Health Consultation

ERIE COKE SITE
ERIE CITY, ERIE COUNTY, PENNSYLVANIA

Public Health Evaluation of July 2019-June 2020 Ambient Air Monitoring for Benzene, Toluene, Ethylbenzene and Xylene (BTEX) Compounds Near the Erie Coke Site

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Health Consultation: A Note of Explanation

A Health Consultation is a verbal or written response from the Agency for Toxic Substances and Disease Registry (ATSDR) or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. To prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting the use of or replacing water supplies, intensifying environmental sampling, restricting site access, or removing the contaminated material.

In addition, health consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes, conducting biological indicators of exposure studies to assess exposure, and providing health education for health care providers and community members.

The Pennsylvania Department of Health (PADOH) prepared this Health Consultation for the Erie Coke site, Erie, Pennsylvania. The conclusions and recommendations presented in this health consultation document are based on an analysis of the environmental sampling data and information made available to the PADOH within a limited time frame. The availability of additional sampling data, new information and/or changes in site conditions could affect the conclusions and recommendations presented in this document. PADOH will consider reviewing additional future data related to the site, if made available and deemed appropriate.

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Contents

1. Summary

The Erie Coke Facility ("the site") is located along the Lake Erie shore in Erie, Erie County, Pennsylvania. It was an industrial facility approximately 183 acres in size and was used to turn coal into foundry coke for steel manufacturing. The site was used for industrial manufacturing since the 1800s and as a coke production facility from 1925 until its closure in December 2019. The site has had a significant history of environmental violations for improperly managing air emissions and emitting hazardous air pollutants into the environment. Based on community concerns and as a part of the legal process, the Pennsylvania Department of Environmental Protection (PADEP) initiated a year-long passive air monitoring program from July 2019-June 2020 to assess airborne concentrations of benzene, toluene, ethylbenzene, and xylene (BTEX) from 13 locations: 9 monitors between the fence line of the site and the community and 4 monitors at nearby community locations. This monitoring occurred when the facility was operating at 50-75% capacity and in December 2019, the site was permanently shut down.

In early 2019, the Department of Health (PADOH) and the Agency for Toxic Substances and Disease Registry (ATSDR) provided a technical assistance on air quality concerns related to the site. In 2020, PADEP shared the July 2019-June 2020 BTEX data with PADOH to evaluate whether people living in the vicinity of the site were being exposed to contaminants at levels that may pose a health hazard. PADOH analyzed these July 2019-June 2020 BTEX monitoring data, which encompassed pre (July-December 2019) and post (January-June 2020) closure data. Based on the analysis of the available BTEX data, PADOH reached the following conclusions:

Conclusion 1: PADOH concludes that acute (less than 15 days), intermediate (15-364 days), and chronic (365 days or more) exposure to the detected levels of BTEX chemicals is not expected to cause non-cancer health effects.

Basis for conclusion: None of the monitored pre- and post-closure BTEX chemicals exceeded ATSDR non-cancer health guidelines for acute, intermediate, or chronic exposures. Therefore, acute, intermediate, or chronic non-cancer health effects are not expected from exposure to the detected BTEX chemicals.

Conclusion 2: Chronic exposure to the detected benzene levels may have posed a cancer risk that is similar to risks from typical benzene exposure levels in ambient air.

Basis for conclusion: The 95% upper confidence limit of the arithmetic mean (95UCL) levels of benzene at all monitoring locations pre- and post-closure exceeded the ATSDR's inhalation cancer risk evaluation guide (CREG) of 0.13 µg/m^3. The estimated cancer risks based on the 4 community monitors ranged from 1 in a million to 3 in a million for children and adults (1-3 excess cancers among a million exposed individuals). These estimated excess cancer risks from benzene are similar to what would be found in most urban or suburban environments.

Conclusion 3: Current and future exposures to site-related contaminants in air are not likely to harm people's health.

Basis for conclusion: The facility was permanently closed as of December 2019. The U.S. Environmental Protection Agency (EPA) has completed a Time-Critical Removal Action for the site. PADEP has recently finalized the Site Investigation Report (July 2023) that characterizes potential contamination in soil, sediment, surface water, and subsurface soil and groundwater at the site. This report includes

recommendations for additional investigation activities. A workplan for these activities is currently under development.

Conclusion 4: PADOH cannot determine whether past exposures to site-related contaminants may have harmed people's health.

Basis for conclusion: There are no site-specific or community exposure data available when the facility was operating at its full capacity prior to 2019 to evaluate for potential health effects from past exposures.

Limitations:

- This assessment is based on limited year-long (six months pre- and post-closure of the facility) air monitoring data of BTEX chemicals. The first six months of data (pre-closure) may not represent true emissions of the site, as the site was not operating at full capacity, but at 50 - 75% capacity during that monitoring period. In addition, there is a lack of data to assess past (before July 2019) exposure during the facility's full capacity of operations.
- Other than the BTEX data, there are no site-specific data available for air emissions that are typically associated with a coke plant. Coke oven emissions involve complex mixtures of dust, vapors, and gases, including known carcinogens and potentially carcinogenic chemicals, such as polycyclic aromatic hydrocarbons (PAHs), nitrosamines, coal tar, arsenic compounds, etc. These chemicals were not monitored in the community or near the site before the facility was shut down.
- The coke plant emissions may have contaminated nearby water and soil in the community surrounding the plant, but at the time of this report's preparation, this data was not available.

