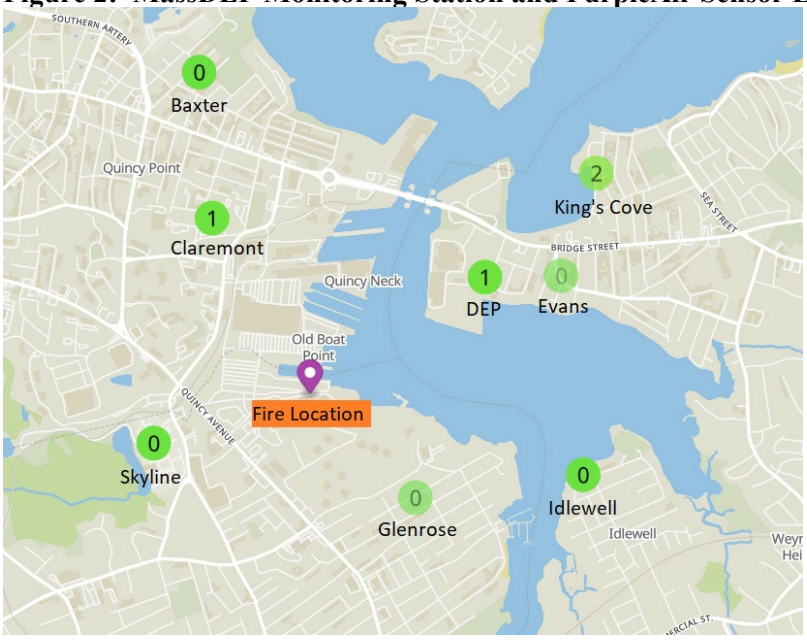
March 16, 2023

Fore River Basin Ambient Air Monitoring Data Summary
Related to Clean Harbors Fire

MassDEP operates an air monitoring station on Monatiquot Street in Weymouth next to the Fore River Energy Center and a residential neighborhood (Figure 1). MassDEP monitors ozone, nitrogen dioxide, and fine particulate matter (PM2.5) on a continuous basis and collects 24-hour volatile organic compounds (VOCs) canister samples and 24-hour carbonyl cartridge samples every sixth day (carbonyls are a subset of VOCs and include formaldehyde and acetaldehyde). Canister samples are sent to the Rhode Island Department of Health (RIDOH) Laboratory for individual VOC analysis, and carbonyl samples are analyzed by MassDEP's Division of Environmental Analysis (DEA) at MassDEP's Wall Experiment Station laboratory in Lawrence. In total, MassDEP measures 60 individual VOCs and 5 carbonyls. MassDEP also collects meteorological data and operates a PurpleAir particulate matter (PM) sensor at the monitoring station. There also are several citizen-operated PurpleAir PM sensors in the Fore River Basin Area (Figure 2). Note that while PurpleAir sensors provide useful air quality data they do not have the precision and accuracy of the laboratory-grade monitors used by MassDEP and other regulatory agencies to monitor air quality.

Figure 1: MassDEP Monitoring Station in Weymouth

Figure 2: MassDEP Monitoring Station and PurpleAir Sensor Locations



The fire at the Clean Harbors facility began at approximately 10:00 pm on Thursday 2/16/23 and was extinguished by approximately 1:00 am on Friday 2/17/23, lasting approximately 3 hours.

