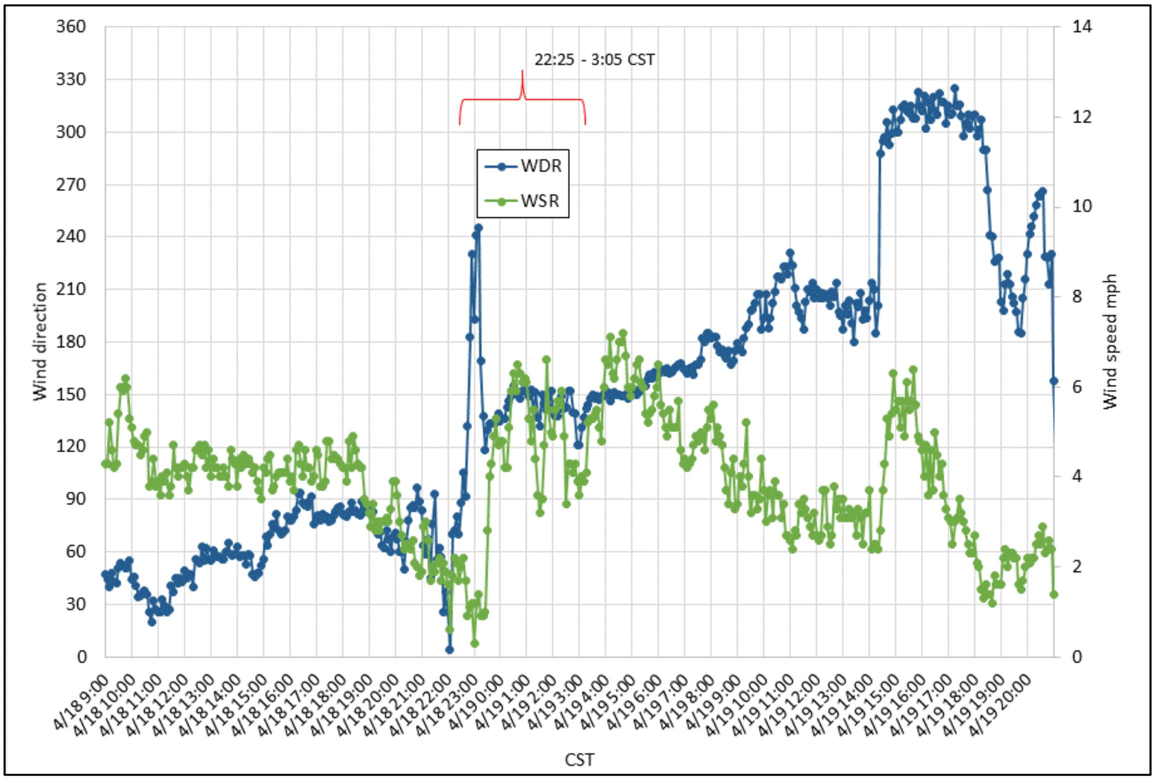

Figure 35. Saturday-Sunday April 18-19 Winds at the GF station

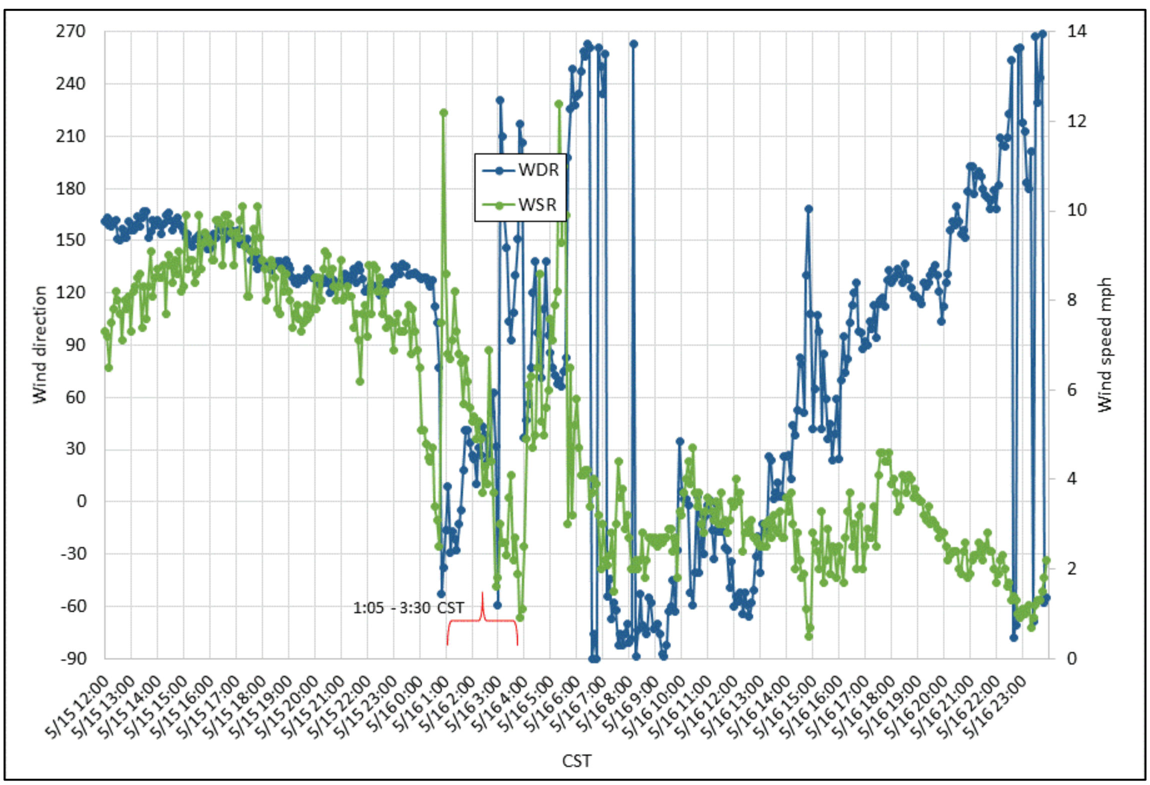

Figure 36. Saturday May 16 Winds at the GF station

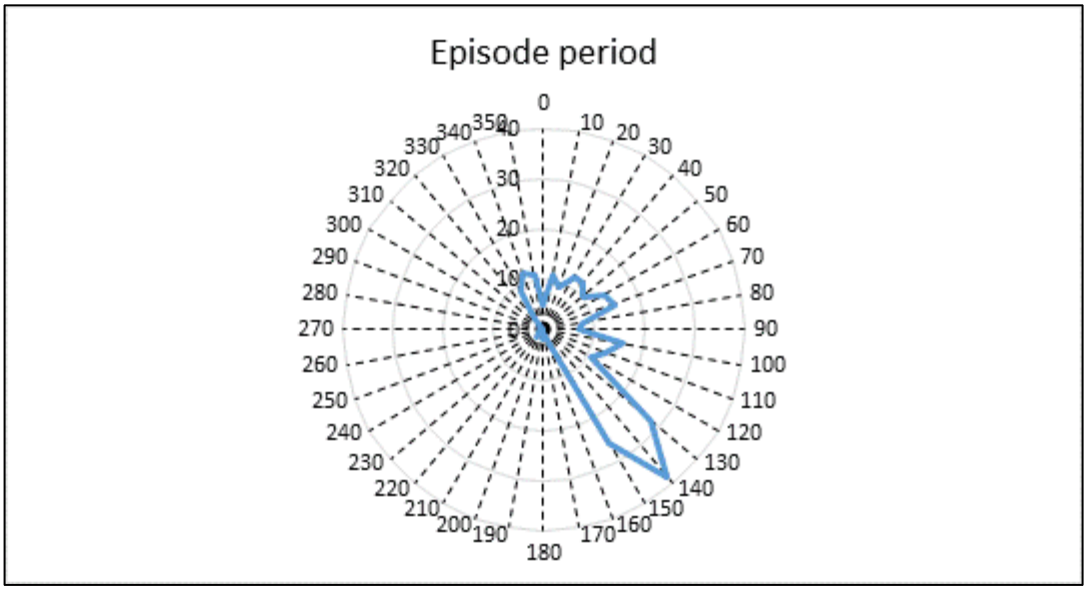

Figure 37. Wind rose at the GF station associated with episode durations (radius=count of 5-min. measurements in a 10 degree wind direction bin)

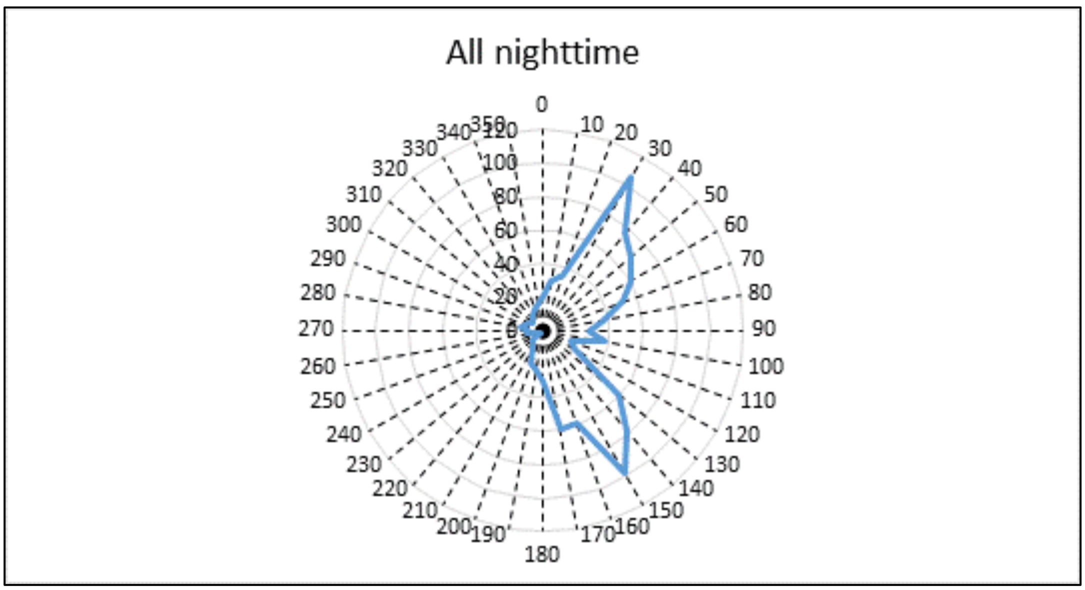

Figure 38. Wind rose at the GF station associated all nighttime wind direction measurements March 21 – May 16, 2020

Figure 39. Three 1-mile rays from the Gregory Fresnos station, at 140 deg. (center), the most frequent upwind direction and at 125 deg. and 155 deg., which are the easternmost and westernmost directions associated with the peak wind direction in Figure 37

6.0 Conclusions

The air monitoring to date has been very successful. Although some concentrations have occasionally exceeded the levels of NAAQS, to date, 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 401 Fresnos St., Gregory, TX	Yes	No	Yes	Yes	Yes	Yes
Portland Buddy Ganem GP High School Portland, TX	Yes	Yes	No	No	Yes	Yes. + precipitation
Portland Broadway Old East Cliff Elementary School Portland, TX.	Yes	Yes	No	No	Yes	Only WS, WD