Recommendations:

With respect to current site updates, PADOH recommends that:

1. PADEP restrict community access to the site to prevent exposures to potentially contaminated soil.
2. As a precaution, community members adhere to best gardening practices to reduce potential exposure to chemicals in soil surrounding the site. Some of the best practices include, using raised garden beds and pots filled with clean soil, mixing additional compost into in-ground gardens, and washing produce, peeling root crops, and removing outer leaves of leafy vegetables before eating.
3. Residents monitor the air quality conditions for their location by visiting www.airnow.gov or by using the AirNow mobile app. These resources will provide an air quality index (AQI) for a location, which uses color-coded categories to provide recommendations for outdoor and indoor activity for the general population and sensitive populations.
4. People living in this area consult their healthcare provider if they have any health issues.

Next Steps:

PADEP is collecting additional environmental samples of soil, sediment, surface water, and subsurface soil and groundwater as part of its site remediation. In July 2023 PADEP released a Site Investigation report to assess the level and extent of contaminants in these other media (soil, sediment, surface

water, and subsurface soil and groundwater) at the site. The July 2023 PADEP report includes recommendations for additional investigation activities, and PADEP is developing a work plan for those activities, which is tentatively scheduled to begin in the fall of 2023.

Upon request, PADOH will provide technical assistance to site stakeholders, the public, and partner agencies to address community health concerns and will review new environmental data as it becomes available if representative of community exposures.

2. Background and Site Information

2.1. Site Background

The Erie Coke facility ("the site") is located along Lake Erie at the foot of East Avenue (925 E Bay Drive, Erie, PA 16507) in the City of Erie, Erie County, Pennsylvania. The site is bordered by Lake Erie and Lampe Marina to the north, East Avenue Boat Launch to the east, a residential area along with the Barber National Institute to the south, and the City of Erie wastewater treatment plant and downtown Erie to the west. The site was used for industrial manufacturing since 1833 (approximately) and as a coke production facility from 1925 to 2019. Erie Coke Corporation ("Erie Coke") acquired the site in 1987 and owned several parcels of land totaling approximately 183 acres, of which an area of approximately 68 acres and 58 coke ovens were used for the coke production [EPA 2020]. In December 2019, the site closed permanently.

Figure 1. Map of the Erie Coke Site in Erie, Pennsylvania. *[Image Credits: Erie Coke Removal Site Community Involvement Plan 2021]*

2.2. Coke Making Process and Emissions

The coke-making process involves blending and heating bituminous coals in coke ovens, to 1,000°C to 1,400°C, in the absence of oxygen [NTP 2021]. During this process, tars and light oils are distilled out of the coal and gases are generated. The generated gases include hydrogen, methane, carbon monoxide, carbon dioxide, ethane, hydrogen sulfide, ammonia, and nitrogen, which are then condensed, cooled, and compressed. This cleaned "coal gas" is recycled back into the coal ovens or sold as fuel. The coke making process generates liquid and solid wastes: liquid wastes include water, tar, and crude light oil;

solid waste includes coal dust, heavy hydrocarbons, and polycyclic aromatic hydrocarbons (PAHs) [EPA 2000]. Coke oven emissions are complex. The emissions are mixtures of dusts, vapors, and gases that typically include PAHs, formaldehyde, acrolein, aliphatic aldehydes, ammonia, carbon monoxide, nitrogen oxides, phenol, and metals including cadmium, arsenic, and mercury [NTP 2021]. Air samples from coke oven emissions contain more than 60 organic compounds, including particulate matter and more than 40 PAHs [NTP 2021]. However, these compounds were not monitored at the site. By-product processing is designed to collect the volatile materials generated during the coking process; however, emissions can escape due to structural defects around the doors or charging lids, improper use of engineering controls, improper work practices, and insufficient engineering controls [NTP 2021].

2.3. Environmental and Regulatory Compliance History

The site had a long history of violations under Pennsylvania's environmental laws – the Air Pollution Control Act, the Solid Waste Management Act, and the Clean Streams Law, as well as federal environmental laws and regulations [EPA 2020]. These violations resulted in, among other things, repeated neighborhood complaints over air quality, PADEP's issuance of numerous Notices of Violations, penalty assessments, and permit denials to the facility owners. After negotiations, the site entered in Consent Decrees and Administrative Orders requiring facility owners to address the facility's violations and its operating conditions. In June 2010, U.S. Senator Casey requested ATSDR to conduct a public health assessment to determine if air emissions from the facility could impact the health of nearby residents. In December 2010, ATSDR responded to the senator's request with a detailed response letter. The ATSDR's response letter stated that "…*some of the maximum measured concentrations exceed ATSDR's health-based comparison values. If those concentrations were continuously present in the surrounding community, residents could be exposed to unhealthful levels of some of the contaminants.*"

In January 2011, ATSDR requested PADEP and the EPA to conduct additional sampling. ATSDR also offered technical support on the sampling strategy and evaluation of sampling data. In 2011-2015, ATSDR and PADOH continued discussions about available data and partnered with EPA to conduct data modeling. Over this period, facility owners made significant upgrades designed to reduce air emissions at the facility as required under a consent decree. By 2015, due to these emissions reductions, the modeling based on older stack data was no longer reflective of community exposures. In 2018, PADEP reached out to ATSDR and PADOH to assist in addressing community health concerns.

In July 2019, PADEP denied Erie Coke's application to renew its Title V Operating Permit and petitioned the Erie County Court of Common Pleas to issue an injunction to shut the plant down due to the lack of a valid operating permit. Erie Coke appealed the denial of the permit, and per the court's directions, continued to operate at 50% to 75% capacity while the legal process played out. In the meantime, based on community concerns and as part of the legal process related to the Title V permit, PADEP initiated a year-long, passive, fence-line air monitoring program to assess airborne benzene, toluene, ethylbenzene, and xylene (BTEX) concentrations. On December 5th, 2019, Erie Coke ceased operations and closed the facility permanently, but PADEP continued BTEX monitoring for another six months until June 2020 [PADEP 2023].