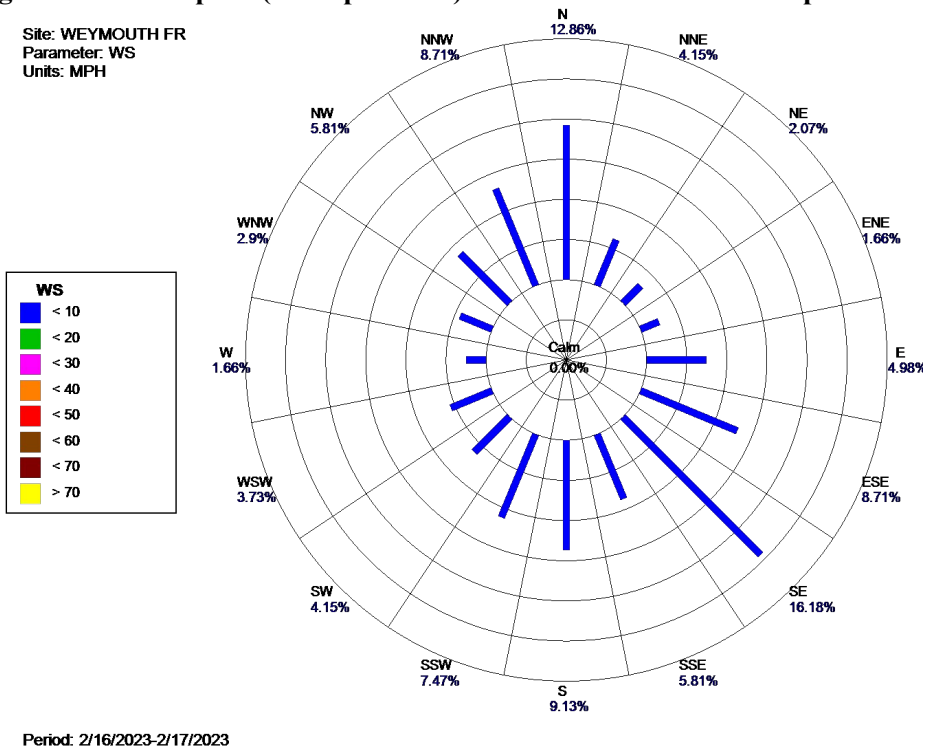
MassDEP has compiled air monitoring and meteorological data from the Weymouth air monitoring station and the local PurpleAir sensors for 2/16 and 2/17. As part of its every 6th day VOC monitoring, MassDEP collected a 24-hour air sample beginning just after midnight on 2/17 that was analyzed for individual VOCs by RIDOH (MassDEP does not yet have carbonyl data results for formaldehyde and acetaldehyde).

The PM2.5 data show a brief but significant increase in fine particulate matter (PM2.5) at the time of the fire incident as would be expected due to the smoke that was emitted. The preliminary VOC concentrations from the 2/17 sample are typical of background levels routinely measured at the Weymouth location and there is no indication of an increase in any of the VOCs due to the fire incident. The ozone and nitrogen dioxide data do not show significant increases that would be fire related. Below is a summary of the air monitoring data. Spreadsheets with collected data are attached.

Meteorological Conditions

The evening of 2/16 into the morning of 2/17 included overcast skies with unseasonably mild temperature levels. Winds were very light and variable. A few scattered showers occurred in eastern areas of the State. Figure 3 shows wind speed and wind direction measured at MassDEP's monitoring station for the five-hour period of 10:00 pm on 2/16 through 3:00 am on 2/17. (The monitoring station is the center point and "SE 16.18%" means winds came from the southeast direction toward the station for 16.18% of the 5-hour period). Under these light and variable wind conditions, smoke from the Clean Harbors fire likely disbursed in multiple directions from the facility location.

