South Portland / Portland
24-Hour Volatile Organic Compounds Air Monitoring Results Analysis and Summary Report Update

Analysis and Summary Update for Sampling Period through October 2020

December 22, 2020

Prepared by the Maine Center for Disease Control and Prevention

Contacts:

Andrew Smith, SM, ScD
State Toxicologist
Maine Center for Disease Control and Prevention
Tel: (207) 287-5189
Email: andy.e.smith@maine.gov

Thomas Simones, PhD
Toxicologist
Maine Center for Disease Control and Prevention
Tel: (207) 287-3365
Email: thomas.simones@maine.gov

Executive summary

The Department of Environmental Protection (DEP) in 2019 initiated an ambient air monitoring program in the South Portland/Portland area. DEP installed five fixed-location 24-hour air sampling stations in South Portland and two additional stations in Portland to monitor air quality for volatile organic compounds (VOCs). All stations have been operational since November 2019 and collect a 24-hour sample of ambient air every six days that are analyzed for the presence of VOCs. DEP provides the 24-hour air sample data from all stations on a monthly basis to the Maine CDC. This report provides an updated summary of Maine CDC's analysis of VOC levels measured in 24-hour air samples from the South Portland and Portland monitoring stations with the addition of sample data from July through October 2020[1].

The analysis provided in this update and the previous two reports is focused on comparing the 24-hour sample results for individual VOCs to short-term, acute, and long-term, chronic, health-based guidelines. For short-term health-based guideline comparisons, individual VOC levels from each 24-hour air sample at each station are compared to acute Minimal Risk Levels (acute MRLs) maintained by the federal Agency for Toxic Substances and Disease Registry (ATSDR). In the case of naphthalene, the Maine Intermediate Intervention Action Level (IIAL) is used for comparison to acute exposure levels as there is no acute MRL currently available from ATSDR. For long-term health-based guideline comparisons, the time-weighted cumulative average of all 24-hour samples for individual VOCs at each station is calculated and compared to the Maine Ambient Air Guideline (AAG) which are derived using the U.S. Environmental Protection Agency (EPA) Regional Screening Level calculator to be protective of human population (including sensitive subpopulation) exposures over a lifetime.

Including results from July through October, no 24-hour VOC sample result has exceeded a health-based guideline for short-term, acute exposures (Figure 1). For long-term exposure comparisons, the time-weighted cumulative averages for most VOCs are more than 3-fold below their corresponding AAG (Figure 2a). The cumulative average for two VOCs, naphthalene (Figure 2a) and acrolein (Figure 2b), continue to exceed the AAG. The cumulative averages for acrolein at all stations remain approximately 20 times higher than the AAG (Figure 2b). Acrolein levels in the South Portland and Portland areas are similar to levels measured at other monitoring stations in the state. At all stations except Portland Deering Oaks the cumulative average for naphthalene was above the AAG. The cumulative naphthalene averages at South Portland stations were 1.1 to 2.7 times higher than the AAG. In Portland, the naphthalene cumulative average was below the AAG at the Deering Oaks station, but 4.4 to 5.4 times higher than the AAG at Ocean Gateway and West Commercial Street (Figure 5).

The naphthalene AAG is set to be protective of an increased risk of cancer and is set at a lifetime incremental cancer risk of one-in-one hundred thousand assuming exposure for 24-hours per day, 7-days per week, for 70 years. The AAG for acrolein is set to be protective of respiratory tract irritation (specifically nasal lesions) and also assumes similar continuous exposure. The forthcoming annual report will provide additional analysis on cumulative cancer risk and non-cancer health endpoints.

[1] Maine CDC reports to date -
https://www.maine.gov/dep/air/monitoring/docs/S.Portland-Portland-24-hour-VOC-summary-report-03.19.20.pdf
https://www.maine.gov/dep/air/monitoring/docs/MECDC-24%20Hour-voc-summary-august-update-08.21.20.pdf

With now nearly a year of monitoring data available, it is possible to start to examine seasonal trends in ambient air levels of VOCs. There were summertime increases in naphthalene levels at most stations. From June through August at Portland West Commercial and Ocean Gateway stations as well as several stations in South Portland naphthalene 24-hour results were higher than previously measured (Figure 8). In September and October of 2020 naphthalene levels decreased at most stations from higher summertime levels. In contrast to summertime peaks, benzene displayed increases from December through February (Figures 8 through 10), with the exception of Bug Light where benzene had seasonally higher levels for both winter and summer weeks. Seasonal trends for 1,3-butadiene were more varied among sampling locations with some showing a pronounced wintertime increase (South Portland Assessor's Office, Bug Light and Portland Deering Oaks), one location with a summertime increase (South Portland High School), and the rest without a pronounced seasonal trend.

For further information regarding Maine CDC's current air monitoring analysis plan and explanation of the presented figures, readers are referred to the November 2019 - January 2020 monitoring report[1]. All air sampling data is available on the Maine DEP website[2]. The following pages include the analysis figures for acute and chronic exposure comparisons to health-based guideline values updated with air monitoring data from July through October 2020.

[2] DEP South Portland/Portland air monitoring data - https://www.maine.gov/dep/air/monitoring/spo-sampling-results.html

Summary Figures

I. Summary figure for short-term exposures - Acute MRL ratio figure

Acute MRL ratio figure

Figure 1. Individual 24-hour sample results-to-acute MRL ratios for chemicals with acute MRLs