In May 2020, PADEP requested assistance from EPA to conduct a Removal Site Evaluation and determine if the site met the threshold criteria for an EPA Removal Action [EPA 2020]. On July 28, 2020, EPA inspected the site and found that it consisted of office buildings, a laboratory, coke ovens, by-products process areas, bulk tank storage areas, a boiler house, other supporting structures, and a large coal yard

[EPA 2020]. Based on the assessment, EPA determined that the site posed a threat to public health and to the environment, and a removal action or cleanup was necessary [EPA n.d.]. In September 2020, EPA signed an Action Memorandum which approved the cleanup of hazardous substances at the facility.

2.4. Remediation of the Site

In Fall 2020, EPA initiated response actions to protect the public from the potential release of hazardous substances from the site. EPA's actions addressed the hazardous substances remaining in tanks, containers, and piping, that posed the immediate threat to public health and to the environment. EPA removed and disposed of wastes, demolished buildings, and recycled appropriate scrap materials. EPA's removal actions were completed in 2022 [PADEP 2022]. EPA actions did not investigate potential contamination of soil, surface water, subsurface soil and groundwater, or sediment. However, in July 2023, PADEP released a Site Investigation report assessing the level and extent of contaminants in these media thorough its Hazardous Sites Cleanup Program. The investigation helps determine the level and extent of contamination present on-site, risks to public health and the environment, and identifies the nature and extent of hazardous substances in soil, sediment, and water at the site in anticipation of its cleanup and reuse [PADEP 2023]. PADEP's July 2023 report included recommendations for additional investigation activities. PADEP is currently beginning a work plan for these activities, which is tentatively scheduled to begin in the fall of 2023.

2.5. Toxic Release Inventory (TRI) Data

The EPA's TRI data tracks the release of certain toxic chemicals into the air or water by industrial facilities. The TRI data are self-reported by the facilities and have limitations regarding their interpretation. However, TRI data are helpful in identifying site-related pollutants and informing communities about possible exposure to harmful chemicals. In the site's TRI data, benzene emissions (62%) were the largest proportion of all emissions (Figure 2).

Figure 2. Total Toxic Release Inventory (TRI) Data (2007 – 2018), Erie Coke, Pennsylvania. *[Source: EPA 2023]*

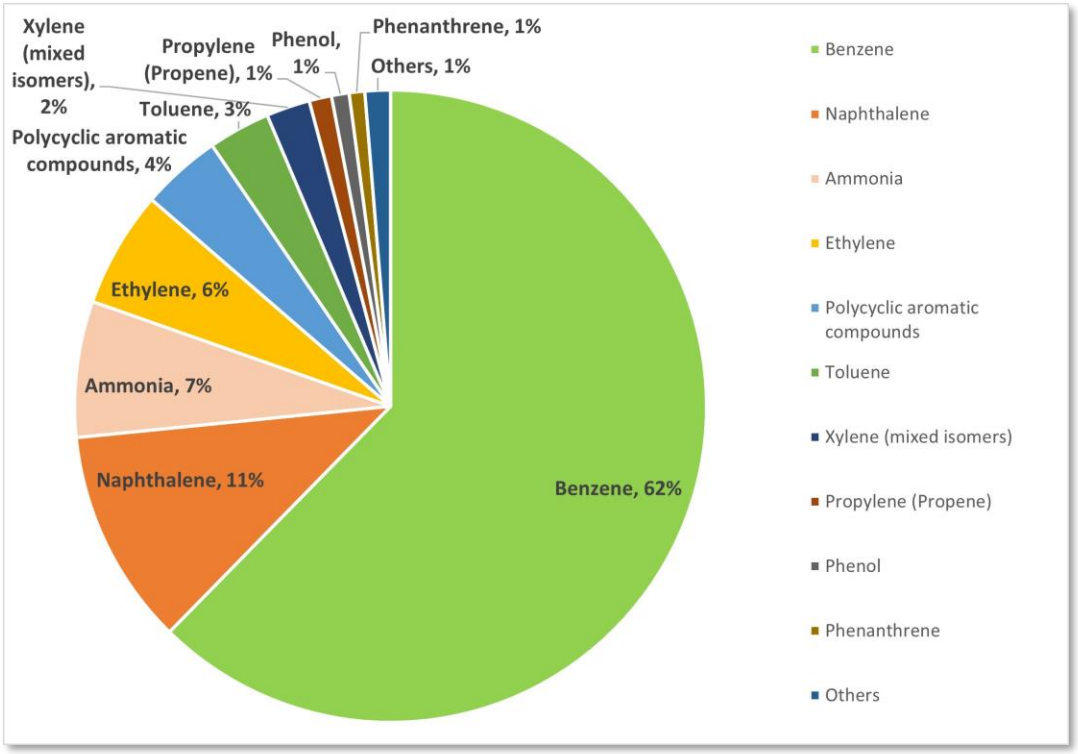
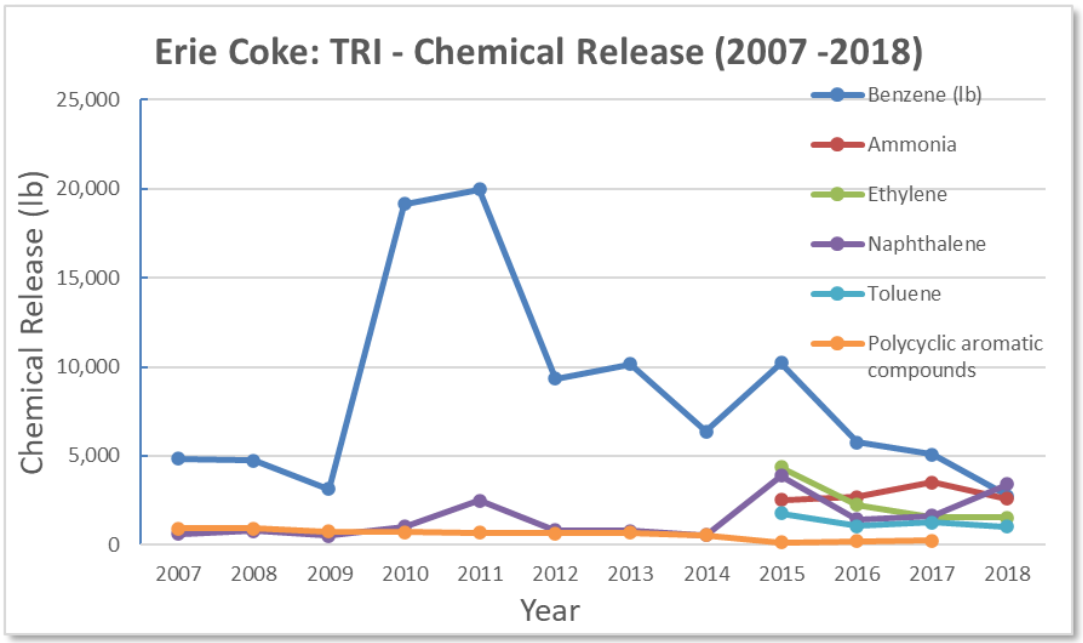