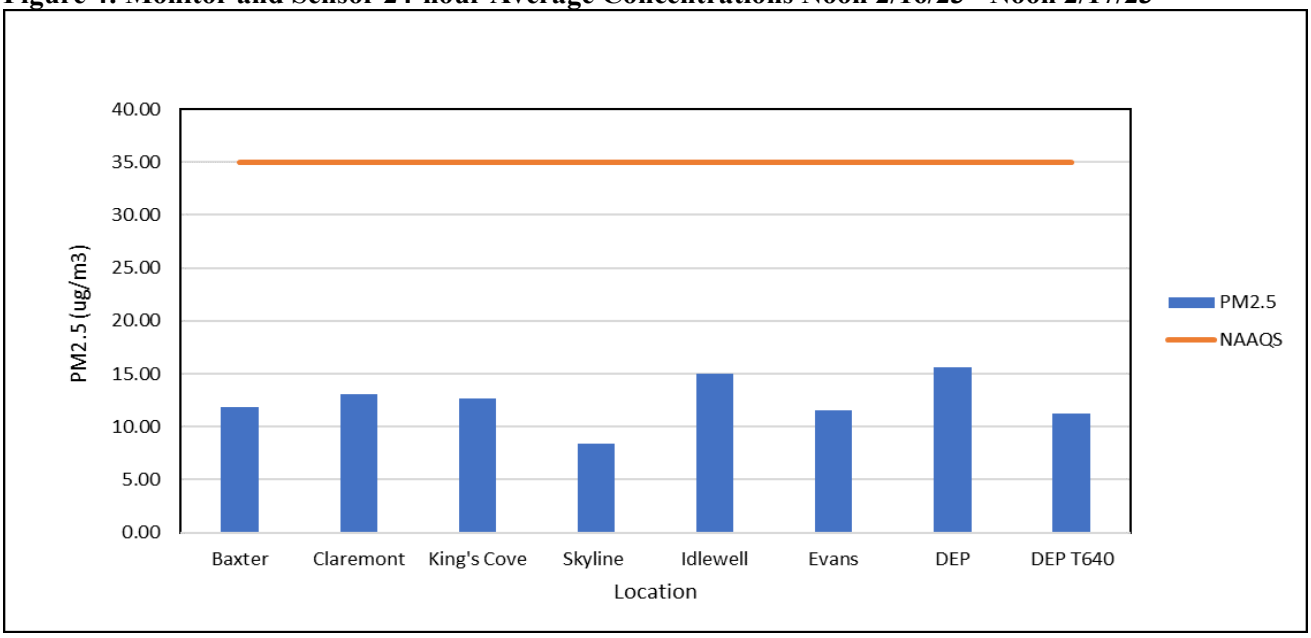
Figure 3: Wind Speed (miles per hour) and Wind Direction 10:00 pm 2/16 – 3:00 am 2/17



Particulate Matter (PM2.5)

PM2.5, also referred to as fine particulate matter, is a mixture of solid particles and liquid droplets found in the air and made up of hundreds of different chemicals. PM2.5 is so small that it can be inhaled deep into the lungs and may even enter a person's bloodstream and at sufficient concentrations can cause serious health effects. The U.S. Environmental Protection Agency (EPA) has established a 24-hour PM2.5 National Ambient Air Quality Standard (NAAQS) of 35 micrograms per cubic meter (µg/m3). When the data collected by MassDEP's monitoring station (T640) and local PurpleAir sensors is averaged over a 24-hour period levels do not exceed the 24-hour PM2.5 NAAQS due to the fire incident as shown in Figure 4.

Figure 4: Monitor and Sensor 24-hour Average Concentrations Noon 2/16/23 - Noon 2/17/23