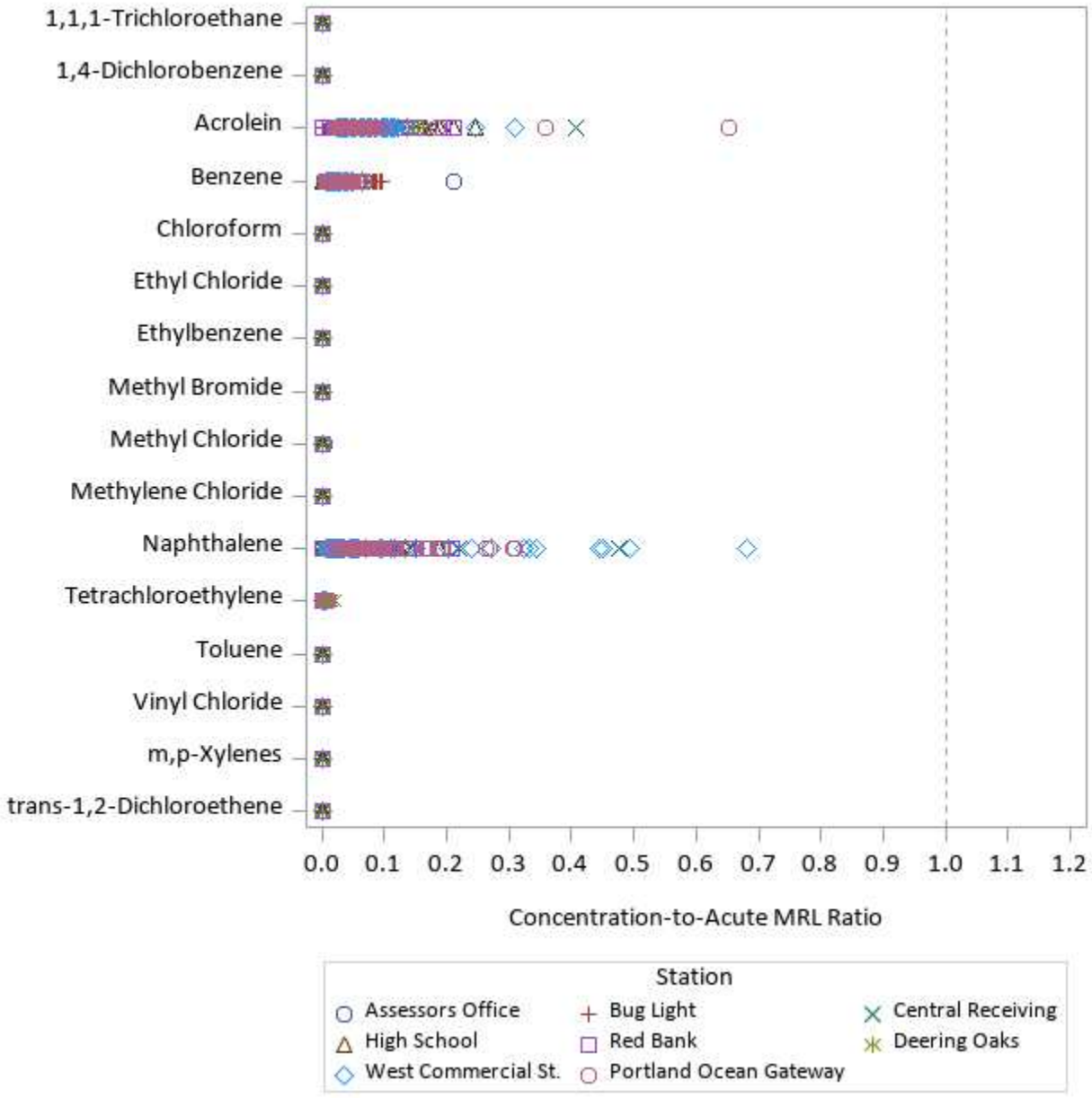

Figure 1 shows the ratio of individual 24-hour sample results collected to date at each sampling station to chemical-specific Agency for Toxic Substances and Disease Registry (ATSDR) acute Minimum Risk Levels (acute MRLs). Acute MRLs are developed for an exposure period of 1 to 14 days and are estimates of the amount of a chemical a person can be exposed to each day without a detectable risk to health. For naphthalene, the Maine Intermediate Intervention Action Level (IIAL) is used for comparison to acute exposure levels as there is no acute MRL for naphthalene currently available from ATSDR. Ratios greater than 1, the dashed grey reference line, indicate that an individual 24-hour sample result exceeded the chemical-specific acute MRL. To date, no VOC levels exceed an acute MRL. Sampling data obtained from Maine DEP current through October 2020.

Summary Figures

II. Summary figures for long-term exposures -

A. Cumulative average to AAG ratio figures

B. Cumulative average uncertainty figures

C. Cumulative average time trends figures

A. Cumulative average to AAG ratio figures

Figure 2a. Cumulative average-to-AAG ratios for individual chemicals with AAGs

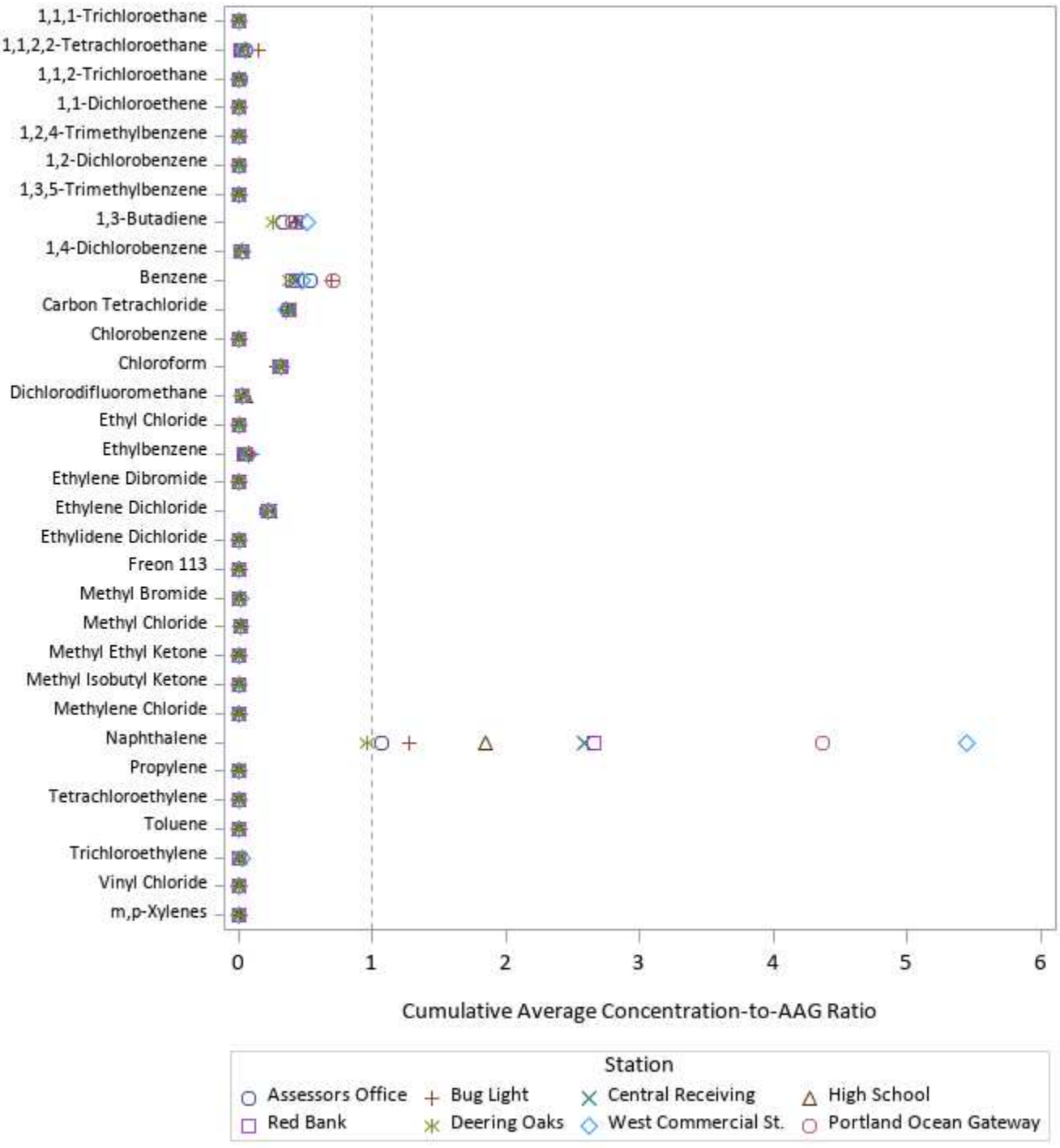

Figure 2a shows the ratio of the time-weighted cumulative average, i.e., the average of all individual 24-hour samples collected to date for an individual chemical by station, to the Maine Ambient Air Guideline (AAG) for all chemicals with an AAG. An AAG is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Ratios that are greater than 1, the dashed grey reference line, indicate that the current 24-hour sample cumulative average exceeds the chemical-specific AAG. Currently, only the chemicals naphthalene (above) and acrolein (Figure 2b) are trending with cumulative averages above an AAG. Sampling data obtained from Maine DEP current through October 2020.

