Update on VOC Monitoring Results for South Portland Area

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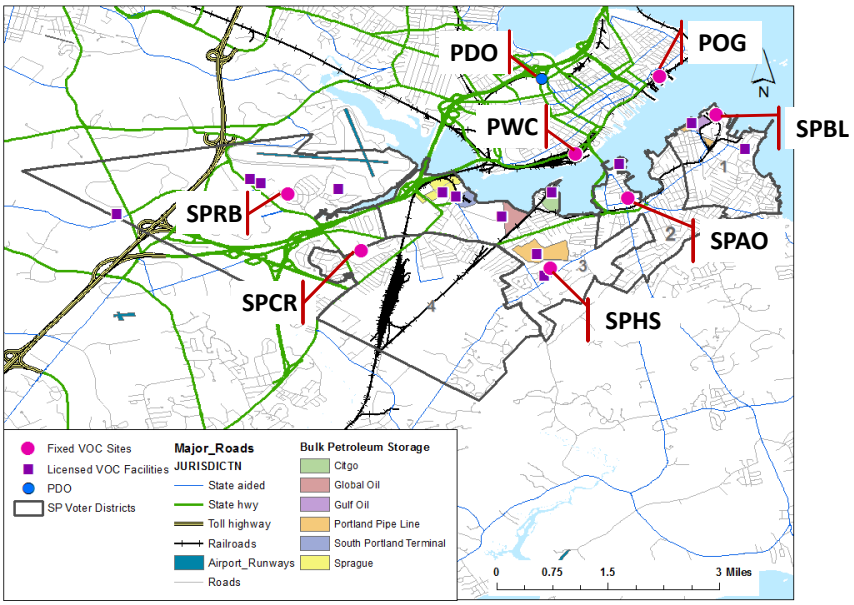
Topics

- Review of VOC data through September 2020
- Comparisons to AAGs
- New cumulative cancer risk computations
- Responses to your questions

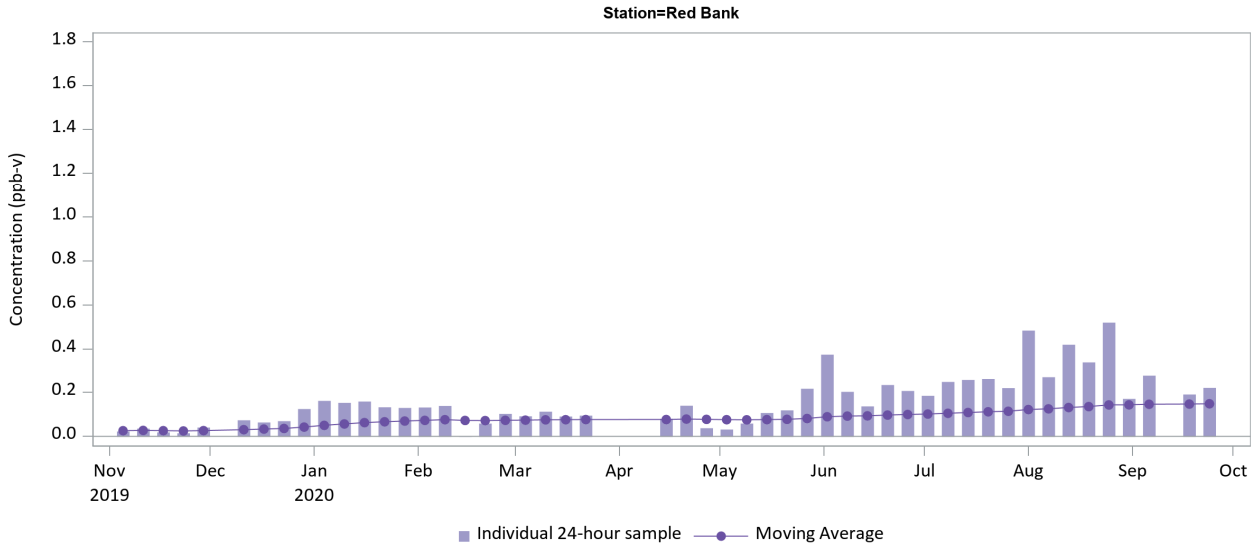
Topics to be discussed.

Location of Monitoring Stations



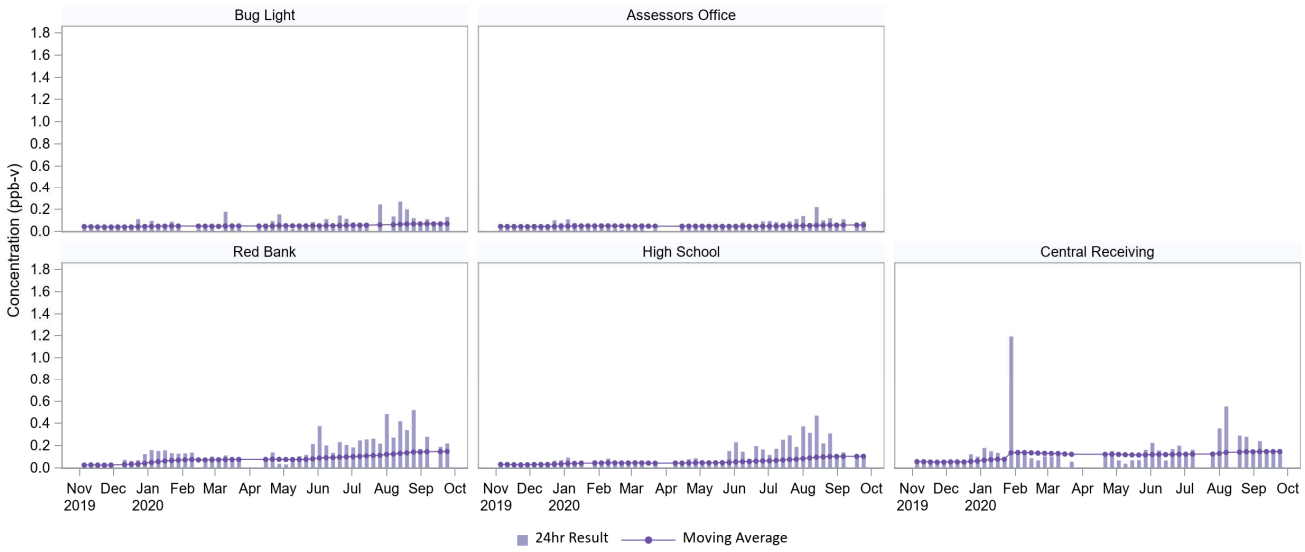
Location of monitoring sites: SPBL = South Portland Bug Light; SPAO = South Portland Assessors Office; SPHS = South Portland High School; SPCR = South Portland Central Receiving; SPRB = South Portland Redbank; PWC = Portland West Commercial; POG = Portland Ocean Gateway; PDO = Portland Deering Oaks