Figure 3. Toxic Release Inventory (TRI) Data by year (2007-2018), Erie Coke, Pennsylvania. *[Source: EPA 2023]*



Annual benzene emissions fluctuated but displayed an increase from the year 2009 until 2011 before undergoing a decreasing trend from 2011 to 2018 with a few fluctuations (Figure 3). By 2018, the annual average benzene released was 4,000 pounds per year (Figure 3).

PADOH also reviewed benzene and toluene ambient air data from the nearby Air Quality System (AQS) stations located in Presque Isle and Erie City before and after the closure of the facility (Appendix F). While this data is available, it is not site-specific due to the AQS monitors' distance from site, wind direction, and other environmental sources of contaminants of concern (e.g., benzene from vehicle exhaust, burning coal or oil for heat, gasoline stations, and tobacco smoke). Therefore, the AQS ambient air data was not considered for site-specific assessment but is included in Appendix F.

2.6. Community Demographics

PADOH examined demographic information of communities surrounding the site to identify population distributions and nearby sensitive populations such as young children (Appendix A). Per EPA's American Community Survey 2015-19 estimates, 9,082 people lived within a 1-mile radius of the site (Appendix C). In this community, 51% of the population are people of color (Appendix A). Among people who reported one race (94%), 57% are white, 27% are black, 16% are Hispanic, and 5% are Asian. Other race constituted 5% of the population, and two or more races constituted 6% of the population. Per capita income was $15,468. In the population residing within a 1-mile radius, 51% are male, 6% are children ages 0-4 years old, 27% are 0-17 years old, and 10% are people over 65 years of age. In this community, 18% speak non-English at home. In terms of home ownership, 62% were renters and 38% were owner-occupied. Within a 1-mile radius, 59% of the population were in the labor force and 41% were not (Appendix A).

2.7. Environmental Justice Considerations

PADOH also reviewed EPA's Environmental Justice (EJ) indicators near the site using EJSCREEN. EJSCREEN uses environmental indicators in a community to assess potential exposures and demographic factors to show potential susceptibility. Environmental risk-burdened communities (EJ communities) have additional factors (e.g., lack of access to healthy foods, open space, and health care) that can impact health in addition to environmental contaminant exposures. Twelve EJ indices allow for percentile-based comparisons of a community to the rest of Pennsylvania, the EPA's region 3 (Pennsylvania, Virginia, West Virginia, District of Columbia, Maryland, and Delaware), and the U.S. Details of these indicators and their respective values and percentiles are presented in Appendices B & D. Additional details on EJSCREEN are provided in Appendix E.

Using EJSCREEN, PADOH reviewed the available EJ indices within a 1-mile radius from the site. Based on the EPA's EJSCREEN report, all 12 indicators are at or above the 75th percentile in comparison to other communities in Pennsylvania and to EPA Region 3; and 11 indicators are at the 75th percentile or above in the U.S. (only 1 indicator – Air Toxic Cancer Risk & Respiratory Hazard Index – is below the U.S. 75th percentile). An index being greater than the 50th percentile means the observed EJ indices were greater or more common within the area in relation to other communities in Pennsylvania, EPA Region 3, and the U.S. The EJ index values are provided in Appendix B.

2.8. Community Health Concerns

PADOH participated in a community meeting on July 13, 2018, to hear concerns from local stakeholders about the impact of emissions from the site on the community's health, and to inform the stakeholders

about the past efforts and activities to analyze health impacts. In the meeting, the community had concerns such as health risks from Erie Coke, odors, possible cancers, on benzene and other airborne contaminants, residue deposits on neighborhood homes, and possible lead contamination in soil and its impact on farming and/or gardening.