Figure 2b. Cumulative average-to-AAG ratios for acrolein

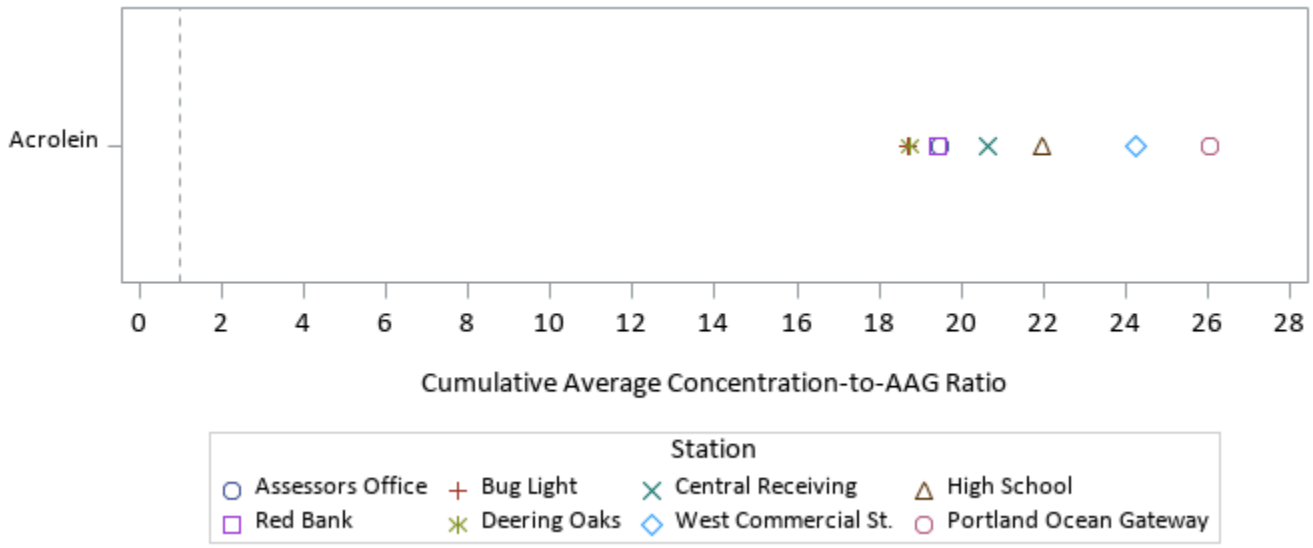

Figure 2b shows the ratio of the time-weighted cumulative average to the Maine Ambient Air Guideline (AAG) for acrolein. All cumulative averages for individual stations exceed the acrolein AAG; this is also the case for all sampling locations across the State of Maine. Sampling data obtained from Maine DEP current through October 2020.

B. Cumulative average uncertainty figures

Figure 3. Average 24-hour sampling results with 95% confidence interval by station for Acrolein

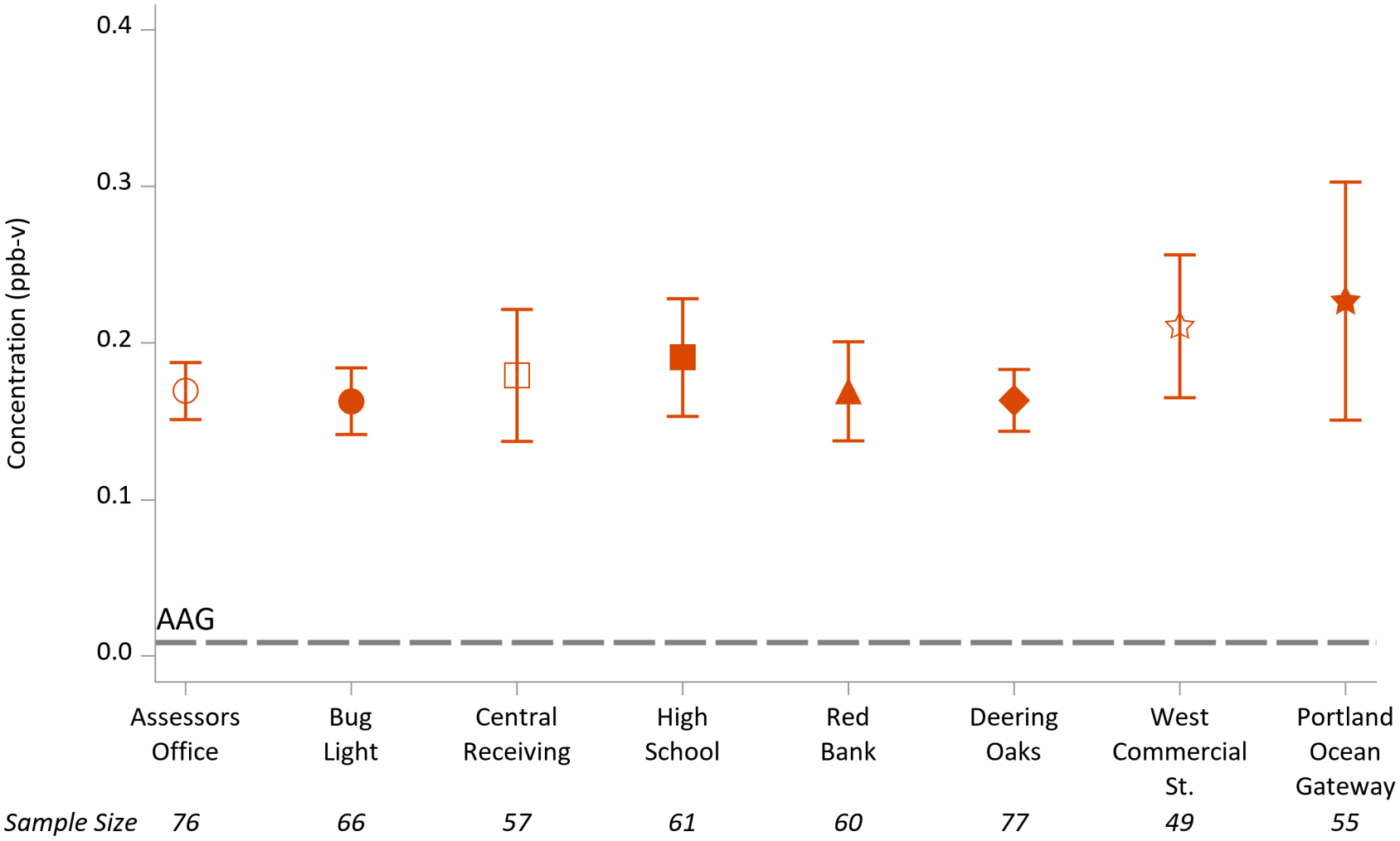

Figure 3 shows the average acrolein level as a marker (circle, square, diamond, triangle, etc.) with 95% confidence interval (vertical lines) for all individual 24-hour samples collected by station. 24-hour air samples are collected every 6 days. The number of samples collected by station is shown as the sample size. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Average acrolein levels exceed the AAG at all sampling locations. Sampling data obtained from Maine DEP current through October 2020.

Figure 4. Average 24-hour sampling results with 95% confidence interval by station for Benzene