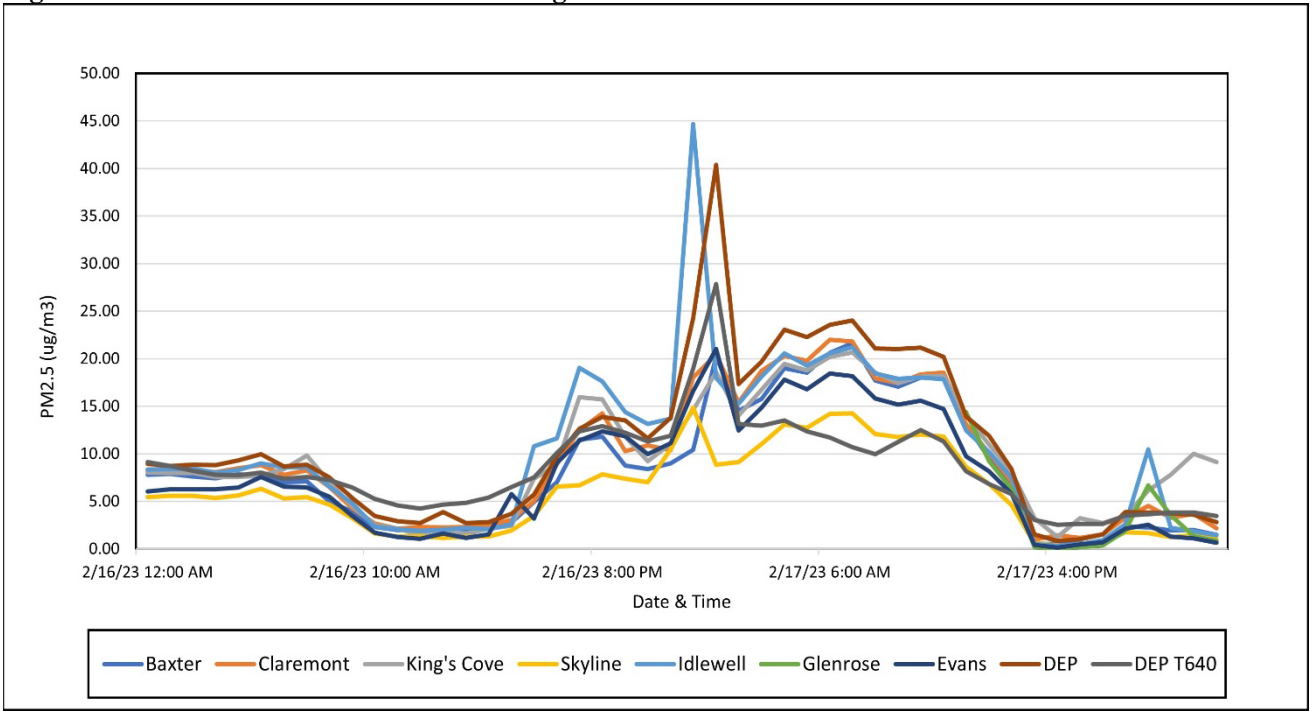
Averaging the sensor results for durations less than 24 hours used for the PM2.5 standard helps to better understand the short-term PM2.5 concentrations associated with the fire that lasted approximately 3 hours.

The 24-hour PM2.5 standard of 35 µg/m^3 is the shortest duration standard available for comparison to the concentrations averaged for 1-hour or 10-minutes. The scientific data on the degree of health risk from shorter-term exposures is limited. However, the level of risk is lower for shorter duration exposures compared to longer ones.

1-Hour Concentrations

Using a shorter 1-hour averaging period indicates that concentrations reported by the sensor at MassDEP's monitoring station and at the Idlewell location exceeded 35 µg/m^3 for 1-hour as shown by the two high points in Figure 5.

Figure 5: Monitor and Sensor 1-hour Average Concentrations



10-Minute Average Concentrations

Using a 10-minute averaging period shows higher short-term concentrations well above 35 µg/m^3 as shown in Figure 6. Figures 7 and 8 show this data broken out by sensors located to the west and to the east of the fire incident.