3. Available Air Data

3.1. Benzene, Toluene, Ethylbenzene, Xylene (BTEX) Air Monitoring Data

Based on community concerns, PADEP conducted passive biweekly fence-line and nearby community air monitoring from July 2019 to June 2020 (48 weeks) to assess airborne concentrations of BTEX. The monitoring device had passive sorbent sampling tubes designed to determine the concentrations of BTEX at the sampling locations. PADEP installed 13 monitoring units: 9 at the site perimeter, and 4 in nearby communities located south-east of the site (Figure 4).

Figure 4. Locations of the 13 monitoring stations (as numbered 'DEP' with thumbnails) near the Erie Coke site: 9 at the fence-line (in yellow, DEP01-09) and 4 in the surrounding community (in orange, DEP10-13) to the south and southeast of the site.

EPA Method 325 was used for the monitoring. Passive air samples were collected 24 hours a day, seven days a week for two weeks in the sampling tubes. Every two weeks, the sampling tubes were collected, and new tubes were placed within the sampler. The collected tubes were submitted for laboratory analysis (EPA Method 325B). PADEP shared the BTEX results with PADOH and requested an evaluation on whether people living in the vicinity of the site were being exposed to contaminants at levels that may pose a health hazard.

4. Exposure Pathway Evaluation – BTEX Data

4.1. Exposure Pathway Analysis

An exposure pathway describes how people (or residents) can come into contact and/or get exposed to contaminants. The evaluation of the exposure pathway determines if contaminants have been in the past, are currently, or could come into contact in the future with local populations. A typical exposure pathway evaluates contaminant exposures in the context of the following five exposure elements [ATSDR 2023]:

> **Element 1: The source** of contaminant release, such as industrial facilities, landfills, or other sites.
>
> **Element 2: Environmental fate and transport** - refers to the way contaminants move through and across different media (e.g., water, soil, or air) and how they degrade and transform after they are released into the environment.
>
> **Element 3: Exposure point** - refers to the medium in which people might come into contact with a contaminant (e.g., ambient air, private residential well water, indoor air, soil etc.).
>
> **Element 4: Exposure route** - refers to how a contaminant may enter the body (by inhalation, ingestion, or through dermal contact).
>
> **Element 5: Potentially exposed populations** - identifies the people (e.g., residents, children, workers) that may come in contact with contaminants.

These five elements largely determine to what extent exposures may have occurred, may be occurring, or may occur in the future at and around a site. Exposure pathways are categorized as completed, potential, or eliminated. A completed exposure pathway is one in which all five elements are present. In a potential exposure pathway, at least one of the pathways elements is uncertain, indicating that exposure to a contaminant could have occurred in the past, is occurring, or could occur in the future. A pathway is eliminated when one or more elements are missing or prevented and are unlikely to be present. Reviewing these elements helps to identify exposure situations that require further investigation for a health assessment. Specific exposure conditions, such as the route of exposure and the magnitude, frequency, and duration of exposures are examined more closely to evaluate possible health implications.

PADOH evaluated the above exposure pathway components to determine whether community exposure to the site could have occurred in the past, is occurring presently, or might occur in the future. PADOH determined that all five elements of the exposure pathway were present (a completed pathway) in the past, but eliminated for the present and future, as the facility closed in December 2019. PADOH determined that exposure occurred via inhalation but lacked data to determine whether dermal exposure occurred, is occurring or will occur in the future (e.g., from air contaminants depositing onto nearby soil). Below is a summary of PADOH's exposure pathway evaluation (Table 1).

Table 1. Exposure pathway evaluation – Erie Coke facility, Erie, Pennsylvania

Element 1: Contaminant Source	Element 2: Fate and Transport Medium	Element 3: Exposure Point	Element 4: Exposure Route	Element 5: Potentially Exposed Population	Exposure Period	Exposure Pathway Classification
Coke production at the Erie Coke Facility (BTEX)	Ambient Air	Contaminated Ambient Air	Inhalation	Residents & Visitors	Past (through December 2019)	Completed
Coke production at the Erie Coke Facility (BTEX)	Ambient Air	Contaminated Ambient Air	Inhalation	Residents & Visitors	Present	Eliminated
Coke production at the Erie Coke Facility (BTEX)	Ambient Air	Contaminated Ambient Air	Inhalation	Residents & Visitors	Future	Eliminated

4.2. Exposure Unit(s) at the site

A typical exposure unit is an area where a person (receptor population) has contact with an environmental medium (e.g., soil, water, or air) containing a potential contaminant within a completed or potential exposure pathway [ATSDR 2023]. A site could have more than one exposure unit depending on the nature of the exposure and/or the site's access restrictions. The site is surrounded by residences to the south and southwest sides (Figure 1). Out of the 13 monitoring stations, 9 were at the perimeter of the site and 4 were in the nearby community located south-east of the site (Figure 4). The 4 community monitoring stations (DEP10, DEP11, DEP12, DEP13; Figure 4) were in a residential area. For this health assessment, each of the 13 monitoring stations is considered an exposure unit.

5. Screening of BTEX Data

The PADOH evaluated the ambient air contaminants of the completed inhalation exposure pathway to determine whether site-specific exposures were at high enough concentrations, frequent enough, and happened for long enough to result in adverse health effects for adults and children. The evaluation included determining potential contaminants of concern (COCs) through data screening and evaluation and calculating Exposure Point Concentrations (EPCs) [ATSDR 2023].

