GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

2020 Forsyth County Air Quality Monitoring Report

Prepared for Forsyth County Board of Commissioners

By the Air Protection Branch

Ambient Monitoring Program
July 2021

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Acronyms and Glossary

AADT	Annual Average Daily Traffic
Aerosols	A gaseous suspension of fine solid or liquid particles
AM	Annual Mean
Anthropogenic	Resulting from human activity
APB	Air Protection Branch
ARITH MEAN	Arithmetic Mean
BAM	Beta Attenuation Monitor
CBSA	Core Based Statistical Area
DNPH	Dinitrophenylhydrazine
EPA	United States Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method- the official measurement technique for a given pollutant
GA AAMP	Georgia Ambient Air Monitoring Program
GA EPD	Georgia Environmental Protection Division
HAP	Hazardous Air Pollutant
HPLC	High Performance Liquid Chromatography
LOD	Limit of Detection
$\mu g/m^3$	Micrograms per cubic meter
m/s	Meter per second
MSA	Metropolitan Statistical Area, as defined by the US Census Bureau
NATTS	National Air Toxics Trends Station
NCore	National Core Multipollutant Monitoring Network
NMHC	Non-Methane Hydrocarbons
NWS	National Weather Service
O_3	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
PAMS	Photochemical Assessment Monitoring Station
$PM_{2.5}$	Particles with an aerodynamic diameter of 2.5 microns or less
PM_{10}	Particles with an aerodynamic diameter of 10 microns or less
$PM_{10-2.5}$	Particles with an aerodynamic diameter between 2.5 and 10 microns
ppb	Parts per Billion
ppm	Parts per Million
Precursor	A substance from which another substance is formed
QTR	Calendar Quarter
Rawinsonde	A source of meteorological data for the upper atmosphere
TBD	To Be Determined
TNMOC	Total Non-Methane Organic Compounds
UV	Ultraviolet
VOC	Volatile Organic Compound
W/m^2	Watts per square meter

Agency Contact

Agency Contacts for Georgia Environmental Protection Division

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1.0 Executive Summary

The Georgia Ambient Air Monitoring Program (GA AAMP) of the Georgia Environmental Protection Division (GA EPD) is submitting this *2020 Forsyth County Air Quality Monitoring Report* to the Forsyth County Board of Commissioners as part of the *Air Quality Monitoring Agreement* (Agreement) established February 4, 2019. The report provides documentation of the establishment and maintenance of a two-year ambient air quality monitoring station in Forsyth County, Georgia.

GA AAMP has been tasked with monitoring for 13 ambient air pollutants near the Eagle Point Landfill in Forsyth County. In this first year, 58 samples were collected for each of the hazardous air pollutants (HAPs), and 8760 samples of hourly particulate matter ($PM_{2.5}$) were collected. Of these 13 pollutants, six pollutants were detected at the Forsyth County monitoring station established by GA AAMP: $PM_{2.5}$, benzene, toluene, *o*-xylene, *m/p*-xylene, and TNMOC. These pollutants that were detected at the Forsyth County monitoring station had concentrations that were comparable to the concentrations detected at GA AAMP monitoring sites in the northern metropolitan Atlanta area where similar pollutants are monitored.

The Forsyth County Risk Assessment was prepared by the Risk Assessment Program of GA EPD to understand whether long-term exposure to specific air toxics in ambient air around the Forsyth County air monitoring station could be harmful to human health. The individual cancer risk for each HAP as well as the cumulative cancer risk estimate do not exceed 1 in 10,000 (10^{-4}) and are at levels considered acceptable to both EPA and EPD from a risk management perspective. None of the target organ specific hazard indexes exceed 1, indicating that there is not a potential for adverse noncancer effects because of exposure to ambient air HAPs measured at the Forsyth County air monitoring station. Based on the first 12 months of measured ambient air HAPs concentrations at the Forsyth County air monitoring station and the process used in preparing this Risk Assessment, it is reasonable to conclude that the 10 HAPs in ambient air do not present a long-term danger to the vast majority of Forsyth County residents who live near the Eagle Point Landfill. Please see Appendix A for more details of this assessment.

With the assessment of 12 months of ambient air quality monitoring data collected for the targeted HAPs, along with the risk assessment performed by GA EPD Risk Assessment Program, the GA AAMP has developed this report, which partially meets the objectives of the Agreement. This report confirms that GA AAMP meets the first year of the Agreement. An additional final report will be produced once the research project has concluded.

2.0 Background

Forsyth County officials received numerous odor complaints in the vicinity of the Eagle Point Landfill in Forsyth County. Multiple meetings were held with elected officials and residents, and as a result, Forsyth County entered into an agreement that GA AAMP would operate the air quality monitoring station for Forsyth County and provide an annual summary report of the air quality monitoring data collected. The objectives of the study include:

- Provide air quality monitoring data in a timely manner
- Characterizing concentrations in the ambient air near Eagle Point Landfill in Forsyth County for the identified Hazardous Air Pollutants and fine particulate matter

- Providing comparison to nearby GA AAMP network sites
- Providing quality data for risk characterization

2.1 Target Pollutants

Based on discussions with the U.S. Environmental Protection Agency (EPA) and GA EPD, it was decided that the following pollutants would be monitored due to their potential prevalence in landfills. The targeted hazardous air pollutant compounds were selected based on their presence and higher concentrations in a significant number of EPA test results for municipal waste landfills. The relative toxicity of the compounds were also considered as part of the selection criteria. This short-term study focused on:

- Non-methane organic compounds (TNMOCs):
  - Found in landfill gas emissions
  - A large group of chemicals including some volatile organic compounds (VOCs) and odorous compounds
- Eleven selected hazardous air pollutants (HAPs):
  - benzene
  - 1,3-butadiene
  - chloroform
  - ethylene dichloride
  - hexane
  - methylene chloride
  - toluene
  - trichloroethylene
  - vinyl chloride
  - *m/p*-xylene
  - *o*-xylene
- Fine Particulate Matter ($PM_{2.5}$)
  - Mixture of extremely small particles and liquid droplets
  - Combustion of diesel fuels is a known source

In addition, wind speed and wind direction is also monitored at the site. The following image displays the wind speed and wind direction monitor. Combining the pollutant data with the wind data will give insight on the direction the pollutants are flowing across the ambient air monitoring site.

Figure 1. Wind Speed and Wind Direction Monitor

2.2 Hazardous Air Pollutants/Volatile Organic Compounds

2.2.1 Description

Air toxic pollutants, or hazardous air pollutants (HAPs), cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. HAPs are a group of air pollutants that have a wide variety of sources—mobile sources (such as vehicles), stationary industrial sources, small area sources, indoor sources (such as cleaning materials), and other environmental sources (such as volcanoes and wildfires). The lifetime, transportation, and make-up of these pollutants are affected by both weather (rain and wind) and landscape (mountains and valleys). In addition, some HAPs that are no longer used, but were commonly used in the past, can still be found in the environment today.

2.2.2 Health Impacts

Negative effects on human health range from headaches, nausea, and dizziness to cancer, birth defects, problems breathing, and other serious illnesses. These effects can vary depending on frequency of exposure, length of exposure time, health of the person that is exposed, along with the toxicity of the compound. People can be exposed to HAPs by breathing contaminated air, consuming food or water contaminated by air pollutants, or touching contaminated water or soil. Some of the substances tend to have only one critical effect, while others may have several. Some of the effects may occur after a short exposure and others appear after long-term exposure, or many years after being exposed. These air pollutants also affect the environment. Wildlife experience symptoms similar to those in humans and pollutants accumulate in the food chain. Many air pollutants can also be absorbed into waterways and have toxic effects on aquatic wildlife.

2.2.3 Measurement Technique

TNMOCs and HAPs volatile organic compounds (VOCs) samples are collected with a stainless steel canister from midnight to midnight for a 24-hour sample, every 6 days. Sampling is conducted once every six (6) days based on U.S. EPA Ambient Monitoring Sampling Calendar (https://www.epa.gov/amtic/sampling-schedule-calendar). The VOCs canisters samples are then sent to contract laboratory, Atmospheric Analysis & Consulting, Inc. in Ventura, CA, for analysis using a gas chromatograph with mass spectroscopy detection (GC/MS) following EPA Method TO-15 for the HAPs and Method TO-12M for TNMOC (see https://xonteck.com/ for more information about the HAPs and TNMOC sampler used in the study).

Figure 2. TNMOC and HAPs Samplers

2.3 $PM_{2.5}$

2.3.1 Description

Fine particulate matter ($PM_{2.5}$) are particles that are 2.5 micrometers in diameter or smaller, and can only be seen with an electron microscope. Approximately thirty $PM_{2.5}$ particles would fit on a cross section of a hair. These particles and droplets are invisible to the naked eye, and composition and sources can vary greatly by region. Most particles form in the atmosphere as a result of complex reactions of chemicals such as sulfur dioxide and nitrogen oxides. Fine particles are produced from dust and all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes. For an area to be in attainment of the National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$, the three-year average of the annual average concentrations has to be less than or equal to 12.0 $\mu g/m^3$. In addition, the 24-hour primary and secondary standard requires that the three-year average of the 98^{th} percentile of the 24-hour concentrations be less than or equal to 35 micrograms per cubic meter.

2.3.2 Health Impacts

Fine particulate matter can penetrate deep into lung tissue and even enter the bloodstream. This may cause significant respiratory or cardiovascular problems that can shorten an individual's lifespan. High risk groups include children, the elderly, and people with cardiovascular or lung diseases such as emphysema and asthma.

2.3.3 Measurement Technique

Fine particulate matter is sampled with a continuous monitor in real-time using a beta attenuation monitor (BAM). The BAM is a continuous $PM_{2.5}$ monitor designed with an inlet to cut out particles larger than 2.5 microns in size (see http://www.metone.com/products/air-quality-monitors/ for more information about the $PM_{2.5}$ monitor used in this study).

Figure 3. $PM_{2.5}$ Sampler

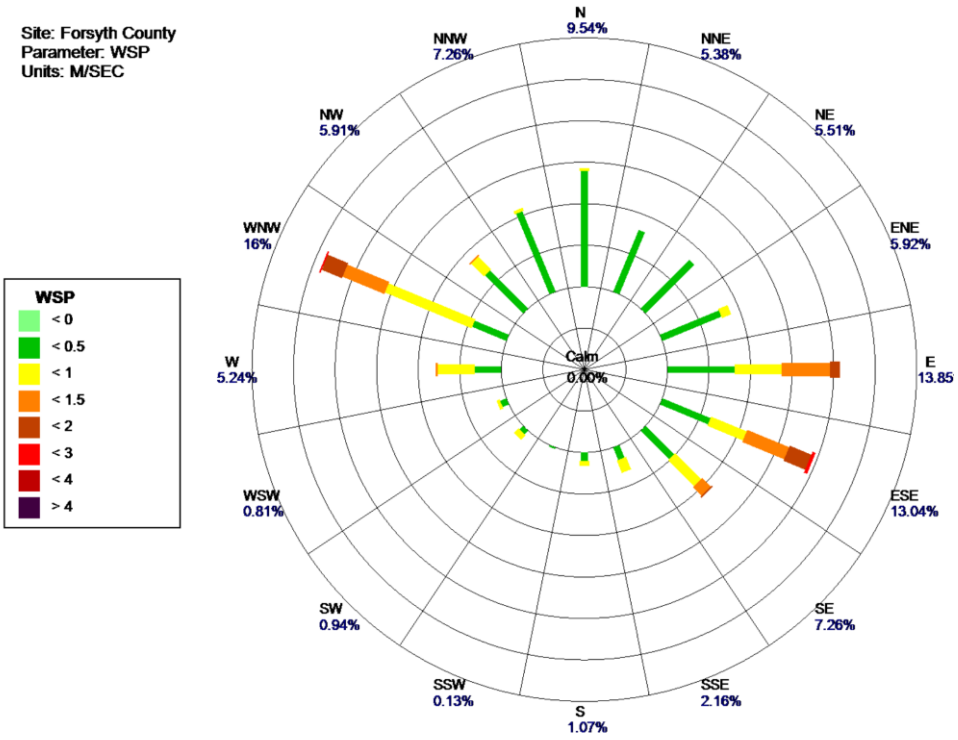
2.4 Quality Assurance

GA AAMP Site Operators and Field Auditors have ensured proper operation of the ambient air monitoring equipment. The Field Auditors of the QA Unit conduct QA audits approximately 6 months. The Data Validation Specialist, Data Verification Specialists, and QA Unit Manager review the data before it is submitted to the GA AAMP's AirVision database. The Field Auditor of the QA Unit performs an annual site evaluation.

In addition, the VOCs sampler is collocated with another VOCs sampler of the same type for quality assurance purposes. GA AAMP can compare the samples collected side by side on the same days to ensure that the samplers are taking similar readings.

3.0 Site Information

The following wind roses were obtained from GA AAMP's meteorological equipment on site to determine average wind direction and wind speed at the ambient air monitoring location. The wind roses below show the monthly averages of general wind direction and speed. The circular format of the wind rose shows the direction the winds blew from and the length of each "spoke" around the circle shows how often the wind blew from that direction. The different colors of each spoke provide details on the speed, in meters per second (m/sec), of the wind from each direction.



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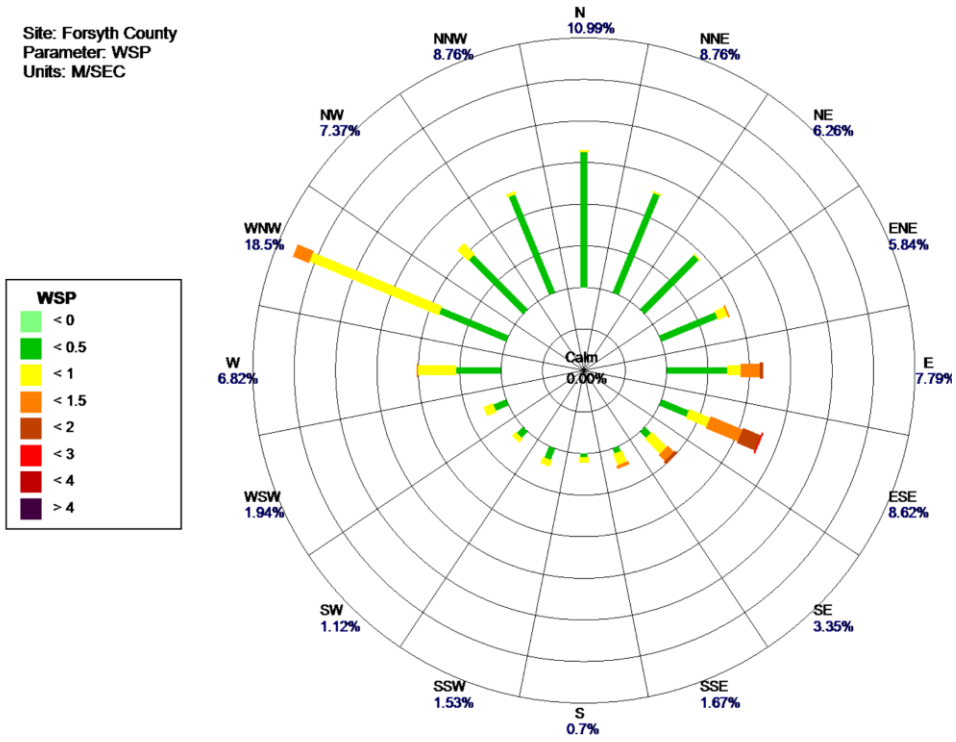

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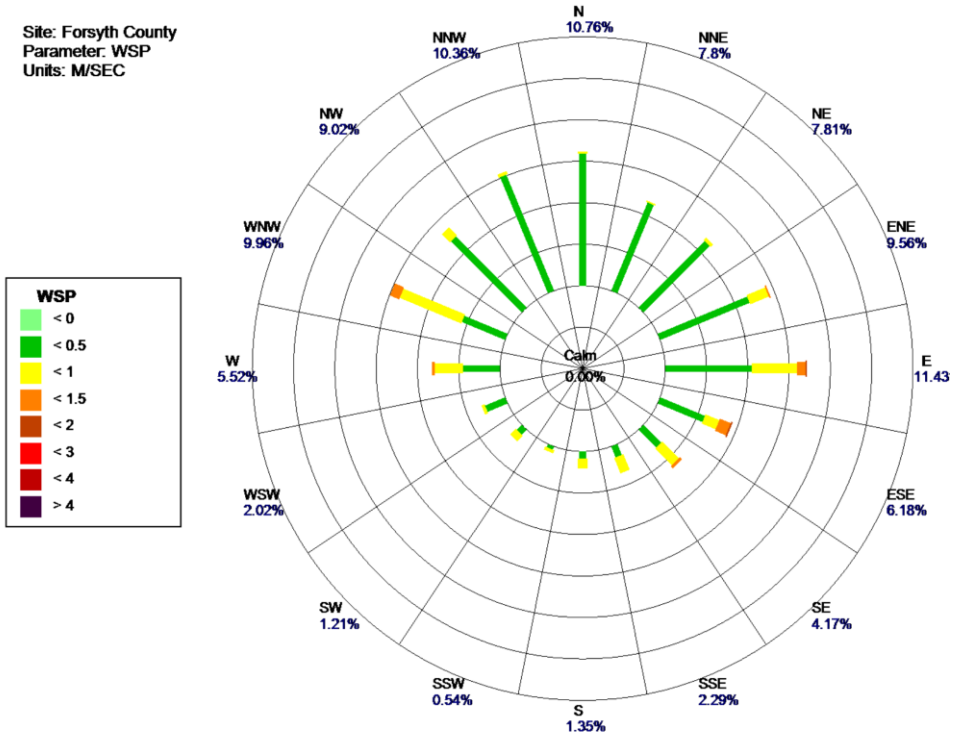

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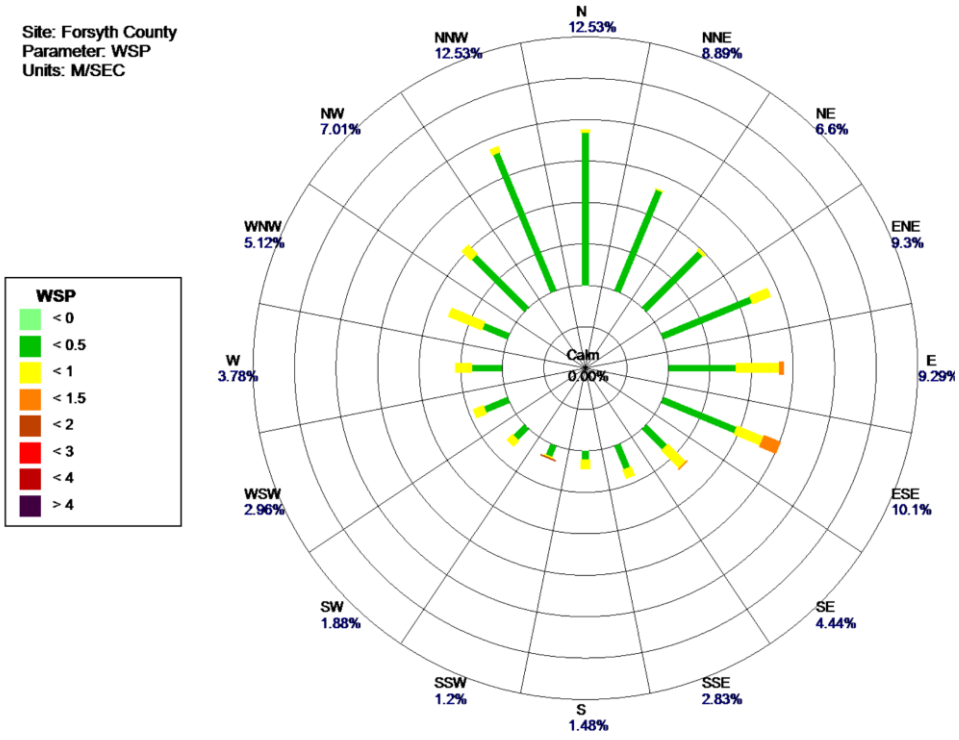

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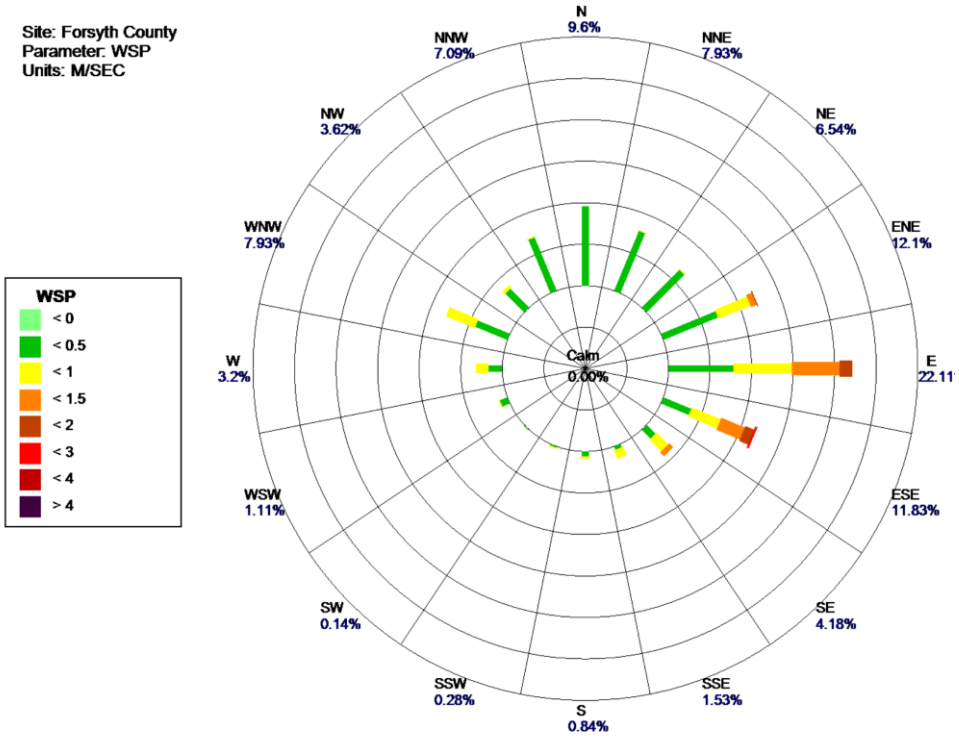

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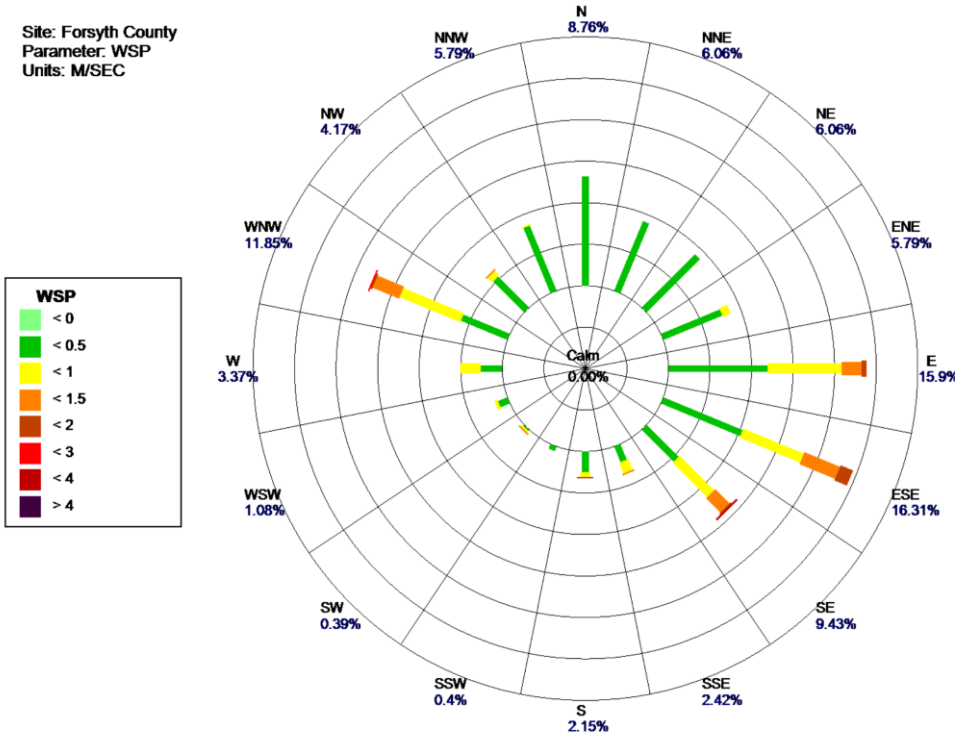

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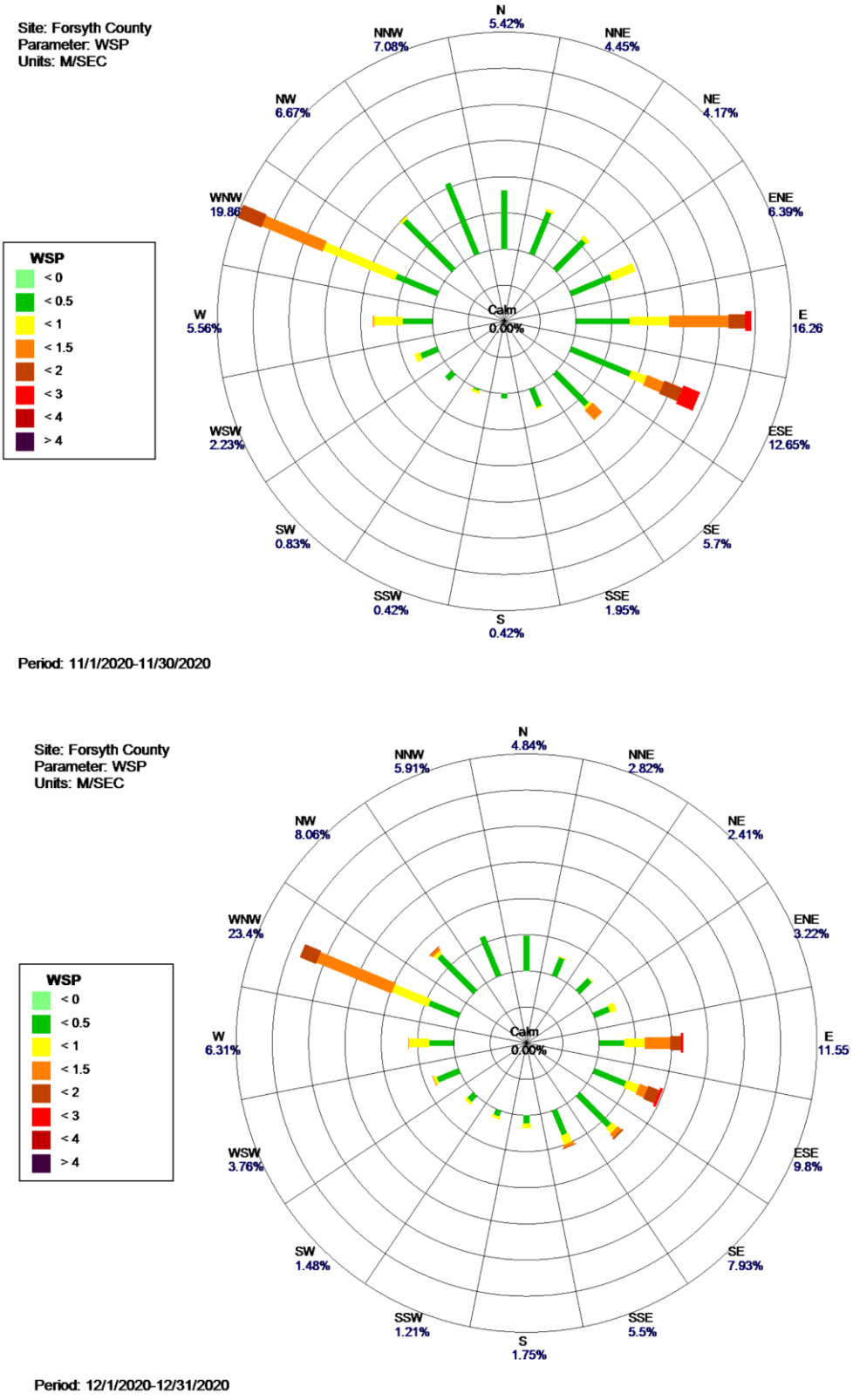


Figure 4. Monthly Averages of Wind Roses in Forsyth County

The ambient air monitoring site was established in the Eagle Beak Park located at 8400 Old Federal Rd., Ball Ground, GA 30107 in Forsyth County (Longitude: W 84.22917 and Latitude: N 34.31250), as indicated by the red circle in the following photo.

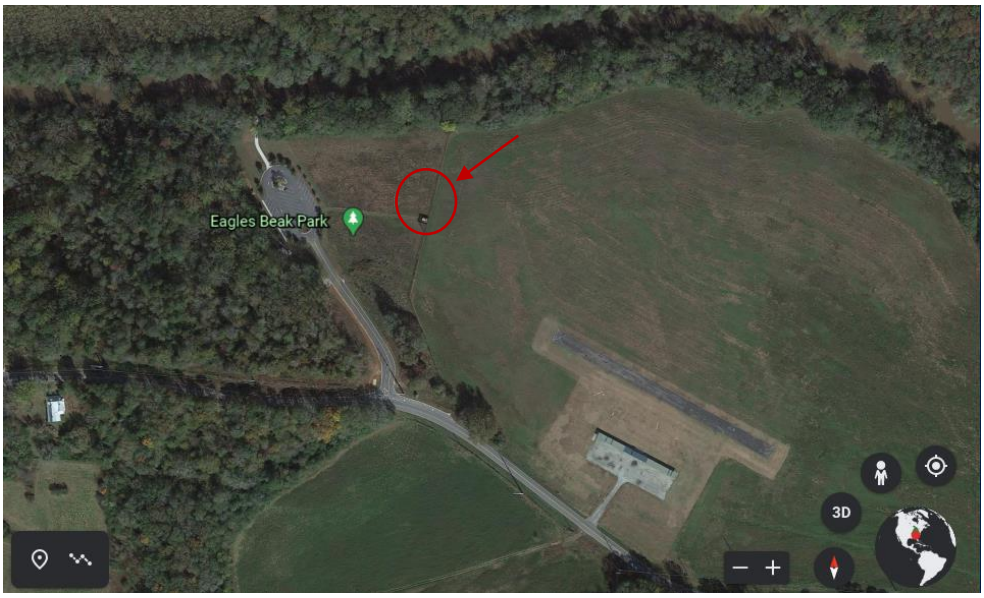


Figure 5. Monitoring Location

The ambient air monitoring site is located approximately 0.90 mile from the Eagle Point Landfill. This is shown with the red line in the following image.

Figure 6. Monitoring Location in Relation to the Eagle Point Landfill

The following photos show the ambient air monitoring site and immediate surroundings.

Figure 7. Monitoring Site Photos

Forsyth County is shown in yellow in the following map, and the blue dot indicates where the Forsyth County site is located within the county. The GA AAMP ambient air monitoring sites that were used to compare to the Forsyth County data are also indicated with blue dots.

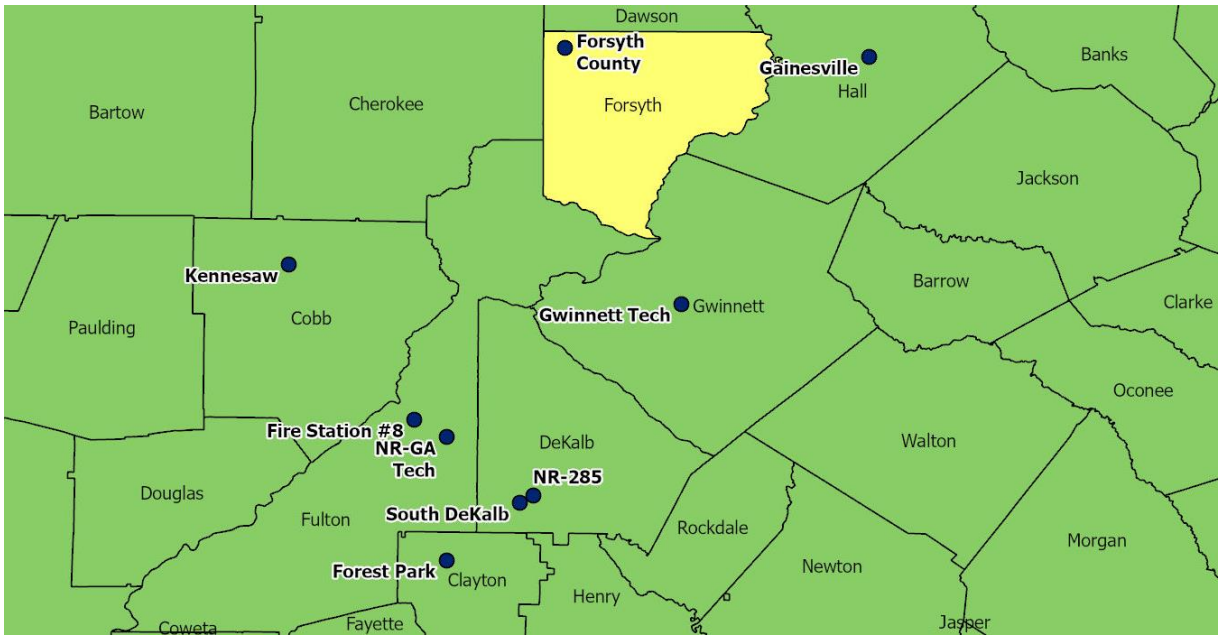


Figure 8. Map of Forsyth County and Surrounding GA AAMP Sites

4.0 Results

The $PM_{2.5}$ and VOCs data collected at the Forsyth site was analyzed and compared to nearby GA AAMP sites. As stated above, the sites used in the comparison and their locations are indicated in the map in Figure 8.

The following two graphs show a comparison of $PM_{2.5}$ data. The first graph shows the hourly data averaged for 24 hours compared to the South DeKalb, Gwinnett Tech and Gainesville sites, which also collect hourly data. The Forsyth data is shown in red, and this graph shows that the Forsyth $PM_{2.5}$ data and GA AAMP $PM_{2.5}$ data are very comparable.

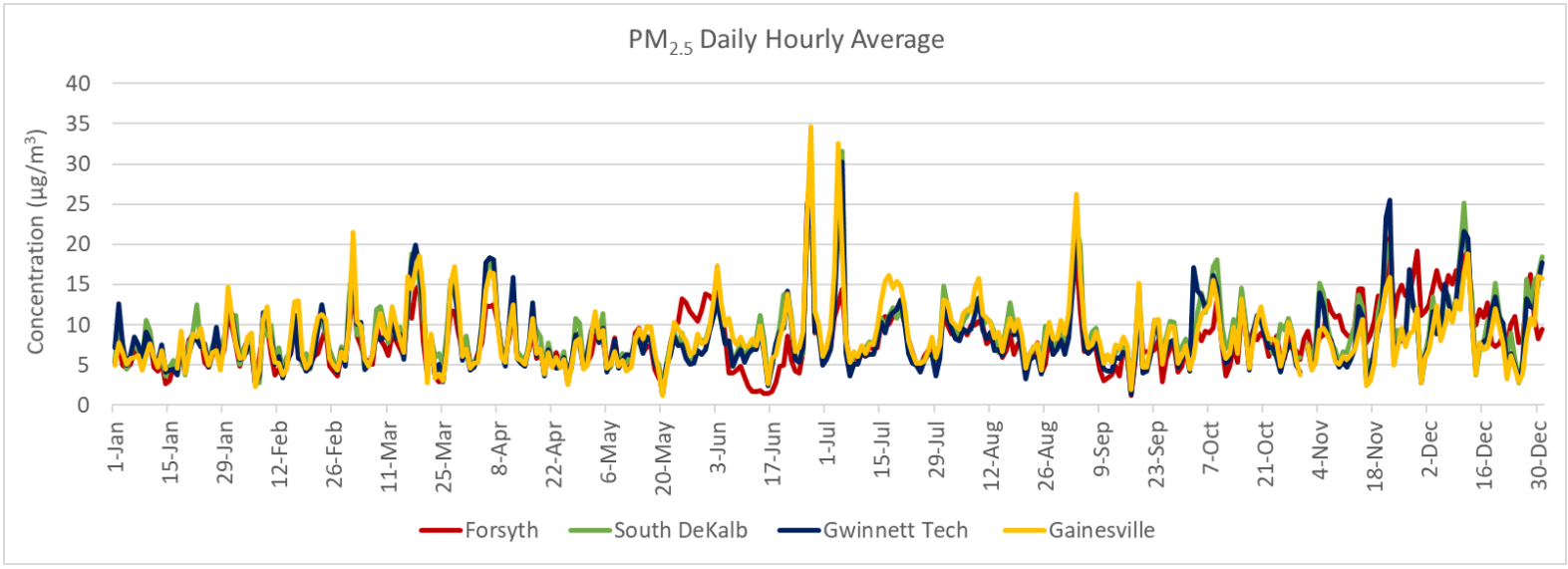


Figure 9. Comparison of $PM_{2.5}$ Daily Hourly Average Data

The next graph shows the Forsyth $PM_{2.5}$ 24-hour average data compared to GA AAMP's sites that collect 24-hour average data. Again, Forsyth is shown in red, and the results show the Forsyth $PM_{2.5}$ concentrations very comparable to the GA AAMP $PM_{2.5}$ concentrations.

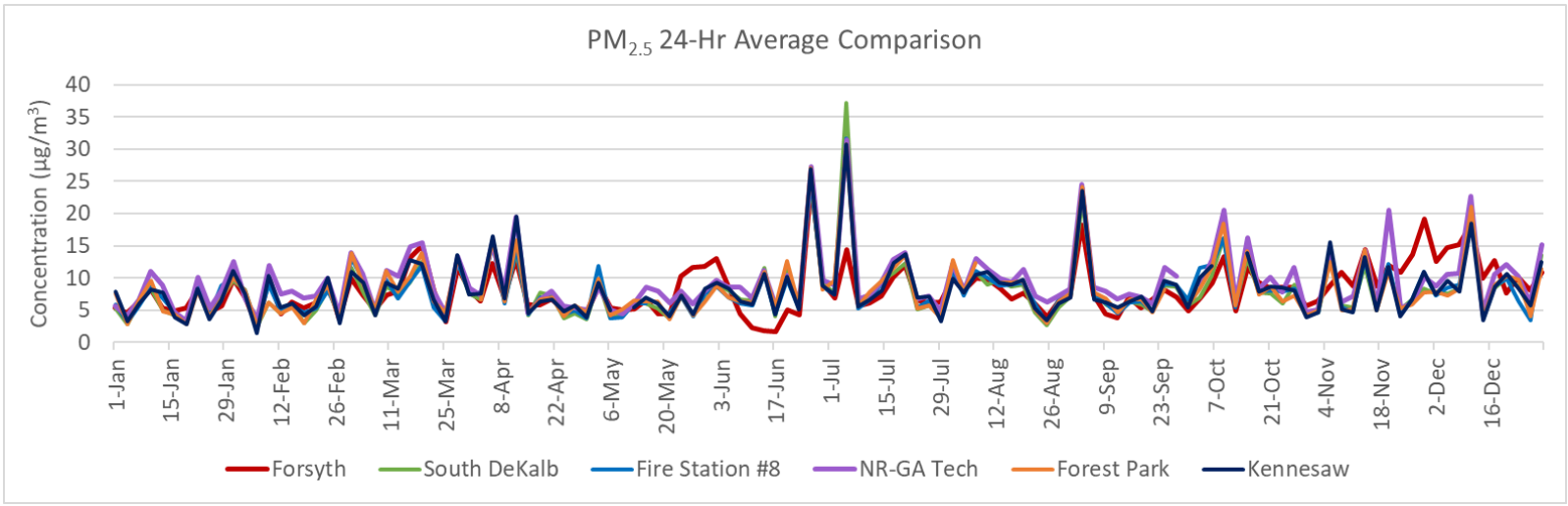


Figure 10. Comparison of $PM_{2.5}$ 24-Hour Average Data

$PM_{2.5}$ Box Plot Comparison

For another perspective, the box plot below compares the Forsyth County continuous hourly $PM_{2.5}$ data to the nearby continuous $PM_{2.5}$ monitors at the Gainesville, Gwinnett Tech, and South DeKalb sites. As shown above, the $PM_{2.5}$ data is comparable for all the sites. The colors for each box represent 25-75% of the range of data, and the line in the middle of the box represents the median (or middle value) of the data. The lines outside the boxes represent the data that is one and a half times (1.5 X) the range of data represented by the box. The black dots are considered outliers, which are shown here outside that line.

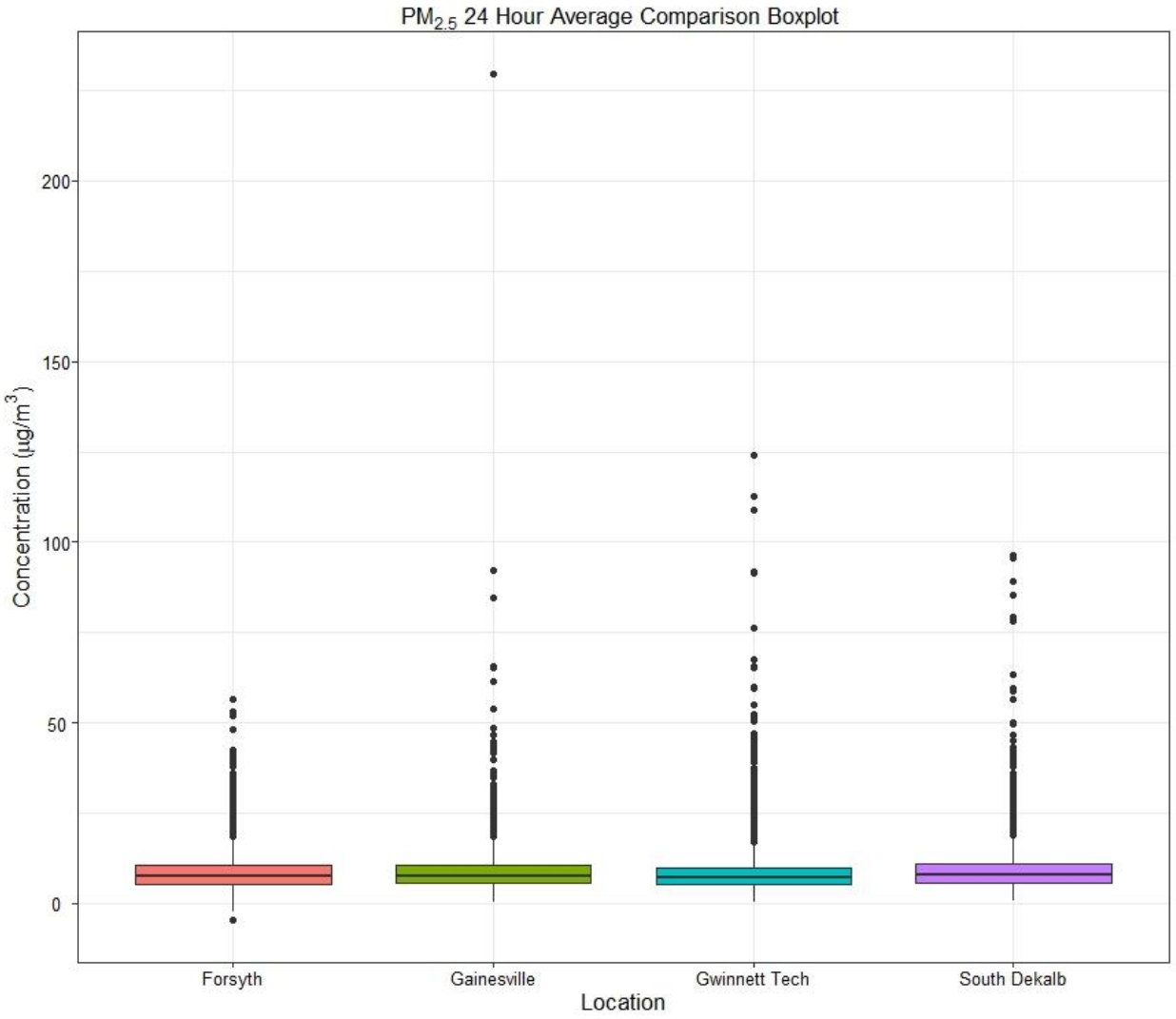


Figure 11. Box Plot Comparison of $PM_{2.5}$ Data

Forsyth $PM_{2.5}$ Calendar Plot

In the following graphic, the hourly $PM_{2.5}$ data was averaged for 24 hours and plotted on a calendar. The lighter days are lower concentrations, and the darker values are higher concentrations. The scale is shown below the calendar, and the values range from 1.2 to 28.5 µg/m^3. A Saharan dust event came through GA on June 26th-June 27th. The higher values exhibited those days in June would have been influenced by the dust event. The months of November and December show slightly higher concentrations than the other months. During these months when there are more fires used for heating homes and prescribed fires, $PM_{2.5}$ concentrations can be elevated. This is explored further in the following sections.

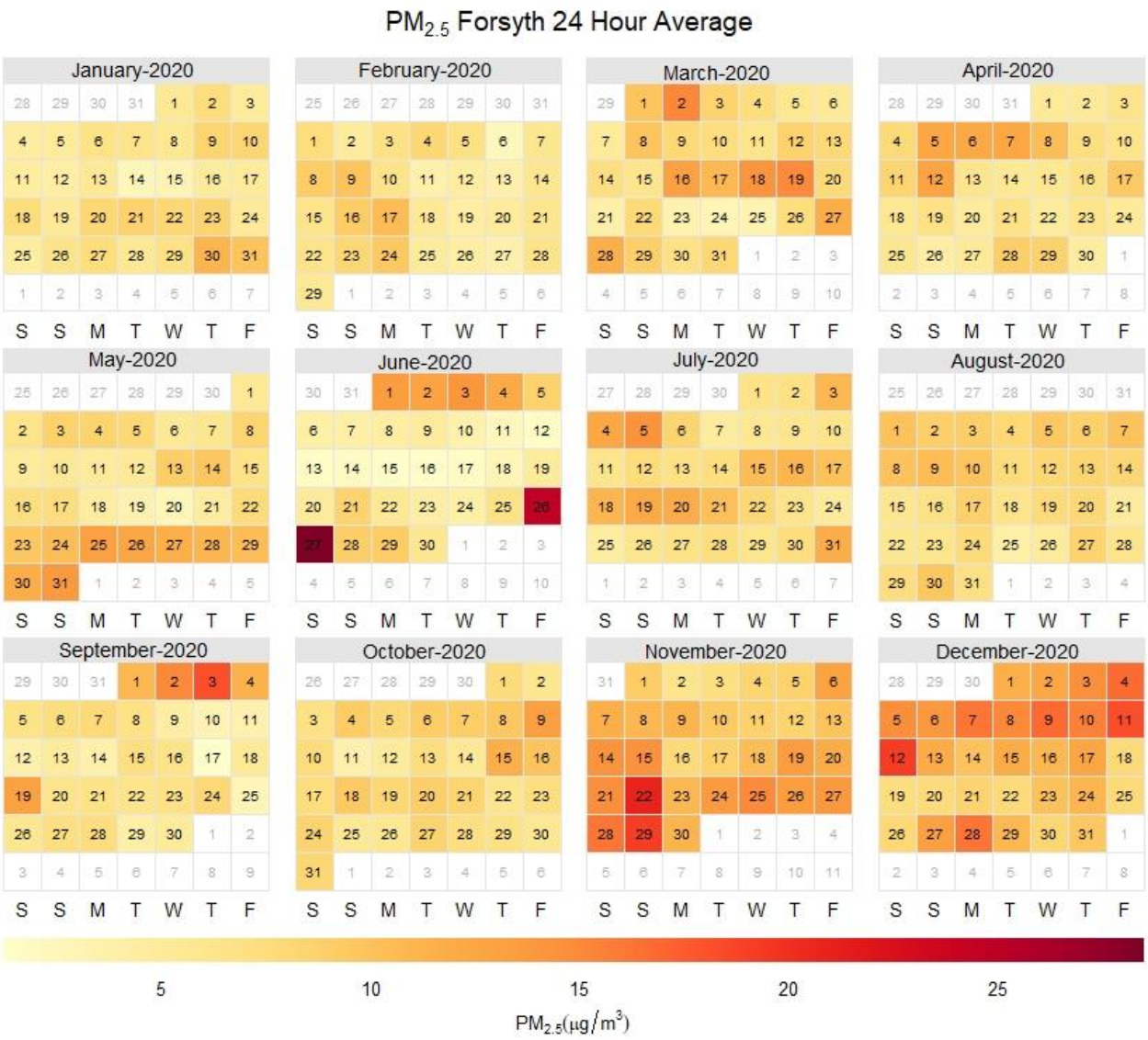


Figure 12. Calendar Plot of Forsyth County $PM_{2.5}$ Data

Forsyth $PM_{2.5}$ Diurnal Variation

The continuous $PM_{2.5}$ data that was collected at the Forsyth monitoring site was examined for temporal variations based on diurnal, weekly, monthly, and annual trends with concentrations ranging up to 11 µg/m^3. These graphs are shown in Figure 13. The darker red line represents the average, and the pink area around each darker red line shows the 95% confidence level for that average. Based on the graphs, $PM_{2.5}$ concentrations do not vary significantly throughout the day on most weekdays and weekends. However, the weekends exhibit a general higher concentration pattern compared to the weekdays. Throughout the week, concentrations tend to peak in the mornings around 6 am, and midday around 12 pm to 3 pm. Additionally, analysis of annual patterns showed that higher concentrations occurred during the months of June, November, and December. The June average would have been affected by the higher values on June 26th and 27th as discussed with the previous figure. The November and December data could have been affected by household heating sources, and prescribed fires.

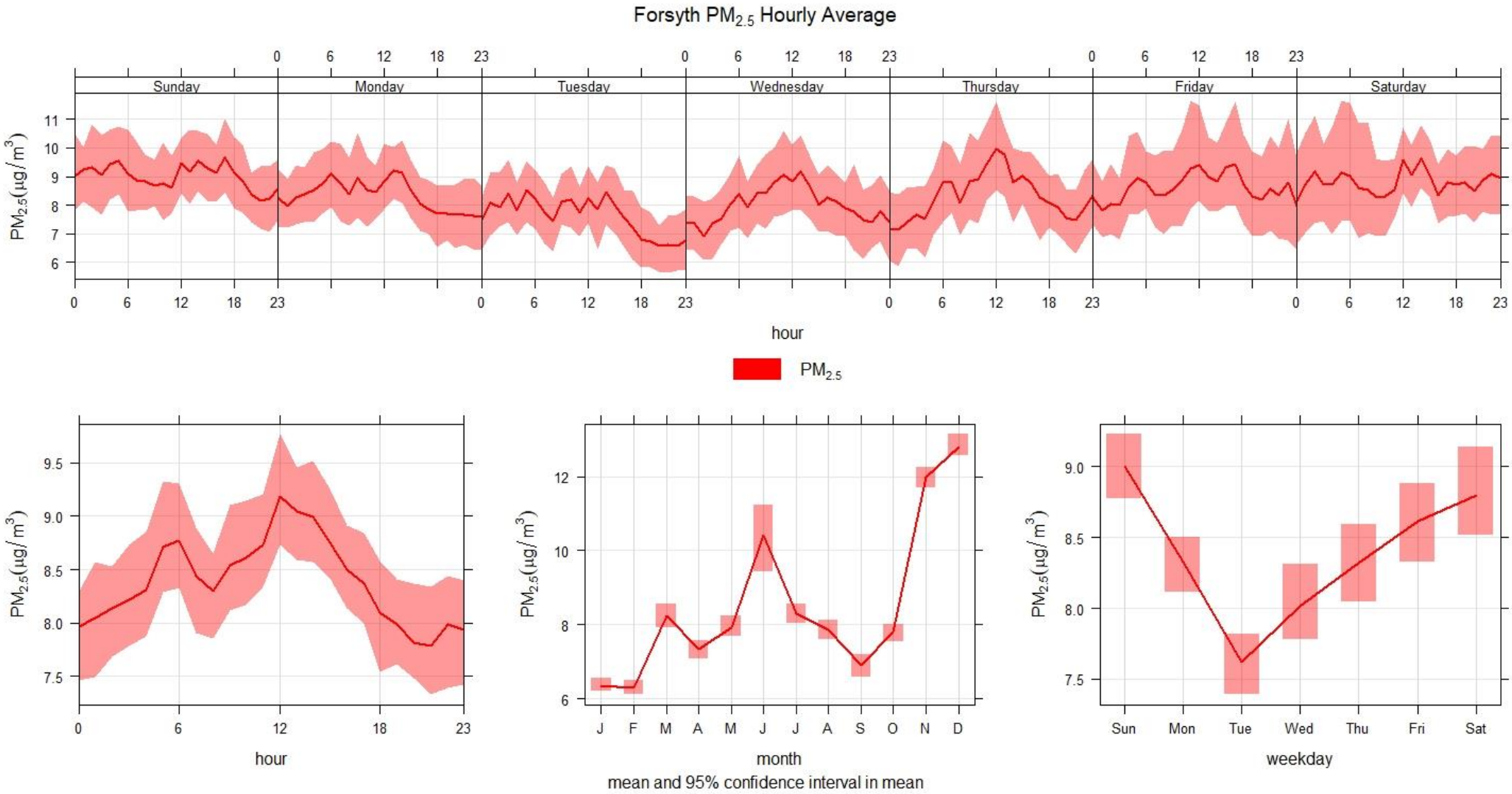


Figure 13. Detailed Trends of Forsyth County $PM_{2.5}$ Data

$PM_{2.5}$ Diurnal Site Comparison

The continuous $PM_{2.5}$ hourly data that was collected at the Forsyth monitoring site is compared to nearby continuous $PM_{2.5}$ monitoring sites in Figure 14. In general, weekly concentration measurements tend to remain around 10 µg/m^3 at most sites. However, Gainesville, Gwinnett Tech, and South DeKalb experienced peaks on Saturday in the late afternoon (around 7 pm). The increases in concentration could have been influenced by local combustion events or weekend traffic. During the day, South DeKalb, Gwinnett Tech, and Gainesville experience peaks in concentration in the mid to late afternoon, most likely caused by peak rush hour, whereas Forsyth experiences peak in concentration around 6 am and 12 pm. The weekday trend is similar across all the sites, with the weekends having relatively higher concentrations of $PM_{2.5}$ compared to during the week. Annual $PM_{2.5}$ patterns for all sites, except Gainesville, showed similar results where concentration peaks occurred in March, June, and December. Higher concentrations in the summer can be influenced by fireworks and fire events. Winter spikes can be influenced by the utilization of household fireplaces and firepits. There appears to be an increase in November and December data for all the sites, indicating the general trend throughout the region.

