48217 COMMUNITY AIR MONITORING PROJECT

September 2016 – September 2017

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Table of Contents

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Michigan's Environmental Justice Policy promotes the fair, non-discriminatory treatment and meaningful involvement of Michigan's residents regarding the development, implementation, and enforcement of environmental laws, regulations, and policies by this state. Fair, non-discriminatory treatment intends that no group of people, including racial, ethnic, or low-income populations, will bear a disproportionately greater burden resulting from environmental laws, regulations, policies, and decision-making. Meaningful involvement of residents ensures an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health.

Background

For many years, residents of the 48217 ZIP code in Southwest Detroit have voiced concerns about impacts from industry and traffic on their air quality and health. These concerns are a subgroup of related concerns, including environmental injustice, health disparities, odors, lack of notification during environmental emergencies, noise, and cumulative impacts.

This outdoor air study was community led in collaboration with state, federal, and academic partners. This project was done to answer the following questions:

- What is the air quality in the 48217 ZIP code?
  - How might the air quality in this ZIP code affect someone's health?
  - How does the air quality compare to other locations?

- How can information about the air quality be used to help this community?

How the Project Started

- In June 2015, MDEQ's Southeast Michigan staff invited MDEQ Director Wyant to speak to local activists. At this meeting he asked for proposals on how the MDEQ could help them.
- In the summer of 2015, community leader, Dr. Dolores Leonard submitted a proposal for air monitoring, which was accepted and funded by the MDEQ.
- In the fall of 2015, Dr. Leonard selected four individuals to represent various 48217 neighborhoods along with a resident with prior science and engineering experience. A member of the Sierra Club also helped facilitate efforts.
- In December 2015, a project kick-off meeting was held with community representatives, MDEQ-AQD staff, University of Michigan researchers, and the United States Environmental Protection Agency (USEPA).

The community stakeholder group identified pollutants that should be measured and provided recommendations to the MDEQ on possible station locations. The stakeholders' goal for The Community Air Monitoring Project was to evaluate the air quality in the neighborhood, not to target a specific facility. To select the pollutants, the stakeholder group worked with two University of Michigan researchers who helped identify major emission sources and the pollutants of interest.

The stakeholder group identified a list of 12 possible locations for the monitoring station. The MDEQ-AQD staff evaluated these locations and provided the stakeholder group with the top four that would meet air monitoring siting criteria. Two location owners declined the request for the monitoring station and one did not respond. The New Mount Hermon Missionary Baptist Church, located at 3225 South Deacon Street, agreed to host the air monitoring site.

Pollutants Monitored in the Project

The 1-year monitoring study began in September 2016 for the following compounds:

Sampled once every six days (sent to laboratories):

- Acids: hydrochloric acid, sulfuric acid, and hydrogen cyanide
- Polyaromatic hydrocarbons (PAHs): 66 different compounds
- Volatile organic compounds (VOCs): 67 different compounds
- Metals: 13 different compounds

Sampled continuously (reported in real-time to website, http://www.deqmiair.org/):

- Fine particulate matter ($PM_{2.5}$)
- Sulfur dioxide (SO_2)

Community Outreach

Open community meetings were held to present and discuss findings from the monitoring project. Meetings were held in the evening at the New Mount Hermon Missionary Baptist Church on February 13, June 27, and November 20, 2017, and May 3, 2018.

Summary and Conclusions

Air Quality and Health Risk Results

Air monitoring results were compared to pollutant levels that are used to protect the public, including sensitive groups like asthmatics and children. For the purposes of this report, these health-protective levels are referred to as "health limits".

- SO_2, lead, and $PM_{2.5}$ were compared to federal health limits: primary National Ambient Air Quality Standards (NAAQS). Monitored levels were below the level of the NAAQS. See Appendix A for a discussion of the NAAQS.

- Other pollutants were compared to state limits, which are the MDEQ-AQD screening levels.
    - Except for sulfuric acid, all pollutants were below the screening levels for noncancer-related health protection.
    - Two out of 53 sulfuric acid samples were above the screening level. Breathing a high level of sulfuric acid can impair lung function, and people with lung disease like asthma are more susceptible to these health problems.
    - For pollutants that can cause cancer, the additional risk of developing cancer over a person's entire lifetime was considered. The pollutants of potential concern in this study were arsenic, naphthalene, and hexavalent chromium.

   - Some pollutants, like benzene, are also likely to be of potential concern. However, these pollutants were rarely or never detected due to limitations at the laboratory. Therefore, some pollutant levels are not known.

To consider cumulative impacts, concentration levels from different pollutants were combined when they had a common health effect. For example, the pollutants that cause irritation were combined, and pollutants that may cause cancer were combined.

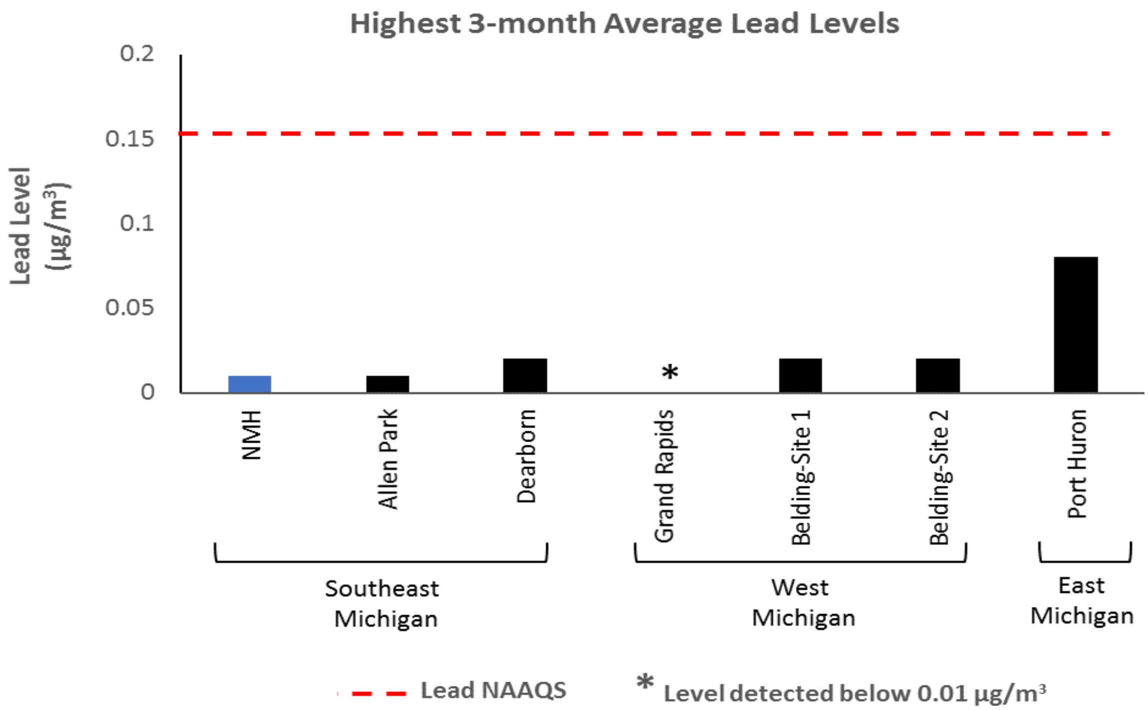
- For noncancer-related risks, the combined risks did not reach a level of a health concern, except for the two occasions when sulfuric acid reached a level of concern by itself.
  - The high levels occurred about a year apart from each other. Attempts were made to identify the source for the two high sulfuric acid levels, but the source was not able to be identified. Since these high levels were not frequent, it is suspected that the source (or sources) is not regularly emitting sulfuric acid to the outdoor air. The AQD is continuing to investigate and is exploring other technologies and opportunities for identifying the source of sulfuric acid.

- For pollutants that can cause cancer, there was a cumulative lifetime additional risk of about eight in one million.
  - This additional risk was mostly due to arsenic, naphthalene and hexavalent chromium. Similar levels for these pollutants are also seen in other urban areas, like the Dearborn air monitoring site.

<u>Air Quality at this Site Compared to Other Sites</u>

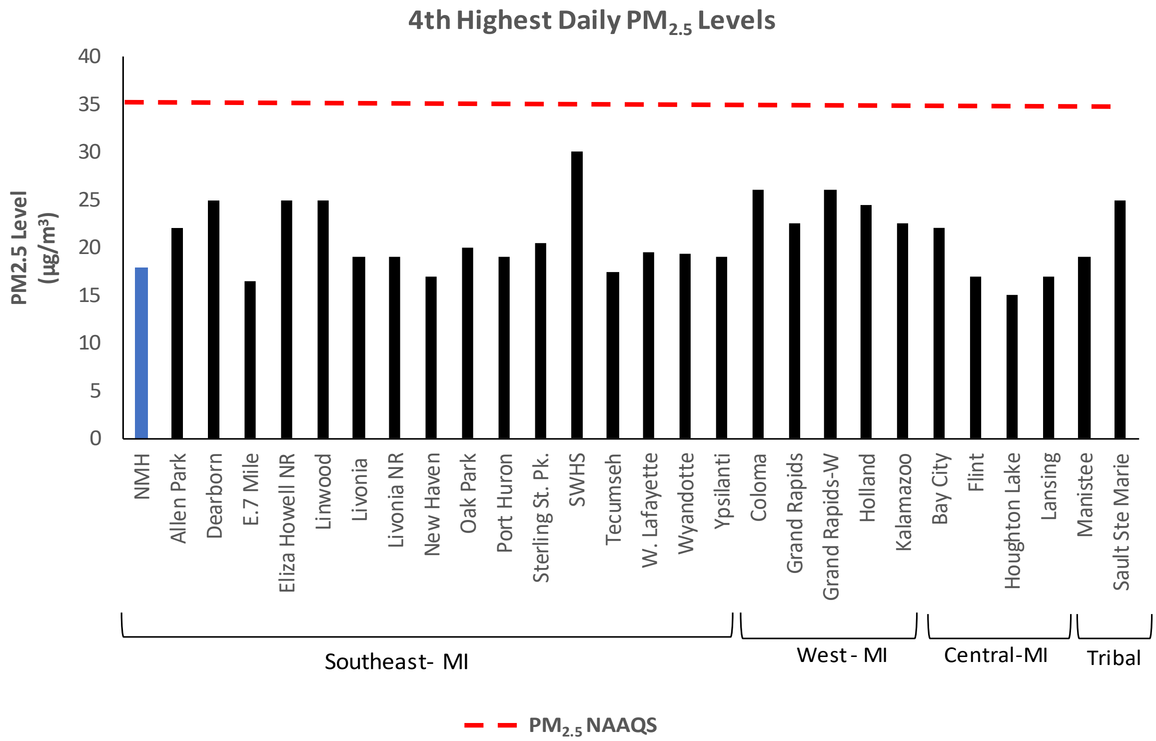
Overall, the pollutant levels at the New Mount Hermon (NMH) site were similar to other monitoring sites in metro Detroit. Other Michigan monitoring sites are monitoring for fewer pollutants, so it's difficult to compare to these other sites.

Air monitoring for lead is also a good example of the different purposes for air monitoring across the state. Lead levels at the NMH site were similar to current levels at most Michigan sites. The NMH site is monitoring for lead because it was a recommendation from the community stakeholder group. The Allen Park and Grand Rapids sites are monitoring for lead as a part of the National Core Network. The Dearborn site is a part of the National Air Toxics Trends Stations. Both programs are used to monitor long-term trends. The Belding sites and the Port Huron site are used for source-oriented monitoring of sources that may emit especially high levels of lead. The Houghton Lake site is a remote background site, where there is relatively little manmade air pollution. The Houghton Lake site previously monitored for lead as well, and it showed levels similar to the levels currently seen at the Grand Rapids site. Lead is used here as an example of a pollutant that is monitored more extensively throughout the state. There is no absolute safe exposure to lead, but the lead NAAQS provides a level of health protection for at-risk groups. Lead levels at the NMH site were similar to current levels at most Michigan sites.

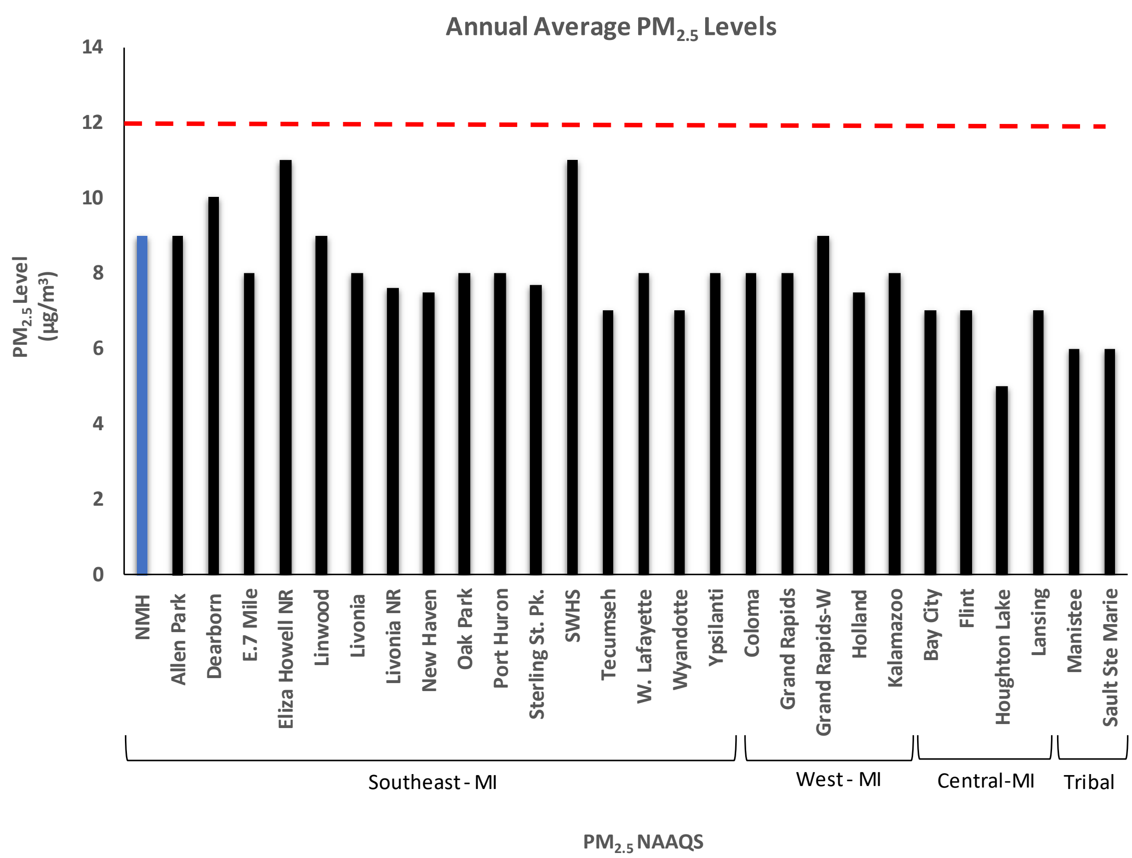


$PM_{2.5}$, SO_2, and lead are used here as examples of pollutants that are monitored more extensively throughout the state. Just as important, they are all significant in terms of health risk. For example, health can be impacted at levels even below the $PM_{2.5}$ NAAQS. While breathing lead in the outside air is usually not the main way that people are exposed, there is also no absolute safe exposure to lead. The NAAQS for both $PM_{2.5}$ and lead provide a level of health protection for at-risk groups.

$PM_{2.5}$ is a mixture of pollutants, and it is one of the main health risk concerns with air pollution. When averaged over the year-long study (the annual average level), $PM_{2.5}$ levels at the NMH site are similar to levels at other sites in Michigan. The annual average level at the NMH site is slightly higher than most levels at sites in West Michigan, Central Michigan and on Tribal lands. With the average over each day (the daily level), levels at the NMH site were similar to other sites in Michigan as well.

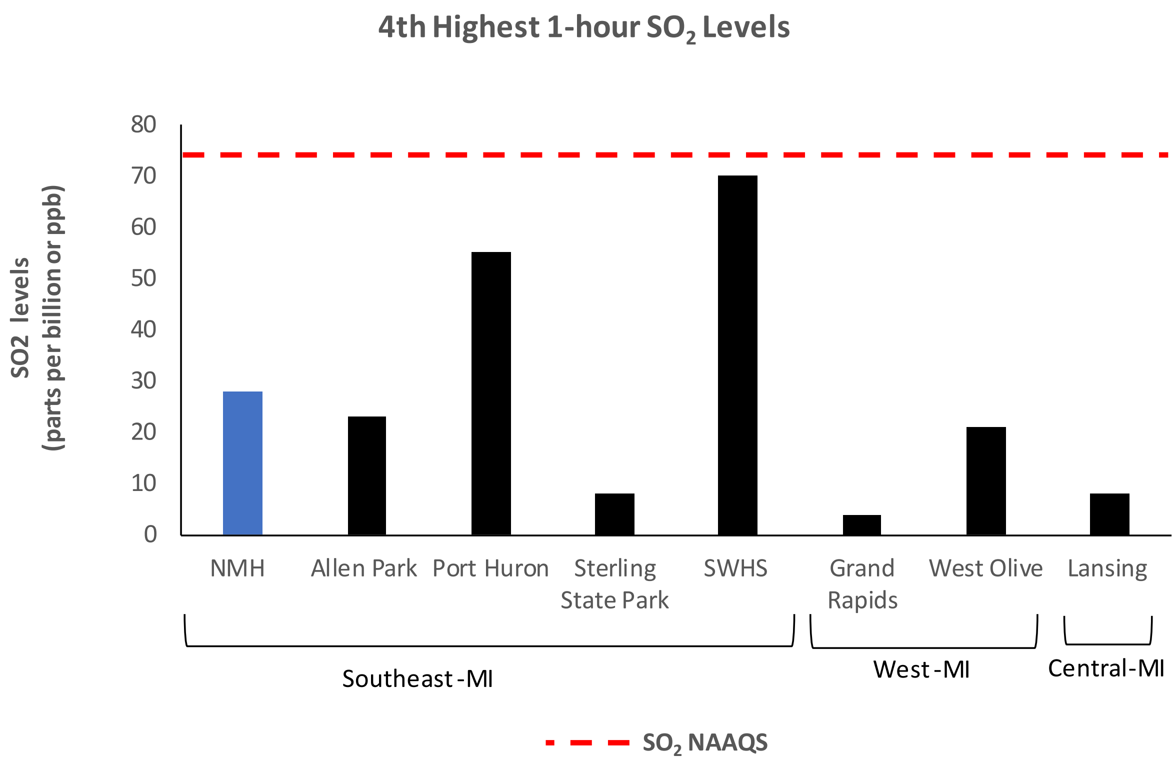


4th Highest Daily $PM_{2.5}$ Levels
PM2.5 Level (µg/m³)
40
35
30
25
20
15
10
5
0
NMH
Allen Park
Dearborn
E.7 Mile
Eliza Howell NR
Linwood
Livonia
Livonia NR
New Haven
Oak Park
Port Huron
Sterling St. Pk.
SWHS
Tecumseh
W. Lafayette
Wyandotte
Ypsilanti
Coloma
Grand Rapids
Grand Rapids-W
Holland
Kalamazoo
Bay City
Flint
Houghton Lake
Lansing
Manistee
Sault Ste Marie
Southeast- MI
West - MI
Central-MI
Tribal
$PM_{2.5}$ NAAQS



Annual Average $PM_{2.5}$ Levels
$PM_{2.5}$ Level (µg/m³)
14
12
10
8
6
4
2
0
NMH
Allen Park
Dearborn
E.7 Mile
Eliza Howell NR
Linwood
Livonia
Livonia NR
New Haven
Oak Park
Port Huron
Sterling St. Pk.
SWHS
Tecumseh
W. Lafayette
Wyandotte
Ypsilanti
Coloma
Grand Rapids
Grand Rapids-W
Holland
Kalamazoo
Bay City
Flint
Houghton Lake
Lansing
Manistee
Sault Ste Marie
Southeast - MI
West - MI
Central-MI
Tribal
$PM_{2.5}$ NAAQS

SO_2 is also an important example here, because the 48217 ZIP Code is currently in an SO_2 non-attainment area, which means that the area is not meeting the health standards based on 3 years of data. SO_2 levels at the NMH site are like some other sites in Michigan, but SO_2 levels greatly depend on local pollution sources. The Allen Park and Grand Rapids sites monitor for SO_2 as part of the National Core Network and the other sites are monitoring to meet federal requirements.



Benefits and Limitations of this Study

This benefits and limitations list identifies ways that this study may be helpful to the community. A limitation, for example, may be an avenue for the community to focus future efforts.

Benefits:

- The community has additional information about air quality in the 48217 ZIP code.
- The NMH site is now a part of the state ambient air monitoring network, which is used to help measure compliance with environmental regulations. The MDEQ anticipates retaining this site for several years.

- One year of monitoring samples were collected and compared to health standards and nearby sites using nationally accepted methods.
- Health risks were studied using well established health-based limits designed to protect the most sensitive populations; cumulative impacts of breathing these pollutant levels were included.
- This study included monitoring for acids, which are not routinely monitored in outdoor air by any state monitoring network.
- Sampling results were shared with the community throughout the study and the community's comments were used to improve the project. For example, the USEPA was recruited to use their mobile air monitor in other areas of the ZIP code.
- The results of this study can be used by others (including other scientists, health professionals, and community members) for future research and projects.

Limitations:

- The monitoring site selection was dependent on siting criteria and property owner cooperation, which limited options for where the monitor could be located.
- There could be other pollutants of concern that were not monitored, do not have reliable monitoring methods, do not have health limits, or have health limits based on very limited information.
- While health effects of some pollutants have no known threshold below which health effects do not occur, this study did not focus on possible risks at levels below established heath limits.
- Of all the potential health impacts this community may face, there was only a risk assessment for the monitored air pollutants.
- Health statistics of this community were not included in the health assessments.
- Interactions between mixtures of pollutants may increase health risks, but all the potential interactions between pollutants are not known.

Next Steps for New Mount Hermon Monitoring Station

The sampling for PAHs, acids, VOCs, and some metals has concluded. MDEQ plans to sample for $PM_{2.5}$, SO_2, and five metals, which include lead, arsenic, cadmium, nickel, and manganese in 2018.

Other Resources for the 48217 ZIP Code Community

Information on Air Quality

Reporting outdoor air complaints
Contact the MDEQ-AQD Detroit Field Office: 313-456-4700

Information on current air quality
MIair: http://www.deqmiair.org/

Air NOW: https://www.airnow.gov/

Tutorial on how to get involved in the air permitting process
http://www.epaejtraining.org/OAQPS/past-trainings/clean-air-act-rulemaking-and-permitting-training-detroit-mi/

Public health action plan to address air quality in Detroit
University of Michigan's Community Action to Promote Healthy Environments:
http://caphedetroit.sph.umich.edu/

Information on Detroit's Anti-Idling Ordinance
http://www.sdevweb.org/issues/anti-idling/

Information on Other Environmental Issues

City of Detroit Emergency Management
www.detroitmi.gov/dhsem (313) 596-2590

USEPA's MyEnvironment Tool
https://www3.epa.gov/myem/envmap/find.html

USEPA's Environmental Justice Screening Tool
https://www.epa.gov/ejscreen

USEPA's Environmental Justice Screening Tool
https://www.epa.gov/ejscreen

State and Federal Contacts on Vapor Intrusion and Soil Issues
MDEQ Remediation and Redevelopment Division and Waste Management and Radiological Protection Division, Southeast Michigan District Office: 586-753-3700

USEPA Grosse Ile Office
Emergency Response: 734-692-7600

Information on Health Statistics

Asthma Hospitalization Rates in 2012-2014
http://www.michigan.gov/documents/mdch/Michigan-and-Detroit-Asthma-Hosp-Rates_498682_7.pdf

Childhood Lead Testing in 2013
http://www.michigan.gov/documents/mdhhs/2013_Child_Lead_Testing_and_Elevated_Levels_Report_515288_7.pdf

Cancer Rates from 1999-2009
http://www.michigan.gov/documents/mdch/Southwest_Detroit_Cancer_Incidence_and_Mortality_Report10_18_12_402088_7.pdf

Global Burden of Disease, including state of Michigan results
https://vizhub.healthdata.org

Appendix A. Pollutants and Health Risk Assessment Methods

Monitored Pollutants

1. Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) is a gas formed by the burning of sulfur-containing materials. Sources of SO_2 include coal-burning power plants, petroleum refineries, pulp and paper mills, steel mills, and other transportation sources. Sulfur dioxide is classified as a criteria pollutant and has a National Ambient Air Quality Standard (NAAQS) that is based on the 4th highest daily 1-hour value for each year, averaged over 3 years. Exposure to elevated levels can affect breathing, cause respiratory distress, aggravate existing cardiovascular and pulmonary disease, and alter the body's immune system. SO_2 was measured continuously using a Federal Reference Method analyzer: Thermo Environmental 43I-Pulsed Fluorescence analyzer.

2. Fine Particulate Matter ($PM_{2.5}$)

Particulate matter (PM) is a general term used for a mixture of solid particles and liquid droplets found in the air. These are further categorized according to size. $PM_{2.5}$ consists of tiny particles with a diameter of 2.5 microns or less. $PM_{2.5}$ is a mixture of very small particles and liquid droplets that are created during combustion when coal, gasoline, and other fuels are burned. Sources of $PM_{2.5}$ include industrial sources and motor vehicles (especially diesel trucks and buses). $PM_{2.5}$ can also be formed in the air by chemical reactions between other pollutants. Because of their small size, fine particles can be inhaled into the lungs. Fine particulate matter is classified as a criteria pollutant and has a NAAQS based on both a 24-hour value of 35 micrograms per cubic meter (ug/m^3) which is based on the 4th highest daily value for each year, averaged over 3 years and an annual 3-year average of 12 ug/m^3. The Exposure to fine particulate matter can affect breathing and cause cardiovascular problems. The fine particulate matter was measured continuously using a Tapered Element Oscillating Microbalance (TEOM) analyzer.

3. Lead (Pb)

Lead (Pb) is a metal found in coal, oil, and other fuels. It is also found in older paints, dusts, soil, and is sometimes released from industrial sources. Lead is classified as a criteria pollutant and has a NAAQS based on a rolling 3-month average. Exposure occurs through the inhalation or ingestion of lead in food, water, soil, or dust particles. Lead primarily accumulates in the body's blood, bones, and soft tissues, and adversely affects the kidneys, liver, nervous system, and other organs. Lead sampling was conducted using a high-volume total suspended particulate sampler. Outside air is pulled into the sampler and material is collected on a filter that is placed in the sampler. The sampler operated every 6 days for a 24-hour period. The filter was removed and sent to the MDEQ Laboratory for metals analysis.

4. Air Toxics

Air toxic pollutants are those chemicals known or suspected to cause human health effects or adverse environmental effects. The 48217 monitoring project measured a large list of compounds classified as air toxics. Some of the air toxics measured included trace metals, volatile organic compounds (VOCs), and poly aromatic hydrocarbons (PAHs). Air toxics can come from a variety of sources such as vehicles, industrial sources, man-made materials such as paints and cleaning products, and natural sources. Air toxics can have a wide range of potential health effects such as the aggravation of asthma; irritation to the eyes, nose, and throat; nervous system effects; and, some could cause cancer. The metals were collected using a high-volume total suspended particulate sampler. Outside air is pulled into the sampler and material is collected on a filter that is placed in the sampler. The sampler operated every 6 days for a 24-hour period. The filter was removed and sent to the MDEQ Laboratory for analysis. The VOCs were collected in a 6-liter, metal, summa-type canister. The programmable sampler operated once every 6 days for a 24-hour period and pulled outside air into the canister. The canister was then sent to a laboratory where it was analyzed using Toxic Organic (TO) Method 15. The PAH compounds were collected using a polyurethane foam (PUF) high-volume sampler. The outside air was pulled into the sampler and collected on an internal cartridge once every 6 days for a 24-hour period. The cartridge is removed and sent to a contract laboratory where it is analyzed using TO-Method 13 for PAH compounds.

The monitoring project also conducted sampling for air toxics that are not routinely being measured in the national air toxics network. These air toxics are sulfuric acid, hydrochloric acid, and hydrogen cyanide.

- Sulfuric acid can be released directly and can be formed from SO_2 released when coal, oil, and gas are burned. The released SO_2 reacts in the atmosphere to form sulfuric acid.
- Hydrogen chloride is used in the manufacture of a variety of industrial chemicals, fertilizers, and dyes. Hydrogen chloride is also known as hydrochloric acid.
- Cyanide enters water, soil, and air from both natural processes and industrial activities. In air, cyanide is present mainly as the gas hydrogen cyanide.

Sampling of the acids was conducted using a programmable Gillian pump. Outside air was pulled through two sorbent tubes. One tube containing silica gel was analyzed for hydrochloric acid and sulfuric acid, and the other tube containing soda lime was analyzed for hydrogen cyanide. Sampling was conducted once every 6 days for an 8-hour period. The tubes were sent to a contract laboratory and analyzed using the National Institute of Occupational Health (NIOSH) method 7903 for hydrochloric and sulfuric acid, and the NIOSH Method 6010 for hydrogen cyanide.

Health Risk Assessment Methods

Evaluation of Pollutants That Can Cause Health Effects Other than Cancer

The monitored pollutant concentrations from this study were compared to health limits when they were available. The health-based limits used in this assessment were either the NAAQS for the USEPA criteria pollutants (SO_2, $PM_{2.5}$, and lead), the USEPA's Air Quality Index (AQI) or the Initial Threshold Screening Levels (ITSLs) developed for toxic air contaminants according to the procedure given in AQD Rule 336.1232. The lead NAAQS is based on a 3-month rolling average, but SO_2 and $PM_{2.5}$ are based on a 3-year calculation. Because 3 years of results are needed for the SO_2 and $PM_{2.5}$ NAAQS, direct comparison to the SO_2 and $PM_{2.5}$ NAAQS cannot be made with a 1-year study. The AQI was used to evaluate how daily SO_2 and $PM_{2.5}$ levels may affect health. ITSLs are utilized in the AQD's permitting program as health limits protective for potential noncancer effects. For this study, some health-based limits were assigned to pollutants that do not currently have specific health-based limits based on structurally similar pollutants and the most toxic component they have in common. This is noted when done.