Naphthalene Example – 24hr Temporal Trend Chart



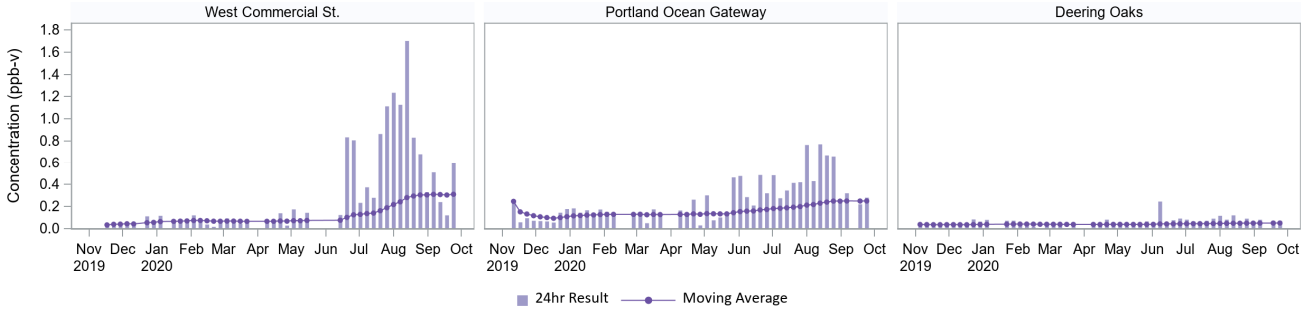
Bar height reflects concentration of chemical measured in a 24-hour sample collection. The line and circle markers show the cumulative average at a point in time. The final circle marker shows the cumulative average from the prior 11 months of sample results.

Naphthalene – 24hr Sample Trends for SoPo Sites



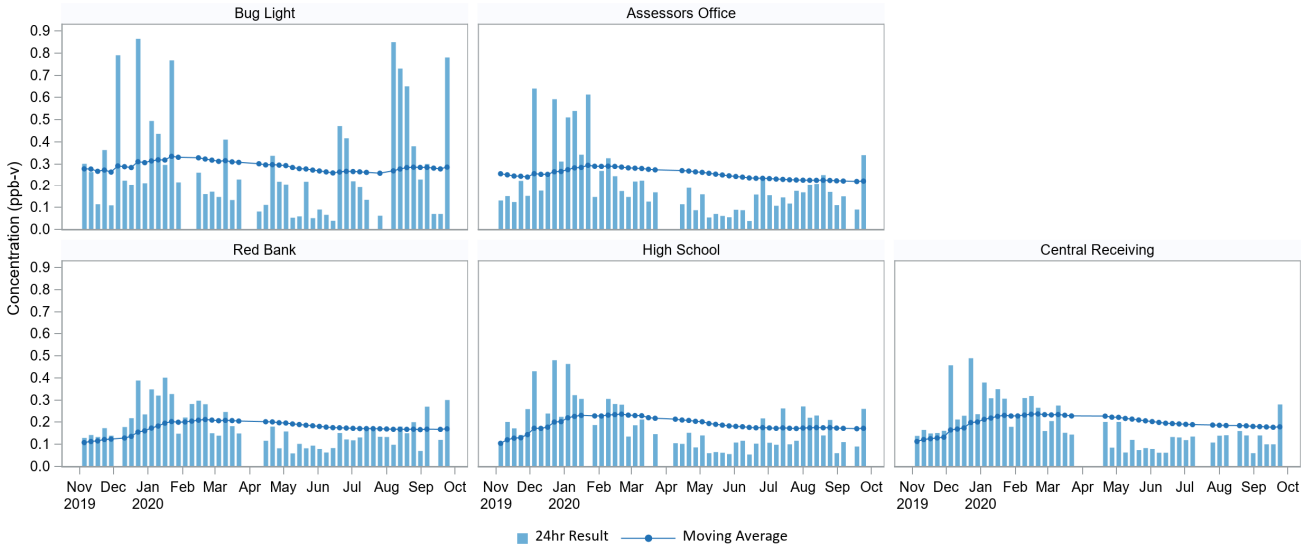
The temporal trends for all 5 South Portland sites. Note the summer-time seasonal peaks and which stations tend to have higher naphthalene levels.

Naphthalene – 24hr Sample Trends for Portland Sites



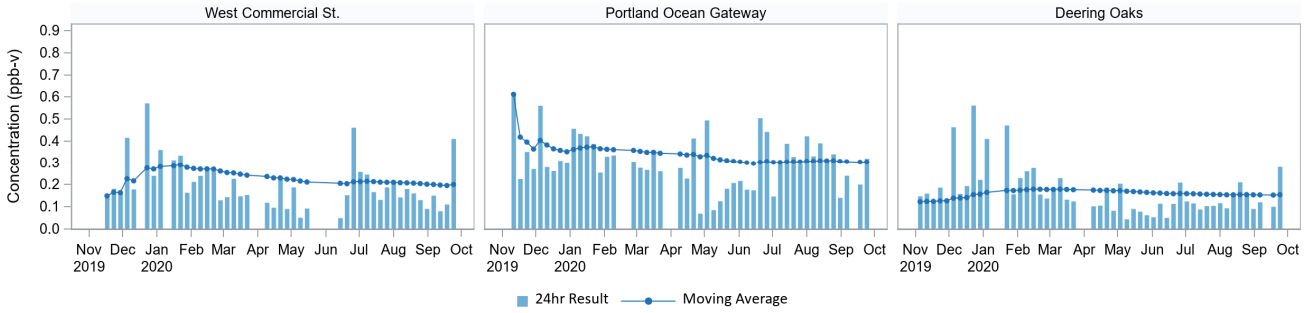
PWC and POG have higher levels than the South Portland sites but similar summer-time peaks. Levels are considerably lower at the Deering Oaks site.