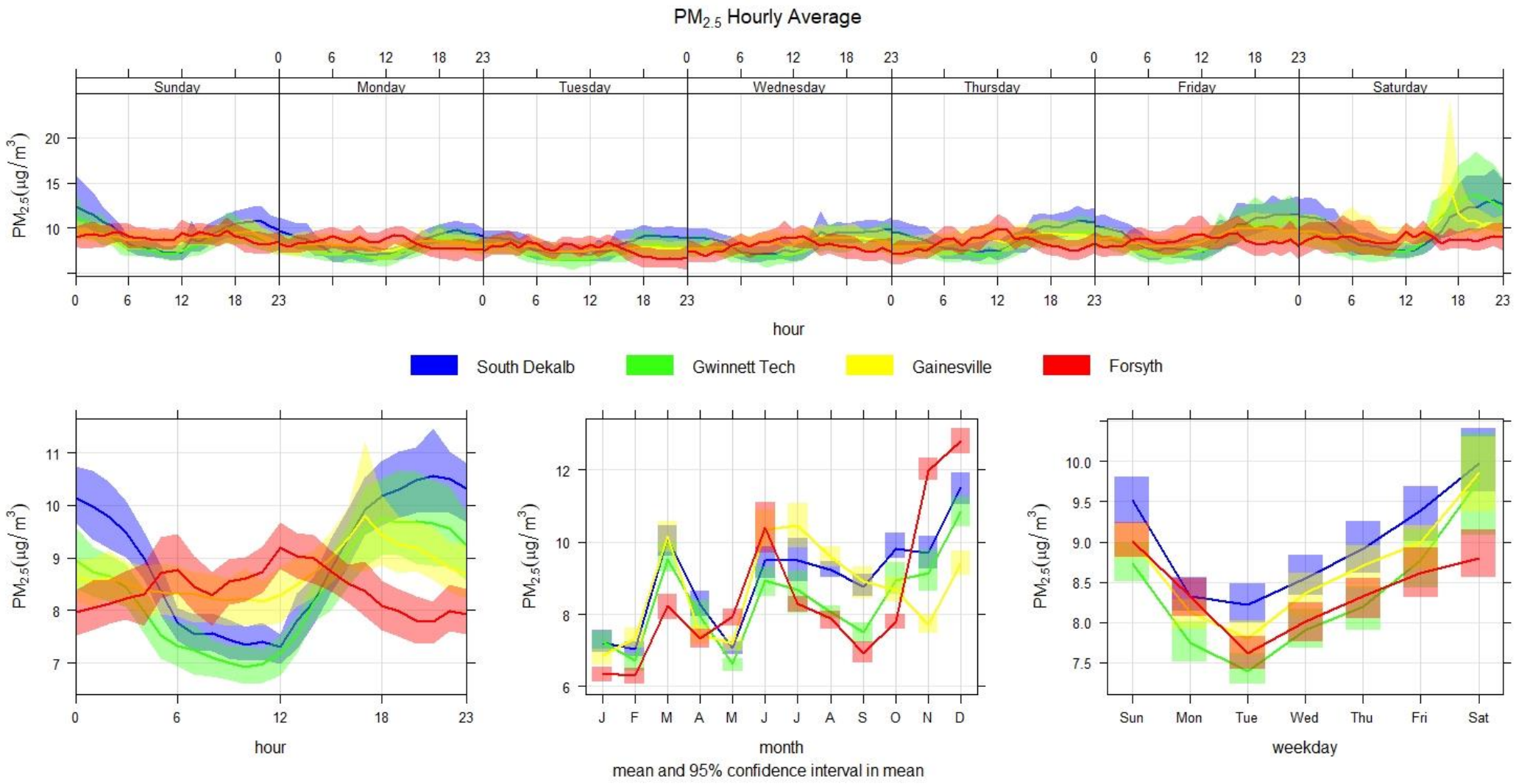


Figure 14. Comparison of Detailed $PM_{2.5}$ Trends

$PM_{2.5}$ Air Quality Index (AQI) Comparison Chart

The Air Quality Index (AQI) is a national air standard rating system developed by the U.S. Environmental Protection Agency. The AQI is used statewide to provide the public, on a daily basis, with an analysis of air pollution levels and possible related health risks. Generally, an index scale of 0 to 500 is used to assess the quality of air, and these numbers are synchronized with a corresponding descriptor word such as: Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy. To protect public health the EPA has set an AQI value of 100 to correspond to the NAAQS for the criteria pollutants. The following chart compares the $PM_{2.5}$ AQI trends at Forsyth County, Gwinnett Tech, South DeKalb, and Gainesville sites in 2020. The black line represents Forsyth County. Among all the sites, the $PM_{2.5}$ concentrations seem to follow a similar pattern throughout the year. AQI values are below 50, or hover around 50, except for those few exceptions in the summer and November and December as noted earlier. There is a noticeable similarity in measurement trends supporting the idea that there is not an independent source effecting $PM_{2.5}$ concentrations at Forsyth. Values may have been effected by combustion events, i.e prescribed burns and wildfires, firework events, and miscellaneous industrial processes occurring in the area. Based on the graph, there seems to be a general trend at all sites, and it appears that the Eagle Point Landfill is not adversely effecting $PM_{2.5}$ concentrations. In fact, Forsyth's $PM_{2.5}$ values for the year were all-around lower, when compared to the nearby GA AAMP sites.

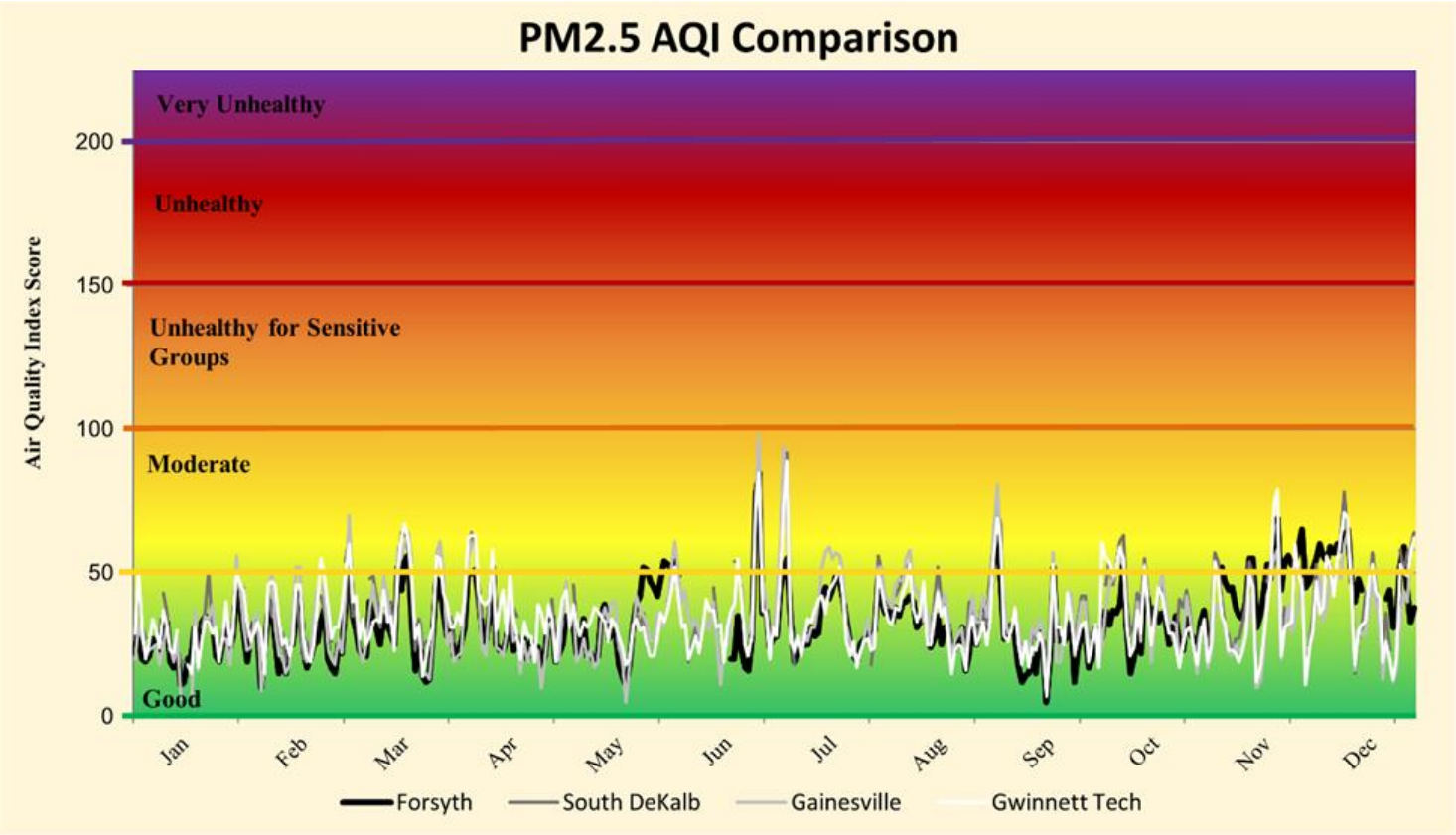
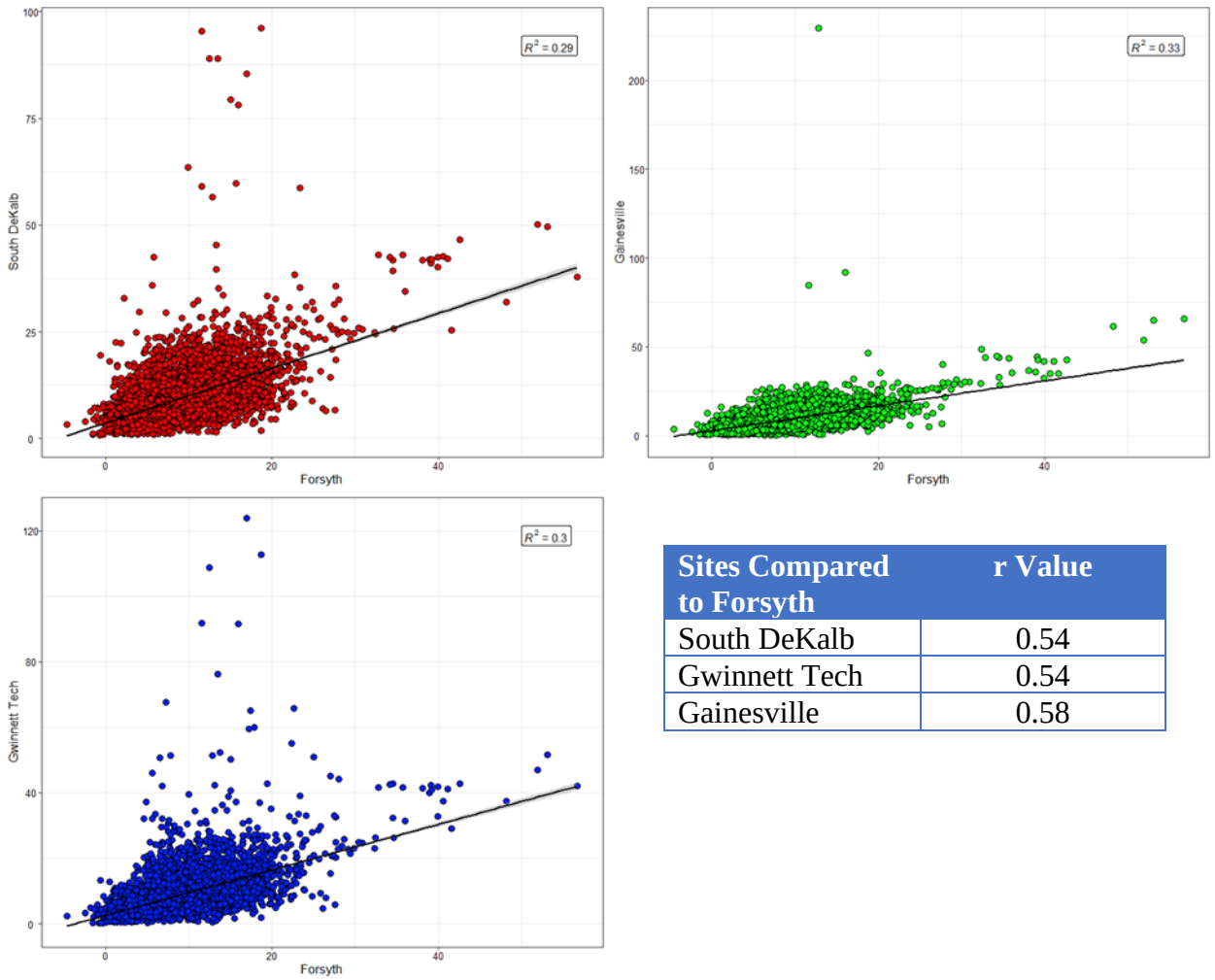


Figure 15. $PM_{2.5}$ AQI Comparison

$PM_{2.5}$ Scatterplots for NR-285, South DeKalb, and Forsyth

The following scatterplots and correlations were created to compare continuous hourly $PM_{2.5}$ data at the Forsyth County, South DeKalb, Gainesville, and Gwinnett Tech sites. Scatterplots graph the concentrations measured at two different sites to see how those concentrations compare, or correlate. A 'perfect positive' correlation would show all of the concentrations on the black line, and the correlation, or r value, would be a 1.00. In short, the r values show how well the two sites correlate.

The graphs show that the majority of samples collected are relatively close in concentration, with the majority of colored dots falling along or close to the black line. The continuous $PM_{2.5}$ concentrations collected at the Forsyth County site have a 'moderate positive' correlation to the South DeKalb, Gwinnett Tech, and Gainesville sites. This can be seen with the r values in the range between 0.50 and 0.70. If the r values were above 0.70, this would be considered a 'strong positive' correlation, and again, if the r values were 1.0, this would be a 'perfect positive' correlation. Therefore, with the r values ranging from 0.54 to 0.58 (as shown in the table below), this indicates that the $PM_{2.5}$ concentrations in Forsyth County are not exactly the same, but are comparable to other areas in the region.



Sites Compared to Forsyth	r Value
South DeKalb	0.54
Gwinnett Tech	0.54
Gainesville	0.58

Figure 16. Scatterplots and Correlation Values for $PM_{2.5}$ Data

Polar Plots

Figures 17-22 are polar plots that show the location of the Forsyth monitoring station, $PM_{2.5}$ and VOCs concentrations for each pollutant that had detections, wind speed and wind direction. The polar plots were mapped in ArcGIS to show the location of Eagle Point Landfill with respect to the Forsyth monitoring station.

The first polar plot shows the $PM_{2.5}$ data. The average concentrations are 8-10 µg/m^3 (green and yellow circles). The circles further away from the center of the plot, where the monitoring station is located, indicate a higher wind speed. Circles NW of the center of the plot mean that the wind was blowing from the landfill area to the monitor. The higher concentrations (yellow circles) were measured when the wind was blowing from the south or southeast or towards the landfill. Concentrations measured are generally lower (green circles) when the wind is blowing from the landfill towards the monitor. This means that the landfill does not appear to be causing an increase in $PM_{2.5}$ concentrations at the monitoring station.

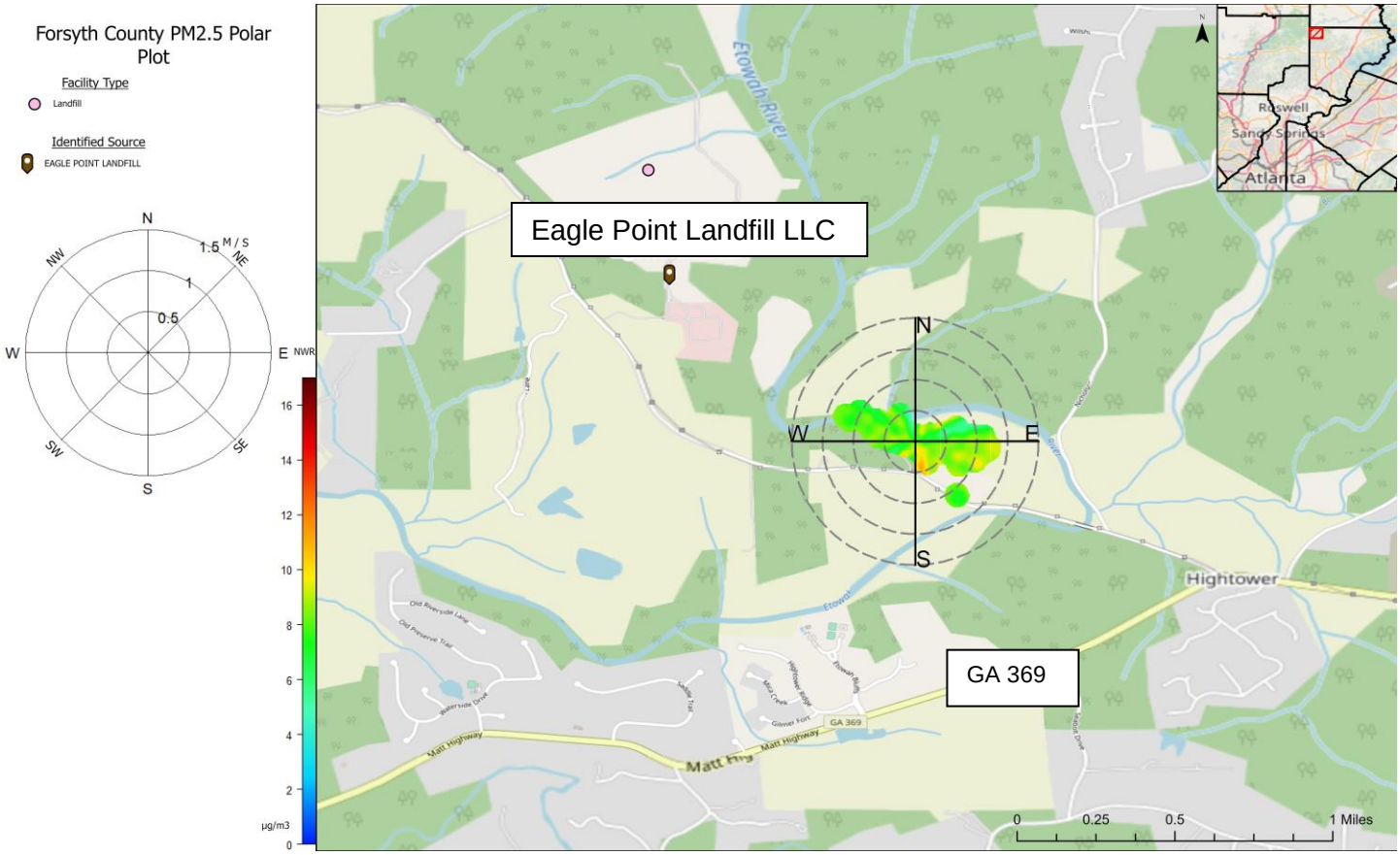


Figure 17. Polar Plot of Forsyth County $PM_{2.5}$ Data

With the volatile organic compounds (HAPs) sampling at the Forsyth County site, only four compounds had detections for the 2020 data: *o*-xylene, benzene, *m/p*-xylene, and toluene. The HAPs that were not detected are: 1,3-butadiene, chloroform, ethylene dichloride, hexane, methylene chloride, and trichloroethylene. HAPs have a wide variety of sources—mobile sources (such as vehicles), stationary industrial sources, small area sources, indoor sources (such as cleaning materials), and other environmental sources (such as volcanoes and wildfires).

shows the polar plot of *o*-xylene data. This polar plot is based on one detection for *o*-xylene, which was 1.11 parts per billion (ppb) (light blue area). The dark blue circles further away from the center of the plot, where the monitoring station is located, indicate a higher wind speed. Circles NW of the center of the plot would mean that the wind was blowing from the landfill area to the monitor. The *o*-xylene value (light blue area) was measured when the wind was blowing from the WNW and does not appear to be coming directly from the Eagle Point Landfill.

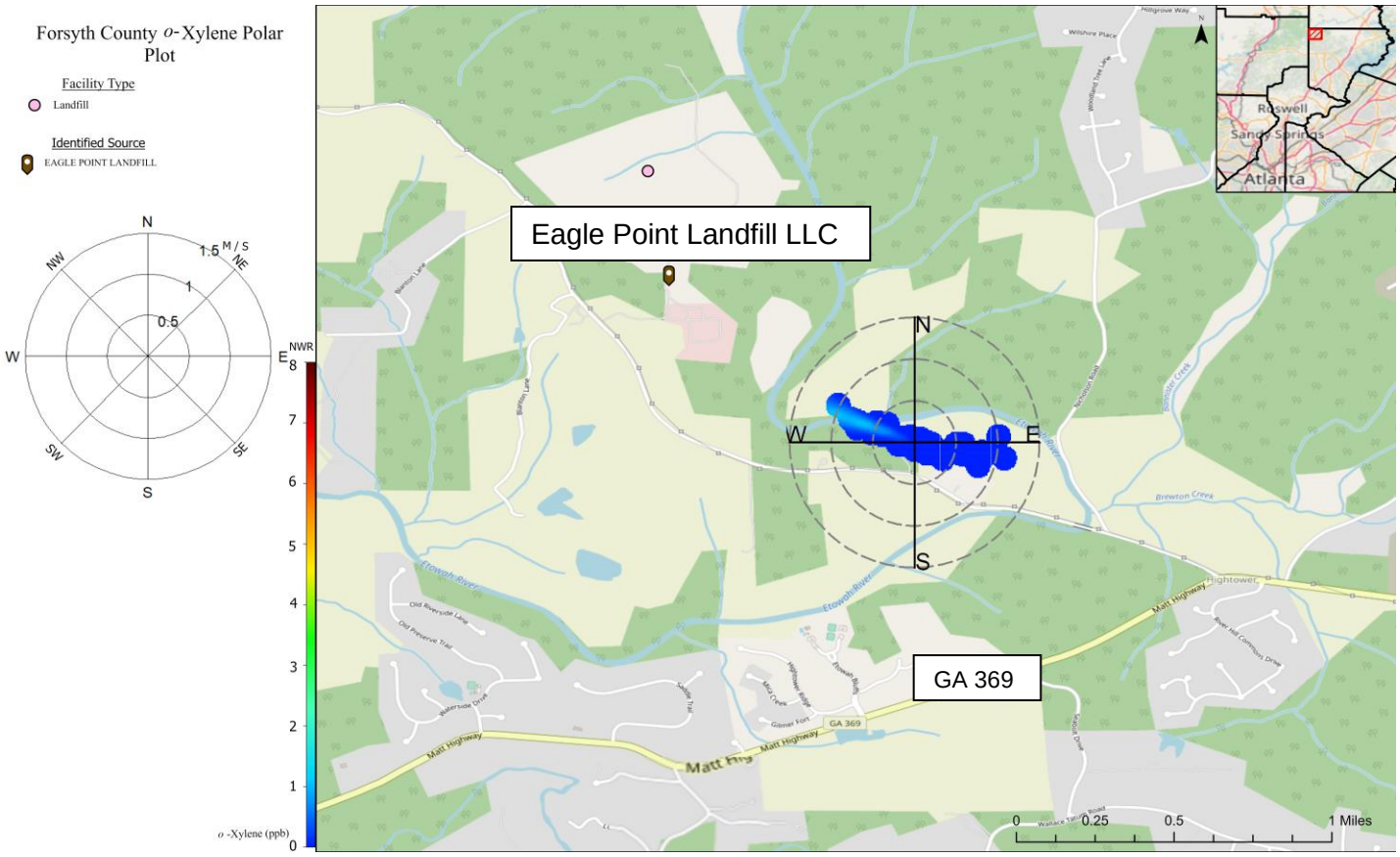


Figure 18. Polar Plot of Forsyth County *o*-Xylene Data

The following polar plot, Figure 19, shows the *m,p*-xylene data. This polar plot is based on one detection for *m,p*-xylene, which was 3.91 parts per billion (ppb) (light green area). The circles further away from the center of the plot, where the monitoring station is located, indicate a higher wind speed. Circles NW of the center of the plot would mean that the wind was blowing from the landfill area to the monitor. Like the *o*-xylene polar plot, the *m,p*-xylene concentration (light green color) appears to be blowing towards the monitor from the WNW and appear to be coming from a source other than the Eagle Point Landfill.

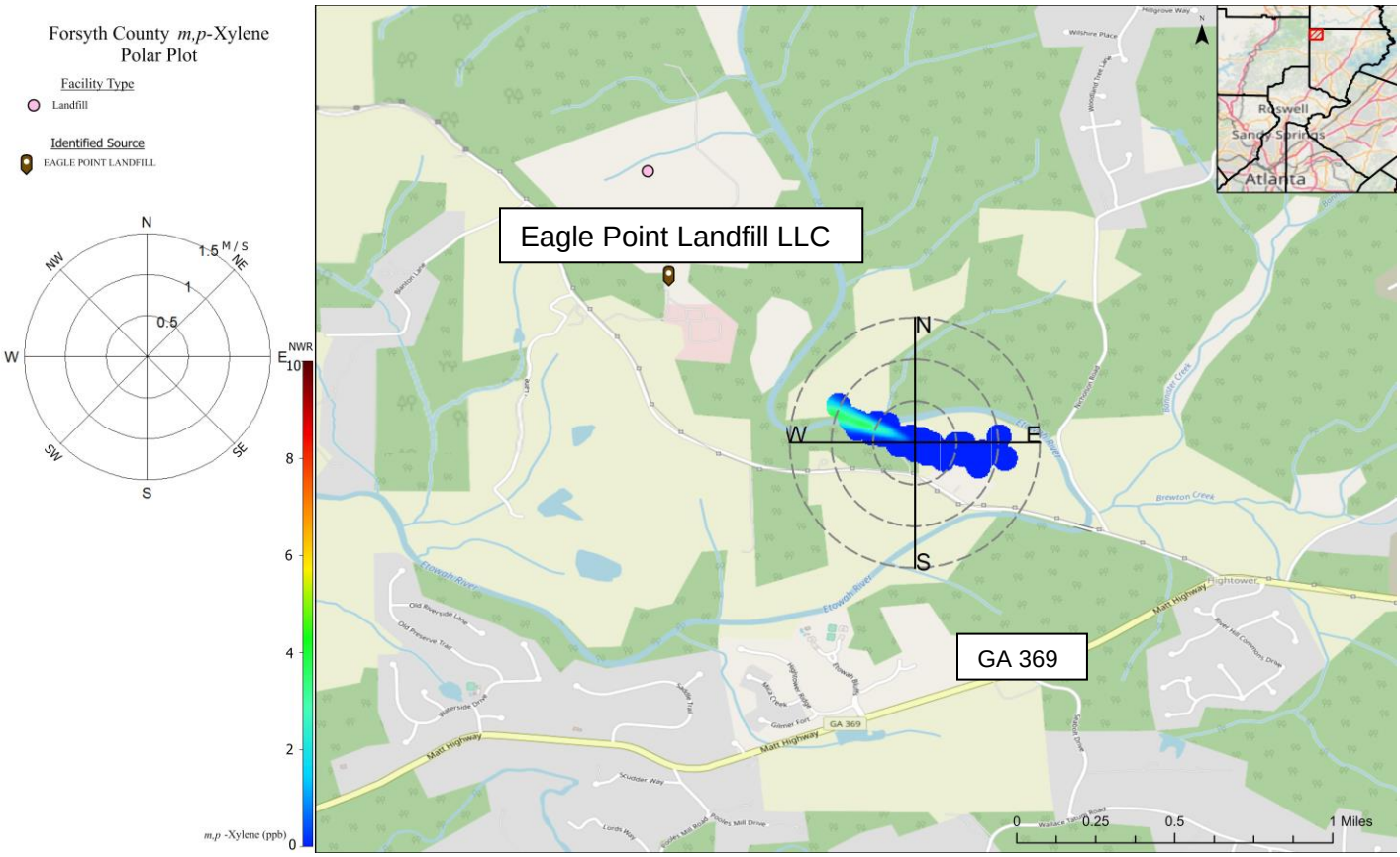


Figure 19. Polar Plot of Forsyth County *m/p*-Xylene Data

Figure 20 displays the polar plot of benzene data, with concentrations ranging from 0.0 to 1.18 ppb (dark blue to dark red area areas). The highest benzene concentrations appear to be blowing towards the monitor from the northeast (dark red area) and southwest (yellow area) at very slow wind speeds (less than 0.5 meters per second). Therefore, it can be inferred that benzene concentrations are not coming from the Eagle Beak Landfill to the NW of the monitoring station.

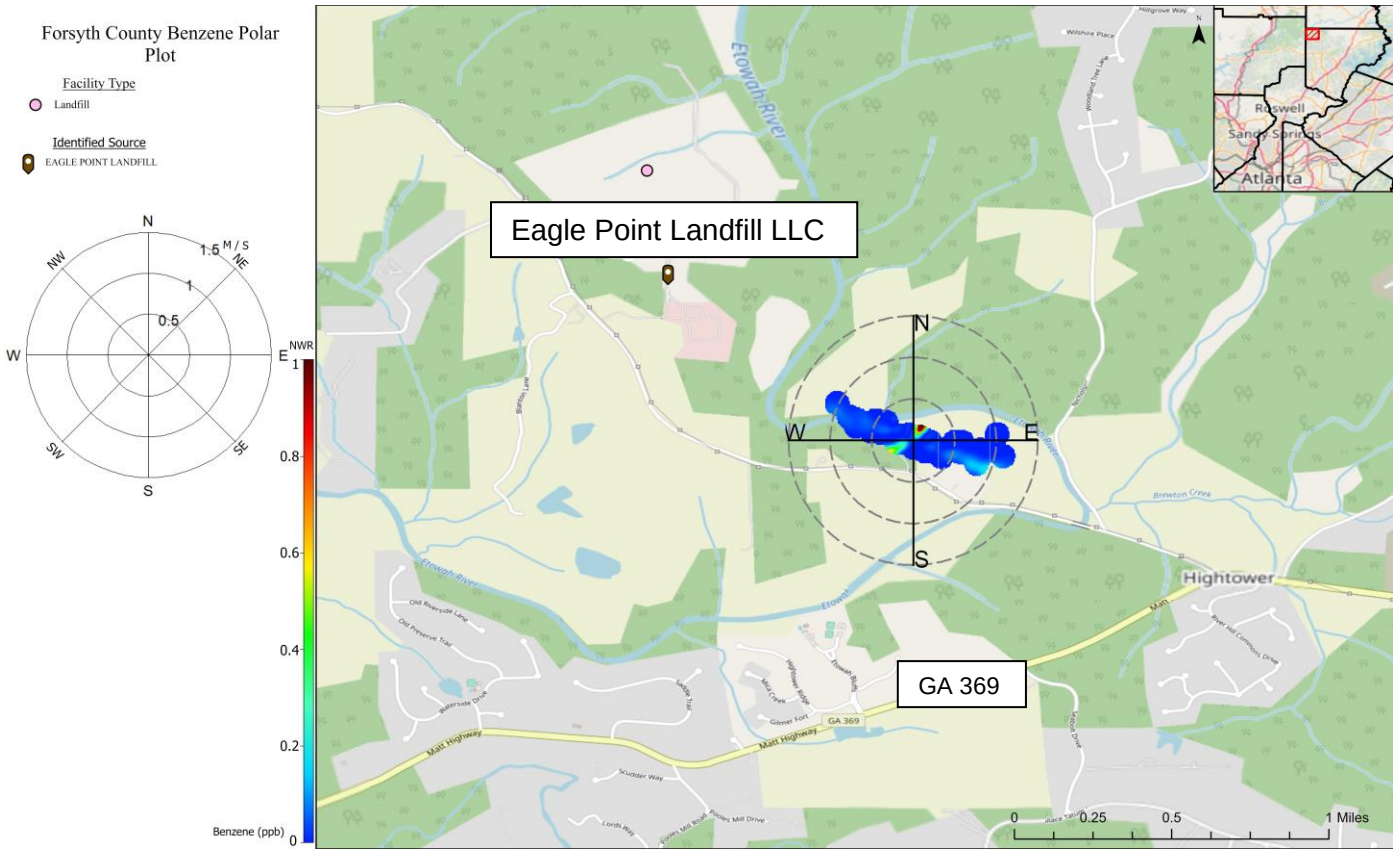


Figure 20. Polar Plot of Forsyth County Benzene Data

The following polar plot, Figure 21, shows the toluene concentrations ranging from approximately 0.0 to 3.91 ppb (dark blue to dark orange color areas). The circles further away from the center of the plot, where the monitoring station is located, indicate a higher wind speed. Circles NW of the center of the plot mean that the wind was blowing from the landfill area to the monitoring station. The higher concentrations (dark orange area) were measured when the wind was blowing at very low wind speed (less than 0.5 meters per second) from the southwest towards the landfill. The toluene concentrations shown in light blue to green areas appear to be coming from the WNW and ESE. This means that the landfill does not appear to be causing an increase in toluene concentrations at the monitoring station.

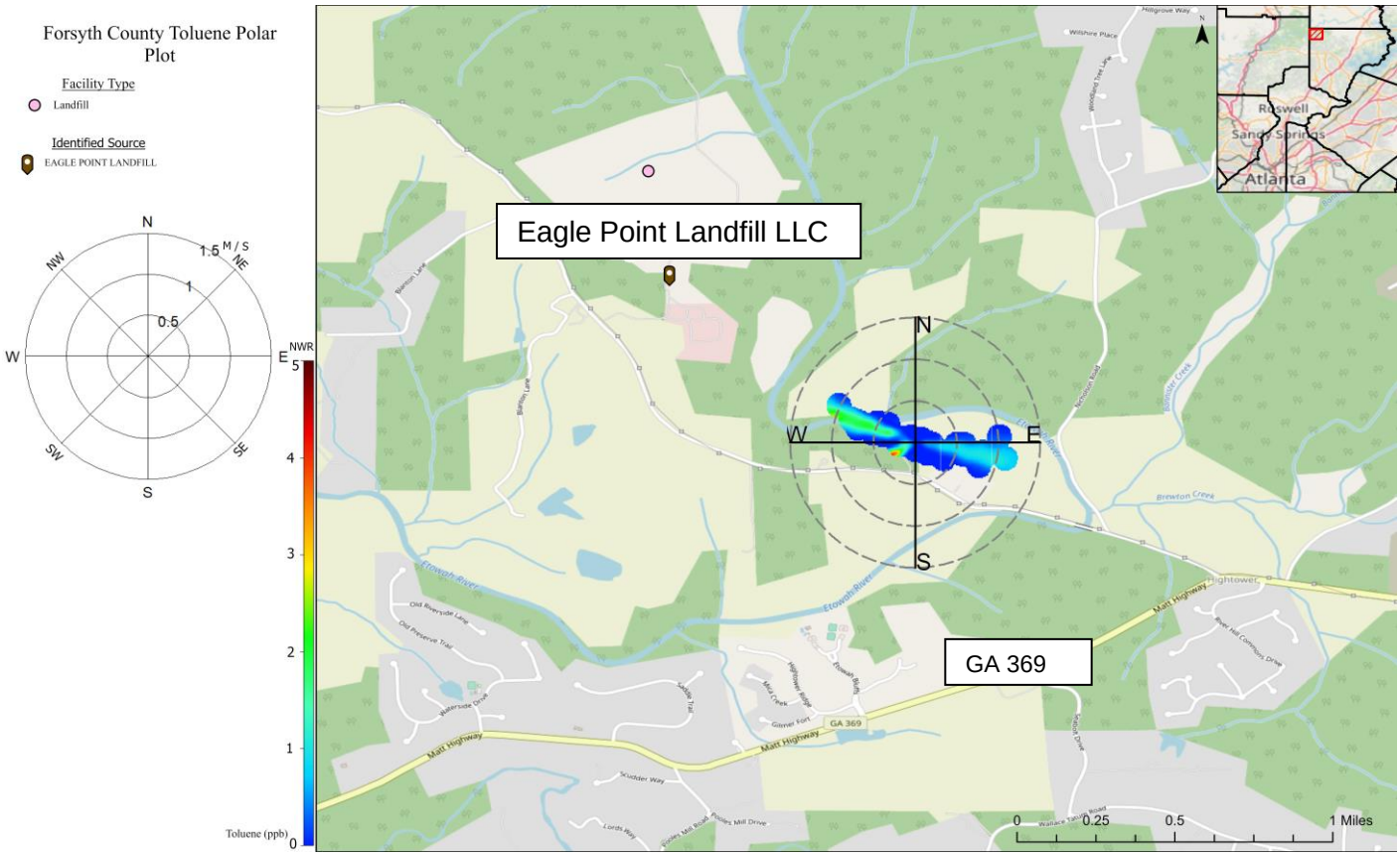


Figure 21. Polar Plot of Forsyth County Toluene Data

Figure 22 shows the polar plot of TNMOC concentrations that were detected at the Forsyth monitoring station. The concentrations range from approximately 20 to greater than 70 ppb (light blue to red areas) at wind speeds less than 0.5 meters per second. The highest TNMOC concentrations (dark red color) appear to be blowing from the northwest, southwest, and south. The concentrations shown in red coming from the northwest could possibly be coming from the area around the Eagle Point Landfill.

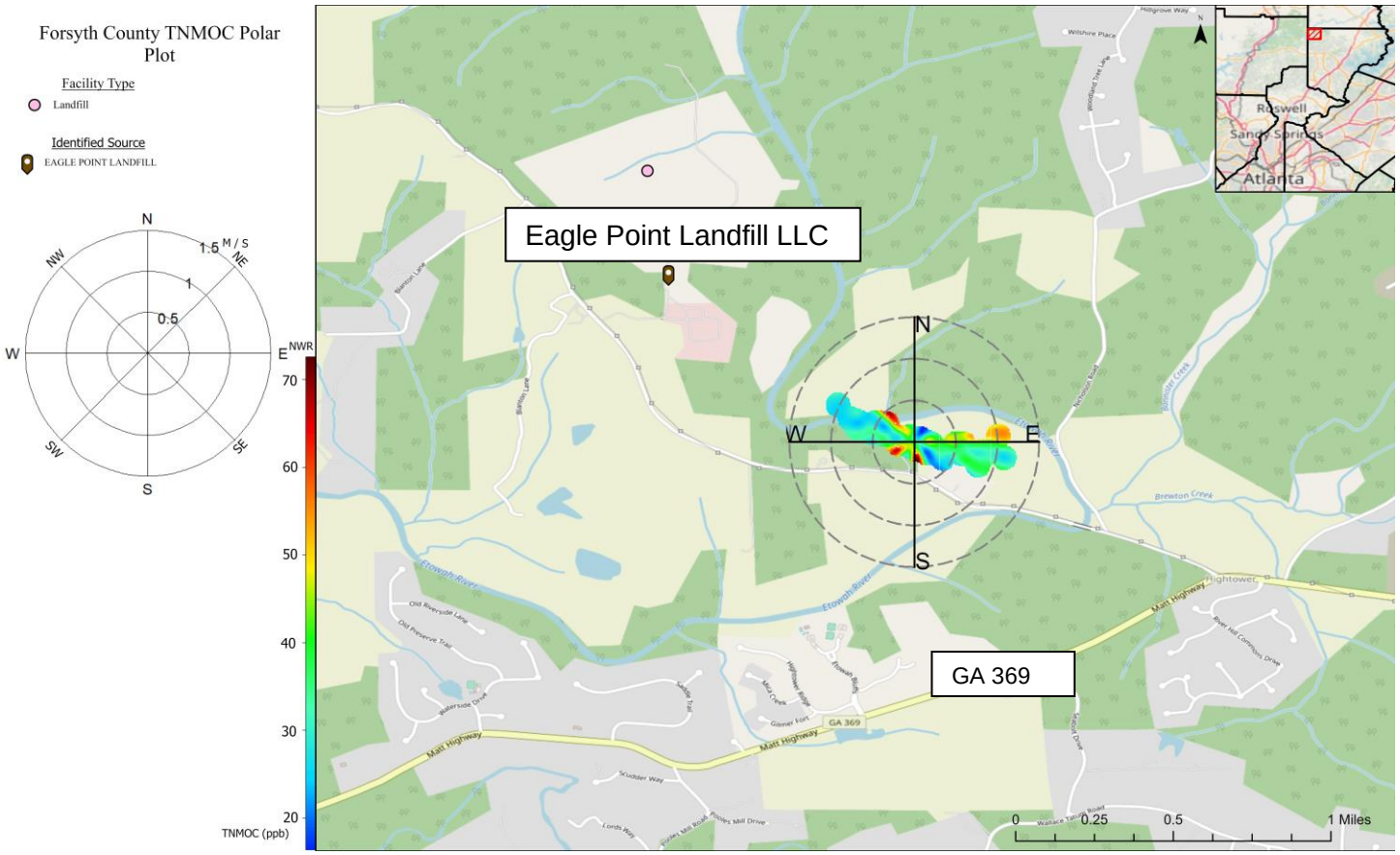


Figure 22. Polar Plot of Forsyth County TNMOC Data

VOCs Comparisons

Of the eleven volatile organic compounds that were monitored at the Forsyth County site, only four compounds had any detections for the 2020 data: *o*-xylene, benzene, *m/p*-xylene, and toluene. Further, there were only a few days within 2020 with data above zero for these four compounds. The next graphs show trends of these detections, and comparisons to GA AAMP's sites that also collect VOCs: South DeKalb and NR-285 sites (locations shown in Figure 8). There is a noticeable increase of the detected VOCs in April. This was investigated; however, no abnormalities were found in the area on this day.

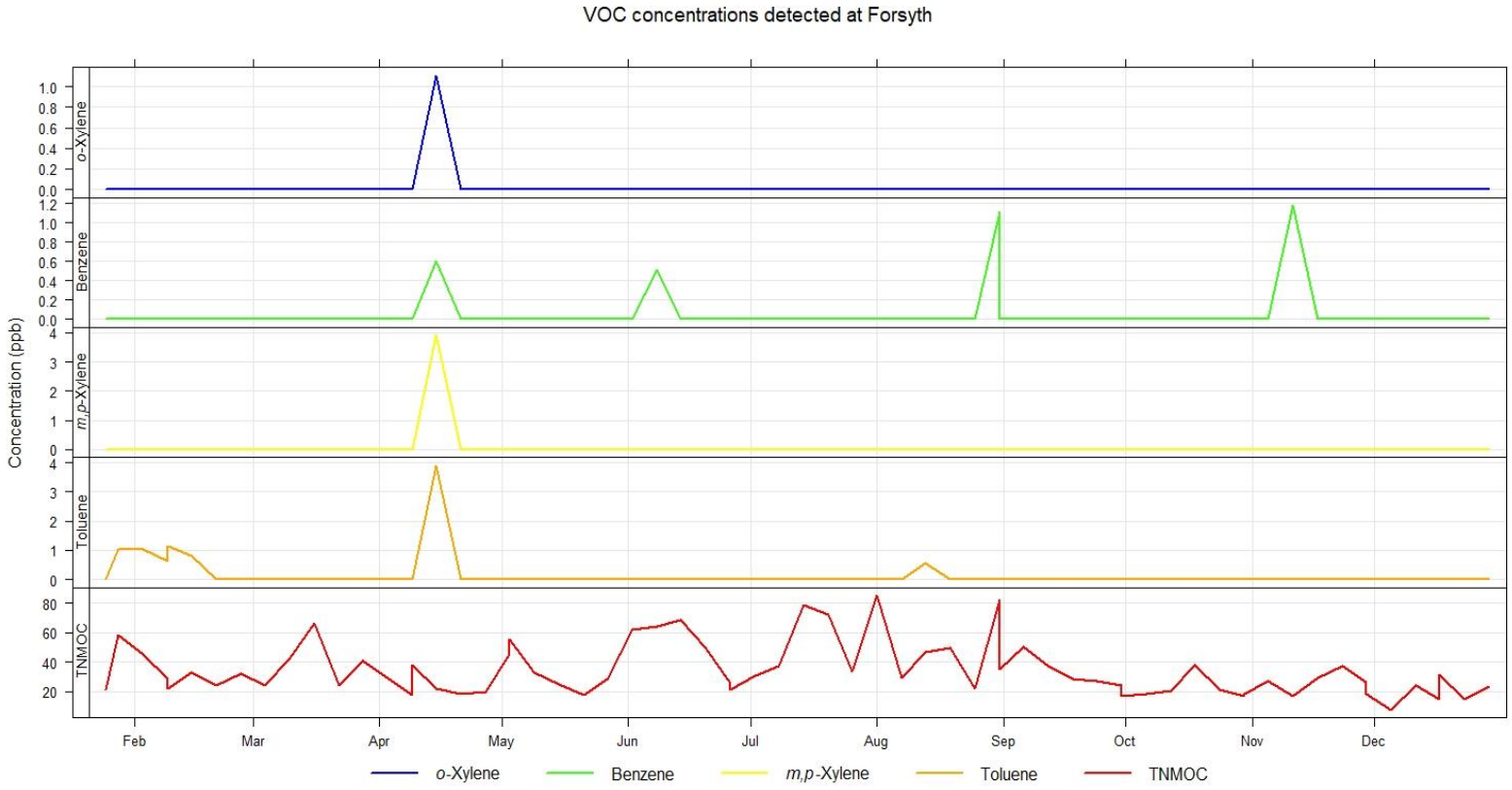


Figure 23. VOCs/TNMOC Concentrations at Forsyth County

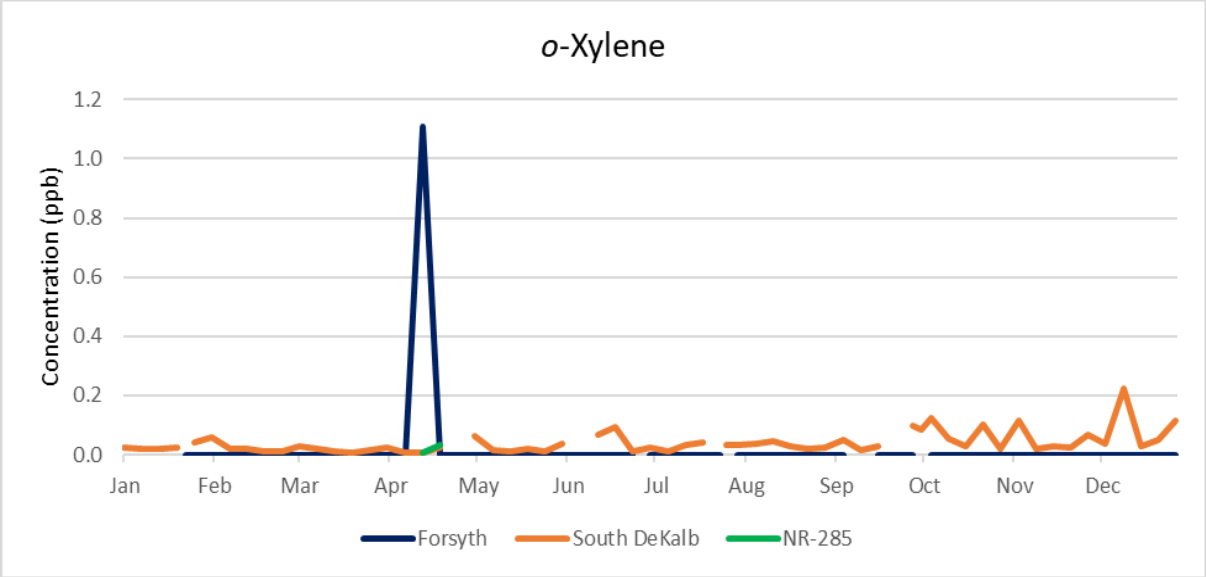


Figure 24. *o*-Xylene Comparisons

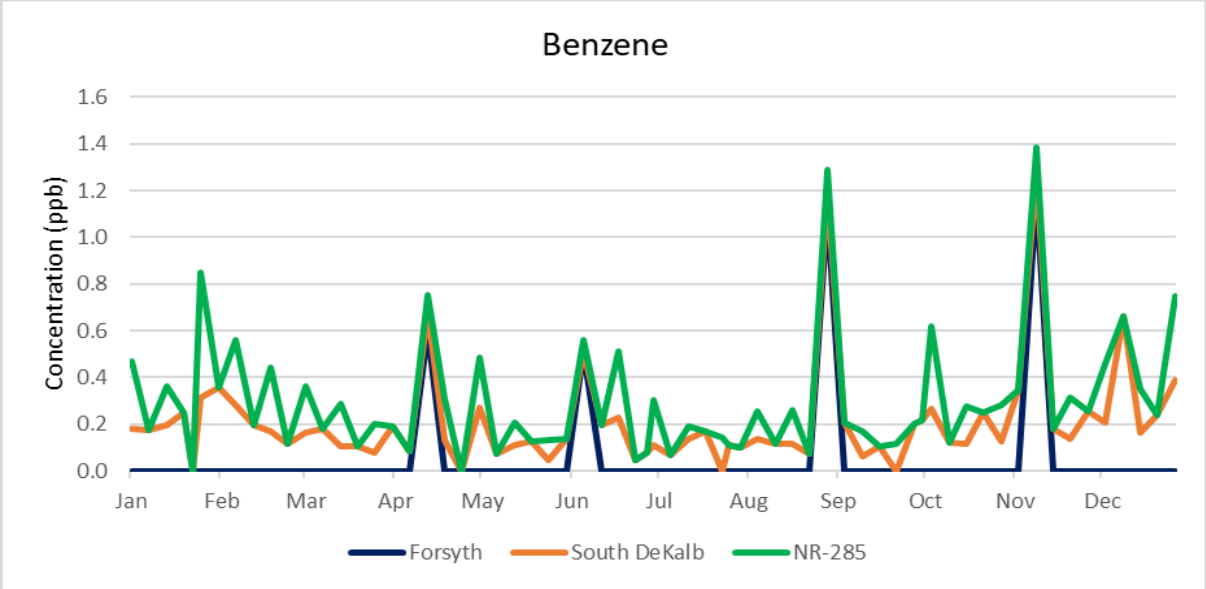


Figure 25. Benzene Comparisons

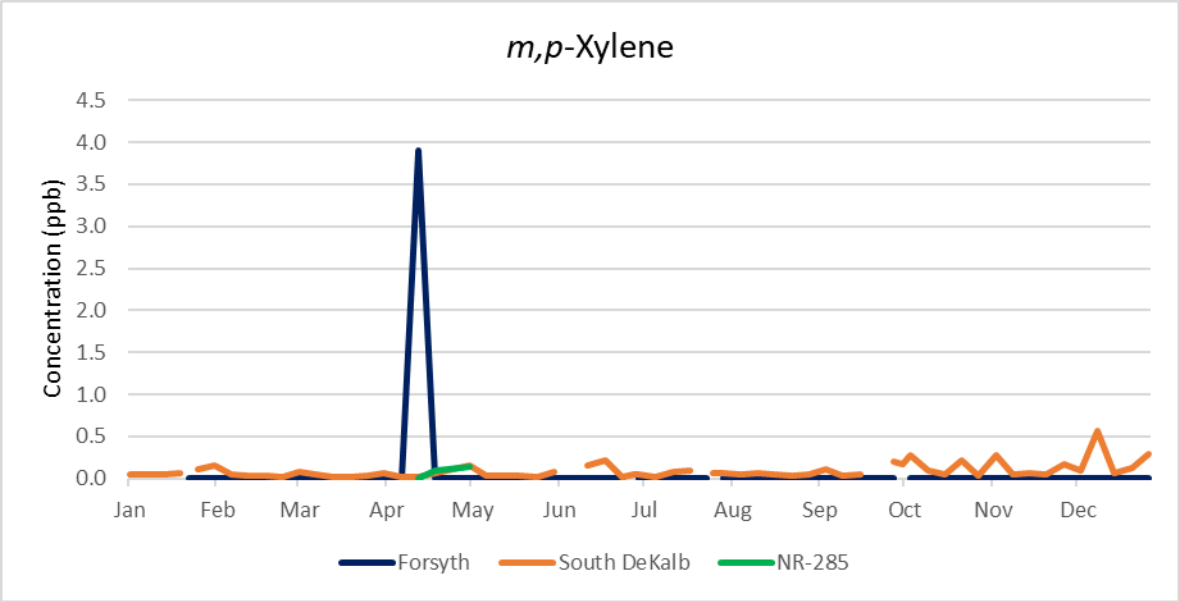


Figure 26. *m/p*-Xylene Comparisons

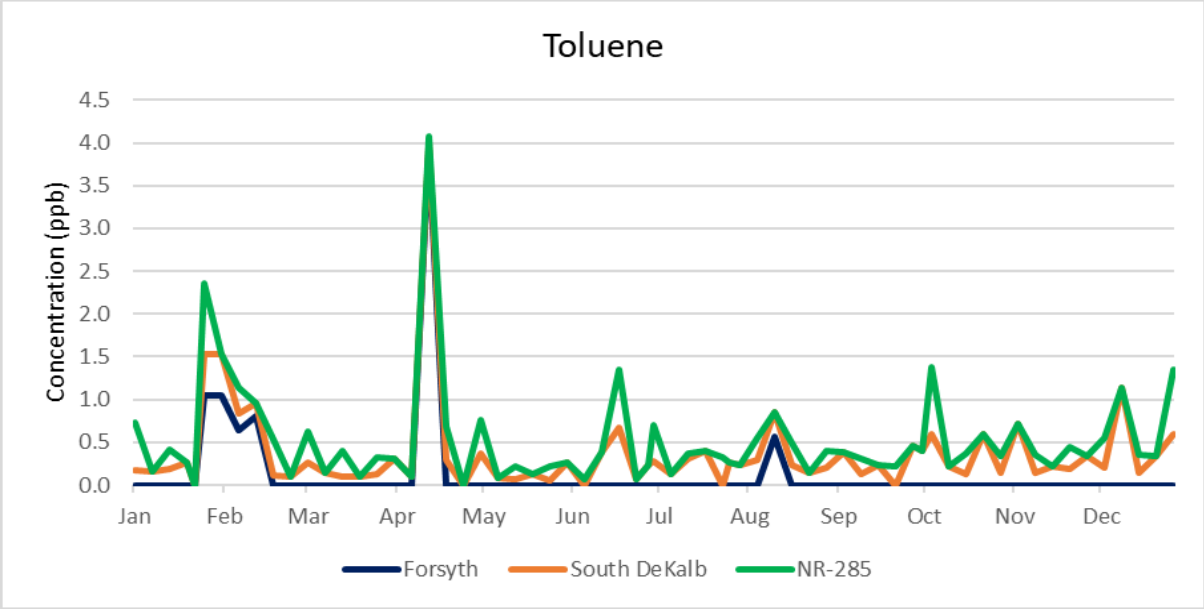


Figure 27. Toluene Comparisons

VOCs Correlations

Correlations were performed between the VOCs detected at both Forsyth County and South DeKalb sites. The r values show no correlation of the VOCs detected at these two sites.