After the appropriate health limits were identified, a hazard quotient (HQ) approach was used to determine if pollutants other than the criteria pollutants were at a level of concern for noncancer (see results in Appendix B-2). The HQ is the pollutant estimate divided by the appropriate long-term or short-term health limit. Long-term describes an exposure that lasts for a year or longer. Short-term describes an exposure that lasts for an hour or one day.

For a given pollutant, pollutant estimates at or below the health limit indicate that adverse noncancer effects are not likely to occur. In Appendix B-2, HQs are described as percentages. Pollutant concentrations found above their respective health limits indicate a potential health hazard; these instances were further evaluated to estimate the health risk.

Risks of health effects from short periods of exposure to a given pollutant were evaluated by comparing the respective health limit to the highest 8-hour concentrations of the acid or the highest 24-hour concentrations of all other pollutants. A two-step process, similar to the one described in the Detroit Air Toxics Initiative (Simon et al, 2005) was used. In the first step, maximum pollutant levels were compared to the short-term health limits without considering whether their averaging times were the same. If a pollutant's maximum detected level was above the health limit, the results were reviewed again to consider averaging times.

Risks of noncancer health effects from long periods of exposure to a given pollutant were evaluated by comparing the respective health limit to the 95% Upper Confidence Limit (UCL) on the mean when that pollutant was measured at levels above the method detection limit or reporting limit more than 15% of the time (USEPA, 2004). When virtually synonymous pollutants are present (e.g., xylene isomers), the measured concentrations for each of the pollutants were added together before comparison to the group's respective health-based limits.

The method detection limit (MDL) is the lowest amount of a chemical that can reliably be observed (with 99% confidence) above the normal, random noise of an analytical instrument or method. Pollutant levels below the MDL are called non-detects. The reporting limit (RL) is the minimum value below which the data are documented as non-detects. When provided by the laboratory, the MDL is used to generate estimates of the pollutant level measured. When the MDL is not available from the laboratory, the RL is used. ProUCL (USEPA, 2015) was used to generate the 95% UCL and average estimates of the mean to account for non-detects.

Evaluation of Pollutants That Can Cause Cancer

For carcinogenic air pollutants, the annual average measured concentrations were compared to health limits associated with specific cancer risk levels. Cancer risk levels characterize the potential cancer risk based upon a lifetime (70 years) of exposure at the annual averaged monitored concentrations. The average level of hexavalent chromium was calculated from total chromium levels using previous estimates of hexavalent chromium in the Detroit area (Simon et al, 2005). The unit risk estimates were used to derive Initial Risk Screening Levels (IRSLs) for the AQD's permitting program. IRSLs are ambient air concentrations associated with an upper-bound lifetime cancer risk estimate of 1 in one million (1×10^{-6}). The IRSLs were used to characterize the potential cancer risk from exposure to the annual average concentration of each individual carcinogenic chemical found at each monitoring site. It should be noted that there is no USEPA or MDEQ ambient air quality standard for an acceptable level of carcinogens in ambient air, for individual substances or cumulatively for multiple collocated carcinogens. However, the 1 in ten thousand (1×10^{-4}) risk level was also presented, since this level is used by the USEPA as an upper limit of the presumptive acceptable risk level for the Clean Air Act Section 112(f) Risk and Technology Reviews (RTRs) for industrial source categories. The USEPA has also used a risk level of 1 in ten thousand or greater to denote high risk facilities for the National Scale Air Toxics Assessment (NATA).

Evaluation of Cumulative Impacts

Exposure to air pollutants generally occurs as a complex mixture, and the potential for interactive effects should be characterized when possible. USEPA guidance for the risk assessment of complex mixtures recommends that dose additivity be assumed for evaluating noncancer risks for a complex mixture that lacks adequate toxicity data on the specific mixture or a similar mixture (Hertzberg et al., 2000). The resulting hazard indices (HIs) are called "Target Organ Specific Hazard Indices," or TOSHIs. For TOSHIs with a value of 1 or less, a lack of adverse effects may be presumed. For TOSHIs exceeding a value of 1, harmful effects should not be presumed, but safety also cannot be presumed without further evaluation. The risk assessment in that situation proceeds with a more extensive assessment of the HQs which contribute the most to the TOSHI.

USEPA guidance also supports a “risk additivity” assumption for characterizing total cancer risk by summing the individual chemical’s cancer risk estimates at each site (Hertzberg et al., 2000). For short-term TOSHIs, a tiered system similar to that as described in the Detroit Air Toxics Initiative was used to consider potential health effects from exposure to the multiple pollutants (Simon et al., 2005). TOSHIs were developed from HQs for detected pollutants with short-term health limits, and then the corresponding time frame during which a spike occurred was also considered. It is important to note that this cumulative impact evaluation focuses on the potential health effects of breathing the multiple pollutants that were detected.

Appendix B. Results

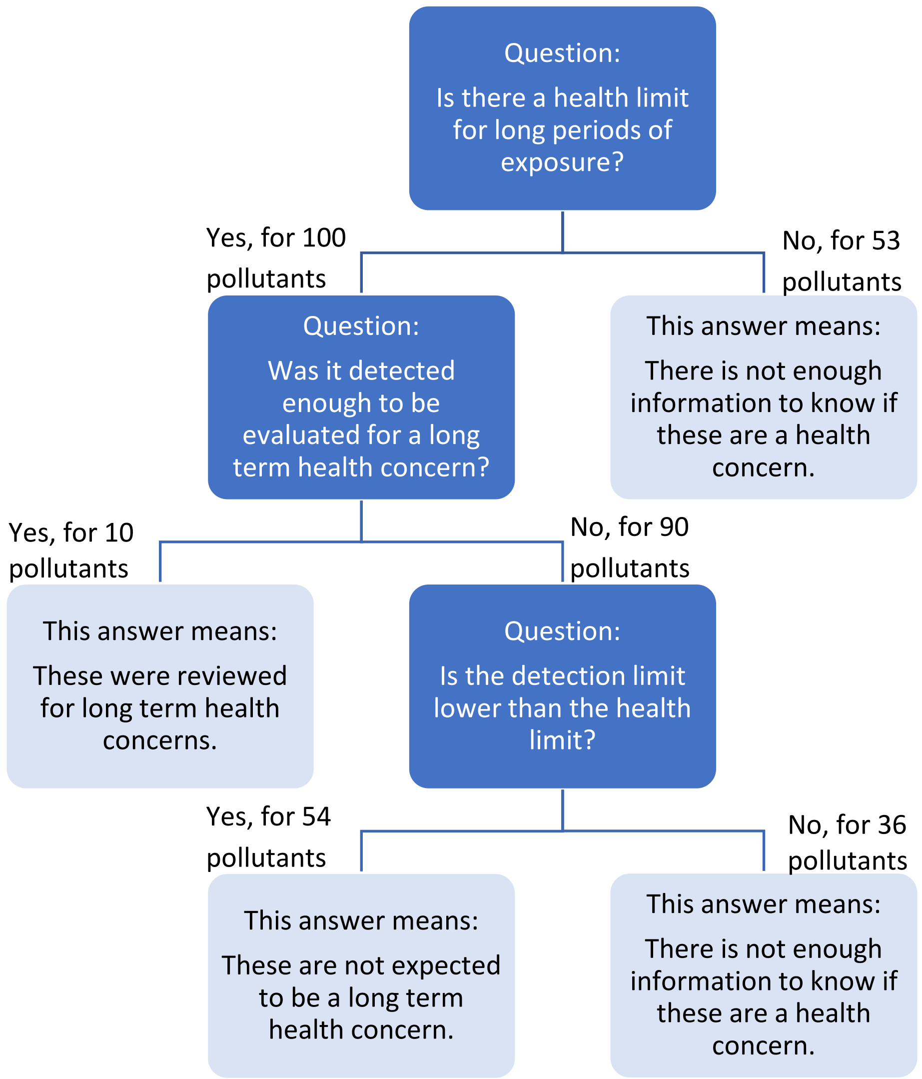
Pollutant levels measured at the New Mount Hermon (NMH) site are shown in comparison to their individual health limits. In cases where it is known that multiple pollutants health-based limits were derived using the same health effect, a cumulative exposure risk analysis was performed.

Pollutant levels are also shown as compared to pollutant levels measured at other sites in Michigan, especially the Marathon-sponsored air monitors in the 48217 ZIP code, the MDEQ-Dearborn site, and the MDEQ-SWHS site. These specific sites were a focus for comparison because they are the only other sites in Michigan that were measuring volatile organic compounds or polyaromatic hydrocarbons that were quality assured and uploaded to the USEPA's Air Quality System at the time of the study. Regional site data for SO_2 and $PM_{2.5}$ are also shown. Since there is such diversity in which pollutants are measured at each site, cumulative impact analysis was only performed for levels measured at the NMH site.

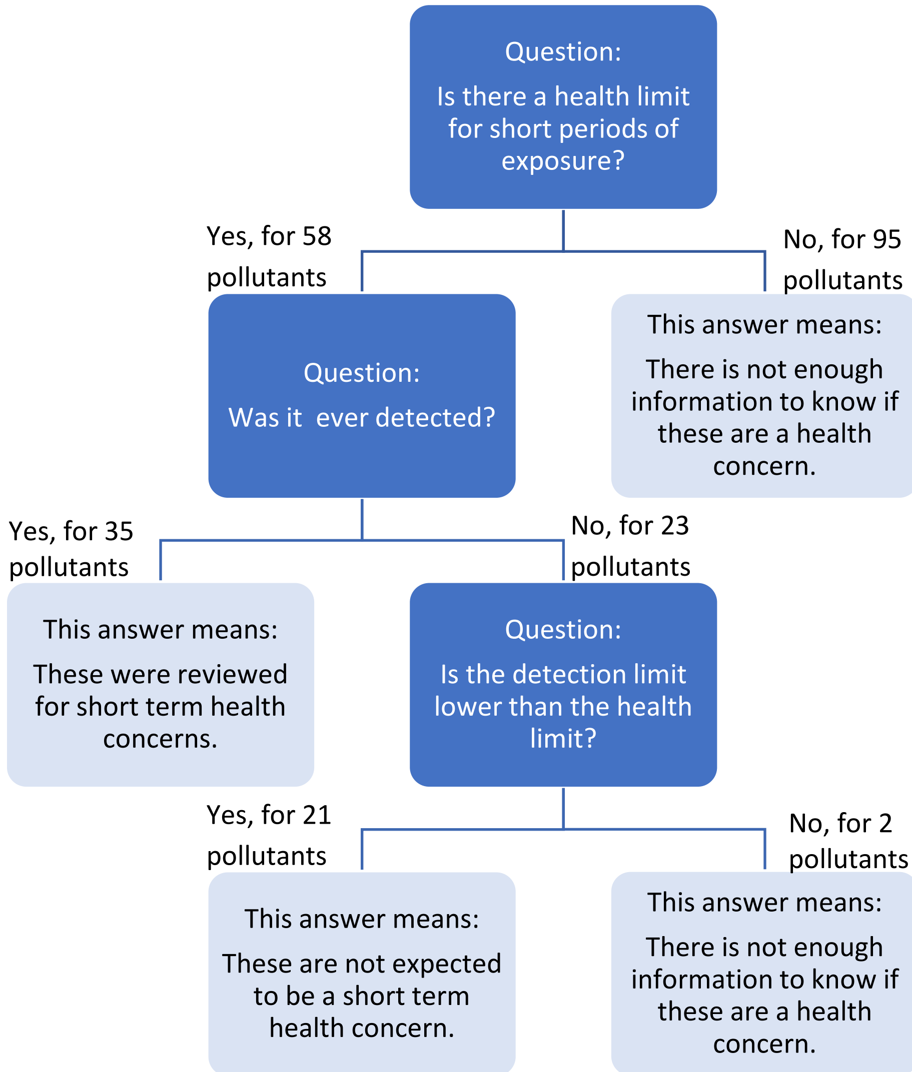
Air Monitoring Site	Corresponding Symbol in Graphs	Types of Pollutants Monitored
NMH		**$PM_{2.5}$; SO_2; 13 metals; acids; PAHs; and VOCs**
Marathon-North		**SO_2; VOCs;** PM_{10}; CO; total reduced sulfur compounds
Marathon-West		**SO_2; VOCs;** PM_{10}; CO; total reduced sulfur compounds
Marathon-East		**SO_2; VOCs;** PM_{10}; CO; total reduced sulfur compounds
Marathon-MTMS		**SO_2; VOCs;** PM_{10}; CO; total reduced sulfur compounds
Dearborn		**$PM_{2.5}$; SO_2; 14 metals; PAHs; VOCs;** PM_{10}; and carbonyls
SWHS		**$PM_{2.}$; SO_2; 4 metals, specifically manganese, arsenic, cadmium and nickel; VOCs;** PM_{10}; and carbonyls

Comparison of Pollutant Levels to Health Limits

Questions to determine if the results may indicate a concern for health effects from long periods of exposure:



Questions to determine if the results may indicate a concern for health effects from short periods of exposure:



B-1. Air Quality Index Summary for SO_2 and $PM_{2.5}$

The Air Quality Index (AQI) allows for review of potential health effects from SO_2 and $PM_{2.5}$ below the federal health limits. The categories and descriptions were developed by the USEPA.

Using the AQI, there were no days when SO_2 or $PM_{2.5}$ reached levels expected to be unhealthy for sensitive groups or the general population. There were 70 days when the $PM_{2.5}$ level might have been a health concern for unusually sensitive individuals. There was only one day when the SO_2 level reached a level that might have affected unusually sensitive individuals. The AQD traditionally does not consider Moderate days as unhealthy days because the range for this category is below the health protective NAAQS values.

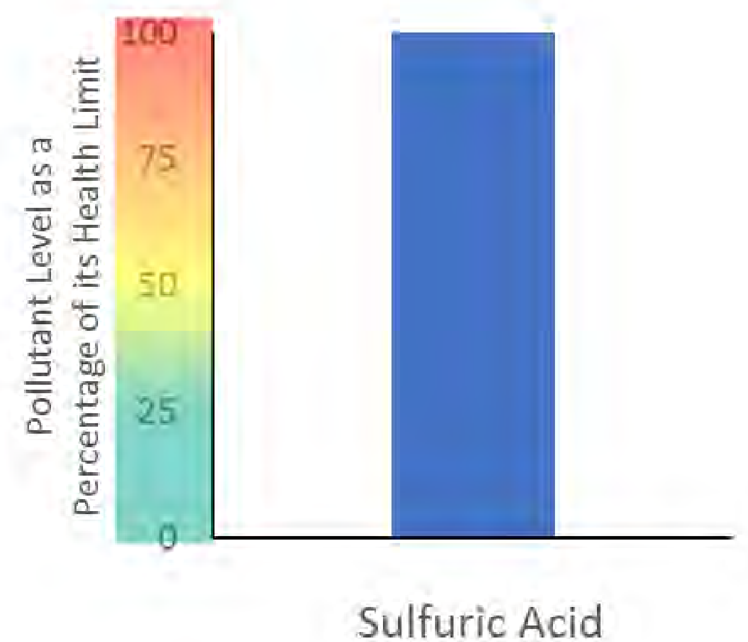
Air Quality Index Category	Number of Days When $PM_{2.5}$ Level was in Each Category	Number of Days When SO_2 Level was in Each Category
Good: Not expected to be a health risk	325	392
Moderate: May be a health concern for unusually sensitive individuals	70	1
Unhealthy for Sensitive Groups: May be a health concern for sensitive groups	0	0
Unhealthy: May be a health concern for everyone and sensitive groups may have more serious health effects	0	0
Very Unhealthy: Everyone may have more serious health effects	0	0
Hazardous: The entire population is likely to be affected	0	0

B-2. Measured Pollutant Levels as a Percentage of the Noncancer-Related Health Limit

In this section, pollutants are described in comparison to their short-term and long-term noncancer health limits using a color scale from 0 to 100%. The pollutant level is the same as the health limit when the pollutant level is 100%. When the pollutant level is 100% or more, it's important to further evaluate those health risks. The sulfuric acid level measured was higher than 100% of the health limit. The health risks of SO2 are further evaluated in Appendix C. Besides sulfuric acid, none of the pollutants that were detected at the NMH site and have noncancer-related health limits reached higher than 20% of the health limit. As a result, they were not considered a health concern.

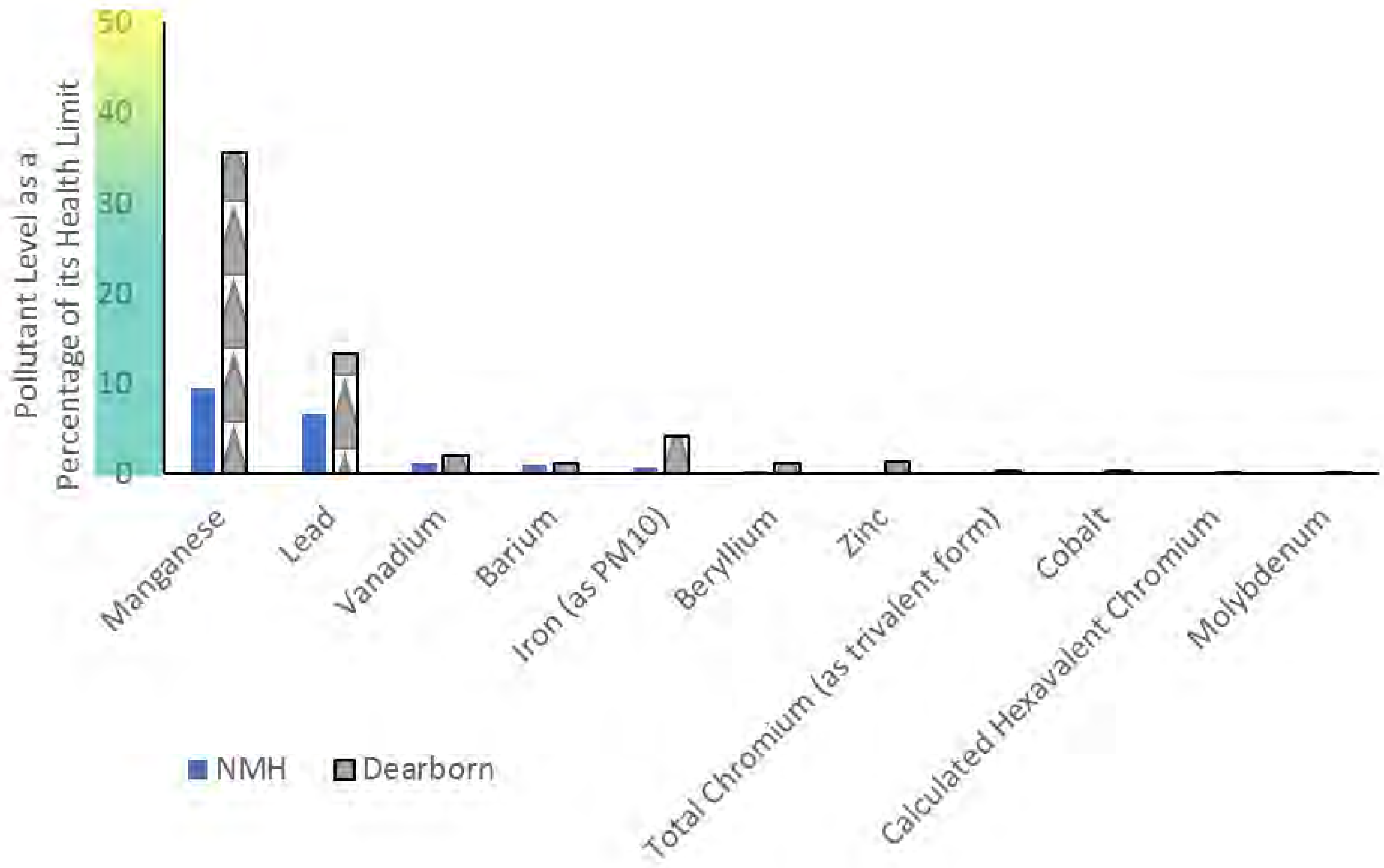
Some pollutants have two noncancer health limits, but the graphs show the comparison that gave the highest percentage. For example, if a pollutant level compared to its short-term health limit is 10% and compared to its long-term noncancer health limit is 20%, then the 20% comparison is shown on the graph.

Pollutant results at the NMH site are also compared to other sites in the 48217 ZIP code (the Marathon-sponsored air monitors) or in metro Detroit.



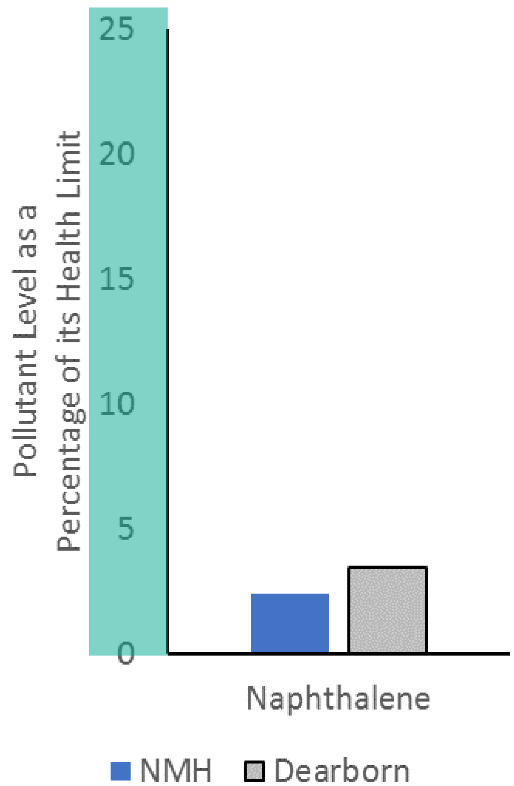
Metals monitored at NMH site compared to Dearborn site

This graph includes metals that were detected at the NMH site and were also detected at the MDEQ-Dearborn site. Manganese and hexavalent chromium are compared to health limits for long-term exposure, and all the other metals shown are compared to health limits for short-term exposure.



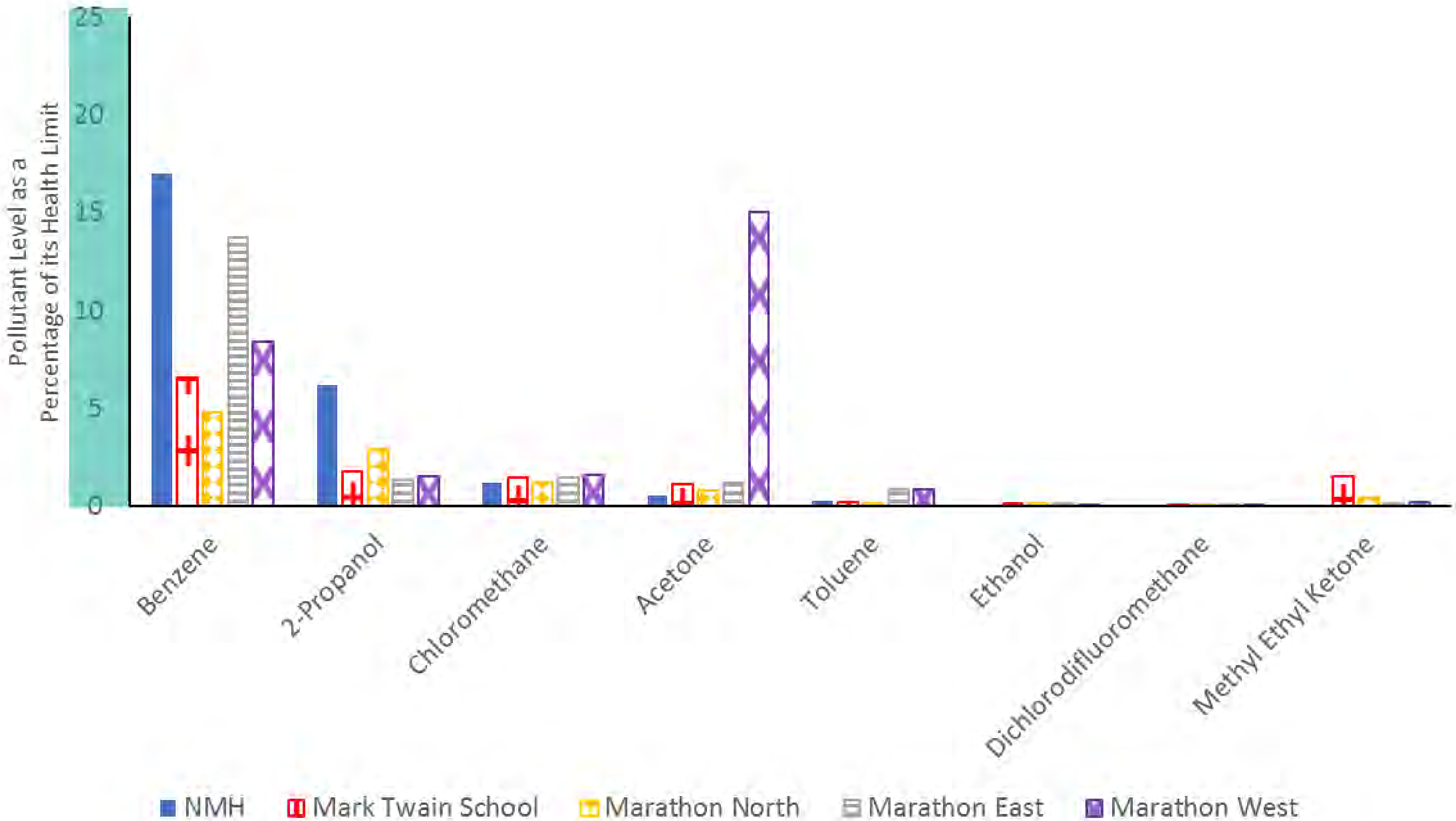
PAH Monitored at NMH Site Compared to Dearborn Site

Naphthalene was the only PAH detected at the NMH site, and also monitored at the Dearborn site. Naphthalene has two noncancer health limits, and the graph shows the comparison to the long-term health limit because it gave the highest percentage.



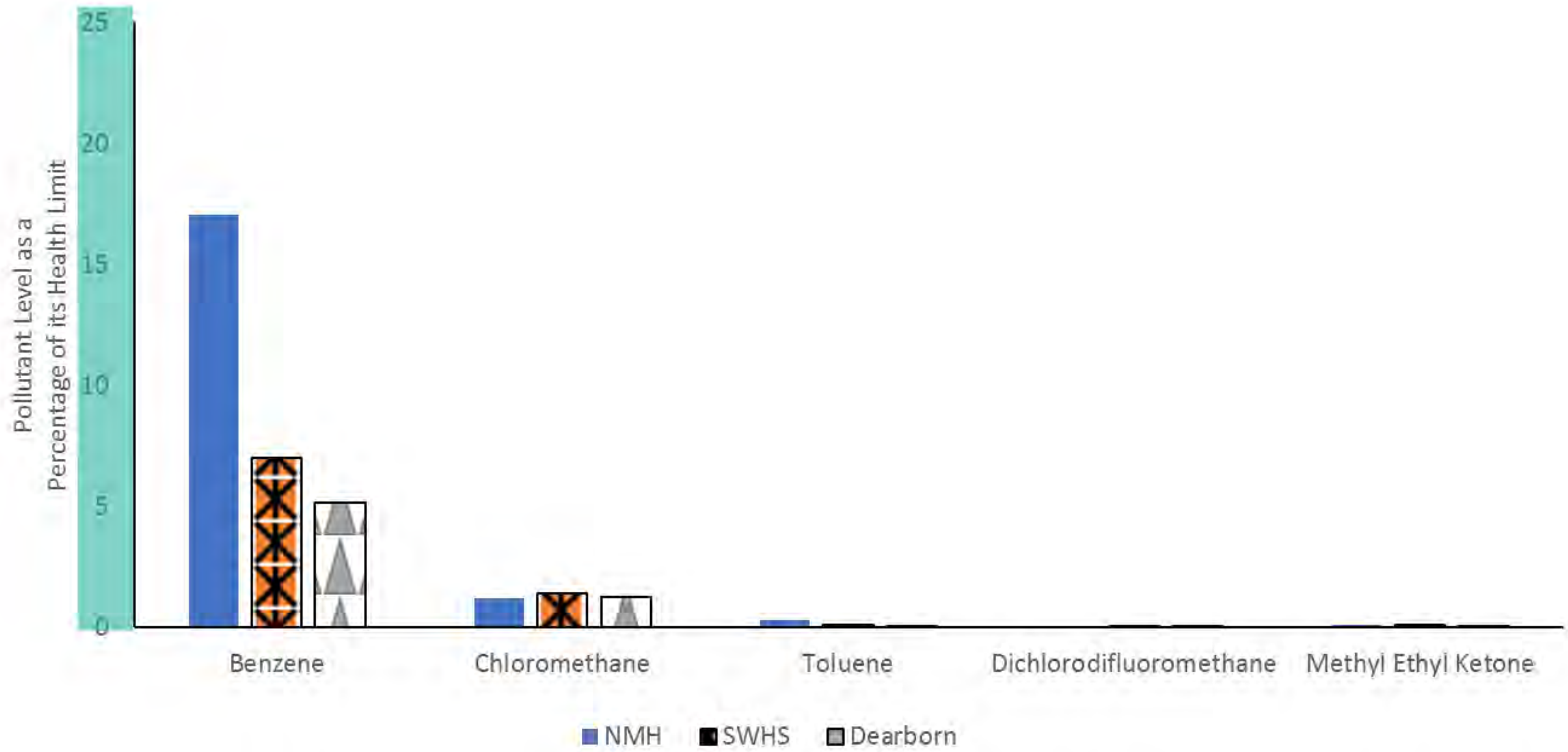
VOCs monitored at NMH and Marathon-sponsored sites in 48217 ZIP code

This graph includes VOCs that were detected at the NMH site and were also detected at the Marathon-sponsored sites in the 48217 ZIP code. Benzene levels were compared to the short-term health limit because it was not detected enough at the NMH site to compare it to the long-term health limit. 2-Propanol and chloromethane levels were compared to long-term health limits. All the other pollutants shown were compared to their respective short-term health limits.