Benzene – 24hr Sample Trends for SoPo Sites



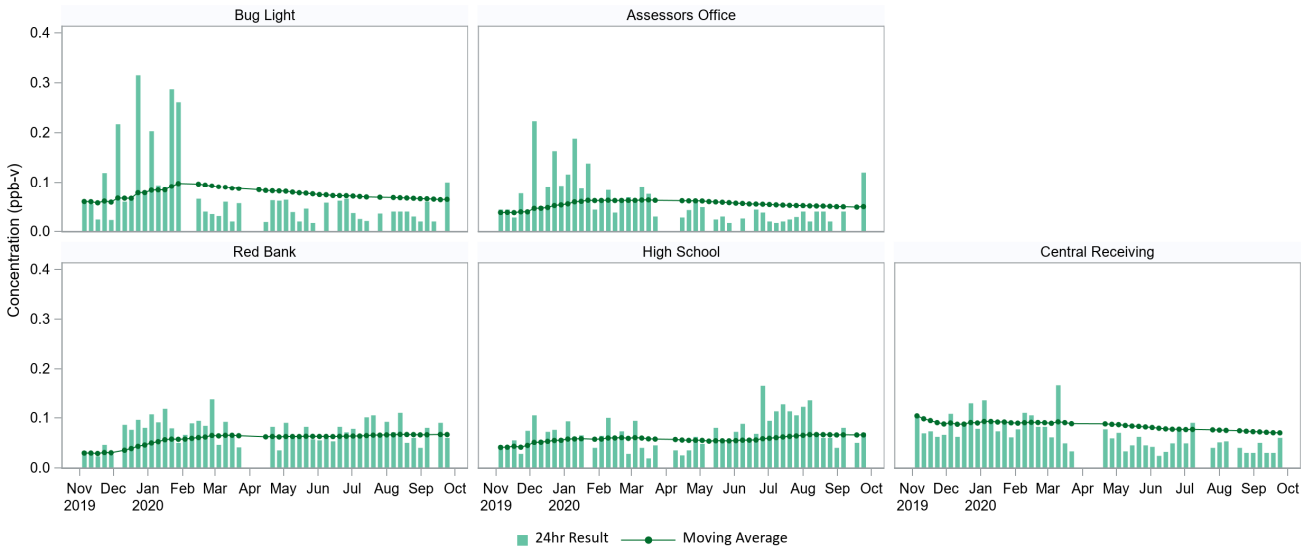
In contrast to naphthalene, most South Portland sites (with the exception of Bug Light) show a winter-time peak benzene levels.

Benzene – 24hr Sample Trends for Portland Sites



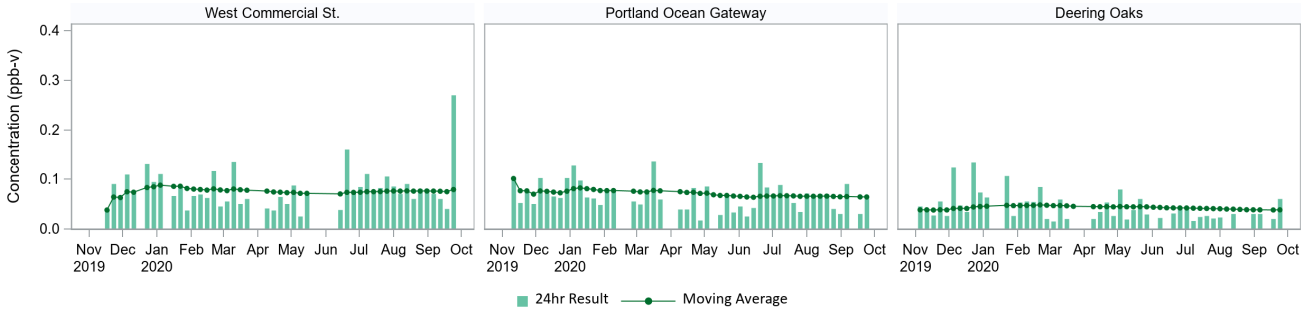
Portland sites have the same similar winter-time peaks for benzene. POG is similar to South Portland Bug Light in that is has a more pronounced summer-time peak. PDO has similar peak levels of benzene to other Portland sites, in contrast to what was seen for naphthalene.

1,3-Butadiene – 24hr Sample Trends for SoPo Sites



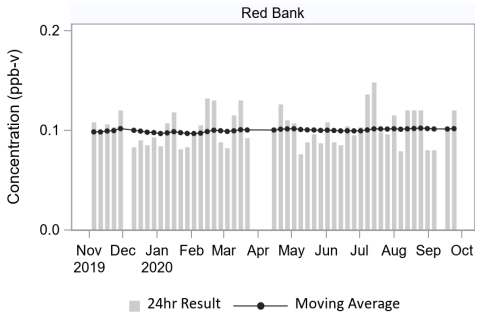
For 1,3-butadiene, there is more variation between sites in the prominence of seasonal peak levels and more similarity in average levels among sampling locations.