Table 1. VOCs Correlations for Forsyth County and South DeKalb Sites

Forsyth/South DeKalb	r Value
Benzene	-0.190
o-Xylene	-0.120
m/p-Xylene	-0.110
Toluene	-0.072

Correlations were performed between the VOCs detected at both Forsyth County and NR-285 sites. The r values show no correlation of the VOCs detected at these two sites.

Table 2. VOCs Correlations for Forsyth County and NR-285 Sites

Forsyth/NR-285	r Value
Benzene	-0.330
o-Xylene	-0.210
m/p-Xylene	-0.200
Toluene	-0.089

5.0 Risk Assessment

The Forsyth County Risk Assessment was prepared by the Risk Assessment Program of EPD to understand whether long-term exposure to specific air toxics in ambient (outdoor) air around the Forsyth County air monitoring site could be harmful to human health. In summary, the overall cumulative potential cancer risk for the 2020 hazardous air pollutants monitored at the Forsyth County site is 7×10^{-5} and the noncarcinogenic hazard index is 2. In comparison to risk assessments that have been done for the GA AAMP sites, the South DeKalb site, which was done for all 2019 air toxics data including metals, semi-VOCs, and several more VOCs, showed an overall cumulative potential cancer risk of 4×10^{-5} and noncarcinogenic hazard index of 30. In addition, the risk assessment performed for GA AAMP's General Coffee background site showed a cumulative potential cancer risk of 2×10^{-5} and noncarcinogenic hazard index of 16.1 for 2018 data, which is the last year the risk assessment was done for this site. Refer to GA AAMP's 2018 and 2019 *Ambient Air Surveillance Reports* for more detail about these GA AAMP risk assessments. For much more explanation and detail about the Forsyth County risk assessment, refer to the full report, which is included as Appendix A of this document.

For questions, please contact:
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6.0 Summary Data

Pollutant Name	Number of Samples	Number Detects	Maximum Value	Annual Arithmetic Mean
$PM_{2.5}$ ($\mu g/m^3$)	8760	8278	56.7	8.38
Benzene (ppb)	58	4	1.18	0.06
1,3-Butadiene (ppb)	58	0	N/A	N/A
Chloroform (ppb)	58	0	N/A	N/A
1,2-Dichloroethane (ppb)	58	0	N/A	N/A
N-Hexane (ppb)	58	0	N/A	N/A
Methylene Chloride (ppb)	58	0	N/A	N/A
Toluene (ppb)	58	6	3.91	0.14
Trichloroethylene (ppb)	58	0	N/A	N/A
Vinyl Chloride (ppb)	58	0	N/A	N/A
m/p-Xylene (ppb)	58	1	3.91	0.07
o-Xylene (ppb)	58	1	1.11	0.02
TNMOC (ppb)	58	58	85.3	35.33

Appendix A. Risk Assessment Prepared by the Risk Assessment Program of GA EPD

5 Main Takeaways from the *Ambient Air Monitoring Report: Risk Assessment for Select Hazardous Air Pollutants (HAPs) Measured at the Forsyth County Air Monitoring Site, First 12 Months of Operation* ("Risk Assessment")

Below are 5 major takeaways from the Risk Assessment to help Forsyth County residents to understand whether the ambient air concentrations of specific Hazardous Air Pollutants (HAPs) that were measured around the Eagle Point Landfill pose a concern. It is recommended that the Risk Assessment is read in full for more information.

1) The Risk Assessment was prepared using the results from 58 ambient air samples collected from January-December 2020. Only 10 specific HAPs[1] were selected to be measured in these samples based on previous data from the United States Environmental Protection Agency. The samples were collected at an air monitoring station installed at Eagle's Beak Park, which is next to the Landfill.

2) The Risk Assessment found that if a hypothetical Forsyth County resident (someone who resides in the vicinity of Eagle's Beak Park and the Landfill) is exposed to the 10 HAPs at larger than average concentrations for a long period of time:

    a. There could potentially be approximately 7 cancer cases out 100,000 residents solely because of exposure to the 10 HAPs.

    b. Given what is currently known, it is unlikely that a resident would experience other adverse health effects solely because of exposure to the 10 HAPs.

3) The Risk Assessment cannot determine whether someone who has cancer developed cancer because of exposure to HAPs in ambient air.

4) It is important to emphasize that the concentrations of the 10 HAPs in ambient air may not necessarily be attributable either in whole or part to landfill gas emissions from the Eagle Point Landfill and could also have originated from other sources.

5) It is important to note that the cancer risks (for each HAP and for all 10 HAPs cumulatively) determined in this Risk Assessment are within the Georgia Environmental Protection Division (EPD) Air Protection Branch acceptable cancer risk range.

[1] Benzene, 1,3-Butadiene, Chloroform, Ethylene Dichloride (1,2-Dichloroethane, 1,2-DCE), Hexane, Methylene Chloride (Dichloromethane), Toluene, Trichloroethylene, Vinyl Chloride, and Xylenes (as m,p-Xylene and o-Xylene)

GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

Ambient Air Monitoring Report: Risk Assessment for Hazardous Air Pollutants (HAPs) Measured at the Forsyth County Air Monitoring Site, First 12 Months of Operation

Prepared to fulfill requirements under the Georgia Environmental Protection Division (GA EPD) Air Quality Monitoring Agreement with Forsyth County, Georgia (Entered February 4, 2019)

Prepared on behalf of Ambient Air Monitoring Program (AAMP) by the Georgia Environmental Protection Division Risk Assessment Program (RAP)
4-30-2021

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Acronyms

- µg/m^3 – micrograms per cubic meter
- 1,2-DCE –1,2- Dichloroethane
- AAMP – EPD Air Protection Branch Ambient Air Monitoring Program
- AQMA – Air Quality Monitoring Agreement
- ATSDR – Agency for Toxic Substances and Disease Registry
- AQS – Air Quality System
- CA – Contaminant Concentration in Air
- CalEPA – California Environmental Protection Agency Office of Environmental Health Hazard Assessment
- EC – Exposure Concentration
- EBP – Eagle's Beak Park
- EPL – Eagle Point Landfill
- GAEPD, EPD – Georgia Environmental Protection Division
- HAP – Hazardous Air Pollutant
- HEAST - USEPA Superfund Program Health Effects Assessment Summary Table
- HI – Hazard Index
- HQ – Hazard Quotient
- IUR – Inhalation Unit Risk
- MDC – Maximum Detected Concentration
- MRL – ATSDR Minimal Risk Levels
- NMOC – Non-methane organic compounds
- OAQPS – EPA's Office of Air Quality Planning and Standards
- ppb (v/v) – parts per billion volume
- PPRTV – USEPA Provisional Peer-Reviewed Toxicity Value
- RAP – EPD Risk Assessment Program
- RfC – Reference Concentration
- RSL – USEPA November 2020 Resident Air Regional Screening Level
- SRL – Sample Reporting Limit
- TCE – Trichloroethylene
- USEPA, EPA – United States Environmental Protection Agency
- 95% UCL – 95% Upper Confidence Limit of the Arithmetic Mean

Important Definitions

- Air Toxics: Defined "*Any air pollutant that causes or may cause cancer, respiratory, cardiovascular, or developmental effects, reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans.*" (USEPA, 2004, glossary)
- Ambient Air: outdoor air external to buildings
- Cancer Risk: also referred to as "risk"; the predicted risk of cancer "*from the exposure being analyzed that is above the risk that the individuals in the population have already (i.e., due to non-air toxics related issues)*" (USEPA, 2004; pg. 13-5)
- Cumulative Cancer Risk: The total cancer risk which is obtained by summing the cancer risk of individual air toxics
- Contaminant Concentration in Air (CA): For a particular air toxic, estimated as the upper-limit value (95% UCL or an MDC or SRL) of all the valid sample values collected over the 1st 12 months at the Station. The CA is an estimate of the chronic (long-term) ambient air concentration of that air toxic at the Station.
- Exposure Concentration (EC): Generally defined as the "*concentration of a chemical in the air at the point where a person breathes the air*" (USEPA, 2004, pg. 6-17). In the context of this Risk Assessment, the EC is a time-weighted contaminant concentration in air (CA) which takes into account the frequency, duration, and time of exposure as well as the time period over which the exposure is averaged (USEPA, 2009, pg. 13 to 17). The EC is the ambient air concentration of a HAP that an individual resident could be exposed to (in the manner presumed as explained in this Risk Assessment).
- Hazardous Air Pollutant (HAP): In this Risk Assessment, refers to any of the 10 air toxics that are being assessed. HAPs are air toxics, but the term HAP is used in this Risk Assessment to be consistent with the terminology used in the AQMA.
- Hazard: Also referred to as "noncancer hazard". Defined as the potential harm from noncarcinogenic air toxics (USEPA, 2004; pg. 13-4)
- Hazard Index (HI): A value which describes the total noncancer hazard which is derived by summing the hazard quotients (HQs) determined for individual HAPs.
- Hazard Quotient (HQ): A value obtained by dividing the exposure concentration (EC) by the reference concentration (RfC). An HQ above 1 indicates the potential for an adverse noncancer effect.
- High-End Risk Estimate: an "*estimate [of the cancer] risk that is expected to occur in the upper range of the distribution (e.g., risk above about the 90th percentile of the population distribution)"* (USEPA, 2004, pg. 13-4)
- High-End Exposure Estimate: "*plausible estimate of individual exposure or dose for those persons at the upper end of an exposure or dose distribution*" (USEPA, 2004, glossary). The Exposure Concentration (EC) is a high-end exposure estimate.
- Inhalation Unit Risk (IUR): "*the upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 $\mu g/m^3$ in air*" (USEPA, 2009, pg. 10)

- Maximum Detected Concentration (MDC): out of all ambient air samples in which a particular HAP was detected, the MDC is the largest of those detected results
- Reasonable Maximum Exposure (RME): "*highest exposure that is reasonably expected to occur at a site*" (USEPA, 1989; pg. 6-5).
- Risk Assessment: Refers to this document, *Ambient Air Monitoring Report: Risk Assessment for Select Hazardous Air Pollutants (HAPs) Measured at the Forsyth County Air Monitoring Site, First 12 Months of Operation*
- Risk Manager: "*persons or groups with the authority to make the decisions about the acceptability of risk and how an unacceptable risk may be mitigated, avoided, or reduced*" (USEPA, 2004, pg. 5-10)
- Reference Concentration (RfC): "*defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer health effects during a lifetime*" (USEPA, 1994; pg. 1-2 to 1-4)
- Resident Air Regional Screening Level (RSL): Conservative air screening levels developed by USEPA. The Cancer RSL is derived at a cancer risk of 10^{-6} and the Noncancer RSL is derived at a hazard quotient of 0.1
- Sample Reporting Limit (SRL): The lowest concentration for a particular HAP that the analytical laboratory will report on an analytical laboratory report. Concentrations below the SRL are not reported. In this Risk Assessment, any concentration that was above the SRL and thus reported was considered a detect.
- 95% Upper Confidence Limit (UCL): the "*upper boundary (or limit) of a confidence interval [95% in this case] of a parameter of interest such as the population mean*" (USEPA, 2015a; pg. 22). 95% UCLs are used as high-end exposure estimates.

Disclaimer

Every effort has been made to use current and technically defensible risk assessment methodologies to prepare the *Ambient Air Monitoring Report: Risk Assessment for Select Hazardous Air Pollutants (HAPs) Measured at the Forsyth County Air Monitoring Site, First 12 Months of Operation* ("Risk Assessment"). However, the methodologies used herein may not necessarily be applicable or relevant when preparing human health and/or ecological risk assessments under State or Federal statutes and regulations (e.g., Georgia Hazardous Site Response Act, Resource Conservation and Recovery Act, etc.). Under no circumstances should regulated parties consider any part of this Risk Assessment to represent EPD risk assessment policy. This Risk Assessment does not substitute State or Federal statutes and regulations and is not a regulation itself.

Section 1 - Introduction

This *Ambient Air Monitoring Report: Risk Assessment for Select Hazardous Air Pollutants (HAPs) Measured at the Forsyth County Air Monitoring Site, First 12 Months of Operation* (hereafter referred to as "Risk Assessment") was prepared on behalf of the Georgia Environmental Protection Division (GAEPD) Air Protection Branch Ambient Air Monitoring Program (AAMP) by the GAEPD Land Protection Branch Risk Assessment Program (RAP). This Risk Assessment was prepared per the requirements of GAEPD's Air Quality Monitoring Agreement (AQMA)[1] with Forsyth County, Georgia, a political subdivision of the State of Georgia acting by and through its Board of Commissioners (hereafter referred to as "County"). GAEPD entered into the AQMA with the County on February 4, 2019.

The AQMA stemmed from the County's desire to address the issue of ambient air quality around Eagle Point Landfill (EPL), which is in northwest Forsyth County (address: 8880 Old Federal Rd, Ball Ground, GA, 30107). The County recognized the air quality in the vicinity of EPL as a matter of public health concern and decided to set up an air quality monitoring station ("Station") next to the EPL at Forsyth County's Eagle's Beak Park (address: 8400 Old Federal Rd. Ball Ground, GA. 30107). Please see Figure 1 for a map of EPL and EBP.

Per the AQMA, it was decided that the following hazardous air pollutants (HAPs) would be monitored at the Station:

- Benzene
- 1,3-Butadiene
- Chloroform
- Ethylene Dichloride (1,2-Dichloroethane, 1,2-DCE)
- Hexane
- Methylene Chloride (Dichloromethane)
- Toluene
- Trichloroethylene
- Vinyl Chloride
- Xylenes – analyzed as:
    - m/p-Xylene
    - o-Xylene

[1] A copy of the AQMA can be found on the Forsyth County local government website: https://www.forsythco.com/Departments-Offices/Recycling-Solid-Waste/Environmental-Compliance. An executed amendment of the AQMA was provided to the County by EPD on August 5, 2020. Please contact AAMP concerning the executed amendment.

As mentioned in the AQMA, these HAPs were selected for monitoring based on the following criteria (determined after a review of landfill gas test results from USEPA[2]):

- Are present in a significant number in USEPA's test results
- Present in higher concentrations in USEPA's test results
- The relative toxicity of the HAP

HAPs , along with fine inhalable particles 2.5 µm and smaller ($PM_{2.5}$) and non-methane organic compounds (NMOC), have been monitored at the Station. This Risk Assessment only focuses on assessing the cancer risk and noncancer hazard that could result from long-term (chronic) inhalation of the monitored HAPs and is based on only the first 12 months of data (HAPs samples collected from January 25, 2020 to December 29, 2020). This Risk Assessment was primarily prepared in accordance with USEPA's *Air Toxics Risk Assessment Reference Library: Volume 1 Technical Resource Manual* (USEPA, 2004). However, other risk assessment guidance documents have been consulted as necessary to ensure that the Risk Assessment reflects current technical recommendations and best practices. Supporting information necessary to understand the conclusions of the Risk Assessment have been referenced or included in the Appendices.

It is important to emphasize that the cancer risks and noncancer hazards determined in Section 4 are representative of a high-end exposure estimate and that there can be various uncertainties with how cancer risks and noncancer hazards have been determined. Section 4 describes the uncertainties inherent to this Risk Assessment.

[2] An explanation into the analysis of USEPA landfill gas test results is beyond the scope of this Risk Assessment. Please contact AAMP for further information concerning how the 10 HAPs were selected.

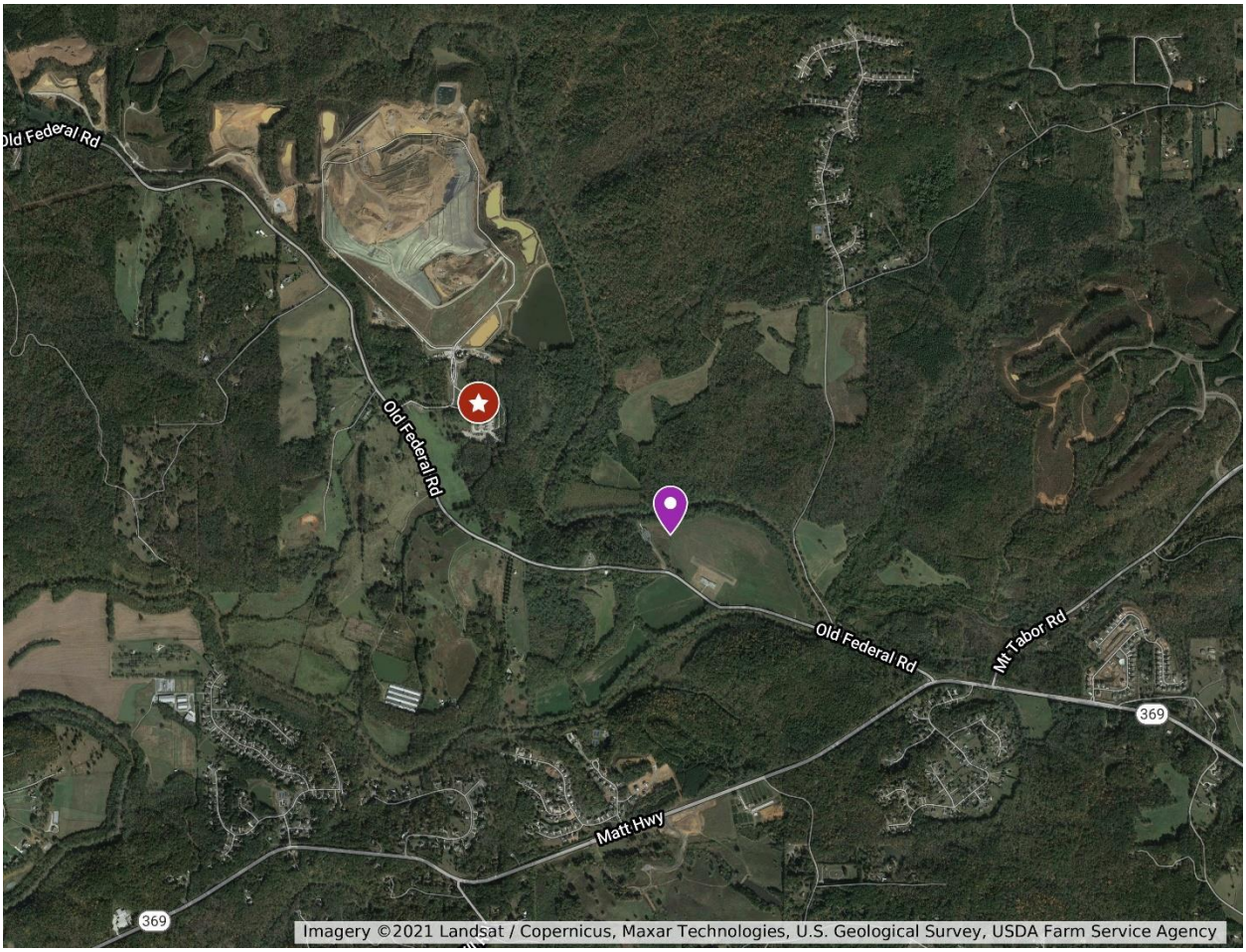

Figure 1: Location of EPL and EBP - the red star represents the location of Eagle Point Landfill (EPL) while the purple location marker represents Eagle's Beak Park (EBP), where the air quality monitoring Station ("Station") was set up.

Section 2: Data Collection and Evaluation

Section 2.1 – Sample Collection and Quality Assurance

Individual ambient air samples were collected over a 24-hour period through a stainless-steel air canister and analyzed at the laboratory for NMOCs and HAPs (only risk and hazard estimates are determined for HAPs in this Risk Assessment). HAPs were analyzed by EPA Method TO-15[3]. Samples were collected from January 25, 2020 to December 29, 2020 (12 months) once every 6 calendar days (except samples collected from January 25, 2020 to February 3, 2020 were collected once every 3 calendar days) for a total of 58 ambient air samples[4]. The rotating sampling frequency helps to account for possible sample variation due to human activity or traffic patterns and allows for the determination of a representative contaminant concentration in air (CA). All sample results have been quality assured by the AAMP Quality Assurance Unit.

During the quality assurance process, the AAMP Quality Assurance Unit qualified all sample results using the data qualifiers from EPA's Air Quality System (AQS)[5]. All HAPs data were qualified with a "2" (Operational Deviation) qualifier since there was > 0.5 psi difference between the air canister pressure measured during retrieval of the air canister from the Station and the air canister pressure measured upon receipt at the laboratory. This operational deviation did not result in any sample results being deemed unusable by the Quality Assurance Unit and sample results from all 58 samples were used to derive the CA (please see Section 3.2.1).

Section 2.2 – Organization and Conversion of Ambient Air Monitoring Results

Sample results were organized by HAP and were assigned as either a detect or non-detect (see Section 2.3). HAP sample values and corresponding Sample Reporting Limits (SRLs)[6] were provided by the laboratory in units of parts per billion volume (ppb v/v) and were converted to units of micrograms per cubic meter ($\mu g/m^3$) using the following formula:

$$\frac{\text{MW x ppb (v/v)}}{24.45} = \text{HAP concentration in } \mu g/m^3$$

Where:

- MW = Molecular weight of HAP in g/mole
- ppb (v/v) = HAP concentration, in parts per billion (v/v)
- 24.45 = "*volume in liters of one mole of an ideal gas at 1 atmosphere and 25 degrees Celsius*" (see USEPA, 2004, pg. 9-8)

[3] Please contact AAMP if more information is required concerning this analytical method.
[4] At the Station, another set of ambient air samples (known as "collocated samples") were collected once a month (except the months of January, March, and July of 2020). However, collocated sample results have not been used to prepare the Risk Assessment since collocated samples were not necessarily collected at the same frequency and were only collected for quality assurance purposes. Sample results from the collocated air monitor have been included with the original sample results in Appendix A (collocated samples are marked with a 2 next to the HAP name).
[5] Please see: https://aqs.epa.gov/aqsweb/documents/codetables/qualifiers.html
[6] In the datasets provided in Appendix A, SRLs are referred to as "minimum detectable limits" due to a slight difference in terminology used by the laboratory and the Quality Assurance Unit. To avoid confusion with the term method detection limit, MDL, which is used in various regulatory programs and described in Appendix B Revision 2 of 40 C.F.R. 136 (https://www.ecfr.gov/cgi-bin/text-idx?SID=984728bcf594005272018e017af94327&mc=true&node=ap40.25.136_17.b&rgn=div9) , the laboratory's terminology has been used throughout this Risk Assessment.

Both the original and organized sample results have been included in Appendix A. Though the original sample result file contains the unconverted NMOC and collocated sample results, these results were not used to prepare this Risk Assessment.

Section 2.3 – Detects and Non-detects

To determine the chemical concentration in air (CA) for each HAP (see Section 3.2.1), it was necessary to determine whether a specific HAP in an ambient air sample was either detected or not detected.

A HAP in an ambient air sample is considered not detected (nondetect) if the HAP result is qualified with an ND ("No Value Detected, Zero Reported") qualifier. The laboratory only reports the concentration of a HAP if that concentration is equal to or above the SRL; a reported concentration is considered to have been detected (detect). In a particular ambient air sample, an ND-qualified HAP result indicates that the HAP was not present in that sample at or above the HAP's Sample Reporting Limit (SRL). During quality assurance of the laboratory data, the AAMP Quality Assurance Unit assigned all nondetect HAP results a concentration of 0 to be consistent with the AQS. However, it is necessary to emphasize that even if a HAP was nondetect, it is uncertain whether the HAP was present/not present in ambient air when the sample was collected.

In Appendix A, all detects have been assigned a code of "1" while nondetects have been assigned a code of "0". This is so the results can be analyzed using EPA's ProUCL software (see Section 3.2.1) for determining the contaminant concentration in air (CA).

Section 3: Chronic, Inhalation Risk Assessment

Section 3.1 – Study-Specific Conceptual Model

The study-specific conceptual model "*explicitly identifies the sources, receptors, exposure pathways, and potential adverse human health effects that the risk assessment will evaluate*" (USEPA, 2004, pg. 6-1). This allows risk managers and the public to understand exactly what is being evaluated in this Risk Assessment. USEPA (2004) recommends specific elements that should be included in a conceptual model, which has been graphically displayed in Figure 2 and further explained below.

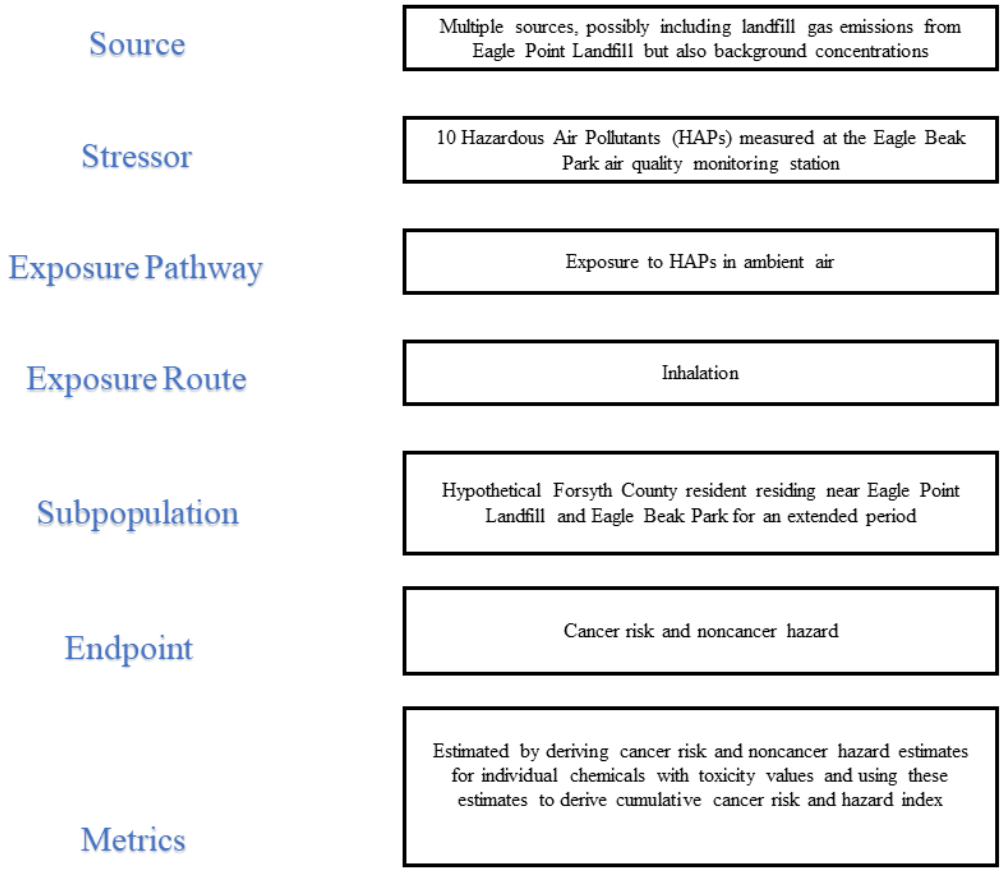

Figure 2: Study-specific conceptual model made similar to the conceptual model in Exhibit 6-1 of USEPA (2004).

Section 3.1.1 – Sources of Air Toxics

The HAPs present in ambient air are a "*combination of background concentrations and the same chemical released from possibly multiple sources*" (USEPA, 2004, pg. 10-37). The HAPs measured at the Station could possibly represent landfill gas emissions from EPL (or the landfill gas emissions from EPL could contribute partly to the HAPs concentrations observed), but the Risk Assessment is not able to directly attribute the measured HAPs in ambient air to EPL.

Section 3.1.2 – Stressors

The stressors are the specific air toxics that will be evaluated in the Risk Assessment, which in this case are the 10 HAPs.

Section 3.1.3 – Exposure Pathway/Exposure Route

This Risk Assessment only evaluates exposure to HAPs resulting from inhalation of ambient (outdoor) air since only validated air monitoring data is available. Though indoor air has not been evaluated, "*indoor air concentrations of air toxics are expected to be the same or lower than the outdoor concentrations*" (USEPA, 2004, pg. 11-2). An individual could possibly be exposed to air toxics that have deposited out of the ambient air onto water bodies, plants, soil, and/or other surfaces (USEPA, 2004, pg. 6-2), but other exposure pathways and routes have not been evaluated since atmospheric deposition data is not available.

Section 3.1.4 – Subpopulation

The estimates discussed in Section 3.4.1 of the Risk Assessment could be said to represent the risk and/or hazard to a hypothetical Forsyth County resident who lives in the vicinity of EBP and EPL. More specifically, this Risk Assessment theoretically assumes that the hypothetical resident is continuously inhaling HAPs in ambient air (the HAPs assumed to be present at a concentration at the higher end of a range of possible HAP concentrations) around-the-clock at the air monitoring Station for an upper-bound length of time (i.e. longer than an than average length of time that a resident would be expected to reside in one area[7]). Deriving risk/hazard estimates in such a conservative manner ensures that any risk management decisions based on these estimates would also protect individuals (e.g. visitors to Forsyth County) who might be exposed to HAPs in ambient air for a shorter length of time.

Section 3.1.5 – Endpoints and Metrics

Endpoints are specific harmful effects that could occur because of being exposed to air toxics in ambient air. This Risk Assessment will not evaluate specific endpoints but will provide quantitative estimates of the cancer risk and noncancer hazard from exposure to HAPs. Cancer risk and noncancer hazard for all HAPs have been estimated using USEPA's RSL Calculator[8], and the cancer risk estimates and hazard quotients are summed to obtain the cumulative cancer risk and hazard index (HI), respectively.

[7] As shown in Table 2 of this Risk Assessment, 26 years is the exposure duration based on the 90th percentile value in Table 16-108 of USEPA (2011a). According to Table 16-108, an estimate of the average (arithmetic mean) residential occupancy period is 11.7 years. Thus 11.7 years is an estimate of the average time that a resident could reside near the Station, but this Risk Assessment assumes that the resident is residing for a longer than average time to ensure that the risk/hazard estimates would also be protective of residents who may be residing for less time. Please also see the following link to Table 16-108: https://www.epa.gov/sites/production/files/2015-09/documents/efh-chapter16.pdf#page=195

[8] Link to USEPA RSL Calculator: https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

Section 3.2 – Exposure Assessment

To determine the risk and/or hazard for each HAP, an exposure concentration (EC) must be estimated for each HAP. The EC generally can be defined as the "*concentration of a chemical in the air at the point where a person breathes the air*" (USEPA, 2004, pg. 6-17) and is a high-end exposure estimate (i.e., a chronic ambient air concentration of a HAP at the upper end of a distribution of plausible ambient air concentrations that an individual could reasonably be exposed to). The EC is estimated as a time-weighted contaminant concentration in air (CA) which considers the frequency, duration, and time of exposure as well as the time over which the exposure is averaged (USEPA, 2009, pg. 13 to 17)[9]. In this Risk Assessment, the EC of a HAP is a conservative estimate of the amount of HAP that a hypothetical resident (as defined in Section 3.2.2) *has the potential* to inhale if they are in the vicinity of Eagle Beak Park/EPL (technically, if the resident is exactly at the Station).

Section 3.2.1 – Estimating the Contaminant Concentration in Air (CA) for a HAP

The CA for a particular HAP is an upper-bound estimate of the chronic (long-term) ambient air concentration of a HAP. A list of all CA's has been provided in Table 1. The CA is time-weighted to obtain the EC.

[9] It is important to clarify that the term exposure concentration (EC) is interpreted in USEPA (2004) to be equivalent to the contaminant concentration in air (CA) as defined in this Risk Assessment. This is because USEPA (2004) recommends deriving risk and/or hazard estimates by directly using the CA (as defined in this Risk Assessment). However, the RSL Calculator follows the methodology from USEPA (2009) and uses a time-weighted CA as an estimate of the EC that is subsequently used to derive the final risk and/or hazard estimate.

Table 1: Contaminant Concentration in Air (CA) for each HAP

HAP	CAS Number	Detection Frequency	Contaminant Concentration in Air ($\mu g/m^3$)	Basis
Benzene	71-43-2	4/58	1.77	95% KM (t) UCL
Butadiene, 1,3-	106-99-0	0/58	1.11	Highest Sample Reporting Limit (SRL)
Chloroform	67-66-3	0/58	2.44	Highest SRL
Dichloroethane, 1,2- (Ethylene Dichloride)	107-06-2	0/58	2.02	Highest SRL
Hexane	110-54-3	0/58	1.76	Highest SRL
Methylene Chloride (Dichloromethane)	75-09-2	0/58	3.47	Highest SRL
Toluene	108-88-3	6/58	2.275	95% H-UCL (KM - Log)
Trichloroethylene	79-01-6	0/58	2.69	Highest SRL
Vinyl Chloride	75-01-4	0/58	1.28	Highest SRL
Xylene, m,p-*	108-38-3	1/58	17.0	Maximum Detected Concentration (MDC)
Xylene, o-	95-47-6	1/58	4.82	MDC

*Inputted into the RSL Calculator as m-Xylene; please see X for more explanation
Detection Frequency: the number of samples where a HAP was detected (i.e. had a result that was not ND-qualified) out of the total number of samples

To obtain a CA, USEPA (2004) recommends deriving the 95% upper confidence limit of the arithmetic mean (95% UCL) of all valid ambient air sample results collected over 12 months and using the 95% UCL as an estimate of the CA (USEPA, 2004, pg. I-4 and I-5). The 95% UCL is intended to be a "*public health protective estimate of the true annual average*" of all valid ambient air sample results collected over the 12 months since a "*simple arithmetic mean of sampling results may underestimate, approach, or overestimate the true annual average*" (USEPA, 2004, pg. I-4). Even though rotating sampling frequency helps to curb variations due to human activity or traffic patterns, USEPA (2004) indicates that there are still uncertainties to using a simple arithmetic mean to determine the CA for reasons such as potential inaccuracies with individual measurements and daily variability in concentrations (USEPA, 2004, pg. I-4).

The most current version of EPA's ProUCL (Version 5.1.002) statistical software[10] was used to determine the 95% UCL. The sample results for each HAP, coded either as nondetect or detect (see Section 2.3), were inputted into ProUCL. Based on the size, distribution, and skewness of the sample results comprising the dataset for each HAP, ProUCL recommends an appropriate 95% UCL or indicates that the 95% UCL cannot be derived (USEPA, 2015a, pg. 7). All ProUCL inputs and outputs have been included in Appendix B. It is recommended that USEPA (2015a) and USEPA (2015b) be consulted for more information about deriving defensible 95% UCLs.

[10] https://www.epa.gov/land-research/proucl-software

Except for Benzene and Toluene, a 95% UCL could not be determined for any other HAP since all or most of the sample results for these HAPs were nondetect. ProUCL indicates that a defensible 95% UCL necessitates greater than or equal to 4 detects in a sample dataset (USEPA, 2015a, pg. 59). For the HAPs where all sample results were nondetect, the highest sample reporting limit (SRL) was used as a conservative estimate of the CA. For o-Xylene and m,p-Xylene, the maximum detected concentration (MDC) was used as a conservative estimate of the CA (both of these HAPs had only 1 detect each). Please see Section 4 for an enhanced discussion on the uncertainties of using the highest SRL or MDC as an estimate of the CA.

For Benzene, a 95% UCL of 1.77 µg/m^3 (95% KM (t) UCL) was suggested by the ProUCL software as an acceptable estimate of the Benzene CA. ProUCL derived the suggested UCL by using the Kaplan-Meier (KM) estimation method to determine the mean and standard error of the dataset (USEPA, 2015b, pg. 129-130) and then inputting these KM estimates into an equation using the Student's t-statistic (USEPA, 2015b, pg. 142). The suggested 95% UCL for Benzene was used in this Risk Assessment since it is a "*good estimate*" of the CA considering that all detected Benzene results are approximately normally distributed (USEPA, 2015b, pg. 142).

For Toluene, a 95% UCL of 2.275 µg/m^3 (95% H-UCL (KM -Log)) was suggested by the ProUCL software as an acceptable estimate of the Toluene CA. A 95% H-UCL is based on the use of KM estimates derived from log-transformed Toluene sample results in an equation based on Land's H-statistic (USEPA, 2015b, pg. 143). However, *ProUCL Version 5.1 Technical Guide* indicates that that "*the use of the H-statistic results in impractical and unacceptably large UCL values*" especially for smaller datasets (less than 20-30 sample results) and moderately to highly skewed data (USEPA, 2015b, pg. 64). In general, the "*developers of ProUCL suggest avoiding the use of the lognormal distribution*" to estimate a CA (USEPA, 2015b, pg. 93). In this case, the 95% H-UCL was suggested since the detected data are only approximately lognormally distributed (and do not follow either a normal or gamma distribution), the dataset is larger than 30 samples, and the dataset is mildly to moderately skewed based on the Standard Deviation (SD) of Logged Detects of 0.699 (USEPA, 2015b, pg. 56, 93). Since the suggested 95% H-UCL does not exceed the MDC and use of the H-statistic does not appear to result in underestimation of the 95% UCL even though it is possible that there might be overestimation, the ProUCL suggested 95% UCL of 2.275 µg/m^3 has been used in this Risk Assessment to obtain an estimate of the Toluene CA that best reflects reasonable maximum exposure (RME) conditions. As shown in Section 3.4.1, Toluene's very small hazard quotient (HQ) of 0.0004 suggests that Toluene is not a noncancer concern.

Section 3.2.2 – How the Exposure Concentration (EC) is Determined from the CA

As previously mentioned, the EC is a time-weighted CA which considers the frequency, duration, and time of exposure as well as the time period over which the exposure is averaged (USEPA, 2009, pg. 13 to 17). However, the EC has not been directly calculated in this Risk Assessment since the risk and/or hazard estimates provided in Section 3.4.1 were derived using USEPA's RSL Calculator. According to Section 2.6.1 of the RSL User's Guide, the RSL Calculator derives risk/hazard estimates for each HAP in accordance with the following equations which only requires the contaminant concentration in air (CA) as the input.

Cancer Risk = (C × TR) / Cancer RSL

Noncancer Hazard Quotient (HQ) = (C × THQ) / Noncancer RSL

Where:

- C = contaminant concentration in air (CA) of the HAP
- TR = $1x10^{-6}$
- THQ = 0.1
- Cancer RSL = November 2020 USEPA Cancer Resident Air Regional Screening Level (RSL) of the HAP derived at a cancer risk level of $1x10^{-6}$.
- Noncancer RSL: November 2020 USEPA Noncancer Resident Air Regional Screening Level (RSL) of the HAP derived at a hazard quotient (HQ) of 0.1.

The Cancer RSLs and Noncancer RSLs were already derived using the default residential parameters in Table 2. Please see Appendix C for a table with the Cancer RSLs and Noncancer RSLs and the equations used to derive these RSLs. Dividing by the RSL automatically time-weights the CA so that the final risk and/or hazard estimate that accounts for the residential parameters in Table 2 and thus is based on a residential exposure scenario. These residential exposure parameters are recommended in EPA guidance and represent RME conditions that "*account for daily exposure over the long term and generally result in the highest potential exposures and risk*" but do not represent the worst possible risk and/or hazard (USEPA, 1991, pg. 2-3). The risk and/or hazard estimates discussed in Section 3.4.1 of the Risk Assessment are representative of a hypothetical resident inhaling ambient air at the Station for longer than an average length of time and where that hypothetical resident could be exposed to concentrations of HAPs that are at the higher end of a range of plausible HAP concentrations but are not the highest concentrations (this assumption is not exactly true for the HAPs where the MDC or SRL was used to estimate the CA; see Section 4 for more information). Deriving risk/hazard estimates based on a residential scenario ensures that risk management decisions based on these estimates would also be protective of others (visitors, workers, etc.) who would be expected to have a lower exposure to the HAPs present in ambient air around EPL and EBP.

Table 2: Default Residential Parameters used in the RSL Calculator to Determine the Exposure Concentration (EC)

ED	Exposure duration	26 years	26 years is a default exposure duration value used in the residential exposure scenario. The value is obtained from Table 16-108; 90th percentile for current residence time in USEPA (2011a). 26 years is a conservative assumption for the total length of time an individual resident could inhale ambient air chemicals within the spatial scale of an air monitoring Site.
EF	Exposure frequency	350 days/year	This value is from page 15 of USEPA (1991) and is a residential exposure frequency. Though 365 days/year (every day per year) is a more conservative exposure frequency, USEPA believes that "*the common assumption that workers take two weeks of vacation per year can be used to support a value of 15 days per year spent away from home (i.e., 350 days/year spent at home)*" (USEPA, 1991, pg. 5). 350 days/year is still a conservative EF but better represents RME conditions.
ET	Exposure time	24 hours/day	A resident is assumed to be able to be exposed to environmental chemicals for a maximum of 24 hours a day (USEPA, 1989, pg. 6-6). 24 hours/day is the maximum amount of time per day that an individual could inhale an air toxic within the spatial scale of an air monitoring Site. Thus, this exposure factor is conservative.
LT	Lifetime	70 years	70 years is a standard assumption used by USEPA (USEPA, 1989, pg. 6-22) to represent a hypothetical individual's lifetime and is the length of time over which exposure to a carcinogenic HAP is prorated. This assumes that exposure to a higher amount of carcinogen over a short period of time is equivalent to exposure to a corresponding lower concentration of carcinogen spread out over a lifetime (USEPA, 2005a, pg. 3-26).

Section 3.3 – Toxicity Assessment

The purpose of the toxicity assessment is to identify the cancer and noncancer effects of a chemical [hazard identification] and to quantify its toxicity [dose-response assessment] (USEPA, 2004, pg. 12-1). For many of the chemicals, toxicity assessments have already been conducted by toxicologists either at USEPA or another Federal/State agency. Thus, the focus of this section is to briefly explain the toxicity values that are used to derive risk/hazard estimates.

Section 3.3.1 – Toxicity Values

During the toxicity assessment, the information from the hazard identification and dose-response assessment are translated into specific toxicity values. Two kinds of toxicity values are used in the risk assessment to evaluate inhalation: the reference concentration (RfC) and the inhalation unit risk (IUR).

The RfC "*is defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncarcinogenic health effects during a lifetime*" (USEPA, 1994, pg. 1-2 to 1-4). Please consult USEPA (1994) and a chemical's noncancer toxicity assessment for more information on how a RfC is derived.

The IUR is defined as "*the upper-bound excess lifetime carcinogenic risk estimated to result from continuous exposure to an agent at a concentration of 1 $\mu g/m^3$ in air*" (USEPA, 2009, pg. 10). Please consult USEPA (2005a) and a chemical's cancer toxicity assessment for more information on how an IUR is derived.

Appendix C lists the toxicity values for all HAPs. Since the purpose of this risk assessment is to assess long-term (chronic) exposure to ambient air, only chronic toxicity values have been used. IURs were used in deriving the Cancer RSL while RfCs were used in deriving the Noncancer RSL. As explained in Section 3.2.2, the cancer risk was derived by dividing by the Cancer RSL while the hazard quotient (HQ) was derived by dividing by the Noncancer RSL.

Section 3.3.2 – USEPA Human Health Toxicity Values Hierarchy

Many different State and Federal organizations publish toxicity values. For some air toxics, one organization may have published an IUR while another organization may have published an RfC, and it is necessary to organize the sources from which toxicity values are selected so that the toxicity values used to assess a particular air toxic are determined using a consistent procedure.

EPA's OAOPS has a published list of chronic toxicity values that it recommends for use in air risk assessment[11] which prioritizes using EPA Integrated Risk Information System (IRIS) toxicity values whenever they are available[12]. However, OAOPS does not consider USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs), which are derived for USEPA's Superfund program and are not considered USEPA consensus values. To ensure that all technically defensible toxicity values available for air toxics are being considered, including the PPRTVs which are derived by EPA scientists and are both internally and externally peer-reviewed[13], this Risk Assessment deviates from the OAOPS hierarchy and has selected the toxicity values in Appendix C following USEPA's Human Health Toxicity Values Hierarchy recommended for Superfund risk assessments, summarized below (USEPA, 2003a):

- Tier 1 toxicity values: USEPA's Integrated Risk Information System (IRIS), found at: https://www.epa.gov/iris, is consulted first. USEPA considers IRIS to be its preferred

[11] https://www.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants
[12] https://www.epa.gov/fera/prioritization-data-sources-chronic-exposure
[13] https://www.epa.gov/pprtv/basic-information-about-provisional-peer-reviewed-toxicity-values-pprtvs#basicinfo

source for toxicity information on air toxics and "*IRIS health assessments contain [USEPA] consensus toxicity values*" (USEPA, 2003a, pg. 2).

- Tier 2 toxicity values: If a chemical does not have a toxicity value listed in IRIS, USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) are consulted next. USEPA PPRTVs are developed by USEPA's Office of Research and Development Center for Public Health and Environmental Assessment and USEPA's Human Health Risk Assessment National Research Program. These values are peer-reviewed but are developed primarily for the Superfund program and not necessarily considered a consensus toxicity value within USEPA. For more information on PPRTVs, please refer to: https://www.epa.gov/pprtv/basic-information-about-provisional-peer-reviewed-toxicity-values-pprtvs.
- Tier 3 toxicity values: If a chemical does not have a PPRTV (or an IRIS toxicity value), then toxicity values from other sources may be used. Though USEPA's Toxicity Values Hierarchy does not have clear criteria to prioritize which Tier 3 toxicity values should be considered first, USEPA generally recommends that Tier 3 values be obtained from "*sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer reviewed*" (USEPA, 2003a, pg. 3). The RSL Calculator defines a hierarchy for Tier 3 toxicity values in Section 2.3 of USEPA (2020). The hierarchy is described below:

    - EPA's Office of Pesticide Programs (OPP) Human Health Benchmarks for Pesticides were considered if a Tier 1 or Tier 2 toxicity value is not available.
    - If an OPP benchmark was not available, then chronic inhalation minimal risk levels (MRLs) from the Agency for Toxic Substances and Disease Registry (ATSDR), found at https://www.atsdr.cdc.gov/mrls/mrllist.asp[14], are selected. For the purposes of the HHRA, MRLs are considered equivalent to RfCs.
    - If an MRL is not available, chronic RfCs published by the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (CalEPA) were used. If an IUR was not available from a Tier 1 or 2 source, then the IUR published by CalEPA was used. CalEPA toxicity values can be found here: https://oehha.ca.gov/chemicals.
    - For some chemicals, the toxicity assessments used to obtain a PPRTV ("PPRTV Assessments") also contain "screening" toxicity values which although published are considered to have more uncertainty in their derivation than a PPRTV. These are used for chemicals when an MRL or CalEPA toxicity value is not available.
    - If a chemical does not have a toxicity value in the aforementioned Tier 3 sources, then toxicity values listed in the USEPA Superfund program's Health Effects Assessment Summary Table (HEAST), found at https://epa-heast.ornl.gov/ were used.

[14] Only the chronic inhalation MRLs are obtained from ATSDR.

Section 3.3.3 – HAPs that Act Through a Mutagenic Mode of Action

Methylene Chloride, Vinyl Chloride, and Trichloroethylene are carcinogens that have been accepted to act through a mutagenic mode of action (MMOA) and a hypothetical resident could potentially have an increased susceptibility to cancer from exposure to these carcinogens earlier in life (starting from birth to generally up to age 16) relative to exposure later in life (USEPA, 2005b, pg. 30-33; USEPA, 2020, Section 5.17). To ensure that the cancer risk estimates presented in Section 3.4.1 are reflective of the MMOA of these HAPs, the RSL Calculator makes some modifications to the standard Cancer RSL equation (USEPA, 2020, Section 4.1.3.2) used to derive the Cancer RSLs (please see Section 3.2.2)

Based on USEPA recommendations, the equation used to derive the Cancer RSL for Methylene Chloride (Dichloromethane) is an adjustment of the standard Cancer RSL equation with incorporation of default age-dependent adjustment factors (ADAFs) (USEPA, 2005b, pg. 37; USEPA, 2020, Section 4.1.3.3).

USEPA's IRIS website lists two IURs for Vinyl Chloride, 4.4E-06 per µg/m^3 (which represents the risk resulting from continuous lifetime exposure during adulthood) and 8.8E-06 per µg/m^3 (which represents the risk from continuous lifetime exposure from birth)[15]. The latter IUR is derived by adjusting the former IUR using a two-fold uncertainty factor. Instead of using the more conservative IUR in the standard Cancer RSL equation, the RSL Calculator uses an alternative equation to derive the Cancer RSL (USEPA, 2020, Section 4.1.3.4). The alternate equation is derived based on an example in the *Toxicological Review of Vinyl Chloride* where early life risk is calculated separately from adult risk (both using the less conservative IUR of 4.4E-06 per µg/m^3) and summed to obtain a total cancer risk (USEPA, 2000b, pg. 56). Since early life risk is calculated separately, the total risk accounts for the potential for increased susceptibility to cancer resulting from exposure to Vinyl Chloride in early life.

The Cancer RSL for Trichloroethylene (TCE) is derived using a modified equation (USEPA, 2020, Section 4.1.3.5) that reflects USEPA's conclusion that TCE only acts through a MMOA for kidney cancer and that the default ADAFs suggested in USEPA (2005b) only apply to the "*kidney cancer component of the total risk*" even though the TCE IRIS IUR of 4.1E-06 per µg/m^3 was derived to also be reflective of the potential risk for Non-Hodgkin's lymphoma (NHL) and liver cancer (USEPA, 2011b, pg. 5-156 to 5-157). Though the RSL Calculator's modified equation (USEPA, 2020, Section 4.1.3.5) is not directly from USEPA (2011b), the cancer risk estimate obtained for TCE in this Risk Assessment using the RSL Calculator agrees with the cancer risk estimate obtained using USEPA's ADAF sample calculator[16] cited in USEPA (2011b). Please see Appendix D for the TCE ADAF sample calculator output.

Section 3.3.4 – Xylenes

As explained in the IRIS *Toxicological Review of Xylenes*, the IRIS Xylenes RfC of 1 x 10^{-1} mg/m^3 is intended to be used for Xylenes (CAS # 1330-20-7), which refers to a mixture of the m-, p-, and o- isomers (USEPA, 2003b, pg. 2-3). The RSL Calculator assesses the m-, p-, and o-

[15] Please see: https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=1001

[16] The TCE ADAF sample calculator can be downloaded from here: https://hero.epa.gov/index.cfm/reference/details/reference_id/758648

Xylene isomers separately and uses the Xylenes RfC as a surrogate to derive the Noncancer RSLs for the individual isomers (USEPA, 2020, Section 5.9).

In the ambient air samples used to prepare this Risk Assessment, the laboratory analyzed "Xylenes" as m,p-Xylene (represents a mixture of the m- and p- isomers) and o-Xylene. In accordance with the RSL Calculator's methodology, the o-Xylene Noncancer RSL was used to determine the o-Xylene HQ. Since the RSL Calculator only assesses each of the Xylene isomers separately and does not list m,p-Xylene, m,p-Xylene was entered into the RSL Calculator as m-Xylene so that the m-Xylene Noncancer RSL was used to determine the m,p-Xylene HQ (please see Section 3.2.2 for an explanation into how the RSL Calculator determines the HQ).

Section 3.4 – Risk Characterization

In the risk characterization step, the information from the exposure assessment and the toxicity assessment are integrated to obtain a cancer risk and/or hazard quotient (HQ) for each HAP as well as a cumulative cancer risk and hazard index (HI). USEPA's RSL calculator was used to obtain these estimates by inputting the CA (the toxicity values in Appendix C are automatically populated by the RSL Calculator and are used in deriving the Cancer and Noncancer RSLs). An explanation into the equations that the RSL Calculator uses to obtain risk/hazard estimates was provided in Section 3.2.2. Please see the screenshots in Appendix D for how the HAPs were entered into the RSL Calculator.

Section 3.4.1 – Risk and/or Hazard Estimates

For each HAP, an estimate of the cancer risk and/or hazard quotient (HQ) has been provided in Table 3. Cancer risk for individual air toxics was reported to 1 significant figure, while HQs were reported to 3 or more significant figures so that enough digits can be seen.

The cumulative cancer risk and hazard index (HI) was determined by summing the cancer risk of individual HAPs, which assumes response addition, and summing the HQs, which assumes concentration addition (USEPA, 2000, pg. 76, 125; USEPA, 2004, pg. 13-6, 13-9). Please see Section 4 of this Risk Assessment for more discussion on response and concentration addition. As recommended by USEPA, the cumulative cancer risk and Hazard Index that have been determined in this Risk Assessment have been reported to 1 significant figure (USEPA, 2004, pg. 13-7).

Cumulative Cancer Risk	Hazard Index (HI)
7×10^{-5}	2

A more comprehensive Risk/Hazard Table as well as supporting RSL Calculator outputs can be found in Appendix D.

The cancer risks for individual HAPs range from 3×10^{-8} to 2×10^{-5}. The cumulative cancer risk of 7×10^{-5} could be interpreted to mean that if 100,000 hypothetical residents were exposed to the 10 ambient air HAPs (in the manner that we have presumed as explained in Section 3.2), 7 of those individuals may possibly develop cancer within their lifetime solely because of their exposure to the 10 ambient air HAPs (USEPA, 2004, pg. 13-6). Given that IURs are upper-bound estimates of cancer risk and response addition is a conservative method to assess exposure to chemical mixtures

(see Section 4), the actual number of residents out of 100,000 who actually would develop cancer attributed solely to HAPs exposure could be much lower than 7 or even zero. In implementing air toxics standards under the Clean Air Act, EPA has ordinarily considered cancer risk as high as 1 in 10,000 (10^{-4}) and as low or lower than 1 in 1 million (10^{-6}) to be acceptable (USEPA, 1999, pg. 119). The cancer risk range of 10^{-4} to 10^{-6}, which has also been used by EPA in setting remediation goals under USEPA's Superfund program[17], has been accepted by EPD's Air Protection Branch in making risk management decisions.

Though none of the individual HQs exceed 1 (at 1 significant figure, the TCE HQ of 1.29 is 1), the HI is above 1. An HI of 2 indicates a potential for adverse noncancer effects resulting from exposure to all 10 HAPs (in the way presumed in Section 3.2). However, since all 10 HAPs do not induce the same toxicological effect by the same mode of action, the assumption of concentration additivity used as the basis to calculate the HI does not hold (USEPA, 2000, pg. A-8) and the HI of all HAPs inaccurately describes the potential for adverse noncancer effects. In accordance with EPA guidance, a target-organ (or effect)-specific-hazard index (TOSHI) for each target organ/toxicological effect was developed (USEPA, 2004, pg. 13-10). As all TOSHIs are below 1, exposure to HAPs (in the way presumed in Section 3.2) is not likely to result in noncancer effects and noncancer effects are not of concern.

Target Organ or Toxicological Effect	TOSHI (reported to 1 significant figure)
Immunological	1
Reproductive	0.5
Neurological	0.5
Liver	0.04

Please see Appendix E for more information on how the TOSHIs were derived.