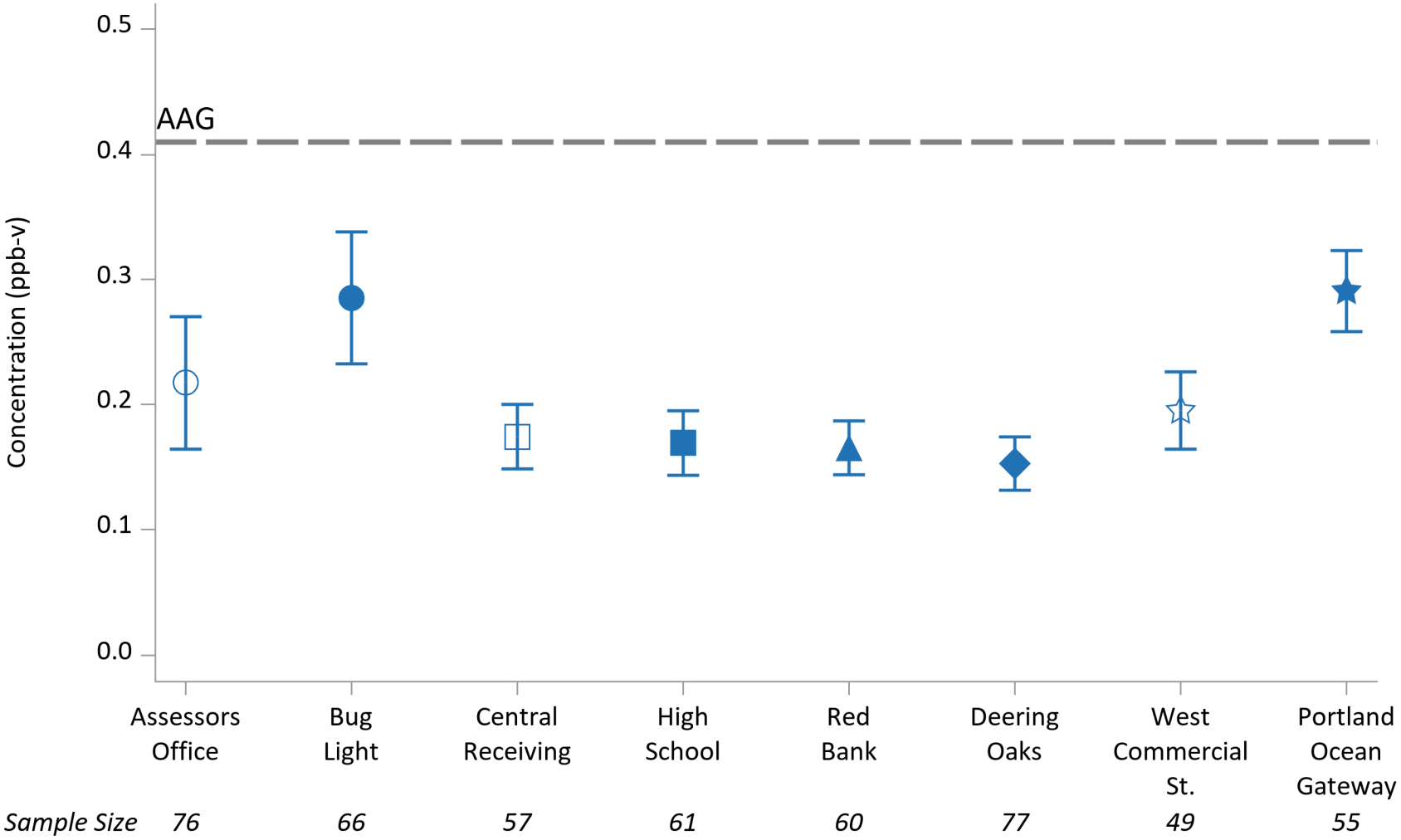

Figure 4 shows the average benzene level as a marker (circle, square, diamond, triangle, etc.) with 95% confidence interval (vertical lines) for all individual 24-hour samples collected by station. 24-hour air samples are collected every 6 days. The number of samples collected by station is shown as the sample size. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. All averages and 95% confidence limits are below the AAG. Sampling data obtained from Maine DEP current through October 2020.

Figure 5. Average 24-hour sampling results with 95% confidence interval by station for Naphthalene

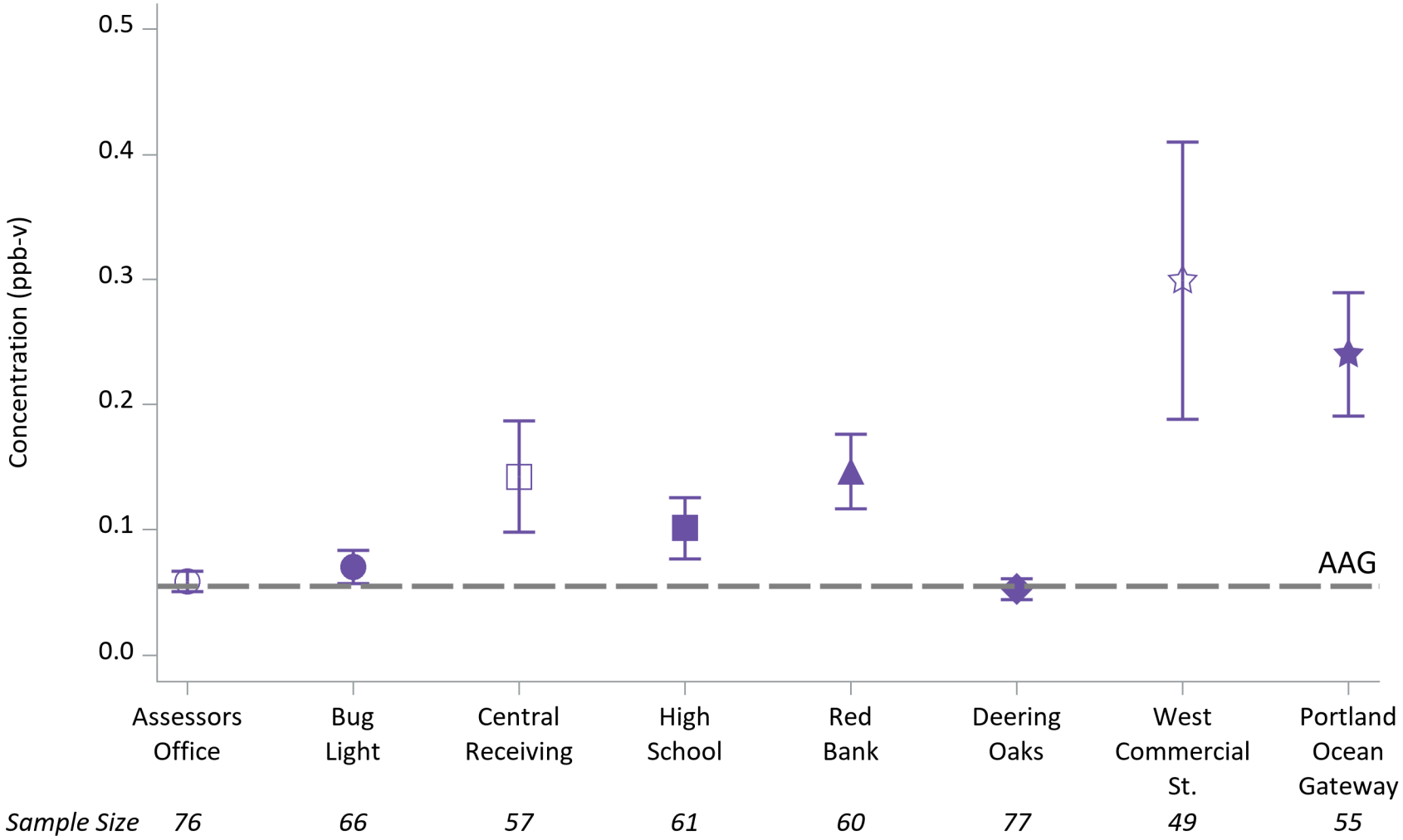

Figure 5 shows the average naphthalene level as a marker (circle, square, diamond, triangle, etc.) with 95% confidence interval (vertical lines) for all individual 24-hour samples collected by station. 24-hour air samples are collected every 6 days. The number of samples collected by station is shown as the sample size. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Seven stations have average naphthalene levels that are above the AAG. Sampling data obtained from Maine DEP current through October 2020.

Figure 6. Average 24-hour sampling results with 95% confidence interval by station for 1,3-Butadiene