PADOH followed the ATSDR Public Health Assessment Guidance Manual [ATSDR 2023] to screen the BTEX data against ATSDR's health-based comparison values (CVs), such as environmental media evaluation guides (EMEGs), reference dose media evaluation guides (RMEGs), and cancer risk evaluation guides (CREGs) to identify the contaminants that required further analysis as part of this assessment. EMEGs are estimated contaminant concentrations in specific media (such as, air, water, soil) that are not expected to result in adverse non-carcinogenic health effects after exposure for a given period, such as, acute (14 days or less), intermediate (15 to 365 days), and chronic (365 days or more) exposures [ATSDR 2023]. EMEGs are based on ATSDR minimal risk levels (MRLs), which are non-cancer health guidelines for a given period (acute, intermediate, and chronic). An MRL is an ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of non-cancerous health effects. RMEGs are estimated contaminant concentrations at which a daily

human exposure for a chronic duration is not likely to result in adverse noncarcinogenic effects. RMEGs are derived from EPA reference doses (RfDs) for oral exposures and reference concentrations (RfCs) for air exposures and are EPA estimates of the daily amounts of a substance over a lifetime of exposure that are unlikely to cause any harm to humans. CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million persons (1 in 1,000,000) exposed during their lifetime (78 years).

These ATSDR CVs (RMEGs, EMEGs, CREGs), and the ATSDR MRLs and EPA RfCs they are derived from, are based on peer-reviewed epidemiologic and toxicologic data and scientific literature with uncertainty or safety factors applied to ensure that they are amply protective of human health. When an ATSDR CV is not available, screening values are acquired from environmental agency medium-specific concentration or cleanup standards (EPA or PADEP). However, the basis for values obtained from the environmental agencies are not reviewed/approved by ATSDR. If contaminant levels are found above health-based CVs, it does not mean adverse health effects will occur, but that further evaluation is required.

PADOH evaluated the available BTEX data for potential health effects for children and adults. Children are generally more susceptible to harmful environmental exposures owing to physiological and behavioral reasons.

According to the ATSDR guidance manual [ATSDR 2023], any contaminant whose detected concentration at the site either exceeds an ATSDR CV or other agency (federal or state) screening value is retained as a potential COC. If a community is concerned about a contaminant or the contaminant does not have a CV, then the contaminant is also retained for further evaluation. The potential COC is then further evaluated for site-specific exposure to derive an EPC and determine the possibility for adverse health effects. Inhalation EPCs were calculated in accordance with ATSDR exposure concentration guidance [ATSDR 2019] and standard default exposure assumptions for inhalation [ATSDR 2020].

As a public health-protective approach, PADOH screened the maximum concentration of BTEX chemicals detected at the site against ATSDR CVs to identify potential COCs (Table 2).

Table 2. Range of detected BTEX concentrations and their respective health-based comparison values (CVs) and Health Guidelines

Contaminant	Range (µg/m^3)	ATSDR Recommended CV (µg/m^3)	Available ATSDR CV Type
Benzene	0.40 – 6.40 (pre-closure) 0.28 – 2.90 (post-closure)	0.13; 9.6; 19; 29; 30	CREG; Chronic EMEG / MRL; Intermediate EMEG / MRL; Acute EMEG / MRL; Chronic RMEG
Toluene	0.32 J – 2.20 (pre-closure) 0.27 J – 1.40 (post-closure)	3,800	Chronic EMEG / MRL
Ethylbenzene	ND (pre-closure) ND (post-closure)	260	Chronic EMEG / MRL

Contaminant	Range (µg/m^3)	ATSDR Recommended CV (µg/m^3)	Available ATSDR CV Type
Total xylenes*	0.27 J – 0.64 (pre-closure) 0.28 J – 0.79 (post-closure)	100; 220	RMEG / RfC; MRL

CV = Comparison Value; µg/m^3 = microgram per cubic meter; EMEG = environmental media evaluation guide; J = value is lab-estimated, above the analytical method detection limit and below the analytical reporting limit; RMEG = reference dose media evaluation guide; RfC = EPA Reference Concentration; MRL = ATSDR minimal risk levels; CREG = cancer risk evaluation guide; ND = Not detected; *Total xylenes account for the three xylene isomers, o-, m-, and p-xylene.

5.1. Screening Results and Selection of Potential Contaminants of Concern (COCs)

Table 2 above represents the range of BTEX concentrations detected among all 13 monitoring stations and their respective ATSDR CV and health guidelines. The range of detected pre- and post-closure BTEX chemicals from *each* of the 13 monitoring stations are given in Appendix G.

The maximum detected pre- and post-closure concentrations of toluene (2.20 micrograms per cubic meter, or µg/m^3) and total xylenes (0.79 µg/m^3) were below ATSDR non-cancer CVs and health guidelines (Table 2). In addition, ethylbenzene was not detected, and the analytical method detection limits for ethylbenzene were below non-cancer CVs and health guidelines. Therefore, concentrations of toluene, ethylbenzene and xylenes during the monitoring period are not expected to harm health. In addition, these chemicals have not been classified as carcinogens by the EPA; therefore, they were not evaluated for cancer risk.

Maximum pre- and post-closure benzene concentrations (6.40 µg/m^3 and 2.9 µg/m^3, respectively) were also less than ATSDR non-cancer CVs and health guidelines for acute (29 µg/m^3), intermediate (19 µg/m^3), and chronic (9.6 µg/m^3) exposures (Table 2). Therefore, adverse non-cancer health effects from benzene are not expected to occur.

Benzene is classified as a carcinogen, with an ATSDR cancer-based CV (CREG) of 0.13 µg/m^3. Pre- and post-closure levels at all 13 monitoring locations exceeded the CREG value and hence benzene was selected as a potential contaminant of concern (COC) for further cancer evaluation.