[17] Please see 40 C.F.R § 300.430(e)(2)(i)(A)(2) (2019)

Table 3: Cancer Risk and Noncancer Hazard Quotients for Forsyth County. For more detailed risk/hazard tables, please see Appendix D

Chemical	CAS Number	Cancer Risk	Noncancer Hazard Quotient (HQ)
Benzene	71-43-2	5E-06	0.057
Butadiene, 1,3-	106-99-0	1E-05	0.532
Chloroform	67-66-3	2E-05	0.024
Dichloroethane, 1,2-	107-06-2	2E-05	0.277
Hexane	110-54-3	-	0.002
Methylene Chloride	75-09-2	3E-08	0.006
Toluene	108-88-3	-	0.0004
Trichloroethylene (TCE)	79-01-6	6E-06	1.29
Vinyl Chloride	75-01-4	8E-06	0.012
Xylene, m,p- (entered into the RSL Calculator as Xylene, m-)	108-38-3 (m-Xylene CAS Number)	-	0.163
Xylene, o-	95-47-6	-	0.046
Cumulative Cancer Risk		**7E-05**	
Hazard Index (HI)			**2**
Immunological TOSHI			1
Reproductive TOSHI			0.5
Neurological TOSHI			0.5
Liver TOSHI			0.04

Section 3.5 – Limitations of this Risk Assessment

It is important to highlight the limitations as to the information that can be obtained from the risk and/or hazard estimates that have been provided. It is important to understand that these estimates:

- are conservative estimates that are representative of risk/hazard to a hypothetical resident inhaling a concentration of HAPs at the Station estimated using a high-end exposure estimate. Deriving a conservative estimate ensures that a risk management decision would be protective of individuals who may be exposed to ambient air for less time.
- only reflect the 10 HAPs analyzed and do not include potential risks or hazards from inhaling NMOC, $PM_{2.5}$, or any other air toxic that was not analyzed.
- represent an individual risk and/or hazard but not necessarily the risk and/or hazard to a specific individual.
- cannot determine if an individual diagnosed with cancer or a noncarcinogenic disorder developed illness due to inhaling ambient air within the vicinity of the Station.
- cannot be used to estimate potential risks and/or hazards at any other location.
- do not represent risks/hazards from generally inhaling ambient air chemicals.
- cannot necessarily attribute the ambient air concentrations measured at the Station in whole or part to EPL. The source of the HAPs in ambient air are "*a combination of background concentrations and the same chemical released from possibly multiple sources*" (USEPA, 2004, pg. 10-37).

Section 4 – Uncertainty Section

An integral part of any risk assessment is the uncertainty section, where "*major uncertainties associated with determining the nature and extent of the risk are identified and discussed*" (USEPA, 2004, pg. 13-1). Uncertainties are inherent to all risk assessments due to the procedures used to obtain risk and/or hazard estimates. The purpose of this section is to discuss specific uncertainties so that the results of the risk assessment can be properly understood and utilized.

Section 4.1 – Scope

Since this Risk Assessment only covers 10 HAPs selected for monitoring at the Station, it is unknown how the cumulative cancer risk or hazard index would be affected if additional air toxics were monitored at the Station. Thus, the risk and/or hazard estimates provided in Section 3 should only be interpreted to be representative of the 10 HAPs as measured at the Station and not for any other air toxics.

Section 4.2 – Representativeness

Ambient air monitoring "*only provides estimates of concentrations at the point at which samples are taken, and it is often difficult to clearly define the spatial coverage that those measured concentrations represent"* (USEPA, 2004, pg. 10-7). The true ambient air concentrations of a HAP can vary even near the Station due to various factors, including:

- meteorological factors, such as wind speed and direction and ambient air temperature
- physical factors, such as buildings/structures or variability in terrain elevation
- chemical transformation of chemicals which may attenuate or increase the concentrations of air pollutants

Since ambient air monitoring data cannot adequately capture the variability of ambient air concentrations near an air monitor, the CA (and thus the EC) is a high-end exposure estimate. Realistically, a resident would possibly be exposed to ambient air concentrations at levels far less than the EC.

Section 4.3 – Only Inhalation Exposure Route is Assessed

Since only ambient air monitoring data is available, only the inhalation exposure route has been assessed in this Risk Assessment. As previously mentioned, it is possible for air toxics to deposit onto soil, water bodies, and other surfaces and for individuals to encounter these chemicals. There could be risks/hazards associated with other routes of exposure that are not quantifiable in this risk assessment. Ecological risk has also not been assessed as part of this Risk Assessment.

Section 4.4 – Toxicity Values

There are several uncertainties involved in the use of toxicity values in this Risk Assessment that have been pointed out in separate paragraphs below.

Toxicity values are derived based on an analysis of the available human and animal studies for a particular HAP. Thus, the toxicity values for different HAPs differ in quality in terms of the scientific literature that lends support to and/or forms the basis for the toxicity value. To provide quantitative risk estimates, a consistent process as outlined in USEPA (2003a) is used in

selecting the toxicity values and treating all toxicity values used in this Risk Assessment as equal in quality. The actual risk/hazard for a particular HAP could be different if there was more evidence and/or a higher quality of evidence to derive that HAP's toxicity value. However, risk and/or hazard estimates provided for individual HAPs are likely overestimations due to the conservative methodology used in deriving toxicity values.

According to the Weight of Evidence description provided in Appendix C, EPA's IRIS determined that there is "*inadequate information to assess carcinogenic potential"* for Hexane, Toluene, m,p-Xylene, and o-Xylene. Thus, a cancer risk was not obtained using the RSL Calculator for any of these HAPs. It is possible that these HAPs may be carcinogenic and pose a cancer risk, but the evidence was deemed by EPA toxicologists to not be sufficient to make a definitive determination. If these HAPs are carcinogenic, the cumulative cancer risk may be underestimated but it is not known by how much.

For Benzene, the IRIS database lists an IUR of 2.2 x 10^{-6} (per 1 µg/m^3)[18]. However, documentation on the IRIS database website indicates EPA's determination that "*the choice of cancer unit risk estimates narrows to a range between 7.1 x 10^{-3} and 2.5 x 10^{-2} at 1 ppm (2.2 x 10^{-6} to 7.8 x 10^{-6} at 1 µg/m^3 of benzene in air)*"[19] with 7.8 x 10^{-6} per µg/m^3 representing the highest risk number within the range. As further indicated by EPA, all IUR estimates within this range are scientifically plausible[20]. The highest IUR of 7.8 x 10^{-6} was used to produce the Benzene cancer risk in this Risk Assessment since this is the most conservative value and is the value used in the RSL Calculator to derive the Benzene Cancer RSL (USEPA, 2020, Frequent Question #35). The individual cancer risk for Benzene and the cumulative cancer risk are within the EPD Air Protection Branch acceptable risk range, which suggests that even the use of the lowest IUR would not change the conclusion of this Risk Assessment.

In this Risk Assessment, the Xylenes RfC was used as a surrogate toxicity value for each of the individual m-, p-, and o- isomers and m,p-Xylene was assessed as m-Xylene in the RSL Calculator. After further review into the IRIS toxicity assessment for Xylenes, it is noted that the critical animal study that serves as the basis for the IRIS Xylenes RfC only exposed test rats to m-Xylene (USEPA, 2003b, pg. 53). Though it is not definitively clear whether m,p-Xylene and o-Xylene are toxicologically similar to m-Xylene, EPA cited a study which found that the "*potencies of individual xylene isomers were similar in affecting neurobehavior, as shown in a study of rats following acute exposures*" (USEPA, 2003b, pg. 66). Since the critical study that forms the basis for the Xylenes RfC found neurobehavioral effects due to exposure ("*Impaired motor coordination (decreased rotarod performance)*"), the use of the Xylenes RfC as a surrogate was deemed acceptable for this Risk Assessment even though there is uncertainty in the use of this value.

[18] Please see: https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=276
[19] Please see page 34 of: https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0276_summary.pdf#nameddest=cancerinhal
[20] Ibid, pg. 35

Section 4.5 – Response and Concentration Addition

The cumulative cancer risk is derived assuming that the individual HAP cancer risks can be added since it is assumed that each carcinogenic HAP acts toxicologically independent of the other at low exposure levels (relative to exposure levels measured in scientific studies) so that the body's response to a particular HAP is not influenced by exposure to the other HAPs (USEPA, 2000a, pg. 12, 71, 119). Termed response addition, this process of aggregating the cancer risk estimates of individual carcinogens has been established in EPA guidance as a method to obtain a cumulative cancer risk estimate that is not "*overly conservative"* (USEPA, 2000a, pg. 125; USEPA, 2004, pg. 13-6). Toxicological interactions between multiple carcinogens may result in greater or lesser risk for cancer than suggested by the cumulative cancer risk estimate (USEPA, 2000, pg. 127). One study cited by EPA determined that response addition produces an "*improbable, but not misleading*" estimate of cumulative cancer risk as the number of chemicals whose risks are summed together increase (USEPA, 2000a, pg. 126). However, given EPA's general acceptance and use of response addition and the lack of detailed, definitive information on possible interactions between the HAPs measured at the Station, the cumulative cancer risk provided in this Risk Assessment could be considered to provide a high-end risk estimate which even if not accurate can assist in making a risk management decision considering various data uncertainties.

Based on concentration addition, the HI is derived by summing the HQs determined for individual noncarcinogenic HAPs. (USEPA, 2004, pg. 13-9). This assumes that each noncancer HAP behaves the same (same/similar toxicokinetics) and induces the same/similar toxicological effects, which EPA has determined can be relaxed to acting on the same target organ (USEPA, 2000a, pg. 28, 80). Since all HAPs do not induce the same toxic effect and/or act on the same organ, the HI determined in this Risk Assessment for all 10 HAPs does not fit the assumptions underlying concentration addition. Thus, TOSHIs were developed for each target organ/toxicological effect and all TOSHIs were either at or below 1, suggesting that there is not an unacceptable noncancer hazard. However, there are various assumptions that were made in order to determine the TOSHIs. For more information, please see Appendix E.

Section 4.6 – Using and MDC or SRLs as an Estimate of the CA

Except for Benzene and Toluene, the MDC or highest SRL was used to estimate the CA that was ultimately used in deriving the risk and/or hazard estimates. For most HAPs except Benzene and Toluene, there was not an appropriate dataset that could be used to derive 95% UCLs which (compared to MDCs or SRLs) are a more refined high-end exposure estimate representative of RME conditions. The MDC used to estimate the CA for both m,p-Xylene and o-Xylene was based on a single ambient air sample collected on 4/15/20 and may overestimate the EC.

The other HAPs were not detected in any of the ambient air samples collected. Thus, the respective HAP's highest SRL was used as an estimate of the CA. It is important to point out that the SRL is a value set by the analytical laboratory and represents the concentration at or above which the laboratory will report a value for a particular HAP in a laboratory analytical report. Though the concentrations for nondetect HAPs are reported as zero, the ambient air concentrations of these HAPs are uncertain but could be lower than the SRL. Assessing the risk/hazard at the SRL ensures that risk/hazard is not underestimated given the uncertainty in an appropriate high-end exposure estimate for nondetect HAPs. Since the estimates presented in

Section 3.4.1 show that the cancer risk and noncancer hazard for individual nondetect HAPs are not of concern even at the SRL, it is evident that exposure to these HAPs at ambient air concentrations lower than the SRL would likely not result in deleterious noncancer effects and possibly result in a zero to very small number of cancer cases.

Section 5 – Conclusion

This Risk Assessment was prepared consistent with relevant, publicly available USEPA risk assessment guidance and has strived to properly represent the validated air monitoring results from the Station while providing risk and or hazard estimates that are derived in a public health conservative manner. The estimates derived in this Risk Assessment could be said to be representative of the risk and hazard to a hypothetical resident residing near the Station (technically at the Station) for a longer than average length of time and inhaling HAPs present in ambient air at concentrations at the upper range of plausible air toxics concentrations (a high end exposure estimate). The purpose behind deriving risk/hazard estimates in this conservative manner is to be consistent with EPA guidance and to ensure that any risk management decision made based on these estimates would be protective of individuals who may be exposed to lower concentrations of HAPs measured at the Station.

The individual cancer risk or each HAP as well as the cumulative cancer risk estimate do not exceed 1 in 10,000 (10^{-4}) and are at levels considered acceptable to both EPA and EPD from a risk management perspective. Though this Risk Assessment estimates that *theoretically* about 7 out of 100,000 residents could develop cancer solely because of exposure to HAPs present in ambient air within the vicinity of the Station, in actuality the number of people could be much less or even zero since the cumulative cancer risk was derived based on public health conservative inputs and assumptions. None of the TOSHIs exceed 1, indicating that there is not a potential for adverse noncancer effects because of exposure to ambient air HAPs measured at the Station.

Based on the 1st 12 months of measured ambient air HAPs concentrations at the Station and the process used in preparing this Risk Assessment, it is reasonable to conclude that the 10 HAPs in ambient air do not present a long-term danger to the vast majority of Forsyth County residents who live near EPL. However, there are uncertainties involving the dataset and the parameters selected to prepare this Risk Assessment and those uncertainties should be kept in mind when interpreting the findings. The uncertainties have been discussed in Section 4. It is also important that this Risk Assessment be evaluated in context with other pieces of information (regulatory policies, social values, economics, etc.) when making a risk management decision(s) and should not be the sole driver for making decisions on how to reduce concentrations of HAPs to health protective levels.

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Appendix A
Original and Organized Data Files

Please see the PDF file attachments (paper-clip icon in Adobe Acrobat/Reader) for .xls (Microsoft Excel) versions of the Original and Organized datafiles.

List of Files Included in Appendix A

- A-Original Dataset - Forsyth VOC 2020 Ver.(03.15.2021).xls
    - This file is the original dataset with sample results for all 10 HAPs, collocated HAPs samples, and NMOC.

- B-Data Converted from ppbv to ugm3.xls (Organized datafile)
    - In this file which only contains sample results for the 10 HAPs (without collocated data), sample results were organized by HAP were converted from ppb (v/v) to $\mu g/m^3$. Data were also coded with "1" or "0" for entry into ProUCL.

Appendix B

ProUCL Inputs and Outputs

Please see the PDF file Attachments (paper clip icon) for Excel (.xlsx) versions of the ProUCL inputs and outputs.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	Ethylene_Di	PPB	#########	0	200208-5438		2, ND	0.5	0.5	98.959	2.0237014	0
3	Forsyth Cou	Ethylene_Di	PPB	#########	0	200242-5592		2, ND	0.5	0.5	98.959	2.0237014	0
4	Forsyth Cou	Ethylene_Di	PPB	#########	0	200274-5709		2, ND	0.5	0.5	98.959	2.0237014	0
5	Forsyth Cou	Ethylene_Di	PPB	#########	0	200297-5802		2, ND	0.5	0.5	98.959	2.0237014	0
6	Forsyth Cou	Ethylene_Di	PPB	#########	0	200322-5892		2, ND	0.5	0.5	98.959	2.0237014	0
7	Forsyth Cou	Ethylene_Di	PPB	#########	0	200361-6162		2, ND	0.5	0.5	98.959	2.0237014	0
8	Forsyth Cou	Ethylene_Di	PPB	#########	0	200420-6499		2, ND	0.5	0.5	98.959	2.0237014	0
9	Forsyth Cou	Ethylene_Di	PPB	#########	0	200454-6646		2, ND	0.5	0.5	98.959	2.0237014	0
10	Forsyth Cou	Ethylene_Di	PPB	#########	0	200480-6791		2, ND	0.5	0.5	98.959	2.0237014	0
11	Forsyth Cou	Ethylene_Di	PPB	#########	0	200498-6913		2, ND	0.5	0.5	98.959	2.0237014	0
12	Forsyth Cou	Ethylene_Di	PPB	#########	0	200515-6984		2, ND	0.5	0.5	98.959	2.0237014	0
13	Forsyth Cou	Ethylene_Di	PPB	#########	0	200584-7724		2, ND	0.5	0.5	98.959	2.0237014	0
14	Forsyth Cou	Ethylene_Di	PPB	#########	0	200637-7423		2, ND	0.5	0.5	98.959	2.0237014	0
15	Forsyth Cou	Ethylene_Di	PPB	#########	0	200670-7530		2, ND	0.5	0.5	98.959	2.0237014	0
16	Forsyth Cou	Ethylene_Di	PPB	#########	0	200690-7588		2, ND	0.5	0.5	98.959	2.0237014	0
17	Forsyth Cou	Ethylene_Di	PPB	#########	0	200746-7832		2, ND	0.5	0.5	98.959	2.0237014	0
18	Forsyth Cou	Ethylene_Di	PPB	#########	0	200775-7895		2, ND	0.5	0.5	98.959	2.0237014	0
19	Forsyth Cou	Ethylene_Di	PPB	#########	0	200809-8075		2, ND	0.5	0.5	98.959	2.0237014	0
20	Forsyth Cou	Ethylene_Di	PPB	#########	0	200885-8392		2, ND	0.5	0.5	98.959	2.0237014	0
21	Forsyth Cou	Ethylene_Di	PPB	#########	0	200886-8393		2, ND	0.5	0.5	98.959	2.0237014	0
22	Forsyth Cou	Ethylene_Di	PPB	#########	0	200945-8627		2, ND	0.5	0.5	98.959	2.0237014	0
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24	Forsyth Cou	Ethylene_Di	PPB	#########	0	201028-9001		2, ND	0.5	0.5	98.959	2.0237014	0
25	Forsyth Cou	Ethylene_Di	PPB	#########	0	201068-9173		2, ND	0.5	0.5	98.959	2.0237014	0
26	Forsyth Cou	Ethylene_Di	PPB	#########	0	201122-9521		2, ND	0.5	0.5	98.959	2.0237014	0
27	Forsyth Cou	Ethylene_Di	PPB	#########	0	201147-9624		2, ND	0.5	0.5	98.959	2.0237014	0
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31	Forsyth Cou	Ethylene_Di	PPB	#########	0	201342-10611		2, ND	0.5	0.5	98.959	2.0237014	0
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33	Forsyth Cou	Ethylene_Di	PPB	#########	0	201437-11097		2, ND	0.5	0.5	98.959	2.0237014	0
34	Forsyth Cou	Ethylene_Di	PPB	#########	0	201449-11161		2, ND	0.5	0.5	98.959	2.0237014	0
35	Forsyth Cou	Ethylene_Di	PPB	#########	0	201540-11688		2, ND	0.5	0.5	98.959	2.0237014	0
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47	Forsyth Cou	Ethylene_Di	PPB	#########	0	201981-13938		2, ND	0.5	0.5	98.959	2.0237014	0
48	Forsyth Cou	Ethylene_Di	PPB	#########	0	202020-14133		2, ND	0.5	0.5	98.959	2.0237014	0
49	Forsyth Cou	Ethylene_Di	PPB	#########	0	202085-14541		2, ND	0.5	0.5	98.959	2.0237014	0
50	Forsyth Cou	Ethylene_Di	PPB	#########	0	202084-14540		2, ND	0.5	0.5	98.959	2.0237014	0
51	Forsyth Cou	Ethylene_Di	PPB	#########	0	202147-14860		2, ND	0.5	0.5	98.959	2.0237014	0
52	Forsyth Cou	Ethylene_Di	PPB	#########	0	202197-15081		2, ND	0.5	0.5	98.959	2.0237014	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	Ethylene_Di	PPB	#########	0	202196-15080		2, ND	0.5	0.5	98.959	2.0237014	0
54	Forsyth Cou	Ethylene_Di	PPB	#########	0	202248-15401		2, ND	0.5	0.5	98.959	2.0237014	0
55	Forsyth Cou	Ethylene_Di	PPB	#########	0	202244-15384		2, ND	0.5	0.5	98.959	2.0237014	0
56	Forsyth Cou	Ethylene_Di	PPB	#########	0	210001-15672		2, ND	0.5	0.5	98.959	2.0237014	0
57	Forsyth Cou	Ethylene_Di	PPB	#########	0	210045-15889		2, ND	0.5	0.5	98.959	2.0237014	0
58	Forsyth Cou	Ethylene_Di	PPB	#########	0	210044-15888		2, ND	0.5	0.5	98.959	2.0237014	0
59	Forsyth Cou	Ethylene_Di	PPB	#########	0	210075-15972		2, ND	0.5	0.5	98.959	2.0237014	0

	N	O	P
1		12dce	d_12dce
2		2.0237014	0
3		2.0237014	0
4		2.0237014	0
5		2.0237014	0
6		2.0237014	0
7		2.0237014	0
8		2.0237014	0
9		2.0237014	0
10		2.0237014	0
11		2.0237014	0
12		2.0237014	0
13		2.0237014	0
14		2.0237014	0
15		2.0237014	0
16		2.0237014	0
17		2.0237014	0
18		2.0237014	0
19		2.0237014	0
20		2.0237014	0
21		2.0237014	0
22		2.0237014	0
23		2.0237014	0
24		2.0237014	0
25		2.0237014	0
26		2.0237014	0
27		2.0237014	0
28		2.0237014	0
29		2.0237014	0
30		2.0237014	0
31		2.0237014	0
32		2.0237014	0
33		2.0237014	0
34		2.0237014	0
35		2.0237014	0
36		2.0237014	0
37		2.0237014	0
38		2.0237014	0
39		2.0237014	0
40		2.0237014	0
41		2.0237014	0
42		2.0237014	0
43		2.0237014	0
44		2.0237014	0
45		2.0237014	0
46		2.0237014	0
47		2.0237014	0
48		2.0237014	0
49		2.0237014	0
50		2.0237014	0
51		2.0237014	0
52		2.0237014	0

	N	O	P
53		2.0237014	0
54		2.0237014	0
55		2.0237014	0
56		2.0237014	0
57		2.0237014	0
58		2.0237014	0
59		2.0237014	0

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3				User Selected Options								
4				Date/Time of Computation	ProUCL 5.13/19/2021 1:07:17 PM							
5				From File	C-ProUCL Input File_d.xls							
6				Full Precision	OFF							
7				Confidence Coefficient	95%							
8				Number of Bootstrap Operations	2000							
9												
10	**12dce**											
11												
12	**General Statistics**											
13						Total Number of Observations	58			Number of Distinct Observations	1		
14						Number of Detects	0			Number of Non-Detects	58	
15						Number of Distinct Detects	0			Number of Distinct Non-Detects	1	
16												
17	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
18	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
19	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
20												
21	**The data set for variable 12dce was not processed!**											
22												
23												

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	1,3-Butadier	PPB	#########	0	200208-5438		2, ND	0.5	0.5	54.0904	1.1061431	0
3	Forsyth Cou	1,3-Butadier	PPB	#########	0	200242-5592		2, ND	0.5	0.5	54.0904	1.1061431	0
4	Forsyth Cou	1,3-Butadier	PPB	#########	0	200274-5709		2, ND	0.5	0.5	54.0904	1.1061431	0
5	Forsyth Cou	1,3-Butadier	PPB	#########	0	200297-5802		2, ND	0.5	0.5	54.0904	1.1061431	0
6	Forsyth Cou	1,3-Butadier	PPB	#########	0	200322-5892		2, ND	0.5	0.5	54.0904	1.1061431	0
7	Forsyth Cou	1,3-Butadier	PPB	#########	0	200361-6162		2, ND	0.5	0.5	54.0904	1.1061431	0
8	Forsyth Cou	1,3-Butadier	PPB	#########	0	200420-6499		2, ND	0.5	0.5	54.0904	1.1061431	0
9	Forsyth Cou	1,3-Butadier	PPB	#########	0	200454-6646		2, ND	0.5	0.5	54.0904	1.1061431	0
10	Forsyth Cou	1,3-Butadier	PPB	#########	0	200480-6791		2, ND	0.5	0.5	54.0904	1.1061431	0
11	Forsyth Cou	1,3-Butadier	PPB	#########	0	200498-6913		2, ND	0.5	0.5	54.0904	1.1061431	0
12	Forsyth Cou	1,3-Butadier	PPB	#########	0	200515-6984		2, ND	0.5	0.5	54.0904	1.1061431	0
13	Forsyth Cou	1,3-Butadier	PPB	#########	0	200584-7724		2, ND	0.5	0.5	54.0904	1.1061431	0
14	Forsyth Cou	1,3-Butadier	PPB	#########	0	200637-7423		2, ND	0.5	0.5	54.0904	1.1061431	0
15	Forsyth Cou	1,3-Butadier	PPB	#########	0	200670-7530		2, ND	0.5	0.5	54.0904	1.1061431	0
16	Forsyth Cou	1,3-Butadier	PPB	#########	0	200690-7588		2, ND	0.5	0.5	54.0904	1.1061431	0
17	Forsyth Cou	1,3-Butadier	PPB	#########	0	200746-7832		2, ND	0.5	0.5	54.0904	1.1061431	0
18	Forsyth Cou	1,3-Butadier	PPB	#########	0	200775-7895		2, ND	0.5	0.5	54.0904	1.1061431	0
19	Forsyth Cou	1,3-Butadier	PPB	#########	0	200809-8075		2, ND	0.5	0.5	54.0904	1.1061431	0
20	Forsyth Cou	1,3-Butadier	PPB	#########	0	200885-8392		2, ND	0.5	0.5	54.0904	1.1061431	0
21	Forsyth Cou	1,3-Butadier	PPB	#########	0	200886-8393		2, ND	0.5	0.5	54.0904	1.1061431	0
22	Forsyth Cou	1,3-Butadier	PPB	#########	0	200945-8627		2, ND	0.5	0.5	54.0904	1.1061431	0
23	Forsyth Cou	1,3-Butadier	PPB	#########	0	200977-8786		2, ND	0.5	0.5	54.0904	1.1061431	0
24	Forsyth Cou	1,3-Butadier	PPB	#########	0	201028-9001		2, ND	0.5	0.5	54.0904	1.1061431	0
25	Forsyth Cou	1,3-Butadier	PPB	#########	0	201068-9173		2, ND	0.5	0.5	54.0904	1.1061431	0
26	Forsyth Cou	1,3-Butadier	PPB	#########	0	201122-9521		2, ND	0.5	0.5	54.0904	1.1061431	0
27	Forsyth Cou	1,3-Butadier	PPB	#########	0	201147-9624		2, ND	0.5	0.5	54.0904	1.1061431	0
28	Forsyth Cou	1,3-Butadier	PPB	#########	0	201175-9779		2, ND	0.5	0.5	54.0904	1.1061431	0
29	Forsyth Cou	1,3-Butadier	PPB	#########	0	201213-9935		2, ND	0.5	0.5	54.0904	1.1061431	0
30	Forsyth Cou	1,3-Butadier	PPB	#########	0	201267-10204		2, ND	0.5	0.5	54.0904	1.1061431	0
31	Forsyth Cou	1,3-Butadier	PPB	#########	0	201342-10611		2, ND	0.5	0.5	54.0904	1.1061431	0
32	Forsyth Cou	1,3-Butadier	PPB	#########	0	201346-10634		2, ND	0.5	0.5	54.0904	1.1061431	0
33	Forsyth Cou	1,3-Butadier	PPB	#########	0	201437-11097		2, ND	0.5	0.5	54.0904	1.1061431	0
34	Forsyth Cou	1,3-Butadier	PPB	#########	0	201449-11161		2, ND	0.5	0.5	54.0904	1.1061431	0
35	Forsyth Cou	1,3-Butadier	PPB	#########	0	201540-11688		2, ND	0.5	0.5	54.0904	1.1061431	0
36	Forsyth Cou	1,3-Butadier	PPB	#########	0	201539-11687		2, ND	0.5	0.5	54.0904	1.1061431	0
37	Forsyth Cou	1,3-Butadier	PPB	#########	0	201616-12153		2, ND	0.5	0.5	54.0904	1.1061431	0
38	Forsyth Cou	1,3-Butadier	PPB	#########	0	201618-12179		2, ND	0.5	0.5	54.0904	1.1061431	0
39	Forsyth Cou	1,3-Butadier	PPB	#########	0	201661-12403		2, ND	0.5	0.5	54.0904	1.1061431	0
40	Forsyth Cou	1,3-Butadier	PPB	#########	0	201689-12518		2, ND	0.5	0.5	54.0904	1.1061431	0
41	Forsyth Cou	1,3-Butadier	PPB	#########	0	201809-12973		2, ND	0.5	0.5	54.0904	1.1061431	0
42	Forsyth Cou	1,3-Butadier	PPB	#########	0	201808-12972		2, ND	0.5	0.5	54.0904	1.1061431	0
43	Forsyth Cou	1,3-Butadier	PPB	#########	0	201838-13178		2, ND	0.5	0.5	54.0904	1.1061431	0
44	Forsyth Cou	1,3-Butadier	PPB	#########	0	201836-13110		2, ND	0.5	0.5	54.0904	1.1061431	0
45	Forsyth Cou	1,3-Butadier	PPB	#########	0	201882-13412		2, ND	0.5	0.5	54.0904	1.1061431	0
46	Forsyth Cou	1,3-Butadier	PPB	#########	0	201919-13594		2, ND	0.5	0.5	54.0904	1.1061431	0
47	Forsyth Cou	1,3-Butadier	PPB	#########	0	201981-13938		2, ND	0.5	0.5	54.0904	1.1061431	0
48	Forsyth Cou	1,3-Butadier	PPB	#########	0	202020-14133		2, ND	0.5	0.5	54.0904	1.1061431	0
49	Forsyth Cou	1,3-Butadier	PPB	#########	0	202085-14541		2, ND	0.5	0.5	54.0904	1.1061431	0
50	Forsyth Cou	1,3-Butadier	PPB	#########	0	202084-14540		2, ND	0.5	0.5	54.0904	1.1061431	0
51	Forsyth Cou	1,3-Butadier	PPB	#########	0	202147-14860		2, ND	0.5	0.5	54.0904	1.1061431	0
52	Forsyth Cou	1,3-Butadier	PPB	#########	0	202197-15081		2, ND	0.5	0.5	54.0904	1.1061431	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	1,3-Butadien	PPB	#########	0	202196-15080		2, ND	0.5	0.5	54.0904	1.1061431	0
54	Forsyth Cou	1,3-Butadien	PPB	#########	0	202248-15401		2, ND	0.5	0.5	54.0904	1.1061431	0
55	Forsyth Cou	1,3-Butadien	PPB	#########	0	202244-15384		2, ND	0.5	0.5	54.0904	1.1061431	0
56	Forsyth Cou	1,3-Butadien	PPB	#########	0	210001-15672		2, ND	0.5	0.5	54.0904	1.1061431	0
57	Forsyth Cou	1,3-Butadien	PPB	#########	0	210045-15889		2, ND	0.5	0.5	54.0904	1.1061431	0
58	Forsyth Cou	1,3-Butadien	PPB	#########	0	210044-15888		2, ND	0.5	0.5	54.0904	1.1061431	0
59	Forsyth Cou	1,3-Butadien	PPB	#########	0	210075-15972		2, ND	0.5	0.5	54.0904	1.1061431	0

	N	O	P	Q
1		13butadiene	d_13butadiene	
2		1.1061431	0	
3		1.1061431	0	
4		1.1061431	0	
5		1.1061431	0	
6		1.1061431	0	
7		1.1061431	0	
8		1.1061431	0	
9		1.1061431	0	
10		1.1061431	0	
11		1.1061431	0	
12		1.1061431	0	
13		1.1061431	0	
14		1.1061431	0	
15		1.1061431	0	
16		1.1061431	0	
17		1.1061431	0	
18		1.1061431	0	
19		1.1061431	0	
20		1.1061431	0	
21		1.1061431	0	
22		1.1061431	0	
23		1.1061431	0	
24		1.1061431	0	
25		1.1061431	0	
26		1.1061431	0	
27		1.1061431	0	
28		1.1061431	0	
29		1.1061431	0	
30		1.1061431	0	
31		1.1061431	0	
32		1.1061431	0	
33		1.1061431	0	
34		1.1061431	0	
35		1.1061431	0	
36		1.1061431	0	
37		1.1061431	0	
38		1.1061431	0	
39		1.1061431	0	
40		1.1061431	0	
41		1.1061431	0	
42		1.1061431	0	
43		1.1061431	0	
44		1.1061431	0	
45		1.1061431	0	
46		1.1061431	0	
47		1.1061431	0	
48		1.1061431	0	
49		1.1061431	0	
50		1.1061431	0	
51		1.1061431	0	
52		1.1061431	0	

	N	O	P	Q
53		1.1061431	0	
54		1.1061431	0	
55		1.1061431	0	
56		1.1061431	0	
57		1.1061431	0	
58		1.1061431	0	
59		1.1061431	0	

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3				User Selected Options								
4				Date/Time of Computation	ProUCL 5.13/19/2021 12:01:28 PM							
5				From File	C-ProUCL Input File.xls							
6				Full Precision	OFF							
7				Confidence Coefficient	95%							
8				Number of Bootstrap Operations	2000							
9												
10	**13butadiene**											
11												
12	**General Statistics**											
13						Total Number of Observations	58			Number of Distinct Observations	1		
14						Number of Detects	0			Number of Non-Detects	58	
15						Number of Distinct Detects	0			Number of Distinct Non-Detects	1	
16												
17	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
18	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
19	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
20												
21	**The data set for variable 13butadiene was not processed!**											
22												
23												

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	Benzene_1	PPB	#########	0	200208-5438		2, ND	0.5	0.5	78.1118	1.5973783	0
3	Forsyth Cou	Benzene_1	PPB	#########	0	200242-5592		2, ND	0.5	0.5	78.1118	1.5973783	0
4	Forsyth Cou	Benzene_1	PPB	#########	0	200274-5709		2, ND	0.5	0.5	78.1118	1.5973783	0
5	Forsyth Cou	Benzene_1	PPB	#########	0	200297-5802		2, ND	0.5	0.5	78.1118	1.5973783	0
6	Forsyth Cou	Benzene_1	PPB	#########	0	200322-5892		2, ND	0.5	0.5	78.1118	1.5973783	0
7	Forsyth Cou	Benzene_1	PPB	#########	0	200361-6162		2, ND	0.5	0.5	78.1118	1.5973783	0
8	Forsyth Cou	Benzene_1	PPB	#########	0	200420-6499		2, ND	0.5	0.5	78.1118	1.5973783	0
9	Forsyth Cou	Benzene_1	PPB	#########	0	200454-6646		2, ND	0.5	0.5	78.1118	1.5973783	0
10	Forsyth Cou	Benzene_1	PPB	#########	0	200480-6791		2, ND	0.5	0.5	78.1118	1.5973783	0
11	Forsyth Cou	Benzene_1	PPB	#########	0	200498-6913		2, ND	0.5	0.5	78.1118	1.5973783	0
12	Forsyth Cou	Benzene_1	PPB	#########	0	200515-6984		2, ND	0.5	0.5	78.1118	1.5973783	0
13	Forsyth Cou	Benzene_1	PPB	#########	0	200584-7724		2, ND	0.5	0.5	78.1118	1.5973783	0
14	Forsyth Cou	Benzene_1	PPB	#########	0	200637-7423		2, ND	0.5	0.5	78.1118	1.5973783	0
15	Forsyth Cou	Benzene_1	PPB	#########	0	200670-7530		2, ND	0.5	0.5	78.1118	1.5973783	0
16	Forsyth Cou	Benzene_1	PPB	#########	0.6	200690-7588		2	0.5	0.6	78.1118	1.916854	1
17	Forsyth Cou	Benzene_1	PPB	#########	0	200746-7832		2, ND	0.5	0.5	78.1118	1.5973783	0
18	Forsyth Cou	Benzene_1	PPB	#########	0	200775-7895		2, ND	0.5	0.5	78.1118	1.5973783	0
19	Forsyth Cou	Benzene_1	PPB	#########	0	200809-8075		2, ND	0.5	0.5	78.1118	1.5973783	0
20	Forsyth Cou	Benzene_1	PPB	#########	0	200885-8392		2, ND	0.5	0.5	78.1118	1.5973783	0
21	Forsyth Cou	Benzene_1	PPB	#########	0	200886-8393		2, ND	0.5	0.5	78.1118	1.5973783	0
22	Forsyth Cou	Benzene_1	PPB	#########	0	200945-8627		2, ND	0.5	0.5	78.1118	1.5973783	0
23	Forsyth Cou	Benzene_1	PPB	#########	0	200977-8786		2, ND	0.5	0.5	78.1118	1.5973783	0
24	Forsyth Cou	Benzene_1	PPB	#########	0	201028-9001		2, ND	0.5	0.5	78.1118	1.5973783	0
25	Forsyth Cou	Benzene_1	PPB	#########	0.51	201068-9173		2	0.5	0.51	78.1118	1.6293259	1
26	Forsyth Cou	Benzene_1	PPB	#########	0	201122-9521		2, ND	0.5	0.5	78.1118	1.5973783	0
27	Forsyth Cou	Benzene_1	PPB	#########	0	201147-9624		2, ND	0.5	0.5	78.1118	1.5973783	0
28	Forsyth Cou	Benzene_1	PPB	#########	0	201175-9779		2, ND	0.5	0.5	78.1118	1.5973783	0
29	Forsyth Cou	Benzene_1	PPB	#########	0	201213-9935		2, ND	0.5	0.5	78.1118	1.5973783	0
30	Forsyth Cou	Benzene_1	PPB	#########	0	201267-10204		2, ND	0.5	0.5	78.1118	1.5973783	0
31	Forsyth Cou	Benzene_1	PPB	#########	0	201342-10611		2, ND	0.5	0.5	78.1118	1.5973783	0
32	Forsyth Cou	Benzene_1	PPB	#########	0	201346-10634		2, ND	0.5	0.5	78.1118	1.5973783	0
33	Forsyth Cou	Benzene_1	PPB	#########	0	201437-11097		2, ND	0.5	0.5	78.1118	1.5973783	0
34	Forsyth Cou	Benzene_1	PPB	#########	0	201449-11161		2, ND	0.5	0.5	78.1118	1.5973783	0
35	Forsyth Cou	Benzene_1	PPB	#########	0	201540-11688		2, ND	0.5	0.5	78.1118	1.5973783	0
36	Forsyth Cou	Benzene_1	PPB	#########	0	201539-11687		2, ND	0.5	0.5	78.1118	1.5973783	0
37	Forsyth Cou	Benzene_1	PPB	#########	0	201616-12153		2, ND	0.5	0.5	78.1118	1.5973783	0
38	Forsyth Cou	Benzene_1	PPB	#########	0	201618-12179		2, ND	0.5	0.5	78.1118	1.5973783	0
39	Forsyth Cou	Benzene_1	PPB	#########	1.11	201661-12403		2	0.5	1.11	78.1118	3.5461799	1
40	Forsyth Cou	Benzene_1	PPB	#########	0	201689-12518		2, ND	0.5	0.5	78.1118	1.5973783	0
41	Forsyth Cou	Benzene_1	PPB	#########	0	201809-12973		2, ND	0.5	0.5	78.1118	1.5973783	0
42	Forsyth Cou	Benzene_1	PPB	#########	0	201808-12972		2, ND	0.5	0.5	78.1118	1.5973783	0
43	Forsyth Cou	Benzene_1	PPB	#########	0	201838-13178		2, ND	0.5	0.5	78.1118	1.5973783	0
44	Forsyth Cou	Benzene_1	PPB	#########	0	201836-13110		2, ND	0.5	0.5	78.1118	1.5973783	0
45	Forsyth Cou	Benzene_1	PPB	#########	0	201882-13412		2, ND	0.5	0.5	78.1118	1.5973783	0
46	Forsyth Cou	Benzene_1	PPB	#########	0	201919-13594		2, ND	0.5	0.5	78.1118	1.5973783	0
47	Forsyth Cou	Benzene_1	PPB	#########	0	201981-13938		2, ND	0.5	0.5	78.1118	1.5973783	0
48	Forsyth Cou	Benzene_1	PPB	#########	0	202020-14133		2, ND	0.5	0.5	78.1118	1.5973783	0
49	Forsyth Cou	Benzene_1	PPB	#########	0	202085-14541		2, ND	0.5	0.5	78.1118	1.5973783	0
50	Forsyth Cou	Benzene_1	PPB	#########	0	202084-14540		2, ND	0.5	0.5	78.1118	1.5973783	0
51	Forsyth Cou	Benzene_1	PPB	#########	1.18	202147-14860		2	0.5	1.18	78.1118	3.7698128	1
52	Forsyth Cou	Benzene_1	PPB	#########	0	202197-15081		2, ND	0.5	0.5	78.1118	1.5973783	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	Benzene_1	PPB	#########	0	202196-15080		2, ND	0.5	0.5	78.1118	1.5973783	0
54	Forsyth Cou	Benzene_1	PPB	#########	0	202248-15401		2, ND	0.5	0.5	78.1118	1.5973783	0
55	Forsyth Cou	Benzene_1	PPB	#########	0	202244-15384		2, ND	0.5	0.5	78.1118	1.5973783	0
56	Forsyth Cou	Benzene_1	PPB	#########	0	210001-15672		2, ND	0.5	0.5	78.1118	1.5973783	0
57	Forsyth Cou	Benzene_1	PPB	#########	0	210045-15889		2, ND	0.5	0.5	78.1118	1.5973783	0
58	Forsyth Cou	Benzene_1	PPB	#########	0	210044-15888		2, ND	0.5	0.5	78.1118	1.5973783	0
59	Forsyth Cou	Benzene_1	PPB	#########	0	210075-15972		2, ND	0.5	0.5	78.1118	1.5973783	0

	N	O	P
1		benzene	d_benzene
2		1.5973783	0
3		1.5973783	0
4		1.5973783	0
5		1.5973783	0
6		1.5973783	0
7		1.5973783	0
8		1.5973783	0
9		1.5973783	0
10		1.5973783	0
11		1.5973783	0
12		1.5973783	0
13		1.5973783	0
14		1.5973783	0
15		1.5973783	0
16		1.916854	1
17		1.5973783	0
18		1.5973783	0
19		1.5973783	0
20		1.5973783	0
21		1.5973783	0
22		1.5973783	0
23		1.5973783	0
24		1.5973783	0
25		1.6293259	1
26		1.5973783	0
27		1.5973783	0
28		1.5973783	0
29		1.5973783	0
30		1.5973783	0
31		1.5973783	0
32		1.5973783	0
33		1.5973783	0
34		1.5973783	0
35		1.5973783	0
36		1.5973783	0
37		1.5973783	0
38		1.5973783	0
39		3.5461799	1
40		1.5973783	0
41		1.5973783	0
42		1.5973783	0
43		1.5973783	0
44		1.5973783	0
45		1.5973783	0
46		1.5973783	0
47		1.5973783	0
48		1.5973783	0
49		1.5973783	0
50		1.5973783	0
51		3.7698128	1
52		1.5973783	0

	N	O	P
53		1.5973783	0
54		1.5973783	0
55		1.5973783	0
56		1.5973783	0
57		1.5973783	0
58		1.5973783	0
59		1.5973783	0

1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.13/19/2021 12:03:10 PM								
5	From File			C-ProUCL Input File_a.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	**benzene**											
11												
12	**General Statistics**											
13	Total Number of Observations			58			Number of Distinct Observations			5		
14	Number of Detects			4			Number of Non-Detects			54		
15	Number of Distinct Detects			4			Number of Distinct Non-Detects			1		
16	Minimum Detect			1.629			Minimum Non-Detect			1.597		
17	Maximum Detect			3.77			Maximum Non-Detect			1.597		
18	Variance Detects			1.206			Percent Non-Detects			93.1%		
19	Mean Detects			2.716			SD Detects			1.098		
20	Median Detects			2.732			CV Detects			0.404		
21	Skewness Detects			-0.0232			Kurtosis Detects			-5.46		
22	Mean of Logged Detects			0.933			SD of Logged Detects			0.426		
23												
24	**Normal GOF Test on Detects Only**											
25	Shapiro Wilk Test Statistic			0.841			**Shapiro Wilk GOF Test**					
26	5% Shapiro Wilk Critical Value			0.748			Detected Data appear Normal at 5% Significance Level					
27	Lilliefors Test Statistic			0.275			**Lilliefors GOF Test**					
28	5% Lilliefors Critical Value			0.375			Detected Data appear Normal at 5% Significance Level					
29	**Detected Data appear Normal at 5% Significance Level**											
30												
31	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
32	KM Mean			1.674			KM Standard Error of Mean			0.0573		
33	KM SD			0.378			95% KM (BCA) UCL			N/A		
34	95% KM (t) UCL			1.77			95% KM (Percentile Bootstrap) UCL			N/A		
35	95% KM (z) UCL			1.769			95% KM Bootstrap t UCL			N/A		
36	90% KM Chebyshev UCL			1.846			95% KM Chebyshev UCL			1.924		
37	97.5% KM Chebyshev UCL			2.032			99% KM Chebyshev UCL			2.244		
38												
39	**Gamma GOF Tests on Detected Observations Only**											
40	A-D Test Statistic			0.486			**Anderson-Darling GOF Test**					
41	5% A-D Critical Value			0.658			Detected data appear Gamma Distributed at 5% Significance Level					
42	K-S Test Statistic			0.314			**Kolmogorov-Smirnov GOF**					
43	5% K-S Critical Value			0.395			Detected data appear Gamma Distributed at 5% Significance Level					
44	**Detected data appear Gamma Distributed at 5% Significance Level**											
45												
46	**Gamma Statistics on Detected Data Only**											
47	k hat (MLE)			7.732			k star (bias corrected MLE)			2.1		
48	Theta hat (MLE)			0.351			Theta star (bias corrected MLE)			1.293		
49	nu hat (MLE)			61.86			nu star (bias corrected)			16.8		
50	Mean (detects)			2.716								
51												
52	**Gamma ROS Statistics using Imputed Non-Detects**											

53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
56	This is especially true when the sample size is small.											
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
58					Minimum	0.01				Mean	0.225	
59					Maximum	3.77				Median	0.01	
60					SD	0.741				CV	3.293	
61					k hat (MLE)	0.276				k star (bias corrected MLE)	0.273	
62					Theta hat (MLE)	0.815				Theta star (bias corrected MLE)	0.823	
63					nu hat (MLE)	32.04				nu star (bias corrected)	31.72	
64					Adjusted Level of Significance (β)	0.0459						
65					Approximate Chi Square Value (31.72, α)	19.85				Adjusted Chi Square Value (31.72, β)	19.61	
66					95% Gamma Approximate UCL (use when n>=50)	0.36				95% Gamma Adjusted UCL (use when n<50)	N/A	
67												
68	**Estimates of Gamma Parameters using KM Estimates**											
69					Mean (KM)	1.674				SD (KM)	0.378	
70					Variance (KM)	0.143				SE of Mean (KM)	0.0573	
71					k hat (KM)	19.65				k star (KM)	18.65	
72					nu hat (KM)	2280				nu star (KM)	2163	
73					theta hat (KM)	0.0852				theta star (KM)	0.0898	
74					80% gamma percentile (KM)	1.989				90% gamma percentile (KM)	2.187	
75					95% gamma percentile (KM)	2.359				99% gamma percentile (KM)	2.706	
76												
77	**Gamma Kaplan-Meier (KM) Statistics**											
78					Approximate Chi Square Value (N/A, α)	2056				Adjusted Chi Square Value (N/A, β)	2053	
79					95% Gamma Approximate KM-UCL (use when n>=50)	1.762				95% Gamma Adjusted KM-UCL (use when n<50)	1.764	
80												
81	**Lognormal GOF Test on Detected Observations Only**											
82					Shapiro Wilk Test Statistic	0.85				**Shapiro Wilk GOF Test**		
83					5% Shapiro Wilk Critical Value	0.748				Detected Data appear Lognormal at 5% Significance Level		
84					Lilliefors Test Statistic	0.283				**Lilliefors GOF Test**		
85					5% Lilliefors Critical Value	0.375				Detected Data appear Lognormal at 5% Significance Level		
86	**Detected Data appear Lognormal at 5% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89					Mean in Original Scale	0.419				Mean in Log Scale	-1.835	
90					SD in Original Scale	0.731				SD in Log Scale	1.43	
91					95% t UCL (assumes normality of ROS data)	0.579				95% Percentile Bootstrap UCL	0.591	
92					95% BCA Bootstrap UCL	0.64				95% Bootstrap t UCL	0.697	
93					95% H-UCL (Log ROS)	0.79						
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96					KM Mean (logged)	0.5				KM Geo Mean	1.649	
97					KM SD (logged)	0.152				95% Critical H Value (KM-Log)	1.714	
98					KM Standard Error of Mean (logged)	0.0231				95% H-UCL (KM -Log)	1.727	
99					KM SD (logged)	0.152				95% Critical H Value (KM-Log)	1.714	
100					KM Standard Error of Mean (logged)	0.0231						
101												
102	**DL/2 Statistics**											
103	**DL/2 Normal**									**DL/2 Log-Transformed**		
104					Mean in Original Scale	0.931				Mean in Log Scale	-0.145	

	A	B	C	D	E	F	G	H	I	J	K	L
105					SD in Original Scale	0.551				SD in Log Scale		0.312
106					95% t UCL (Assumes normality)	1.052				95% H-Stat UCL		0.974
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Detected Data appear Normal Distributed at 5% Significance Level**											
111												
112	**Suggested UCL to Use**											
113					95% KM (t) UCL	1.77						
114												
115	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
116	Recommendations are based upon data size, data distribution, and skewness.											
117	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
118	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
119												

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	Chloroform_	PPB	#########	0	200208-5438		2, ND	0.5	0.5	119.378	2.4412679	0
3	Forsyth Cou	Chloroform_	PPB	#########	0	200242-5592		2, ND	0.5	0.5	119.378	2.4412679	0
4	Forsyth Cou	Chloroform_	PPB	#########	0	200274-5709		2, ND	0.5	0.5	119.378	2.4412679	0
5	Forsyth Cou	Chloroform_	PPB	#########	0	200297-5802		2, ND	0.5	0.5	119.378	2.4412679	0
6	Forsyth Cou	Chloroform_	PPB	#########	0	200322-5892		2, ND	0.5	0.5	119.378	2.4412679	0
7	Forsyth Cou	Chloroform_	PPB	#########	0	200361-6162		2, ND	0.5	0.5	119.378	2.4412679	0
8	Forsyth Cou	Chloroform_	PPB	#########	0	200420-6499		2, ND	0.5	0.5	119.378	2.4412679	0
9	Forsyth Cou	Chloroform_	PPB	#########	0	200454-6646		2, ND	0.5	0.5	119.378	2.4412679	0
10	Forsyth Cou	Chloroform_	PPB	#########	0	200480-6791		2, ND	0.5	0.5	119.378	2.4412679	0
11	Forsyth Cou	Chloroform_	PPB	#########	0	200498-6913		2, ND	0.5	0.5	119.378	2.4412679	0
12	Forsyth Cou	Chloroform_	PPB	#########	0	200515-6984		2, ND	0.5	0.5	119.378	2.4412679	0
13	Forsyth Cou	Chloroform_	PPB	#########	0	200584-7724		2, ND	0.5	0.5	119.378	2.4412679	0
14	Forsyth Cou	Chloroform_	PPB	#########	0	200637-7423		2, ND	0.5	0.5	119.378	2.4412679	0
15	Forsyth Cou	Chloroform_	PPB	#########	0	200670-7530		2, ND	0.5	0.5	119.378	2.4412679	0
16	Forsyth Cou	Chloroform_	PPB	#########	0	200690-7588		2, ND	0.5	0.5	119.378	2.4412679	0
17	Forsyth Cou	Chloroform_	PPB	#########	0	200746-7832		2, ND	0.5	0.5	119.378	2.4412679	0
18	Forsyth Cou	Chloroform_	PPB	#########	0	200775-7895		2, ND	0.5	0.5	119.378	2.4412679	0
19	Forsyth Cou	Chloroform_	PPB	#########	0	200809-8075		2, ND	0.5	0.5	119.378	2.4412679	0
20	Forsyth Cou	Chloroform_	PPB	#########	0	200885-8392		2, ND	0.5	0.5	119.378	2.4412679	0
21	Forsyth Cou	Chloroform_	PPB	#########	0	200886-8393		2, ND	0.5	0.5	119.378	2.4412679	0
22	Forsyth Cou	Chloroform_	PPB	#########	0	200945-8627		2, ND	0.5	0.5	119.378	2.4412679	0
23	Forsyth Cou	Chloroform_	PPB	#########	0	200977-8786		2, ND	0.5	0.5	119.378	2.4412679	0
24	Forsyth Cou	Chloroform_	PPB	#########	0	201028-9001		2, ND	0.5	0.5	119.378	2.4412679	0
25	Forsyth Cou	Chloroform_	PPB	#########	0	201068-9173		2, ND	0.5	0.5	119.378	2.4412679	0
26	Forsyth Cou	Chloroform_	PPB	#########	0	201122-9521		2, ND	0.5	0.5	119.378	2.4412679	0
27	Forsyth Cou	Chloroform_	PPB	#########	0	201147-9624		2, ND	0.5	0.5	119.378	2.4412679	0
28	Forsyth Cou	Chloroform_	PPB	#########	0	201175-9779		2, ND	0.5	0.5	119.378	2.4412679	0
29	Forsyth Cou	Chloroform_	PPB	#########	0	201213-9935		2, ND	0.5	0.5	119.378	2.4412679	0
30	Forsyth Cou	Chloroform_	PPB	#########	0	201267-10204		2, ND	0.5	0.5	119.378	2.4412679	0
31	Forsyth Cou	Chloroform_	PPB	#########	0	201342-10611		2, ND	0.5	0.5	119.378	2.4412679	0
32	Forsyth Cou	Chloroform_	PPB	#########	0	201346-10634		2, ND	0.5	0.5	119.378	2.4412679	0
33	Forsyth Cou	Chloroform_	PPB	#########	0	201437-11097		2, ND	0.5	0.5	119.378	2.4412679	0
34	Forsyth Cou	Chloroform_	PPB	#########	0	201449-11161		2, ND	0.5	0.5	119.378	2.4412679	0
35	Forsyth Cou	Chloroform_	PPB	#########	0	201540-11688		2, ND	0.5	0.5	119.378	2.4412679	0
36	Forsyth Cou	Chloroform_	PPB	#########	0	201539-11687		2, ND	0.5	0.5	119.378	2.4412679	0
37	Forsyth Cou	Chloroform_	PPB	#########	0	201616-12153		2, ND	0.5	0.5	119.378	2.4412679	0
38	Forsyth Cou	Chloroform_	PPB	#########	0	201618-12179		2, ND	0.5	0.5	119.378	2.4412679	0
39	Forsyth Cou	Chloroform_	PPB	#########	0	201661-12403		2, ND	0.5	0.5	119.378	2.4412679	0
40	Forsyth Cou	Chloroform_	PPB	#########	0	201689-12518		2, ND	0.5	0.5	119.378	2.4412679	0
41	Forsyth Cou	Chloroform_	PPB	#########	0	201809-12973		2, ND	0.5	0.5	119.378	2.4412679	0
42	Forsyth Cou	Chloroform_	PPB	#########	0	201808-12972		2, ND	0.5	0.5	119.378	2.4412679	0
43	Forsyth Cou	Chloroform_	PPB	#########	0	201838-13178		2, ND	0.5	0.5	119.378	2.4412679	0
44	Forsyth Cou	Chloroform_	PPB	#########	0	201836-13110		2, ND	0.5	0.5	119.378	2.4412679	0
45	Forsyth Cou	Chloroform_	PPB	#########	0	201882-13412		2, ND	0.5	0.5	119.378	2.4412679	0
46	Forsyth Cou	Chloroform_	PPB	#########	0	201919-13594		2, ND	0.5	0.5	119.378	2.4412679	0
47	Forsyth Cou	Chloroform_	PPB	#########	0	201981-13938		2, ND	0.5	0.5	119.378	2.4412679	0
48	Forsyth Cou	Chloroform_	PPB	#########	0	202020-14133		2, ND	0.5	0.5	119.378	2.4412679	0
49	Forsyth Cou	Chloroform_	PPB	#########	0	202085-14541		2, ND	0.5	0.5	119.378	2.4412679	0
50	Forsyth Cou	Chloroform_	PPB	#########	0	202084-14540		2, ND	0.5	0.5	119.378	2.4412679	0
51	Forsyth Cou	Chloroform_	PPB	#########	0	202147-14860		2, ND	0.5	0.5	119.378	2.4412679	0
52	Forsyth Cou	Chloroform_	PPB	#########	0	202197-15081		2, ND	0.5	0.5	119.378	2.4412679	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	Chloroform_	PPB	#########	0	202196-15080		2, ND	0.5	0.5	119.378	2.4412679	0
54	Forsyth Cou	Chloroform_	PPB	#########	0	202248-15401		2, ND	0.5	0.5	119.378	2.4412679	0
55	Forsyth Cou	Chloroform_	PPB	#########	0	202244-15384		2, ND	0.5	0.5	119.378	2.4412679	0
56	Forsyth Cou	Chloroform_	PPB	#########	0	210001-15672		2, ND	0.5	0.5	119.378	2.4412679	0
57	Forsyth Cou	Chloroform_	PPB	#########	0	210045-15889		2, ND	0.5	0.5	119.378	2.4412679	0
58	Forsyth Cou	Chloroform_	PPB	#########	0	210044-15888		2, ND	0.5	0.5	119.378	2.4412679	0
59	Forsyth Cou	Chloroform_	PPB	#########	0	210075-15972		2, ND	0.5	0.5	119.378	2.4412679	0