1,3-Butadiene – 24hr Sample Trends for Portland Sites

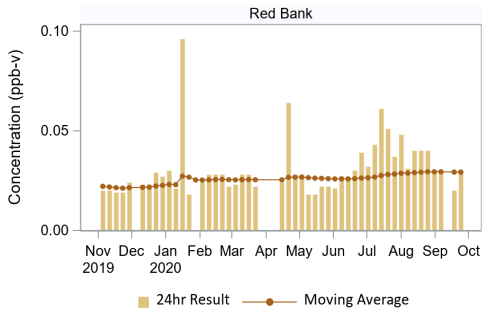


Other VOCs – 24hr Sample Example Trends for Other VOCs

Carbon tetrachloride

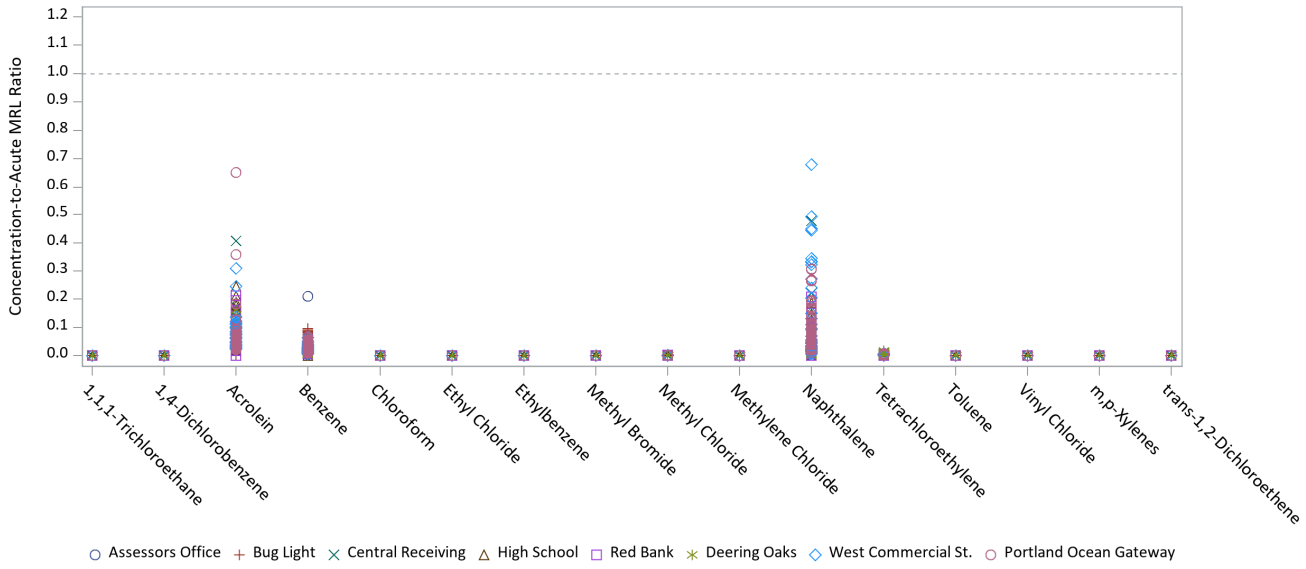


Chloroform



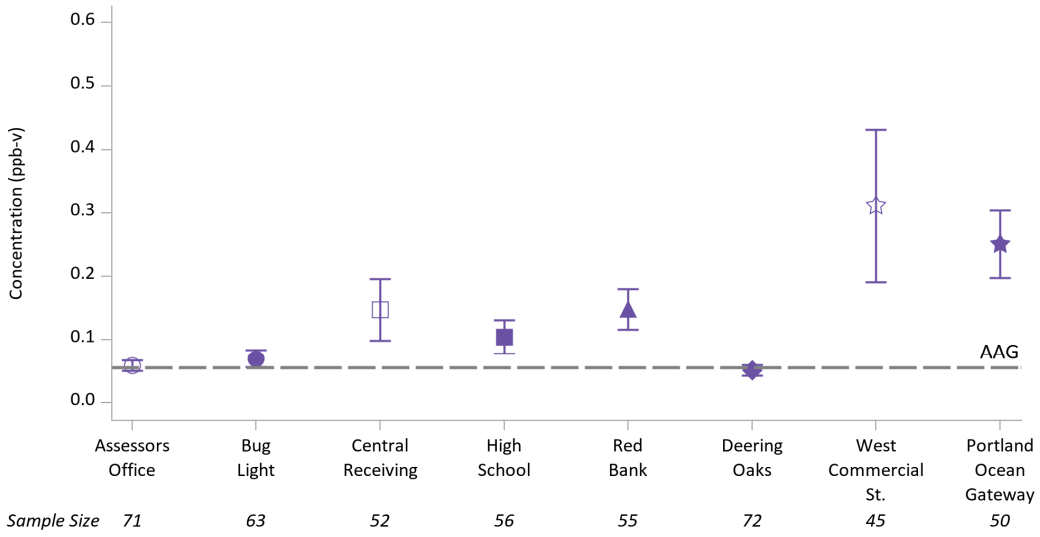
Both carbon tetrachloride and chloroform are substantial contributors to estimated cumulative cancer risk. This slide illustrates temporal trends. Both average levels and lack of any seasonal trends for carbon tetrachloride are fairly consistent among all South Portland and Portland sampling locations. Chloroform levels are also very similar among all sampling locations and most show a summer-time peak.

Ratio of 24hr Sample Level to Acute MRLs



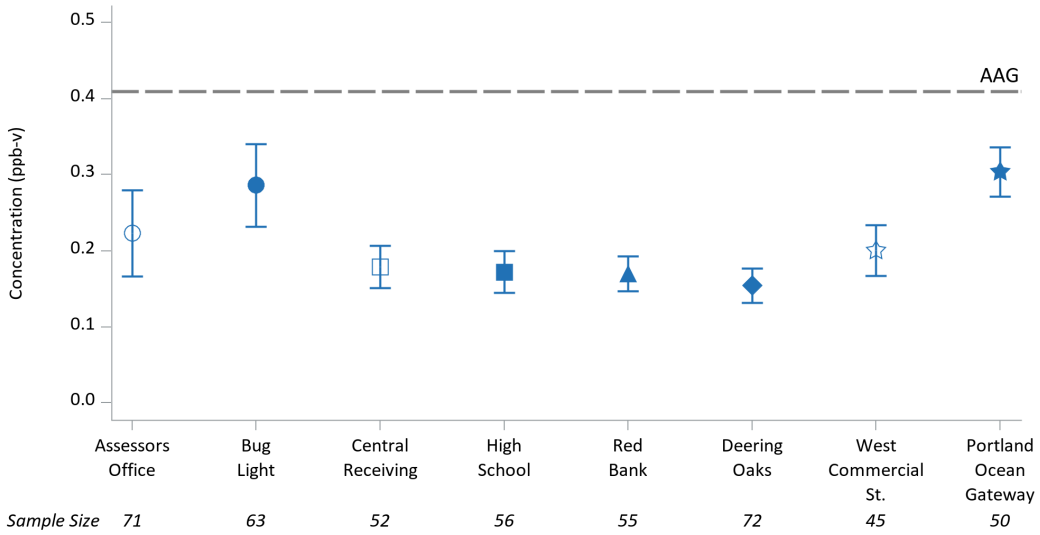
This figure shows the result of comparing all of the individual 24-hour sampling results to acute minimal risk levels (an ATSDR toxicity value) for those chemicals where we have acute MRLs and our own acute toxicity value for naphthalene. A ratio of 1 means the measured level is at the acute MRL. A ratio of less than 1 means the measured level is below the acute MRL. None of the chemicals with acute MRLs were measured at levels above their toxicity value. Naphthalene and acrolein were the closest.

Naphthalene - Cumulative Average and 95% CI



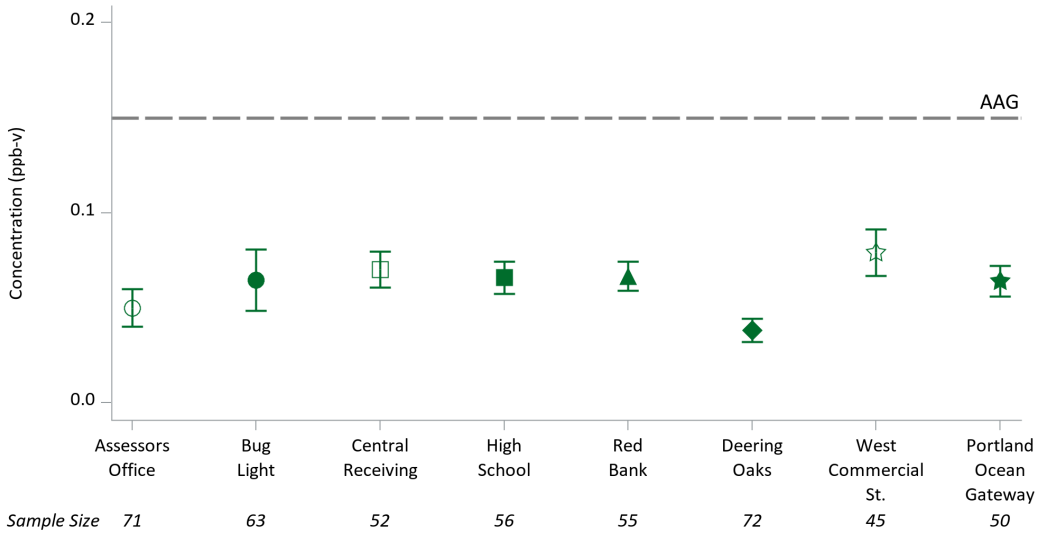
Cumulative averages for naphthalene by station with confidence intervals to reflect uncertainty in the estimated cumulative average.