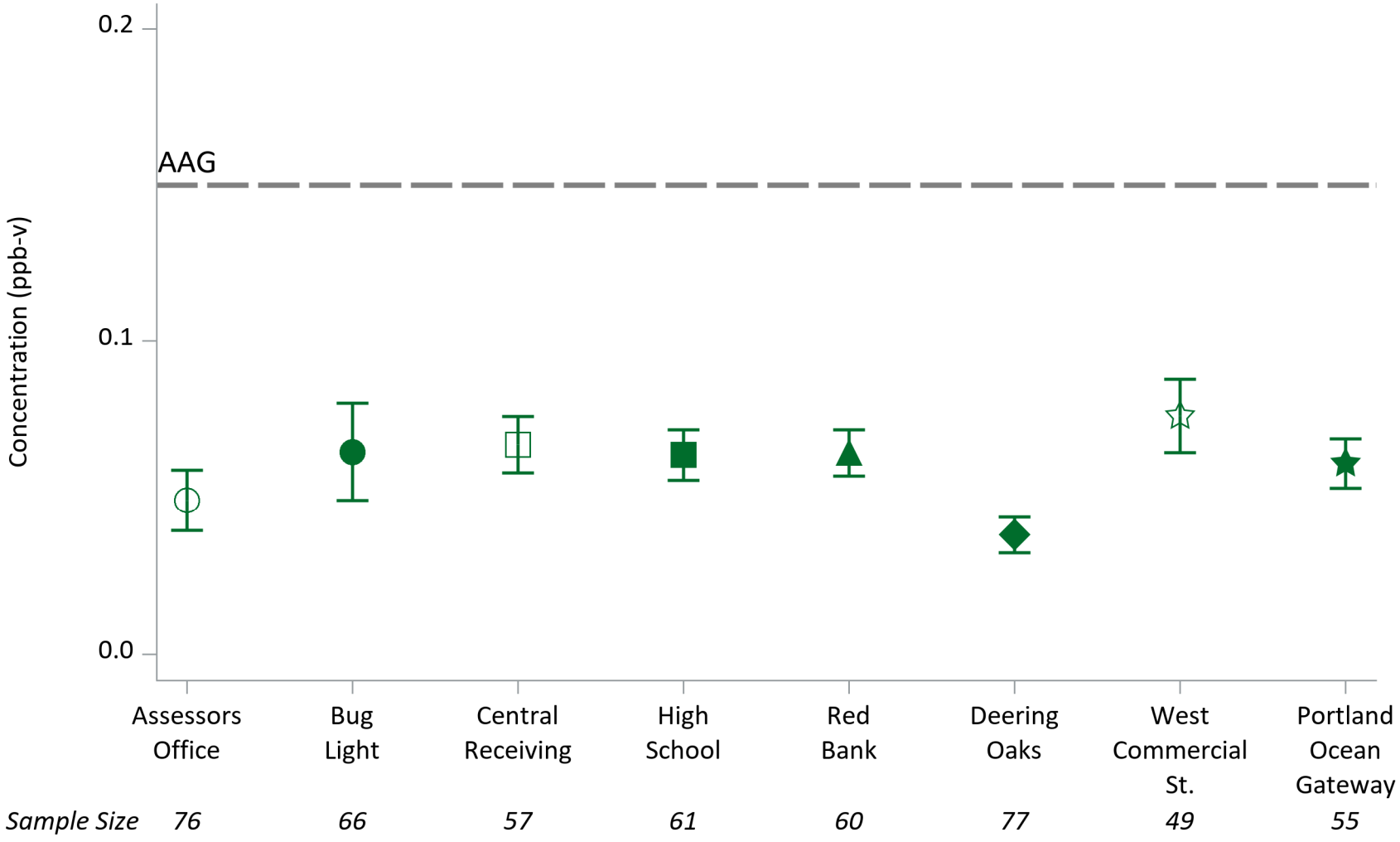

Figure 6 shows the average 1,3-butadiene level as a marker (circle, square, diamond, triangle, etc.) with 95% confidence interval (vertical lines) for all individual 24-hour samples collected by station. 24-hour air samples are collected every 6 days. The number of samples collected by station is shown as the sample size. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. All averages and 95% confidence limits are below the AAG. Sampling data obtained from Maine DEP current through October 2020.

Figure 7. Average 24-hour sampling results with 95% confidence interval by station for Carbon Tetrachloride

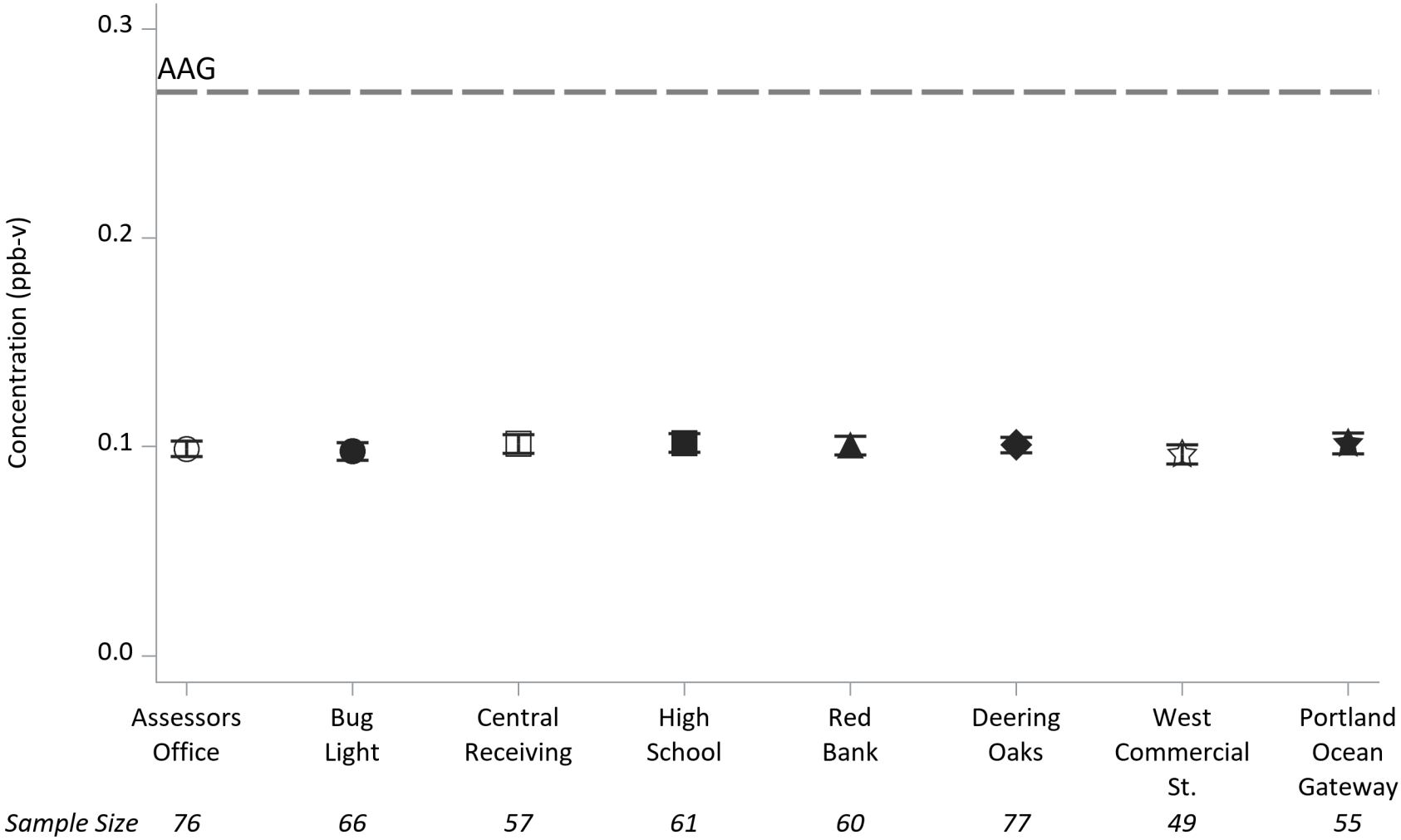

Figure 7 shows the average carbon tetrachloride level as a marker (circle, square, diamond, triangle, etc.) with 95% confidence interval (vertical lines) for all individual 24-hour samples collected by station. 24-hour air samples are collected every 6 days. The number of samples collected by station is shown as the sample size. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. All averages and 95% confidence limits are below the AAG. Sampling data obtained from Maine DEP current through October 2020.

C. Cumulative average time trends figures

Figure 8. Individual 24-hour sampling results with the cumulative average time trends for Naphthalene