	N	O	P	Q
1		chloroform	d_chloroform	
2		2.4412679	0	
3		2.4412679	0	
4		2.4412679	0	
5		2.4412679	0	
6		2.4412679	0	
7		2.4412679	0	
8		2.4412679	0	
9		2.4412679	0	
10		2.4412679	0	
11		2.4412679	0	
12		2.4412679	0	
13		2.4412679	0	
14		2.4412679	0	
15		2.4412679	0	
16		2.4412679	0	
17		2.4412679	0	
18		2.4412679	0	
19		2.4412679	0	
20		2.4412679	0	
21		2.4412679	0	
22		2.4412679	0	
23		2.4412679	0	
24		2.4412679	0	
25		2.4412679	0	
26		2.4412679	0	
27		2.4412679	0	
28		2.4412679	0	
29		2.4412679	0	
30		2.4412679	0	
31		2.4412679	0	
32		2.4412679	0	
33		2.4412679	0	
34		2.4412679	0	
35		2.4412679	0	
36		2.4412679	0	
37		2.4412679	0	
38		2.4412679	0	
39		2.4412679	0	
40		2.4412679	0	
41		2.4412679	0	
42		2.4412679	0	
43		2.4412679	0	
44		2.4412679	0	
45		2.4412679	0	
46		2.4412679	0	
47		2.4412679	0	
48		2.4412679	0	
49		2.4412679	0	
50		2.4412679	0	
51		2.4412679	0	
52		2.4412679	0	

	N	O	P	Q
53		2.4412679	0	
54		2.4412679	0	
55		2.4412679	0	
56		2.4412679	0	
57		2.4412679	0	
58		2.4412679	0	
59		2.4412679	0	

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3				User Selected Options								
4				Date/Time of Computation	ProUCL 5.13/19/2021 12:22:13 PM							
5				From File	C-ProUCL Input File_b.xls							
6				Full Precision	OFF							
7				Confidence Coefficient	95%							
8				Number of Bootstrap Operations	2000							
9												
10	**chloroform**											
11												
12	**General Statistics**											
13						Total Number of Observations	58			Number of Distinct Observations	1		
14						Number of Detects	0			Number of Non-Detects	58	
15						Number of Distinct Detects	0			Number of Distinct Non-Detects	1	
16												
17	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
18	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
19	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
20												
21	**The data set for variable chloroform was not processed!**											
22												
23												

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	Dichloromet	PPB	#########	0	200208-5438		2, ND	1	1	84.933	3.4737423	0
3	Forsyth Cou	Dichloromet	PPB	#########	0	200242-5592		2, ND	1	1	84.933	3.4737423	0
4	Forsyth Cou	Dichloromet	PPB	#########	0	200274-5709		2, ND	1	1	84.933	3.4737423	0
5	Forsyth Cou	Dichloromet	PPB	#########	0	200297-5802		2, ND	1	1	84.933	3.4737423	0
6	Forsyth Cou	Dichloromet	PPB	#########	0	200322-5892		2, ND	1	1	84.933	3.4737423	0
7	Forsyth Cou	Dichloromet	PPB	#########	0	200361-6162		2, ND	1	1	84.933	3.4737423	0
8	Forsyth Cou	Dichloromet	PPB	#########	0	200420-6499		2, ND	1	1	84.933	3.4737423	0
9	Forsyth Cou	Dichloromet	PPB	#########	0	200454-6646		2, ND	1	1	84.933	3.4737423	0
10	Forsyth Cou	Dichloromet	PPB	#########	0	200480-6791		2, ND	1	1	84.933	3.4737423	0
11	Forsyth Cou	Dichloromet	PPB	#########	0	200498-6913		2, ND	1	1	84.933	3.4737423	0
12	Forsyth Cou	Dichloromet	PPB	#########	0	200515-6984		2, ND	1	1	84.933	3.4737423	0
13	Forsyth Cou	Dichloromet	PPB	#########	0	200584-7724		2, ND	1	1	84.933	3.4737423	0
14	Forsyth Cou	Dichloromet	PPB	#########	0	200637-7423		2, ND	1	1	84.933	3.4737423	0
15	Forsyth Cou	Dichloromet	PPB	#########	0	200670-7530		2, ND	1	1	84.933	3.4737423	0
16	Forsyth Cou	Dichloromet	PPB	#########	0	200690-7588		2, ND	1	1	84.933	3.4737423	0
17	Forsyth Cou	Dichloromet	PPB	#########	0	200746-7832		2, ND	1	1	84.933	3.4737423	0
18	Forsyth Cou	Dichloromet	PPB	#########	0	200775-7895		2, ND	1	1	84.933	3.4737423	0
19	Forsyth Cou	Dichloromet	PPB	#########	0	200809-8075		2, ND	1	1	84.933	3.4737423	0
20	Forsyth Cou	Dichloromet	PPB	#########	0	200885-8392		2, ND	1	1	84.933	3.4737423	0
21	Forsyth Cou	Dichloromet	PPB	#########	0	200886-8393		2, ND	1	1	84.933	3.4737423	0
22	Forsyth Cou	Dichloromet	PPB	#########	0	200945-8627		2, ND	1	1	84.933	3.4737423	0
23	Forsyth Cou	Dichloromet	PPB	#########	0	200977-8786		2, ND	1	1	84.933	3.4737423	0
24	Forsyth Cou	Dichloromet	PPB	#########	0	201028-9001		2, ND	1	1	84.933	3.4737423	0
25	Forsyth Cou	Dichloromet	PPB	#########	0	201068-9173		2, ND	1	1	84.933	3.4737423	0
26	Forsyth Cou	Dichloromet	PPB	#########	0	201122-9521		2, ND	1	1	84.933	3.4737423	0
27	Forsyth Cou	Dichloromet	PPB	#########	0	201147-9624		2, ND	1	1	84.933	3.4737423	0
28	Forsyth Cou	Dichloromet	PPB	#########	0	201175-9779		2, ND	1	1	84.933	3.4737423	0
29	Forsyth Cou	Dichloromet	PPB	#########	0	201213-9935		2, ND	1	1	84.933	3.4737423	0
30	Forsyth Cou	Dichloromet	PPB	#########	0	201267-10204		2, ND	1	1	84.933	3.4737423	0
31	Forsyth Cou	Dichloromet	PPB	#########	0	201342-10611		2, ND	1	1	84.933	3.4737423	0
32	Forsyth Cou	Dichloromet	PPB	#########	0	201346-10634		2, ND	1	1	84.933	3.4737423	0
33	Forsyth Cou	Dichloromet	PPB	#########	0	201437-11097		2, ND	1	1	84.933	3.4737423	0
34	Forsyth Cou	Dichloromet	PPB	#########	0	201449-11161		2, ND	1	1	84.933	3.4737423	0
35	Forsyth Cou	Dichloromet	PPB	#########	0	201540-11688		2, ND	1	1	84.933	3.4737423	0
36	Forsyth Cou	Dichloromet	PPB	#########	0	201539-11687		2, ND	1	1	84.933	3.4737423	0
37	Forsyth Cou	Dichloromet	PPB	#########	0	201616-12153		2, ND	1	1	84.933	3.4737423	0
38	Forsyth Cou	Dichloromet	PPB	#########	0	201618-12179		2, ND	1	1	84.933	3.4737423	0
39	Forsyth Cou	Dichloromet	PPB	#########	0	201661-12403		2, ND	1	1	84.933	3.4737423	0
40	Forsyth Cou	Dichloromet	PPB	#########	0	201689-12518		2, ND	1	1	84.933	3.4737423	0
41	Forsyth Cou	Dichloromet	PPB	#########	0	201809-12973		2, ND	1	1	84.933	3.4737423	0
42	Forsyth Cou	Dichloromet	PPB	#########	0	201808-12972		2, ND	1	1	84.933	3.4737423	0
43	Forsyth Cou	Dichloromet	PPB	#########	0	201838-13178		2, ND	1	1	84.933	3.4737423	0
44	Forsyth Cou	Dichloromet	PPB	#########	0	201836-13110		2, ND	1	1	84.933	3.4737423	0
45	Forsyth Cou	Dichloromet	PPB	#########	0	201882-13412		2, ND	1	1	84.933	3.4737423	0
46	Forsyth Cou	Dichloromet	PPB	#########	0	201919-13594		2, ND	1	1	84.933	3.4737423	0
47	Forsyth Cou	Dichloromet	PPB	#########	0	201981-13938		2, ND	1	1	84.933	3.4737423	0
48	Forsyth Cou	Dichloromet	PPB	#########	0	202020-14133		2, ND	1	1	84.933	3.4737423	0
49	Forsyth Cou	Dichloromet	PPB	#########	0	202085-14541		2, ND	1	1	84.933	3.4737423	0
50	Forsyth Cou	Dichloromet	PPB	#########	0	202084-14540		2, ND	1	1	84.933	3.4737423	0
51	Forsyth Cou	Dichloromet	PPB	#########	0	202147-14860		2, ND	1	1	84.933	3.4737423	0
52	Forsyth Cou	Dichloromet	PPB	#########	0	202197-15081		2, ND	1	1	84.933	3.4737423	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	Dichloromet	PPB	#########	0	202196-15080		2, ND	1	1	84.933	3.4737423	0
54	Forsyth Cou	Dichloromet	PPB	#########	0	202248-15401		2, ND	1	1	84.933	3.4737423	0
55	Forsyth Cou	Dichloromet	PPB	#########	0	202244-15384		2, ND	1	1	84.933	3.4737423	0
56	Forsyth Cou	Dichloromet	PPB	#########	0	210001-15672		2, ND	1	1	84.933	3.4737423	0
57	Forsyth Cou	Dichloromet	PPB	#########	0	210045-15889		2, ND	1	1	84.933	3.4737423	0
58	Forsyth Cou	Dichloromet	PPB	#########	0	210044-15888		2, ND	1	1	84.933	3.4737423	0
59	Forsyth Cou	Dichloromet	PPB	#########	0	210075-15972		2, ND	1	1	84.933	3.4737423	0

	N	O	P	Q
1		dichloromet	d_dichloromethane	
2		3.4737423	0	
3		3.4737423	0	
4		3.4737423	0	
5		3.4737423	0	
6		3.4737423	0	
7		3.4737423	0	
8		3.4737423	0	
9		3.4737423	0	
10		3.4737423	0	
11		3.4737423	0	
12		3.4737423	0	
13		3.4737423	0	
14		3.4737423	0	
15		3.4737423	0	
16		3.4737423	0	
17		3.4737423	0	
18		3.4737423	0	
19		3.4737423	0	
20		3.4737423	0	
21		3.4737423	0	
22		3.4737423	0	
23		3.4737423	0	
24		3.4737423	0	
25		3.4737423	0	
26		3.4737423	0	
27		3.4737423	0	
28		3.4737423	0	
29		3.4737423	0	
30		3.4737423	0	
31		3.4737423	0	
32		3.4737423	0	
33		3.4737423	0	
34		3.4737423	0	
35		3.4737423	0	
36		3.4737423	0	
37		3.4737423	0	
38		3.4737423	0	
39		3.4737423	0	
40		3.4737423	0	
41		3.4737423	0	
42		3.4737423	0	
43		3.4737423	0	
44		3.4737423	0	
45		3.4737423	0	
46		3.4737423	0	
47		3.4737423	0	
48		3.4737423	0	
49		3.4737423	0	
50		3.4737423	0	
51		3.4737423	0	
52		3.4737423	0	

	N	O	P	Q
53		3.4737423	0	
54		3.4737423	0	
55		3.4737423	0	
56		3.4737423	0	
57		3.4737423	0	
58		3.4737423	0	
59		3.4737423	0	

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/19/2021 1:07:01 PM
From File	C-ProUCL Input File_c.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

dichloromethane

General Statistics

Total Number of Observations	58	Number of Distinct Observations	1
Number of Detects	0	Number of Non-Detects	58
Number of Distinct Detects	0	Number of Distinct Non-Detects	1

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable dichloromethane was not processed!

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum Detectable Lim		Value to Us	Molecular W	Result in µg
2	Forsyth Cou	Hexane_1	PPB	#########	0	200208-5438		2, ND	0.5		0.5	86.1754	1.7622781
3	Forsyth Cou	Hexane_1	PPB	#########	0	200242-5592		2, ND	0.5		0.5	86.1754	1.7622781
4	Forsyth Cou	Hexane_1	PPB	#########	0	200274-5709		2, ND	0.5		0.5	86.1754	1.7622781
5	Forsyth Cou	Hexane_1	PPB	#########	0	200297-5802		2, ND	0.5		0.5	86.1754	1.7622781
6	Forsyth Cou	Hexane_1	PPB	#########	0	200322-5892		2, ND	0.5		0.5	86.1754	1.7622781
7	Forsyth Cou	Hexane_1	PPB	#########	0	200361-6162		2, ND	0.5		0.5	86.1754	1.7622781
8	Forsyth Cou	Hexane_1	PPB	#########	0	200420-6499		2, ND	0.5		0.5	86.1754	1.7622781
9	Forsyth Cou	Hexane_1	PPB	#########	0	200454-6646		2, ND	0.5		0.5	86.1754	1.7622781
10	Forsyth Cou	Hexane_1	PPB	#########	0	200480-6791		2, ND	0.5		0.5	86.1754	1.7622781
11	Forsyth Cou	Hexane_1	PPB	#########	0	200498-6913		2, ND	0.5		0.5	86.1754	1.7622781
12	Forsyth Cou	Hexane_1	PPB	#########	0	200515-6984		2, ND	0.5		0.5	86.1754	1.7622781
13	Forsyth Cou	Hexane_1	PPB	#########	0	200584-7724		2, ND	0.5		0.5	86.1754	1.7622781
14	Forsyth Cou	Hexane_1	PPB	#########	0	200637-7423		2, ND	0.5		0.5	86.1754	1.7622781
15	Forsyth Cou	Hexane_1	PPB	#########	0	200670-7530		2, ND	0.5		0.5	86.1754	1.7622781
16	Forsyth Cou	Hexane_1	PPB	#########	0	200690-7588		2, ND	0.5		0.5	86.1754	1.7622781
17	Forsyth Cou	Hexane_1	PPB	#########	0	200746-7832		2, ND	0.5		0.5	86.1754	1.7622781
18	Forsyth Cou	Hexane_1	PPB	#########	0	200775-7895		2, ND	0.5		0.5	86.1754	1.7622781
19	Forsyth Cou	Hexane_1	PPB	#########	0	200809-8075		2, ND	0.5		0.5	86.1754	1.7622781
20	Forsyth Cou	Hexane_1	PPB	#########	0	200885-8392		2, ND	0.5		0.5	86.1754	1.7622781
21	Forsyth Cou	Hexane_1	PPB	#########	0	200886-8393		2, ND	0.5		0.5	86.1754	1.7622781
22	Forsyth Cou	Hexane_1	PPB	#########	0	200945-8627		2, ND	0.5		0.5	86.1754	1.7622781
23	Forsyth Cou	Hexane_1	PPB	#########	0	200977-8786		2, ND	0.5		0.5	86.1754	1.7622781
24	Forsyth Cou	Hexane_1	PPB	#########	0	201028-9001		2, ND	0.5		0.5	86.1754	1.7622781
25	Forsyth Cou	Hexane_1	PPB	#########	0	201068-9173		2, ND	0.5		0.5	86.1754	1.7622781
26	Forsyth Cou	Hexane_1	PPB	#########	0	201122-9521		2, ND	0.5		0.5	86.1754	1.7622781
27	Forsyth Cou	Hexane_1	PPB	#########	0	201147-9624		2, ND	0.5		0.5	86.1754	1.7622781
28	Forsyth Cou	Hexane_1	PPB	#########	0	201175-9779		2, ND	0.5		0.5	86.1754	1.7622781
29	Forsyth Cou	Hexane_1	PPB	#########	0	201213-9935		2, ND	0.5		0.5	86.1754	1.7622781
30	Forsyth Cou	Hexane_1	PPB	#########	0	201267-10204		2, ND	0.5		0.5	86.1754	1.7622781
31	Forsyth Cou	Hexane_1	PPB	#########	0	201342-10611		2, ND	0.5		0.5	86.1754	1.7622781
32	Forsyth Cou	Hexane_1	PPB	#########	0	201346-10634		2, ND	0.5		0.5	86.1754	1.7622781
33	Forsyth Cou	Hexane_1	PPB	#########	0	201437-11097		2, ND	0.5		0.5	86.1754	1.7622781
34	Forsyth Cou	Hexane_1	PPB	#########	0	201449-11161		2, ND	0.5		0.5	86.1754	1.7622781
35	Forsyth Cou	Hexane_1	PPB	#########	0	201540-11688		2, ND	0.5		0.5	86.1754	1.7622781
36	Forsyth Cou	Hexane_1	PPB	#########	0	201539-11687		2, ND	0.5		0.5	86.1754	1.7622781
37	Forsyth Cou	Hexane_1	PPB	#########	0	201616-12153		2, ND	0.5		0.5	86.1754	1.7622781
38	Forsyth Cou	Hexane_1	PPB	#########	0	201618-12179		2, ND	0.5		0.5	86.1754	1.7622781
39	Forsyth Cou	Hexane_1	PPB	#########	0	201661-12403		2, ND	0.5		0.5	86.1754	1.7622781
40	Forsyth Cou	Hexane_1	PPB	#########	0	201689-12518		2, ND	0.5		0.5	86.1754	1.7622781
41	Forsyth Cou	Hexane_1	PPB	#########	0	201809-12973		2, ND	0.5		0.5	86.1754	1.7622781
42	Forsyth Cou	Hexane_1	PPB	#########	0	201808-12972		2, ND	0.5		0.5	86.1754	1.7622781
43	Forsyth Cou	Hexane_1	PPB	#########	0	201838-13178		2, ND	0.5		0.5	86.1754	1.7622781
44	Forsyth Cou	Hexane_1	PPB	#########	0	201836-13110		2, ND	0.5		0.5	86.1754	1.7622781
45	Forsyth Cou	Hexane_1	PPB	#########	0	201882-13412		2, ND	0.5		0.5	86.1754	1.7622781
46	Forsyth Cou	Hexane_1	PPB	#########	0	201919-13594		2, ND	0.5		0.5	86.1754	1.7622781
47	Forsyth Cou	Hexane_1	PPB	#########	0	201981-13938		2, ND	0.5		0.5	86.1754	1.7622781
48	Forsyth Cou	Hexane_1	PPB	#########	0	202020-14133		2, ND	0.5		0.5	86.1754	1.7622781
49	Forsyth Cou	Hexane_1	PPB	#########	0	202085-14541		2, ND	0.5		0.5	86.1754	1.7622781
50	Forsyth Cou	Hexane_1	PPB	#########	0	202084-14540		2, ND	0.5		0.5	86.1754	1.7622781
51	Forsyth Cou	Hexane_1	PPB	#########	0	202147-14860		2, ND	0.5		0.5	86.1754	1.7622781
52	Forsyth Cou	Hexane_1	PPB	#########	0	202197-15081		2, ND	0.5		0.5	86.1754	1.7622781

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	Hexane_1	PPB	#########	0	202196-15080		2, ND	0.5		0.5	86.1754	1.7622781
54	Forsyth Cou	Hexane_1	PPB	#########	0	202248-15401		2, ND	0.5		0.5	86.1754	1.7622781
55	Forsyth Cou	Hexane_1	PPB	#########	0	202244-15384		2, ND	0.5		0.5	86.1754	1.7622781
56	Forsyth Cou	Hexane_1	PPB	#########	0	210001-15672		2, ND	0.5		0.5	86.1754	1.7622781
57	Forsyth Cou	Hexane_1	PPB	#########	0	210045-15889		2, ND	0.5		0.5	86.1754	1.7622781
58	Forsyth Cou	Hexane_1	PPB	#########	0	210044-15888		2, ND	0.5		0.5	86.1754	1.7622781
59	Forsyth Cou	Hexane_1	PPB	#########	0	210075-15972		2, ND	0.5		0.5	86.1754	1.7622781

	N	O	P	Q
1	Detection Status		hexane	d_hexane
2	0		1.7622781	0
3	0		1.7622781	0
4	0		1.7622781	0
5	0		1.7622781	0
6	0		1.7622781	0
7	0		1.7622781	0
8	0		1.7622781	0
9	0		1.7622781	0
10	0		1.7622781	0
11	0		1.7622781	0
12	0		1.7622781	0
13	0		1.7622781	0
14	0		1.7622781	0
15	0		1.7622781	0
16	0		1.7622781	0
17	0		1.7622781	0
18	0		1.7622781	0
19	0		1.7622781	0
20	0		1.7622781	0
21	0		1.7622781	0
22	0		1.7622781	0
23	0		1.7622781	0
24	0		1.7622781	0
25	0		1.7622781	0
26	0		1.7622781	0
27	0		1.7622781	0
28	0		1.7622781	0
29	0		1.7622781	0
30	0		1.7622781	0
31	0		1.7622781	0
32	0		1.7622781	0
33	0		1.7622781	0
34	0		1.7622781	0
35	0		1.7622781	0
36	0		1.7622781	0
37	0		1.7622781	0
38	0		1.7622781	0
39	0		1.7622781	0
40	0		1.7622781	0
41	0		1.7622781	0
42	0		1.7622781	0
43	0		1.7622781	0
44	0		1.7622781	0
45	0		1.7622781	0
46	0		1.7622781	0
47	0		1.7622781	0
48	0		1.7622781	0
49	0		1.7622781	0
50	0		1.7622781	0
51	0		1.7622781	0
52	0		1.7622781	0

	N	O	P	Q
53	0		1.7622781	0
54	0		1.7622781	0
55	0		1.7622781	0
56	0		1.7622781	0
57	0		1.7622781	0
58	0		1.7622781	0
59	0		1.7622781	0

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/19/2021 1:07:36 PM
From File	C-ProUCL Input File_e.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

hexane

General Statistics

Total Number of Observations	58	Number of Distinct Observations	1
Number of Detects	0	Number of Non-Detects	58
Number of Distinct Detects	0	Number of Distinct Non-Detects	1

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable hexane was not processed!

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum Detectable Lim		Value to Us	Molecular W	Result in µg
2	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200208-5438		2, ND	1		1	106.165	4.3421268
3	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200242-5592		2, ND	1		1	106.165	4.3421268
4	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200274-5709		2, ND	1		1	106.165	4.3421268
5	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200297-5802		2, ND	1		1	106.165	4.3421268
6	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200322-5892		2, ND	1		1	106.165	4.3421268
7	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200361-6162		2, ND	1		1	106.165	4.3421268
8	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200420-6499		2, ND	1		1	106.165	4.3421268
9	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200454-6646		2, ND	1		1	106.165	4.3421268
10	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200480-6791		2, ND	1		1	106.165	4.3421268
11	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200498-6913		2, ND	1		1	106.165	4.3421268
12	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200515-6984		2, ND	1		1	106.165	4.3421268
13	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200584-7724		2, ND	1		1	106.165	4.3421268
14	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200637-7423		2, ND	1		1	106.165	4.3421268
15	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200670-7530		2, ND	1		1	106.165	4.3421268
16	Forsyth Cou	m,p-Xylene_	PPB	#########	3.91	200690-7588		2	1		3.91	106.165	16.977716
17	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200746-7832		2, ND	1		1	106.165	4.3421268
18	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200775-7895		2, ND	1		1	106.165	4.3421268
19	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200809-8075		2, ND	1		1	106.165	4.3421268
20	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200885-8392		2, ND	1		1	106.165	4.3421268
21	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200886-8393		2, ND	1		1	106.165	4.3421268
22	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200945-8627		2, ND	1		1	106.165	4.3421268
23	Forsyth Cou	m,p-Xylene_	PPB	#########	0	200977-8786		2, ND	1		1	106.165	4.3421268
24	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201028-9001		2, ND	1		1	106.165	4.3421268
25	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201068-9173		2, ND	1		1	106.165	4.3421268
26	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201122-9521		2, ND	1		1	106.165	4.3421268
27	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201147-9624		2, ND	1		1	106.165	4.3421268
28	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201175-9779		2, ND	1		1	106.165	4.3421268
29	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201213-9935		2, ND	1		1	106.165	4.3421268
30	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201267-10204		2, ND	1		1	106.165	4.3421268
31	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201342-10611		2, ND	1		1	106.165	4.3421268
32	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201346-10634		2, ND	1		1	106.165	4.3421268
33	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201437-11097		2, ND	1		1	106.165	4.3421268
34	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201449-11161		2, ND	1		1	106.165	4.3421268
35	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201540-11688		2, ND	1		1	106.165	4.3421268
36	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201539-11687		2, ND	1		1	106.165	4.3421268
37	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201616-12153		2, ND	1		1	106.165	4.3421268
38	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201618-12179		2, ND	1		1	106.165	4.3421268
39	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201661-12403		2, ND	1		1	106.165	4.3421268
40	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201689-12518		2, ND	1		1	106.165	4.3421268
41	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201809-12973		2, ND	1		1	106.165	4.3421268
42	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201808-12972		2, ND	1		1	106.165	4.3421268
43	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201838-13178		2, ND	1		1	106.165	4.3421268
44	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201836-13110		2, ND	1		1	106.165	4.3421268
45	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201882-13412		2, ND	1		1	106.165	4.3421268
46	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201919-13594		2, ND	1		1	106.165	4.3421268
47	Forsyth Cou	m,p-Xylene_	PPB	#########	0	201981-13938		2, ND	1		1	106.165	4.3421268
48	Forsyth Cou	m,p-Xylene_	PPB	#########	0	202020-14133		2, ND	1		1	106.165	4.3421268
49	Forsyth Cou	m,p-Xylene_	PPB	#########	0	202085-14541		2, ND	1		1	106.165	4.3421268
50	Forsyth Cou	m,p-Xylene_	PPB	#########	0	202084-14540		2, ND	1		1	106.165	4.3421268
51	Forsyth Cou	m,p-Xylene_	PPB	#########	0	202147-14860		2, ND	1		1	106.165	4.3421268
52	Forsyth Cou	m,p-Xylene_	PPB	#########	0	202197-15081		2, ND	1		1	106.165	4.3421268

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	m,p-Xylene_	PPB	#########	0	202196-15080		2, ND	1		1	106.165	4.3421268
54	Forsyth Cou	m,p-Xylene_	PPB	#########	0	202248-15401		2, ND	1		1	106.165	4.3421268
55	Forsyth Cou	m,p-Xylene_	PPB	#########	0	202244-15384		2, ND	1		1	106.165	4.3421268
56	Forsyth Cou	m,p-Xylene_	PPB	#########	0	210001-15672		2, ND	1		1	106.165	4.3421268
57	Forsyth Cou	m,p-Xylene_	PPB	#########	0	210045-15889		2, ND	1		1	106.165	4.3421268
58	Forsyth Cou	m,p-Xylene_	PPB	#########	0	210044-15888		2, ND	1		1	106.165	4.3421268
59	Forsyth Cou	m,p-Xylene_	PPB	#########	0	210075-15972		2, ND	1		1	106.165	4.3421268

	N	O	P	Q	R
1	Detection Status		mpxylene	d_mpxylene	
2	0		4.3421268	0	
3	0		4.3421268	0	
4	0		4.3421268	0	
5	0		4.3421268	0	
6	0		4.3421268	0	
7	0		4.3421268	0	
8	0		4.3421268	0	
9	0		4.3421268	0	
10	0		4.3421268	0	
11	0		4.3421268	0	
12	0		4.3421268	0	
13	0		4.3421268	0	
14	0		4.3421268	0	
15	0		4.3421268	0	
16	1		16.977716	1	
17	0		4.3421268	0	
18	0		4.3421268	0	
19	0		4.3421268	0	
20	0		4.3421268	0	
21	0		4.3421268	0	
22	0		4.3421268	0	
23	0		4.3421268	0	
24	0		4.3421268	0	
25	0		4.3421268	0	
26	0		4.3421268	0	
27	0		4.3421268	0	
28	0		4.3421268	0	
29	0		4.3421268	0	
30	0		4.3421268	0	
31	0		4.3421268	0	
32	0		4.3421268	0	
33	0		4.3421268	0	
34	0		4.3421268	0	
35	0		4.3421268	0	
36	0		4.3421268	0	
37	0		4.3421268	0	
38	0		4.3421268	0	
39	0		4.3421268	0	
40	0		4.3421268	0	
41	0		4.3421268	0	
42	0		4.3421268	0	
43	0		4.3421268	0	
44	0		4.3421268	0	
45	0		4.3421268	0	
46	0		4.3421268	0	
47	0		4.3421268	0	
48	0		4.3421268	0	
49	0		4.3421268	0	
50	0		4.3421268	0	
51	0		4.3421268	0	
52	0		4.3421268	0	

	N	O	P	Q	R
53	0		4.3421268	0	
54	0		4.3421268	0	
55	0		4.3421268	0	
56	0		4.3421268	0	
57	0		4.3421268	0	
58	0		4.3421268	0	
59	0		4.3421268	0	

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3				User Selected Options								
4				Date/Time of Computation	ProUCL 5.13/19/2021 1:09:10 PM							
5				From File	C-ProUCL Input File_f.xls							
6				Full Precision	OFF							
7				Confidence Coefficient	95%							
8				Number of Bootstrap Operations	2000							
9												
10	**mpxylene**											
11												
12	**General Statistics**											
13						Total Number of Observations	58			Number of Distinct Observations	2		
14						Number of Detects	1			Number of Non-Detects	57		
15						Number of Distinct Detects	1			Number of Distinct Non-Detects	1		
16												
17	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
18	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
19												
20	**The data set for variable mpxylene was not processed!**											
21												
22												

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	o-Xylene_1	PPB	#########	0	200208-5438		2, ND	0.5	0.5	106.165	2.1710634	0
3	Forsyth Cou	o-Xylene_1	PPB	#########	0	200242-5592		2, ND	0.5	0.5	106.165	2.1710634	0
4	Forsyth Cou	o-Xylene_1	PPB	#########	0	200274-5709		2, ND	0.5	0.5	106.165	2.1710634	0
5	Forsyth Cou	o-Xylene_1	PPB	#########	0	200297-5802		2, ND	0.5	0.5	106.165	2.1710634	0
6	Forsyth Cou	o-Xylene_1	PPB	#########	0	200322-5892		2, ND	0.5	0.5	106.165	2.1710634	0
7	Forsyth Cou	o-Xylene_1	PPB	#########	0	200361-6162		2, ND	0.5	0.5	106.165	2.1710634	0
8	Forsyth Cou	o-Xylene_1	PPB	#########	0	200420-6499		2, ND	0.5	0.5	106.165	2.1710634	0
9	Forsyth Cou	o-Xylene_1	PPB	#########	0	200454-6646		2, ND	0.5	0.5	106.165	2.1710634	0
10	Forsyth Cou	o-Xylene_1	PPB	#########	0	200480-6791		2, ND	0.5	0.5	106.165	2.1710634	0
11	Forsyth Cou	o-Xylene_1	PPB	#########	0	200498-6913		2, ND	0.5	0.5	106.165	2.1710634	0
12	Forsyth Cou	o-Xylene_1	PPB	#########	0	200515-6984		2, ND	0.5	0.5	106.165	2.1710634	0
13	Forsyth Cou	o-Xylene_1	PPB	#########	0	200584-7724		2, ND	0.5	0.5	106.165	2.1710634	0
14	Forsyth Cou	o-Xylene_1	PPB	#########	0	200637-7423		2, ND	0.5	0.5	106.165	2.1710634	0
15	Forsyth Cou	o-Xylene_1	PPB	#########	0	200670-7530		2, ND	0.5	0.5	106.165	2.1710634	0
16	Forsyth Cou	o-Xylene_1	PPB	#########	1.11	200690-7588		2	0.5	1.11	106.165	4.8197607	1
17	Forsyth Cou	o-Xylene_1	PPB	#########	0	200746-7832		2, ND	0.5	0.5	106.165	2.1710634	0
18	Forsyth Cou	o-Xylene_1	PPB	#########	0	200775-7895		2, ND	0.5	0.5	106.165	2.1710634	0
19	Forsyth Cou	o-Xylene_1	PPB	#########	0	200809-8075		2, ND	0.5	0.5	106.165	2.1710634	0
20	Forsyth Cou	o-Xylene_1	PPB	#########	0	200885-8392		2, ND	0.5	0.5	106.165	2.1710634	0
21	Forsyth Cou	o-Xylene_1	PPB	#########	0	200886-8393		2, ND	0.5	0.5	106.165	2.1710634	0
22	Forsyth Cou	o-Xylene_1	PPB	#########	0	200945-8627		2, ND	0.5	0.5	106.165	2.1710634	0
23	Forsyth Cou	o-Xylene_1	PPB	#########	0	200977-8786		2, ND	0.5	0.5	106.165	2.1710634	0
24	Forsyth Cou	o-Xylene_1	PPB	#########	0	201028-9001		2, ND	0.5	0.5	106.165	2.1710634	0
25	Forsyth Cou	o-Xylene_1	PPB	#########	0	201068-9173		2, ND	0.5	0.5	106.165	2.1710634	0
26	Forsyth Cou	o-Xylene_1	PPB	#########	0	201122-9521		2, ND	0.5	0.5	106.165	2.1710634	0
27	Forsyth Cou	o-Xylene_1	PPB	#########	0	201147-9624		2, ND	0.5	0.5	106.165	2.1710634	0
28	Forsyth Cou	o-Xylene_1	PPB	#########	0	201175-9779		2, ND	0.5	0.5	106.165	2.1710634	0
29	Forsyth Cou	o-Xylene_1	PPB	#########	0	201213-9935		2, ND	0.5	0.5	106.165	2.1710634	0
30	Forsyth Cou	o-Xylene_1	PPB	#########	0	201267-10204		2, ND	0.5	0.5	106.165	2.1710634	0
31	Forsyth Cou	o-Xylene_1	PPB	#########	0	201342-10611		2, ND	0.5	0.5	106.165	2.1710634	0
32	Forsyth Cou	o-Xylene_1	PPB	#########	0	201346-10634		2, ND	0.5	0.5	106.165	2.1710634	0
33	Forsyth Cou	o-Xylene_1	PPB	#########	0	201437-11097		2, ND	0.5	0.5	106.165	2.1710634	0
34	Forsyth Cou	o-Xylene_1	PPB	#########	0	201449-11161		2, ND	0.5	0.5	106.165	2.1710634	0
35	Forsyth Cou	o-Xylene_1	PPB	#########	0	201540-11688		2, ND	0.5	0.5	106.165	2.1710634	0
36	Forsyth Cou	o-Xylene_1	PPB	#########	0	201539-11687		2, ND	0.5	0.5	106.165	2.1710634	0
37	Forsyth Cou	o-Xylene_1	PPB	#########	0	201616-12153		2, ND	0.5	0.5	106.165	2.1710634	0
38	Forsyth Cou	o-Xylene_1	PPB	#########	0	201618-12179		2, ND	0.5	0.5	106.165	2.1710634	0
39	Forsyth Cou	o-Xylene_1	PPB	#########	0	201661-12403		2, ND	0.5	0.5	106.165	2.1710634	0
40	Forsyth Cou	o-Xylene_1	PPB	#########	0	201689-12518		2, ND	0.5	0.5	106.165	2.1710634	0
41	Forsyth Cou	o-Xylene_1	PPB	#########	0	201809-12973		2, ND	0.5	0.5	106.165	2.1710634	0
42	Forsyth Cou	o-Xylene_1	PPB	#########	0	201808-12972		2, ND	0.5	0.5	106.165	2.1710634	0
43	Forsyth Cou	o-Xylene_1	PPB	#########	0	201838-13178		2, ND	0.5	0.5	106.165	2.1710634	0
44	Forsyth Cou	o-Xylene_1	PPB	#########	0	201836-13110		2, ND	0.5	0.5	106.165	2.1710634	0
45	Forsyth Cou	o-Xylene_1	PPB	#########	0	201882-13412		2, ND	0.5	0.5	106.165	2.1710634	0
46	Forsyth Cou	o-Xylene_1	PPB	#########	0	201919-13594		2, ND	0.5	0.5	106.165	2.1710634	0
47	Forsyth Cou	o-Xylene_1	PPB	#########	0	201981-13938		2, ND	0.5	0.5	106.165	2.1710634	0
48	Forsyth Cou	o-Xylene_1	PPB	#########	0	202020-14133		2, ND	0.5	0.5	106.165	2.1710634	0
49	Forsyth Cou	o-Xylene_1	PPB	#########	0	202085-14541		2, ND	0.5	0.5	106.165	2.1710634	0
50	Forsyth Cou	o-Xylene_1	PPB	#########	0	202084-14540		2, ND	0.5	0.5	106.165	2.1710634	0
51	Forsyth Cou	o-Xylene_1	PPB	#########	0	202147-14860		2, ND	0.5	0.5	106.165	2.1710634	0
52	Forsyth Cou	o-Xylene_1	PPB	#########	0	202197-15081		2, ND	0.5	0.5	106.165	2.1710634	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	o-Xylene_1	PPB	#########	0	202196-15080		2, ND	0.5	0.5	106.165	2.1710634	0
54	Forsyth Cou	o-Xylene_1	PPB	#########	0	202248-15401		2, ND	0.5	0.5	106.165	2.1710634	0
55	Forsyth Cou	o-Xylene_1	PPB	#########	0	202244-15384		2, ND	0.5	0.5	106.165	2.1710634	0
56	Forsyth Cou	o-Xylene_1	PPB	#########	0	210001-15672		2, ND	0.5	0.5	106.165	2.1710634	0
57	Forsyth Cou	o-Xylene_1	PPB	#########	0	210045-15889		2, ND	0.5	0.5	106.165	2.1710634	0
58	Forsyth Cou	o-Xylene_1	PPB	#########	0	210044-15888		2, ND	0.5	0.5	106.165	2.1710634	0
59	Forsyth Cou	o-Xylene_1	PPB	#########	0	210075-15972		2, ND	0.5	0.5	106.165	2.1710634	0

	N	O	P
1		oxylene	d_oxylene
2		2.1710634	0
3		2.1710634	0
4		2.1710634	0
5		2.1710634	0
6		2.1710634	0
7		2.1710634	0
8		2.1710634	0
9		2.1710634	0
10		2.1710634	0
11		2.1710634	0
12		2.1710634	0
13		2.1710634	0
14		2.1710634	0
15		2.1710634	0
16		4.8197607	1
17		2.1710634	0
18		2.1710634	0
19		2.1710634	0
20		2.1710634	0
21		2.1710634	0
22		2.1710634	0
23		2.1710634	0
24		2.1710634	0
25		2.1710634	0
26		2.1710634	0
27		2.1710634	0
28		2.1710634	0
29		2.1710634	0
30		2.1710634	0
31		2.1710634	0
32		2.1710634	0
33		2.1710634	0
34		2.1710634	0
35		2.1710634	0
36		2.1710634	0
37		2.1710634	0
38		2.1710634	0
39		2.1710634	0
40		2.1710634	0
41		2.1710634	0
42		2.1710634	0
43		2.1710634	0
44		2.1710634	0
45		2.1710634	0
46		2.1710634	0
47		2.1710634	0
48		2.1710634	0
49		2.1710634	0
50		2.1710634	0
51		2.1710634	0
52		2.1710634	0

	N	O	P
53		2.1710634	0
54		2.1710634	0
55		2.1710634	0
56		2.1710634	0
57		2.1710634	0
58		2.1710634	0
59		2.1710634	0

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/19/2021 1:09:38 PM
From File	C-ProUCL Input File_g.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

oxylene

General Statistics

Total Number of Observations	58	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	57
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable oxylene was not processed!

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	Toluene_1	PPB	#########	0	200208-5438		2, ND	0.5	0.5	92.1384	1.8842209	0
3	Forsyth Cou	Toluene_1	PPB	#########	1.04	200242-5592		2	0.5	1.04	92.1384	3.9191794	1
4	Forsyth Cou	Toluene_1	PPB	#########	1.04	200274-5709		2	0.5	1.04	92.1384	3.9191794	1
5	Forsyth Cou	Toluene_1	PPB	#########	0.64	200297-5802		2	0.5	0.64	92.1384	2.4118027	1
6	Forsyth Cou	Toluene_1	PPB	#########	0.8	200322-5892		2	0.5	0.8	92.1384	3.0147534	1
7	Forsyth Cou	Toluene_1	PPB	#########	0	200361-6162		2, ND	0.5	0.5	92.1384	1.8842209	0
8	Forsyth Cou	Toluene_1	PPB	#########	0	200420-6499		2, ND	0.5	0.5	92.1384	1.8842209	0
9	Forsyth Cou	Toluene_1	PPB	#########	0	200454-6646		2, ND	0.5	0.5	92.1384	1.8842209	0
10	Forsyth Cou	Toluene_1	PPB	#########	0	200480-6791		2, ND	0.5	0.5	92.1384	1.8842209	0
11	Forsyth Cou	Toluene_1	PPB	#########	0	200498-6913		2, ND	0.5	0.5	92.1384	1.8842209	0
12	Forsyth Cou	Toluene_1	PPB	#########	0	200515-6984		2, ND	0.5	0.5	92.1384	1.8842209	0
13	Forsyth Cou	Toluene_1	PPB	#########	0	200584-7724		2, ND	0.5	0.5	92.1384	1.8842209	0
14	Forsyth Cou	Toluene_1	PPB	#########	0	200637-7423		2, ND	0.5	0.5	92.1384	1.8842209	0
15	Forsyth Cou	Toluene_1	PPB	#########	0	200670-7530		2, ND	0.5	0.5	92.1384	1.8842209	0
16	Forsyth Cou	Toluene_1	PPB	#########	3.91	200690-7588		2	0.5	3.91	92.1384	14.734607	1
17	Forsyth Cou	Toluene_1	PPB	#########	0	200746-7832		2, ND	0.5	0.5	92.1384	1.8842209	0
18	Forsyth Cou	Toluene_1	PPB	#########	0	200775-7895		2, ND	0.5	0.5	92.1384	1.8842209	0
19	Forsyth Cou	Toluene_1	PPB	#########	0	200809-8075		2, ND	0.5	0.5	92.1384	1.8842209	0
20	Forsyth Cou	Toluene_1	PPB	#########	0	200885-8392		2, ND	0.5	0.5	92.1384	1.8842209	0
21	Forsyth Cou	Toluene_1	PPB	#########	0	200886-8393		2, ND	0.5	0.5	92.1384	1.8842209	0
22	Forsyth Cou	Toluene_1	PPB	#########	0	200945-8627		2, ND	0.5	0.5	92.1384	1.8842209	0
23	Forsyth Cou	Toluene_1	PPB	#########	0	200977-8786		2, ND	0.5	0.5	92.1384	1.8842209	0
24	Forsyth Cou	Toluene_1	PPB	#########	0	201028-9001		2, ND	0.5	0.5	92.1384	1.8842209	0
25	Forsyth Cou	Toluene_1	PPB	#########	0	201068-9173		2, ND	0.5	0.5	92.1384	1.8842209	0
26	Forsyth Cou	Toluene_1	PPB	#########	0	201122-9521		2, ND	0.5	0.5	92.1384	1.8842209	0
27	Forsyth Cou	Toluene_1	PPB	#########	0	201147-9624		2, ND	0.5	0.5	92.1384	1.8842209	0
28	Forsyth Cou	Toluene_1	PPB	#########	0	201175-9779		2, ND	0.5	0.5	92.1384	1.8842209	0
29	Forsyth Cou	Toluene_1	PPB	#########	0	201213-9935		2, ND	0.5	0.5	92.1384	1.8842209	0
30	Forsyth Cou	Toluene_1	PPB	#########	0	201267-10204		2, ND	0.5	0.5	92.1384	1.8842209	0
31	Forsyth Cou	Toluene_1	PPB	#########	0	201342-10611		2, ND	0.5	0.5	92.1384	1.8842209	0
32	Forsyth Cou	Toluene_1	PPB	#########	0	201346-10634		2, ND	0.5	0.5	92.1384	1.8842209	0
33	Forsyth Cou	Toluene_1	PPB	#########	0	201437-11097		2, ND	0.5	0.5	92.1384	1.8842209	0
34	Forsyth Cou	Toluene_1	PPB	#########	0	201449-11161		2, ND	0.5	0.5	92.1384	1.8842209	0
35	Forsyth Cou	Toluene_1	PPB	#########	0	201540-11688		2, ND	0.5	0.5	92.1384	1.8842209	0
36	Forsyth Cou	Toluene_1	PPB	#########	0.56	201539-11687		2	0.5	0.56	92.1384	2.1103274	1
37	Forsyth Cou	Toluene_1	PPB	#########	0	201616-12153		2, ND	0.5	0.5	92.1384	1.8842209	0
38	Forsyth Cou	Toluene_1	PPB	#########	0	201618-12179		2, ND	0.5	0.5	92.1384	1.8842209	0
39	Forsyth Cou	Toluene_1	PPB	#########	0	201661-12403		2, ND	1	1	92.1384	3.7684417	0
40	Forsyth Cou	Toluene_1	PPB	#########	0	201689-12518		2, ND	0.5	0.5	92.1384	1.8842209	0
41	Forsyth Cou	Toluene_1	PPB	#########	0	201809-12973		2, ND	0.5	0.5	92.1384	1.8842209	0
42	Forsyth Cou	Toluene_1	PPB	#########	0	201808-12972		2, ND	0.5	0.5	92.1384	1.8842209	0
43	Forsyth Cou	Toluene_1	PPB	#########	0	201838-13178		2, ND	0.5	0.5	92.1384	1.8842209	0
44	Forsyth Cou	Toluene_1	PPB	#########	0	201836-13110		2, ND	0.5	0.5	92.1384	1.8842209	0
45	Forsyth Cou	Toluene_1	PPB	#########	0	201882-13412		2, ND	0.5	0.5	92.1384	1.8842209	0
46	Forsyth Cou	Toluene_1	PPB	#########	0	201919-13594		2, ND	0.5	0.5	92.1384	1.8842209	0
47	Forsyth Cou	Toluene_1	PPB	#########	0	201981-13938		2, ND	0.5	0.5	92.1384	1.8842209	0
48	Forsyth Cou	Toluene_1	PPB	#########	0	202020-14133		2, ND	0.5	0.5	92.1384	1.8842209	0
49	Forsyth Cou	Toluene_1	PPB	#########	0	202085-14541		2, ND	0.5	0.5	92.1384	1.8842209	0
50	Forsyth Cou	Toluene_1	PPB	#########	0	202084-14540		2, ND	0.5	0.5	92.1384	1.8842209	0
51	Forsyth Cou	Toluene_1	PPB	#########	0	202147-14860		2, ND	0.5	0.5	92.1384	1.8842209	0
52	Forsyth Cou	Toluene_1	PPB	#########	0	202197-15081		2, ND	0.5	0.5	92.1384	1.8842209	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	Toluene_1	PPB	#########	0	202196-15080		2, ND	0.5	0.5	92.1384	1.8842209	0
54	Forsyth Cou	Toluene_1	PPB	#########	0	202248-15401		2, ND	0.5	0.5	92.1384	1.8842209	0
55	Forsyth Cou	Toluene_1	PPB	#########	0	202244-15384		2, ND	0.5	0.5	92.1384	1.8842209	0
56	Forsyth Cou	Toluene_1	PPB	#########	0	210001-15672		2, ND	0.5	0.5	92.1384	1.8842209	0
57	Forsyth Cou	Toluene_1	PPB	#########	0	210045-15889		2, ND	0.5	0.5	92.1384	1.8842209	0
58	Forsyth Cou	Toluene_1	PPB	#########	0	210044-15888		2, ND	0.5	0.5	92.1384	1.8842209	0
59	Forsyth Cou	Toluene_1	PPB	#########	0	210075-15972		2, ND	0.5	0.5	92.1384	1.8842209	0

	N	O	P
1		toluene	d_toluene
2		1.8842209	0
3		3.9191794	1
4		3.9191794	1
5		2.4118027	1
6		3.0147534	1
7		1.8842209	0
8		1.8842209	0
9		1.8842209	0
10		1.8842209	0
11		1.8842209	0
12		1.8842209	0
13		1.8842209	0
14		1.8842209	0
15		1.8842209	0
16		14.734607	1
17		1.8842209	0
18		1.8842209	0
19		1.8842209	0
20		1.8842209	0
21		1.8842209	0
22		1.8842209	0
23		1.8842209	0
24		1.8842209	0
25		1.8842209	0
26		1.8842209	0
27		1.8842209	0
28		1.8842209	0
29		1.8842209	0
30		1.8842209	0
31		1.8842209	0
32		1.8842209	0
33		1.8842209	0
34		1.8842209	0
35		1.8842209	0
36		2.1103274	1
37		1.8842209	0
38		1.8842209	0
39		3.7684417	0
40		1.8842209	0
41		1.8842209	0
42		1.8842209	0
43		1.8842209	0
44		1.8842209	0
45		1.8842209	0
46		1.8842209	0
47		1.8842209	0
48		1.8842209	0
49		1.8842209	0
50		1.8842209	0
51		1.8842209	0
52		1.8842209	0

	N	O	P
53		1.8842209	0
54		1.8842209	0
55		1.8842209	0
56		1.8842209	0
57		1.8842209	0
58		1.8842209	0
59		1.8842209	0

1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3			User Selected Options									
4			Date/Time of Computation	ProUCL 5.13/19/2021 1:10:15 PM								
5			From File	C-ProUCL Input File_h.xls								
6			Full Precision	OFF								
7			Confidence Coefficient	95%								
8			Number of Bootstrap Operations	2000								
9												
10	**toluene**											
11												
12					**General Statistics**							
13				Total Number of Observations	58			Number of Distinct Observations	7			
14				Number of Detects	6			Number of Non-Detects	52			
15				Number of Distinct Detects	5			Number of Distinct Non-Detects	2			
16				Minimum Detect	2.11			Minimum Non-Detect	1.884			
17				Maximum Detect	14.73			Maximum Non-Detect	3.768			
18				Variance Detects	23.22			Percent Non-Detects	89.66%			
19				Mean Detects	5.018			SD Detects	4.818			
20				Median Detects	3.467			CV Detects	0.96			
21				Skewness Detects	2.318			Kurtosis Detects	5.501			
22				Mean of Logged Detects	1.359			SD of Logged Detects	0.699			
23												
24					**Normal GOF Test on Detects Only**							
25				Shapiro Wilk Test Statistic	0.64			**Shapiro Wilk GOF Test**				
26				5% Shapiro Wilk Critical Value	0.788			Detected Data Not Normal at 5% Significance Level				
27				Lilliefors Test Statistic	0.424			**Lilliefors GOF Test**				
28				5% Lilliefors Critical Value	0.325			Detected Data Not Normal at 5% Significance Level				
29					**Detected Data Not Normal at 5% Significance Level**							
30												
31					**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**							
32				KM Mean	2.209			KM Standard Error of Mean	0.246			
33				KM SD	1.707			95% KM (BCA) UCL	2.662			
34				95% KM (t) UCL	2.62			95% KM (Percentile Bootstrap) UCL	2.624			
35				95% KM (z) UCL	2.613			95% KM Bootstrap t UCL	3.524			
36				90% KM Chebyshev UCL	2.946			95% KM Chebyshev UCL	3.279			
37				97.5% KM Chebyshev UCL	3.742			99% KM Chebyshev UCL	4.652			
38												
39					**Gamma GOF Tests on Detected Observations Only**							
40				A-D Test Statistic	0.803			**Anderson-Darling GOF Test**				
41				5% A-D Critical Value	0.704			Detected Data Not Gamma Distributed at 5% Significance Level				
42				K-S Test Statistic	0.377			**Kolmogorov-Smirnov GOF**				
43				5% K-S Critical Value	0.336			Detected Data Not Gamma Distributed at 5% Significance Level				
44					**Detected Data Not Gamma Distributed at 5% Significance Level**							
45												
46					**Gamma Statistics on Detected Data Only**							
47				k hat (MLE)	2.118			k star (bias corrected MLE)	1.17			
48				Theta hat (MLE)	2.37			Theta star (bias corrected MLE)	4.289			
49				nu hat (MLE)	25.41			nu star (bias corrected)	14.04			
50				Mean (detects)	5.018							
51												
52					**Gamma ROS Statistics using Imputed Non-Detects**							