Benzene - Cumulative Average and 95% CI



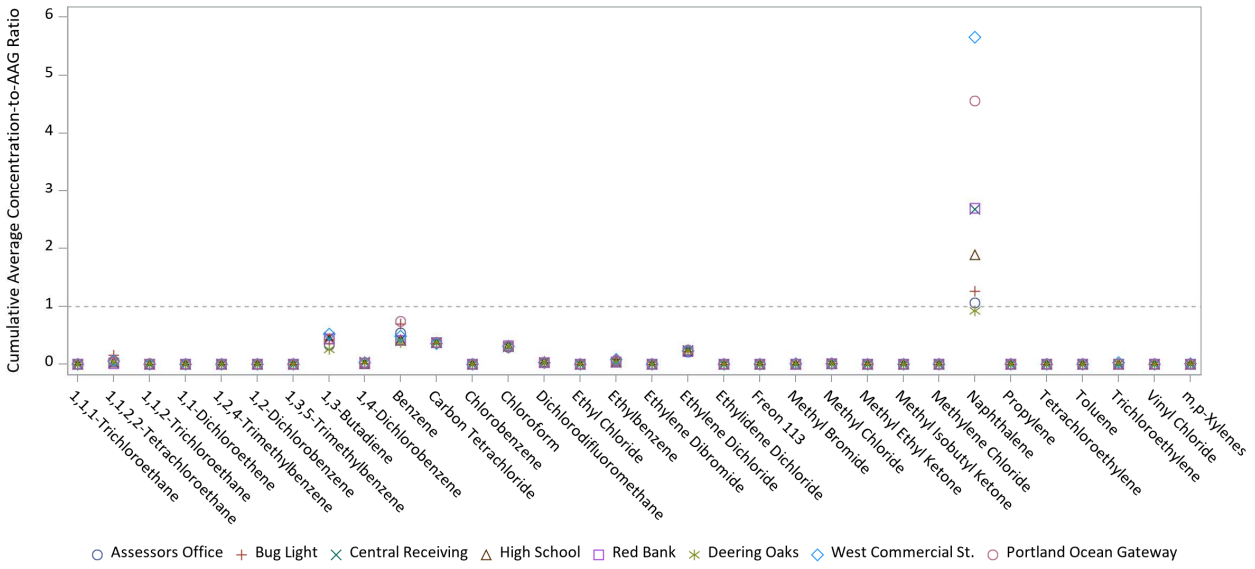
Cumulative averages for benzene by station with confidence intervals to reflect uncertainty in the estimated cumulative average.

1,3-Butadiene - Cumulative Average and 95% CI



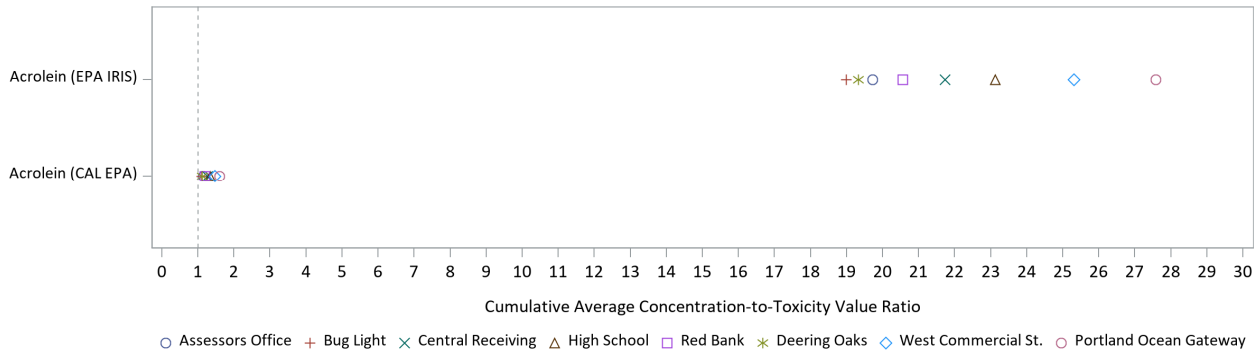
Cumulative averages for 1,3-butadiene by station with confidence intervals to reflect uncertainty in the estimated cumulative average.

Ratio of Cumulative Average Level to AAGs



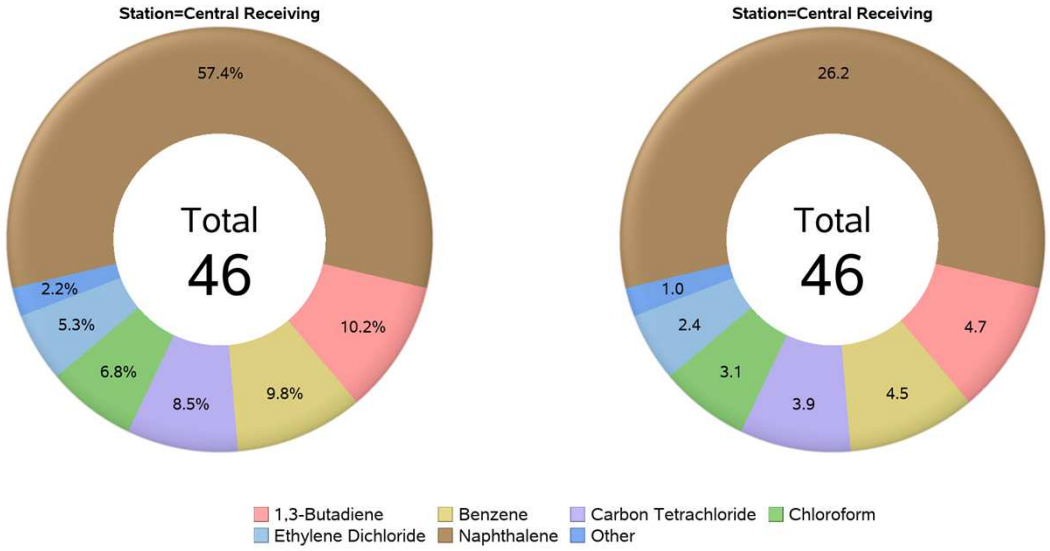
This figure shows the result of comparing all cumulative averages for all the 24-hour sampling results to their corresponding AAGs for those chemicals where we have an AAG. A ratio of 1 means the measured level is at the AAG. A ratio of less than 1 means the measured level is below the AAG. Naphthalene and acrolein (next figure) are the only chemicals that had cumulative averages above their corresponding AAG.