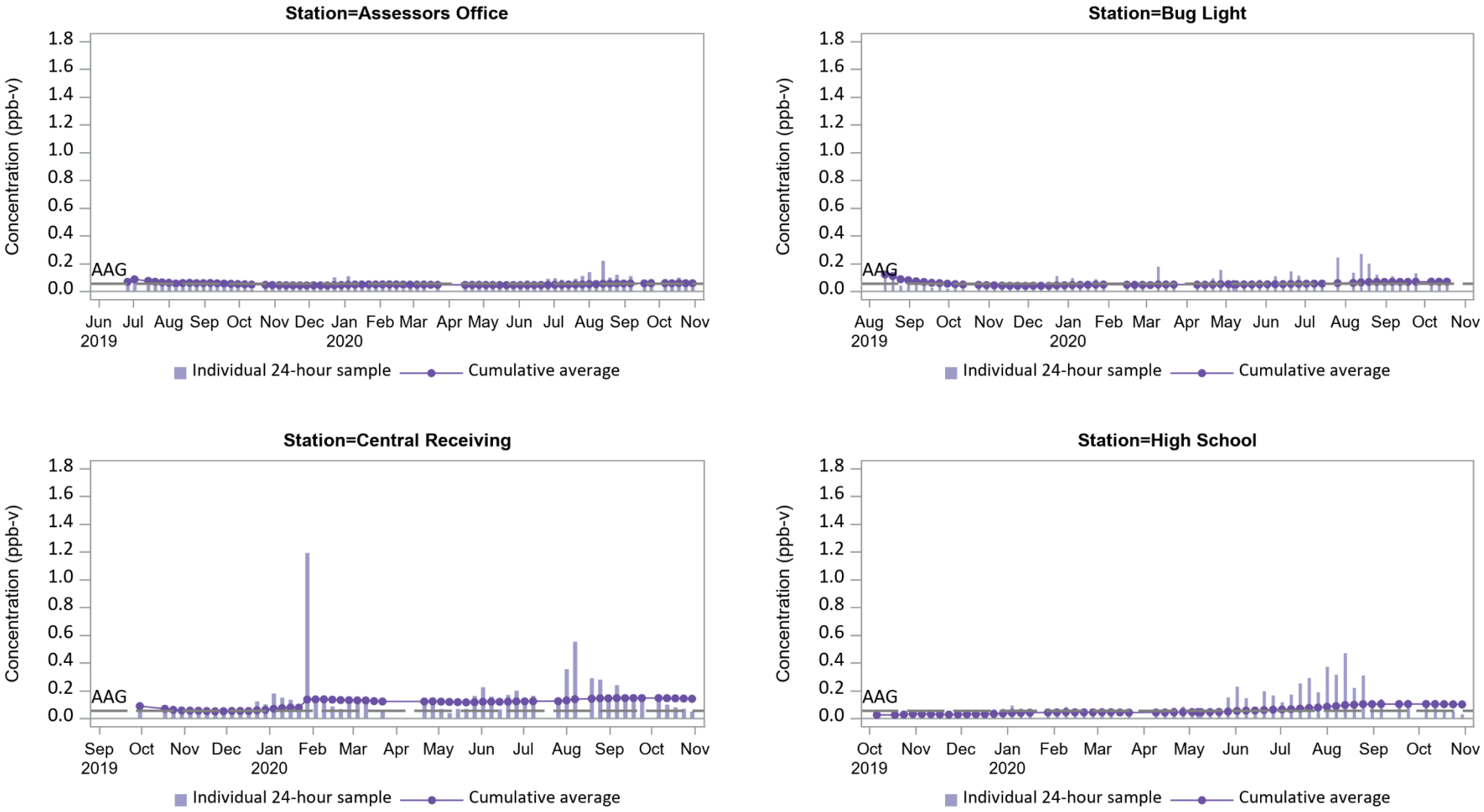

Figure 8 shows the individual 24-hour sample results by date for naphthalene displayed as bars with the cumulative average displayed as a line with markers showing the average trend over time. 24-hour air samples are collected every 6 days. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Sampling data obtained from Maine DEP current through October 2020.

Figure 8. Individual 24-hour sampling results with the cumulative average time trends for Naphthalene

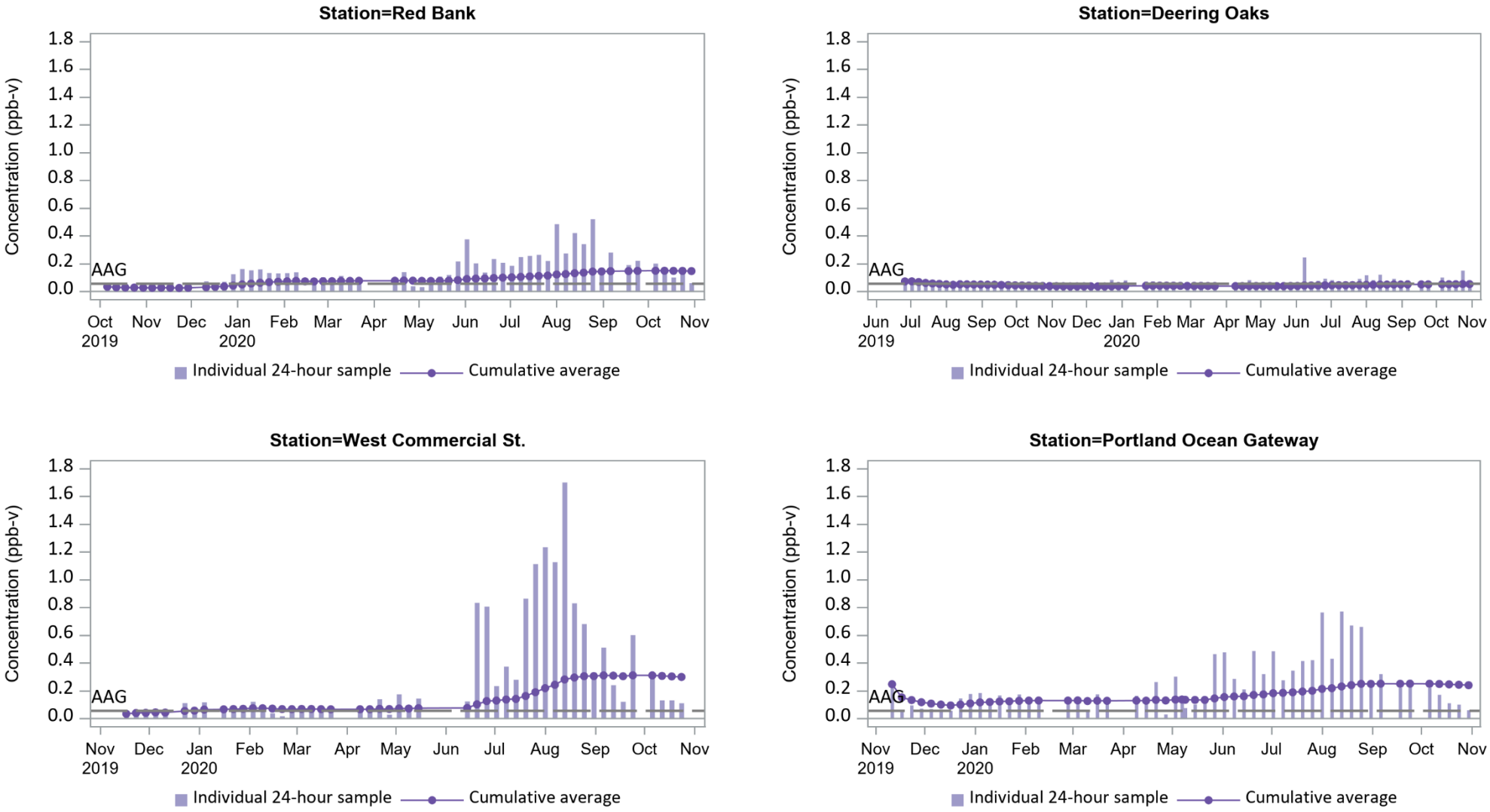

Figure 8 shows the individual 24-hour sample results by date for naphthalene displayed as bars with the cumulative average displayed as a line with markers showing the average trend over time. 24-hour air samples are collected every 6 days. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Sampling data obtained from Maine DEP current through October 2020.