5.2. Calculations of Exposure Point Concentrations (EPCs) for the Potential COC (Benzene)

PADOH calculated EPCs for benzene for all 13 monitoring locations to determine whether site-specific exposures were at high enough concentrations, frequent enough, and lasted long enough to result in adverse health effects [ATSDR 2019]. PADOH calculated a public-health protective EPC, which is the 95% upper confidence limit of the arithmetic mean (95UCL) that represents an estimated upper bound for the actual or true average exposure concentration for a population. For intermediate and chronic exposure evaluations, 95UCLs are typically used as a public-health protective approach, when sufficient data is available (8 or more samples) [ATSDR 2019]. PADOH calculated 95UCLs for both pre- and post-closure benzene levels, as shown in Table 3 below. PADOH used ATSDR's EPC tool to calculate 95UCLs.

Table 3. Benzene Exposure Point Concentrations (EPC)-95UCLs at all Monitoring Stations

Monitor ID / Exposure Unit	Pre-closure Benzene Exposure Point Concentrations (EPC) - 95 UCLs ($\mu g/m^3$)	Post-closure Benzene Exposure Point Concentrations (EPC) - 95 UCLs ($\mu g/m^3$)
DEP01	2.52	**1.34**
DEP02	1.41	0.97
DEP03	1.04	0.87
DEP04	**3.67**	0.77
DEP05	2.03	0.69
DEP06	1.20	0.80
DEP07	0.96	0.64
DEP08	0.56	0.52
DEP09	0.60	0.49
DEP10*	0.98	0.71
DEP11*	0.80	0.80
DEP12*	0.67	0.69
DEP13*	0.54	0.59

The highest 95UCL benzene concentrations PRE- and POST-closure of the facility are **bolded**.
*These monitors are in the community.

6. Estimated Excess Cancer Risk Evaluation for Benzene

6.1. Benzene Overview

Benzene is a colorless liquid with a sweet odor [ATSDR 2007]. It has a number of industrial uses and is in the top 20 of U.S. chemicals by production volume. Benzene is commonly found in the environment, and everyone is exposed to small amounts each day. Common exposure sources include emissions of burning coal and oil, tobacco smoke, waste and storage operations, motor vehicle exhaust, and evaporation from gasoline service stations. In the U.S., benzene levels in outdoor air ranged from 0.02 to 34 ppb (0.06 to 109 $\mu g/m^3$), which includes levels in remote and rural areas to urban cities [ATSDR 2007]. Median benzene air concentrations in rural, suburban, and urban areas have been reported at 0.47 ppb (1.4 $\mu g/m^3$), 1.8 ppb (5.7 $\mu g/m^3$), and 1.8 ppb (5.7 $\mu g/m^3$), respectively [ATSDR 2007].

Based on evidence from human and laboratory animal studies, EPA, the U.S. Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have classified benzene as a known human carcinogen. For more information on benzene, please refer to Appendix H.

6.2. Estimated Cancer Risks from Benzene Exposure

PADOH estimated cancer risk from benzene exposure near the site by multiplying the EPCs by EPA's inhalation unit risk (IUR). Excess cancer risk estimates are theoretical proportions of the population that may be affected from exposure to a chemical at its detected concentration. These estimates are health

protective estimates; actual (true) risk is unknown, but may be substantially lower, perhaps by several orders of magnitude.

The formula used to calculate excess cancer risk is:

$$CR = EPC \times IUR \times (ED \div LY)$$

Where,
CR = cancer risk
EPC = A contaminant's exposure point concentration. For this site, the EPC is the 95UCL for detected benzene in air, in $\mu g/m^3$.
IUR = EPA inhalation unit risk ($(\mu g/m^3)^{-1}$) for a specific contaminant
ED = exposure duration (years). For this calculation, the ED is 21 years for a child and 33 years for an adult, based on a residential, Reasonable Maximum Exposure scenario (described below).
LY = lifetime years (78 years), which is the average life expectancy for adults.

For these calculations, PADOH assumed a default reasonable maximum exposure scenario (RME) for children and adults as a public-health protective approach. The RME assumes a child is exposed for 21 years (from birth up to age 21) and that adults are exposed for 33 years. These RMEs for residency are derived from EPA's 2011 Exposure Factors Handbook and are based on the 95th percentile of household occupancy [ATSDR 2016]. RMEs are intended to assess exposures that are higher than average, but still within a realistic exposure range [ATSDR 2023]. The calculated pre- and post-closure benzene EPCs at all monitoring locations exceeded ATSDR's CREG CV of 0.13 $\mu g/m^3$ (Table 3). As a health-protective approach and to be more representative of exposures while the facility was in operation, PADOH used the pre-closure EPCs of benzene to estimate excess cancer risk for each monitoring station (Table 4). The EPCs were multiplied by the benzene IUR of 7.8E-06 per $\mu g/m^3$ and then by exposure duration over lifetime years to estimate excess cancer risks for each exposure unit (each monitoring station).

Below is an example calculation of excess cancer risk for the pre-closure benzene EPC of 0.98 $\mu g/m^3$ at monitor 10 (DEP10, Table 4) assuming child residential exposure (21 years). This EPC represents the highest 95UCL concentration detected at a site community monitor:

$$CR = EPC \times IUR \times (ED \div LY)$$

$CR = 0.98\ \mu g/m^3 \times 7.8E\text{-}06\ (\mu g/m^3)^{-1} \times (21\ years/78\ years) =$ **2.1×10^{-6}, or 2 in 1 million**

PADOH used ATSDR's Public Health Assessment Site Tool (PHAST) to estimate excess cancer risks for benzene at all monitoring locations, which are provided in Table 4 below.