Ratio of Acrolein Cumulative Average Level to AAG



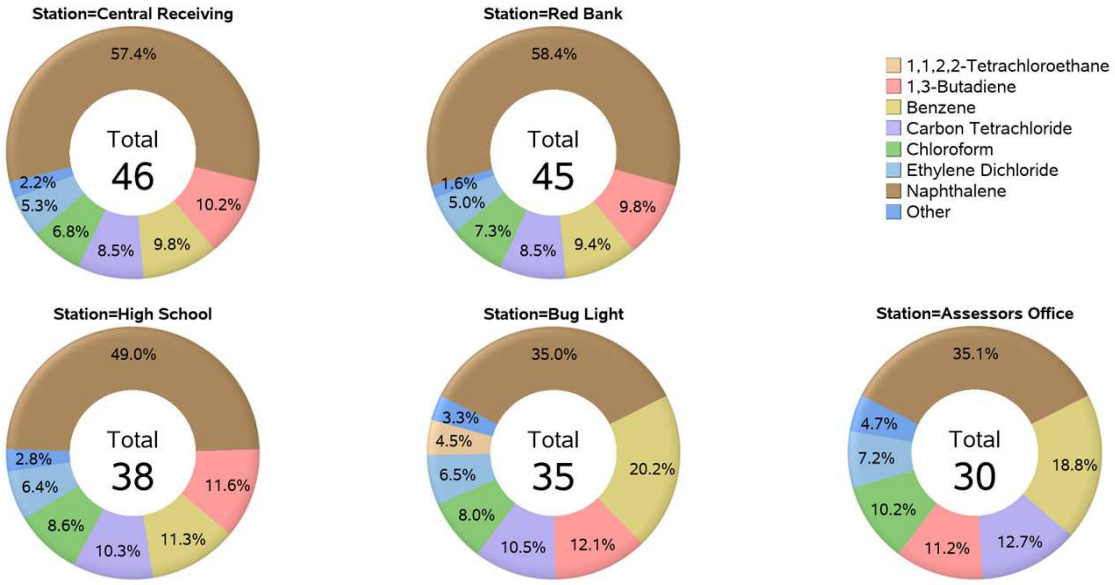
Acrolein is presented as a separate ratio figure because measured levels are so much higher than the AAG that including it with other chemicals would mask their results. As there is interest in the use of the USEPA HEM model, we want to point out that this EPA office has decided to use a toxicity value for acrolein derived by California EPA rather than the USEPA toxicity value from the Integrated Risk Information System (IRIS) which is view as the “gold standard” for most toxicity values. Both USEPA and CAL EPA had access to the same key studies so the difference in derivation of toxicity values reflects different decision-making rather than differences in available studies.

Cumulative Lifetime Cancer Risk (# per million)



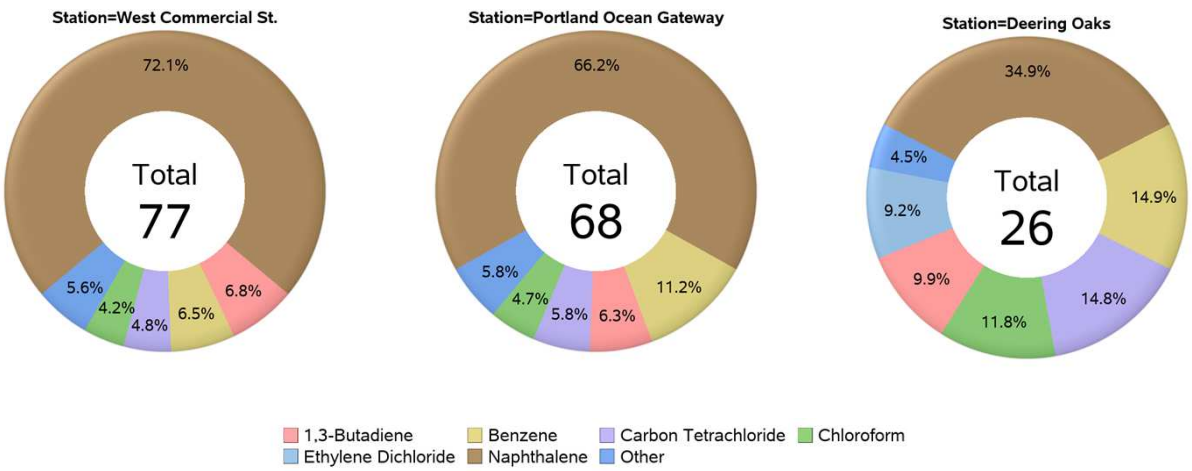
We have been previously asked to estimate cumulative risk. Now that we have nearly a full year of data to estimate cumulative averages we are approaching the point where if becomes more reasonable to make estimates of cancer risk and we can estimate cumulative cancer risk assuming individual chemical risks are independent and additive. Here we present two ways of visualizing the cumulative risk. These are referred to as "donut charts". The number in the hole of the donut is the cumulative cancer risk per million, here in this example is 46 per million (which is the same as 4.6 per hundred thousand). The contribution of individual chemicals to the cumulative risk is shown by the colored segments of the donut with labels either as the % of the total (left figure) or absolute cancer risk by each chemical (right figure) that add to the total of 46. What follows are the cumulative cancer risk donut figures for each sampling location. We are interested in the South Portland CAACs preference for use of the figure on the left versus the right to display results in future reports.

Cumulative Lifetime Cancer Risk (# per million)



Cumulative cancer risks for South Portland sampling locations, with highest risks at SPCR and SPRB. Naphthalene makes the largest contribution to the cumulative cancer risk followed by benzene and 1,3-butadiene.