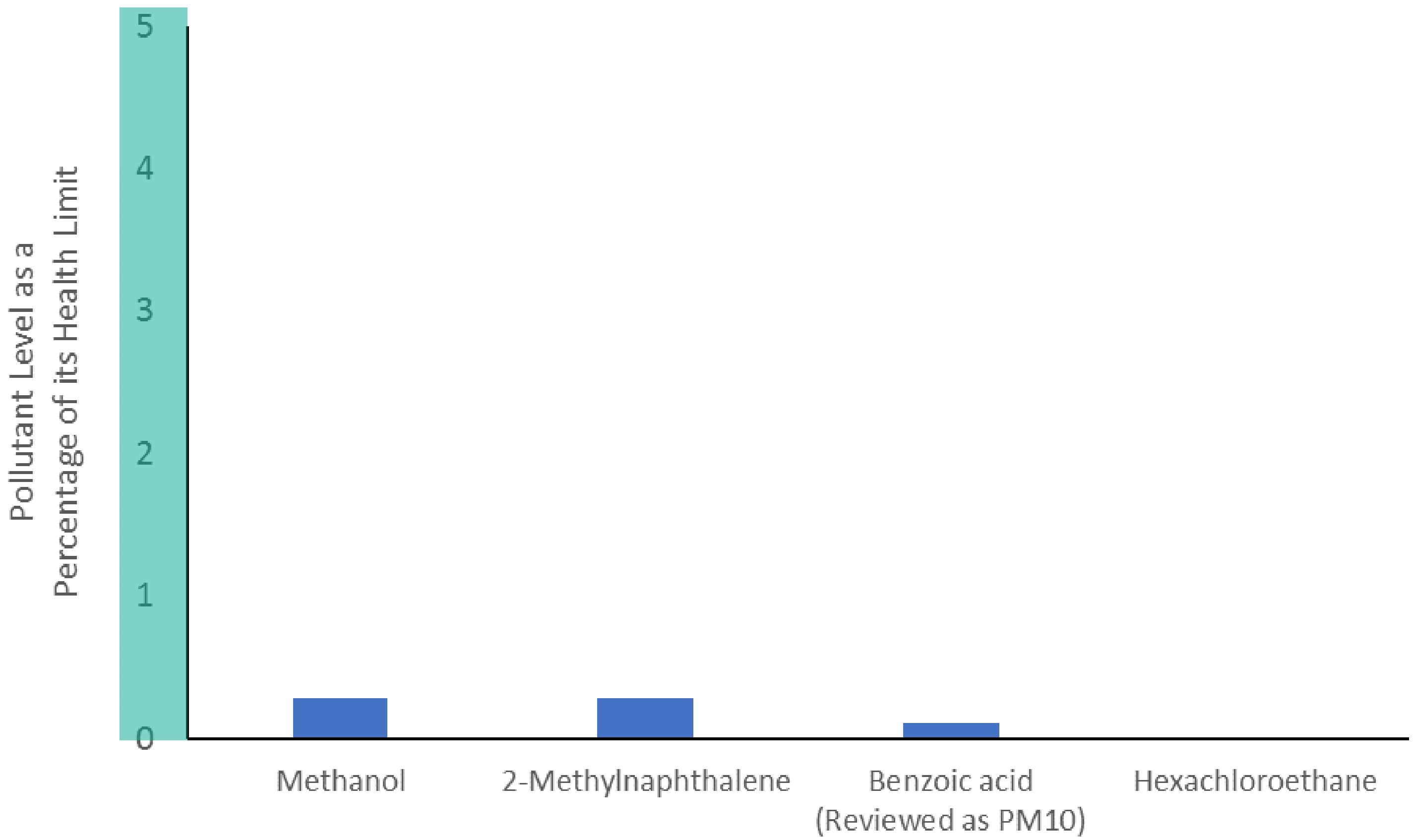
VOCs monitored at NMH and other metro Detroit monitors

This graph includes VOCs that were detected at the NMH site and were also detected at the MDEQ-SWHS and MDEQ-Dearborn sites. Benzene levels were compared to the short-term health limit because it was not detected enough at the NMH site to compare it to the long-term health limit. Chloromethane levels were compared the chloromethane long-term health limit. All the other pollutants shown were compared to their respective short-term health limits.



Pollutants Monitored and Detected Only at NMH Site

This graph includes pollutants that were only monitored and detected at the NMH site. Methanol was compared to its short-term limits, and the comparison that gave the highest percentage is shown below. 2-Methylnaphthalene was compared to its long-term health limit, and benzoic acid and hexachloroethane were compared to short-term health limits since they were only detected once.



B-3. Cumulative Impact Assessment

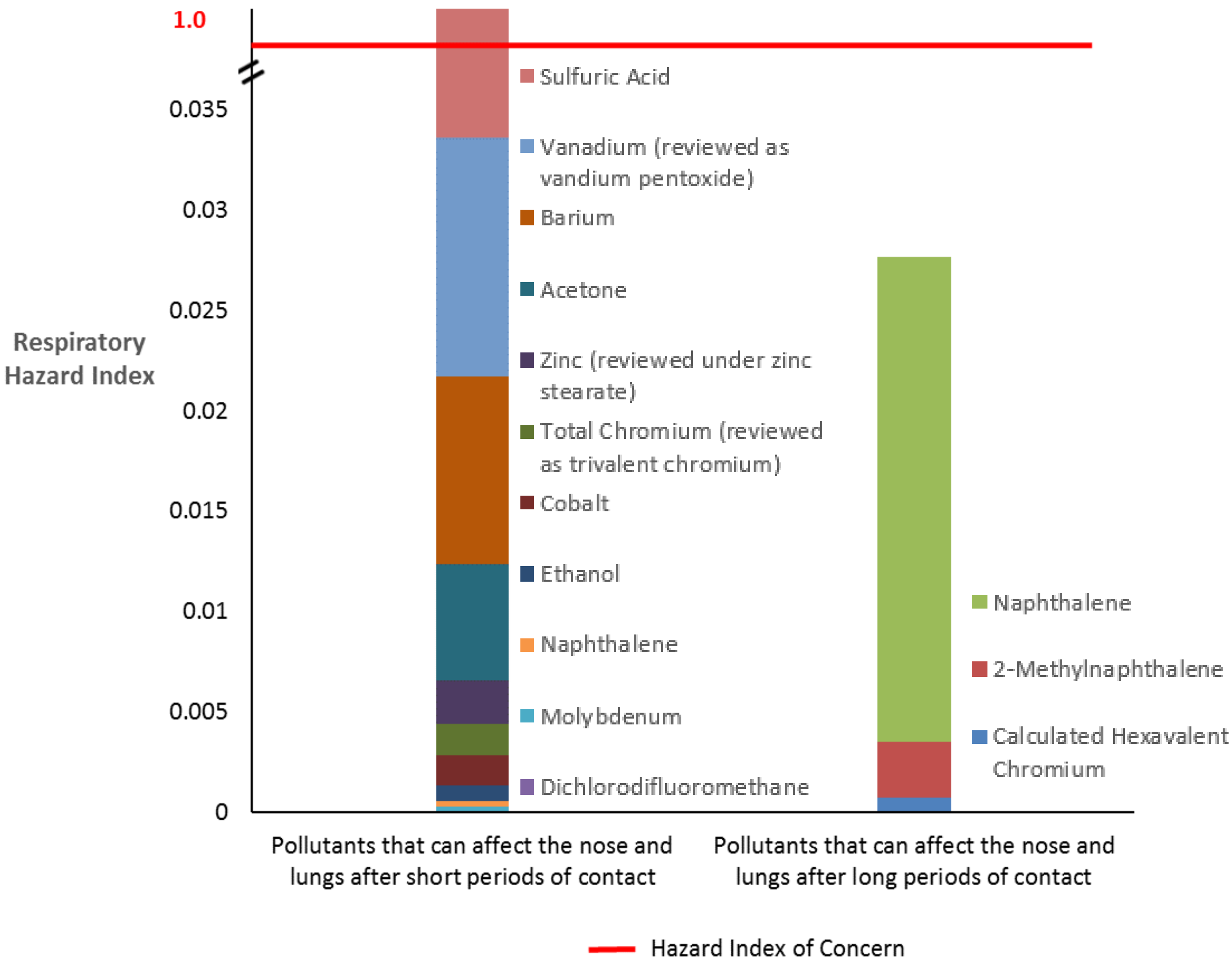
The cumulative impacts of breathing the multiple pollutants that were detected at the NMH site are described for pollutants that affect the respiratory system (nose and lungs), the nervous system (brain and nerves), and pollutants that can cause cancer. Most of the pollutants that were detected are known to affect the respiratory and nervous system, therefore these systems were a focus for this study.

When combined impacts for noncancer effects are less than one on the hazard index scale, the combined impacts do not reach a level of a health concern. When combined impacts are more than one, it's important to review which pollutants are driving the high combined risk and try to understand why the levels for those pollutants are high.

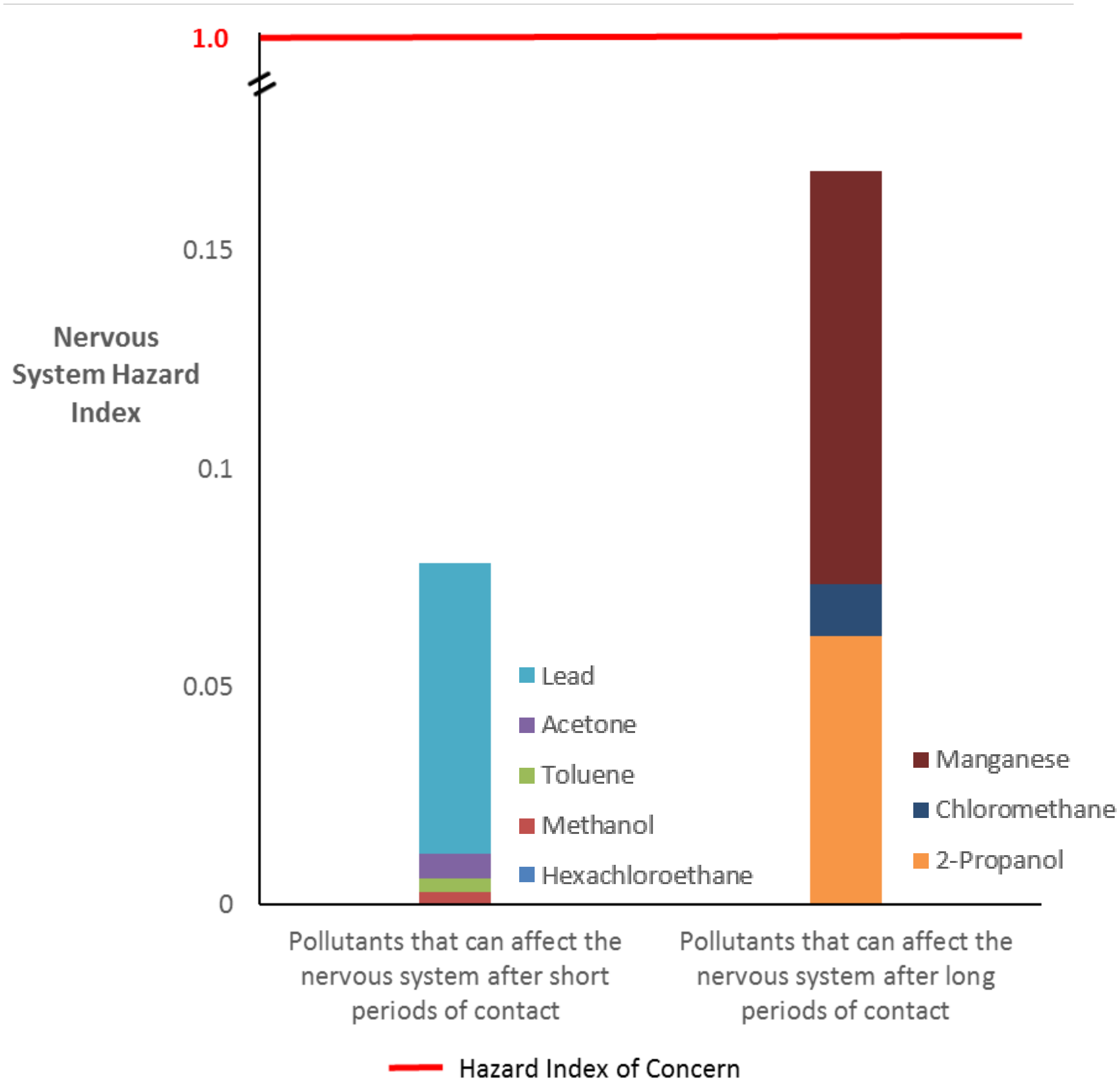
For the cumulative impact of the pollutants that have long-term noncancer health effects, the combined impact of the pollutants detected did not reach a level of concern. Besides sulfuric acid, which reached a level of health concern by itself, the cumulative impact of the pollutants that have short-term health effects did not reach a level where they are expected to be a health concern. Since this evaluation began with the conservative consideration of the combined impact of the maximum sample collected at any time during the one-year study, and a level of concern was not reached outside of the impact of sulfuric acid alone, further analysis into whether timeframes corresponded was not considered.

The combined impact of the pollutants detected that may cause cancer were evaluated and found to have an incremental cancer risk of 8 in one million if a person was exposed to those pollutant levels over their entire lifetime (see Appendix A, page A3 for details).

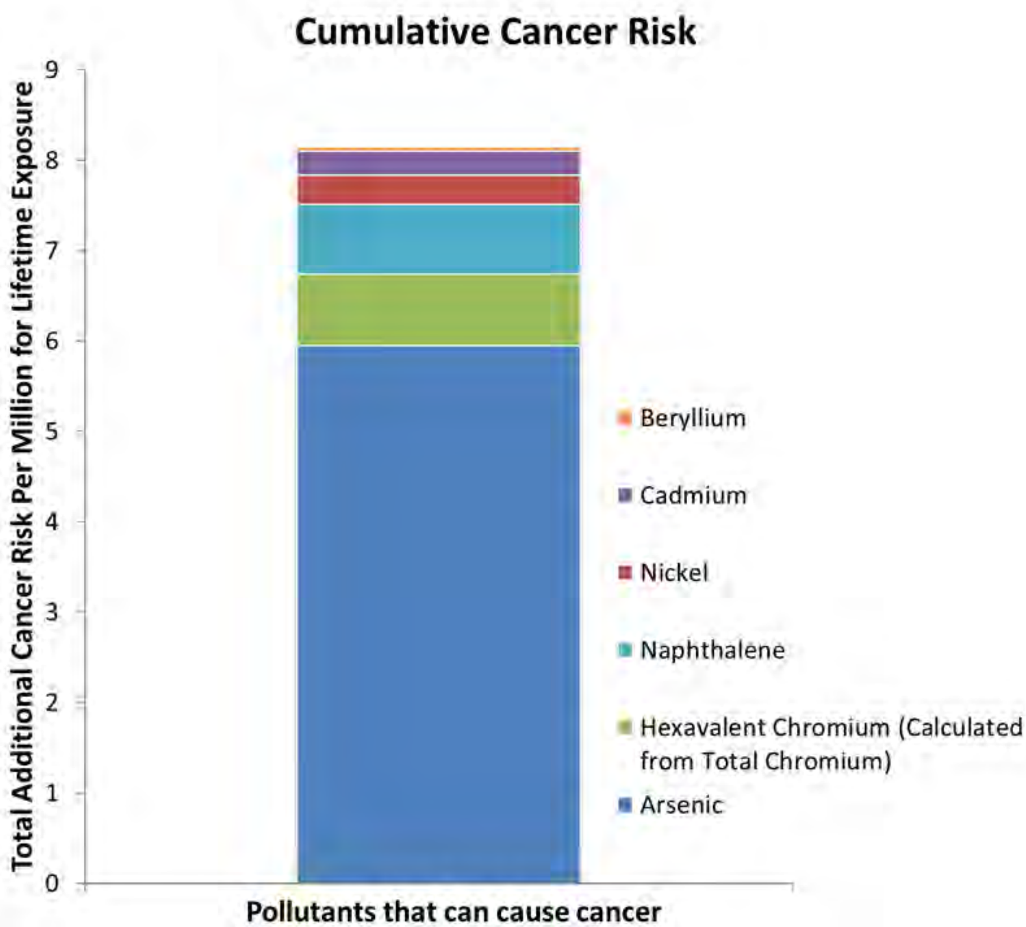
Cumulative Impact: Pollutants that can affect the respiratory system (nose and lungs)



Cumulative Impact: Pollutants that can affect the nervous system (brain and nerves)



Cumulative Impact: Sum of Cancer Risk



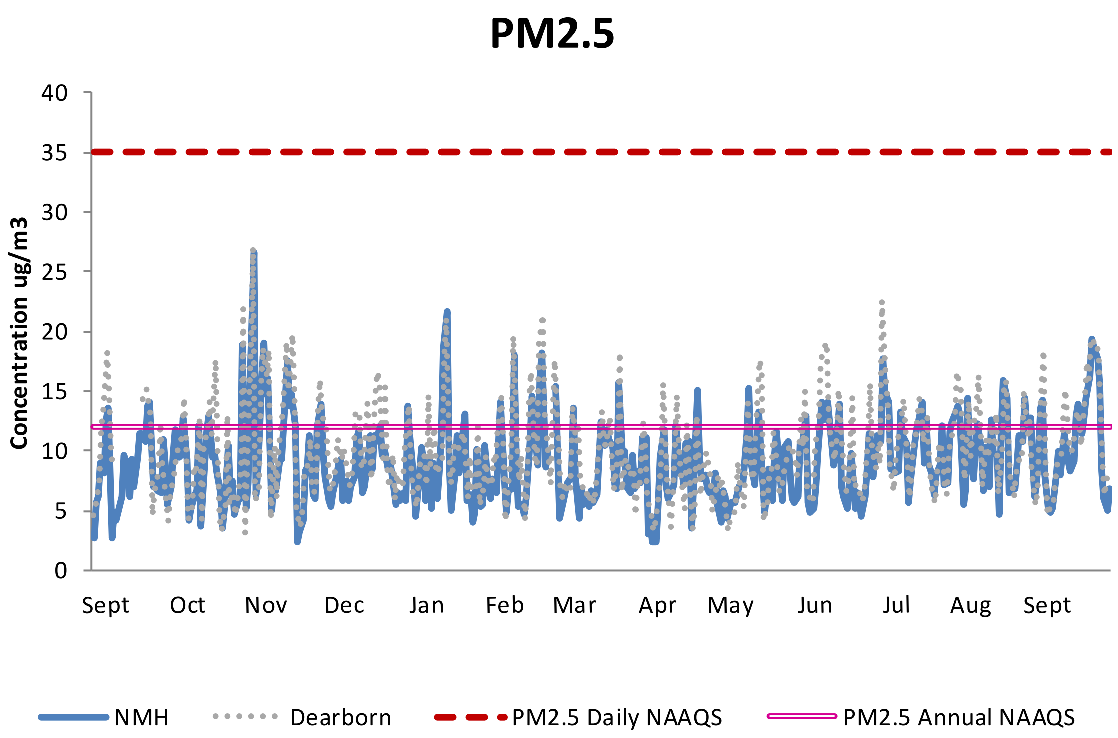
B-4. Time series

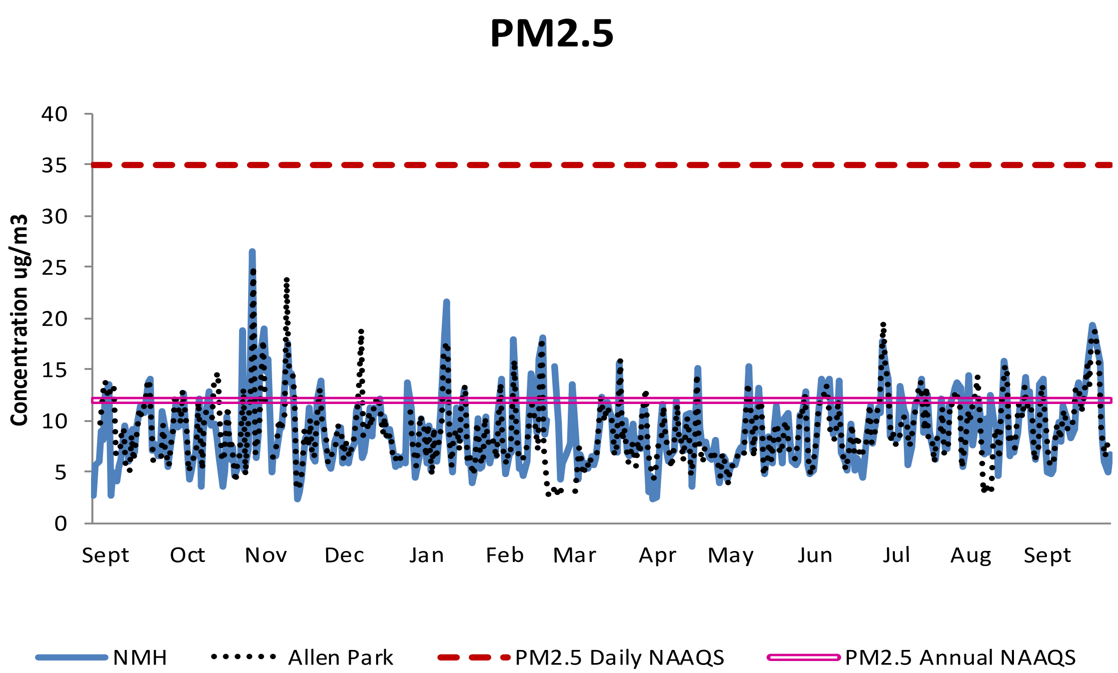
Results from the NMH site are shown in time series graphs so that each sample over the one-year study can be seen. This was done for all pollutants except $PM_{2.5}$ and SO_2. The daily average level is shown for $PM_{2.5}$ and the daily, 1-hour maximum is shown for SO_2. When a sample was collected, but the pollutant level was too low to detect, it is represented as a dark gray symbol on the graph. The results from the NMH site are shown in comparison to other sites in the region and health limits. For some of the parameters, the graphs became difficult to read when all the sites were put on one graph. Therefore, we provided multiple graphs for a single pollutant.

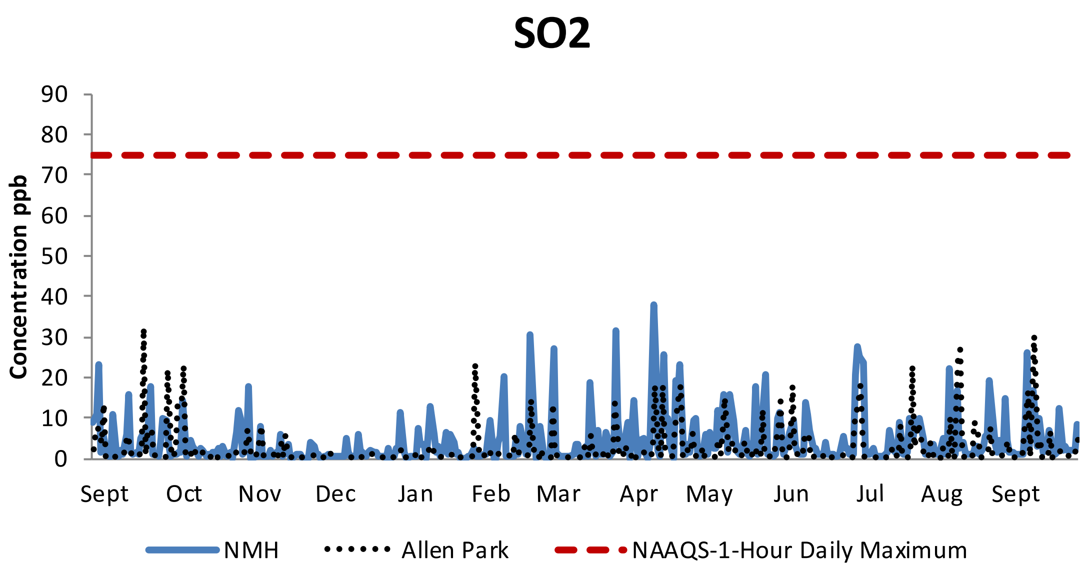
Pollutant levels at the NMH site were below noncancer-related health limits, except for 2 samples of sulfuric acid. For arsenic, naphthalene, and a calculation of hexavalent chromium, pollutant levels reached the one in one million cancer risk level. However, none of these pollutants reached the 1 in 10,000 cancer risk level (the risk level used by the USEPA for RTR and NATA analyses). Both risk levels are used in regulatory processes to identify pollutants and facilities of concern, but it should be noted that there is no USEPA or MDEQ health limit for an acceptable ambient air level for pollutants that can cause cancer.

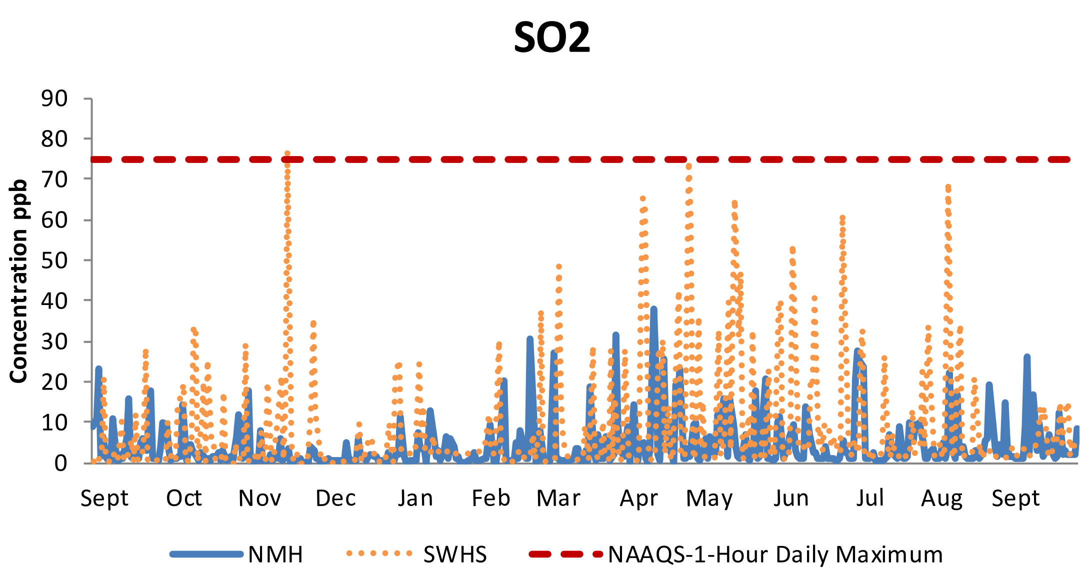
With few exceptions, the time series plots of pollutant concentration levels monitored at the NMH site were like that of other sites in metro-Detroit. Noted exceptions are higher 2-propanol levels at the NMH site, higher SO_2 levels at SWHS, and higher levels of acetone and toluene on the west side of Marathon’s property.