Figure 6: Monitor and Sensor 10-minute Average Concentrations

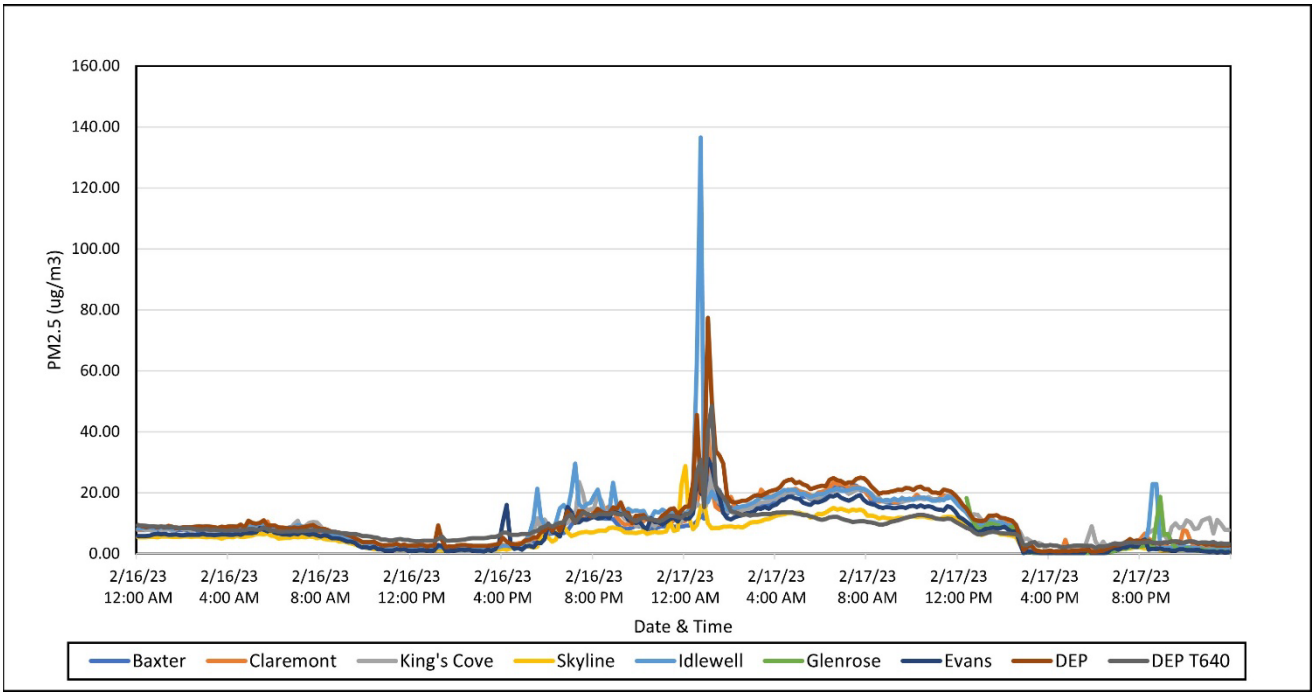