Cumulative Lifetime Cancer Risk (# per million)



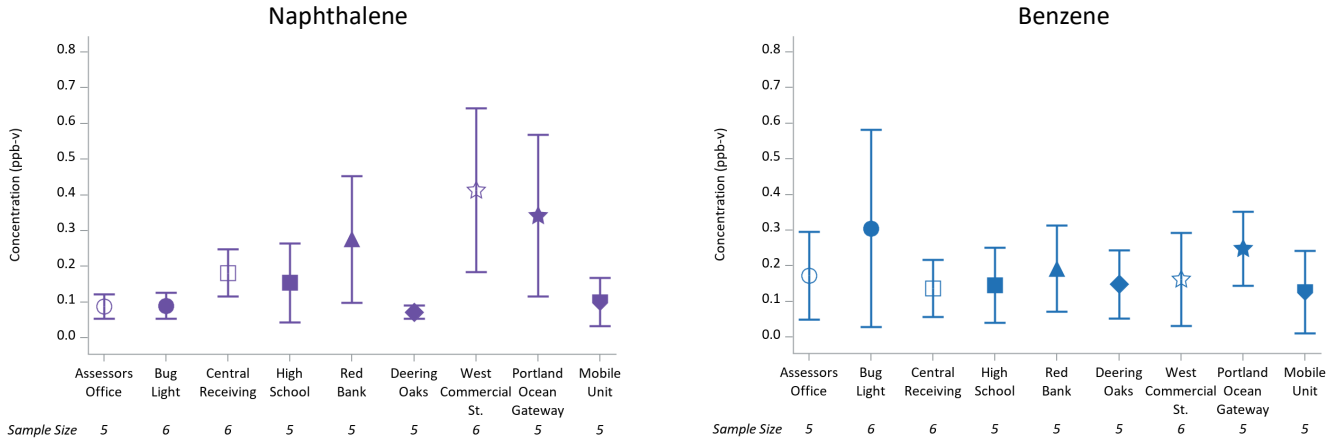
Cumulative cancer risks for Portland sampling locations, with highest risks at PWC and POG. Naphthalene makes an even larger contribution to the cumulative cancer risk for PWC and POG, followed by benzene and 1,3-butadiene. PDO clearly looks different in magnitude and importance of specific chemicals to cumulative risk.

Your Questions

- Mobile unit: Have you analyzed the results from the mobile unit that was placed outside a Portland residence for 6-weeks?
- HEM3 Modeling: What is your reaction to David Falatko's HEM3 modeling analysis.
- What is your reaction to CAAC member Tom Mikulka's analysis of the grab samples by neighborhood, looking at benzene and naphthalene.
- Budget and priorities: What work related to South Portland air quality will you be able to do next year?
- Funding sources: Do you see any opportunities on the horizon for grants or other sources?
- Indoor air quality: Could you imagine an indoor air quality study design to be applied in South Portland?
- Risk calculation: CAAC would like your opinion about whether you believe this level is protective in situations such as air quality concerns in South Portland?

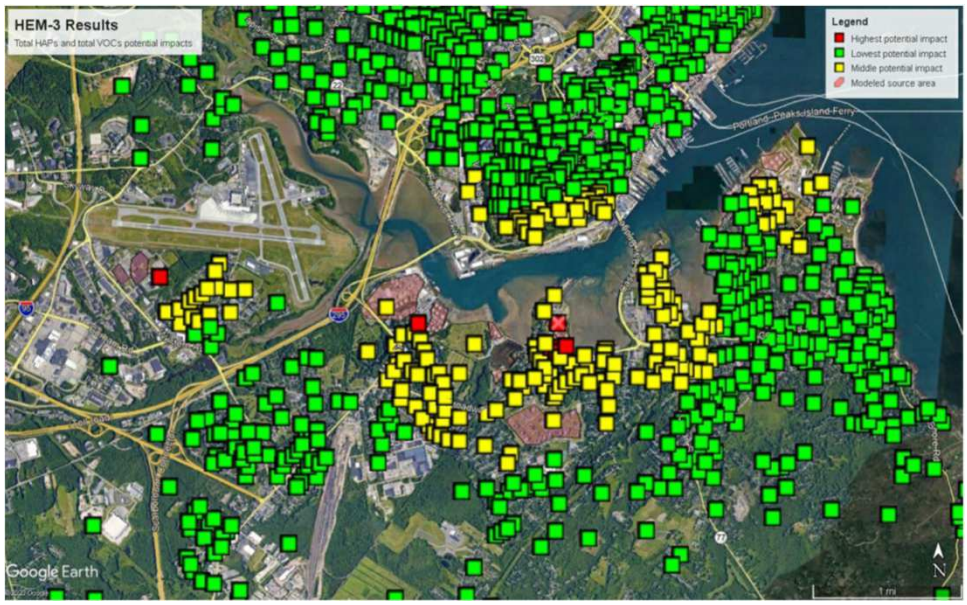
CAAC questions submitted to MECDC.

Mobile Unit



We have not had the opportunity to give much thought as to how to analyze the VOC data from the mobile station. This figure shows one option, which is to compare results from the mobile unit to other stations by matching on sampling dates. These results show that for this period of observation, the mobile unit found levels of naphthalene and benzene similar to or lower than other sampling locations.