Criteria Pollutants: $PM_{2.5}$, SO_2, and Lead (Pb)

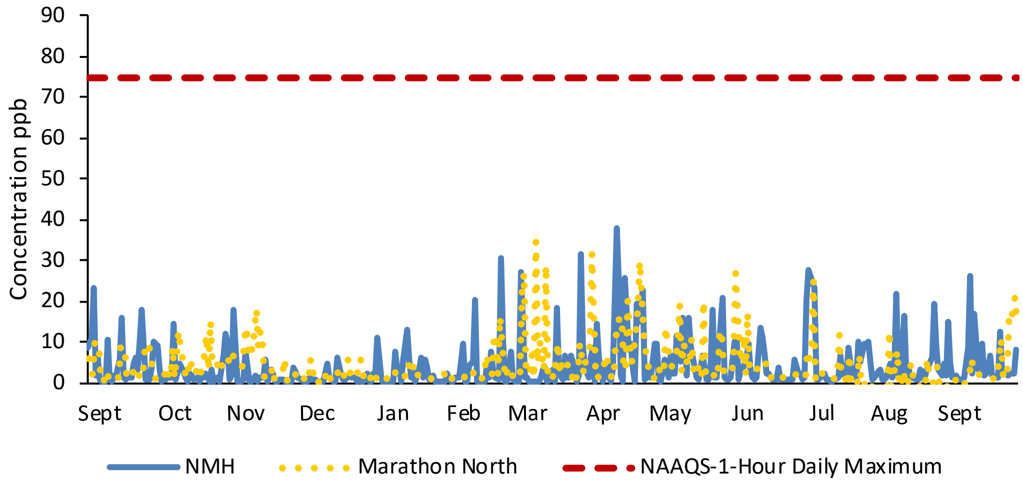





SO2
90
80
70
60
50
40
30
20
10
0
Concentration ppb
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Allen Park
NAAQS-1-Hour Daily Maximum

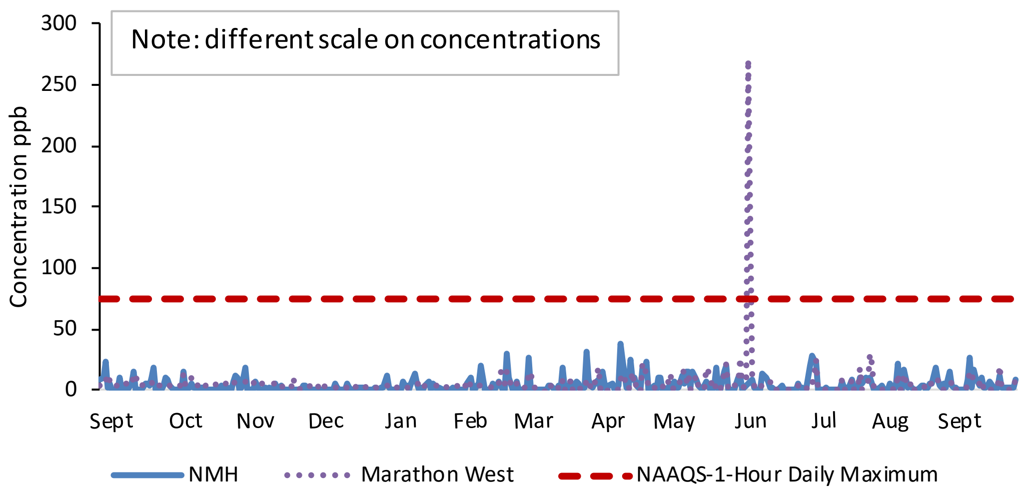

SO2
90
80
70
60
50
40
30
20
10
0
Concentration ppb
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
SWHS
NAAQS-1-Hour Daily Maximum

SO2

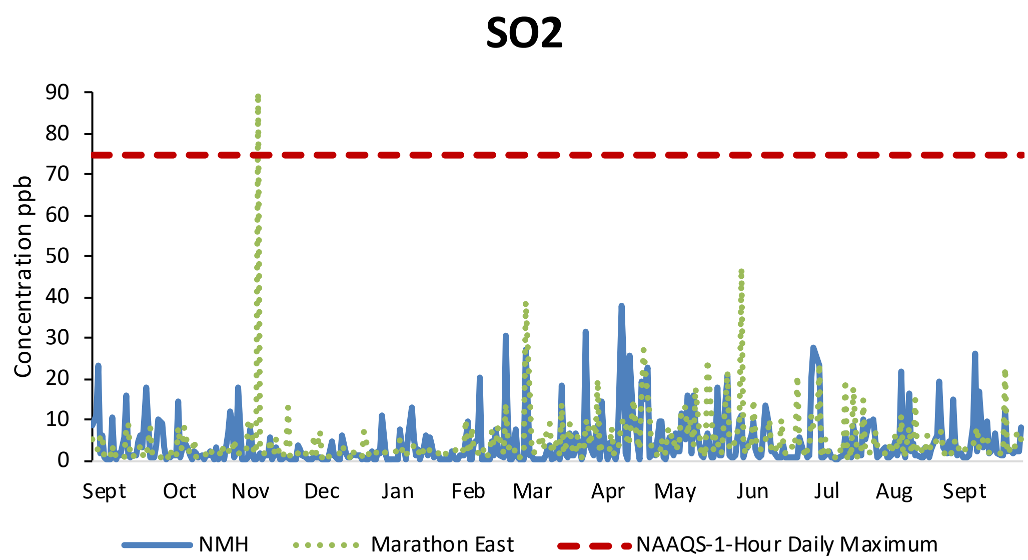


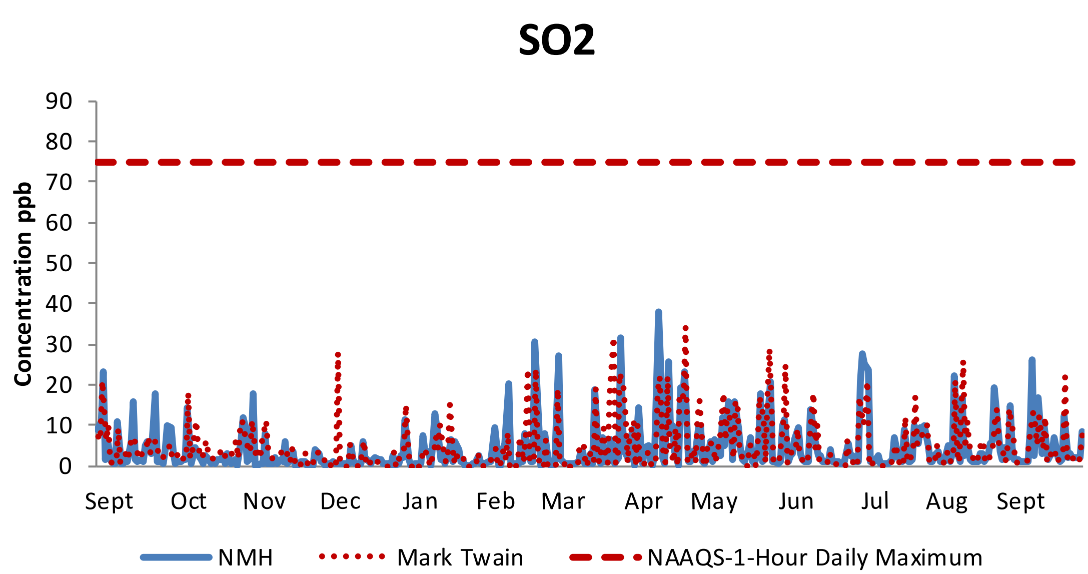
90
80
70
60
50
40
30
20
10
0
Concentration ppb
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Marathon North
NAAQS-1-Hour Daily Maximum

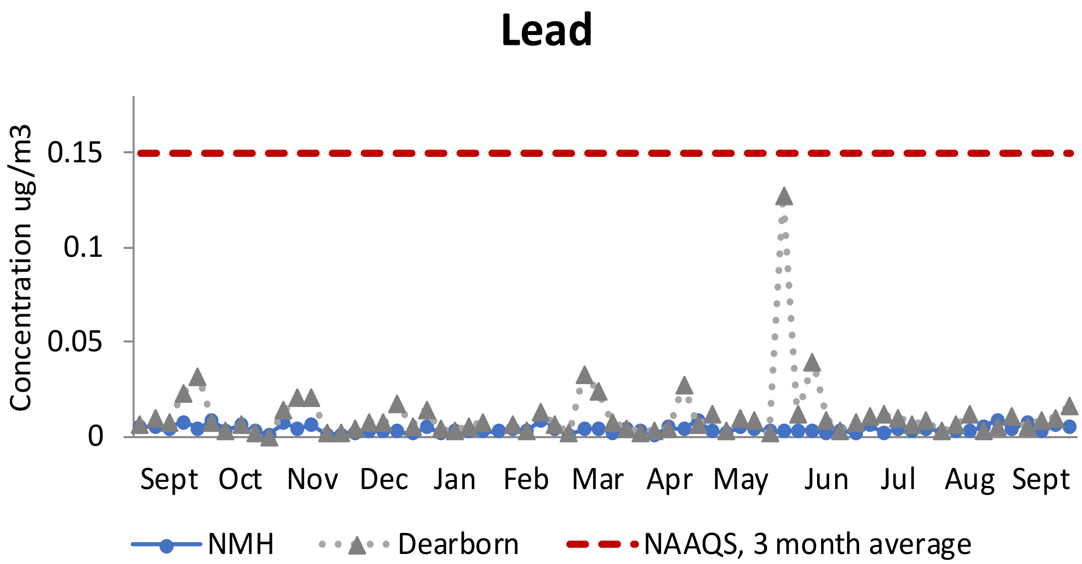
SO2



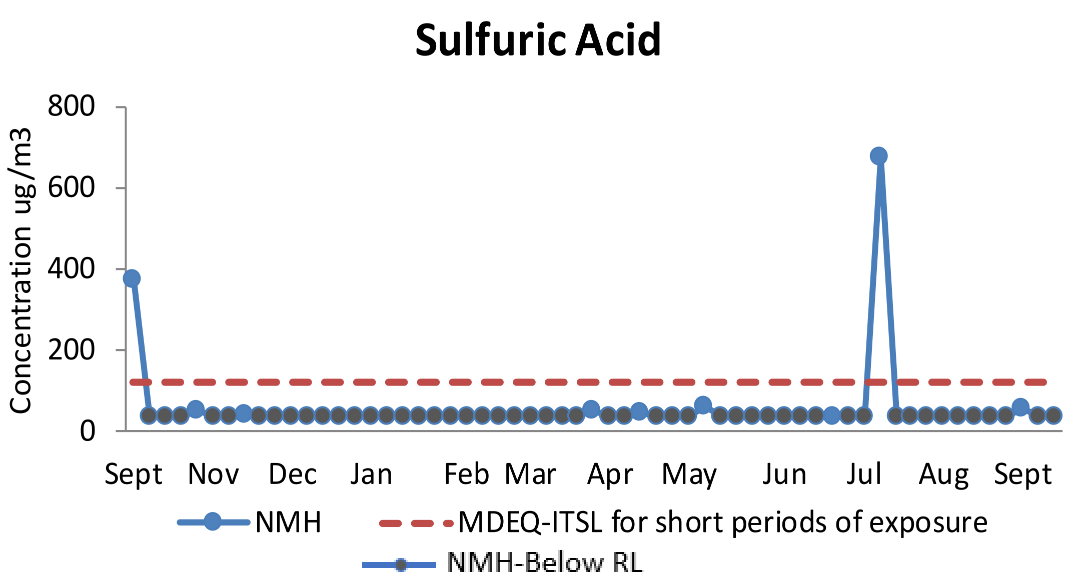
Note: different scale on concentrations
300
250
200
150
100
50
0
Concentration ppb
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Marathon West
NAAQS-1-Hour Daily Maximum


SO2
90
80
70
60
50
40
30
20
10
0
Concentration ppb
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Marathon East
NAAQS-1-Hour Daily Maximum

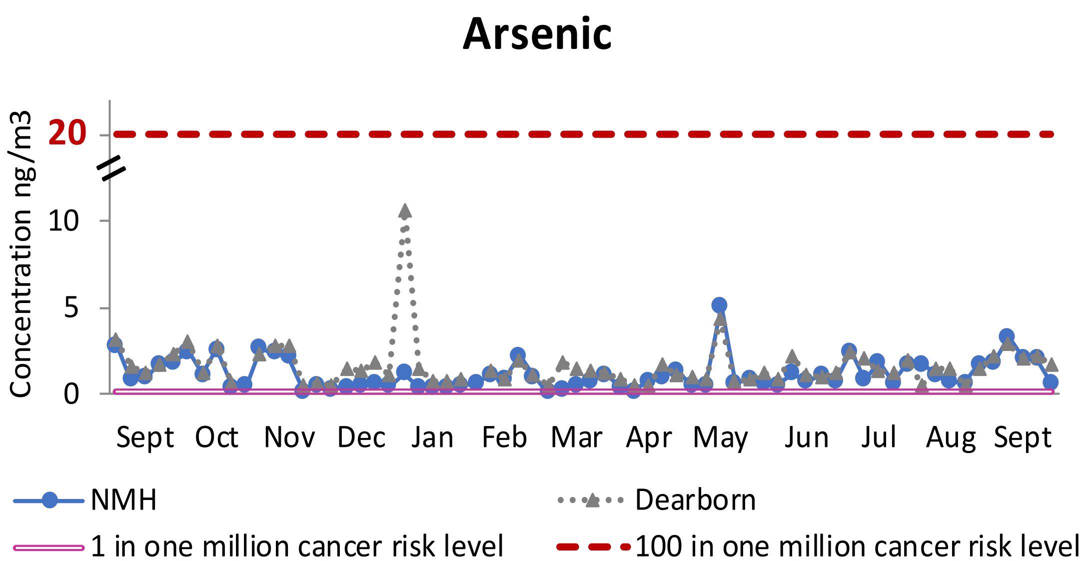

SO2
90
80
70
60
50
40
30
20
10
0
Concentration ppb
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Mark Twain
NAAQS-1-Hour Daily Maximum

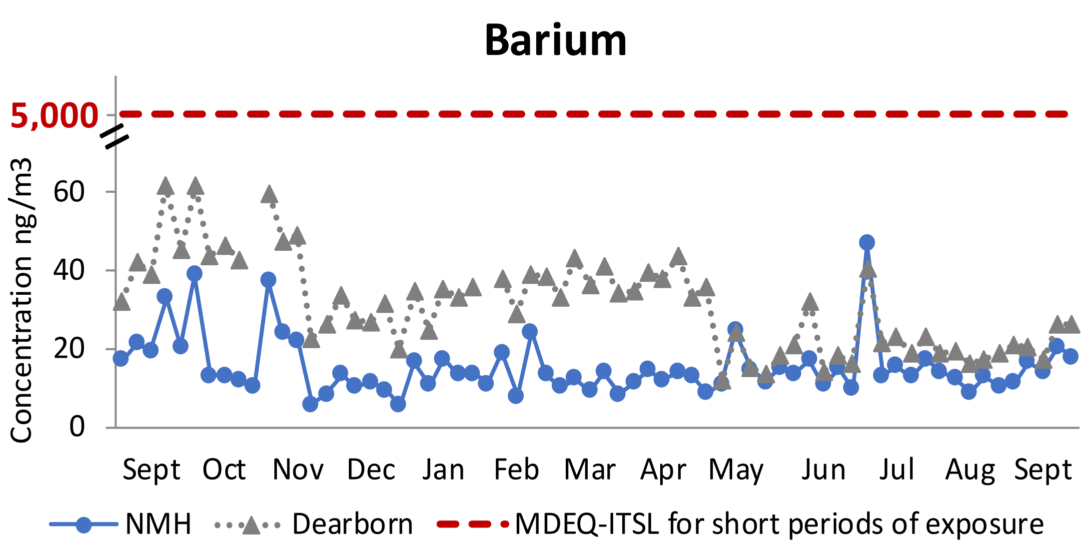

Lead
Concentration ug/m3
0.15
0.1
0.05
0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Dearborn
NAAQS, 3 month average

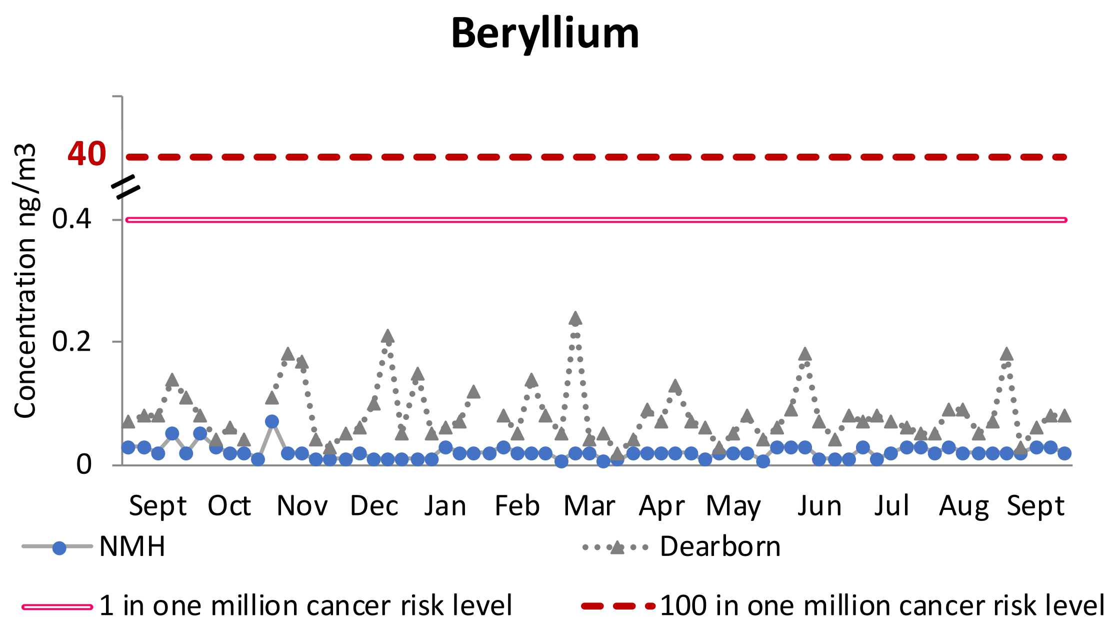
ACIDS:

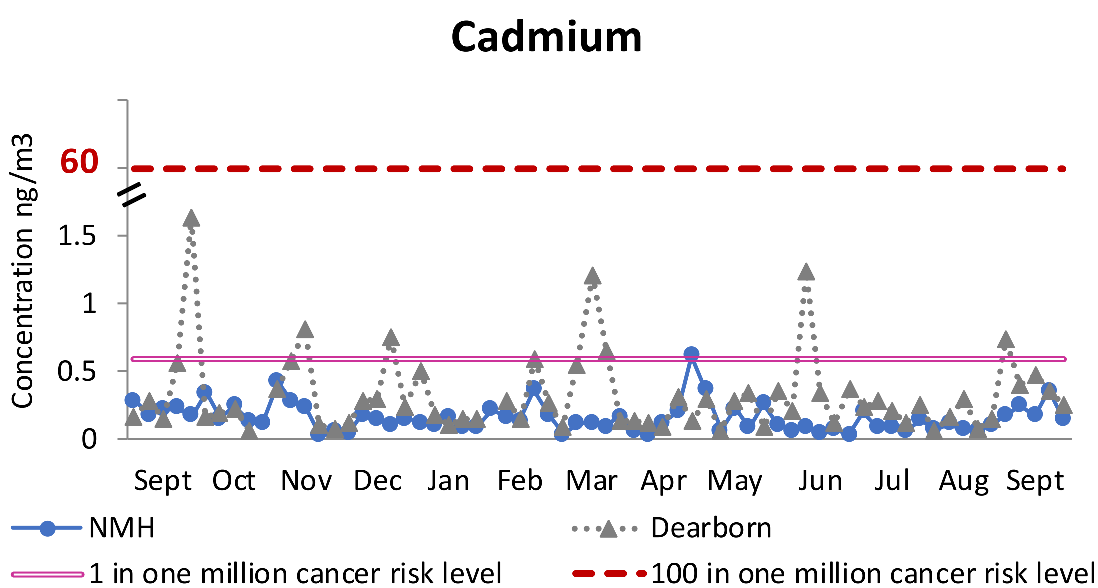

Sulfuric Acid
Concentration ug/m3
800
600
400
200
0
Sept
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
MDEQ-ITSL for short periods of exposure
NMH-Below RL

Air Toxics: Metals

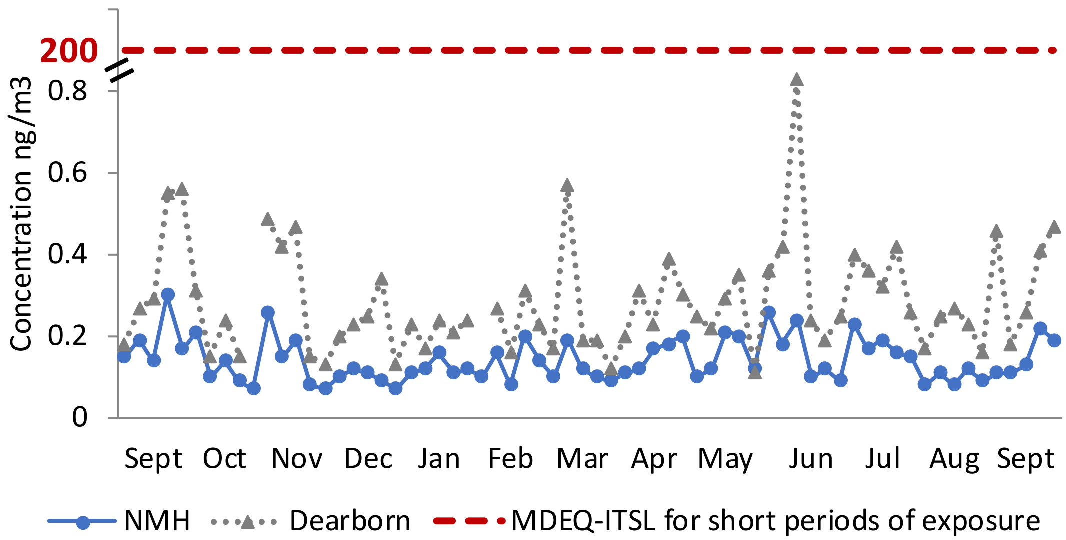





Beryllium
40
0.4
0.2
0
Concentration ng/m3
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Dearborn
1 in one million cancer risk level
100 in one million cancer risk level

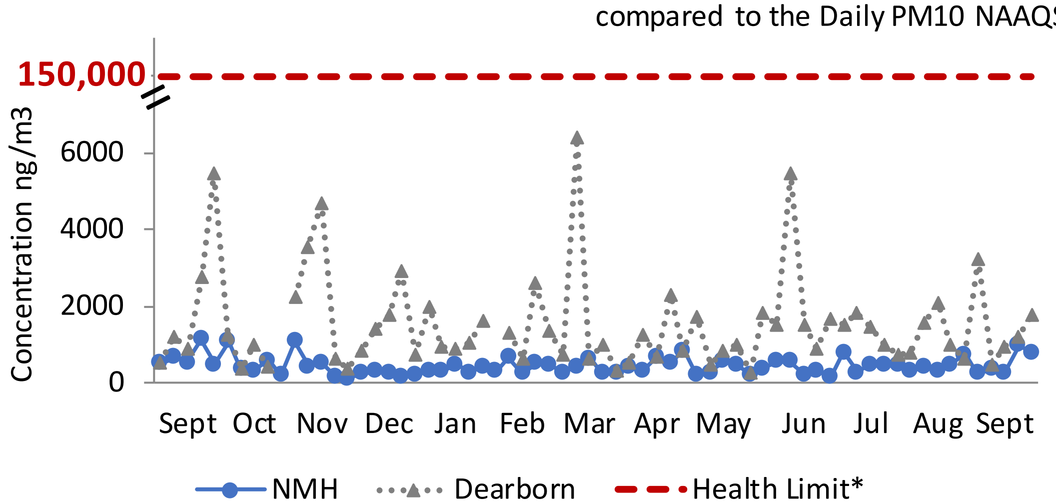

Cadmium
60
1.5
1
0.5
0
Concentration ng/m3
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Dearborn
1 in one million cancer risk level
100 in one million cancer risk level

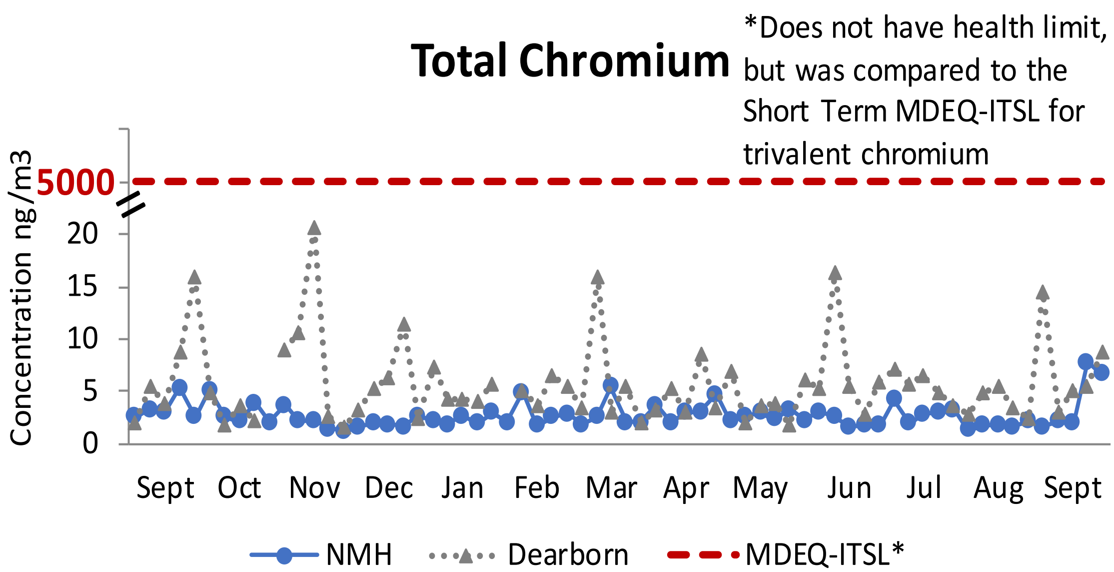
Cobolt

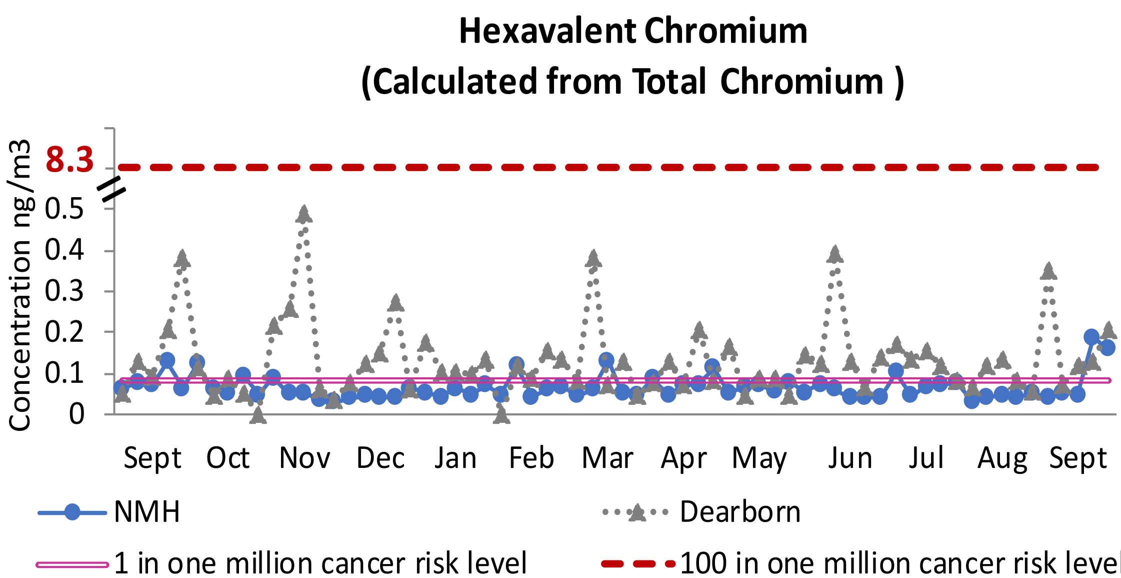


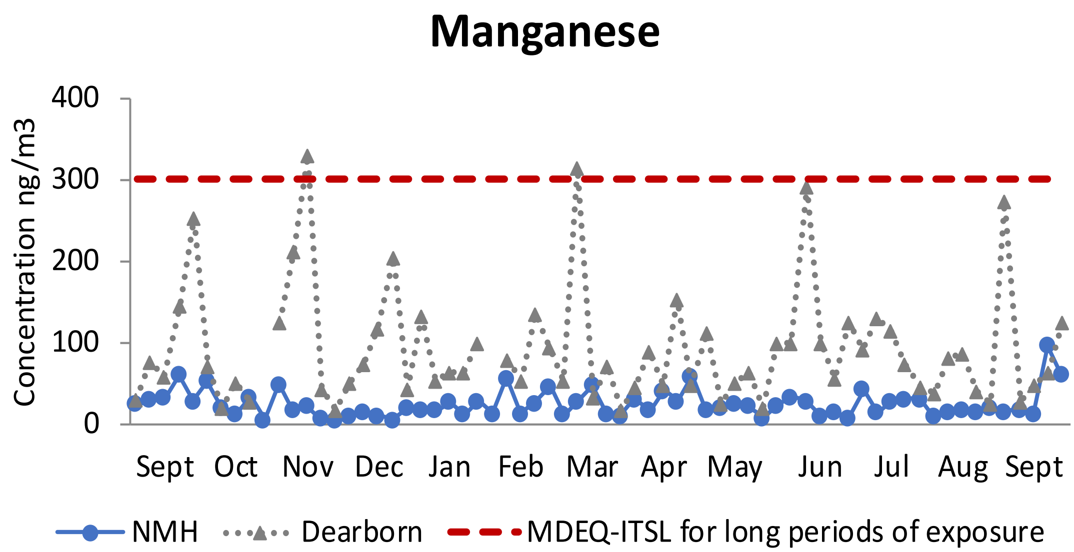
Iron

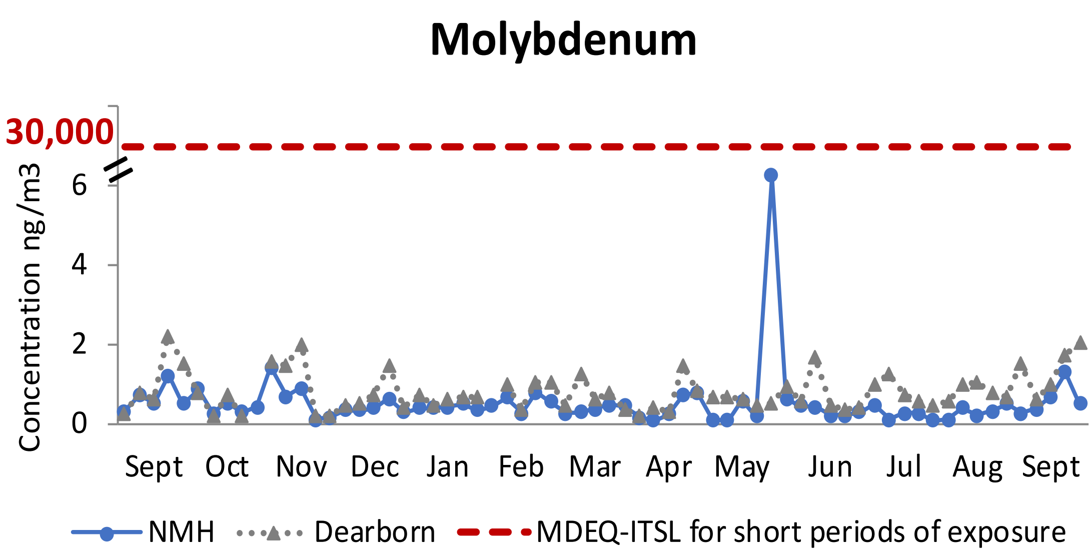
*Does not have health limit, but was compared to the Daily PM10 NAAQS



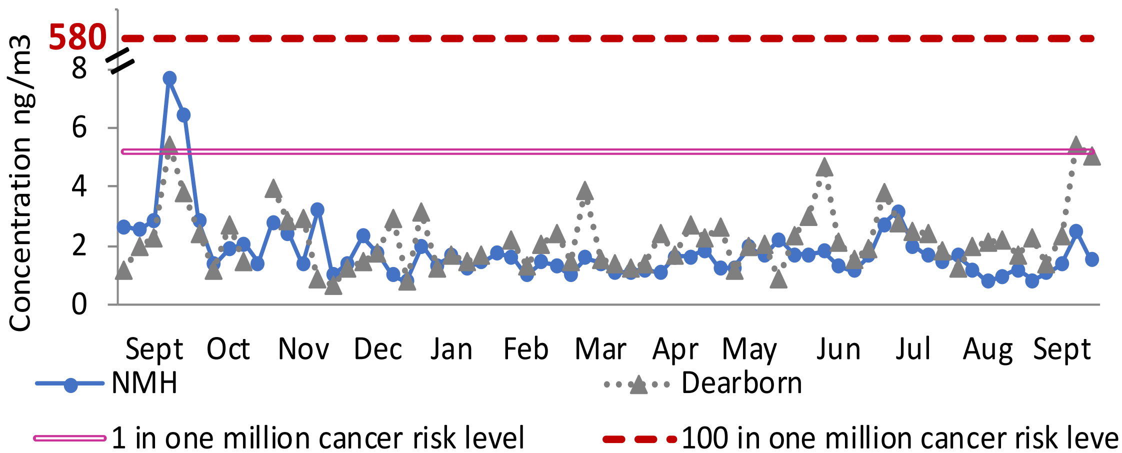

Total Chromium
*Does not have health limit, but was compared to the Short Term MDEQ-ITSL for trivalent chromium
Concentration ng/m3
5000
20
15
10
5
0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Dearborn
MDEQ-ITSL*