53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
56	This is especially true when the sample size is small.											
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
58					Minimum	0.01				Mean	0.528	
59					Maximum	14.73				Median	0.01	
60					SD	2.099				CV	3.974	
61					k hat (MLE)	0.217				k star (bias corrected MLE)	0.217	
62					Theta hat (MLE)	2.435				Theta star (bias corrected MLE)	2.432	
63					nu hat (MLE)	25.16				nu star (bias corrected)	25.19	
64					Adjusted Level of Significance (β)	0.0459						
65					Approximate Chi Square Value (25.19, α)	14.76				Adjusted Chi Square Value (25.19, β)	14.56	
66					95% Gamma Approximate UCL (use when n>=50)	0.901				95% Gamma Adjusted UCL (use when n<50)	0.914	
67												
68	**Estimates of Gamma Parameters using KM Estimates**											
69					Mean (KM)	2.209				SD (KM)	1.707	
70					Variance (KM)	2.913				SE of Mean (KM)	0.246	
71					k hat (KM)	1.675				k star (KM)	1.6	
72					nu hat (KM)	194.3				nu star (KM)	185.6	
73					theta hat (KM)	1.319				theta star (KM)	1.38	
74					80% gamma percentile (KM)	3.393				90% gamma percentile (KM)	4.531	
75					95% gamma percentile (KM)	5.632				99% gamma percentile (KM)	8.107	
76												
77	**Gamma Kaplan-Meier (KM) Statistics**											
78					Approximate Chi Square Value (185.63, α)	155.1				Adjusted Chi Square Value (185.63, β)	154.4	
79					95% Gamma Approximate KM-UCL (use when n>=50)	2.644				95% Gamma Adjusted KM-UCL (use when n<50)	2.656	
80												
81	**Lognormal GOF Test on Detected Observations Only**											
82					Shapiro Wilk Test Statistic	0.813				**Shapiro Wilk GOF Test**		
83					5% Shapiro Wilk Critical Value	0.788				Detected Data appear Lognormal at 5% Significance Level		
84					Lilliefors Test Statistic	0.329				**Lilliefors GOF Test**		
85					5% Lilliefors Critical Value	0.325				Detected Data Not Lognormal at 5% Significance Level		
86	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89					Mean in Original Scale	0.756				Mean in Log Scale	-1.825	
90					SD in Original Scale	2.066				SD in Log Scale	1.799	
91					95% t UCL (assumes normality of ROS data)	1.21				95% Percentile Bootstrap UCL	1.268	
92					95% BCA Bootstrap UCL	1.525				95% Bootstrap t UCL	1.886	
93					95% H-UCL (Log ROS)	1.883						
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96					KM Mean (logged)	0.709				KM Geo Mean	2.032	
97					KM SD (logged)	0.302				95% Critical H Value (KM-Log)	1.692	
98					KM Standard Error of Mean (logged)	0.0434				95% H-UCL (KM -Log)	2.275	
99					KM SD (logged)	0.302				95% Critical H Value (KM-Log)	1.692	
100					KM Standard Error of Mean (logged)	0.0434						
101												
102	**DL/2 Statistics**											
103	**DL/2 Normal**									**DL/2 Log-Transformed**		
104					Mean in Original Scale	1.38				Mean in Log Scale	0.0991	

	A	B	C	D	E	F	G	H	I	J	K	L
105					SD in Original Scale	1.899				SD in Log Scale		0.487
106					95% t UCL (Assumes normality)	1.797				95% H-Stat UCL		1.404
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Detected Data appear Approximate Lognormal Distributed at 5% Significance Level**											
111												
112	**Suggested UCL to Use**											
113					KM H-UCL	2.275						
114												
115	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
116	Recommendations are based upon data size, data distribution, and skewness.											
117	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
118	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
119												

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	Trichloroeth	PPB	#########	0	200208-5438		2, ND	0.5	0.5	131.388	2.6868712	0
3	Forsyth Cou	Trichloroeth	PPB	#########	0	200242-5592		2, ND	0.5	0.5	131.388	2.6868712	0
4	Forsyth Cou	Trichloroeth	PPB	#########	0	200274-5709		2, ND	0.5	0.5	131.388	2.6868712	0
5	Forsyth Cou	Trichloroeth	PPB	#########	0	200297-5802		2, ND	0.5	0.5	131.388	2.6868712	0
6	Forsyth Cou	Trichloroeth	PPB	#########	0	200322-5892		2, ND	0.5	0.5	131.388	2.6868712	0
7	Forsyth Cou	Trichloroeth	PPB	#########	0	200361-6162		2, ND	0.5	0.5	131.388	2.6868712	0
8	Forsyth Cou	Trichloroeth	PPB	#########	0	200420-6499		2, ND	0.5	0.5	131.388	2.6868712	0
9	Forsyth Cou	Trichloroeth	PPB	#########	0	200454-6646		2, ND	0.5	0.5	131.388	2.6868712	0
10	Forsyth Cou	Trichloroeth	PPB	#########	0	200480-6791		2, ND	0.5	0.5	131.388	2.6868712	0
11	Forsyth Cou	Trichloroeth	PPB	#########	0	200498-6913		2, ND	0.5	0.5	131.388	2.6868712	0
12	Forsyth Cou	Trichloroeth	PPB	#########	0	200515-6984		2, ND	0.5	0.5	131.388	2.6868712	0
13	Forsyth Cou	Trichloroeth	PPB	#########	0	200584-7724		2, ND	0.5	0.5	131.388	2.6868712	0
14	Forsyth Cou	Trichloroeth	PPB	#########	0	200637-7423		2, ND	0.5	0.5	131.388	2.6868712	0
15	Forsyth Cou	Trichloroeth	PPB	#########	0	200670-7530		2, ND	0.5	0.5	131.388	2.6868712	0
16	Forsyth Cou	Trichloroeth	PPB	#########	0	200690-7588		2, ND	0.5	0.5	131.388	2.6868712	0
17	Forsyth Cou	Trichloroeth	PPB	#########	0	200746-7832		2, ND	0.5	0.5	131.388	2.6868712	0
18	Forsyth Cou	Trichloroeth	PPB	#########	0	200775-7895		2, ND	0.5	0.5	131.388	2.6868712	0
19	Forsyth Cou	Trichloroeth	PPB	#########	0	200809-8075		2, ND	0.5	0.5	131.388	2.6868712	0
20	Forsyth Cou	Trichloroeth	PPB	#########	0	200885-8392		2, ND	0.5	0.5	131.388	2.6868712	0
21	Forsyth Cou	Trichloroeth	PPB	#########	0	200886-8393		2, ND	0.5	0.5	131.388	2.6868712	0
22	Forsyth Cou	Trichloroeth	PPB	#########	0	200945-8627		2, ND	0.5	0.5	131.388	2.6868712	0
23	Forsyth Cou	Trichloroeth	PPB	#########	0	200977-8786		2, ND	0.5	0.5	131.388	2.6868712	0
24	Forsyth Cou	Trichloroeth	PPB	#########	0	201028-9001		2, ND	0.5	0.5	131.388	2.6868712	0
25	Forsyth Cou	Trichloroeth	PPB	#########	0	201068-9173		2, ND	0.5	0.5	131.388	2.6868712	0
26	Forsyth Cou	Trichloroeth	PPB	#########	0	201122-9521		2, ND	0.5	0.5	131.388	2.6868712	0
27	Forsyth Cou	Trichloroeth	PPB	#########	0	201147-9624		2, ND	0.5	0.5	131.388	2.6868712	0
28	Forsyth Cou	Trichloroeth	PPB	#########	0	201175-9779		2, ND	0.5	0.5	131.388	2.6868712	0
29	Forsyth Cou	Trichloroeth	PPB	#########	0	201213-9935		2, ND	0.5	0.5	131.388	2.6868712	0
30	Forsyth Cou	Trichloroeth	PPB	#########	0	201267-10204		2, ND	0.5	0.5	131.388	2.6868712	0
31	Forsyth Cou	Trichloroeth	PPB	#########	0	201342-10611		2, ND	0.5	0.5	131.388	2.6868712	0
32	Forsyth Cou	Trichloroeth	PPB	#########	0	201346-10634		2, ND	0.5	0.5	131.388	2.6868712	0
33	Forsyth Cou	Trichloroeth	PPB	#########	0	201437-11097		2, ND	0.5	0.5	131.388	2.6868712	0
34	Forsyth Cou	Trichloroeth	PPB	#########	0	201449-11161		2, ND	0.5	0.5	131.388	2.6868712	0
35	Forsyth Cou	Trichloroeth	PPB	#########	0	201540-11688		2, ND	0.5	0.5	131.388	2.6868712	0
36	Forsyth Cou	Trichloroeth	PPB	#########	0	201539-11687		2, ND	0.5	0.5	131.388	2.6868712	0
37	Forsyth Cou	Trichloroeth	PPB	#########	0	201616-12153		2, ND	0.5	0.5	131.388	2.6868712	0
38	Forsyth Cou	Trichloroeth	PPB	#########	0	201618-12179		2, ND	0.5	0.5	131.388	2.6868712	0
39	Forsyth Cou	Trichloroeth	PPB	#########	0	201661-12403		2, ND	0.5	0.5	131.388	2.6868712	0
40	Forsyth Cou	Trichloroeth	PPB	#########	0	201689-12518		2, ND	0.5	0.5	131.388	2.6868712	0
41	Forsyth Cou	Trichloroeth	PPB	#########	0	201809-12973		2, ND	0.5	0.5	131.388	2.6868712	0
42	Forsyth Cou	Trichloroeth	PPB	#########	0	201808-12972		2, ND	0.5	0.5	131.388	2.6868712	0
43	Forsyth Cou	Trichloroeth	PPB	#########	0	201838-13178		2, ND	0.5	0.5	131.388	2.6868712	0
44	Forsyth Cou	Trichloroeth	PPB	#########	0	201836-13110		2, ND	0.5	0.5	131.388	2.6868712	0
45	Forsyth Cou	Trichloroeth	PPB	#########	0	201882-13412		2, ND	0.5	0.5	131.388	2.6868712	0
46	Forsyth Cou	Trichloroeth	PPB	#########	0	201919-13594		2, ND	0.5	0.5	131.388	2.6868712	0
47	Forsyth Cou	Trichloroeth	PPB	#########	0	201981-13938		2, ND	0.5	0.5	131.388	2.6868712	0
48	Forsyth Cou	Trichloroeth	PPB	#########	0	202020-14133		2, ND	0.5	0.5	131.388	2.6868712	0
49	Forsyth Cou	Trichloroeth	PPB	#########	0	202085-14541		2, ND	0.5	0.5	131.388	2.6868712	0
50	Forsyth Cou	Trichloroeth	PPB	#########	0	202084-14540		2, ND	0.5	0.5	131.388	2.6868712	0
51	Forsyth Cou	Trichloroeth	PPB	#########	0	202147-14860		2, ND	0.5	0.5	131.388	2.6868712	0
52	Forsyth Cou	Trichloroeth	PPB	#########	0	202197-15081		2, ND	0.5	0.5	131.388	2.6868712	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	Trichloroeth	PPB	#########	0	202196-15080		2, ND	0.5	0.5	131.388	2.6868712	0
54	Forsyth Cou	Trichloroeth	PPB	#########	0	202248-15401		2, ND	0.5	0.5	131.388	2.6868712	0
55	Forsyth Cou	Trichloroeth	PPB	#########	0	202244-15384		2, ND	0.5	0.5	131.388	2.6868712	0
56	Forsyth Cou	Trichloroeth	PPB	#########	0	210001-15672		2, ND	0.5	0.5	131.388	2.6868712	0
57	Forsyth Cou	Trichloroeth	PPB	#########	0	210045-15889		2, ND	0.5	0.5	131.388	2.6868712	0
58	Forsyth Cou	Trichloroeth	PPB	#########	0	210044-15888		2, ND	0.5	0.5	131.388	2.6868712	0
59	Forsyth Cou	Trichloroeth	PPB	#########	0	210075-15972		2, ND	0.5	0.5	131.388	2.6868712	0

	N	O	P
1		tce	d_tce
2		2.6868712	0
3		2.6868712	0
4		2.6868712	0
5		2.6868712	0
6		2.6868712	0
7		2.6868712	0
8		2.6868712	0
9		2.6868712	0
10		2.6868712	0
11		2.6868712	0
12		2.6868712	0
13		2.6868712	0
14		2.6868712	0
15		2.6868712	0
16		2.6868712	0
17		2.6868712	0
18		2.6868712	0
19		2.6868712	0
20		2.6868712	0
21		2.6868712	0
22		2.6868712	0
23		2.6868712	0
24		2.6868712	0
25		2.6868712	0
26		2.6868712	0
27		2.6868712	0
28		2.6868712	0
29		2.6868712	0
30		2.6868712	0
31		2.6868712	0
32		2.6868712	0
33		2.6868712	0
34		2.6868712	0
35		2.6868712	0
36		2.6868712	0
37		2.6868712	0
38		2.6868712	0
39		2.6868712	0
40		2.6868712	0
41		2.6868712	0
42		2.6868712	0
43		2.6868712	0
44		2.6868712	0
45		2.6868712	0
46		2.6868712	0
47		2.6868712	0
48		2.6868712	0
49		2.6868712	0
50		2.6868712	0
51		2.6868712	0
52		2.6868712	0

	N	O	P
53		2.6868712	0
54		2.6868712	0
55		2.6868712	0
56		2.6868712	0
57		2.6868712	0
58		2.6868712	0
59		2.6868712	0

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.13/19/2021 1:11:29 PM
From File	C-ProUCL Input File_i.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

tce

General Statistics

Total Number of Observations	58	Number of Distinct Observations	1
Number of Detects	0	Number of Non-Detects	58
Number of Distinct Detects	0	Number of Distinct Non-Detects	1

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable tce was not processed!

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	Parameter	Units	Sample Tim	Value	Sample ID	Null Code	Qualifier Co	Minimum De	Value to Us	Molecular W	Result in µg	Detection S
2	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200208-5438		2, ND	0.5	0.5	62.498	1.2780777	0
3	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200242-5592		2, ND	0.5	0.5	62.498	1.2780777	0
4	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200274-5709		2, ND	0.5	0.5	62.498	1.2780777	0
5	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200297-5802		2, ND	0.5	0.5	62.498	1.2780777	0
6	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200322-5892		2, ND	0.5	0.5	62.498	1.2780777	0
7	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200361-6162		2, ND	0.5	0.5	62.498	1.2780777	0
8	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200420-6499		2, ND	0.5	0.5	62.498	1.2780777	0
9	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200454-6646		2, ND	0.5	0.5	62.498	1.2780777	0
10	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200480-6791		2, ND	0.5	0.5	62.498	1.2780777	0
11	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200498-6913		2, ND	0.5	0.5	62.498	1.2780777	0
12	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200515-6984		2, ND	0.5	0.5	62.498	1.2780777	0
13	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200584-7724		2, ND	0.5	0.5	62.498	1.2780777	0
14	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200637-7423		2, ND	0.5	0.5	62.498	1.2780777	0
15	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200670-7530		2, ND	0.5	0.5	62.498	1.2780777	0
16	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200690-7588		2, ND	0.5	0.5	62.498	1.2780777	0
17	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200746-7832		2, ND	0.5	0.5	62.498	1.2780777	0
18	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200775-7895		2, ND	0.5	0.5	62.498	1.2780777	0
19	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200809-8075		2, ND	0.5	0.5	62.498	1.2780777	0
20	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200885-8392		2, ND	0.5	0.5	62.498	1.2780777	0
21	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200886-8393		2, ND	0.5	0.5	62.498	1.2780777	0
22	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200945-8627		2, ND	0.5	0.5	62.498	1.2780777	0
23	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	200977-8786		2, ND	0.5	0.5	62.498	1.2780777	0
24	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201028-9001		2, ND	0.5	0.5	62.498	1.2780777	0
25	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201068-9173		2, ND	0.5	0.5	62.498	1.2780777	0
26	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201122-9521		2, ND	0.5	0.5	62.498	1.2780777	0
27	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201147-9624		2, ND	0.5	0.5	62.498	1.2780777	0
28	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201175-9779		2, ND	0.5	0.5	62.498	1.2780777	0
29	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201213-9935		2, ND	0.5	0.5	62.498	1.2780777	0
30	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201267-10204		2, ND	0.5	0.5	62.498	1.2780777	0
31	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201342-10611		2, ND	0.5	0.5	62.498	1.2780777	0
32	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201346-10634		2, ND	0.5	0.5	62.498	1.2780777	0
33	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201437-11097		2, ND	0.5	0.5	62.498	1.2780777	0
34	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201449-11161		2, ND	0.5	0.5	62.498	1.2780777	0
35	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201540-11688		2, ND	0.5	0.5	62.498	1.2780777	0
36	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201539-11687		2, ND	0.5	0.5	62.498	1.2780777	0
37	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201616-12153		2, ND	0.5	0.5	62.498	1.2780777	0
38	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201618-12179		2, ND	0.5	0.5	62.498	1.2780777	0
39	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201661-12403		2, ND	0.5	0.5	62.498	1.2780777	0
40	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201689-12518		2, ND	0.5	0.5	62.498	1.2780777	0
41	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201809-12973		2, ND	0.5	0.5	62.498	1.2780777	0
42	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201808-12972		2, ND	0.5	0.5	62.498	1.2780777	0
43	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201838-13178		2, ND	0.5	0.5	62.498	1.2780777	0
44	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201836-13110		2, ND	0.5	0.5	62.498	1.2780777	0
45	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201882-13412		2, ND	0.5	0.5	62.498	1.2780777	0
46	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201919-13594		2, ND	0.5	0.5	62.498	1.2780777	0
47	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	201981-13938		2, ND	0.5	0.5	62.498	1.2780777	0
48	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	202020-14133		2, ND	0.5	0.5	62.498	1.2780777	0
49	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	202085-14541		2, ND	0.5	0.5	62.498	1.2780777	0
50	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	202084-14540		2, ND	0.5	0.5	62.498	1.2780777	0
51	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	202147-14860		2, ND	0.5	0.5	62.498	1.2780777	0
52	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	202197-15081		2, ND	0.5	0.5	62.498	1.2780777	0

	A	B	C	D	E	F	G	H	I	J	K	L	M
53	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	202196-15080		2, ND	0.5	0.5	62.498	1.2780777	0
54	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	202248-15401		2, ND	0.5	0.5	62.498	1.2780777	0
55	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	202244-15384		2, ND	0.5	0.5	62.498	1.2780777	0
56	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	210001-15672		2, ND	0.5	0.5	62.498	1.2780777	0
57	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	210045-15889		2, ND	0.5	0.5	62.498	1.2780777	0
58	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	210044-15888		2, ND	0.5	0.5	62.498	1.2780777	0
59	Forsyth Cou	Vinyl_Chlori	PPB	#########	0	210075-15972		2, ND	0.5	0.5	62.498	1.2780777	0

	N	O	P	Q
1		vinylchloride	d_vinylchloride	
2		1.2780777	0	
3		1.2780777	0	
4		1.2780777	0	
5		1.2780777	0	
6		1.2780777	0	
7		1.2780777	0	
8		1.2780777	0	
9		1.2780777	0	
10		1.2780777	0	
11		1.2780777	0	
12		1.2780777	0	
13		1.2780777	0	
14		1.2780777	0	
15		1.2780777	0	
16		1.2780777	0	
17		1.2780777	0	
18		1.2780777	0	
19		1.2780777	0	
20		1.2780777	0	
21		1.2780777	0	
22		1.2780777	0	
23		1.2780777	0	
24		1.2780777	0	
25		1.2780777	0	
26		1.2780777	0	
27		1.2780777	0	
28		1.2780777	0	
29		1.2780777	0	
30		1.2780777	0	
31		1.2780777	0	
32		1.2780777	0	
33		1.2780777	0	
34		1.2780777	0	
35		1.2780777	0	
36		1.2780777	0	
37		1.2780777	0	
38		1.2780777	0	
39		1.2780777	0	
40		1.2780777	0	
41		1.2780777	0	
42		1.2780777	0	
43		1.2780777	0	
44		1.2780777	0	
45		1.2780777	0	
46		1.2780777	0	
47		1.2780777	0	
48		1.2780777	0	
49		1.2780777	0	
50		1.2780777	0	
51		1.2780777	0	
52		1.2780777	0	

	N	O	P	Q
53		1.2780777	0	
54		1.2780777	0	
55		1.2780777	0	
56		1.2780777	0	
57		1.2780777	0	
58		1.2780777	0	
59		1.2780777	0	

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3				User Selected Options								
4				Date/Time of Computation	ProUCL 5.13/19/2021 1:11:57 PM							
5				From File	C-ProUCL Input File_j.xls							
6				Full Precision	OFF							
7				Confidence Coefficient	95%							
8				Number of Bootstrap Operations	2000							
9												
10	**vinylchloride**											
11												
12	**General Statistics**											
13						Total Number of Observations	58			Number of Distinct Observations	1		
14						Number of Detects	0			Number of Non-Detects	58	
15						Number of Distinct Detects	0			Number of Distinct Non-Detects	1	
16												
17	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
18	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
19	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
20												
21	**The data set for variable vinylchloride was not processed!**											
22												
23												

Appendix C

Toxicity Values, Cancer RSLs and Noncancer RSLs, and Equations Used to Derive RSLs

Cancer Toxicity Values Used in this Risk Assessment

Constituent	CAS Number	IUR $(\mu g/m^3)^{-1}$	Source	EPA Mode of Action	EPA Weight of Evidence (WOE) Description	Information on Tumor Site and Type	Link to Toxicity Assessment	Link to WOE Description
1,3-Butadiene	106-99-0	3.00E-05	IRIS		Carcinogenic to humans	Hematologic; Leukemia	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=139	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=139
Methylene chloride (Dichloromethane)	75-09-2	1.00E-08	IRIS	M	Likely to be carcinogenic to humans	Hepatic, Respiratory; Hepatocellular carcinomas or adenomas, bronchoalveolar carcinomas or adenomas	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=70	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=70
Chloroform	67-66-3	2.30E-05	IRIS		B2 (Probable human carcinogen - based on sufficient evidence of carcinogenicity in animals)	Hepatic; hepatocellular carcinoma	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=25	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=25
Dichloroethane, 1,2- (Ethylene dichloride)	107-06-2	2.60E-05	IRIS		B2 (Probable human carcinogen - based on sufficient evidence of carcinogenicity in animals)	Other; Hemangiosarcomas	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=149	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=149
Trichloroethylene	79-01-6	4.10E-06	IRIS	M	Carcinogenic to humans	Hematologic, Hepatic, Urinary; Renal cell carcinoma, non-Hodgkin's lymphoma, and liver tumors	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=199	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=199
Vinyl chloride	75-01-4	4.40E-06	IRIS	M	Known/likely human carcinogen	Hepatic; Liver angiosarcomas, angiomas, hepatomas, and neoplastic nodules	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=1001	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=1001
m/p-Xylene	N/A (assessed as m-Xylene in the RSL calculator)				Data are inadequate for an assessment of human carcinogenic potential			https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=270
Benzene	71-43-2	7.80E-06	IRIS		A (Human carcinogen)	Hematologic; Leukemia	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=276	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=276
Toluene	108-88-3				Inadequate information to assess carcinogenic potential			https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=118
o-Xylene	95-47-6				Data are inadequate for an assessment of human carcinogenic potential			https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=270
Hexane	110-54-3				Inadequate information to assess carcinogenic potential			https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=486

Noncancer Toxicity Values Used in this Risk Assessment

Constituent	**CAS Number**	**RfC (mg/m^3)**	**RfC Source**	**Critical Effect (from the Critical Study)**	**Link to Noncancer Toxicity Assessment**
1,3-Butadiene	106-99-0	2.00E-03	IRIS	Ovarian atrophy	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=139
Methylene chloride (Dichloromethane)	75-09-2	6.00E-01	IRIS	Hepatic effects (hepatic vacuolation)	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=70
Chloroform	67-66-3	9.77E-02	ATSDR	Hepatomegaly	https://www.atsdr.cdc.gov/toxprofiles/tp6.pdf
Dichloroethane, 1,2-	107-06-2	7.00E-03	PPRTV	Neurobehavioral impairment	https://cfpub.epa.gov/ncea/pprtv/chemicalLanding.cfm?pprtv_sub_id=1682
Trichloroethylene	79-01-6	2.00E-03	IRIS	Decreased thymus weight in female B6C3F1 mice (immunotoxicity)	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=199
Vinyl chloride	75-01-4	1.00E-01	IRIS	Liver cell polymorphism	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=1001
m/p Xylene	N/A	1.00E-01	IRIS	Impaired motor coordination (decreased rotarod performance)	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=270
Benzene	71-43-2	3.00E-02	IRIS	Decreased lymphocyte count	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=276
Toluene	108-88-3	5.00E+00	IRIS	Neurological effects in occupationally-exposed workers	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=118
o-Xylene	95-47-6	1.00E-01	IRIS	Impaired motor coordination (decreased rotarod performance)	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=270
Hexane	110-54-3	7.00E-01	IRIS	Peripheral neuropathy (decreased MCV at 12 weeks)	https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=486

Notes

Please see Section 3.3 of the *Ambient Air Monitoring Report: Risk Assessment for Select Hazardous Air Pollutants (HAPs) Measured at the Forsyth County Air Monitoring Site, First 12 Months of Operation* ("Risk Assessment") text for more information on how toxicity values were selected and additional information about the sources for these toxicity values.

EPA's Cancer Weight of Evidence descriptor, Mode of Action, noncancer critical effect description, and tumor site/type were obtained from the toxicity assessment for each air toxic. Links to the toxicity assessment for individual air toxics have been provided in the tables.

Acronyms

IUR = Inhalation Unit Risk

RfC = Reference Concentration

M = Air Toxic is considered to have a mutagenic Mode of Action.

Toxicity Value Sources

- IRIS = USEPA Integrated Risk Information System (IRIS); https://www.epa.gov/iris
- PPRTV = USEPA Provisional Peer Reviewed Toxicity Value (PPRTV); https://www.epa.gov/pprtv/provisional-peer-reviewed-toxicity-values-pprtvs-assessments
- CalEPA = California Environmental Protection Agency Office of Environmental Health Hazard Assessment (CalEPA); https://oehha.ca.gov/chemicals
- ATSDR = Minimal Risk Level (considered equivalent to a RfC) from Agency for Toxic Substances and Disease Registry (ATSDR); https://www.atsdr.cdc.gov/mrls/mrllist.asp
- SCREEN = PPRTV Screening Value; https://www.epa.gov/pprtv/provisional-peer-reviewed-toxicity-values-pprtvs-assessments
- HEAST = Health Effects Assessment Summary Tables; https://epa-heast.ornl.gov/

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR ($(ug/m^3)^{-1}$)	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or fibers/m^3)
						Acephate	30560-19-1		
2.2E-06	I	9.0E-03	I	V		Acetaldehyde	75-07-0	1.3E+00	9.4E-01
						Acetochlor	34256-82-1		
		3.1E+01	A	V		Acetone	67-64-1		3.2E+03
		2.0E-03	X			Acetone Cyanohydrin	75-86-5		2.1E-01
		6.0E-02	I	V		Acetonitrile	75-05-8		6.3E+00
				V		Acetophenone	98-86-2		
1.3E-03	C					Acetylaminofluorene, 2-	53-96-3	2.2E-03	
		2.0E-05	I	V		Acrolein	107-02-8		2.1E-03
1.0E-04	I	6.0E-03	I		M	Acrylamide	79-06-1	1.0E-02	6.3E-01
		1.0E-03	I	V		Acrylic Acid	79-10-7		1.0E-01
6.8E-05	I	2.0E-03	I	V		Acrylonitrile	107-13-1	4.1E-02	2.1E-01
		6.0E-03	P			Adiponitrile	111-69-3		6.3E-01
						Alachlor	15972-60-8		
						Aldicarb	116-06-3		
						Aldicarb Sulfone	1646-88-4		
						Aldicarb sulfoxide	1646-87-3		
4.9E-03	I			V		Aldrin	309-00-2	5.7E-04	
		1.0E-04	X	V		Allyl Alcohol	107-18-6		1.0E-02
6.0E-06	C	1.0E-03	I	V		Allyl Chloride	107-05-1	4.7E-01	1.0E-01
		5.0E-03	P			Aluminum	7429-90-5		5.2E-01
						Aluminum Phosphide	20859-73-8		
						Ametryn	834-12-8		
6.0E-03	C					Aminobiphenyl, 4-	92-67-1	4.7E-04	
						Aminophenol, m-	591-27-5		
						Aminophenol, o-	95-55-6		
						Aminophenol, p-	123-30-8		
						Amitraz	33089-61-1		
		5.0E-01	I	V		Ammonia	7664-41-7		5.2E+01
						Ammonium Picrate	131-74-8		
						Ammonium Sulfamate	7773-06-0		
		3.0E-03	X	V		Amyl Alcohol, tert-	75-85-4		3.1E-01
1.6E-06	C	1.0E-03	I			Aniline	62-53-3	1.8E+00	1.0E-01
						Anthraquinone, 9,10-	84-65-1		
		3.0E-04	A			Antimony (metallic)	7440-36-0		3.1E-02
						Antimony Pentoxide	1314-60-9		
						Antimony Tetroxide	1332-81-6		
		2.0E-04	I			Antimony Trioxide	1309-64-4		2.1E-02
4.3E-03	I	1.5E-05	C			Arsenic, Inorganic	7440-38-2	6.5E-04	1.6E-03
		5.0E-05	I			Arsine	7784-42-1		5.2E-03
						Asbestos (units in fibers)	1332-21-4		
						Asulam	3337-71-1		
						Atrazine	1912-24-9		
2.5E-04	C					Auramine	492-80-8	1.1E-02	
						Avermectin B1	65195-55-3		
		1.0E-02	A			Azinphos-methyl	86-50-0		1.0E+00
3.1E-05	I			V		Azobenzene	103-33-3	9.1E-02	
		7.0E-06	P			Azodicarbonamide	123-77-3		7.3E-04
		5.0E-04	H			Barium	7440-39-3		5.2E-02
				V		Benfluralin	1861-40-1		
						Benomyl	17804-35-2		
						Bensulfuron-methyl	83055-99-6		
						Bentazon	25057-89-0		
				V		Benzaldehyde	100-52-7		
7.8E-06	I	3.0E-02	I	V		Benzene	71-43-2	3.6E-01	3.1E+00
						Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1		
				V		Benzenethiol	108-98-5		
6.7E-02	I				M	Benzidine	92-87-5	1.5E-05	
						Benzoic Acid	65-85-0		
				V		Benzotrichloride	98-07-7		
						Benzyl Alcohol	100-51-6		
4.9E-05	C	1.0E-03	P	V		Benzyl Chloride	100-44-7	5.7E-02	1.0E-01
2.4E-03	I	2.0E-05	I			Beryllium and compounds	7440-41-7	1.2E-03	2.1E-03
						Bifenox	42576-02-3		
						Biphenthrin	82657-04-3		
		4.0E-04	X	V		Biphenyl, 1,1'-	92-52-4		4.2E-02
				V		Bis(2-chloro-1-methylethyl) ether	108-60-1		
						Bis(2-chloroethoxy)methane	111-91-1		
3.3E-04	I			V		Bis(2-chloroethyl)ether	111-44-4	8.5E-03	
6.2E-02	I			V		Bis(chloromethyl)ether	542-88-1	4.5E-05	
						Bisphenol A	80-05-7		
		2.0E-02	H			Boron And Borates Only	7440-42-8		2.1E+00
		2.0E-02	P	V		Boron Trichloride	10294-34-5		2.1E+00
		1.3E-02	C	V		Boron Trifluoride	7637-07-2		1.4E+00
						Bromate	15541-45-4		
6.0E-04	X			V		Bromo-2-chloroethane, 1-	107-04-0	4.7E-03	
				V		Bromo-3-fluorobenzene, 1-	1073-06-9		
				V		Bromo-4-fluorobenzene, 1-	460-00-4		
						Bromoacetic acid	79-08-3		
		6.0E-02	I	V		Bromobenzene	108-86-1		6.3E+00
		4.0E-02	X	V		Bromochloromethane	74-97-5		4.2E+00
3.7E-05	C			V		Bromodichloromethane	75-27-4	7.6E-02	
1.1E-06	I			V		Bromoform	75-25-2	2.6E+00	
		5.0E-03	I	V		Bromomethane	74-83-9		5.2E-01
				V		Bromophos	2104-96-3		
		1.0E-01	A	V		Bromopropane, 1-	106-94-5		1.0E+01
						Bromoxynil	1689-84-5		
				V		Bromoxynil Octanoate	1689-99-2		
3.0E-05	I	2.0E-03	I	V		Butadiene, 1,3-	106-99-0	9.4E-02	2.1E-01
						Butanoic acid, 4-(2,4-dichlorophenoxy)-	94-82-6		
				V		Butanol, N-	71-36-3		

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR $(ug/m^3)^{-1}$	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or fibers/m^3)
		3.0E+01	P	V		Butyl alcohol, sec-	78-92-2		3.1E+03
				V		Butylate	2008-41-5		
5.7E-08	C					Butylated hydroxyanisole	25013-16-5	4.9E+01	
						Butylated hydroxytoluene	128-37-0		
				V		Butylbenzene, n-	104-51-8		
				V		Butylbenzene, sec-	135-98-8		
				V		Butylbenzene, tert-	98-06-6		
						Cacodylic Acid	75-60-5		
1.8E-03	I	1.0E-05	A			Cadmium (Diet)	7440-43-9		
1.8E-03	I	1.0E-05	A			Cadmium (Water)	7440-43-9	1.6E-03	1.0E-03
		2.2E-03	C			Caprolactam	105-60-2		2.3E-01
4.3E-05	C					Captafol	2425-06-1	6.5E-02	
6.6E-07	C					Captan	133-06-2	4.3E+00	
						Carbaryl	63-25-2		
						Carbofuran	1563-66-2		
		7.0E-01	I	V		Carbon Disulfide	75-15-0		7.3E+01
6.0E-06	I	1.0E-01	I	V		Carbon Tetrachloride	56-23-5	4.7E-01	1.0E+01
		1.0E-01	P	V		Carbonyl Sulfide	463-58-1		1.0E+01
						Carbosulfan	55285-14-8		
						Carboxin	5234-68-4		
		9.0E-04	I			Ceric oxide	1306-38-3		9.4E-02
				V		Chloral Hydrate	302-17-0		
						Chloramben	133-90-4		
						Chloramines, Organic	E701235		
						Chloranil	118-75-2		
1.0E-04	I	7.0E-04	I	V		Chlordane (technical mixture)	12789-03-6	2.8E-02	7.3E-02
4.6E-03	C					Chlordecone (Kepone)	143-50-0	6.1E-04	
						Chlorfenvinphos	470-90-6		
						Chlorimuron, Ethyl-	90982-32-4		
		1.5E-04	A	V		Chlorine	7782-50-5		1.5E-02
		2.0E-04	I	V		Chlorine Dioxide	10049-04-4		2.1E-02
						Chlorite (Sodium Salt)	7758-19-2		
		5.0E+01	I	V		Chloro-1,1-difluoroethane, 1-	75-68-3		5.2E+03
3.0E-04	I	2.0E-02	I	V		Chloro-1,3-butadiene, 2-	126-99-8	9.4E-03	2.1E+00
						Chloro-2-methylaniline HCl, 4-	3165-93-3		
7.7E-05	C					Chloro-2-methylaniline, 4-	95-69-2	3.6E-02	
				V		Chloroacetaldehyde, 2-	107-20-0		
						Chloroacetic Acid	79-11-8		
		3.0E-05	I			Chloroacetophenone, 2-	532-27-4		3.1E-03
						Chloroaniline, p-	106-47-8		
		5.0E-02	P	V		Chlorobenzene	108-90-7		5.2E+00
						Chlorobenzene sulfonic acid, p-	98-66-8		
3.1E-05	C					Chlorobenzilate	510-15-6	9.1E-02	
						Chlorobenzoic Acid, p-	74-11-3		
8.6E-06	C	3.0E-01	P	V		Chlorobenzotrifluoride, 4-	98-56-6	3.3E-01	3.1E+01
				V		Chlorobutane, 1-	109-69-3		
		5.0E+01	I	V		Chlorodifluoromethane	75-45-6		5.2E+03
				V		Chloroethanol, 2-	107-07-3		
2.3E-05	I	9.8E-02	A	V		Chloroform	67-66-3	1.2E-01	1.0E+01
		9.0E-02	I	V		Chloromethane	74-87-3		9.4E+00
6.9E-04	C			V		Chloromethyl Methyl Ether	107-30-2	4.1E-03	
		1.0E-05	X			Chloronitrobenzene, o-	88-73-3		1.0E-03
		2.0E-03	P			Chloronitrobenzene, p-	100-00-5		2.1E-01
				V		Chlorophenol, 2-	95-57-8		
		4.0E-04	C	V		Chloropicrin	76-06-2		4.2E-02
						Chlorothalonil	1897-45-6		
				V		Chlorotoluene, o-	95-49-8		
				V		Chlorotoluene, p-	106-43-4		
6.9E-02	C					Chlorozotocin	54749-90-5	4.1E-05	
						Chlorpropham	101-21-3		
						Chlorpyrifos	2921-88-2		
						Chlorpyrifos Methyl	5598-13-0		
						Chlorsulfuron	64902-72-3		
						Chlorthal-dimethyl	1861-32-1		
						Chlorthiophos	60238-56-4		
						Chromium(III), Insoluble Salts	16065-83-1		
8.4E-02	G	1.0E-04	I		M	Chromium(VI)	18540-29-9	1.2E-05	1.0E-02
						Chromium, Total	7440-47-3		
						Clofentezine	74115-24-5		
9.0E-03	P	6.0E-06	P			Cobalt	7440-48-4	3.1E-04	6.3E-04
6.2E-04	I			V	M	Coke Oven Emissions	E649830	1.6E-03	
						Copper	7440-50-8		
		6.0E-01	C			Cresol, m-	108-39-4		6.3E+01
		6.0E-01	C			Cresol, o-	95-48-7		6.3E+01
		6.0E-01	C			Cresol, p-	106-44-5		6.3E+01
						Cresol, p-chloro-m-	59-50-7		
		6.0E-01	C			Cresols	1319-77-3		6.3E+01
				V		Crotonaldehyde, trans-	123-73-9		
		4.0E-01	I	V		Cumene	98-82-8		4.2E+01
6.3E-05	C					Cupferron	135-20-6	4.5E-02	
						Cyanazine	21725-46-2		
						Cyanides			
						~Calcium Cyanide	592-01-8		
						~Copper Cyanide	544-92-3		
		8.0E-04	G	V		~Cyanide (CN-)	57-12-5		8.3E-02
				V		~Cyanogen	460-19-5		
				V		~Cyanogen Bromide	506-68-3		
				V		~Cyanogen Chloride	506-77-4		
		8.0E-04	I	V		~Hydrogen Cyanide	74-90-8		8.3E-02
						~Potassium Cyanide	151-50-8		
						~Potassium Silver Cyanide	506-61-6		

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR $(ug/m^3)^{-1}$	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or $fibers/m^3$)
						~Silver Cyanide	506-64-9		
						~Sodium Cyanide	143-33-9		
						~Thiocyanates	E1790664		
				V		~Thiocyanic Acid	463-56-9		
						~Zinc Cyanide	557-21-1		
		6.0E+00	I	V		Cyclohexane	110-82-7		6.3E+02
						Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3		
		7.0E-01	P	V		Cyclohexanone	108-94-1		7.3E+01
		1.0E+00	X	V		Cyclohexene	110-83-8		1.0E+02
				V		Cyclohexylamine	108-91-8		
						Cyfluthrin	68359-37-5		
						Cyhalothrin	68085-85-8		
						Cyromazine	66215-27-8		
6.9E-05	C					DDD, p,p`- (DDD)	72-54-8	4.1E-02	
9.7E-05	C			V		DDE, p,p'-	72-55-9	2.9E-02	
9.7E-05	I					DDT	50-29-3	2.9E-02	
						Dalapon	75-99-0		
5.1E-06	C					Daminozide	1596-84-5	5.5E-01	
						Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5		
						Demeton	8065-48-3		
						Di(2-ethylhexyl)adipate	103-23-1		
						Diallate	2303-16-4		
						Diazinon	333-41-5		
				V		Dibenzothiophene	132-65-0		
6.0E-03	P	2.0E-04	I	V	M	Dibromo-3-chloropropane, 1,2-	96-12-8	1.7E-04	2.1E-02
						Dibromoacetic acid	631-64-1		
				V		Dibromobenzene, 1,3-	108-36-1		
				V		Dibromobenzene, 1,4-	106-37-6		
				V		Dibromochloromethane	124-48-1		
6.0E-04	I	9.0E-03	I	V		Dibromoethane, 1,2-	106-93-4	4.7E-03	9.4E-01
		4.0E-03	X	V		Dibromomethane (Methylene Bromide)	74-95-3		4.2E-01
						Dibutyltin Compounds	E1790660		
						Dicamba	1918-00-9		
						Dichloramine	3400-09-7		
4.2E-03	P			V		Dichloro-2-butene, 1,4-	764-41-0	6.7E-04	
4.2E-03	P			V		Dichloro-2-butene, cis-1,4-	1476-11-5	6.7E-04	
4.2E-03	P			V		Dichloro-2-butene, trans-1,4-	110-57-6	6.7E-04	
						Dichloroacetic Acid	79-43-6		
		2.0E-01	H	V		Dichlorobenzene, 1,2-	95-50-1		2.1E+01
1.1E-05	C	8.0E-01	I	V		Dichlorobenzene, 1,4-	106-46-7	2.6E-01	8.3E+01
3.4E-04	C					Dichlorobenzidine, 3,3'-	91-94-1	8.3E-03	
						Dichlorobenzophenone, 4,4'-	90-98-2		
		1.0E-01	X	V		Dichlorodifluoromethane	75-71-8		1.0E+01
1.6E-06	C			V		Dichloroethane, 1,1-	75-34-3	1.8E+00	
2.6E-05	I	7.0E-03	P	V		Dichloroethane, 1,2-	107-06-2	1.1E-01	7.3E-01
		2.0E-01	I	V		Dichloroethylene, 1,1-	75-35-4		2.1E+01
				V		Dichloroethylene, cis-1,2-	156-59-2		
		4.0E-02	X	V		Dichloroethylene, trans-1,2-	156-60-5		4.2E+00
						Dichlorophenol, 2,4-	120-83-2		
						Dichlorophenoxy Acetic Acid, 2,4-	94-75-7		
3.7E-06	P	4.0E-03	I	V		Dichloropropane, 1,2-	78-87-5	7.6E-01	4.2E-01
				V		Dichloropropane, 1,3-	142-28-9		
						Dichloropropanol, 2,3-	616-23-9		
4.0E-06	I	2.0E-02	I	V		Dichloropropene, 1,3-	542-75-6	7.0E-01	2.1E+00
8.3E-05	C	5.0E-04	I			Dichlorvos	62-73-7	3.4E-02	5.2E-02
						Dicrotophos	141-66-2		
		3.0E-04	X	V		Dicyclopentadiene	77-73-6		3.1E-02
4.6E-03	I					Dieldrin	60-57-1	6.1E-04	
3.0E-04	C	5.0E-03	I			Diesel Engine Exhaust	E17136615	9.4E-03	5.2E-01
		2.0E-04	P			Diethanolamine	111-42-2		2.1E-02
		1.0E-04	P			Diethylene Glycol Monobutyl Ether	112-34-5		1.0E-02
		3.0E-04	P			Diethylene Glycol Monoethyl Ether	111-90-0		3.1E-02
				V		Diethylformamide	617-84-5		
1.0E-01	C					Diethylstilbestrol	56-53-1	2.8E-05	
						Difenzoquat	43222-48-6		
						Diflubenzuron	35367-38-5		
		4.0E+01	I	V		Difluoroethane, 1,1-	75-37-6		4.2E+03
		3.0E+01	X	V		Difluoropropane, 2,2-	420-45-1		3.1E+03
1.3E-05	C			V		Dihydrosafrole	94-58-6	2.2E-01	
		7.0E-01	P	V		Diisopropyl Ether	108-20-3		7.3E+01
				V		Diisopropyl Methylphosphonate	1445-75-6		
						Dimethipin	55290-64-7		
						Dimethoate	60-51-5		
						Dimethoxybenzidine, 3,3'-	119-90-4		
						Dimethyl methylphosphonate	756-79-6		
1.3E-03	C					Dimethylamino azobenzene [p-]	60-11-7	2.2E-03	
						Dimethylaniline HCl, 2,4-	21436-96-4		
						Dimethylaniline, 2,4-	95-68-1		
				V		Dimethylaniline, N,N-	121-69-7		
						Dimethylbenzidine, 3,3'-	119-93-7		
		3.0E-02	I	V		Dimethylformamide	68-12-2		3.1E+00
		2.0E-06	X	V		Dimethylhydrazine, 1,1-	57-14-7		2.1E-04
1.6E-01	C			V		Dimethylhydrazine, 1,2-	540-73-8	1.8E-05	
						Dimethylphenol, 2,4-	105-67-9		
						Dimethylphenol, 2,6-	576-26-1		
						Dimethylphenol, 3,4-	95-65-8		
1.3E-05	C			V		Dimethylvinylchloride	513-37-1	2.2E-01	
						Dinitro-o-cresol, 4,6-	534-52-1		
						Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5		
						Dinitrobenzene, 1,2-	528-29-0		
						Dinitrobenzene, 1,3-	99-65-0		

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Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR ($(ug/m^3)^{-1}$)	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or $fibers/m^3$)
						Dinitrobenzene, 1,4-	100-25-4		
						Dinitrophenol, 2,4-	51-28-5		
						Dinitrotoluene Mixture, 2,4/2,6-	E1615210		
8.9E-05	C					Dinitrotoluene, 2,4-	121-14-2	3.2E-02	
						Dinitrotoluene, 2,6-	606-20-2		
						Dinitrotoluene, 2-Amino-4,6-	35572-78-2		
						Dinitrotoluene, 4-Amino-2,6-	19406-51-0		
						Dinitrotoluene, Technical grade	25321-14-6		
						Dinoseb	88-85-7		
5.0E-06	I	3.0E-02	I	V		Dioxane, 1,4-	123-91-1	5.6E-01	3.1E+00
						Dioxins			
1.3E+00	I					~Hexachlorodibenzo-p-dioxin, Mixture	34465-46-8	2.2E-06	
3.8E+01	C	4.0E-08	C	V		~TCDD, 2,3,7,8-	1746-01-6	7.4E-08	4.2E-06
						Diphenamid	957-51-7		
		4.0E-04	X	V		Diphenyl Ether	101-84-8		4.2E-02
						Diphenyl Sulfone	127-63-9		
						Diphenylamine	122-39-4		
2.2E-04	I					Diphenylhydrazine, 1,2-	122-66-7	1.3E-02	
						Diquat	2764-72-9		
2.1E-03	C					Direct Black 38	1937-37-7	1.3E-03	
2.1E-03	C					Direct Blue 6	2602-46-2	1.3E-03	
1.9E-03	C					Direct Brown 95	16071-86-6	1.5E-03	
						Disulfoton	298-04-4		
				V		Dithiane, 1,4-	505-29-3		
						Diuron	330-54-1		
						Dodine	2439-10-3		
				V		EPTC	759-94-4		
				V		Endosulfan	115-29-7		
						Endosulfan Sulfate	1031-07-8		
						Endothall	145-73-3		
						Endrin	72-20-8		
1.2E-06	I	1.0E-03	I	V		Epichlorohydrin	106-89-8	2.3E+00	1.0E-01
		2.0E-02	I	V		Epoxybutane, 1,2-	106-88-7		2.1E+00
						Ethanol, 2-(2-methoxyethoxy)-	111-77-3		
						Ethephon	16672-87-0		
						Ethion	563-12-2		
		6.0E-02	P	V		Ethoxyethanol Acetate, 2-	111-15-9		6.3E+00
		2.0E-01	I	V		Ethoxyethanol, 2-	110-80-5		2.1E+01
		7.0E-02	P	V		Ethyl Acetate	141-78-6		7.3E+00
		8.0E-03	P	V		Ethyl Acrylate	140-88-5		8.3E-01
		1.0E+01	I	V		Ethyl Chloride (Chloroethane)	75-00-3		1.0E+03
				V		Ethyl Ether	60-29-7		
		3.0E-01	P	V		Ethyl Methacrylate	97-63-2		3.1E+01
						Ethyl-p-nitrophenyl Phosphonate	2104-64-5		
2.5E-06	C	1.0E+00	I	V		Ethylbenzene	100-41-4	1.1E+00	1.0E+02
						Ethylene Cyanohydrin	109-78-4		
				V		Ethylene Diamine	107-15-3		
		4.0E-01	C			Ethylene Glycol	107-21-1		4.2E+01
		1.6E+00	I			Ethylene Glycol Monobutyl Ether	111-76-2		1.7E+02
3.0E-03	I	3.0E-02	C	V	M	Ethylene Oxide	75-21-8	3.4E-04	3.1E+00
1.3E-05	C					Ethylene Thiourea	96-45-7	2.2E-01	
1.9E-02	C			V		Ethyleneimine	151-56-4	1.5E-04	
						Ethylphthalyl Ethyl Glycolate	84-72-0		
						Fenamiphos	22224-92-6		
						Fenpropathrin	39515-41-8		
						Fenvalerate	51630-58-1		
						Fluometuron	2164-17-2		
		1.3E-02	C			Fluoride	16984-48-8		1.4E+00
		1.3E-02	C			Fluorine (Soluble Fluoride)	7782-41-4		1.4E+00
						Fluridone	59756-60-4		
						Flurprimidol	56425-91-3		
						Flusilazole	85509-19-9		
						Flutolanil	66332-96-5		
						Fluvalinate	69409-94-5		
						Folpet	133-07-3		
						Fomesafen	72178-02-0		
						Fonofos	944-22-9		
1.3E-05	I	9.8E-03	A	V		Formaldehyde	50-00-0	2.2E-01	1.0E+00
		3.0E-04	X	V		Formic Acid	64-18-6		3.1E-02
						Fosetyl-AL	39148-24-8		
						Furans			
				V		~Dibenzofuran	132-64-9		
				V		~Furan	110-00-9		
		2.0E+00	I	V		~Tetrahydrofuran	109-99-9		2.1E+02
						Furazolidone	67-45-8		
		5.0E-02	H	V		Furfural	98-01-1		5.2E+00
4.3E-04	C					Furium	531-82-8	6.5E-03	
8.6E-06	C					Furmecyclox	60568-05-0	3.3E-01	
						Glufosinate, Ammonium	77182-82-2		
		8.0E-05	C			Glutaraldehyde	111-30-8		8.3E-03
		1.0E-03	X	V		Glycidaldehyde	765-34-4		1.0E-01
						Glyphosate	1071-83-6		
				V		Guanidine	113-00-8		
						Guanidine Chloride	50-01-1		
						Guanidine Nitrate	506-93-4		
						Haloxyfop, Methyl	69806-40-2		
1.3E-03	I			V		Heptachlor	76-44-8	2.2E-03	
2.6E-03	I			V		Heptachlor Epoxide	1024-57-3	1.1E-03	
		3.0E-03	X	V		Heptanal, n-	111-71-7		3.1E-01
		4.0E-01	P	V		Heptane, N-	142-82-5		4.2E+01
				V		Hexabromobenzene	87-82-1		

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Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR ($(ug/m^3)^{-1}$)	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or fibers/m^3)
						Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2		
4.6E-04	I			V		Hexachlorobenzene	118-74-1	6.1E-03	
2.2E-05	I			V		Hexachlorobutadiene	87-68-3	1.3E-01	
1.8E-03	I					Hexachlorocyclohexane, Alpha-	319-84-6	1.6E-03	
5.3E-04	I					Hexachlorocyclohexane, Beta-	319-85-7	5.3E-03	
3.1E-04	C					Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	9.1E-03	
5.1E-04	I					Hexachlorocyclohexane, Technical	608-73-1	5.5E-03	
		2.0E-04	I	V		Hexachlorocyclopentadiene	77-47-4		2.1E-02
1.1E-05	C	3.0E-02	I	V		Hexachloroethane	67-72-1	2.6E-01	3.1E+00
						Hexachlorophene	70-30-4		
						Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4		
		1.0E-05	I	V		Hexamethylene Diisocyanate, 1,6-	822-06-0		1.0E-03
		4.0E-04	C			Hexamethylene diisocyanate biuret	4035-89-6		4.2E-02
		4.0E-04	C			Hexamethylene diisocyanate isocyanurate	3779-63-3		4.2E-02
						Hexamethylphosphoramide	680-31-9		
2.0E-07	X	6.0E-01	P	V		Hexane, Commercial	E5241997	1.4E+01	6.3E+01
		7.0E-01	I	V		Hexane, N-	110-54-3		7.3E+01
						Hexanedioic Acid	124-04-9		
		4.0E-04	P	V		Hexanol, 1-,2-ethyl- (2-Ethyl-1-hexanol)	104-76-7		4.2E-02
		3.0E-02	I	V		Hexanone, 2-	591-78-6		3.1E+00
						Hexazinone	51235-04-2		
						Hexythiazox	78587-05-0		
						Hydramethylnon	67485-29-4		
4.9E-03	I	3.0E-05	P	V		Hydrazine	302-01-2	5.7E-04	3.1E-03
4.9E-03	I					Hydrazine Sulfate	10034-93-2	5.7E-04	
		2.0E-02	I	V		Hydrogen Chloride	7647-01-0		2.1E+00
		1.4E-02	C	V		Hydrogen Fluoride	7664-39-3		1.5E+00
		2.0E-03	I	V		Hydrogen Sulfide	7783-06-4		2.1E-01
						Hydroquinone	123-31-9		
						Imazalil	35554-44-0		
						Imazaquin	81335-37-7		
						Imazethapyr	81335-77-5		
						Iodine	7553-56-2		
						Iprodione	36734-19-7		
						Iron	7439-89-6		
				V		Isobutyl Alcohol	78-83-1		
		2.0E+00	C			Isophorone	78-59-1		2.1E+02
				V		Isopropalin	33820-53-0		
		2.0E-01	P	V		Isopropanol	67-63-0		2.1E+01
						Isopropyl Methyl Phosphonic Acid	1832-54-8		
						Isoxaben	82558-50-7		
		3.0E-01	A	V		JP-7	E1737665		3.1E+01
						Lactofen	77501-63-4		
						Lactonitrile	78-97-7		
						Lanthanum	7439-91-0		
						Lanthanum Acetate Hydrate	100587-90-4		
						Lanthanum Chloride Heptahydrate	10025-84-0		
						Lanthanum Chloride, Anhydrous	10099-58-8		
						Lanthanum Nitrate Hexahydrate	10277-43-7		
						Lead Compounds			
1.2E-05	C					~Lead Phosphate	7446-27-7	2.3E-01	
8.0E-05	C					~Lead acetate	301-04-2	3.5E-02	
						~Lead and Compounds	7439-92-1		1.5E-01
1.1E-05	C					~Lead subacetate	1335-32-6	2.6E-01	
				V		~Tetraethyl Lead	78-00-2		
				V		Lewisite	541-25-3		
						Linuron	330-55-2		
						Lithium	7439-93-2		
						MCPA	94-74-6		
						MCPB	94-81-5		
						MCPP	93-65-2		
						Malathion	121-75-5		
		7.0E-04	C			Maleic Anhydride	108-31-6		7.3E-02
						Maleic Hydrazide	123-33-1		
						Malononitrile	109-77-3		
						Mancozeb	8018-01-7		
						Maneb	12427-38-2		
		5.0E-05	I			Manganese (Diet)	7439-96-5		
		5.0E-05	I			Manganese (Non-diet)	7439-96-5		5.2E-03
						Mephosfolan	950-10-7		
						Mepiquat Chloride	24307-26-4		
						Mercaptobenzothiazole, 2-	149-30-4		
						Mercury Compounds			
		3.0E-04	G			~Mercuric Chloride (and other Mercury salts)	7487-94-7		3.1E-02
		3.0E-04	I	V		~Mercury (elemental)	7439-97-6		3.1E-02
						~Methyl Mercury	22967-92-6		
						~Phenylmercuric Acetate	62-38-4		
				V		Merphos	150-50-5		
						Metalaxyl	57837-19-1		
		3.0E-02	P	V		Methacrylonitrile	126-98-7		3.1E+00
						Methamidophos	10265-92-6		
		2.0E+01	I	V		Methanol	67-56-1		2.1E+03
						Methidathion	950-37-8		
						Methomyl	16752-77-5		
						Methoxy-5-nitroaniline, 2-	99-59-2		
						Methoxychlor	72-43-5		
		1.0E-03	P	V		Methoxyethanol Acetate, 2-	110-49-6		1.0E-01
		2.0E-02	I	V		Methoxyethanol, 2-	109-86-4		2.1E+00
				V		Methyl Acetate	79-20-9		
		2.0E-02	P	V		Methyl Acrylate	96-33-3		2.1E+00
		5.0E+00	I	V		Methyl Ethyl Ketone (2-Butanone)	78-93-3		5.2E+02