HEM Modeling



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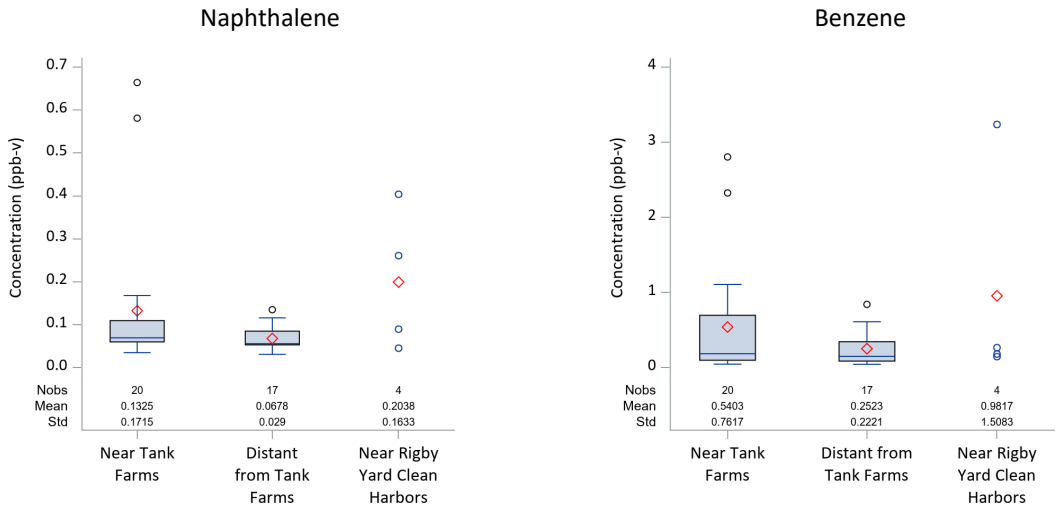
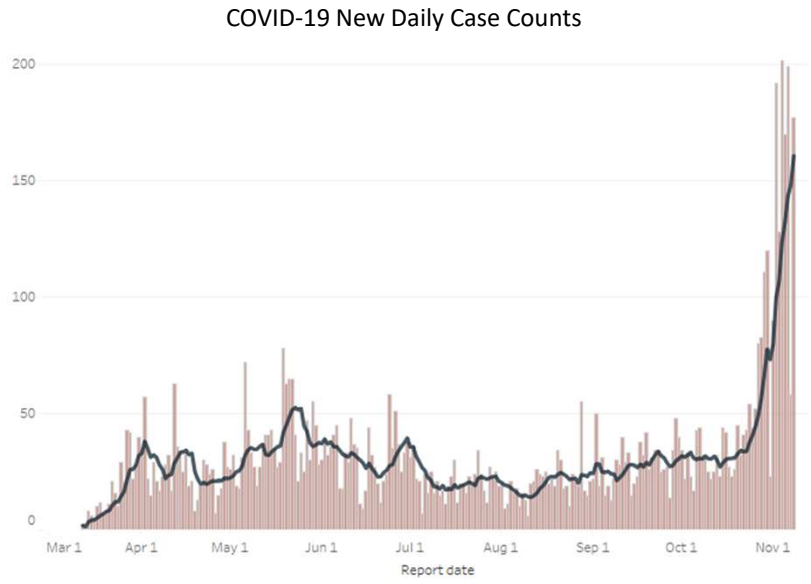
We have not had a chance to review Mr. Falatko's work in any depth. We have been on several calls with a USEPA HEM group and DEP staff on possible HEM application to the South Portland/Portland area. Our sense is that they are very much in the exploratory stage with questions about reliability of emission data and local meteorology data and associated concerns with localized meteorology (i.e., differences between sampling locations). We suggested use of dispersion modeling early on in our involvement as a way to explore placement of the monitoring stations, but the message we got back from DEP's meteorologists is that the micro-meteorology in this river basin made any such work questionable until they had local met stations operational. From our vantage point as health risk assessors, it is not clear to us why we would look to the HEM modeling (or any modeling approach) for health assessment when we have such a dense network for monitoring stations within a small area – eight stations. But we still see the value of performing this type of modeling to explore the impact of specific emission sources and to assess where to place monitoring stations – either fixed or mobile. One thing we did notice with Mr. Falatko's HEM modeling is that it seems to miss the higher VOC levels measured for the Portland Ocean Gate station, and it is an interesting question of whether this suggests an unaccounted emission source or localized meteorology that is different than Portland Jetport. Likewise, it is interesting that the SPCR does not show up as an impacted area, again, consistent with either another source or localized meteorology. These are both interesting examples of the value of this sort of modeling work, and the value of doing such work when you have a dense ambient air monitoring network to ground-truth model predictions against.

Grouped Analysis of Grab Samples



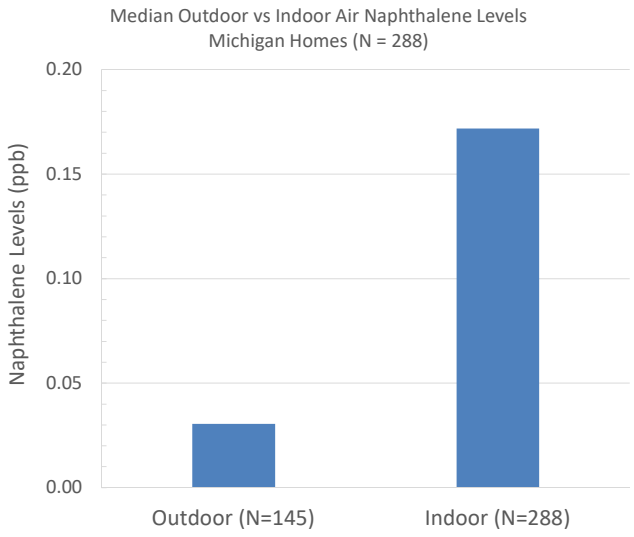
We have also not had much opportunity to review Mr. Mikulka's analysis of the grab air sample results where he sorts and compares results by proximity to the tank farms. In this figure, we show how we would begin to explore such a comparison by looking at box plots to describe results for "near" and "distant" from the tank farms. The box plots illustrate the distribution of values, the median (line inside the box), the mean (red diamond), the intra-quartile range (the lower and upper boundaries of the box). The whisker below the box shows the minimum observation and the whisker above the box shows the maximum observation that is no greater than 1.5 times the intra-quartile range above the 75th percentile. The dots in the box plots show outlying observations falling outside the upper whisker. We have performed initial statistical tests of these two groups by a couple of parametric and non-parametric methods and neither find these two groups to be statistically different, though that may in part just reflect a small and highly variable data set. For the near Rigby Yard Clean Harbors area, there are not enough samples to appropriately display a box plot. Therefore, the dots represent individual observations with the read diamond representing the mean.

Our Future Work



We were asked how the State budget (given the impact of the COVID pandemic on State revenues) might impact our continued ability to engage and review future VOC monitoring data for the South Portland/Portland sampling locations. We are not aware of any budgetary issues that will impact our ability to continue our work with DEP. However, the recent surge in cases could mean toxicology staff will once again be re-deployed to support MECDC's COVID-19 response. Both Tom and I were heavily redeployed between April and August.

Indoor Air



Batterman et al., Indoor Air. 2012 August ; 22(4): 266–278

We were asked about whether we think there is merit to a study that looks at indoor VOC levels in addition to outdoor VOC levels. There is an existing scientific literature here in which the general finding is that that many VOCs tend to have higher levels in indoor air from sources in the home (or attached garage) as compared to outdoor levels. The above shows results for naphthalene reported in a paper by Batterman and colleagues that looked at matched indoor and outdoor levels in Michigan homes. Note that these reported indoor air naphthalene levels for Michigan homes are similar or lower than the outdoor air levels found for some of the South Portland and Portland sampling locations.

Risk Level Policy

- 1-in-1 million for individual chemical-specific ambient water quality standards
- 5-in-1 million for cumulative cancer risk for beneficial use of waste residuals
- 1-in-100,000 for cumulative cancer risk for RAGs for hazardous site clean-up
- 1-in-100,000 for individual chemical-specific AAGs
- 1-in-100,000 for individual chemical-specific Fish Tissue Action Levels
- 1-in-1000 to 1-in-1,000,000 for Drinking Water Standards for PWS

Risk level policy is a risk management decision, not a risk assessment question. Our office is mostly engaged in risk assessment. It is worth noting that there is policy in Maine to use different risk standards (or guidelines) for different settings, such as when permitting a discharge to and otherwise less contaminated environment versus addressing contamination in an already polluted environment. It is certainly appropriate to have a discussion as to what is the appropriate risk level policy for ambient air guidelines.

Questions?

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