Hexavalent Chromium
(Calculated from Total Chromium)
Concentration ng/m3
8.3
0.5
0.4
0.3
0.2
0.1
0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Dearborn
1 in one million cancer risk level
100 in one million cancer risk level


Manganese
Concentration ng/m3
400
300
200
100
0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Dearborn
MDEQ-ITSL for long periods of exposure

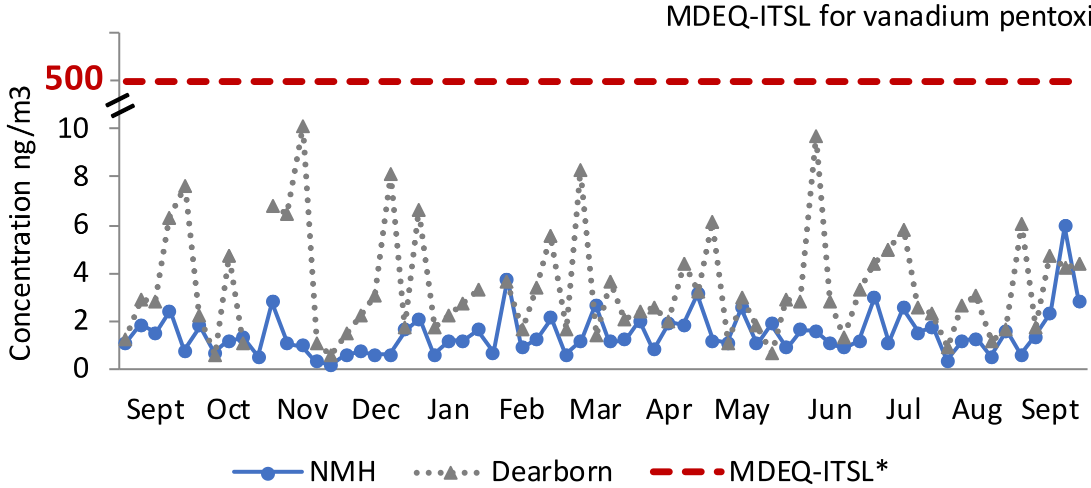

Molybdenum
30,000
Concentration ng/m3
6
4
2
0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Dearborn
MDEQ-ITSL for short periods of exposure

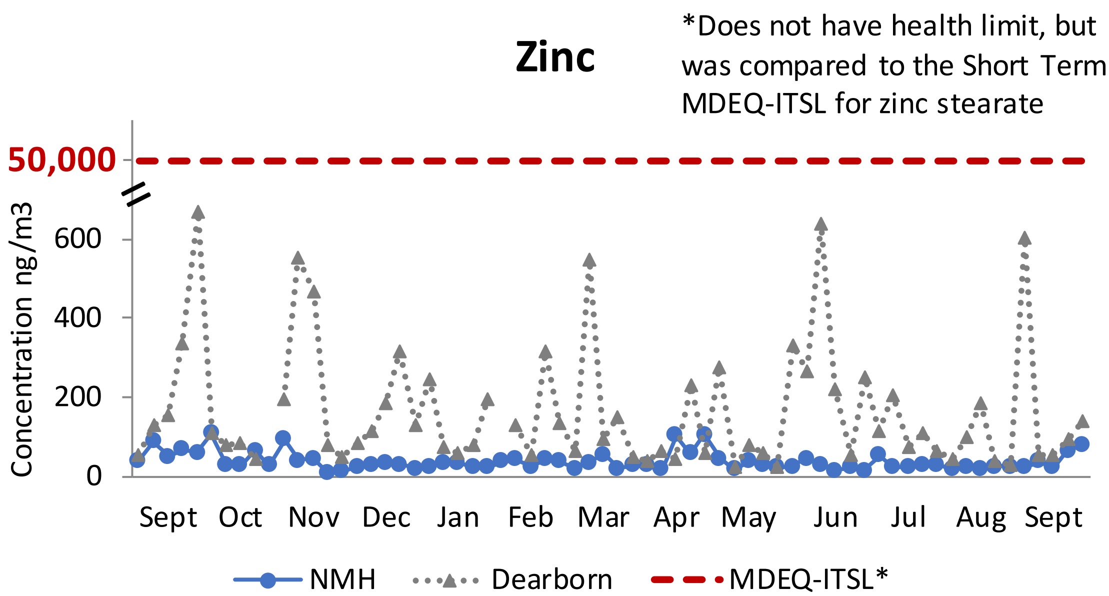
Nickel



Vanadium

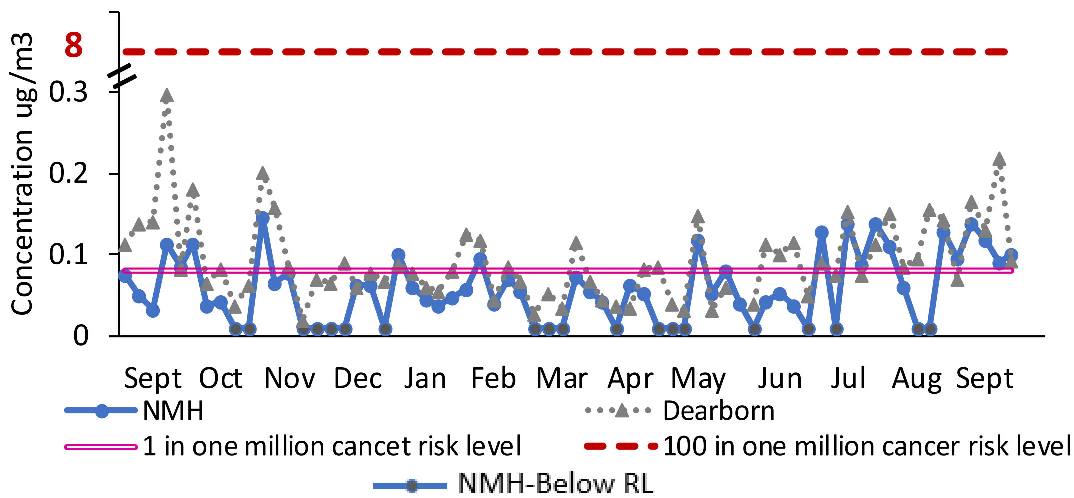
*Does not have health limit, but was compared to the Short Term MDEQ-ITSL for vanadium pentoxide



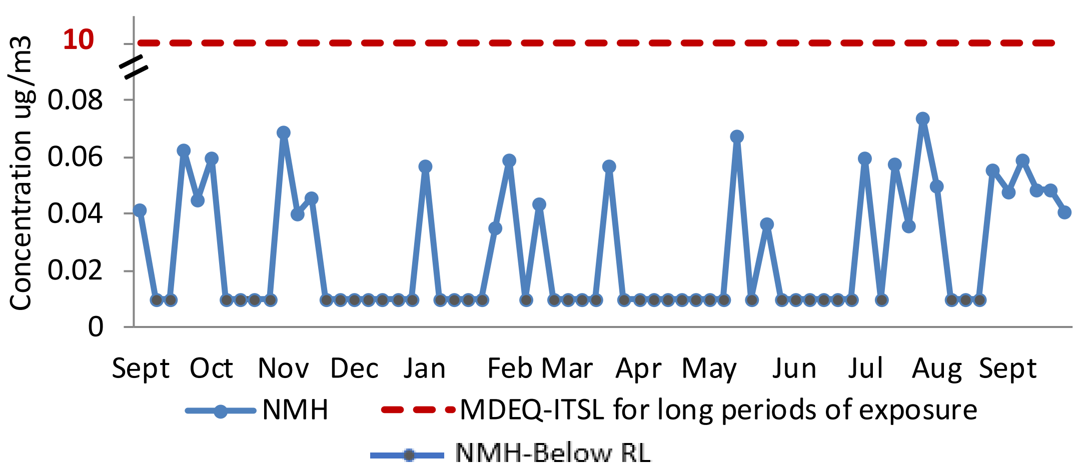

Zinc
*Does not have health limit, but was compared to the Short Term MDEQ-ITSL for zinc stearate
50,000
Concentration ng/m3
600
400
200
0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Dearborn
MDEQ-ITSL*

Air Toxics: Polyaromatic Hydrocarbons (PAHs)

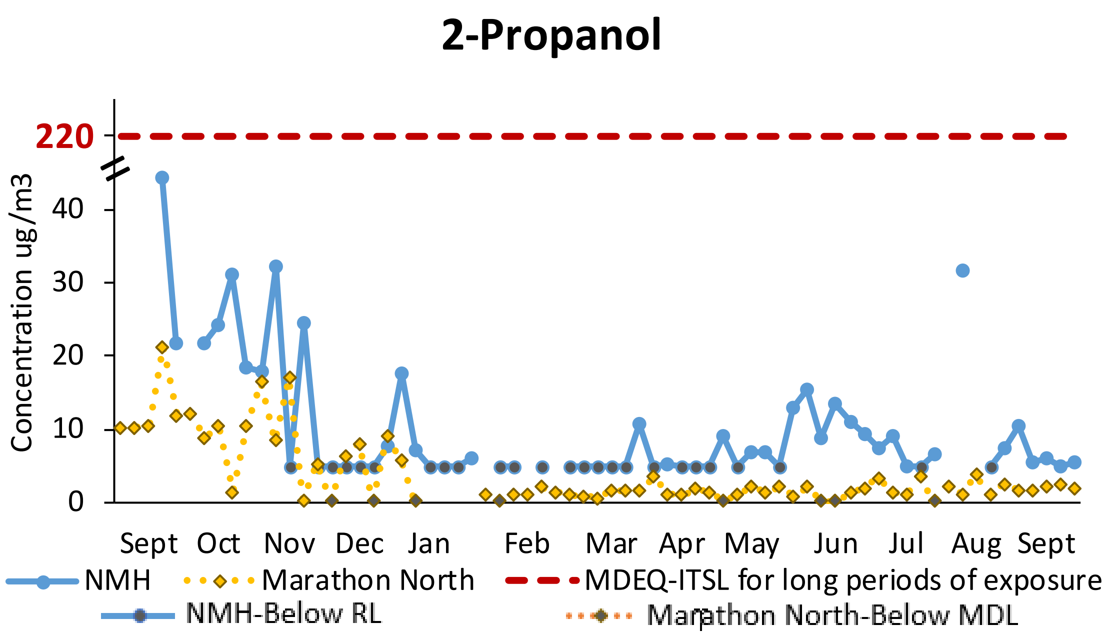
Naphthalene

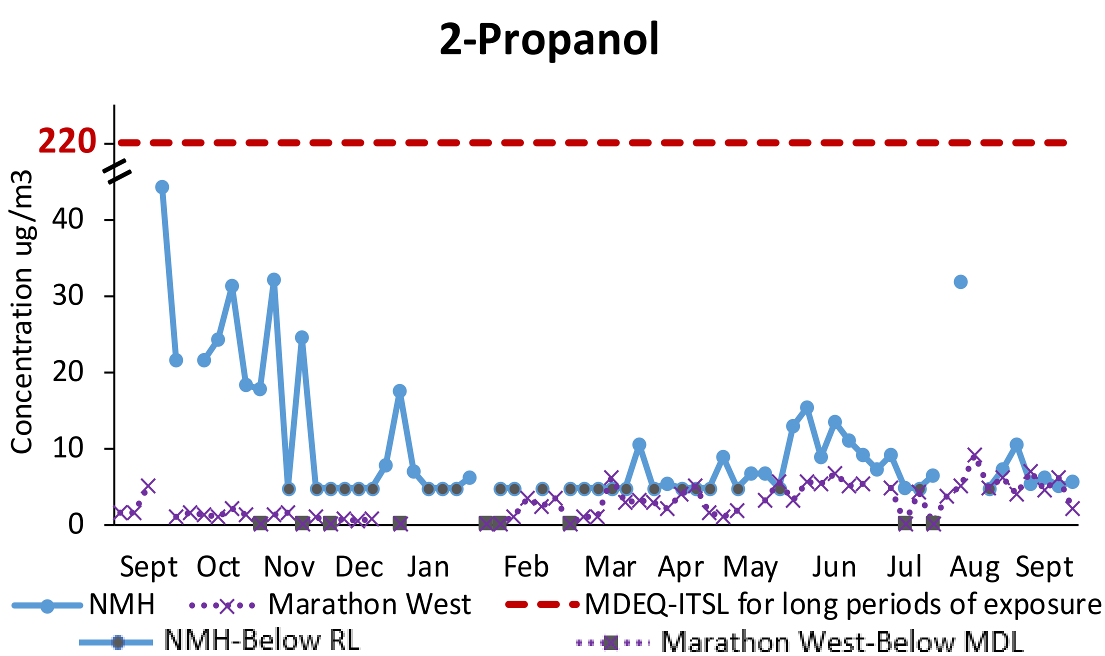


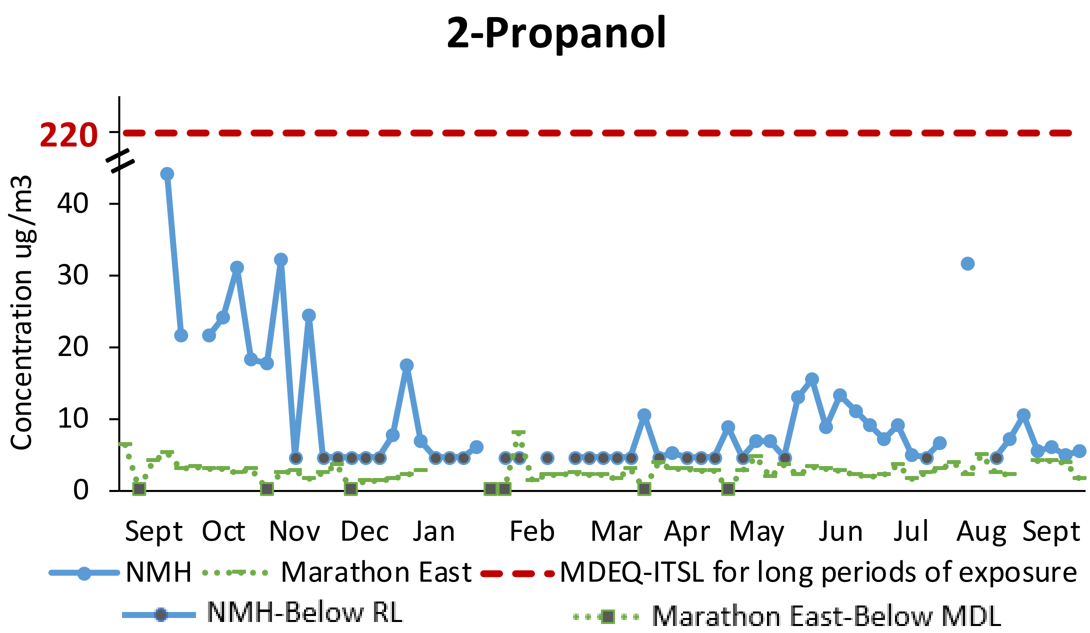
2-Methylnaphthalene

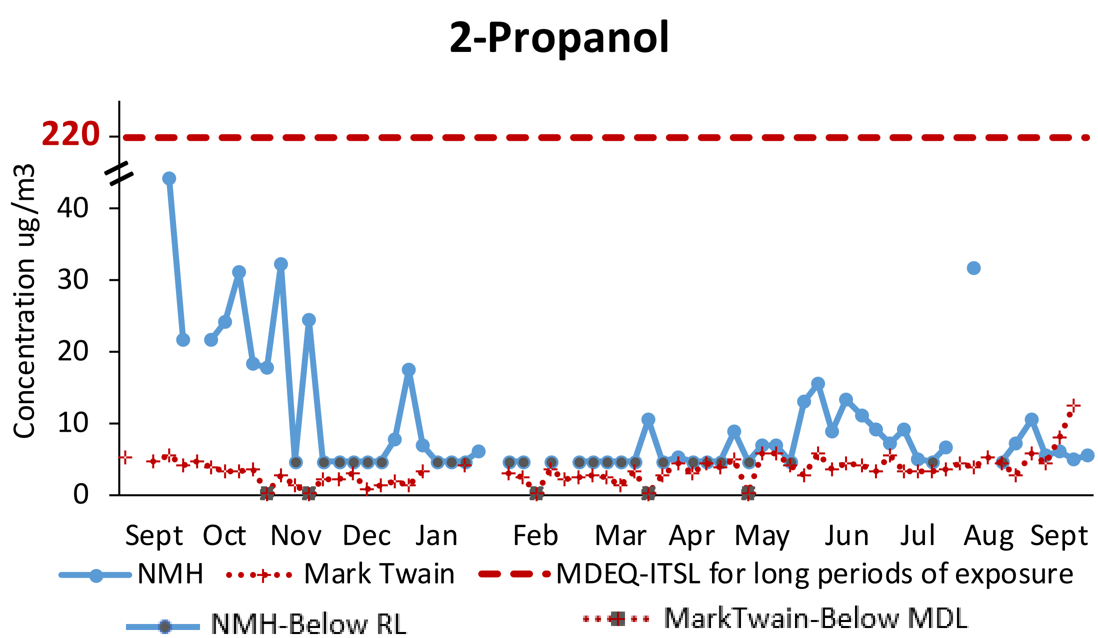


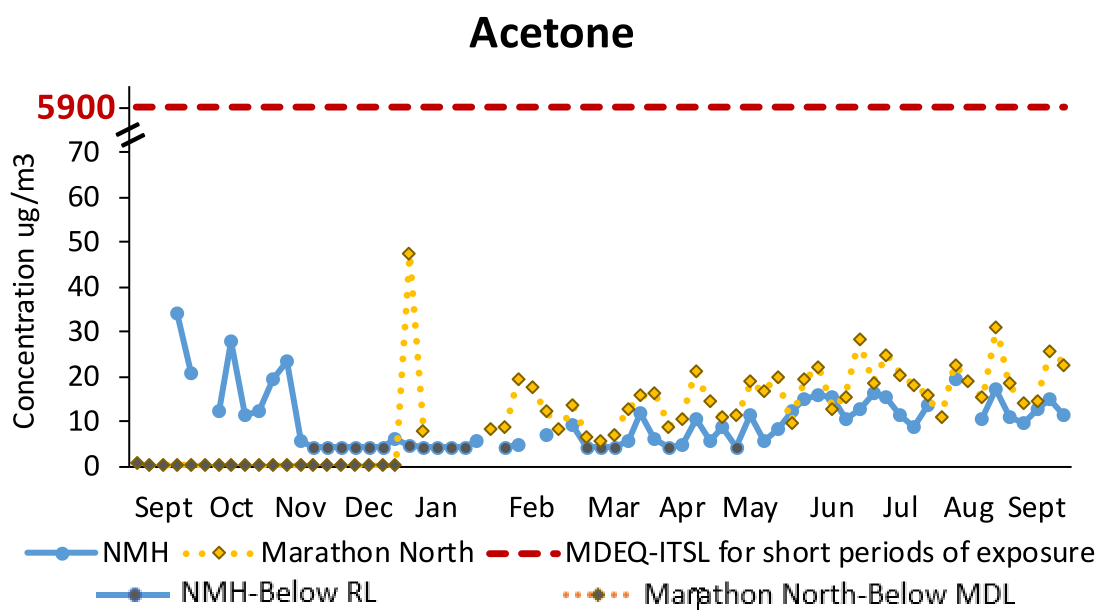
Air Toxics: Volatile Organic Compounds (VOCs)

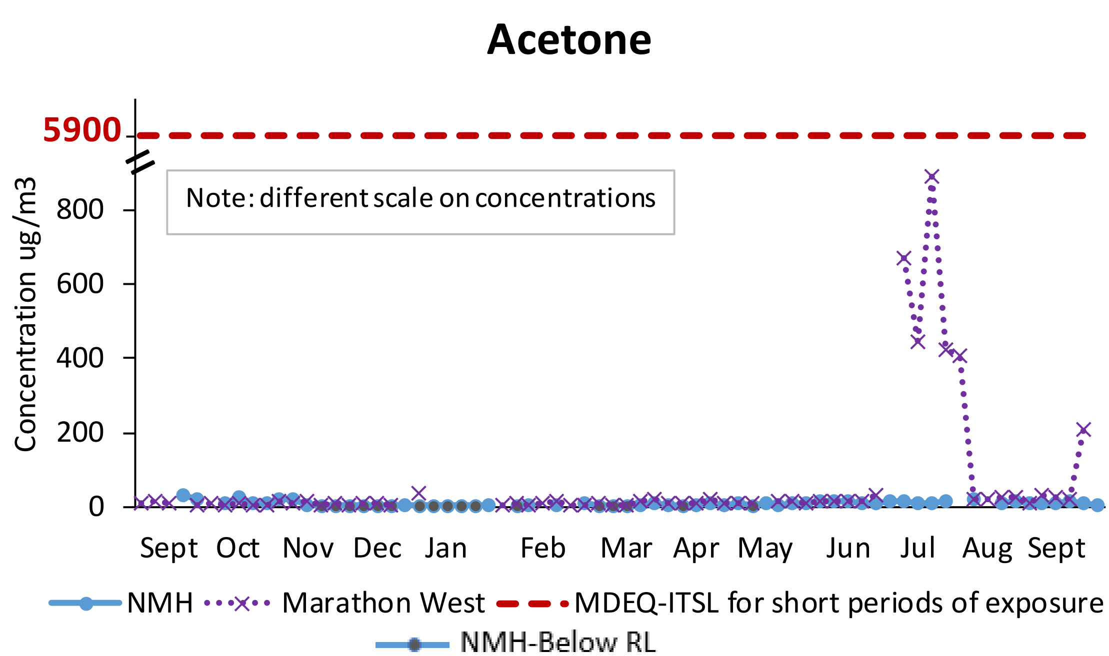


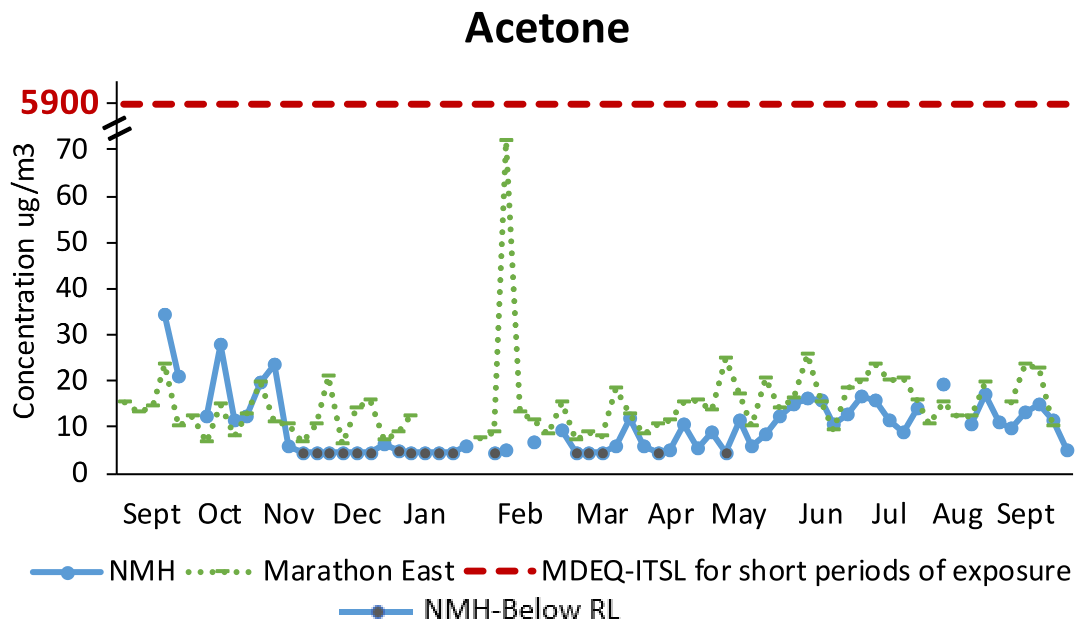


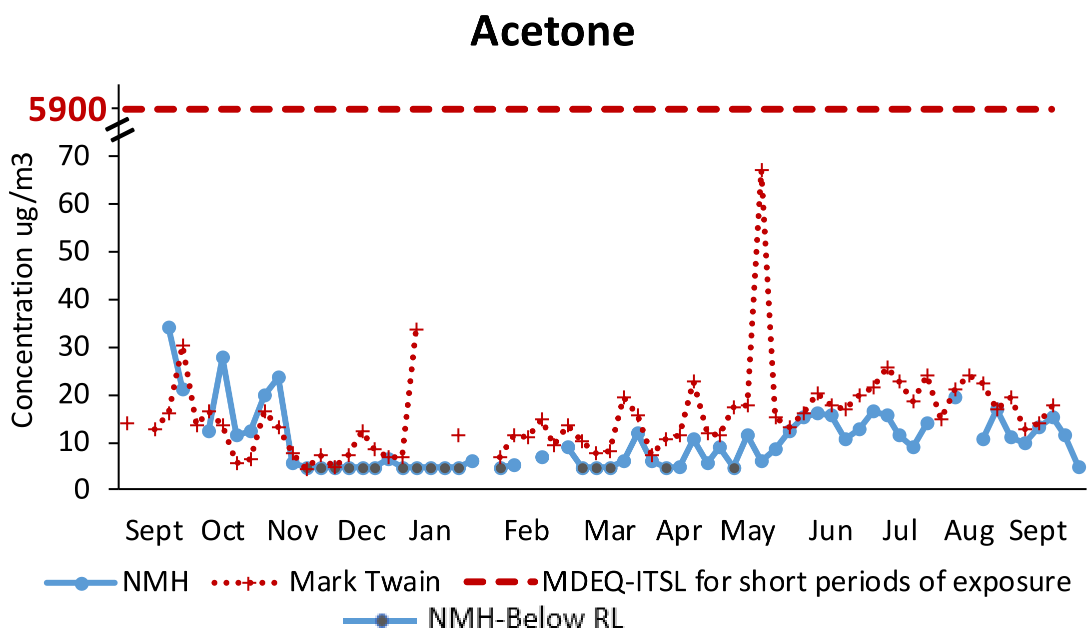

2-Propanol
220
40
30
20
10
0
Concentration ug/m3
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Marathon East
MDEQ-ITSL for long periods of exposure
NMH-Below RL
Marathon East-Below MDL


2-Propanol
220
40
30
20
10
0
Concentration ug/m3
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Mark Twain
MDEQ-ITSL for long periods of exposure
NMH-Below RL
MarkTwain-Below MDL

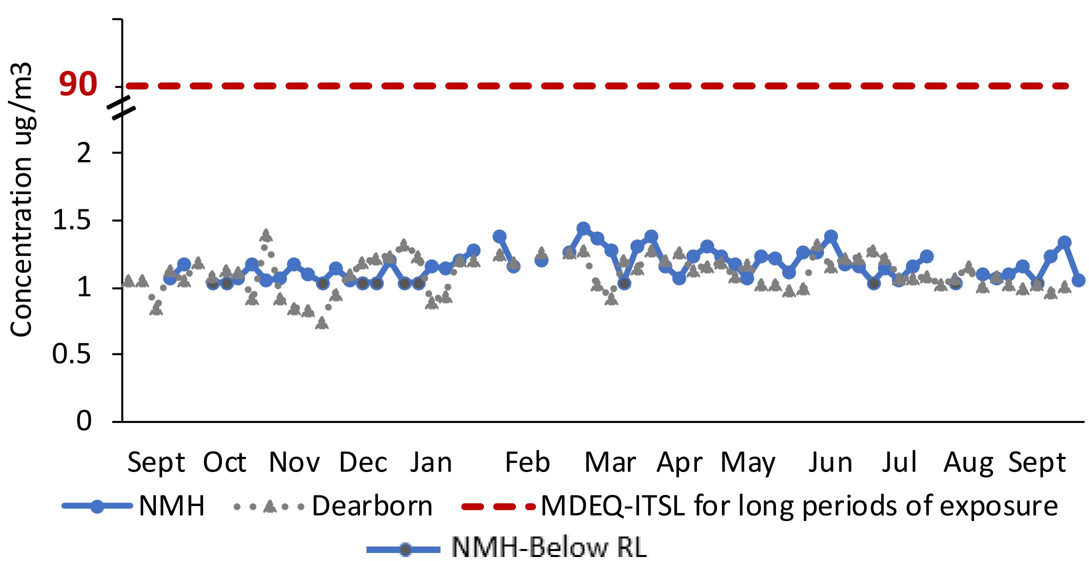

Acetone
5900
70
60
50
40
30
20
10
0
Concentration ug/m3
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon North
MDEQ-ITSL for short periods of exposure
NMH-Below RL
Marathon North-Below MDL


Acetone
5900
800
600
400
200
0
Concentration ug/m3
Note: different scale on concentrations
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon West
MDEQ-ITSL for short periods of exposure
NMH-Below RL