Figure 7: West Sensors 10-minute Average Concentrations

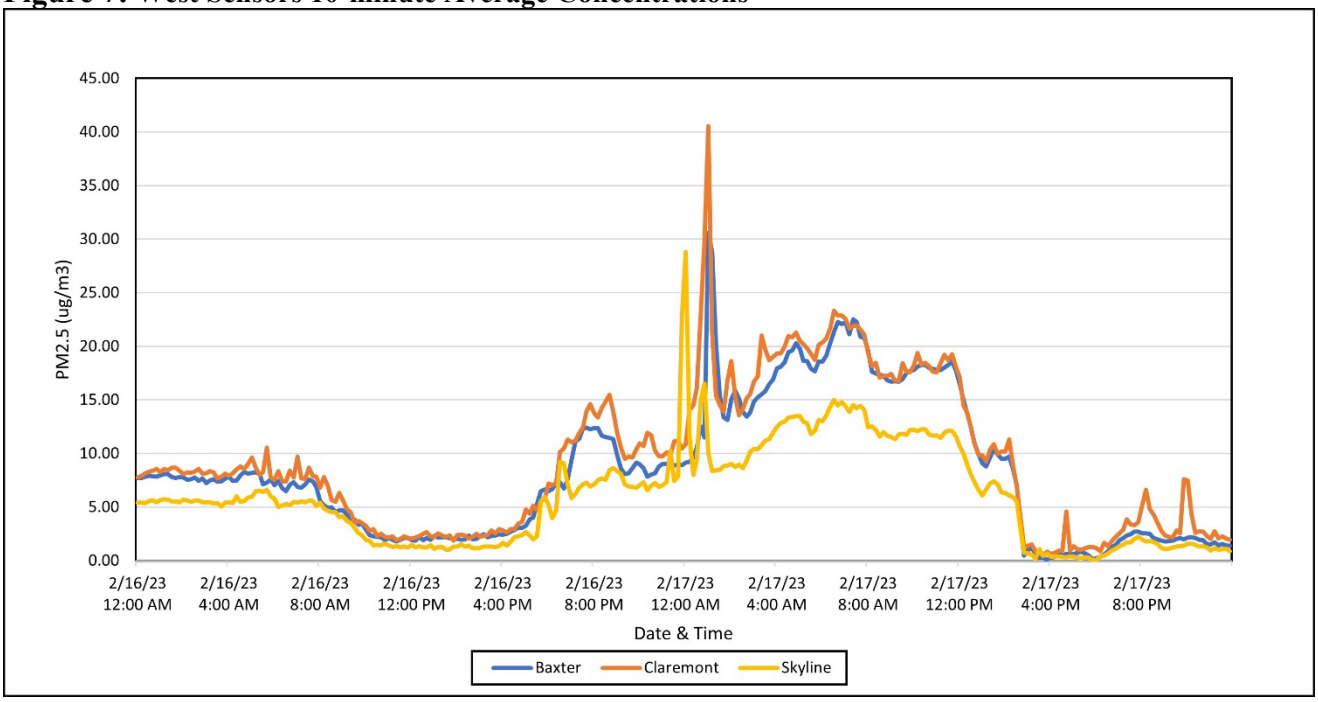
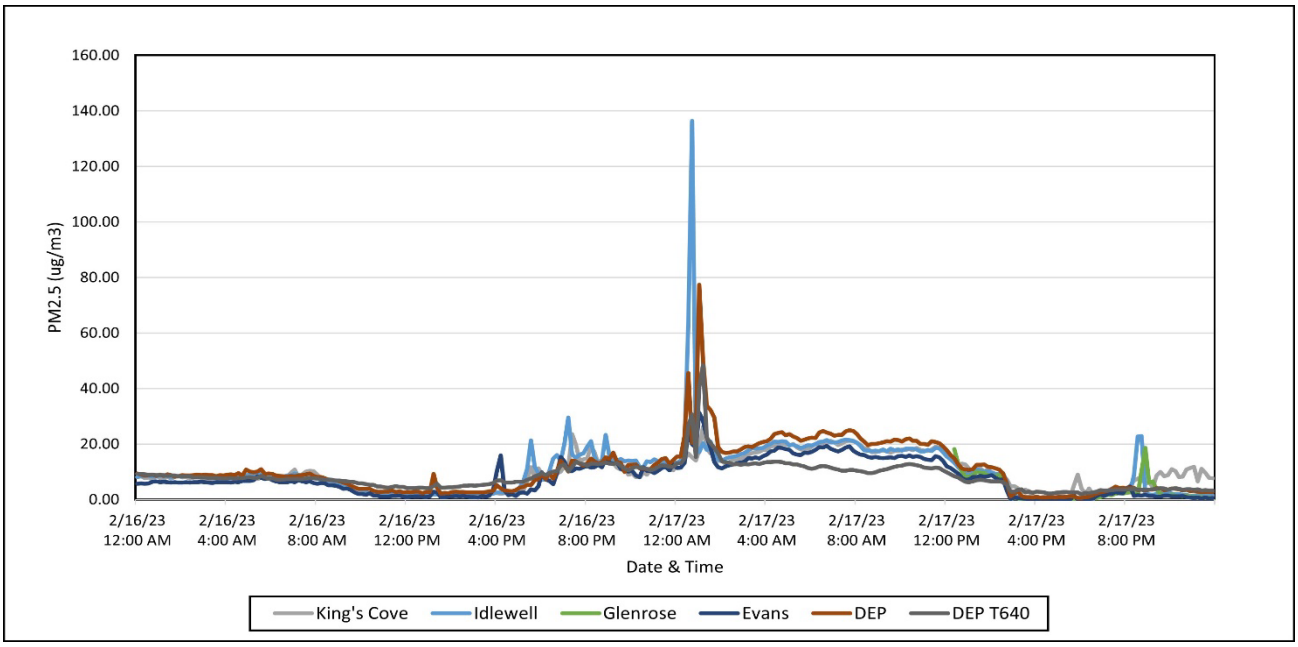