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Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR ($(ug/m^3)^{-1}$)	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or fibers/m^3)
1.0E-03	X	2.0E-05	X	V		Methyl Hydrazine	60-34-4	2.8E-03	2.1E-03
		3.0E+00	I	V		Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1		3.1E+02
		1.0E-03	C	V		Methyl Isocyanate	624-83-9		1.0E-01
		7.0E-01	I	V		Methyl Methacrylate	80-62-6		7.3E+01
						Methyl Parathion	298-00-0		
						Methyl Phosphonic Acid	993-13-5		
		4.0E-02	H	V		Methyl Styrene (Mixed Isomers)	25013-15-4		4.2E+00
2.8E-05	C					Methyl methanesulfonate	66-27-3	1.0E-01	
2.6E-07	C	3.0E+00	I	V		Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.1E+01	3.1E+02
						Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2		
		3.0E+00	X	V		Methyl-2-Pentanol, 4-	108-11-2		3.1E+02
						Methyl-5-Nitroaniline, 2-	99-55-8		
2.4E-03	C					Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	1.2E-03	
3.7E-05	C					Methylaniline Hydrochloride, 2-	636-21-5	7.6E-02	
						Methylarsonic acid	124-58-3		
						Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7		
						Methylbenzene-1,4-diamine sulfate, 2-	615-50-9		
6.3E-03	C				M	Methylcholanthrene, 3-	56-49-5	1.6E-04	
1.0E-08	I	6.0E-01	I	V	M	Methylene Chloride	75-09-2	1.0E+02	6.3E+01
4.3E-04	C				M	Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	2.4E-03	
1.3E-05	C					Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	2.2E-01	
4.6E-04	C	2.0E-02	C			Methylenebisbenzenamine, 4,4'-	101-77-9	6.1E-03	2.1E+00
		6.0E-04	I			Methylenediphenyl Diisocyanate	101-68-8		6.3E-02
				V		Methylstyrene, Alpha-	98-83-9		
						Metolachlor	51218-45-2		
						Metribuzin	21087-64-9		
						Metsulfuron-methyl	74223-64-6		
4.5E-06	X	1.0E-01	P	V		Midrange Aliphatic Hydrocarbon Streams	E1790669	6.2E-01	1.0E+01
				V		Mineral oils	8012-95-1		
5.1E-03	C			V		Mirex	2385-85-5	5.5E-04	
						Molinate	2212-67-1		
		2.0E-03	A			Molybdenum	7439-98-7		2.1E-01
						Monochloramine	10599-90-3		
						Monomethylaniline	100-61-8		
						Myclobutanil	88671-89-0		
						N,N'-Diphenyl-1,4-benzenediamine	74-31-7		
				V		Naled	300-76-5		
		1.0E-01	P	V		Naphtha, High Flash Aromatic (HFAN)	64742-95-6		1.0E+01
0.0E+00	C					Naphthylamine, 2-	91-59-8		
						Napropamide	15299-99-7		
2.6E-04	C	1.4E-05	C			Nickel Acetate	373-02-4	1.1E-02	1.5E-03
2.6E-04	C	1.4E-05	C			Nickel Carbonate	3333-67-3	1.1E-02	1.5E-03
2.6E-04	C	1.4E-05	C	V		Nickel Carbonyl	13463-39-3	1.1E-02	1.5E-03
2.6E-04	C	1.4E-05	C			Nickel Hydroxide	12054-48-7	1.1E-02	1.5E-03
2.6E-04	C	2.0E-05	C			Nickel Oxide	1313-99-1	1.1E-02	2.1E-03
2.4E-04	I	1.4E-05	C			Nickel Refinery Dust	E715532	1.2E-02	1.5E-03
2.6E-04	C	9.0E-05	A			Nickel Soluble Salts	7440-02-0	1.1E-02	9.4E-03
4.8E-04	I	1.4E-05	C			Nickel Subsulfide	12035-72-2	5.8E-03	1.5E-03
2.6E-04	C	1.4E-05	C			Nickelocene	1271-28-9	1.1E-02	1.5E-03
						Nitrate (measured as nitrogen)	14797-55-8		
						Nitrate + Nitrite (measured as nitrogen)	E701177		
						Nitrite (measured as nitrogen)	14797-65-0		
		5.0E-05	X			Nitroaniline, 2-	88-74-4		5.2E-03
		6.0E-03	P			Nitroaniline, 4-	100-01-6		6.3E-01
4.0E-05	I	9.0E-03	I	V		Nitrobenzene	98-95-3	7.0E-02	9.4E-01
						Nitrocellulose	9004-70-0		
						Nitrofurantoin	67-20-9		
3.7E-04	C					Nitrofurazone	59-87-0	7.6E-03	
						Nitroglycerin	55-63-0		
						Nitroguanidine	556-88-7		
8.8E-06	P	5.0E-03	P	V		Nitromethane	75-52-5	3.2E-01	5.2E-01
5.8E-04	X	2.0E-02	I	V		Nitropropane, 2-	79-46-9	4.8E-03	2.1E+00
7.7E-03	C				M	Nitroso-N-ethylurea, N-	759-73-9	1.3E-04	
3.4E-02	C				M	Nitroso-N-methylurea, N-	684-93-5	3.0E-05	
1.6E-03	I			V		Nitroso-di-N-butylamine, N-	924-16-3	1.8E-03	
2.0E-03	C					Nitroso-di-N-propylamine, N-	621-64-7	1.4E-03	
8.0E-04	C					Nitrosodiethanolamine, N-	1116-54-7	3.5E-03	
4.3E-02	I				M	Nitrosodiethylamine, N-	55-18-5	2.4E-05	
1.4E-02	I	4.0E-05	X	V	M	Nitrosodimethylamine, N-	62-75-9	7.2E-05	4.2E-03
2.6E-06	C					Nitrosodiphenylamine, N-	86-30-6	1.1E+00	
6.3E-03	C			V		Nitrosomethylethylamine, N-	10595-95-6	4.5E-04	
1.9E-03	C					Nitrosomorpholine [N-]	59-89-2	1.5E-03	
2.7E-03	C					Nitrosopiperidine [N-]	100-75-4	1.0E-03	
6.1E-04	I					Nitrosopyrrolidine, N-	930-55-2	4.6E-03	
						Nitrotoluene, m-	99-08-1		
				V		Nitrotoluene, o-	88-72-2		
						Nitrotoluene, p-	99-99-0		
		2.0E-02	P	V		Nonane, n-	111-84-2		2.1E+00
						Norflurazon	27314-13-2		
						Octabromodiphenyl Ether	32536-52-0		
						Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0		
						Octamethylpyrophosphoramide	152-16-9		
						Oryzalin	19044-88-3		
						Oxadiazon	19666-30-9		
						Oxamyl	23135-22-0		
						Oxyfluorfen	42874-03-3		
						Paclobutrazol	76738-62-0		
						Paraquat Dichloride	1910-42-5		
						Parathion	56-38-2		
				V		Pebulate	1114-71-2		
						Pendimethalin	40487-42-1		

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Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR ($(ug/m^3)^{-1}$)	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or $fibers/m^3$)
				V		Pentabromodiphenyl Ether	32534-81-9		
						Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9		
				V		Pentachlorobenzene	608-93-5		
				V		Pentachloroethane	76-01-7		
				V		Pentachloronitrobenzene	82-68-8		
5.1E-06	C					Pentachlorophenol	87-86-5	5.5E-01	
						Pentaerythritol tetranitrate (PETN)	78-11-5		
						Pentamethylphosphoramide (PMPA)	10159-46-3		
		1.0E+00	P	V		Pentane, n-	109-66-0		1.0E+02
						Perchlorates			
						~Ammonium Perchlorate	7790-98-9		
						~Lithium Perchlorate	7791-03-9		
						~Perchlorate and Perchlorate Salts	14797-73-0		
						~Potassium Perchlorate	7778-74-7		
						~Sodium Perchlorate	7601-89-0		
						Perfluorobutane sulfonic acid (PFBS)	375-73-5		
						Perfluorobutanesulfonate	45187-15-3		
						Permethrin	52645-53-1		
6.3E-07	C					Phenacetin	62-44-2	4.5E+00	
						Phenmedipham	13684-63-4		
		2.0E-01	C			Phenol	108-95-2		2.1E+01
						Phenol, 2-(1-methylethoxy)-, methylcarbamate	114-26-1		
						Phenothiazine	92-84-2		
				V		Phenyl Isothiocyanate	103-72-0		
						Phenylenediamine, m-	108-45-2		
						Phenylenediamine, o-	95-54-5		
						Phenylenediamine, p-	106-50-3		
						Phenylphenol, 2-	90-43-7		
						Phorate	298-02-2		
		3.0E-04	I	V		Phosgene	75-44-5		3.1E-02
						Phosmet	732-11-6		
						Phosphates, Inorganic			
						~Aluminum metaphosphate	13776-88-0		
						~Ammonium polyphosphate	68333-79-9		
						~Calcium pyrophosphate	7790-76-3		
						~Diammonium phosphate	7783-28-0		
						~Dicalcium phosphate	7757-93-9		
						~Dimagnesium phosphate	7782-75-4		
						~Dipotassium phosphate	7758-11-4		
						~Disodium phosphate	7558-79-4		
						~Monoaluminum phosphate	13530-50-2		
						~Monoammonium phosphate	7722-76-1		
						~Monocalcium phosphate	7758-23-8		
						~Monomagnesium phosphate	7757-86-0		
						~Monopotassium phosphate	7778-77-0		
						~Monosodium phosphate	7558-80-7		
						~Polyphosphoric acid	8017-16-1		
						~Potassium tripolyphosphate	13845-36-8		
						~Sodium acid pyrophosphate	7758-16-9		
						~Sodium aluminum phosphate (acidic)	7785-88-8		
						~Sodium aluminum phosphate (anhydrous)	10279-59-1		
						~Sodium aluminum phosphate (tetrahydrate)	10305-76-7		
						~Sodium hexametaphosphate	10124-56-8		
						~Sodium polyphosphate	68915-31-1		
						~Sodium trimetaphosphate	7785-84-4		
						~Sodium tripolyphosphate	7758-29-4		
						~Tetrapotassium phosphate	7320-34-5		
						~Tetrasodium pyrophosphate	7722-88-5		
						~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5		
						~Tricalcium phosphate	7758-87-4		
						~Trimagnesium phosphate	7757-87-1		
						~Tripotassium phosphate	7778-53-2		
						~Trisodium phosphate	7601-54-9		
		3.0E-04	I	V		Phosphine	7803-51-2		3.1E-02
		1.0E-02	I			Phosphoric Acid	7664-38-2		1.0E+00
				V		Phosphorus, White	7723-14-0		
						Phthalates			
2.4E-06	C					~Bis(2-ethylhexyl)phthalate	117-81-7	1.2E+00	
						~Butyl Benzyl Phthalate	85-68-7		
						~Butylphthalyl Butylglycolate	85-70-1		
						~Dibutyl Phthalate	84-74-2		
						~Diethyl Phthalate	84-66-2		
				V		~Dimethylterephthalate	120-61-6		
						~Octyl Phthalate, di-N-	117-84-0		
						~Phthalic Acid, p-	100-21-0		
		2.0E-02	C			~Phthalic Anhydride	85-44-9		2.1E+00
						Picloram	1918-02-1		
						Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3		
						Picric Acid (2,4,6-Trinitrophenol)	88-89-1		
						Pirimiphos, Methyl	29232-93-7		
8.6E-03	C					Polybrominated Biphenyls	36355-01-8	3.3E-04	
						Polychlorinated Biphenyls (PCBs)			
2.0E-05	G			V		~Aroclor 1016	12674-11-2	1.4E-01	
5.7E-04	G			V		~Aroclor 1221	11104-28-2	4.9E-03	
5.7E-04	G			V		~Aroclor 1232	11141-16-5	4.9E-03	
5.7E-04	G			V		~Aroclor 1242	53469-21-9	4.9E-03	
5.7E-04	G			V		~Aroclor 1248	12672-29-6	4.9E-03	
5.7E-04	G			V		~Aroclor 1254	11097-69-1	4.9E-03	
5.7E-04	G			V		~Aroclor 1260	11096-82-5	4.9E-03	
				V		~Aroclor 5460	11126-42-4		
1.1E-03	W	1.3E-03	W	V		~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	2.5E-03	1.4E-01

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Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR $(ug/m^3)^{-1}$	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or fibers/m^3)
1.1E-03	W	1.3E-03	W	V		~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	2.5E-03	1.4E-01
1.1E-03	W	1.3E-03	W	V		~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	2.5E-03	1.4E-01
1.1E-03	W	1.3E-03	W	V		~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	2.5E-03	1.4E-01
1.1E+00	W	1.3E-06	W	V		~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	2.5E-06	1.4E-04
1.1E-03	W	1.3E-03	W	V		~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	2.5E-03	1.4E-01
1.1E-03	W	1.3E-03	W	V		~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	2.5E-03	1.4E-01
1.1E-03	W	1.3E-03	W	V		~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	2.5E-03	1.4E-01
1.1E-03	W	1.3E-03	W	V		~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	2.5E-03	1.4E-01
3.8E+00	W	4.0E-07	W	V		~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	7.4E-07	4.2E-05
5.7E-04	I			V		~Polychlorinated Biphenyls (high risk)	1336-36-3	4.9E-03	
1.0E-04	I			V		~Polychlorinated Biphenyls (low risk)	1336-36-3	2.8E-02	
2.0E-05	I			V		~Polychlorinated Biphenyls (lowest risk)	1336-36-3	1.4E-01	
3.8E-03	W	4.0E-04	W			~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	7.4E-04	4.2E-02
1.1E-02	W	1.3E-04	W	V		~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	2.5E-04	1.4E-02
		6.0E-04	I			Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9		6.3E-02
						Polynuclear Aromatic Hydrocarbons (PAHs)			
				V		~Acenaphthene	83-32-9		
				V		~Anthracene	120-12-7		
6.0E-05	E			V	M	~Benz[a]anthracene	56-55-3	1.7E-02	
1.1E-04	C					~Benzo(j)fluoranthene	205-82-3	2.6E-02	
6.0E-04	I	2.0E-06	I		M	~Benzo[a]pyrene	50-32-8	1.7E-03	2.1E-04
6.0E-05	E				M	~Benzo[b]fluoranthene	205-99-2	1.7E-02	
6.0E-06	E				M	~Benzo[k]fluoranthene	207-08-9	1.7E-01	
				V		~Chloronaphthalene, Beta-	91-58-7		
6.0E-07	E				M	~Chrysene	218-01-9	1.7E+00	
6.0E-04	E				M	~Dibenz[a,h]anthracene	53-70-3	1.7E-03	
1.1E-03	C					~Dibenzo(a,e)pyrene	192-65-4	2.6E-03	
7.1E-02	C				M	~Dimethylbenz(a)anthracene, 7,12-	57-97-6	1.4E-05	
						~Fluoranthene	206-44-0		
				V		~Fluorene	86-73-7		
6.0E-05	E				M	~Indeno[1,2,3-cd]pyrene	193-39-5	1.7E-02	
				V		~Methylnaphthalene, 1-	90-12-0		
				V		~Methylnaphthalene, 2-	91-57-6		
3.4E-05	C	3.0E-03	I	V		~Naphthalene	91-20-3	8.3E-02	3.1E-01
1.1E-04	C					~Nitropyrene, 4-	57835-92-4	2.6E-02	
				V		~Pyrene	129-00-0		
						Potassium Perfluorobutane Sulfonate	29420-49-3		
						Prochloraz	67747-09-5		
				V		Profluralin	26399-36-0		
						Prometon	1610-18-0		
						Prometryn	7287-19-6		
						Pronamide	23950-58-5		
						Propachlor	1918-16-7		
						Propanil	709-98-8		
						Propargite	2312-35-8		
				V		Propargyl Alcohol	107-19-7		
						Propazine	139-40-2		
						Propham	122-42-9		
						Propiconazole	60207-90-1		
		8.0E-03	I	V		Propionaldehyde	123-38-6		8.3E-01
		1.0E+00	X	V		Propyl benzene	103-65-1		1.0E+02
		3.0E+00	C	V		Propylene	115-07-1		3.1E+02
						Propylene Glycol	57-55-6		
		2.7E-04	A			Propylene Glycol Dinitrate	6423-43-4		2.8E-02
		2.0E+00	I	V		Propylene Glycol Monomethyl Ether	107-98-2		2.1E+02
3.7E-06	I	3.0E-02	I	V		Propylene Oxide	75-56-9	7.6E-01	3.1E+00
				V		Pyridine	110-86-1		
						Quinalphos	13593-03-8		
						Quinoline	91-22-5		
						Quizalofop-ethyl	76578-14-8		
		3.0E+04	A			Refractory Ceramic Fibers (units in fibers)	E715557		3.1E+03
						Resmethrin	10453-86-8		
				V		Ronnel	299-84-3		
						Rotenone	83-79-4		
6.3E-05	C				M	Safrole	94-59-7	1.6E-02	
						Selenious Acid	7783-00-8		
		2.0E-02	C			Selenium	7782-49-2		2.1E+00
		2.0E-02	C			Selenium Sulfide	7446-34-6		2.1E+00
						Sethoxydim	74051-80-2		
		3.0E-03	C			Silica (crystalline, respirable)	7631-86-9		3.1E-01
						Silver	7440-22-4		
						Simazine	122-34-9		
						Sodium Acifluorfen	62476-59-9		
						Sodium Azide	26628-22-8		
						Sodium Diethyldithiocarbamate	148-18-5		
		1.3E-02	C			Sodium Fluoride	7681-49-4		1.4E+00
						Sodium Fluoroacetate	62-74-8		
						Sodium Metavanadate	13718-26-8		
						Sodium Tungstate	13472-45-2		
						Sodium Tungstate Dihydrate	10213-10-2		
						Stirofos (Tetrachlorovinphos)	961-11-5		
						Strontium, Stable	7440-24-6		
						Strychnine	57-24-9		
		1.0E+00	I	V		Styrene	100-42-5		1.0E+02
						Styrene-Acrylonitrile (SAN) Trimer (THNA isomer)	57964-39-3		
						Styrene-Acrylonitrile (SAN) Trimer (THNP isomer)	57964-40-6		
		2.0E-03	X			Sulfolane	126-33-0		2.1E-01
						Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9		
		1.0E-03	C	V		Sulfur Trioxide	7446-11-9		1.0E-01
		1.0E-03	C			Sulfuric Acid	7664-93-9		1.0E-01
7.1E-06	I					Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	4.0E-01	

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR $(ug/m^3)^{-1}$	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or $fibers/m^3$)
						TCMTB	21564-17-0		
						Tebuthiuron	34014-18-1		
						Temephos	3383-96-8		
						Terbacil	5902-51-2		
					V	Terbufos	13071-79-9		
						Terbutryn	886-50-0		
1.3E-06	C				V	Tert-Butyl Acetate	540-88-5	2.2E+00	
						Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1		
					V	Tetrachlorobenzene, 1,2,4,5-	95-94-3		
7.4E-06	I				V	Tetrachloroethane, 1,1,1,2-	630-20-6	3.8E-01	
5.8E-05	C				V	Tetrachloroethane, 1,1,2,2-	79-34-5	4.8E-02	
2.6E-07	I	4.0E-02	I		V	Tetrachloroethylene	127-18-4	1.1E+01	4.2E+00
						Tetrachlorophenol, 2,3,4,6-	58-90-2		
					V	Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1		
						Tetraethyl Dithiopyrophosphate	3689-24-5		
		8.0E+01	I		V	Tetrafluoroethane, 1,1,1,2-	811-97-2		8.3E+03
						Tetramethylphosphoramide, -N,N,N',N" (TMPA)	16853-36-4		
						Tetryl (Trinitrophenylmethylnitramine)	479-45-8		
						Thallic Oxide	1314-32-5		
						Thallium (I) Nitrate	10102-45-1		
						Thallium (Soluble Salts)	7440-28-0		
					V	Thallium Acetate	563-68-8		
					V	Thallium Carbonate	6533-73-9		
						Thallium Chloride	7791-12-0		
						Thallium Selenite	12039-52-0		
						Thallium Sulfate	7446-18-6		
						Thifensulfuron-methyl	79277-27-3		
						Thiobencarb	28249-77-6		
						Thiodiglycol	111-48-8		
						Thiofanox	39196-18-4		
						Thiophanate, Methyl	23564-05-8		
						Thiram	137-26-8		
						Tin	7440-31-5		
		1.0E-04	A	V		Titanium Tetrachloride	7550-45-0		1.0E-02
		5.0E+00	I	V		Toluene	108-88-3		5.2E+02
1.1E-05	C	8.0E-06	C	V		Toluene-2,4-diisocyanate	584-84-9	2.6E-01	8.3E-04
						Toluene-2,5-diamine	95-70-5		
1.1E-05	C	8.0E-06	C	V		Toluene-2,6-diisocyanate	91-08-7	2.6E-01	8.3E-04
						Toluic Acid, p-	99-94-5		
5.1E-05	C					Toluidine, o- (Methylaniline, 2-)	95-53-4	5.5E-02	
						Toluidine, p-	106-49-0		
					V	Total Petroleum Hydrocarbons (Aliphatic High)	E1790670		
		6.0E-01	P	V		Total Petroleum Hydrocarbons (Aliphatic Low)	E1790666		6.3E+01
		1.0E-01	P	V		Total Petroleum Hydrocarbons (Aliphatic Medium)	E1790668		1.0E+01
						Total Petroleum Hydrocarbons (Aromatic High)	E1790676		
		3.0E-02	P	V		Total Petroleum Hydrocarbons (Aromatic Low)	E1790672		3.1E+00
		3.0E-03	P	V		Total Petroleum Hydrocarbons (Aromatic Medium)	E1790674		3.1E-01
3.2E-04	I					Toxaphene	8001-35-2	8.8E-03	
						Toxaphene, Weathered	E1841606		
						Tralomethrin	66841-25-6		
					V	Tri-n-butyltin	688-73-3		
						Triacetin	102-76-1		
						Triadimefon	43121-43-3		
					V	Triallate	2303-17-5		
						Triasulfuron	82097-50-5		
						Tribenuron-methyl	101200-48-0		
					V	Tribromobenzene, 1,2,4-	615-54-3		
						Tribromophenol, 2,4,6-	118-79-6		
						Tribufos	78-48-8		
						Tributyl Phosphate	126-73-8		
						Tributyltin Compounds	E1790678		
						Tributyltin Oxide	56-35-9		
						Trichloramine	10025-85-1		
		5.0E+00	P	V		Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1		5.2E+02
						Trichloroacetic Acid	76-03-9		
						Trichloroaniline HCl, 2,4,6-	33663-50-2		
						Trichloroaniline, 2,4,6-	634-93-5		
					V	Trichlorobenzene, 1,2,3-	87-61-6		
		2.0E-03	P	V		Trichlorobenzene, 1,2,4-	120-82-1		2.1E-01
		5.0E+00	I	V		Trichloroethane, 1,1,1-	71-55-6		5.2E+02
1.6E-05	I	2.0E-04	X	V		Trichloroethane, 1,1,2-	79-00-5	1.8E-01	2.1E-02
4.1E-06	I	2.0E-03	I	V	M	Trichloroethylene	79-01-6	4.8E-01	2.1E-01
				V		Trichlorofluoromethane	75-69-4		
						Trichlorophenol, 2,4,5-	95-95-4		
3.1E-06	I					Trichlorophenol, 2,4,6-	88-06-2	9.1E-01	
						Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5		
						Trichlorophenoxypropionic acid, -2,4,5	93-72-1		
				V		Trichloropropane, 1,1,2-	598-77-6		
		3.0E-04	I	V	M	Trichloropropane, 1,2,3-	96-18-4		3.1E-02
		3.0E-04	P	V		Trichloropropene, 1,2,3-	96-19-5		3.1E-02
						Tricresyl Phosphate (TCP)	1330-78-5		
						Tridiphane	58138-08-2		
		7.0E-03	I	V		Triethylamine	121-44-8		7.3E-01
						Triethylene Glycol	112-27-6		
		2.0E+01	P	V		Trifluoroethane, 1,1,1-	420-46-2		2.1E+03
				V		Trifluralin	1582-09-8		
						Trimethyl Phosphate	512-56-1		
		6.0E-02	I	V		Trimethylbenzene, 1,2,3-	526-73-8		6.3E+00
		6.0E-02	I	V		Trimethylbenzene, 1,2,4-	95-63-6		6.3E+00
		6.0E-02	I	V		Trimethylbenzene, 1,3,5-	108-67-8		6.3E+00
				V		Trimethylpentene, 2,4,4-	25167-70-8		

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; W = TEF applied; E = RPF applied; G = user's guide Section 5; M = mutagen; V = volatile; R = RBA applied ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded.

Toxicity and Chemical-specific Information						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 0.1
IUR $(ug/m^3)^{-1}$	key	RfC_i (mg/m^3)	key	vol	mutagen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or fibers/m^3)
						Trinitrobenzene, 1,3,5-	99-35-4		
						Trinitrotoluene, 2,4,6-	118-96-7		
						Triphenylphosphine Oxide	791-28-6		
						Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8		
						Tris(1-chloro-2-propyl)phosphate	13674-84-5		
6.6E-04	C			V		Tris(2,3-dibromopropyl)phosphate	126-72-7	4.3E-03	
						Tris(2-chloroethyl)phosphate	115-96-8		
						Tris(2-ethylhexyl)phosphate	78-42-2		
						Tungsten	7440-33-7		
		4.0E-05	A			Uranium	7440-61-1		4.2E-03
2.9E-04	C				M	Urethane	51-79-6	3.5E-03	
8.3E-03	P	7.0E-06	P			Vanadium Pentoxide	1314-62-1	3.4E-04	7.3E-04
		1.0E-04	A			Vanadium and Compounds	7440-62-2		1.0E-02
				V		Vernolate	1929-77-7		
						Vinclozolin	50471-44-8		
		2.0E-01	I	V		Vinyl Acetate	108-05-4		2.1E+01
1.5E-05	P	3.0E-03	I	V		Vinyl Bromide	593-60-2	1.9E-01	3.1E-01
4.4E-06	I	1.0E-01	I	V	M	Vinyl Chloride	75-01-4	1.7E-01	1.0E+01
						Warfarin	81-81-2		
		1.0E-01	G	V		Xylene, m-	108-38-3		1.0E+01
		1.0E-01	G	V		Xylene, o-	95-47-6		1.0E+01
		1.0E-01	G	V		Xylene, p-	106-42-3		1.0E+01
		1.0E-01	I	V		Xylenes	1330-20-7		1.0E+01
						Zinc Phosphide	1314-84-7		
						Zinc and Compounds	7440-66-6		
						Zineb	12122-67-7		
						Zirconium	7440-67-7		

Equations used to Derive Noncancer and Cancer RSLs

4.1.3 Resident Air

This receptor spends most, if not all, of the day at home. The activities for this receptor involve typical home making chores (cooking, cleaning and laundering) as well as outdoor activities. The resident is assumed to be exposed to contaminants via the following pathway: inhalation of ambient air. This land use has no assumptions of how contaminants get into the air and the RSLs derived should be compared to air samples.

This land use is for developing residential default screening levels that are presented in the RSL Generic Tables.

4.1.3.1 Noncarcinogenic

The air land use equation, presented here, contains the following exposure routes:

- inhalation

$$SL_{res\text{-}air\text{-}nc}\left(\mu g/m^3\right) = \frac{THQ \times AT_{res\text{-}a}\left(\frac{365\ days}{year} \times ED_{res}\left(26\ years\right)\right) \times \left(\frac{1000\ \mu g}{mg}\right)}{EF_{res}\left(\frac{350\ days}{year}\right) \times ED_{res}\left(26\ years\right) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times \frac{1}{RfC\left(\frac{mg}{m^3}\right)}}$$

4.1.3.2 Carcinogenic

The air land use equation, presented here, contains the following exposure routes:

- inhalation

$$SL_{res\text{-}air\text{-}ca}\left(\mu g/m^3\right) = \frac{TR \times AT_{res}\left(\frac{365\ days}{year} \times LT\left(70\ years\right)\right)}{EF_{res}\left(\frac{350\ days}{year}\right) \times ED_{res}\left(26\ years\right) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times IUR\left(\frac{\mu g}{m^3}\right)^{-1}}$$

4.1.3.3 Mutagenic

The air land use equation, presented here, contains the following exposure routes:

- inhalation

$$SL_{res\text{-}air\text{-}mu}\left(\mu g/m^3\right) = \frac{TR \times AT_{res}\left(\frac{365\ days}{year} \times LT\ (70\ years)\right)}{IUR\left(\frac{\mu g}{m^3}\right)^{-1} \times \left(\frac{1\ day}{24\ hours}\right) \times \left(\begin{array}{l}\left(ED_{0\text{-}2}\ (2\ years) \times EF_{0\text{-}2}\left(\frac{350\ days}{year}\right) \times ET_{0\text{-}2}\left(\frac{24\ hours}{day}\right) \times 10\right) + \\ \left(ED_{2\text{-}6}\ (4\ years) \times EF_{2\text{-}6}\left(\frac{350\ days}{year}\right) \times ET_{2\text{-}6}\left(\frac{24\ hours}{day}\right) \times 3\right) + \\ \left(ED_{6\text{-}16}\ (10\ years) \times EF_{6\text{-}16}\left(\frac{350\ days}{year}\right) \times ET_{6\text{-}16}\left(\frac{24\ hours}{day}\right) \times 3\right) + \\ \left(ED_{16\text{-}26}\ (10\ years) \times EF_{16\text{-}26}\left(\frac{350\ days}{year}\right) \times ET_{16\text{-}26}\left(\frac{24\ hours}{day}\right) \times 1\right)\end{array}\right)}$$

4.1.3.4 Vinyl Chloride - Carcinogenic

The air land use equation, presented here, contains the following exposure routes:

- inhalation

$$SL_{res\text{-}air\text{-}ca\text{-}vc}\left(\mu g/m^3\right) = \frac{TR}{IUR\left(\frac{\mu g}{m^3}\right)^{-1} + \left(\frac{IUR\left(\frac{\mu g}{m^3}\right)^{-1} \times EF_{res}\left(\frac{350\ days}{year}\right) \times ED_{res}\ (26\ years) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right)}{AT_{res}\left(\frac{365\ days}{year} \times LT\ (70\ years)\right)}\right)}$$

4.1.3.5 Trichloroethylene - Carcinogenic and Mutagenic

The air land use equation, presented here, contains the following exposure routes:

- inhalation

$$SL_{res\text{-}air\text{-}tce}\left(\mu g/m^3\right) = \frac{TR \times AT_{res}\left(\frac{365\ days}{year} \times LT\ (70\ years)\right)}{IUR\left(\frac{\mu g}{m^3}\right)^{-1} \times \left(\frac{1\ day}{24\ hours}\right) \times \left(\begin{array}{l}\left(ED_{res}\ (26\ years) \times EF_{res}\left(\frac{350\ days}{year}\right) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times CAF_i\ (0.756)\right) + \\ \left(\begin{array}{l}\left(ED_{0\text{-}2}\ (2\ years) \times EF_{0\text{-}2}\left(\frac{350\ days}{year}\right) \times ET_{0\text{-}2}\left(\frac{24\ hours}{day}\right) \times MAF_i\ (0.244) \times 10\right) + \\ \left(ED_{2\text{-}6}\ (4\ years) \times EF_{2\text{-}6}\left(\frac{350\ days}{year}\right) \times ET_{2\text{-}6}\left(\frac{24\ hours}{day}\right) \times MAF_i\ (0.244) \times 3\right) + \\ \left(ED_{6\text{-}16}\ (10\ years) \times EF_{6\text{-}16}\left(\frac{350\ days}{year}\right) \times ET_{6\text{-}16}\left(\frac{24\ hours}{day}\right) \times MAF_i\ (0.244) \times 3\right) + \\ \left(ED_{16\text{-}26}\ (10\ years) \times EF_{16\text{-}26}\left(\frac{350\ days}{year}\right) \times ET_{16\text{-}26}\left(\frac{24\ hours}{day}\right) \times MAF_i\ (0.244) \times 1\right)\end{array}\right)\end{array}\right)}$$

Appendix D
Expanded Risk/Hazard Estimates Table and Supporting Outputs

Included in this Appendix:

- More detailed table of the risk and hazard estimates with cumulative cancer risk and target-organ(or effect)-specific hazard index (TOSHI)
- Data entry into the RSL Calculator
    - Screenshots showing how each HAP was entered into the RSL Calculator
- RSL Calculator Output
    - Original PDF output from the RSL calculator showing the risk and hazard estimates. The purpose of including this output is for transparency purposes to show how risk and hazard estimates were obtained using the RSL calculator.
        - The RSL calculator also produces an Excel version of this output. The Excel version was modified as necessary (i.e. rounding data to 1 significant figure, adding TOSHIs) in order to produce the tables both in the Risk Assessment text and in this Appendix.
- EPA Trichloroethylene (TCE) ADAF Calculator Output
    - The cancer risk estimate of 6E-06 agrees (at 1 significant figure) with the cancer risk estimate for TCE produced by the RSL Calculator.

Detailed Risk/Hazard Table

Hazardous Air Pollutant (HAP)	CAS Number	IUR ($\mu g/m^3)^{-1}$	IUR Ref	RfC (mg/m^3)	RfC Ref	Contaminant Concentration in Air (CA), $\mu g/m^3$	Cancer Risk	Hazard Quotient (HQ)	Target Organ/Toxicological Endpoint
Benzene	71-43-2	7.80E-06	I	3.00E-02	I	1.77E+00	5E-06	0.057	Immunological
Butadiene, 1,3-	106-99-0	3.00E-05	I	2.00E-03	I	1.11E+00	1E-05	0.532	Reproductive
Chloroform	67-66-3	2.30E-05	I	9.77E-02	A	2.44E+00	2E-05	0.024	Liver
Dichloroethane, 1,2- (Ethylene Dichloride, 1,2-DCE)	107-06-2	2.60E-05	I	7.00E-03	P	2.02E+00	2E-05	0.277	Neurological
Hexane	110-54-3	-		7.00E-01	I	1.76E+00	-	0.002	Neurological
Methylene Chloride (Dichloromethane)	75-09-2	1.00E-08	I	6.00E-01	I	3.47E+00	3E-08	0.006	Liver
Toluene	108-88-3	-		5.00E+00	I	2.28E+00	-	0.0004	Neurological
Trichloroethylene	79-01-6	4.10E-06	I	2.00E-03	I	2.69E+00	6E-06	1.29	Immunological
Vinyl Chloride	75-01-4	4.40E-06	I	1.00E-01	I	1.28E+00	8E-06	0.012	Liver
Xylene, m,p- **	108-38-3	-		1.00E-01	G	1.70E+01	-	0.163	Neurological
Xylene, o-	95-47-6	-		1.00E-01	G	4.82E+00	-	0.046	Neurological
					Cumulative Cancer Risk		**7.00E-05**		
					Hazard Index (HI)			**2**	

Target Organ Specific Hazard Index (TOSHI)	
Immunological HI	**1**
Reproductive HI	**0.5**
Neurological HI	**0.5**
Liver HI	**0.04**

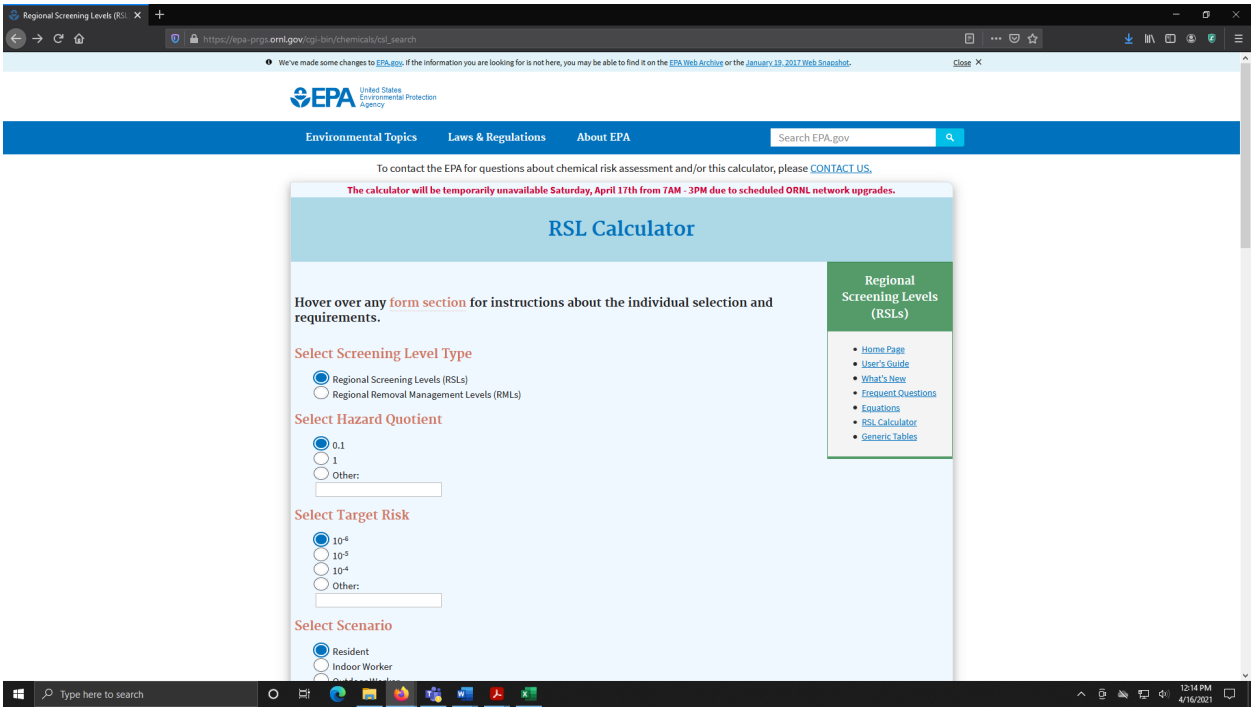
Acronyms

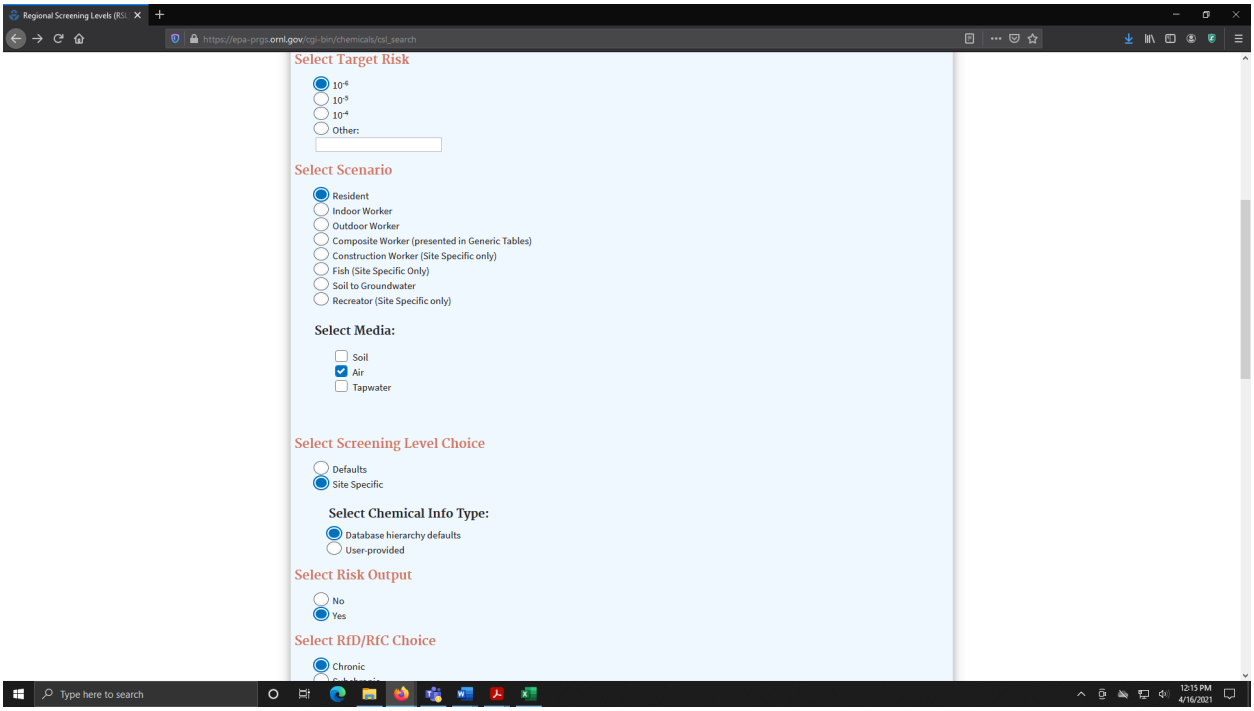
I	IRIS
A	ATSDR
P	PPRTV
G	Xylenes IRIS RfC Used as a surrogate value (please see Section 3.3 of the Risk Assessment)

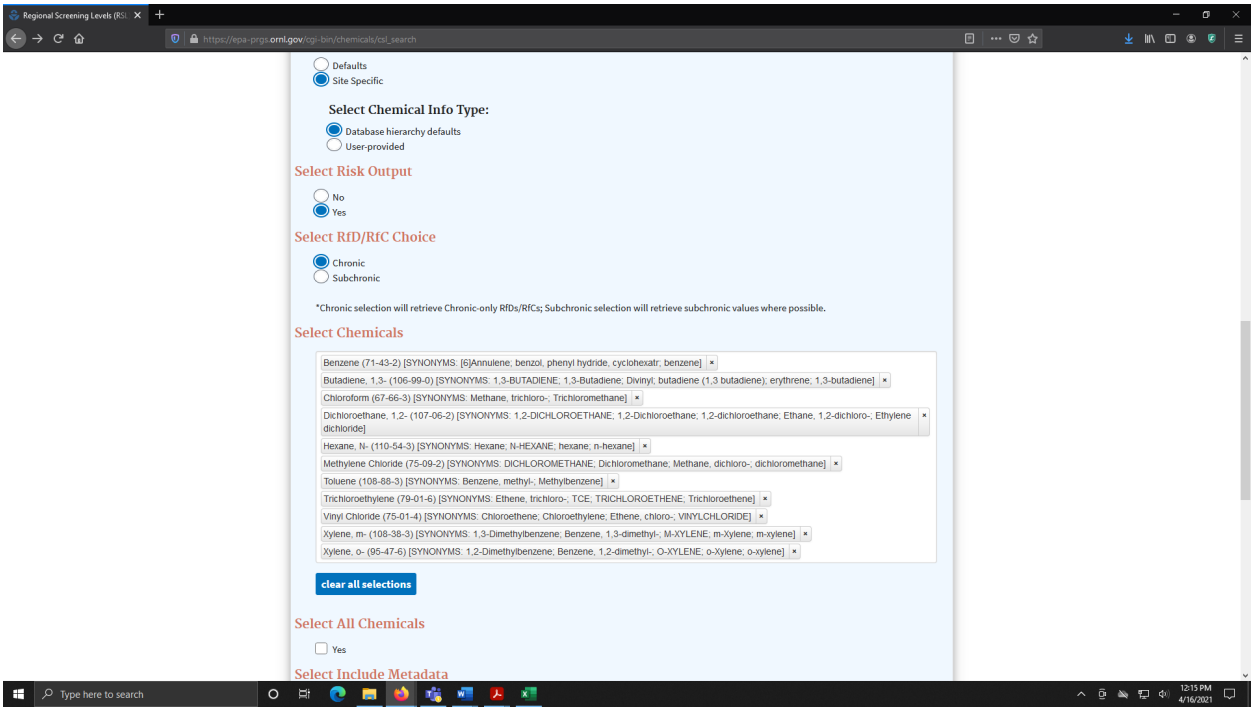
Notes

** m,p- Xylene entered as m-Xylene into the RSL calculator (please see Section 3.3 of the Risk Assessment)

Data Entry into the RSL Calculator






Regional Screening Levels (RSL
https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search
Defaults
Site Specific
Select Chemical Info Type:
Database hierarchy defaults
User-provided
Select Risk Output
No
Yes
Select RfD/RfC Choice
Chronic
Subchronic
*Chronic selection will retrieve Chronic-only RfDs/RfCs; Subchronic selection will retrieve subchronic values where possible.
Select Chemicals
Benzene (71-43-2) [SYNONYMS: [6]Annulene; benzol, phenyl hydride, cyclohexatr; benzene]
Butadiene, 1,3- (106-99-0) [SYNONYMS: 1,3-BUTADIENE; 1,3-Butadiene; Divinyl; butadiene (1,3 butadiene); erythrene; 1,3-butadiene]
Chloroform (67-66-3) [SYNONYMS: Methane, trichloro-; Trichloromethane]
Dichloroethane, 1,2- (107-06-2) [SYNONYMS: 1,2-DICHLOROETHANE; 1,2-Dichloroethane; 1,2-dichloroethane; Ethane, 1,2-dichloro-; Ethylene dichloride]
Hexane, N- (110-54-3) [SYNONYMS: Hexane; N-HEXANE; hexane; n-hexane]
Methylene Chloride (75-09-2) [SYNONYMS: DICHLOROMETHANE; Dichloromethane; Methane, dichloro-; dichloromethane]
Toluene (108-88-3) [SYNONYMS: Benzene, methyl-; Methylbenzene]
Trichloroethylene (79-01-6) [SYNONYMS: Ethene, trichloro-; TCE; TRICHLOROETHENE; Trichloroethene]
Vinyl Chloride (75-01-4) [SYNONYMS: Chloroethene; Chloroethylene; Ethene, chloro-; VINYLCHLORIDE]
Xylene, m- (108-38-3) [SYNONYMS: 1,3-Dimethylbenzene; Benzene, 1,3-dimethyl-; M-XYLENE; m-Xylene; m-xylene]
Xylene, o- (95-47-6) [SYNONYMS: 1,2-Dimethylbenzene; Benzene, 1,2-dimethyl-; O-XYLENE; o-Xylene; o-xylene]
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Select All Chemicals
Yes
Select Include Metadata
Type here to search
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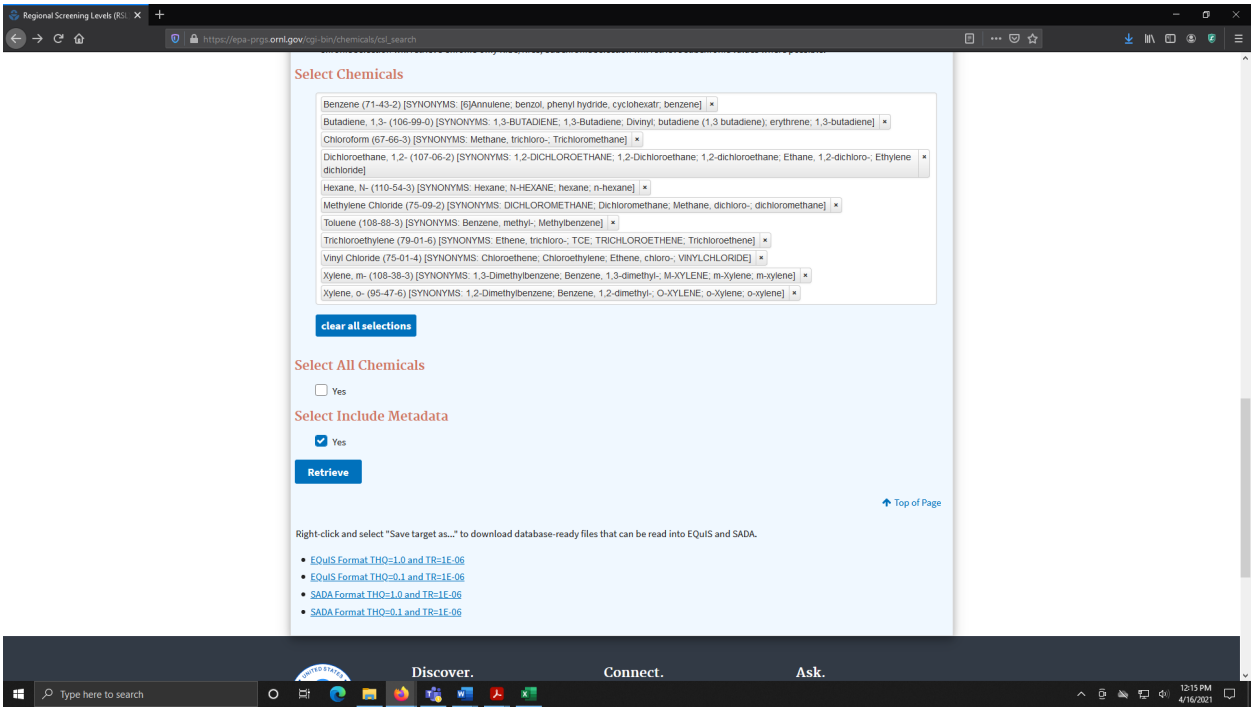
4/16/2021


Regional Screening Levels (RSL
https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search
Select Chemicals
Benzene (71-43-2) [SYNONYMS: [6]Annulene; benzol, phenyl hydride, cyclohexatr; benzene]
Butadiene, 1,3- (106-99-0) [SYNONYMS: 1,3-BUTADIENE; 1,3-Butadiene; Divinyl; butadiene (1,3 butadiene); erythrene; 1,3-butadiene]
Chloroform (67-66-3) [SYNONYMS: Methane, trichloro-; Trichloromethane]
Dichloroethane, 1,2- (107-06-2) [SYNONYMS: 1,2-DICHLOROETHANE; 1,2-Dichloroethane; 1,2-dichloroethane; Ethane, 1,2-dichloro-; Ethylene dichloride]
Hexane, N- (110-54-3) [SYNONYMS: Hexane; N-HEXANE; hexane; n-hexane]
Methylene Chloride (75-09-2) [SYNONYMS: DICHLOROMETHANE; Dichloromethane; Methane, dichloro-; dichloromethane]
Toluene (108-88-3) [SYNONYMS: Benzene, methyl-; Methylbenzene]
Trichloroethylene (79-01-6) [SYNONYMS: Ethene, trichloro-; TCE; TRICHLOROETHENE; Trichloroethene]
Vinyl Chloride (75-01-4) [SYNONYMS: Chloroethene; Chloroethylene; Ethene, chloro-; VINYLCHLORIDE]
Xylene, m- (108-38-3) [SYNONYMS: 1,3-Dimethylbenzene; Benzene, 1,3-dimethyl-; M-XYLENE; m-Xylene; m-xylene]
Xylene, o- (95-47-6) [SYNONYMS: 1,2-Dimethylbenzene; Benzene, 1,2-dimethyl-; O-XYLENE; o-Xylene; o-xylene]
clear all selections
Select All Chemicals
Yes
Select Include Metadata
Yes
Retrieve
Top of Page
Right-click and select "Save target as..." to download database-ready files that can be read into EQuIS and SADA.
EQuIS Format THQ=1.0 and TR=1E-06
EQuIS Format THQ=0.1 and TR=1E-06
SADA Format THQ=1.0 and TR=1E-06
SADA Format THQ=0.1 and TR=1E-06
Discover.
Connect.
Ask.
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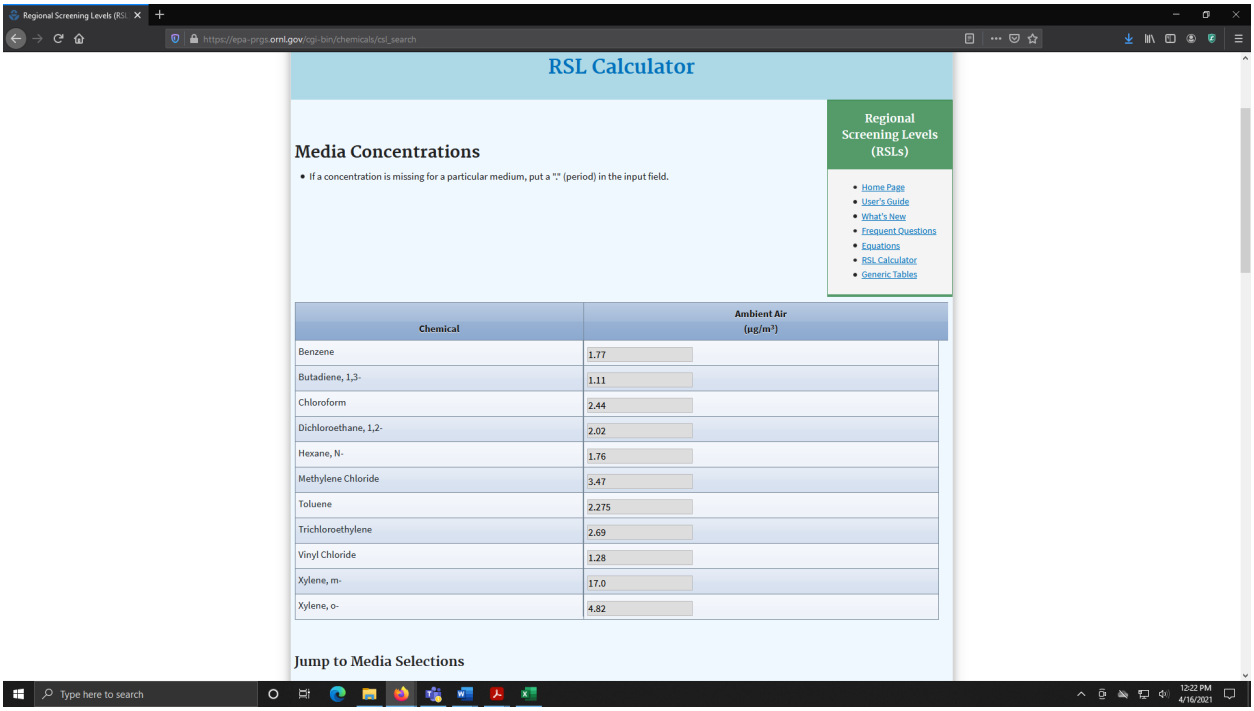


RSL Calculator

Media Concentrations

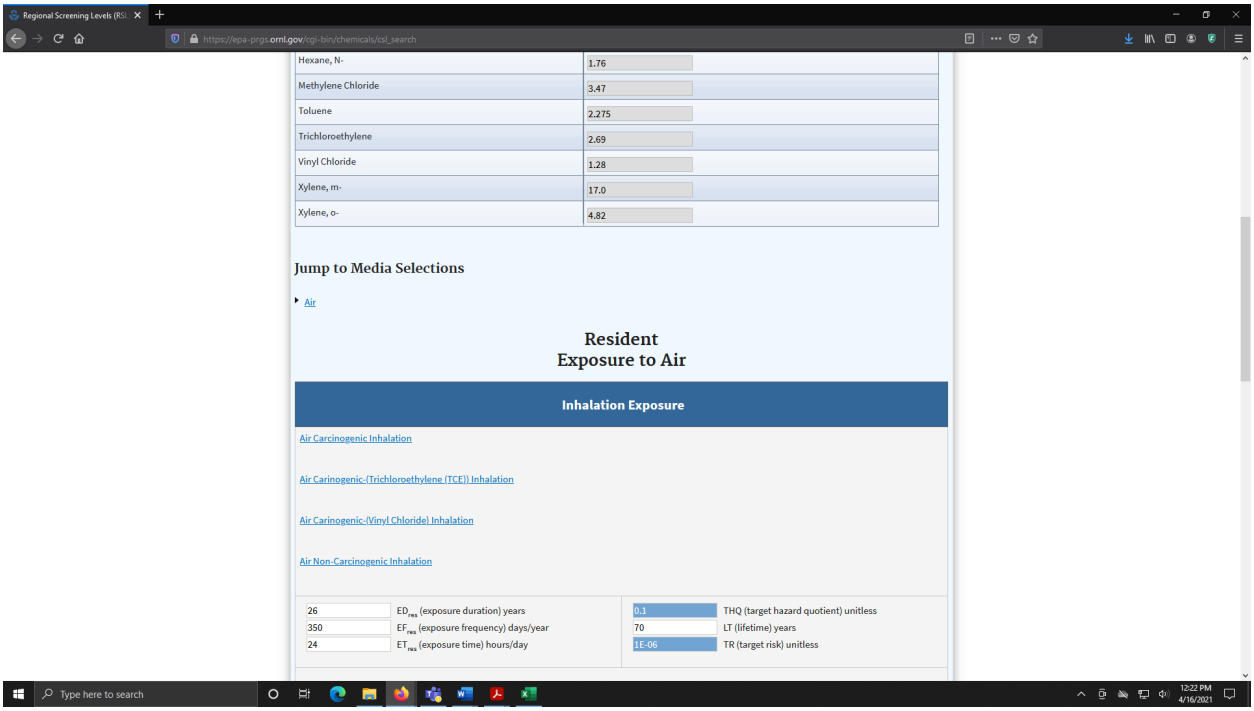
- If a concentration is missing for a particular medium, put a "." (period) in the input field.