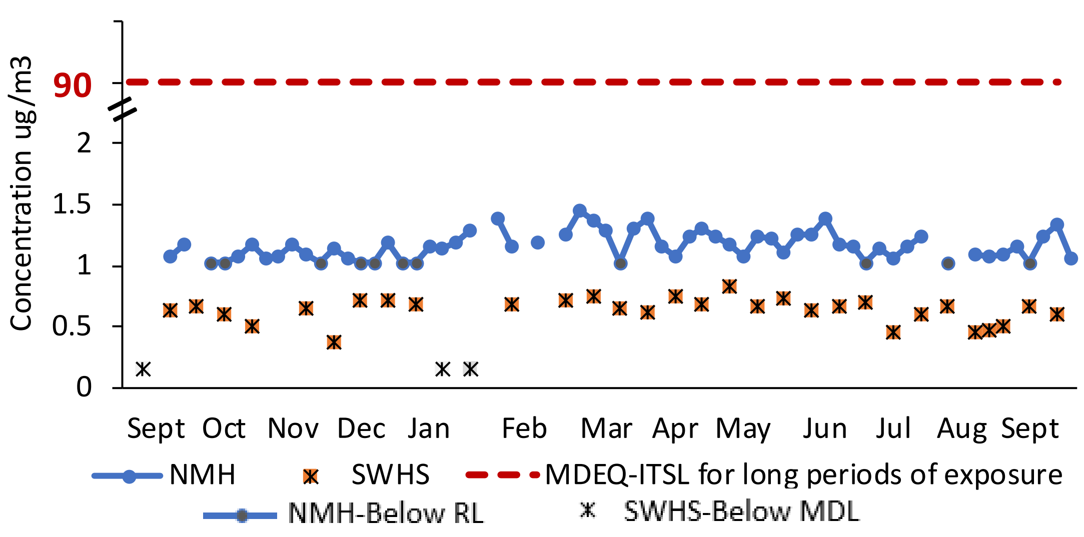

Acetone
5900
70
60
50
40
30
20
10
0
Concentration ug/m3
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon East
MDEQ-ITSL for short periods of exposure
NMH-Below RL

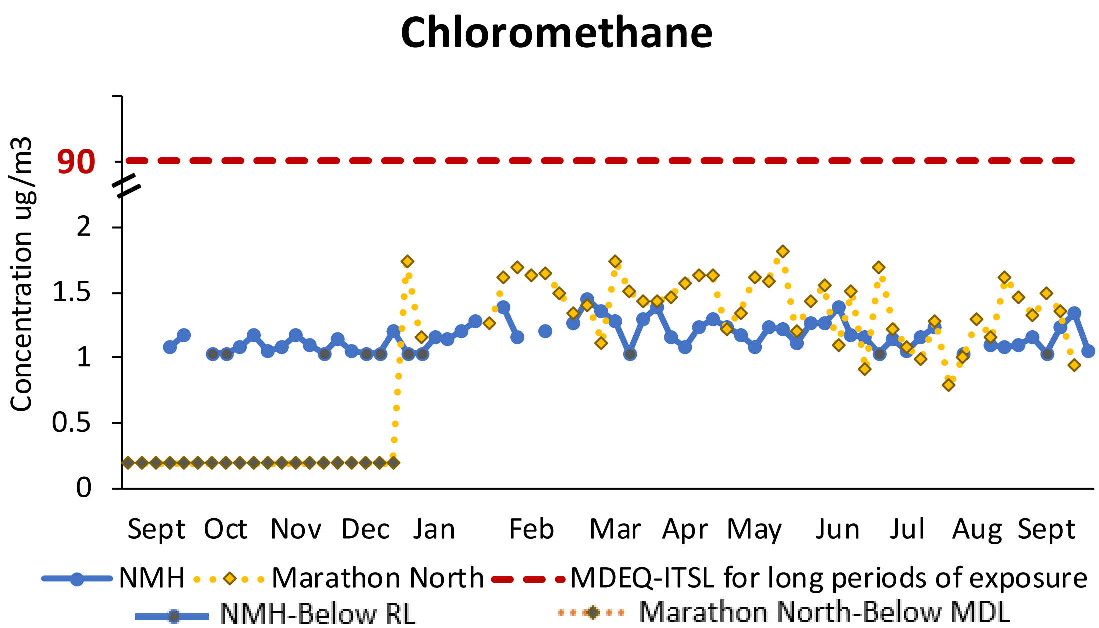

Acetone
5900
70
60
50
40
30
20
10
0
Concentration ug/m3
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Mark Twain
MDEQ-ITSL for short periods of exposure
NMH-Below RL

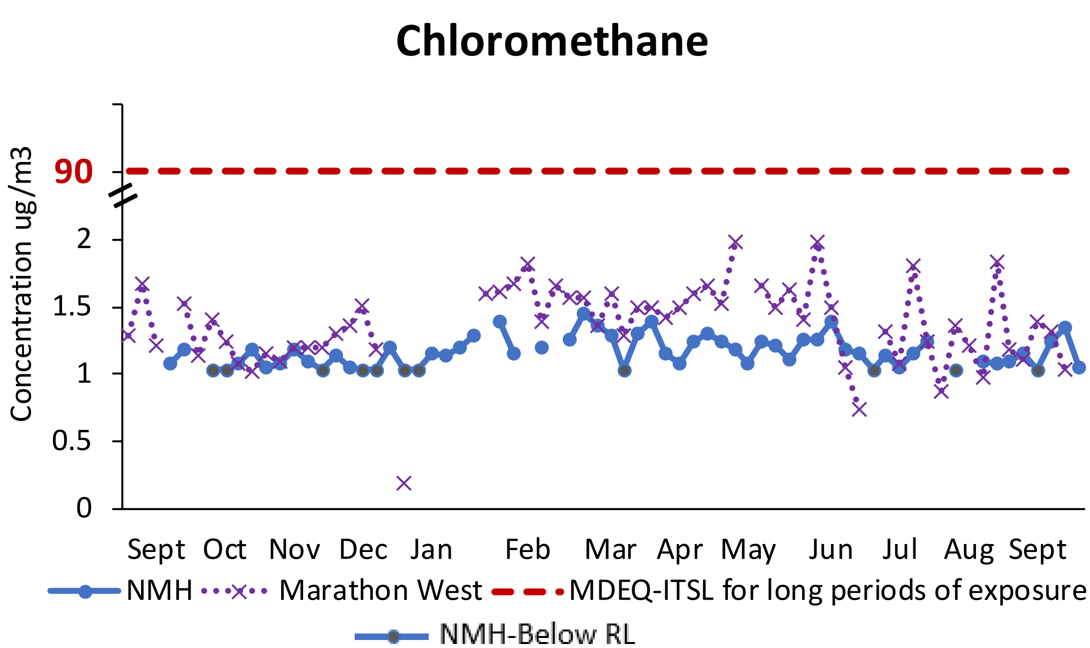
Chloromethane

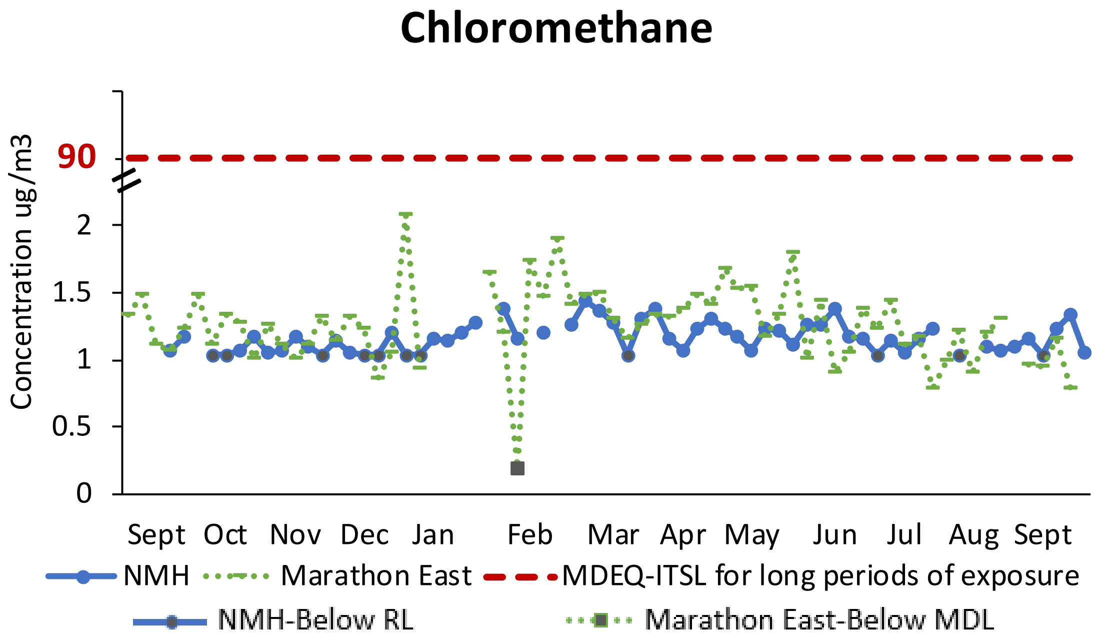


Chloromethane




Chloromethane
Concentration ug/m3
90
2
1.5
1
0.5
0
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon North
MDEQ-ITSL for long periods of exposure
NMH-Below RL
Marathon North-Below MDL


Chloromethane
Concentration ug/m3
90
2
1.5
1
0.5
0
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon West
MDEQ-ITSL for long periods of exposure
NMH-Below RL


Chloromethane
Concentration ug/m3
90
2
1.5
1
0.5
0
Sept
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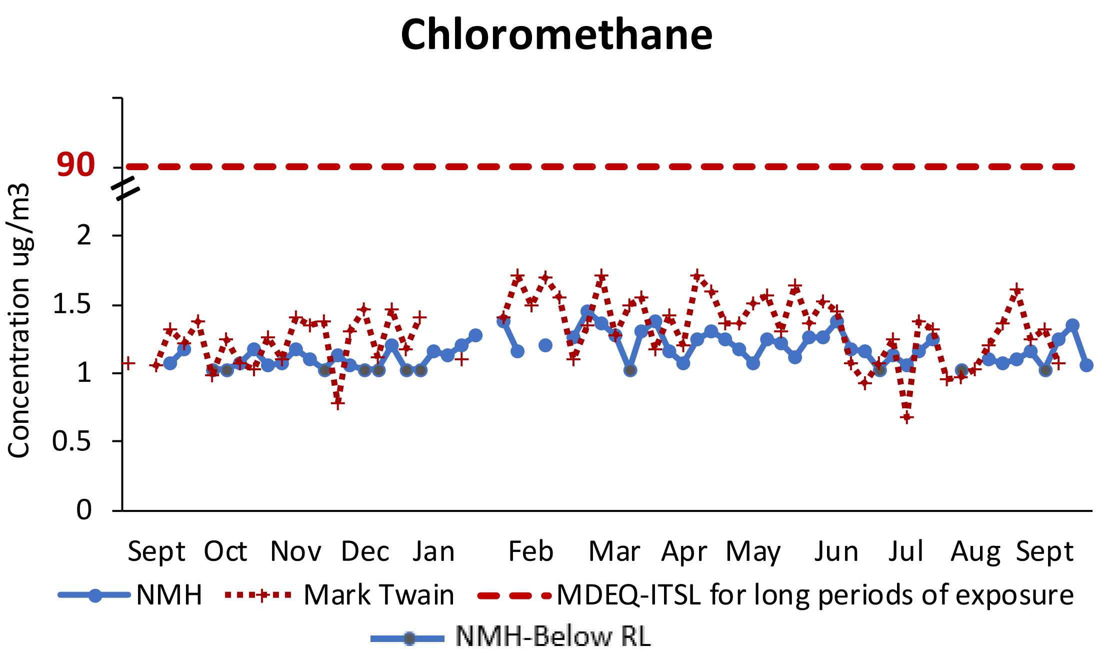
Sept
NMH
Marathon East
MDEQ-ITSL for long periods of exposure
NMH-Below RL
Marathon East-Below MDL


Chloromethane
Concentration ug/m3
90
2
1.5
1
0.5
0
Sept
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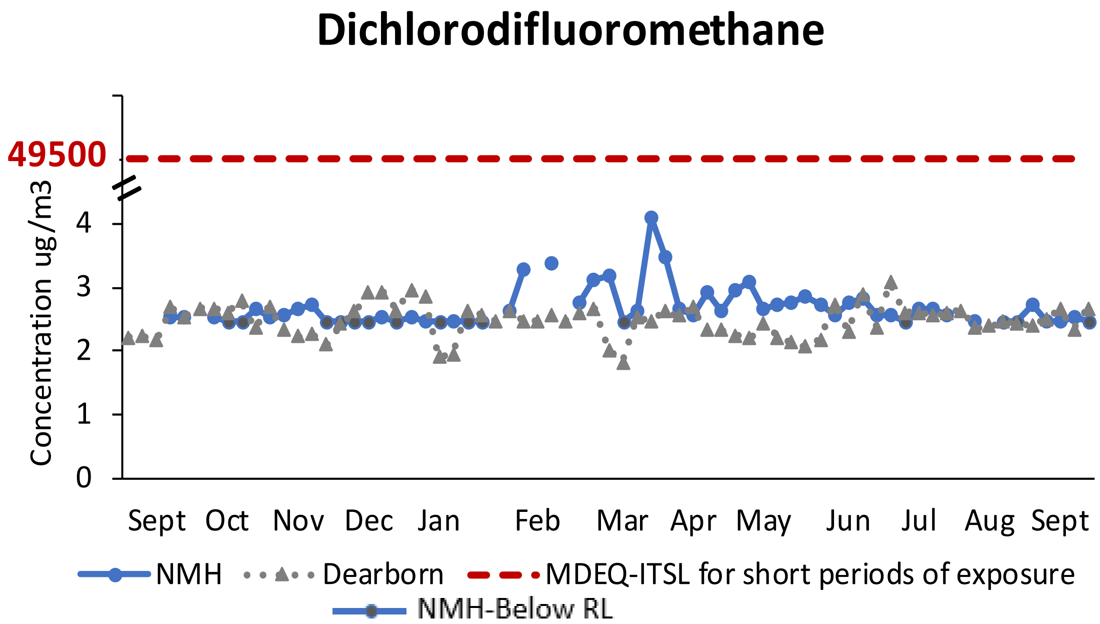
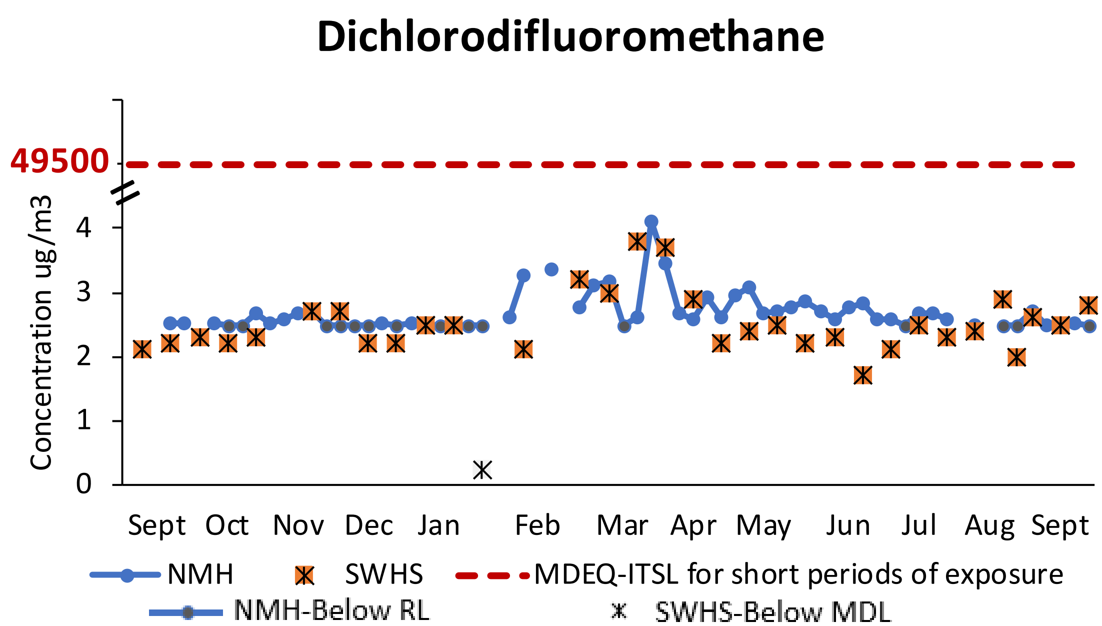
Jul
Aug
Sept
NMH
Mark Twain
MDEQ-ITSL for long periods of exposure
NMH-Below RL



Dichlorodifluoromethane
49500
Concentration ug/m3
4
3
2
1
0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Dearborn
MDEQ-ITSL for short periods of exposure
NMH-Below RL



Dichlorodifluoromethane
49500
Concentration ug/m3
4
3
2
1
0
Sept
Oct
Nov
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Jan
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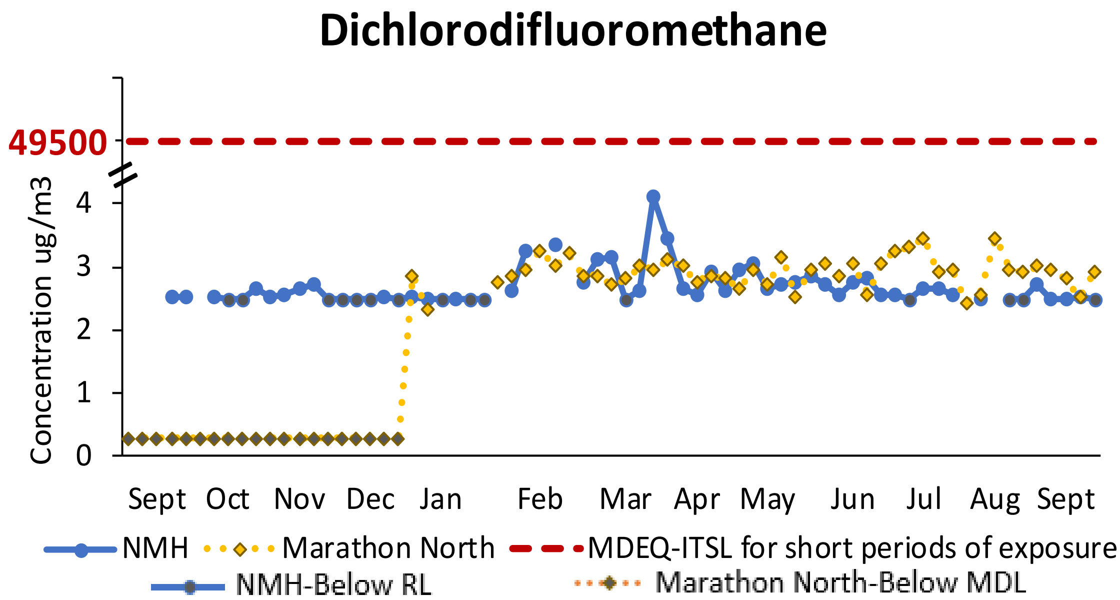
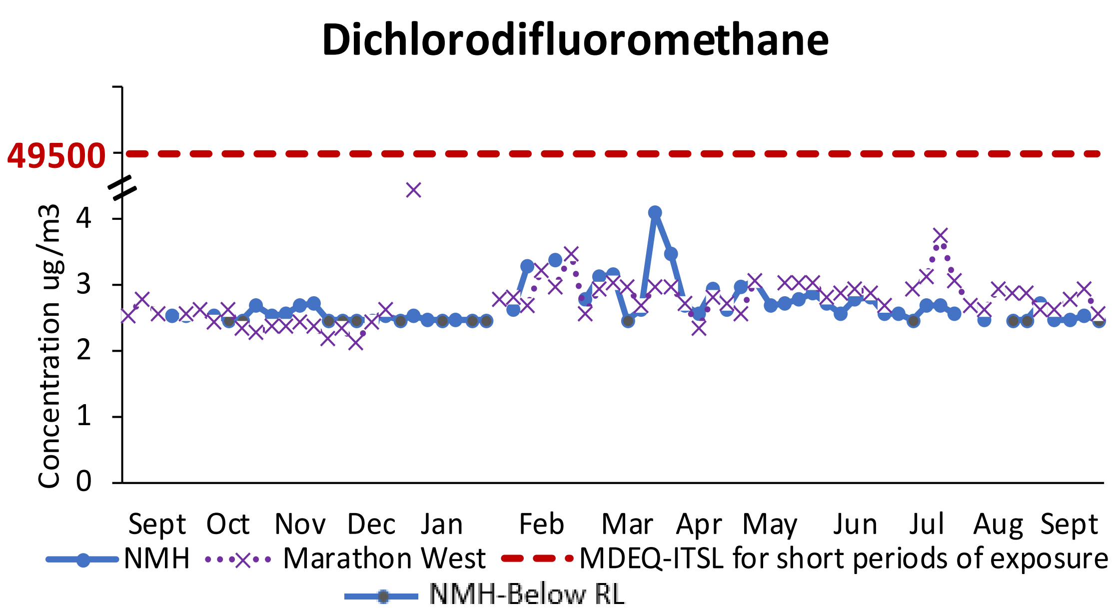
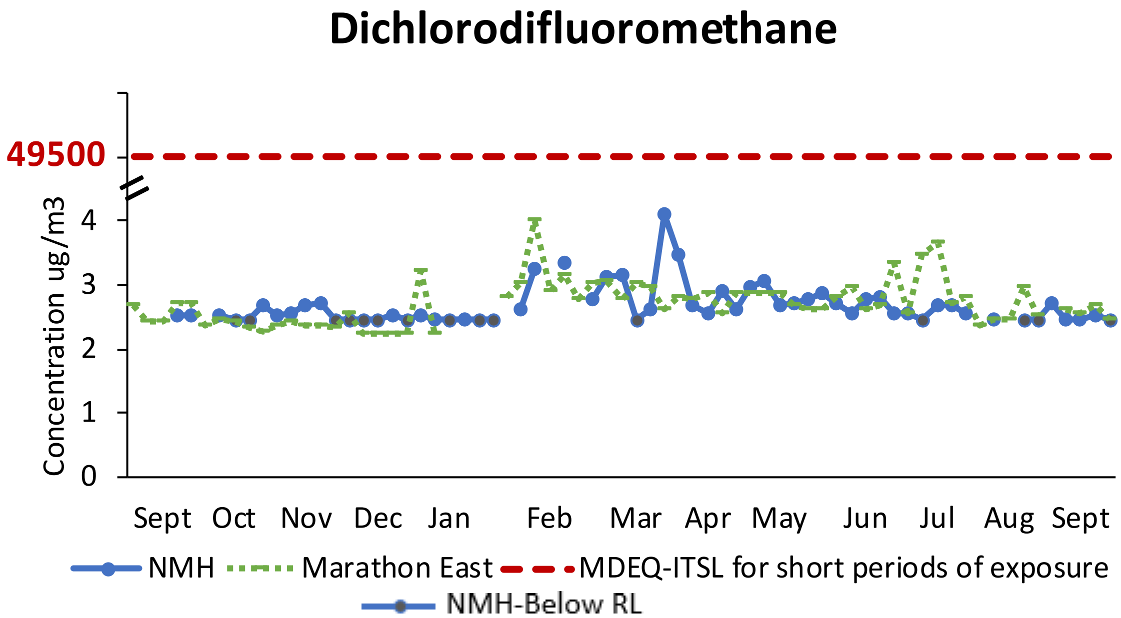
May
Jun
Jul
Aug
Sept
NMH
SWHS
MDEQ-ITSL for short periods of exposure
NMH-Below RL
SWHS-Below MDL


Dichlorodifluoromethane
49500
4
3
2
1
0
Concentration ug/m3
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon North
MDEQ-ITSL for short periods of exposure
NMH-Below RL
Marathon North-Below MDL


Dichlorodifluoromethane
49500
4
3
2
1
0
Concentration ug/m3
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon West
MDEQ-ITSL for short periods of exposure
NMH-Below RL



Dichlorodifluoromethane
49500
4
3
2
1
0
Concentration ug/m3
Sept
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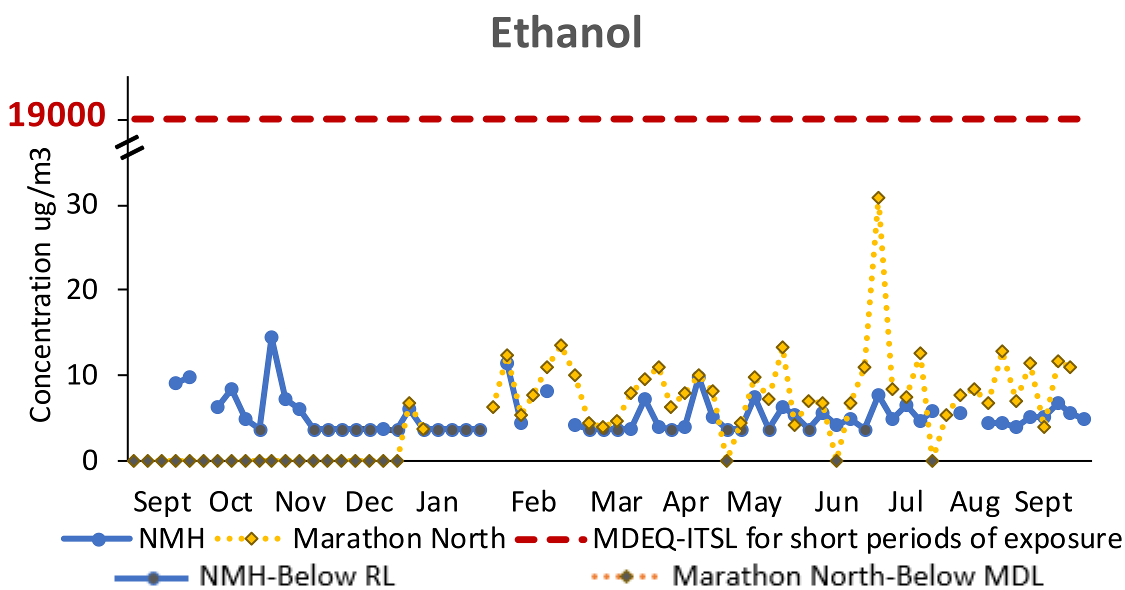
Aug
Sept
NMH
Marathon East
MDEQ-ITSL for short periods of exposure
NMH-Below RL


Ethanol
19000
Concentration ug/m3
30
20
10
0
Sept
Oct
Nov
Dec
Jan
Feb
Mar
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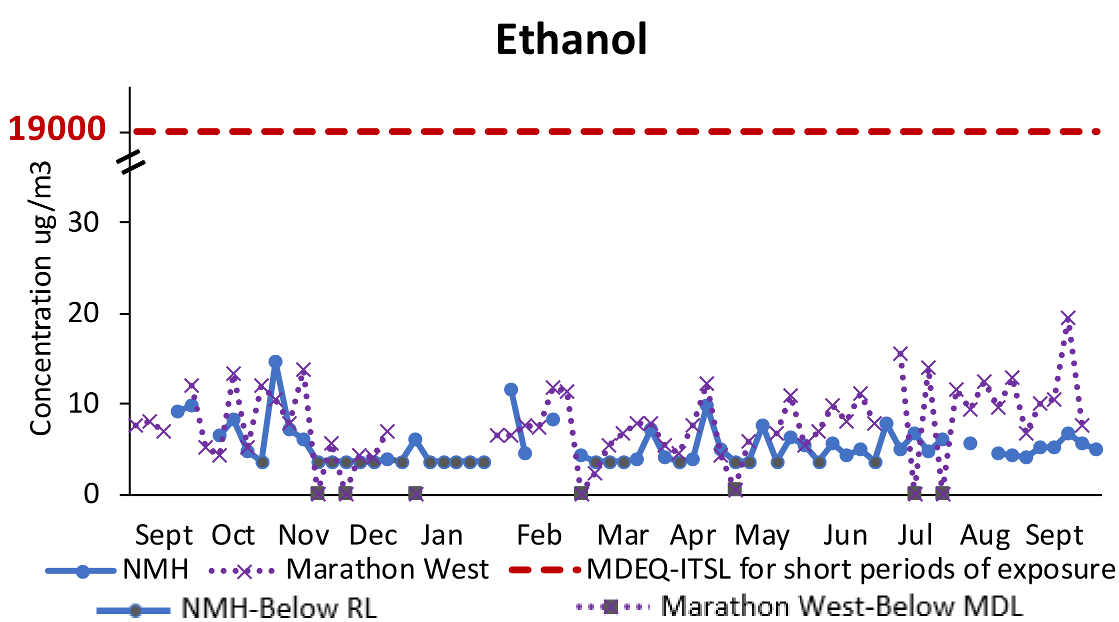
May
Jun
Jul
Aug
Sept
NMH
Marathon North
MDEQ-ITSL for short periods of exposure
NMH-Below RL
Marathon North-Below MDL