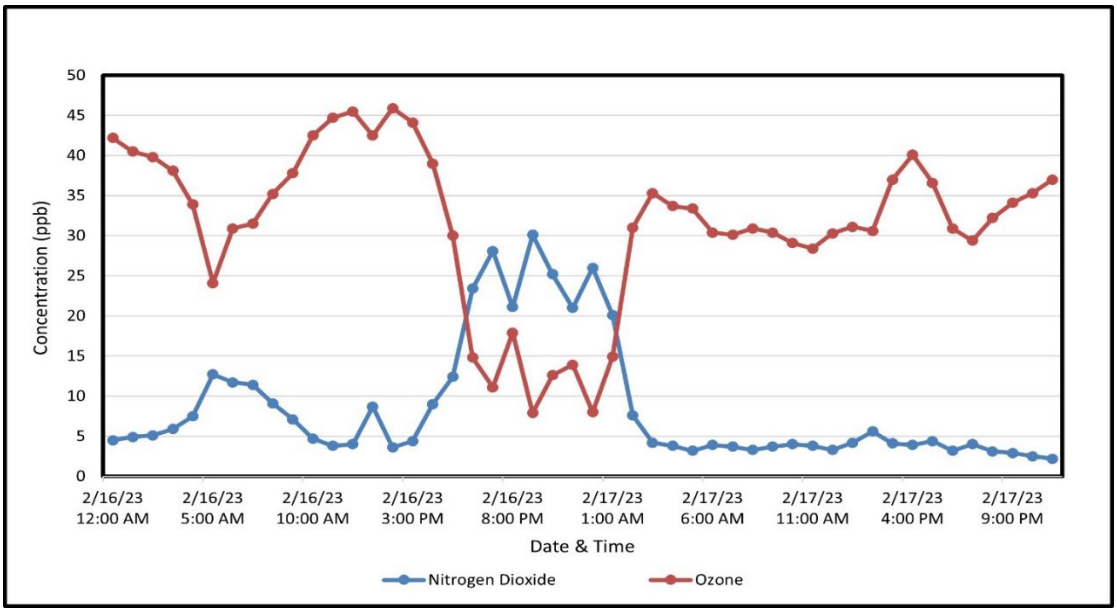
Figure 8: East Sensors 10-minute Average Concentrations



Ozone and Nitrogen Dioxide

Figure 9 shows ozone and nitrogen dioxide hourly concentrations. The ozone NAAQS is 75 parts per billion (ppb) based on a 4th highest 8-hour concentration. The nitrogen dioxide NAAQS is 100 ppb based on the 98th percentile 1-hour concentration. Both ozone and nitrogen dioxide are well below their respective NAAQS.

Figure 9: Ozone and Nitrogen Dioxide Concentrations (ppb)



Volatile Organic Compounds

MassDEP monitors volatile organic compounds (VOCs) in Boston (Roxbury), Chelsea, Lynn, and Weymouth. VOCs can contribute to ozone formation and some VOCs are toxic and can adversely affect human health and the environment. VOCs are ubiquitous in the environment because they are emitted by fossil fuel combustion (e.g., cars and trucks, power plants, homes, and businesses), manufacturing processes (e.g., solvents), commercial and household products (e.g., paints, cleaners), and by natural sources (e.g., vegetation, forest fires). The preliminary VOC concentrations from the 2/17 Weymouth sample are typical of background levels routinely measured at the Weymouth location and there is no indication of an increase in any of the VOCs due to the fire incident. The attached VOC data spreadsheet contains preliminary VOC data on 2/5 and 2/11 for comparison purposes.

Spreadsheet Attachments
Fore River Air Monitoring Data 3-10-23
February 2023 VOC Air Monitoring Data 3-10-23

Appendix

About PurpleAir Sensors

PurpleAir sensors are small, low-cost air quality monitors that measure particulate matter in real time using a pair of laser particle counters. Each particle counter draws in air with a fan and uses a beam of light to determine a particle count. An algorithm then uses the particle count to calculate and report a concentration.

PurpleAir denotes the two particle counters as “Channel A” and “Channel B” and reports the data from both particle counters. The use of two channels within the same sensor increases the confidence of the measurements being reported by the sensor and is a way to evaluate sensor health. Good channel agreement indicates the sensor is operating properly. It is important to note that while channel agreement increases confidence in the sensor data and that sensors provide useful air quality data, sensors do not have the precision and accuracy of laboratory-grade monitors used by MassDEP and other regulatory agencies.

When analyzing sensor data, it is a common quality control practice to use the average reading of channel A and channel B to get a single measurement value. This helps to eliminates channel bias, where one channel may read slightly higher or lower than the other. The data in this summary is using averaged channel data from each sensor unless otherwise specified. Averaged channel data from sensors is also displayed on EPA’s Fire and Smoke Map.