Regional Screening Levels (RSLs)

- Home Page
- User's Guide
- What's New
- Frequent Questions
- Equations
- RSL Calculator
- Generic Tables

Chemical	Ambient Air (µg/m³)
Benzene	1.77
Butadiene, 1,3-	1.11
Chloroform	2.44
Dichloroethane, 1,2-	2.02
Hexane, N-	1.76
Methylene Chloride	3.47
Toluene	2.275
Trichloroethylene	2.69
Vinyl Chloride	1.28
Xylene, m-	17.0
Xylene, o-	4.82

Jump to Media Selections



Chemical	Ambient Air (µg/m³)
Hexane, N-	1.76
Methylene Chloride	3.47
Toluene	2.275
Trichloroethylene	2.69
Vinyl Chloride	1.28
Xylene, m-	17.0
Xylene, o-	4.82

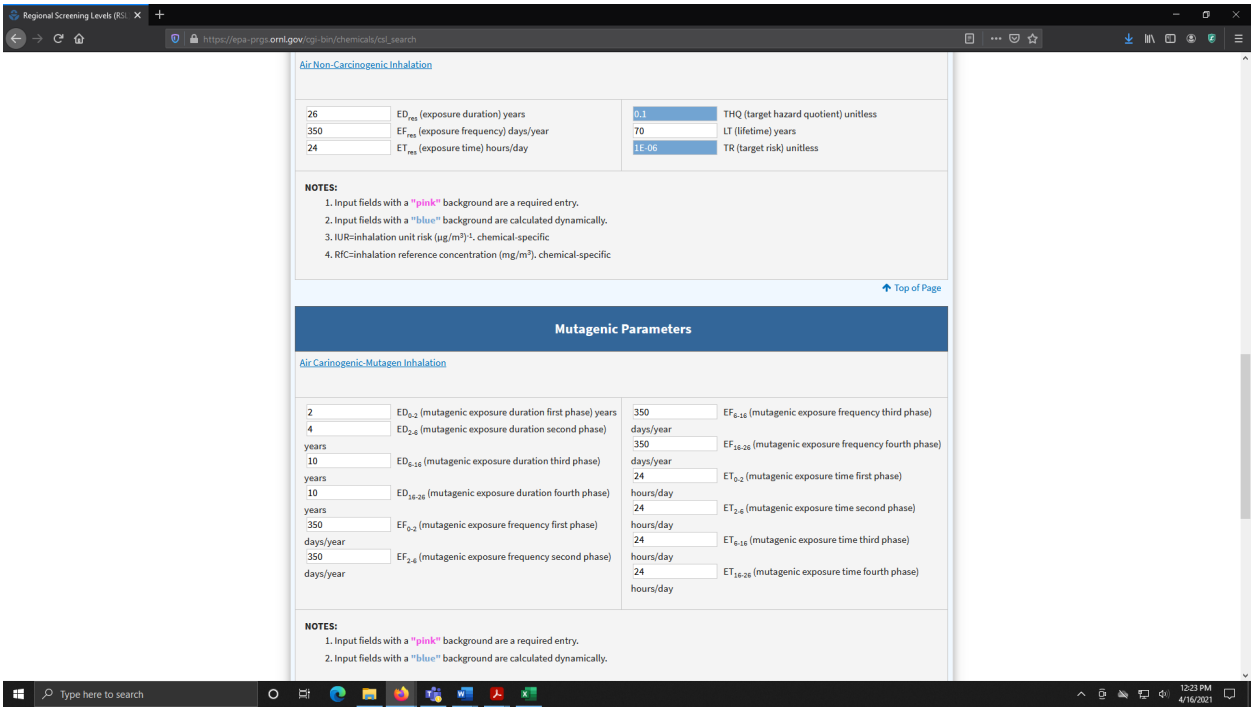
Jump to Media Selections

- Air

Resident Exposure to Air

Inhalation Exposure
Air Carcinogenic Inhalation
Air Carinogenic-(Trichloroethylene (TCE)) Inhalation
Air Carinogenic-(Vinyl Chloride) Inhalation
Air Non-Carcinogenic Inhalation

26	ED_{res} (exposure duration) years	0.1	THQ (target hazard quotient) unitless
350	EF_{res} (exposure frequency) days/year	70	LT (lifetime) years
24	ET_{res} (exposure time) hours/day	1E-06	TR (target risk) unitless


Regional Screening Levels (RSL
https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search
Air Non-Carcinogenic Inhalation
26 ED res (exposure duration) years
350 EF res (exposure frequency) days/year
24 ET res (exposure time) hours/day
0.1 THQ (target hazard quotient) unitless
70 LT (lifetime) years
1E-06 TR (target risk) unitless
NOTES:
1. Input fields with a "pink" background are a required entry.
2. Input fields with a "blue" background are calculated dynamically.
3. IUR=inhalation unit risk (µg/m³)-1. chemical-specific
4. RfC=inhalation reference concentration (mg/m³). chemical-specific
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Mutagenic Parameters
Air Carinogenic-Mutagen Inhalation
2 ED 0-2 (mutagenic exposure duration first phase) years
4 ED 2-6 (mutagenic exposure duration second phase) years
10 ED 6-16 (mutagenic exposure duration third phase) years
10 ED 16-26 (mutagenic exposure duration fourth phase) years
350 EF 0-2 (mutagenic exposure frequency first phase) days/year
350 EF 2-6 (mutagenic exposure frequency second phase) days/year
350 EF 6-16 (mutagenic exposure frequency third phase) days/year
350 EF 16-26 (mutagenic exposure frequency fourth phase) days/year
24 ET 0-2 (mutagenic exposure time first phase) hours/day
24 ET 2-6 (mutagenic exposure time second phase) hours/day
24 ET 6-16 (mutagenic exposure time third phase) hours/day
24 ET 16-26 (mutagenic exposure time fourth phase) hours/day
NOTES:
1. Input fields with a "pink" background are a required entry.
2. Input fields with a "blue" background are calculated dynamically.
Type here to search
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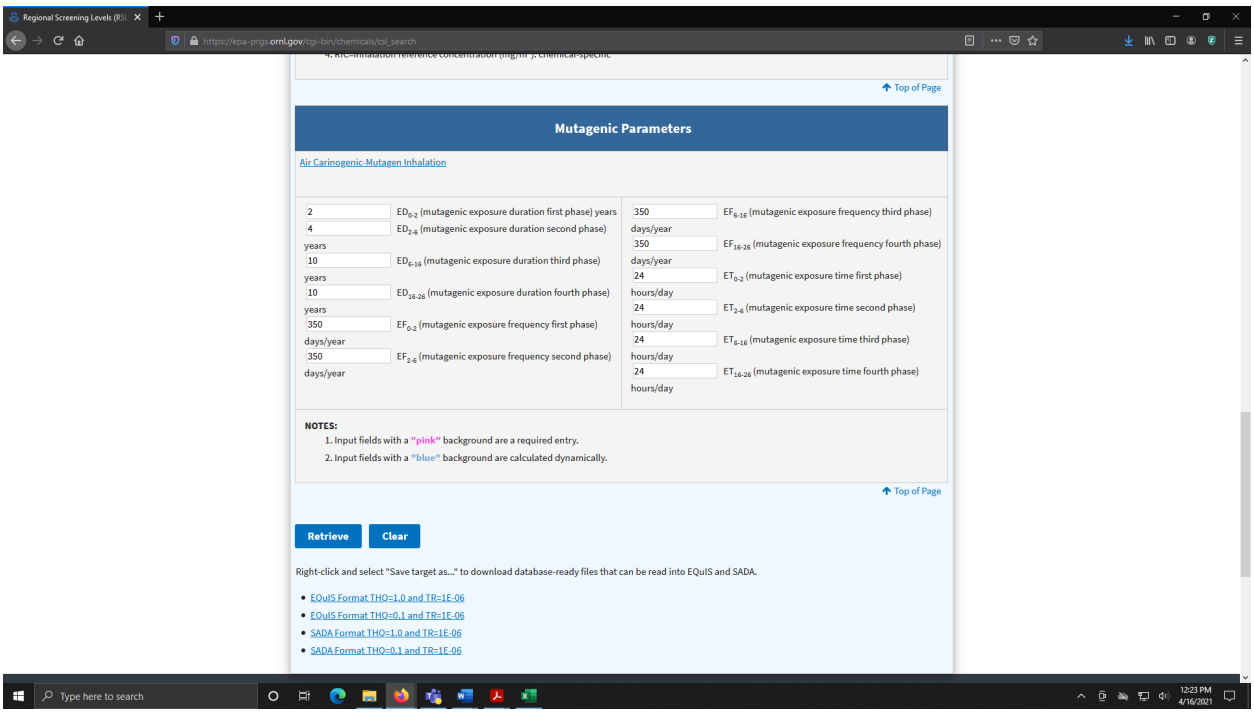
4/16/2021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Top of Page
Mutagenic Parameters
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Top of Page
Retrieve
Clear
Right-click and select "Save target as..." to download database-ready files that can be read into EQuIS and SADA.
EQuIS Format THQ=1.0 and TR=1E-06
EQuIS Format THQ=0.1 and TR=1E-06
SADA Format THQ=1.0 and TR=1E-06
SADA Format THQ=0.1 and TR=1E-06
Type here to search
12:23 PM
4/16/2021

Site-specific
Resident Air Inputs

Variable	Resident Air Default Value	Form-input Value
ED_{res} (exposure duration) years	26	26
ED_{0-2} (mutagenic exposure duration first phase) years	2	2
ED_{2-6} (mutagenic exposure duration second phase) years	4	4
ED_{6-16} (mutagenic exposure duration third phase) years	10	10
ED_{16-26} (mutagenic exposure duration fourth phase) years	10	10
EF_{res} (exposure frequency) days/year	350	350
EF_{0-2} (mutagenic exposure frequency first phase) days/year	350	350
EF_{2-6} (mutagenic exposure frequency second phase) days/year	350	350
EF_{6-16} (mutagenic exposure frequency third phase) days/year	350	350
EF_{16-26} (mutagenic exposure frequency fourth phase) days/year	350	350
ET_{res} (exposure time) hours/day	24	24
ET_{0-2} (mutagenic exposure time first phase) hours/day	24	24
ET_{2-6} (mutagenic exposure time second phase) hours/day	24	24
ET_{6-16} (mutagenic exposure time third phase) hours/day	24	24
ET_{16-26} (mutagenic exposure time fourth phase) hours/day	24	24
THQ (target hazard quotient) unitless	0.1	0.1
LT (lifetime) years	70	70
TR (target risk) unitless	1.0E-06	1.0E-06

Site-specific

Resident Regional Screening Levels (RSL) for Air

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = DWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	IUR (ug/m^3)$^{-1}$	IUR Ref	RfC (mg/m^3)	RfC Ref	Carcinogenic SL TR=1E-06 (ug/m^3)	Noncarcinogenic SL THI=0.1 (ug or $fibers/m^3$)	Screening Level (ug or $fibers/m^3$)
Benzene	71-43-2	No	Yes	Organics	7.80E-06	I	3.00E-02	I	3.60E-01	3.13E+00	3.60E-01 ca**
Butadiene, 1,3-	106-99-0	No	Yes	Organics	3.00E-05	I	2.00E-03	I	9.36E-02	2.09E-01	9.36E-02 ca**
Chloroform	67-66-3	No	Yes	Organics	2.30E-05	I	9.77E-02	A	1.22E-01	1.02E+01	1.22E-01 ca*
Dichloroethane, 1,2-	107-06-2	No	Yes	Organics	2.60E-05	I	7.00E-03	P	1.08E-01	7.30E-01	1.08E-01 ca**
Hexane, N-	110-54-3	No	Yes	Organics	-		7.00E-01	I	-	7.30E+01	7.30E+01 nc
Methylene Chloride	75-09-2	Yes	Yes	Organics	1.00E-08	I	6.00E-01	I	1.01E+02	6.26E+01	6.26E+01 nc
Toluene	108-88-3	No	Yes	Organics	-		5.00E+00	I	-	5.21E+02	5.21E+02 nc
Trichloroethylene	79-01-6	Yes	Yes	Organics	4.10E-06	I	2.00E-03	I	4.78E-01	2.09E-01	2.09E-01 nc
Vinyl Chloride	75-01-4	Yes	Yes	Organics	4.40E-06	I	1.00E-01	I	1.68E-01	1.04E+01	1.68E-01 ca*
Xylene, m-	108-38-3	No	Yes	Organics	-		1.00E-01	G	-	1.04E+01	1.04E+01 nc
Xylene, o-	95-47-6	No	Yes	Organics	-		1.00E-01	G	-	1.04E+01	1.04E+01 nc

Site-specific
Resident Risk for Air

Chemical	IUR (ug/m^3)$^{-1}$	IUR Ref	RfC (mg/m^3)	RfC Ref	Concentration (ug or fibers/m^3)	Carcinogenic Risk	Noncarcinogenic HI
Benzene	7.80E-06	I	3.00E-02	I	1.77E+00	4.92E-06	5.66E-02
Butadiene, 1,3-	3.00E-05	I	2.00E-03	I	1.11E+00	1.19E-05	5.32E-01
Chloroform	2.30E-05	I	9.77E-02	A	2.44E+00	2.00E-05	2.40E-02
Dichloroethane, 1,2-	2.60E-05	I	7.00E-03	P	2.02E+00	1.87E-05	2.77E-01
Hexane, N-	-		7.00E-01	I	1.76E+00	-	2.41E-03
Methylene Chloride	1.00E-08	I	6.00E-01	I	3.47E+00	3.42E-08	5.55E-03
Toluene	-		5.00E+00	I	2.28E+00	-	4.36E-04
Trichloroethylene	4.10E-06	I	2.00E-03	I	2.69E+00	5.62E-06	1.29E+00
Vinyl Chloride	4.40E-06	I	1.00E-01	I	1.28E+00	7.64E-06	1.23E-02
Xylene, m-	-		1.00E-01	G	1.70E+01	-	1.63E-01
Xylene, o-	-		1.00E-01	G	4.82E+00	-	4.62E-02
*Total Risk/HI	-		-		-	6.88E-05	2.41E+00

Inhalation Unit Risk Toxicity Metadata

Chemical	CAS Number	Chemical Type	IUR $(ug/m^3)^{-1}$	Toxicity Source	EPA Cancer Classification	Inhalation Unit Risk Tumor Type	Inhalation Unit Risk Target Organ	Inhalation Unit Risk Species
Benzene	71-43-2	Organics	7.8E-6	IRIS	Known/likely human carcinogen	Leukemia	Blood	Human
Butadiene, 1,3-	106-99-0	Organics	0.00003	IRIS	Carcinogenic to humans	Leukemia	Blood	Human
Chloroform	67-66-3	Organics	0.000023	IRIS	likely to be carcinogenic to humans	Hepatocellular carcinoma	Liver	Mouse
Dichloroethane, 1,2-	107-06-2	Organics	0.000026	IRIS	B2	Hemangioscarcomas	Blood	Rat
Hexane, N-	110-54-3	Organics	-					
Methylene Chloride	75-09-2	Organics	1E-8	IRIS	likely to be carcinogenic in humans	Hepatocellular carcinomas or adenomas, bronchoalveolar carcinomas or adenomas	Liver	male B6C3F1 mice
Toluene	108-88-3	Organics	-					
Trichloroethylene	79-01-6	Organics	4.1E-6	IRIS	carcinogenic to humans	Renal cell carcinoma, non-Hodgkin's lymphoma, and liver tumors	Kidney, Liver	human
Vinyl Chloride	75-01-4	Organics	4.4E-6	IRIS	Known/likely human carcinogen	Liver angiosarcomas, angiomas, hepatomas, and neoplastic nodules	Liver	Rat
Xylene, m-	108-38-3	Organics	-					
Xylene, o-	95-47-6	Organics	-					

Inhalation Unit Risk Toxicity Metadata

Inhalation Unit Risk Method	Inhalation Unit Risk Route	Inhalation Unit Risk Treatment Duration	Inhalation Unit Risk Study Reference	Inhalation Unit Risk Notes
Low-dose linearity utilizing maximum likelihood estimates	NA	NA	Rinsky et al. 1981, 1987, Paustenbach et al. 1993, Crump and Allen 1984, Crump 1992, 1994, U.S. EPA 1998	NA
Linear extrapolation from LEC01 (0.254 ppm); LEC01 derived from linear relative rate model (RR = 1 + (B)(x)) using lifetable analysis with leukemia incidence data; an adjustment factor of 2 was applied.	NA	NA	Health Canada 1998, U.S. EPA 2002	NA
Linearized multistage procedure, extra risk	NA	NA	NCI 1976	NA
Linearized multistage procedure, extra risk	NA	NA	NCI 1978	NA
Multistage model with linear extrapolation from the point of departure (BMDL10)	NA	NA	Mennear et al. 1988 and NTP 1986	NA
LEC01	NA	NA	Charbotel et al. 2006, EPA 2011, Raaschou-Nielsen et al. 2003	NA
LED 10/ linear method	NA	NA	Maltoni et al. 1981, Maltoni et al. 1984	NA

Oral Slope Factor Toxicity Metadata

Chemical	CAS Number	Chemical Type	SF_o (mg/kg-day) $^{-1}$	Toxicity Source	EPA Cancer Classification	Oral Slope Factor Tumor Type	Oral Slope Factor Target Organ	Oral Slope Factor Species	Oral Slope Factor Method	Oral Slope Factor Route	Oral Slope Factor Treatment Duration
Benzene	71-43-2	Organics	0.055	IRIS	Known/likely human carcinogen	Leukemia	Blood	Human	Linear extrapolation of human occupational data	NA	NA
Butadiene, 1,3-	106-99-0	Organics	0.6	CALEPA	Carcinogenic to humans	NA	NA	NA	NA	NA	NA
Chloroform	67-66-3	Organics	0.031	CALEPA	likely to be carcinogenic to humans	NA	NA	NA	NA	NA	NA
Dichloroethane, 1,2-	107-06-2	Organics	0.091	IRIS	B2	Hemangiosarcomas	Blood	Rat	Linearized multistage procedure with time-to-death analysis, extra risk	NA	NA
Hexane, N-	110-54-3	Organics	-								
Methylene Chloride	75-09-2	Organics	0.002	IRIS	likely to be carcinogenic in humans	Hepatocellular carcinomas or adenomas	Liver	male B6C3F1 mice	Multistage model with linear extrapolation from the point of departure (BMDL10)	NA	NA
Toluene	108-88-3	Organics	-								
Trichloroethylene	79-01-6	Organics	0.046	IRIS	carcinogenic to humans	Derived from IUR	Derived from IUR	Derived from IUR	Derived from IUR	NA	NA
Vinyl Chloride	75-01-4	Organics	0.72	IRIS	Known/likely human carcinogen	Total of liver angiosarcoma, hepatocellular carcinoma, and neoplastic nodules	Liver	Rat	LMS method	NA	NA
Xylene, m-	108-38-3	Organics	-								
Xylene, o-	95-47-6	Organics	-								

Oral Slope Factor Toxicity Metadata

Oral Slope Factor Study Reference	Oral Slope Factor Notes
Rinsky et al. 1981, Rinsky et al. 1987, Paustenbach et al. 1993, Crump 1994, U. S. EPA 1998, U.S. EPA 1999	NA
NA	NA
NA	NA
NCI 1978	NA
Serota et al. 1986	NA
Derived from IUR	NA
Feron et al. 1981	NA

Oral Chronic Toxicity Metadata

Chemical	CAS Number	Chemical Type	Chronic RfD (mg/kg-day)	Toxicity Source	Oral Chronic Reference Dose Basis	Oral Chronic Reference Dose Confidence Level	Oral Chronic Reference Dose Critical Effect	Oral Chronic Reference Dose Target Organ	Oral Chronic Reference Dose Modifying Factor	Oral Chronic Reference Dose Uncertainty Factor	Oral Chronic Reference Dose Species
Benzene	71-43-2	Organics	0.004	IRIS	BMDL: 1.2 mg/kg-day	Medium	Decreased lymphocyte count	Blood	1	300	Human
Butadiene, 1,3-	106-99-0	Organics	-								
Chloroform	67-66-3	Organics	0.01	IRIS	BMDL 10: 1.0 mg/kg-day	Medium	Moderate/marked fatty cyst formation in the liver and elevated SGPT	Liver	1	100	Dog
Dichloroethane, 1,2-	107-06-2	Organics	0.006	SCREEN	LOAEL: 58 mg/kg-day	NA	Greater than 10 percent increase in relative kidney weight	Kidney	NA	10000	Rat
Hexane, N-	110-54-3	Organics	-								
Methylene Chloride	75-09-2	Organics	0.006	IRIS	BMDL10 (HED): 0.19 mg/kg-day	high	hepatic effects (hepatic vacuolation, liver foci)	Liver	1	30	rat
Toluene	108-88-3	Organics	0.08	IRIS	BMDL: 238 mg/kg-day	Medium	Increased kidney weight	Kidney	1	3000	Rat
Trichloroethylene	79-01-6	Organics	0.0005	IRIS	BMDL01 (HED99): 0.0051 mg/kg/day	High	Increased fetal cardiac malformations in Sprague-Dawley rats	Heart	1	10	rat
Vinyl Chloride	75-01-4	Organics	0.003	IRIS	NOAEL (HED): 0.09 mg/kg-day	Medium	Liver cell polymorphism	Liver	1	30	Rat
Xylene, m-	108-38-3	Organics	0.2	SURROGATE. See Xylenes	NOAEL: 179 mg/kg-day	Medium	Decreased body weight, increased mortality	Other	1	1000	Rat
Xylene, o-	95-47-6	Organics	0.2	SURROGATE. See Xylenes	NOAEL: 179 mg/kg-day	Medium	Decreased body weight, increased mortality	Other	1	1000	Rat

Oral Chronic Toxicity Metadata

Oral Chronic Reference Dose Route	Oral Chronic Reference Dose Study Duration	Oral Chronic Reference Dose Study Reference	Oral Chronic Reference Dose Notes
NA	NA	Rothman et al. 1996	NA
NA	NA	Heywood et al. 1979	NA
Oral: drinking water	13 weeks	NTP 1991	NA
NA	NA	Serota et al. 1986	NA
NA	NA	NTP 1990	NA
NA	NA	Johnson et al. 2003 (Supported by Keil et al. 2009 and Peden-Adams et al. 2006)	NA
NA	NA	Til et al. 1983, Til et al. 1991	NA
NA	NA	NTP 1986	SURROGATE. See Xylenes
NA	NA	NTP 1986	SURROGATE. See Xylenes

Inhalation Chronic Toxicity Metadata

Chemical	CAS Number	Chemical Type	Chronic RfC (mg/m^3)	Toxicity Source	Inhalation Chronic Reference Concentration Basis	Inhalation Chronic Reference Concentration Confidence Level	Inhalation Chronic Reference Concentration Critical Effect	Inhalation Chronic Reference Concentration Target Organ	Inhalation Chronic Reference Concentration Modifying Factor
Benzene	71-43-2	Organics	0.03	IRIS	BMCL: 8.2 mg/m3	Medium	Decreased lymphocyte count	Blood	1
Butadiene, 1,3-	106-99-0	Organics	0.002	IRIS	BMCL 10 (HEC): 1.98 mg/m3	Medium	Atrophy	Ovaries	1
Chloroform	67-66-3	Organics	0.0976524	ATSDR	LOAEL: 2 ppm	NA	Hepatomegaly	Hepatic	NA
Dichloroethane, 1,2-	107-06-2	Organics	0.007	PPRTV	LOAEL-HEC: 22 mg/m3	Low	Neurobehavioral impairment	Neurological	NA
Hexane, N-	110-54-3	Organics	0.7	IRIS	BMCL (HEC): 215 mg/m3	Medium	Peripheral neuropathy (decreased MCV at 12 weeks)	Neurological	1
Methylene Chloride	75-09-2	Organics	0.6	IRIS	BMDL10 (HEC): 17.2 mg/m3	medium/high	hepatic effects (hepatic vacuolation)	Liver	1
Toluene	108-88-3	Organics	5	IRIS	NOAEL (ADJ): 46 mg/m3	High	Neurological effects in occupationally-exposed workers	Neurological	1
Trichloroethylene	79-01-6	Organics	0.002	IRIS	LOAEL (HEC99): 0.19 mg/m3	High	Decreased thymus weight in female B6C3F1 mice (immunotoxicity)	Thymus	1
Vinyl Chloride	75-01-4	Organics	0.1	IRIS	NOAEL (HEC): 2.5 mg/m3	Medium	Liver cell polymorphism	Liver	1
Xylene, m-	108-38-3	Organics	0.1	SURROGATE. See Xylenes	NOAEL-HEC: 39 mg/m3	Medium	Impaired motor coordination (decreased rotarod performance)	Nervous	1
Xylene, o-	95-47-6	Organics	0.1	SURROGATE. See Xylenes	NOAEL-HEC: 39 mg/m3	Medium	Impaired motor coordination (decreased rotarod performance)	Nervous	1

Inhalation Chronic Toxicity Metadata

Inhalation Chronic Reference Concentration Uncertainty Factor	Inhalation Chronic Reference Concentration Species	Inhalation Chronic Reference Concentration Route	Inhalation Chronic Reference Concentration Study Duration	Inhalation Chronic Reference Concentration Study Reference	Inhalation Chronic Reference Concentration Notes
300	Human	NA	NA	Rothman et al. 1996	NA
1000	Mouse	NA	NA	NTP 1993	NA
100	Human	Hepatic	1-4 years	Bomski et al. 1967	NA
3000	Human	Inhalation	Occupational	Kozik 1957	NA
300	Rat	NA	NA	Huang et al. 1989	NA
30	rat	NA	NA	Nitschke et al. 1988	NA
10	Human	NA	NA	Abbate et al. 1993, Boey et al. 1997, Cavalleri et al. 2000, Eller et al. 1999, Foo et al. 1990, Murata et al. 1993, Nakatsuka et al. 1992, Neubert et al. 2001, Vrca et al. 1995, and Zavalic et al. 1998a	NA
100	mice	NA	NA	Keil et al. 2009 (Supported by Johnson et al. 2003)	NA
30	Rat	NA	NA	Til et al. 1991, Til et al. 1983	NA
300	Rat	NA	NA	Korsak et al. 1994	SURROGATE. See Xylenes
300	Rat	NA	NA	Korsak et al. 1994	SURROGATE. See Xylenes

EPA Trichloroethylene (TCE) ADAF Calculator Output

Note: Highlighed cells can be adjusted depending on exposure scenario (e.g., in Col C, set to 0 for age groups without exposure)

Inhalation (concentration-equivalence across age groups)

Col A	Col B	Col C	Col D	Col E	Col F	Col G	Col H	Col I	Col J	Col K	Col L
	Exposure scenario parameters				Dose-response assessment calculations						
Units:		(µg/m^3 air)	yr	-	(µg/m^3 air)$^{-1}$	-	-	(µg/m^3 air)$^{-1}$	(µg/m^3 air)$^{-1}$	-	-
Age group	risk per µg/m^3 air equivalence	Exposure concentration	Age group duration	Duration adjustment (Col D / 70 yr)	Kidney unadjusted lifetime unit risk (p 5-137 [5.2.2.1.4])	Kidney cancer default ADAF	**Kidney ADAF-adjusted partial risk (Col B x Col C x Col E x Col F x Col G)**	Kidney+NHL+ liver unadjusted lifetime unit risk (p 5-139 [5.2.2.2])	NHL+ liver lifetime unit risk (Col I − Col F)	**NHL and liver partial risk (Col B x Col C x Col E x Col J)**	**Total partial risk (Col H + Col K)**
Birth to <1 month	1	2.690	0.083	0.0012	1.0E-06	10	**3.2E-08**	4.1E-06	3.1E-06	**9.9E-09**	**4.2E-08**
1 to <3 months	1	2.690	0.167	0.0024	1.0E-06	10	**6.4E-08**	4.1E-06	3.1E-06	**2.0E-08**	**8.4E-08**
3 to <6 months	1	2.690	0.250	0.0036	1.0E-06	10	**9.6E-08**	4.1E-06	3.1E-06	**3.0E-08**	**1.3E-07**
6 to <12 months	1	2.690	0.500	0.0071	1.0E-06	10	**1.9E-07**	4.1E-06	3.1E-06	**6.0E-08**	**2.5E-07**
1 to <2 years	1	2.690	1.000	0.0143	1.0E-06	10	**3.8E-07**	4.1E-06	3.1E-06	**1.2E-07**	**5.0E-07**
2 to <3 years	1	2.690	1.000	0.0143	1.0E-06	3	**1.2E-07**	4.1E-06	3.1E-06	**1.2E-07**	**2.3E-07**
3 to <6 years	1	2.690	3.000	0.0429	1.0E-06	3	**3.5E-07**	4.1E-06	3.1E-06	**3.6E-07**	**7.0E-07**
6 to <11 years	1	2.690	5.000	0.0714	1.0E-06	3	**5.8E-07**	4.1E-06	3.1E-06	**6.0E-07**	**1.2E-06**
11 to <16 years	1	2.690	5.000	0.0714	1.0E-06	3	**5.8E-07**	4.1E-06	3.1E-06	**6.0E-07**	**1.2E-06**
16 to <18	1	2.690	2.000	0.0286	1.0E-06	1	**7.7E-08**	4.1E-06	3.1E-06	**2.4E-07**	**3.2E-07**
18 to <21	1	2.690	3.000	0.0429	1.0E-06	1	**1.2E-07**	4.1E-06	3.1E-06	**3.6E-07**	**4.7E-07**
21 to <30	1	2.690	6.000	0.0857	1.0E-06	1	**2.3E-07**	4.1E-06	3.1E-06	**7.1E-07**	**9.5E-07**
30 to 70	1	0.000	0.000	0.0000	1.0E-06	1	**0.0E+00**	4.1E-06	3.1E-06	**0.0E+00**	**0.0E+00**
										Total unit risk:	**6E-06**

Appendix E
TOSHI Technical Documentation

Included in this Appendix:

- TOSHI Technical Document
- EPA HEM4 Excel file (Target_Organ_Endpoints.xlsx); This file has been included in the PDF file attachments (see paper clip icon in Adobe Acrobat/Reader). This file was obtained from the "resources" folder in the downloaded version of the HEM4 air risk assessment software. The software and associated files can be downloaded from here: https://www.epa.gov/fera/download-human-exposure-model-hem
- RSL Calculator Metadata (this has also been included in Appendix D)

Appendix E: TOSHI Technical Documentation

Disclaimer: The purpose of this TOSHI Technical Documentation is to explain the process that was used in this Risk Assessment for deriving TOSHIs. The processes provided here should not be used by regulated parties as an instructional manual for determining TOSHIs. EPA or EPD guidance on this matter may change in the future and the processes provided here may no longer be considered applicable.

HAP	CAS Number	Hazard Quotient (HQ)	Target Organ or Toxicological Effect	Critical Effect	Notes
Benzene	71-43-2	0.057	Immunological	Decreased lymphocyte count	Target Organ listed as "Blood" in RSL Calculator Metadata; Target Endpoint Used According to HEM4
Butadiene, 1,3-	106-99-0	0.532	Reproductive	Ovarian atrophy	Target Organ listed as "Ovaries" in RSL Calculator Metadata; Target Endpoint Used According to HEM4
Chloroform	67-66-3	0.024	Liver	Hepatomegaly	
Dichloroethane, 1,2-	107-06-2	0.277	Neurological	Neurobehavioral impairment	Target Organ Listed as "Kidney" in HEM4; Since RfC is PPRTV and not considered in HEM4, the Critical Effect of the Critical Study (Neurological effects) is used as the target endpoint
Hexane	110-54-3	0.002	Neurological	Peripheral neuropathy (decreased MCV at 12 weeks)	Target "Organ" Listed as "Neurological" in RSL Calculator Metadata based on the IRIS RfC critical effect; since Hexane is not listed in HEM4, went with RSL Calculator Metadata
Methylene Chloride	75-09-2	0.006	Liver	Hepatic effects (hepatic vacuolation)	
Toluene	108-88-3	0.0004	Neurological	Neurological effects in occupationally-exposed workers	
Trichloroethylene	79-01-6	1.29	Immunological	Decreased thymus weight in female B6C3F1 mice (immunotoxicity)	Target Organ listed as "Thymus" in RSL Calculator Metadata; Target Endpoint Used According to HEM4
Vinyl Chloride	75-01-4	0.012	Liver	Liver cell polymorphism	
Xylene, m-	108-38-3	0.163	Neurological	Impaired motor coordination (decreased rotarod performance)	Target Organ listed as "Nervous" in RSL Calculator Metadata
Xylene, o-	95-47-6	0.046	Neurological	Impaired motor coordination (decreased rotarod performance)	Target Organ listed as "Nervous" in RSL Calculator Metadata

The purpose of this document is to provide an explanation into how the target-organ (or effect)-specific hazard indices (TOSHIs) was determined in the *Ambient Air Monitoring Report: Risk Assessment for Select Hazardous Air Pollutants (HAPs) Measured at the Forsyth County Air Monitoring Site, First 12 Months of Operation* ("Risk Assessment"). It was necessary to derive TOSHIs in this Risk Assessment since the Hazard Index of all 10 HAPs exceeded 1.

It is important to emphasize that EPA prefers toxicologists with experience in developing TOSHIs undertake this practice to avoid any potential underestimation of hazard that could occur if TOSHIs are not developed correctly (USEPA, 2004, pg. 13-10). Thus, EPA air risk assessment guidance does not specify clear procedures on how best to separate air toxics (HAPs in the case of this Risk Assessment) by toxicological effects and/or by the organs they target except to indicate that all the major effects that a particular HAP can induce should be identified (USEPA, 2004, pg. 13-10). To provide more refined TOSHIs that could better represent the noncancer hazard, a process for target organ/effect separation was developed for this Risk Assessment that would be simple, not require intensive toxicological research, and would be grounded in documentation from EPA sources. The steps of this process are outlined below:

1) For each of the 10 HAPs, the critical effect was noted:
    a. For all 10 HAPs, the toxicity values have been provided in Appendix C of this Risk Assessment. When compiling the toxicity values used, information on the critical effect/critical study was also compiled from the information provided in the sources for each toxicity value. The RSL Calculator Output (see Appendix D) also includes metadata containing various pieces of information regarding critical effects and target organs. All this information was surveyed in the process of determining TOSHIs.
2) The list of target organs/effects from the HEM4 software was consulted.
    a. EPA has a publicly available air risk assessment software known as the Human Exposure Model (HEM). The most current version of the software is HEM4. The HEM4 is generally used to produce estimates of risk and hazard on modeled ambient air data and can be found here: https://www.epa.gov/fera/risk-assessment-and-modeling-human-exposure-model-hem. The HEM4 calculates TOSHIs as part of the software and groups air toxics into the following target organs or generalized toxicological effects (referred to as "organ systems" in *The HEM4 Users Guide*): respiratory; liver; neurological; developmental; reproductive; kidney; ocular; endocrine; hematological; immunological; skeletal; spleen; thyroid; and whole body (USEPA, 2020 pg. 109). Though ideally similarity in toxicological effects should be the basis for grouping HAPs together when deriving a TOSHI, in practice EPA indicates that air toxics that affect the same organ can be grouped together (USEPA, 2000, pg. 80). In the case of the HEM4, the classifications used in separating air toxics to determine a TOSHI are a mixture of target organs and general toxicological effects. The Excel file listing the target organs/effects (Target_Organ_Endpoints.xlsx) for all air toxics is found

in the resources folder that is part of the HEM4 software and has been included with Appendix E.

3) For each of the 10 HAPs, all the target organ(s)/toxicological effect(s) listed in Target_Organ_Endpoints.xlsx ("Excel file") were identified. For each air toxic, the Excel file codes "1" if that particular target organ/toxicological effect is applicable to the air toxic and codes "0" if it does not.
4) The target organs/toxicological effects identified using the HEM4 Excel file were compared to the critical effect of each HAP and with the RSL calculator metadata. The target organ/toxicological effect listed for a particular HAP in the HEM4 Excel file that best coincided with the critical effect was considered as the target organ/toxicological effect of that HAP for the purposes of determining the TOSHIs. All HAPs were separated into 4 target organs/toxicological effects: Immunological, Reproductive, Liver, and Neurological.
    a. Since the hazard quotient (HQ) for each HAP is derived based on the reference concentration (RfC) of that HAP, an assumption that can be made about the HQ is that in practicality it only considers the adverse noncancer effect that was found in the critical (or principal) study—the study that forms the basis of the RfC— as the only toxicological effect of concern. It is assumed that if the critical toxic effect is prevented, then all other toxic effects of a chemical would be prevented (USEPA, 1994, 4-69). Thus, it is assumed for the purposes of developing the TOSHI that each HAP only induces the critical toxic effect.
    b. Please see the Notes section in the table above for various exceptions that were made to this procedure.
    c. Since the Xylenes RfC was used as a surrogate for m,p-Xylene and o-Xylene to derive the HQ, the "Neurological" Toxicological Effect is also assumed for m-,p-isomer mixture and for the o- isomer.
5) TOSHIs were derived (within an assumption of concentration addition as explained in the Risk Assessment) for each of the 4 target organs/toxicological effects. All TOSHIs were at or below 1 (at 1 significant figure).

Chemical	CAS Number	Target Organ or Toxicological Effect	Noncancer Hazard Quotient (HQ)
Benzene	71-43-2	Immunological	0.057
Butadiene, 1,3-	106-99-0	Reproductive	0.532
Chloroform	67-66-3	Liver	0.024
Dichloroethane, 1,2-	107-06-2	Neurological	0.277
Hexane, N-	110-54-3	Neurological	0.002
Methylene Chloride	75-09-2	Liver	0.006
Toluene	108-88-3	Neurological	0.0004
Trichloroethylene (TCE)	79-01-6	Immunological	1.29
Vinyl Chloride	75-01-4	Liver	0.012
Xylene, m,p- (entered into the RSL Calculator as Xylene, m-)	108-38-3 (m-Xylene CAS Number)	Neurological	0.163
Xylene, o-	95-47-6	Neurological	0.046
Immunological TOSHI			**1**
Reproductive TOSHI			**0.5**
Neurological TOSHI			**0.5**
Liver TOSHI			**0.04**

Sources Cited:

United States Environmental Protection Agency (USEPA). 1994. *Methods For Derivation Of Inhalation Reference Concentrations And Application Of Inhalation Dosimetry.* EPA-600-8-90-066F. Research Triangle Park, NC: United States Environmental Protection Agency, Environmental Criteria and Assessment Office

United States Environmental Protection Agency (USEPA). 2000. *Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures.* EPA/630/R-00/002. Washington, D.C.: U.S. Environmental Protection Agency, Risk Assessment Forum

United States Environmental Protection Agency (USEPA). 2020. *The HEM4 User's Guide.* EPA/635R-00/004. Research Triangle Park, N.C.: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. https://www.epa.gov/sites/production/files/2020-10/documents/hem4_users_guide.pdf

Inhalation Unit Risk Toxicity Metadata

Chemical	CAS Number	Chemical Type	IUR $(ug/m^3)^{-1}$	Toxicity Source	EPA Cancer Classification	Inhalation Unit Risk Tumor Type	Inhalation Unit Risk Target Organ	Inhalation Unit Risk Species
Benzene	71-43-2	Organics	7.8E-6	IRIS	Known/likely human carcinogen	Leukemia	Blood	Human
Butadiene, 1,3-	106-99-0	Organics	0.00003	IRIS	Carcinogenic to humans	Leukemia	Blood	Human
Chloroform	67-66-3	Organics	0.000023	IRIS	likely to be carcinogenic to humans	Hepatocellular carcinoma	Liver	Mouse
Dichloroethane, 1,2-	107-06-2	Organics	0.000026	IRIS	B2	Hemangioscarcomas	Blood	Rat
Hexane, N-	110-54-3	Organics	-					
Methylene Chloride	75-09-2	Organics	1E-8	IRIS	likely to be carcinogenic in humans	Hepatocellular carcinomas or adenomas, bronchoalveolar carcinomas or adenomas	Liver	male B6C3F1 mice
Toluene	108-88-3	Organics	-					
Trichloroethylene	79-01-6	Organics	4.1E-6	IRIS	carcinogenic to humans	Renal cell carcinoma, non-Hodgkin's lymphoma, and liver tumors	Kidney, Liver	human
Vinyl Chloride	75-01-4	Organics	4.4E-6	IRIS	Known/likely human carcinogen	Liver angiosarcomas, angiomas, hepatomas, and neoplastic nodules	Liver	Rat
Xylene, m-	108-38-3	Organics	-					
Xylene, o-	95-47-6	Organics	-					

Inhalation Unit Risk Toxicity Metadata

Inhalation Unit Risk Method	Inhalation Unit Risk Route	Inhalation Unit Risk Treatment Duration	Inhalation Unit Risk Study Reference	Inhalation Unit Risk Notes
Low-dose linearity utilizing maximum likelihood estimates	NA	NA	Rinsky et al. 1981, 1987, Paustenbach et al. 1993, Crump and Allen 1984, Crump 1992, 1994, U.S. EPA 1998	NA
Linear extrapolation from LEC01 (0.254 ppm); LEC01 derived from linear relative rate model (RR = 1 + (B)(x)) using lifetable analysis with leukemia incidence data; an adjustment factor of 2 was applied.	NA	NA	Health Canada 1998, U.S. EPA 2002	NA
Linearized multistage procedure, extra risk	NA	NA	NCI 1976	NA
Linearized multistage procedure, extra risk	NA	NA	NCI 1978	NA
Multistage model with linear extrapolation from the point of departure (BMDL10)	NA	NA	Mennear et al. 1988 and NTP 1986	NA
LEC01	NA	NA	Charbotel et al. 2006, EPA 2011, Raaschou-Nielsen et al. 2003	NA
LED 10/ linear method	NA	NA	Maltoni et al. 1981, Maltoni et al. 1984	NA

Oral Slope Factor Toxicity Metadata

Chemical	CAS Number	Chemical Type	SF_o (mg/kg-day) $^{-1}$	Toxicity Source	EPA Cancer Classification	Oral Slope Factor Tumor Type	Oral Slope Factor Target Organ	Oral Slope Factor Species	Oral Slope Factor Method	Oral Slope Factor Route	Oral Slope Factor Treatment Duration
Benzene	71-43-2	Organics	0.055	IRIS	Known/likely human carcinogen	Leukemia	Blood	Human	Linear extrapolation of human occupational data	NA	NA
Butadiene, 1,3-	106-99-0	Organics	0.6	CALEPA	Carcinogenic to humans	NA	NA	NA	NA	NA	NA
Chloroform	67-66-3	Organics	0.031	CALEPA	likely to be carcinogenic to humans	NA	NA	NA	NA	NA	NA
Dichloroethane, 1,2-	107-06-2	Organics	0.091	IRIS	B2	Hemangiosarcomas	Blood	Rat	Linearized multistage procedure with time-to-death analysis, extra risk	NA	NA
Hexane, N-	110-54-3	Organics	-								
Methylene Chloride	75-09-2	Organics	0.002	IRIS	likely to be carcinogenic in humans	Hepatocellular carcinomas or adenomas	Liver	male B6C3F1 mice	Multistage model with linear extrapolation from the point of departure (BMDL10)	NA	NA
Toluene	108-88-3	Organics	-								
Trichloroethylene	79-01-6	Organics	0.046	IRIS	carcinogenic to humans	Derived from IUR	Derived from IUR	Derived from IUR	Derived from IUR	NA	NA
Vinyl Chloride	75-01-4	Organics	0.72	IRIS	Known/likely human carcinogen	Total of liver angiosarcoma, hepatocellular carcinoma, and neoplastic nodules	Liver	Rat	LMS method	NA	NA
Xylene, m-	108-38-3	Organics	-								
Xylene, o-	95-47-6	Organics	-								

Oral Slope Factor Toxicity Metadata

Oral Slope Factor Study Reference	Oral Slope Factor Notes
Rinsky et al. 1981, Rinsky et al. 1987, Paustenbach et al. 1993, Crump 1994, U. S. EPA 1998, U.S. EPA 1999	NA
NA	NA
NA	NA
NCI 1978	NA
Serota et al. 1986	NA
Derived from IUR	NA
Feron et al. 1981	NA

Oral Chronic Toxicity Metadata

Chemical	CAS Number	Chemical Type	Chronic RfD (mg/kg-day)	Toxicity Source	Oral Chronic Reference Dose Basis	Oral Chronic Reference Dose Confidence Level	Oral Chronic Reference Dose Critical Effect	Oral Chronic Reference Dose Target Organ	Oral Chronic Reference Dose Modifying Factor	Oral Chronic Reference Dose Uncertainty Factor	Oral Chronic Reference Dose Species
Benzene	71-43-2	Organics	0.004	IRIS	BMDL: 1.2 mg/kg-day	Medium	Decreased lymphocyte count	Blood	1	300	Human
Butadiene, 1,3-	106-99-0	Organics	-								
Chloroform	67-66-3	Organics	0.01	IRIS	BMDL 10: 1.0 mg/kg-day	Medium	Moderate/marked fatty cyst formation in the liver and elevated SGPT	Liver	1	100	Dog
Dichloroethane, 1,2-	107-06-2	Organics	0.006	SCREEN	LOAEL: 58 mg/kg-day	NA	Greater than 10 percent increase in relative kidney weight	Kidney	NA	10000	Rat
Hexane, N-	110-54-3	Organics	-								
Methylene Chloride	75-09-2	Organics	0.006	IRIS	BMDL10 (HED): 0.19 mg/kg-day	high	hepatic effects (hepatic vacuolation, liver foci)	Liver	1	30	rat
Toluene	108-88-3	Organics	0.08	IRIS	BMDL: 238 mg/kg-day	Medium	Increased kidney weight	Kidney	1	3000	Rat
Trichloroethylene	79-01-6	Organics	0.0005	IRIS	BMDL01 (HED99): 0.0051 mg/kg/day	High	Increased fetal cardiac malformations in Sprague-Dawley rats	Heart	1	10	rat
Vinyl Chloride	75-01-4	Organics	0.003	IRIS	NOAEL (HED): 0.09 mg/kg-day	Medium	Liver cell polymorphism	Liver	1	30	Rat
Xylene, m-	108-38-3	Organics	0.2	SURROGATE. See Xylenes	NOAEL: 179 mg/kg-day	Medium	Decreased body weight, increased mortality	Other	1	1000	Rat
Xylene, o-	95-47-6	Organics	0.2	SURROGATE. See Xylenes	NOAEL: 179 mg/kg-day	Medium	Decreased body weight, increased mortality	Other	1	1000	Rat

Oral Chronic Toxicity Metadata

Oral Chronic Reference Dose Route	Oral Chronic Reference Dose Study Duration	Oral Chronic Reference Dose Study Reference	Oral Chronic Reference Dose Notes
NA	NA	Rothman et al. 1996	NA
NA	NA	Heywood et al. 1979	NA
Oral: drinking water	13 weeks	NTP 1991	NA
NA	NA	Serota et al. 1986	NA
NA	NA	NTP 1990	NA
NA	NA	Johnson et al. 2003 (Supported by Keil et al. 2009 and Peden-Adams et al. 2006)	NA
NA	NA	Til et al. 1983, Til et al. 1991	NA
NA	NA	NTP 1986	SURROGATE. See Xylenes
NA	NA	NTP 1986	SURROGATE. See Xylenes

Inhalation Chronic Toxicity Metadata

Chemical	CAS Number	Chemical Type	Chronic RfC (mg/m^3)	Toxicity Source	Inhalation Chronic Reference Concentration Basis	Inhalation Chronic Reference Concentration Confidence Level	Inhalation Chronic Reference Concentration Critical Effect	Inhalation Chronic Reference Concentration Target Organ	Inhalation Chronic Reference Concentration Modifying Factor
Benzene	71-43-2	Organics	0.03	IRIS	BMCL: 8.2 mg/m3	Medium	Decreased lymphocyte count	Blood	1
Butadiene, 1,3-	106-99-0	Organics	0.002	IRIS	BMCL 10 (HEC): 1.98 mg/m3	Medium	Atrophy	Ovaries	1
Chloroform	67-66-3	Organics	0.0976524	ATSDR	LOAEL: 2 ppm	NA	Hepatomegaly	Hepatic	NA
Dichloroethane, 1,2-	107-06-2	Organics	0.007	PPRTV	LOAEL-HEC: 22 mg/m3	Low	Neurobehavioral impairment	Neurological	NA
Hexane, N-	110-54-3	Organics	0.7	IRIS	BMCL (HEC): 215 mg/m3	Medium	Peripheral neuropathy (decreased MCV at 12 weeks)	Neurological	1
Methylene Chloride	75-09-2	Organics	0.6	IRIS	BMDL10 (HEC): 17.2 mg/m3	medium/high	hepatic effects (hepatic vacuolation)	Liver	1
Toluene	108-88-3	Organics	5	IRIS	NOAEL (ADJ): 46 mg/m3	High	Neurological effects in occupationally-exposed workers	Neurological	1
Trichloroethylene	79-01-6	Organics	0.002	IRIS	LOAEL (HEC99): 0.19 mg/m3	High	Decreased thymus weight in female B6C3F1 mice (immunotoxicity)	Thymus	1
Vinyl Chloride	75-01-4	Organics	0.1	IRIS	NOAEL (HEC): 2.5 mg/m3	Medium	Liver cell polymorphism	Liver	1
Xylene, m-	108-38-3	Organics	0.1	SURROGATE. See Xylenes	NOAEL-HEC: 39 mg/m3	Medium	Impaired motor coordination (decreased rotarod performance)	Nervous	1
Xylene, o-	95-47-6	Organics	0.1	SURROGATE. See Xylenes	NOAEL-HEC: 39 mg/m3	Medium	Impaired motor coordination (decreased rotarod performance)	Nervous	1

Inhalation Chronic Toxicity Metadata

Inhalation Chronic Reference Concentration Uncertainty Factor	Inhalation Chronic Reference Concentration Species	Inhalation Chronic Reference Concentration Route	Inhalation Chronic Reference Concentration Study Duration	Inhalation Chronic Reference Concentration Study Reference	Inhalation Chronic Reference Concentration Notes
300	Human	NA	NA	Rothman et al. 1996	NA
1000	Mouse	NA	NA	NTP 1993	NA
100	Human	Hepatic	1-4 years	Bomski et al. 1967	NA
3000	Human	Inhalation	Occupational	Kozik 1957	NA
300	Rat	NA	NA	Huang et al. 1989	NA
30	rat	NA	NA	Nitschke et al. 1988	NA
10	Human	NA	NA	Abbate et al. 1993, Boey et al. 1997, Cavalleri et al. 2000, Eller et al. 1999, Foo et al. 1990, Murata et al. 1993, Nakatsuka et al. 1992, Neubert et al. 2001, Vrca et al. 1995, and Zavalic et al. 1998a	NA
100	mice	NA	NA	Keil et al. 2009 (Supported by Johnson et al. 2003)	NA
30	Rat	NA	NA	Til et al. 1991, Til et al. 1983	NA
300	Rat	NA	NA	Korsak et al. 1994	SURROGATE. See Xylenes
300	Rat	NA	NA	Korsak et al. 1994	SURROGATE. See Xylenes