Figure 9. Individual 24-hour sampling results with the cumulative average time trends for Benzene

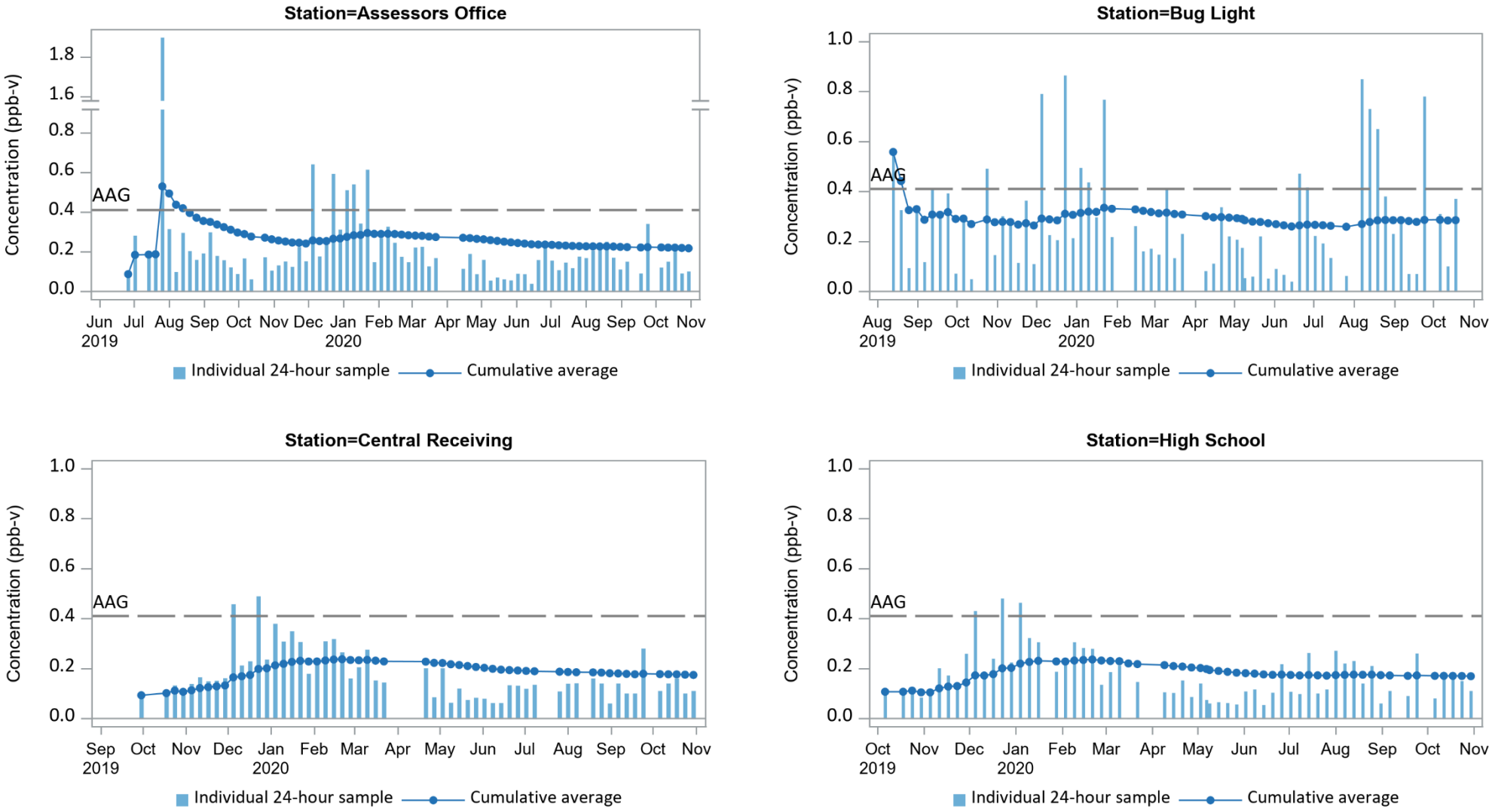

Figure 9 shows the individual 24-hour sample results by date for benzene displayed as bars with the cumulative average displayed as a line with markers showing the average trend over time. 24-hour air samples are collected every 6 days. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Sampling data obtained from Maine DEP current through October 2020.

Figure 9. Individual 24-hour sampling results with the cumulative average time trends for Benzene

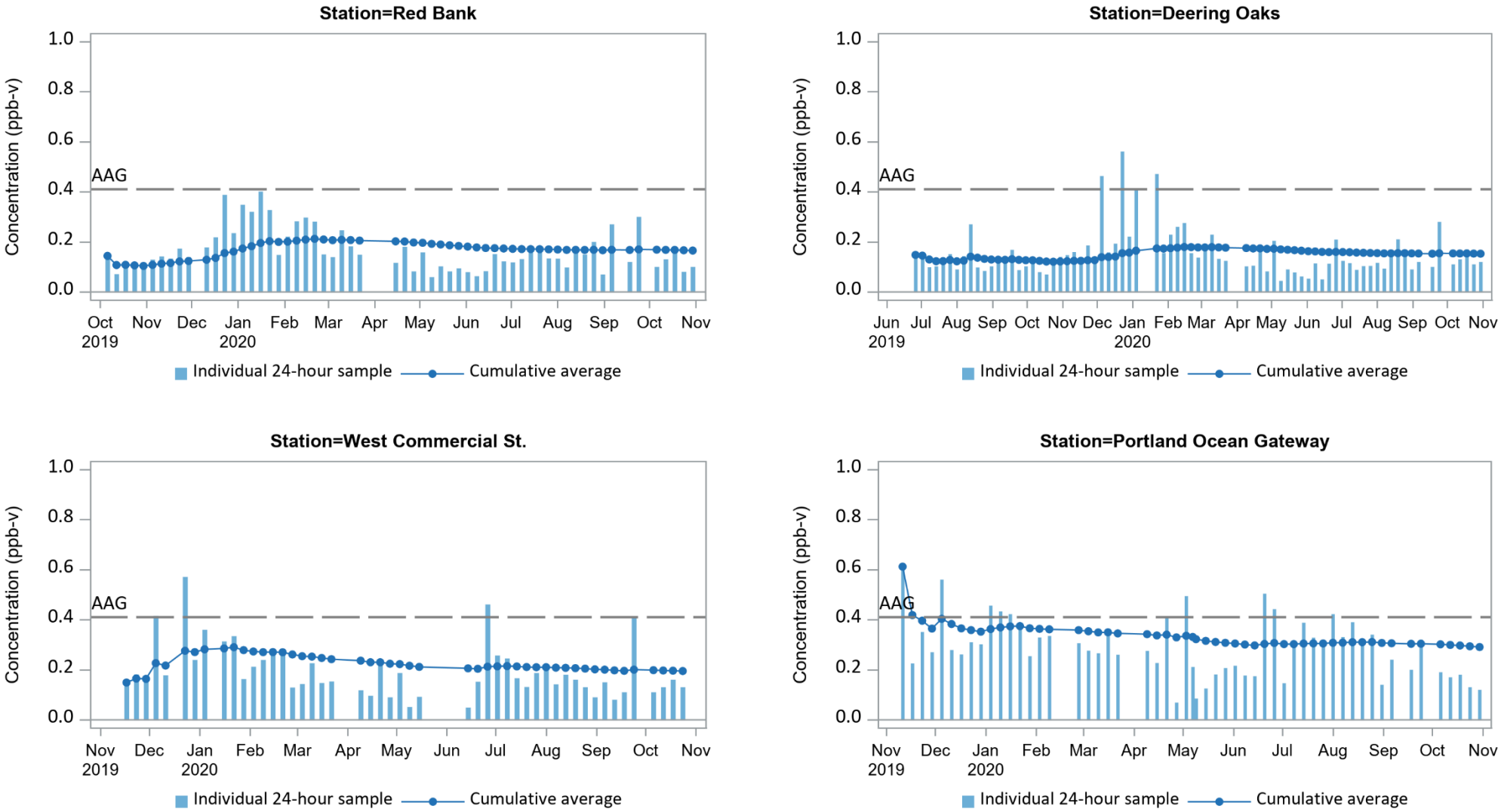

Figure 9 shows the individual 24-hour sample results by date for benzene displayed as bars with the cumulative average displayed as a line with markers showing the average trend over time. 24-hour air samples are collected every 6 days. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Sampling data obtained from Maine DEP current through October 2020.