Ethanol
19000
Concentration ug/m3
30
20
10
0
Sept
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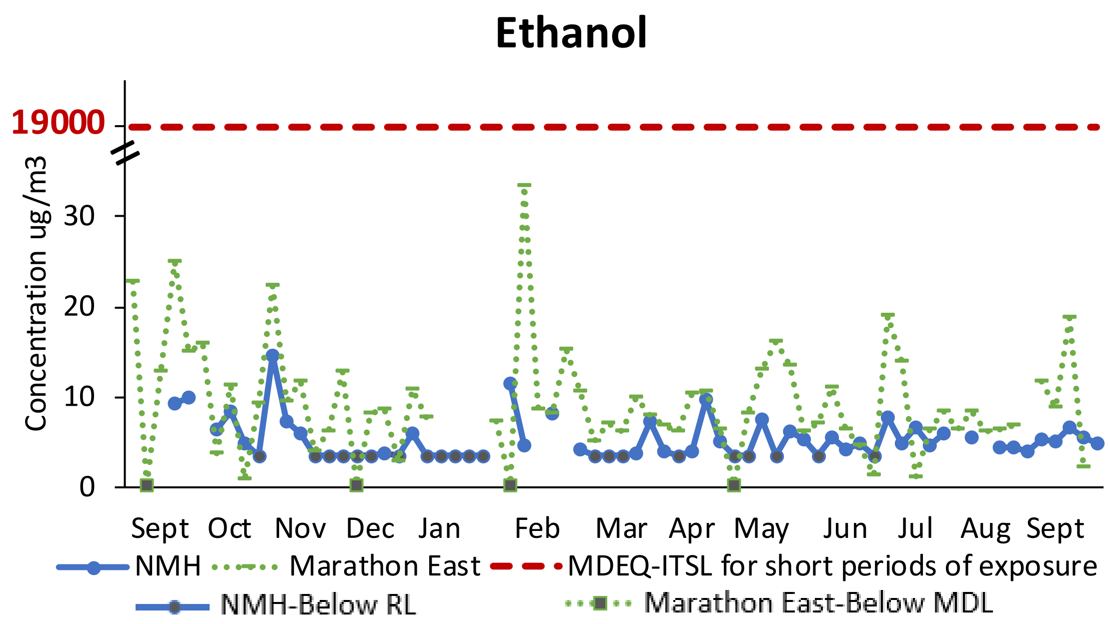
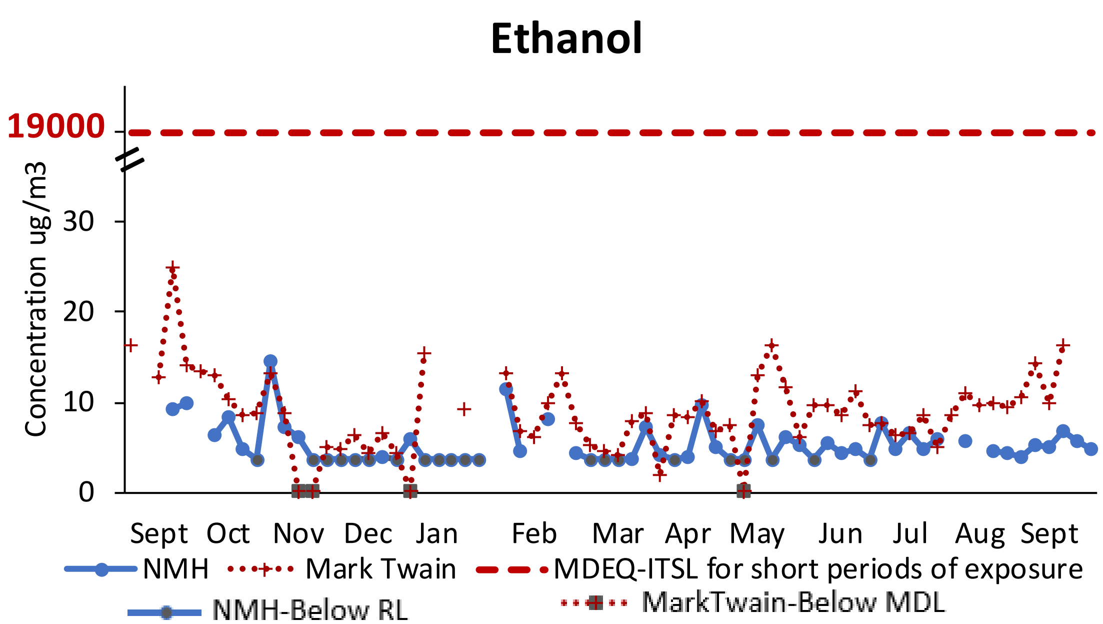
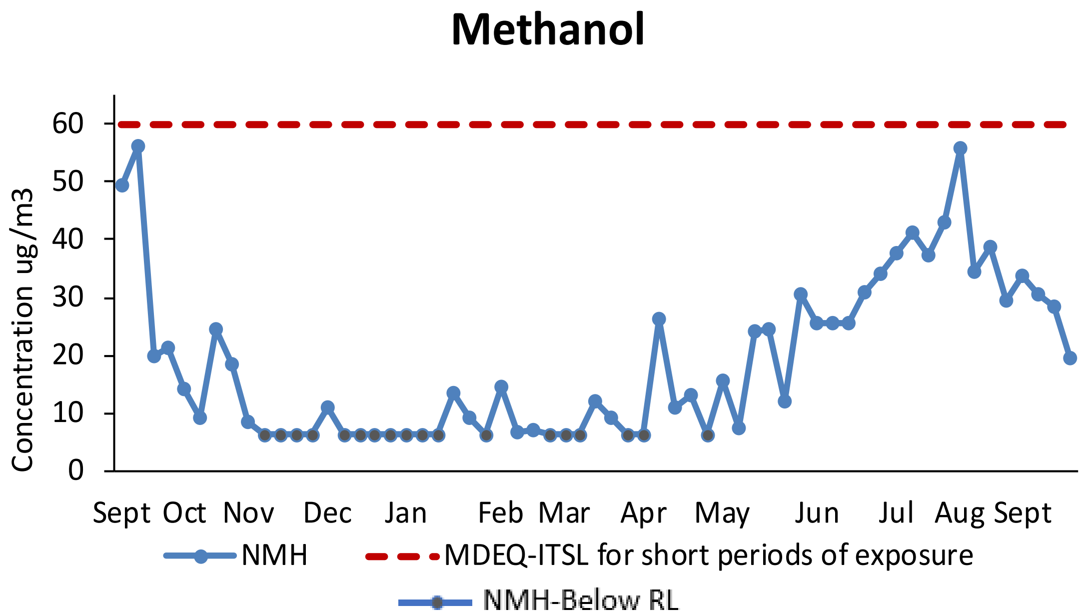
Sept
NMH
Marathon West
MDEQ-ITSL for short periods of exposure
NMH-Below RL
Marathon West-Below MDL


Ethanol
19000
Concentration ug/m3
30
20
10
0
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon East
MDEQ-ITSL for short periods of exposure
NMH-Below RL
Marathon East-Below MDL


Ethanol
19000
Concentration ug/m3
30
20
10
0
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Mark Twain
MDEQ-ITSL for short periods of exposure
NMH-Below RL
MarkTwain-Below MDL


Methanol
Concentration ug/m3
60
50
40
30
20
10
0
Sept
Oct
Nov
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Jan
Feb
Mar
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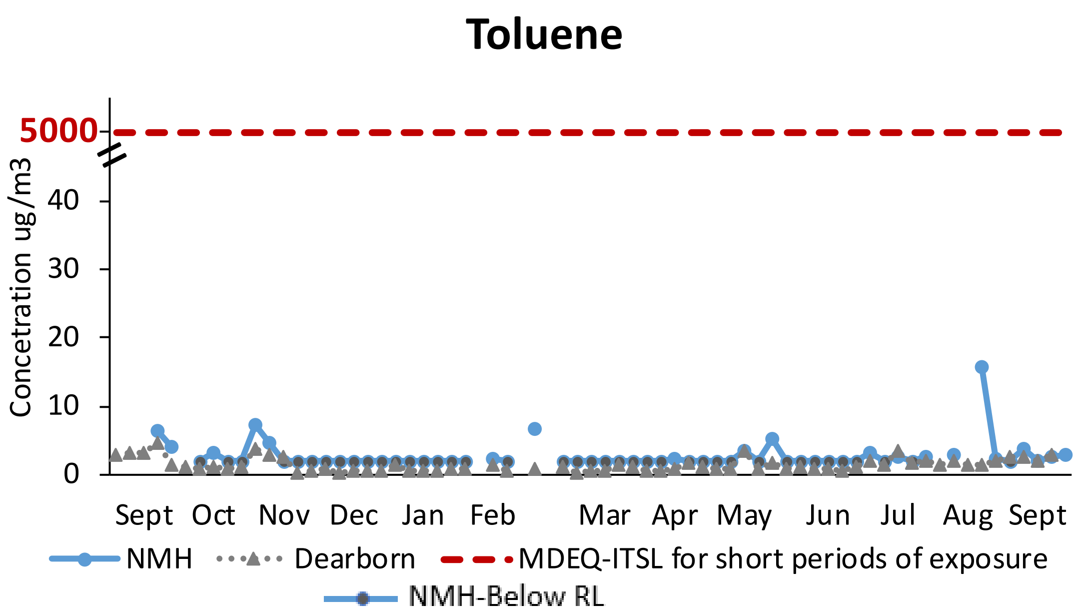
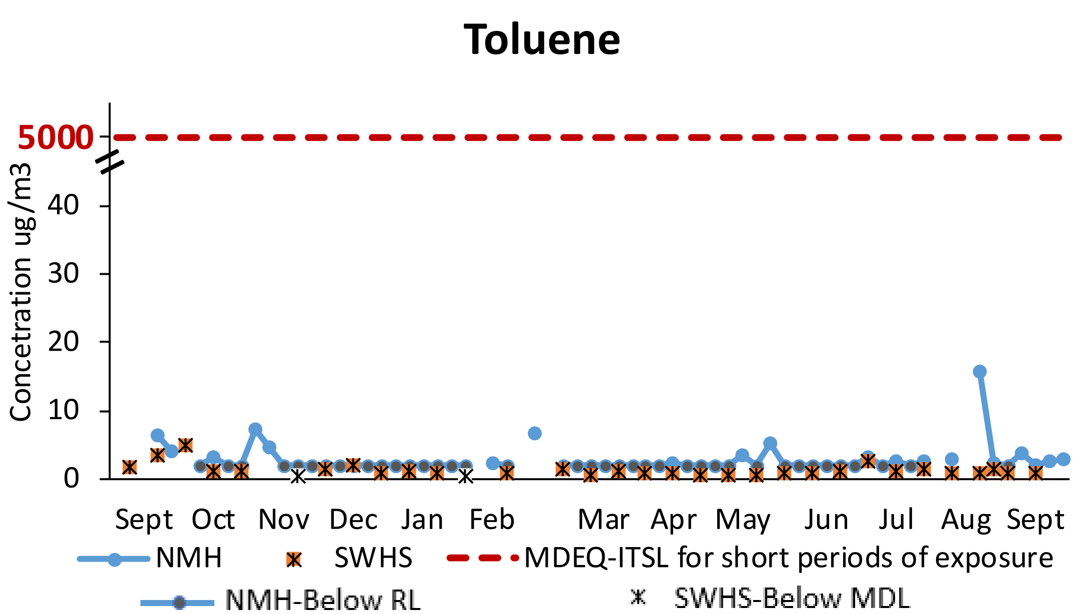
May
Jun
Jul
Aug
Sept
NMH
MDEQ-ITSL for short periods of exposure
NMH-Below RL


Toluene
5000
40
30
20
10
0
Concetration ug/m3
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
NMH
Dearborn
MDEQ-ITSL for short periods of exposure
NMH-Below RL


Toluene
5000
40
30
20
10
0
Concetration ug/m3
Sept
Oct
Nov
Dec
Jan
Feb
Mar
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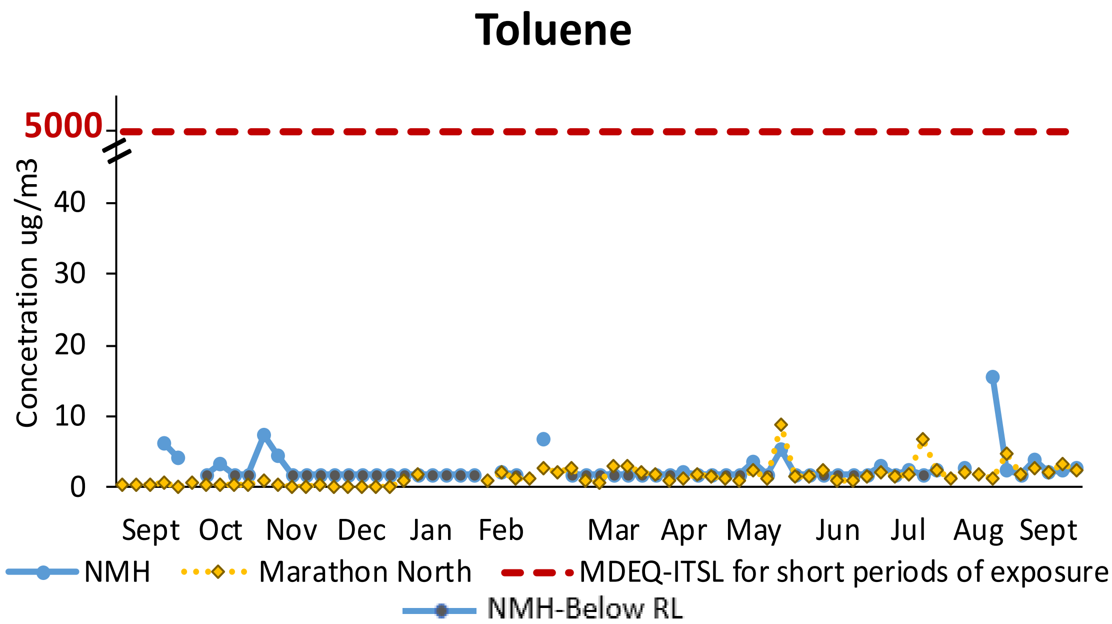
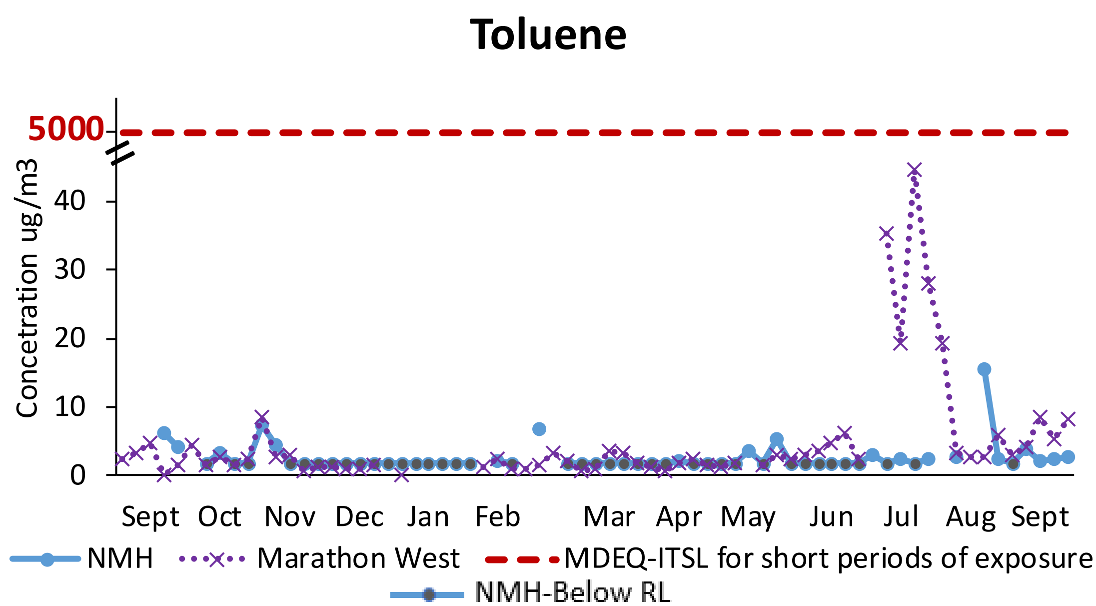
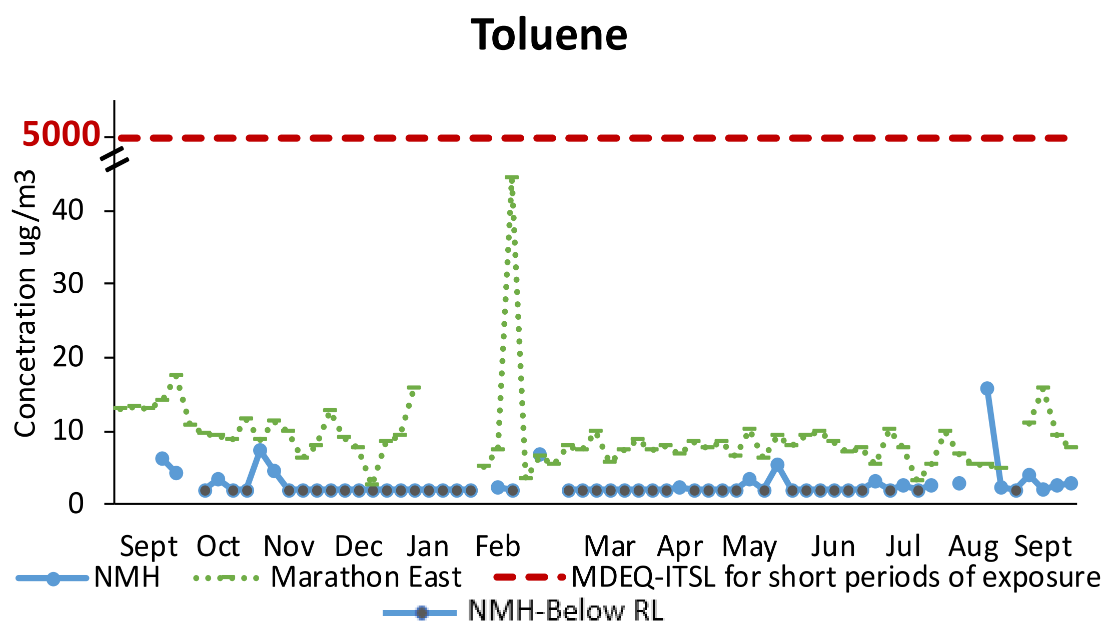
May
Jun
Jul
Aug
Sept
NMH
SWHS
MDEQ-ITSL for short periods of exposure
NMH-Below RL
SWHS-Below MDL


Toluene
5000
Concetration ug/m3
40
30
20
10
0
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon North
MDEQ-ITSL for short periods of exposure
NMH-Below RL


Toluene
5000
Concetration ug/m3
40
30
20
10
0
Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sept
NMH
Marathon West
MDEQ-ITSL for short periods of exposure
NMH-Below RL



Toluene
5000
40
30
20
10
0
Concetration ug/m3
Sept
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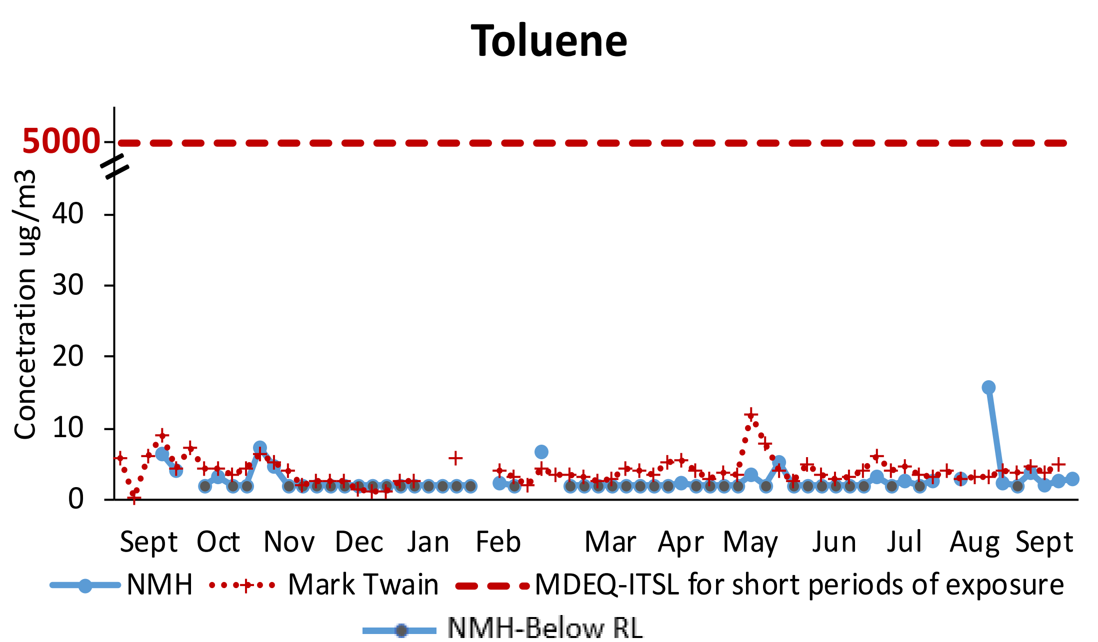
NMH
Marathon East
MDEQ-ITSL for short periods of exposure
NMH-Below RL



Toluene
5000
40
30
20
10
0
Concetration ug/m3
Sept
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NMH
Mark Twain
MDEQ-ITSL for short periods of exposure
NMH-Below RL

Appendix C: Evaluation of Sulfuric Acid Results

Summary
Two of the 53 sulfuric acid samples exceeded short-term health-based limits, where sulfuric acid was present at concentrations that could cause respiratory irritation and were also potentially at levels that would cause lung function changes. This led to further investigation into the potential health risks associated with these levels and the potential source(s) of these levels.

Methods and Results
Air sampling began on September 30, 2016, for sulfuric acid. Sulfuric acid samples were collected as described in Appendix A. Samples were analyzed by TestAmerica Laboratories, Inc., and the reporting limit provided by the laboratory was approximately 2 micrograms (µg) per sample or 37 micrograms per cubic meter (µg/m^3). Samples that gave results above the reporting limit are summarized in Table 1 along with wind speed and direction information taken from the meteorological data from the MDEQ Fort Street air monitoring site.

Table 1. Sulfuric Acid Sampling Results

Sample Date	H_2SO_4 in (µg/m³)	Wind speed (mph)/direction
9/30/2016	372	5/NE
11/8/2016	52	5/S-SW
11/26/2016	40	7/NW
4/7/2017	51	13/NW
4/25/2017	48	6/SE
5/19/2017	64	7/N
7/6/2017	40	5/SE, but variable
7/24/2017	677	10/N-NW
9/16/2017	57	5/S-SE

Background Levels of Sulfuric Acid
Sulfuric acid levels are not currently being monitored in the outdoor air by programs like the National Air Toxics Trends Stations. As a result, typical outdoor air levels of sulfuric acid are difficult to know. Around the 1980s, most sulfuric acid levels in the outdoor air in the United States were less than 5 µg/m^3 (ATSDR, 1998; Lioy and Waldman, 1989). These historical levels would be below the detection limit for an 8-hour sample collected with the method used in this study. Previous studies also show that higher levels occurred in the summer as compared to the winter, and higher levels occurred during the day as compared to the nighttime (ATSDR, 1998). One study estimated that peaks in sulfuric acid could have reached as high as 2,000 µg/m^3, with 1-hour averaging time during historical London air pollution episodes (Lioy and Waldman, 1989).

Short-term Health Limits of Sulfuric Acid:

There are a number of health limits for sulfuric acid from regulatory and health advisory agencies (Table 2). It should also be noted that sulfuric acid-related health limits from the Agency for Toxic Substances and Disease Registry (ATSDR) and the USEPA were considered, but not developed (ATSDR, 1998; USEPA, 1989). ATSDR, in particular, noted the complexity of factors that may influence health effects from sulfuric acid exposure. On the other hand, sulfuric acid has been well-studied, and all the short-term health limits listed below were derived with respect to health effects observed in controlled human studies. Furthermore, the AEGL-1 and MDEQ ITSL were derived with respect to controlled human studies that included the most sensitive known subpopulations, asthmatics.

Table 2. Health Limit for Sulfuric Acid

Health Limit (Agency Reference)	Health Limit (μg/m³), Averaging Time
AEGL-1 (USEPA, 2008)	200, 8-hr*
ITSL (MDEQ-AQD, 2015)**	120, 1-hr 1, annual
REL (NIOSH, 1978)	1000, 8-hr
TLV (ACGIH, 2004)	200, 8-hr***
PEL (OSHA, 2012)	1000, 8-hr

*AEGLs also have other averaging times (ATs). For sulfuric acid, all AEGL-1 values are 200 μg/m^3 regardless of the AT.
**These ITSLs were derived from CalEPA acute and chronic RELs.
***This benchmark is specifically applicable to thoracic particulate mass.

It is often most appropriate to use a health limit with the averaging time that matches the sample collection time. In this case, the averaging time would match an 8-hour sample collection time. Since sulfuric acid is expected to be a primary irritant where the health effects are dose-dependent and not time-dependent, health limits with either 1-hour or 8-hour averaging times are appropriate (USEPA, 2008). The MDEQ ITSL is based on a controlled study in asthmatics, where lung function changes were the critical effect and the no observable adverse effect level (NOAEL) was 450 μg/m^3 after 16 minutes of exposure. However, respiratory irritation has been shown to occur at 230 μg/m^3. So, the AEGL-1 is based on the more sensitive effect, but the MDEQ ITSL has been established at a level that is more health-protective. As a result, the MDEQ ITSL will be used in this evaluation because it is designed to be health protective for the public, including sensitive populations.

Health Risk Evaluation

As shown in Tables 1 and 2, there were two dates when sulfuric acid levels exceeded the short-term ITSL. Since respiratory irritation has been shown to occur at 230 μg/m^3, exposure to the levels measured on September 30 might cause a person to experience irritation symptoms like sore throat or coughing. However, even sensitive populations would probably not experience lung function changes. However, with exposure to the levels measured on July 24 (677 μg/m^3), an exposed person may have experienced both respiratory irritation and lung function changes, like bronchoconstriction.

With evaluating the health impacts from long periods of exposure, the 95% UCL is above the ITSL that protects against health effects from long periods of exposure. This ITSL is based on a controlled study in Cynomolgus monkeys, and lung changes were seen at 380 μg/m^3 after 78 weeks of exposure. Since there is no NOAEL, there is a lot of uncertainty about the level of sulfuric acid to which people may be exposed for a long period of time and not experience effects. Studies have shown that sulfuric acid can cause cancer in workplace settings (NTP, 2016). When enough information is available, these types of studies are used to calculate cancer risk levels. The cancer risk levels would be used to estimate the risk of the sulfuric acid levels that the public would breathe. However, there is a lack of information needed to determine a cancer risk level (MDEQ, 1996). And currently, no state or federal agency has calculated cancer risk levels for sulfuric acid. Furthermore, since the detection limit itself significantly contributes to the estimation of the level of sulfuric acid over a long period of time, there is a lot of uncertainty in the 95% UCL. As a result, there is not enough information from the current sampling results and the study used to derive the annual ITSL to reach conclusions about the public health significance of the long-term exposures.

Evaluation of Potential Sources

The results and the accompanying wind direction data were shared with the AQD district staff. The district staff were not able to identify an industrial source associated with elevated emissions of sulfuric acid. On the days when the two samples were collected that were above the health-based limits, the wind was out of the northern direction. However, there were other days when the wind direction was also out of the north, but the samples collected were non-detect for sulfuric acid. Collecting additional 8-hour samples for sulfuric acid are not practical for the identification of the source because the lag time between sampling and receiving the lab results is approximately 3 weeks. Instead, the AQD district staff is evaluating other techniques and strategies for identifying the source of sulfuric acid in the 48217 ZIP code.

Appendix D. Summary Statistics for New Mount Herman

This table describes the laboratory's ability to detect the pollutants. The average RL is the Reporting Limit, which is the value that the laboratory is confident in reporting. The MDL is the Method Detection Limit, which is the very lowest concentration the laboratory can detect and is based on repeating the analysis of known laboratory standards. Since the pollutant levels are not measured continuously, the true average level is not known. The mean is an estimate of the true annual average. The 95% UCL (upper confidence limit) is an estimate that is expected to be above the true annual average.