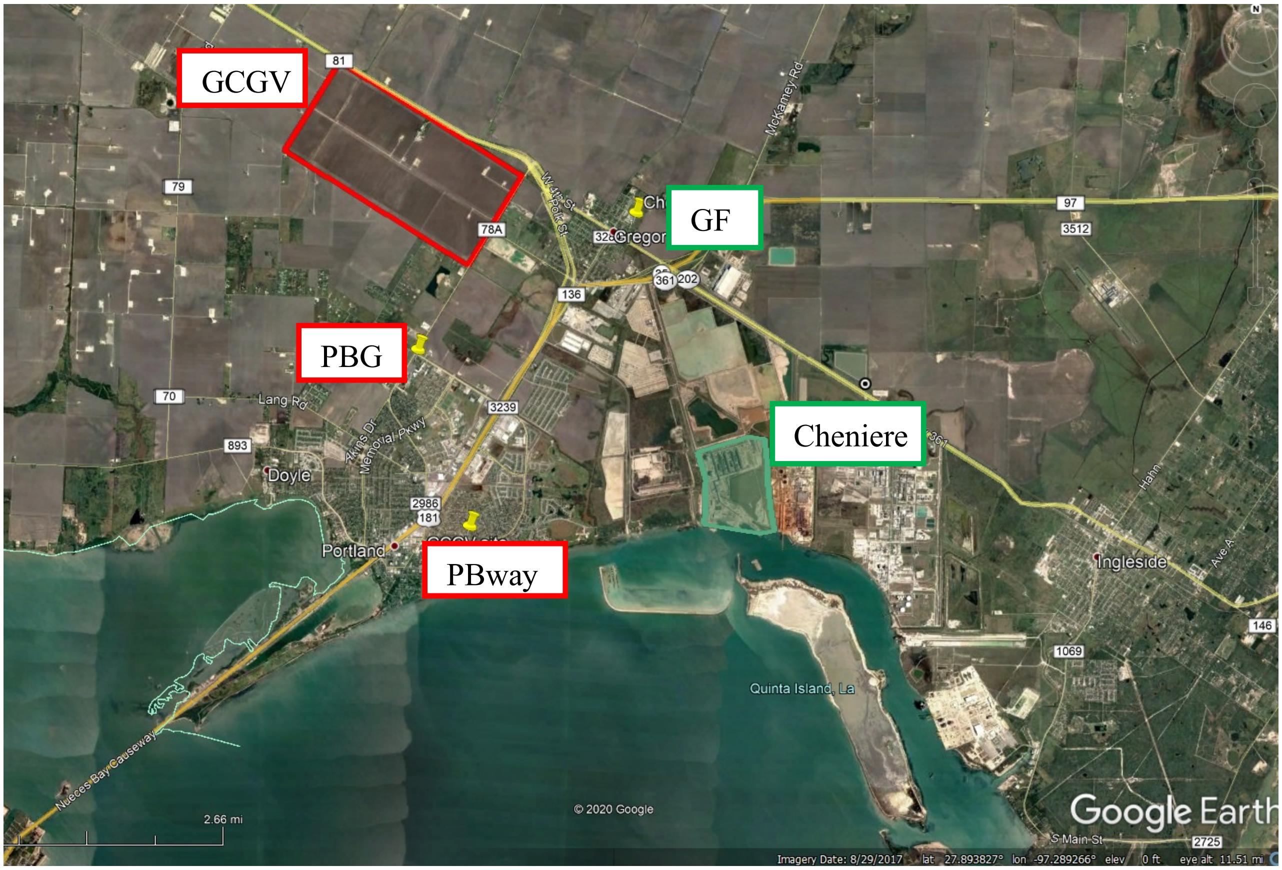

Figure 22. Location of Gregory-Fresnos Community Air Monitoring Station (GF), and two GCGV stations on GPISD sites in Portland on Buddy Ganem (PBG) and on Broadway (PBway) and two industrial facilities

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 (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 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 July 2015). 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 http://www.epa.gov/air/criteria.html (accessed July 2015).

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.