Figure 10. Individual 24-hour sampling results with the cumulative average time trends for 1,3-Butadiene

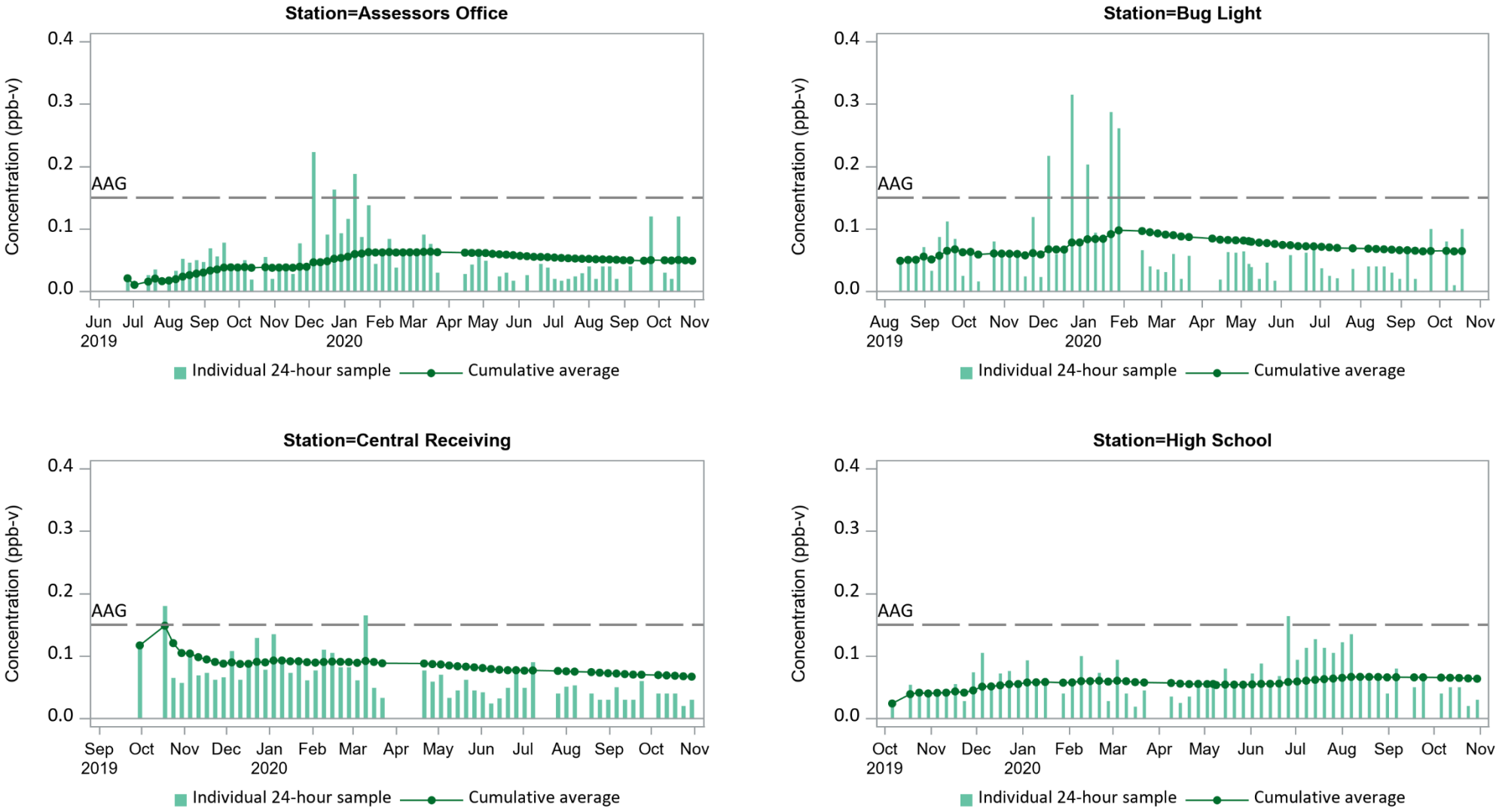

Figure 10 shows the individual 24-hour sample results by date for 1,3-butadiene displayed as bars with the cumulative average displayed as a line with markers showing the average trend over time. 24-hour air samples are collected every 6 days. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Sampling data obtained from Maine DEP current through October 2020.

Figure 10. Individual 24-hour sampling results with the cumulative average time trends for 1,3-Butadiene

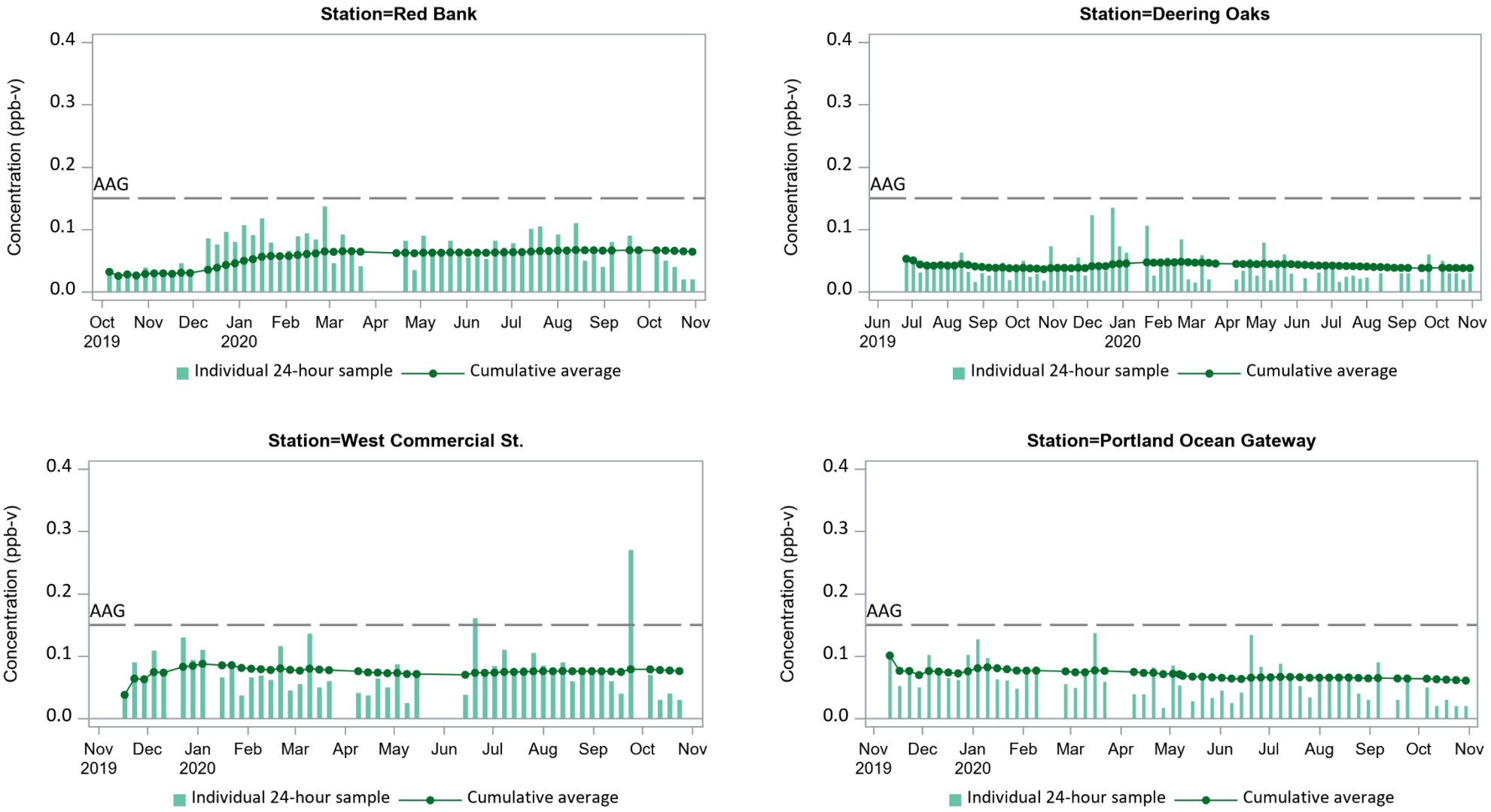

Figure 10 shows the individual 24-hour sample results by date for 1,3-butadiene displayed as bars with the cumulative average displayed as a line with markers showing the average trend over time. 24-hour air samples are collected every 6 days. AAG = State of Maine Ambient Air Guideline, which is an exposure level believed to be associated with a minimal risk of an adverse health effect from life-time exposure, even for sensitive members of the population. Sampling data obtained from Maine DEP current through October 2020.