D.1 Criteria Pollutants:

Pollutants - 2017	Average	Maximum Value	Compares to (Standard)
Lead – Pb	0.004 µg/m^3	0.009 µg/m^3	0.004 µg/m^3 (3-month rolling: 0.15 µg/m^3)
$PM_{2.5}$	9.0 µg/m^3	1 hour: 122 µg/m^3 (July4th)	18 µg/m^3 (Daily 35) and 9.0 µg/m^3 (Annual 12)
SO_2	1.07 ppb	1 hour: 37.8 ppb	28 ppb (4th highest 1-hour value: 75 ppb)

µg/m^3: micrograms per cubic meter. *ppb: parts per billion*

D.2 Air Toxics:

Pollutants	Avg RL or MDL in µg/m^3	% Not Detected	Minimum Level Detected in µg/m^3	Maximum Level Detected in µg/m^3	95%UCL in µg/m^3	Mean in µg/m^3
1,1,1-Trichloroethane	2.7	100%	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	3.4	100%	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane	2.7	100%	N/A	N/A	N/A	N/A
1,1-Dichloroethane	2.0	100%	N/A	N/A	N/A	N/A
1,1-Dichloroethene	2.0	100%	N/A	N/A	N/A	N/A
1,2,4-Trichlorobenzene	3.7	100%	N/A	N/A	N/A	N/A
1,2,4-Trimethylbenzene	3.8	100%	N/A	N/A	N/A	N/A
1,2-Dibromoethane	3.8	100%	N/A	N/A	N/A	N/A
1,2-Dichlorobenzene	3.0	100%	N/A	N/A	N/A	N/A
1,2-Dichloroethane	2.0	100%	N/A	N/A	N/A	N/A
1,2-Dichloropropane	2.3	100%	N/A	N/A	N/A	N/A
1,3,5-Trimethylbenzene	3.8	100%	N/A	N/A	N/A	N/A
1,3-Butadiene	1.1	100%	N/A	N/A	N/A	N/A
1,3-Dichlorobenzene	3.0	100%	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	3.0	100%	N/A	N/A	N/A	N/A
1,4-Dioxane	1.8	100%	N/A	N/A	N/A	N/A
2,2,4-Trimethylpentane	2.3	100%	N/A	N/A	N/A	N/A
2-Propanol	4.8	43%	4.917	44.250	13.56	7.918
3-Chloropropene	1.6	100%	N/A	N/A	N/A	N/A
Acetone	4.6	26%	4.823	34.210	10.870	8.981
Benzene	1.6	97%	2.141	5.112	N/A	N/A
Bromodichloromethane	3.4	100%	N/A	N/A	N/A	N/A
Bromoform	5.2	100%	N/A	N/A	N/A	N/A
Bromomethane	1.9	100%	N/A	N/A	N/A	N/A

Pollutants	Avg RL or MDL in µg/m³	% Not Detected	Minimum Level Detected in µg/m³	Maximum Level Detected in µg/m³	95%UCL in µg/m³	Mean in µg/m³
Carbon Disulfide	1.6	97%	2.46	2.709	N/A	N/A
Carbon Tetrachloride	3.1	100%	N/A	N/A	N/A	N/A
Chlorobenzene	2.3	100%	N/A	N/A	N/A	N/A
Chlorodifluoromethane	1.8	97%	1.874	121.000	N/A	N/A
Chloroethane	1.3	100%	N/A	N/A	N/A	N/A
Chloroform	2.4	100%	N/A	N/A	N/A	N/A
Chloromethane	1.0	18%	1.053	1.446	1.077	0.976
Chloromethyl Benzene	2.6	100%	N/A	N/A	N/A	N/A
Cis-1,2-Dichloroethene	2.0	100%	N/A	N/A	N/A	N/A
Cis-1,3-Dischloropropene	2.3	100%	N/A	N/A	N/A	N/A
Cyclohexane	1.7	100%	N/A	N/A	N/A	N/A
Dibromochloromethane	4.3	100%	N/A	N/A	N/A	N/A
Dichlorodifluoromethane	2.5	33%	2.522	4.105	2.619	1.868
Dichlorofluoromethane	2.1	100%	N/A	N/A	N/A	N/A
Dichlorotetrafluoroethane	3.5	100%	N/A	N/A	N/A	N/A
Ethyl Acetate	1.8	98%	1.838	1.838	N/A	N/A
Ethyl Alcohol	3.7	34%	3.788	14.570	4.966	4.093
Ethylbenzene	2.2	100%	N/A	N/A	N/A	N/A
Furan, Tetrahydro-	1.5	100%	N/A	N/A	N/A	N/A
Heptane	2.0	100%	N/A	N/A	N/A	N/A
Hexachloro-1,3-butadiene	5.3	100%	N/A	N/A	N/A	N/A
M&P-Xylene	4.3	98%	5.559	5.559	N/A	N/A
Methanol	6.2	30%	6.79	56.240	20.45	17.07
Methyl Butyl Ketone	2.0	100%	N/A	N/A	N/A	N/A
Methyl Ethyl Ketone	2.9	92%	2.95	5.015	N/A	N/A
Methyl Isobutyl Ketone	2.0	100%	N/A	N/A	N/A	N/A
Methylene Chloride	3.4	100%	N/A	N/A	N/A	N/A
Methyltertiarybutylether	1.8	100%	N/A	N/A	N/A	N/A

Pollutants	Avg RL or MDL in µg/m3	% Not Detected	Minimum Level Detected in µg/m3	Maximum Level Detected in µg/m3	95%UCL in µg/m3	Mean in µg/m3
N-Hexane	1.8	87%	1.798	3.878	N/A	N/A
O-Xylene	2.2	100%	N/A	N/A	N/A	N/A
P-Ethyltoluene	2.5	100%	N/A	N/A	N/A	N/A
Propylene	1.7	100%	N/A	N/A	N/A	N/A
Styrene	2.1	100%	N/A	N/A	N/A	N/A
Tetrachloroethene	3.4	100%	N/A	N/A	N/A	N/A
Toluene	1.9	67%	2.035	15.640	2.205	1.402
Trans-1,2-Dichloroethene	2.0	100%	N/A	N/A	N/A	N/A
Trans-1,3-Dichloropropene	2.3	100%	N/A	N/A	N/A	N/A
Trichloroethene	2.7	100%	N/A	N/A	N/A	N/A
Trichlorofluoromethane	2.8	100%	N/A	N/A	N/A	N/A
Trichlorotrifluoroethane	3.8	100%	N/A	N/A	N/A	N/A
Vinyl Acetate	3.5	100%	N/A	N/A	N/A	N/A
Vinyl Bromide	2.2	100%	N/A	N/A	N/A	N/A
Vinyl Chloride	1.3	100%	N/A	N/A	N/A	N/A
Hydrochloric acid	40	100%	N/A	N/A	N/A	N/A
Hydrogen cyanide	40	100%	N/A	N/A	N/A	N/A
Sulfuric acid	35	83%	40	677	119	57
Arsenic	0.0000084	0%	1.30E-04	0.005	0.00168	0.00119
Barium	0.0003348	0%	0.00553	0.047	0.0169	0.0153
Beryllium	0.0000056	0%	6.00E-06	0.000	0.000	0.000
Cadmium	0.0000084	0%	3.00E-05	0.001	0.000	0.000
Chromium	0.0001345	0%	0.00127	0.008	0.003	0.003
Cobalt	0.0000200	0%	7.00E-05	0.000	0.000	0.000
Iron	0.0030682	0%	0.124	1.128	0.495	0.446
Lead	0.0000000	0%	8.90E-04	0.009	0.004	0.004
Manganese	0.0000564	0%	0.0044	0.096	0.028	0.025
Molybdenum	0.0000100	0%	8.00E-05	0.006	0.001	0.001
Nickel	0.0000515	0%	7.80E-04	0.008	0.002	0.002
Vanadium	0.0000200	0%	1.90E-04	0.006	0.002	0.001
Zinc	0.0011050	0%	0.011	0.109	0.0505	0.0382

Pollutants	Avg RL or MDL in µg/m³	% Not Detected	Minimum Level Detected in µg/m³	Maximum Level Detected in µg/m³	95%UCL in µg/m³	Mean in µg/m³
1,2,4-Trichlorobenzene	0.03	100%	N/A	N/A	N/A	N/A
2,4,5-Trichlorophenol	0.03	100%	N/A	N/A	N/A	N/A
2,4,6-Trichlorophenol	0.17	100%	N/A	N/A	N/A	N/A
2,4-Dichlorophenol	0.03	100%	N/A	N/A	N/A	N/A
2,4-Dimethylphenol	0.03	100%	N/A	N/A	N/A	N/A
2,4-Dinitrophenol	0.17	100%	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	0.03	100%	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	0.03	100%	N/A	N/A	N/A	N/A
2-Chloronaphthalene	0.03	100%	N/A	N/A	N/A	N/A
2-Chlorophenol	0.03	100%	N/A	N/A	N/A	N/A
2-Methylnaphthalene	0.01	58%	0.035	0.074	0.028	0.022
2-Nitroaniline	0.03	100%	N/A	N/A	N/A	N/A
2-Nitrophenol	0.17	100%	N/A	N/A	N/A	N/A
3,3-Dichlorobenzidine	0.03	100%	N/A	N/A	N/A	N/A
3-Nitroaniline	0.03	100%	N/A	N/A	N/A	N/A
4-Bromophenyl phenyl ether	0.03	100%	N/A	N/A	N/A	N/A
4-Chloro-3-methylphenol	0.17	100%	N/A	N/A	N/A	N/A
4-Chloroaniline	0.03	100%	N/A	N/A	N/A	N/A
4-Chlorophenyl phenyl ether	0.03	100%	N/A	N/A	N/A	N/A
4-Nitroaniline	0.17	100%	N/A	N/A	N/A	N/A
4-Nitrophenol	0.17	100%	N/A	N/A	N/A	N/A
Acenaphthene	0.03	100%	N/A	N/A	N/A	N/A
Acenaphthylene	0.03	100%	N/A	N/A	N/A	N/A
Anthracene	0.03	100%	N/A	N/A	N/A	N/A
Benz(a)anthracene	0.03	100%	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.03	100%	N/A	N/A	N/A	N/A
Benzo(g,h,i)perylene	0.03	100%	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.03	100%	N/A	N/A	N/A	N/A
Benzo[b]fluoranthene	0.03	100%	N/A	N/A	N/A	N/A
Benzoic acid	0.17	99%	0.17	0.17	N/A	N/A
Benzyl alcohol	0.03	100%	N/A	N/A	N/A	N/A
Bis(2-chloroethoxy)methane	0.03	100%	N/A	N/A	N/A	N/A
Bis(2-chloroethyl) ether	0.03	100%	N/A	N/A	N/A	N/A
Bis(2-chloroisopropyl)ether	0.03	100%	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	0.03	100%	N/A	N/A	N/A	N/A
Butyl benzyl phthalate	0.03	100%	N/A	N/A	N/A	N/A

Pollutants	Avg RL or MDL in µg/m^3	% Not Detected	Minimum Level Detected in µg/m^3	Maximum Level Detected in µg/m^3	95%UCL in µg/m^3	Mean in µg/m^3
Chrysene	0.03	100%	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	0.03	100%	N/A	N/A	N/A	N/A
Dibenzofuran	0.03	100%	N/A	N/A	N/A	N/A
Diethyl phthalate	0.02	95%	0.044	0.058	N/A	N/A
Dimethyl phthalate	0.03	100%	N/A	N/A	N/A	N/A
Di-n-butyl phthalate	0.07	100%	N/A	N/A	N/A	N/A
Dinitro-o-cresol (4,6-dinitro-2-methyl phenol)	0.17	100%	N/A	N/A	N/A	N/A
Di-n-octyl phthalate	0.03	100%	N/A	N/A	N/A	N/A
Fluoranthene	0.03	100%	N/A	N/A	N/A	N/A
Fluorene	0.03	100%	N/A	N/A	N/A	N/A
Hexachloro-1,3-butadiene	0.03	100%	N/A	N/A	N/A	N/A
Hexachloro-1,3-cyclopentadiene	0.17	100%	N/A	N/A	N/A	N/A
Hexachlorobenzene	0.03	100%	N/A	N/A	N/A	N/A
Hexachloroethane	0.01	99%	0.039	0.039	N/A	N/A
Indeno(1,2,3-cd)pyrene	0.03	100%	N/A	N/A	N/A	N/A
Isophorone	0.03	100%	N/A	N/A	N/A	N/A
m-Cresol (3-methylphenol)	0.17	100%	N/A	N/A	N/A	N/A
m-Dichlorobenzene (1,3-dichloro benzene)	0.03	100%	N/A	N/A	N/A	N/A
Naphthalene	0.01	20%	0.034	0.146	0.072	0.062
Nitrobenzene	0.03	100%	N/A	N/A	N/A	N/A
N-Nitrosodimethylamine	0.03	100%	N/A	N/A	N/A	N/A
N-Nitrosodi-n-propylamine	0.03	100%	N/A	N/A	N/A	N/A
N-Nitrosodiphenylamine	0.03	100%	N/A	N/A	N/A	N/A
o-Cresol (2-methylphenol)	0.03	100%	N/A	N/A	N/A	N/A
o-Dichlorobenzene (1,2-dichlorobenzene)	0.03	100%	N/A	N/A	N/A	N/A
p-Cresol (4-methylphenol)	0.17	100%	N/A	N/A	N/A	N/A
p-Dichlorobenzene (1,4-dichlorobenzene)	0.03	100%	N/A	N/A	N/A	N/A
Pentachlorophenol	0.17	100%	N/A	N/A	N/A	N/A
Phenanthrene	0.03	100%	N/A	N/A	N/A	N/A
Phenol	0.03	100%	N/A	N/A	N/A	N/A
Pyrene	0.03	100%	N/A	N/A	N/A	N/A

Appendix E. Descriptions of Health Protective Limits for Air Toxics

The health protective limits for air toxics used in this study are the initial threshold screening levels (ITSLs) and initial risk screening levels (IRSLs). ITSLs and IRSLs are used in the AQD's permitting program. ITSLs and IRSLs are developed to protect against the most sensitive health effect (critical effect) that a pollutant might cause. They are also developed to reflect the best toxicological results available at the time. They are often developed from health limits from other state or federal environmental agencies.

References listed in the Health Limit Description Table
USEPA Integrated Risk Information System (EPA IRIS)
American Conference of Governmental Industrial Hygienists Threshold Limit Value (ACGIH TLV)
Agency for Toxic Substances and Disease Registry Minimal Risk Level (ATSDR MRL)
California Environmental Protection Agency Reference Exposure Level (CALEPA REL)
National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH REL)
National Toxicology Program (NTP)
USEPA Health Effects Assessment Summary Tables (EPA HEAST)
Scientific Advisory Panel (SAP)
USEPA Provisional Peer-Reviewed Toxicity Values (EPA PPRTV)

Chemical Name (CAS#)	ITSL in µg/m^3 based on averaging time				IRSL in µg/m^3
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
ACIDS: Hydrogen Chloride (7647-01-0)	20 (Respiratory; EPA IRIS)			2100 (Respiratory; CalEPA REL)	
Hydrogen Cyanide (57-12-5)	0.8 (endocrine; EPA IRIS)			50 (Respiratory; ACGIH TLV ceiling)	
Sulfuric Acid (7664-93-9)	1 (respiratory; CalEPA REL)			120 (respiratory; CalEPA REL)	
METALS: Arsenic (7440-38-2)					0.0002 (lung; EPA IRIS)
Barium (7440-39-3)			5 (respiratory; ACGIH TLV)		
Beryllium (7440-41-7)		0.02 (respiratory; EPA IRIS)			0.0004 (lung; EPA IRIS)
Cadmium (7440-43-9)					0.0006 (lung; EPA IRIS)
Total Chromium (But Considered Trivalent (16065-83-1)			5 (respiratory; ACGIH TLV)		
Hexavalent Chromium (18540-29-9)	0.1 particulate (respiratory, EPA IRIS) 0.008 mist (nasal septum atrophy, EPA IRIS)				0.000083 (lung; EPA IRIS)
Cobalt (7440-48-4)			0.2 (respiratory; ACGIH TLV)		
Copper (7440-50-8)			2 (respiratory; ACGIH TLV)		

Chemical Name (CAS#)	ITSL in μg/m^3 based on averaging time				IRSL in μg/m^3
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
Iron (Considered under PM_{10}) (7439-89-6)					
Lead (7439-92-1)					
Manganese (7439-96-5)	0.3 (neurological; ATSDR MRL)				
Molybdenum (7439-98-7)			30 (respiratory; ACGIH TLV)		
Nickel (7440-02-0)					0.0058 (respiratory; EPA IRIS)
Vanadium (using ITSL for vanadium pentoxide (1314-62-1)				0.5 (respiratory; NIOSH REL)	
Zinc (Considered under zinc stearate (557-05-1)			50 (respiratory; NIOSH REL)		
PAHs and VOCs:					
Naphthalene (91-20-3)	3 (respiratory; EPA IRIS)		520 (ocular; ACGIH TLV)		0.08 (nasal; NTP)
1,1,1-Trichloroethane (71-55-6)		6000 (neurological; EPA IRIS)			
1,1,2,2-Tetrachloroethane (79-34-5)					0.02 (liver; EPA IRIS)
1,1,2-Trichloroethane (79-00-5)					0.06 (liver; EPA IRIS)
1,1-Dichloroethane (75-34-3)	500 (renal; EPA HEAST)				

Chemical Name (CAS#)	ITSL in μg/m³ based on averaging time				IRSL in μg/m³
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
1,1-Dichloroethene (75-35-4)	200 (liver; EPA IRIS)				
1,2,4-Trichlorobenzene (120-82-1)	4 (renal; AQD)				
1,2,4-Trimethylbenzene (95-63-6)	185 (neurological; EPA IRIS)		1200 (respiratory; ACGIH TLV)		
1,2-Dibromoethane (106-93-4)	9 (nasal; EPA IRIS)				0.002 (nasal; EPA IRIS)
1,2-Dichlorobenzene (95-50-1)	300 (kidney; EPA IRIS)				
1,2-Dichloroethane (107-06-2)					0.04 (circulatory; EPA IRIS)
1,2-Dichloropropane (78-87-5)	4 (nasal; EPA IRIS)				0.2 (nasal; AQD)
1,3,5-Trimethylbenzene (108-67-8)	185 (neurological; EPA IRIS)		1200 (respiratory; ACGIH TLV)		
1,3-Butadiene (106-99-0)	33(ovary; TCEQ)				0.03 (leukemia; EPA IRIS)
1,3-Dichlorobenzene (541-73-1)	3 (thyroid; AQD)				
1,4-Dichlorobenzene (106-46-7)	800 (liver; EPA IRIS)				0.25 (liver; AQD)
1,4-Dioxane (123-91-1)	100 (nasal; EPA IRIS)			7200 (eyes, nose, and throat irritation; AQD)	0.2 (multi-organ; EPA IRIS)
2,2,4-Trimethylpentane (540-84-1)			3500 (neurological; NIOSH REL)		

Chemical Name (CAS#)	ITSL in µg/m³ based on averaging time				IRSL in µg/m³
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
2,4,5-Trichlorophenol (95-95-4)	350 (liver and urinary; EPA IRIS)				
2,4,6-Trichlorophenol (88-06-2)					0.3 (Leukemia; EPA IRIS)
2,4-Dichlorophenol (120-83-2)		11 (immune; EPA IRIS)			
2,4-Dimethylphenol (105-67-9)	70 (nervous; hematologic; EPA IRIS)				
2,4-Dinitrophenol (51-28-5)	7 (ocular; EPA IRIS)				
2,4-Dinitrotoluene (121-14-2)			2 (hematologic and nervous; ACGIH TLV)		0.009 (renal; AQD)
2-Chlorophenol (95-57-8)		18 (reproductive; EPA IRIS)			
2-Methylnaphthalene (91-57-6)	10 (respiratory; AQD LC50)				
2-Nitrophenol (88-75-5)		18 (Respiratory; AQD)			
2-Propanol (67-63-0)	220 (neurological; AQD SAP)				
3,3-Dichlorobenzidine (91-94-1)					0.002 (bladder; AQD)
3-Chloropropene (107-05-1)	1 (neurological; EPA IRIS)		31 (neurological; ACGIH TLV)		
4-Nitrophenol (100-02-7)	0.7 (ocular; AQD)				

Chemical Name (CAS#)	ITSL in µg/m³ based on averaging time				IRSL in µg/m³
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
Acenaphthene (83-32-9)	210 (liver; EPA IRIS)				
Acenaphthylene (208-96-8)	35 (Mortality, liver and renal; AQD)				
Acetone (67-64-1)			5900 (irritation and neurological; NIOSH REL)		
Acetonitrile (75-05-8)	200 (mortality; EPA IRIS)				
Anthracene (120-12-7)	1000 (no effects seen; EPA IRIS)				
Acrylonitrile (107-13-1)	2 (respiratory; EPA IRIS)				0.01 (gastral; nervous; respiratory; EPA IRIS)
Benz(a)anthracene (56-55-3)					Based on benzo (a) pyrene IRSL
Benzene (71-43-2)	30 (immune; EPA IRIS)	30 (immune; ATSDR MRL)			0.1 (leukemia; EPA IRIS)
Benzo(a)pyrene (50-32-8)		0.002 (fetal; EPA IRIS)			0.001 (respiratory and gastral; EPA IRIS)
Benzo[b]fluoranthene (205-99-2)					Based on benzo (a) pyrene IRSL
Benzo(g,h,i)perylene (191-24-2)	13 (respiratory; AQD)				

Chemical Name (CAS#)	ITSL in μg/m^3 based on averaging time				IRSL in μg/m^3
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
Benzo(k)fluoranthene (207-08-9)					Based on benzo (a) pyrene IRSL
Benzyl alcohol (100-51-6)	5000 (body weight; AQD)				
Bis (2-chloroisopropyl) ether (108-60-1)	140 (hematologic; EPA IRIS)				
Bis(2-chloroethyl) ether (111-44-4)					0.003 (liver; EPA IRIS)
Bis(2-ethylhexyl)phthalate (117-81-7)	70 (liver; EPA IRIS)				0.61 (liver; EPA IRIS)
Bromodichloromethane (75-27-4)					0.06 (urinary; EPA IRIS)
Bromoform (75-25-2)					0.9 (gastral; EPA IRIS)
Bromomethane (74-83-9)	5 (respiratory; EPA IRIS)				
Butyl benzyl phthalate (85-68-7)	700 (liver; EPA IRIS)				
Carbon Disulfide (75-15-0)	700 (neurological; EPA IRIS)				
Carbon Tetrachloride (56-23-5)	480 (liver; EPA IRIS)				0.17 (adrenal; EPA IRIS)
Chlorobenzene (108-90-7)	50 (kidney; EPA PPRTV)		440 (irritation and neurological; AQD)		
Chlorodifluoromethane (75-45-6)	50000 (kidney, adrenal, pituitary; EPA IRIS)				

Chemical Name (CAS#)	ITSL in µg/m^3 based on averaging time				IRSL in µg/m^3
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
Chloroethane (75-00-3)		10000 (fetotoxicity; EPA IRIS)			
Chloroform (67-66-3)					0.4 (kidney; AQD)
Chloromethane (74-87-3)	90 (brain; EPA IRIS)				
Chloromethyl Benzene (27987-13-9)					
Chrysene (218-01-9)					Based on benzo (a) pyrene IRSL
Cis-1,2-Dichloroethene (156-59-2)	18 (kidney; EPA IRIS)				
Cis-1,3-Dichloropropene (542-75-6)	20 (nasal; EPA IRIS)				0.2 (lung; EPA IRIS)
Cyclohexane (110-82-7)		6000 (developmental; EPA IRIS)			
Dibromochloromethane (124-48-1)	70 (liver; EPA IRIS)				0.042 (liver; AQD)
Dichlorodifluoromethane (75-71-8)			49500 (liver; ACGIH TLV)		
Dichlorofluoromethane (75-43-4)					
Dichlorotetrafluoroethane (76-14-2)			69000 (respiratory; ACGIH TLV)		
Dibenzofuran (132-64-9)	40 (reduced organ weights and excess fat;EPA PPRTV)				
Dibenz(a,h)anthracene (53-70-3)					Based on benzo (a) pyrene IRSL

Chemical Name (CAS#)	ITSL in µg/m³ based on averaging time				IRSL in µg/m³
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
Dimethyl phthalate (131-11-3)			50 (irritation; ACGIH TLV)		
Di-n-butyl phthalate (84-74-2)			50 (irritation; ACGIH TLV)		
Di-n-octyl phthalate (117-84-0)	470 (liver and thyroid; AQD)				
Dinitro-o-cresol (534-52-1)			2 (metabolic; ACGIH TLV)		
Ethyl Acetate (141-78-6)	3200 (liver; EPA IRIS)				
Ethyl Alcohol (64-17-5)				19000 (fetotoxicity; ACGIH TLV)	
Ethylbenzene (100-41-4)		1000 (developmental; EPA IRIS)			0.4 (kidney; AQD)
Fluoranthene (206-44-0)	140 (liver and urinary; EPA IRIS)				
Fluorene (86-73-7)	140 (hematologic; EPA IRIS)				
Tetrahydrofuran (109-99-9)	8000 (liver and neurological; AQD)				
Heptane (142-82-5)			3500 (NIOSH REL)		
Hexachloro-1,3-Butadiene (87-68-3)					0.05 (kidney; EPA IRIS)
Hexachloro-1,3-cyclopentadiene (77-47-4)	0.2 (respiratory; EPA IRIS)				

Chemical Name (CAS#)	ITSL in µg/m³ based on averaging time				IRSL in µg/m³
	Annual (critical effect; reference)	**24-hr (critical effect; reference)**	**8-hr (critical effect; reference)**	**1-hr (critical effect; reference)**	**(Type of cancer; reference)**
Hexachlorobenzene (118-74-1)		0.35 (reproductive; ATSDR MRL)			0.0022 (liver; EPA IRIS)
Indeno(1,2,3-cd)pyrene (193-39-5)					Based on benzo (a) pyrene IRSL
Isophorone (78-59-1)				280 (irritation, nervous and malaise; ACGIH TLV)	3.7 (reproductive; EPA IRIS)
M-Cresol (108-39-4)			100 (nervous; NIOSH REL)		
M-Dichlorobenzene (541-73-1)	3 (thyroid; AQD)				
M/P-Xylene (108-38-3/106-42-3)	390 (impaired motor coordination; EPA IRIS)				
Methyl Butyl Ketone (591-78-6)	30 (neurological; EPA IRIS)				
Methyl Ethyl Ketone (78-93-3)		5000 (developmental; EPA IRIS)			
Methyl Isobutyl Ketone (108-10-1)			820 (neurological; ACGIH TLV)		2 (leukemia; AQD)
Methylene Chloride (75-09-2)	2000 (liver; EPA IRIS)			14000 (neurological; Cal EPA short-term REL)	60 (liver; EPA IRIS)
Methyl Tertiary-Butyl Ether (1634-04-4)	3000 (liver and kidney; EPA IRIS)				
N-Hexane (110-54-3)	700 (neurological; EPA IRIS)				

Chemical Name (CAS#)	ITSL in µg/m^3 based on averaging time				IRSL in µg/m^3
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
N-Nitrosodi-n-propylamine (621-64-7)					0.0005 (liver; AQD)
N-Nitrosodimethylamine (62-75-9)					0.00007 (liver; EPA IRIS)
Nitrobenzene (98-95-3)	9 (nervous and respiratory; EPA IRIS)				0.025 (endocrine, liver, urinary; EPA IRIS)
O-Cresol (95-48-7)			100 (nervous; NIOSH REL)		
O-Dichlorobenzene (95-50-1)	300 (no effects seen; EPA IRIS)				0.25 (liver; AQD)
O-Xylene (95-47-6)	390 (impaired motor coordination; EPA IRIS)				
P-Cresol (106-44-5)			100 (nervous; NIOSH REL)		
P-Dichlorobenzene (106-46-7)	800 (liver; EPA IRIS)				
P-Ethyltoluene (622-96-8)	350 (liver; AQD)				
Pentachlorophenol (87-86-5)	20 (liver; EPA IRIS)				0.009 (liver and endocrine; EPA IRIS)
Phenol (108-95-2)			190 (irritation, respiratory, and nervous; ACGIH TLV)		
Phenanthrene (85-01-8)	0.1 (default; AQD)				
Propylene (115-07-1)			8600 (respiratory; ACGIH TLV)		

Chemical Name (CAS#)	ITSL in μg/m³ based on averaging time				IRSL in μg/m³
	Annual (critical effect; reference)	24-hr (critical effect; reference)	8-hr (critical effect; reference)	1-hr (critical effect; reference)	(Type of cancer; reference)
Pyrene (129-00-0)	100 (urinary; EPA IRIS)				
Styrene (100-42-5)	1000 (neurological; EPA IRIS)				2 (leukemia; EPA)
Tetrachloroethene (127-18-4)	40 (neurological; EPA IRIS)	1400 (neurological; ATSDR MRL)			4 (liver; EPA IRIS)
Toluene (108-88-3)		5000 (neurological; EPA IRIS)			
Trans-1,2-Dichloroethene (540-59-0)		35 (neurological; EPA HEAST)			
Trans-1,3-Dichloropropene (542-75-6)	20 (nasal; EPA IRIS)				0.2 (lung; EPA IRIS)
Trichloroethene (79-01-6)		2 (immune and developmental; EPA IRIS)			0.2 (kidney; EPA IRIS)
Trichlorofluoromethane (75-69-4)				56200 (systemic; ACGIH TLV ceiling)	
Trichlorotrifluoromethane (76-13-1)		19140 (neurological; AQD)			
Vinyl Acetate (108-05-4)	200 (nasal; EPA IRIS)				
Vinyl Bromide (593-60-2)	30 (liver; EPA IRIS)				
Vinyl Chloride (75-01-4)	100 (liver; EPA IRIS)				0.11 (liver; EPA IRIS)
Methanol (67-56-1)		20000 (developmental; EPA IRIS)		28000 (neurological; Cal EPA)	

Appendix F. Other Air Monitoring Efforts in the 48217 ZIP code

USEPA Mobile Air Monitoring:

The MDEQ, Air Quality Division requested that the USEPA conduct a mobile monitoring investigation of air pollution in the neighborhoods near Marathon, and specifically, the former Jefferies School area. This monitoring was conducted in August 2017.

MDEQ Investigative Monitoring for VOCs

In August and September 2017, the MDEQ conducted VOC sampling at a residence in the northern part of the 48217 ZIP code. Samples were collected for 24 hours using the same sampling method and laboratory as the New Mount Hermon (NMH) site and Marathon. A total of 8 samples were collected. Four samples were collected on the USEPA published ambient air sampling schedule and the other four were collected on non-scheduled days. The goals of the north 48217 ZIP code study were to:

1. Evaluate whether any compounds were detected that are above health limits (AQD screening levels);
2. Compare results of north 48217 and the NMH site;
3. Compare the results to Marathon's monitors;
4. Compare the results to the MDEQ monitor on Waterman Street near the former Southwestern High School (SWHS); and
5. Compare results that were collected on regular sample days verses several Saturdays that were not scheduled sample days.

The results of the sampling at the northern and southern sites in the 48217 ZIP code did not identify any VOC compounds above the health limits. Except for ethanol, the MDEQ SWHS monitor site had higher concentrations of VOC compounds than both 48217 sites and the Marathon sites. Samples collected on weekends were not higher or substantially different from those collected on regularly scheduled sample days. Ethanol was detected at much higher concentrations at the northern 48217 site, but below the health limits of 19,000 micrograms per cubic meter (µg/m^3). The MDEQ SWHS samples are analyzed by a different laboratory that does not report ethanol in the data package. The table below documents the ethanol values in micrograms per cubic meter.

Summary of Ethanol Values:

Date	North 48217	New Mount Hermon (south 48217)	Marathon North site (Sanders St.)	Marathon West site (Schaffer-Dix)	Marathon East site (close to North 48217)	Marathon Mark Twain School site (close to NMH)
8/19/2017	193.0	malfunction				
8/23/2017	138.0	4.56 *(8/24/2017)*	6.9	9.7	6.5	10.2
8/29/2017	106.0	4.43	13.2	13.1	7.1	9.7
9/9/2017	729.0	5.24				
9/16/2017	760.0	5.16	4.0	10.6	8.9	10.1
9/23/2017	873.0	6.76				
9/28/2017	486.0	5.65	11.1	7.9	2.2	void
9/30/2017	122.0	4.96				

<u>Marathon Air Monitoring Network</u>:

Since 2012, Marathon has been conducting ambient air monitoring at four locations for various pollutants. Three are on the plant property and one is to the south at a school. One of the stations on Marathon's property, the Marathon-East site, is close to Fort and Pleasant Streets, which is near the Jefferies neighborhood. This data is submitted to the AQD each month and it is reported to the USEPA's Air Quality Database, which is available to the public.

<u>USEPA Investigation Monitoring</u>:

In 2011, some extensive air sampling was conducted near the former Jefferies School site. In response to the sewer gas issue, USEPA staff conducted some extensive indoor and outdoor air sampling for VOC sampling using the 24-hour 'summa canister method' (same as the MDEQ and Marathon) and some real-time measurement instruments. Along with indoor air, drain and sewer sampling, measurements were also conducted outside in the community. Monthly outdoor ambient air sampling was conducted from March 2011 through February 2012 in the areas of I-75 (near Pleasant), Liebold, Patricia, and Liddesdale Streets.

Monthly background samples were collected at Edsel & Patricia, Leonard & Deacon, Pleasant & Deacon, East Fort Street, and West Fort Street. The monthly ambient air VOC samples that were collected from March 2011 to February 2012 did not show elevated levels of benzene, one of the key VOC compounds. Mr. Brian Kelly of the USEPA Grosse Ile office was the primary contact and investigator.

Appendix G: References

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Appendix H: Map of Southwest Detroit with Emphasis on Emission Sources

Southwest Detroit Area Air Emission Sources and Air Monitoring Locations