Table 4. Benzene Exposure Cancer Risk Estimates for Each Monitoring Station Pre-closure

Exposure Units	Exposure Point Concentrations (EPC) ($\mu g/m^3$)	RME Children Cancer Risk Estimates	RME Adult Cancer Risk Estimates
DEP01	2.52	5.3×10^{-6}	8.3×10^{-6}
DEP02	1.41	3.0×10^{-6}	4.7×10^{-6}
DEP03	1.04	2.2×10^{-6}	3.4×10^{-6}
DEP04	**3.67**	**7.7×10^{-6}**	**1.2×10^{-5}**
DEP05	2.03	4.3×10^{-6}	6.7×10^{-6}
DEP06	1.20	2.5×10^{-6}	4.0×10^{-6}

Exposure Units	Exposure Point Concentrations (EPC) (µg/m^3)	RME Children Cancer Risk Estimates	RME Adult Cancer Risk Estimates
DEP07	0.96	2.0 X 10^{-6}	3.2 X 10^{-6}
DEP08	0.56	1.2 X 10^{-6}	1.8 X 10^{-6}
DEP09	0.60	1.3 X 10^{-6}	2.0 X 10^{-6}
DEP10*	0.98	2.1 X 10^{-6}	3.2 X 10^{-6}
DEP11*	0.80	1.7 X 10^{-6}	2.6 X 10^{-6}
DEP12*	0.67	1.4 X 10^{-6}	2.2 X 10^{-6}
DEP13*	0.54	1.1 X 10^{-6}	1.8 X 10^{-6}

RME = reasonable maximum exposure considering 33 years for adults, and 21 years for children exposure. The **bolded** cell is maximum cancer risk at the site. *These monitors are in the community.

The estimated cancer risk based on the highest EPC (3.67 µg/m^3) was 1.2x10^{-5} (or 1.2 excess cancers among 100,000 exposed individuals, or 10.2 excess cancers among 1 million exposed individuals) for adults assuming 33 years of exposure, and 7.7x10^{-6} (or 8 excess cancers among 1 million exposed individuals) for children assuming 21 years of exposure. It is important to note, the monitor producing the above cancer risks was located at the fence-line and not within the community. For the community-based air monitor locations (monitors DEP10 to DEP13), the highest estimated cancer risk was 3.2x10^{-6} (or 3.2 excess cancers among 1 million exposed individuals, Table 4).

The highest EPC of 3.67 µg/m^3 used to calculate the highest estimated cancer risks at the site overall is within the range of median benzene concentrations that have been reported in several urban areas, which have ranged from 1 ppb (3.19 µg/m^3) in Philadelphia, PA to 4.1 ppb (13.8 µg/m^3) in Denver, CO during various sampling periods [ATSDR 2007]. The highest EPC is also similar to or below averages that have been reported in San Francisco, CA (average ± standard deviation (SD), 8.3 ± 4.4 µg/m^3), Staten Island, NY (average ± SD, 14 ± 21 µg/m^3), and Anchorage, AK (annual averages: 3.7 µg/m^3 in a low density area and 17.5 µg/m^3 near a major midtown intersection) [ATSDR 2007], and Detroit, MI (1.3-4.1 µg/m^3) [ATSDR 2015]. In addition, this highest EPC at the site (3.67 µg/m^3) was not from the community location, but from a monitor at the site's southern fence line location (Figure 1). Among the four community monitors (DEP10, 11, 12, and 13), the highest estimated cancer risks for adults and children were 3.2x10^{-6} (or 3 in 1 million) and 2.1x10^{-6} (or 2 in 1 million), respectively, based on an EPC of 0.98 µg/m^3 (Table 4). These estimated cancer risks are similar to or below what would be expected from ambient air benzene in urban and suburban areas.

7. Children's Health Considerations

Children and infants are more susceptible to harm from inhaling pollutants because children inhale more air per pound of body weight, breathe faster, spend more time outdoors, and have smaller body sizes than adults. Children are not small adults, and developing fetuses, infants and children have unique vulnerabilities to environmental contamination. Because children's bodies are rapidly developing, exposure to high levels of certain compounds during critical developmental periods can lead to lasting effects. Also, children are dependent on adults for access to housing, access to medical care, and risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children's health. The estimated cancer risk for children (from birth to 21 years old) from the 13 monitoring sites ranged from 1.1x10^{-6} to 7.7x10^{-6}. The ambient benzene concentrations that produced

these cancer risk estimates are similar to or below observed benzene concentrations in other urban and suburban areas across the country. The measured benzene concentrations at all monitors at the site or in the community were below acute, intermediate, and chronic screening values and health guidelines for non-cancer health effects; therefore, adverse non-cancer health effects from benzene exposure are unlikely to occur.

8. Limitations

PADOH identified several limitations to this assessment:

- This assessment is based on limited year-long (six months pre- and post-closure of the facility) air monitoring data of BTEX chemicals. The first six months of data (pre-closure) may not represent true emissions of the site, as the site was not operating at full capacity, but at 50 - 75% capacity during that monitoring period. In addition, there is a lack of data to assess past (before July 2019) exposure during the facility's full capacity of operations.
- Other than the BTEX data, there are no site-specific data available for air emissions that are typically associated with a coke plant. Coke oven emissions involve complex mixtures of dust, vapors, and gases, including known carcinogens and potentially carcinogenic chemicals, such as polycyclic aromatic hydrocarbons (PAHs), nitrosamines, coal tar, arsenic compounds, etc. These chemicals were not monitored in the community or near the site before the facility was shut down.
- The coke plant emissions may have contaminated nearby water and soil in the community surrounding the plant, but at the time of this report's preparation, this data was not available.

9. Conclusions

After the assessment of available data, PADOH calculated the health risks to surrounding communities, analyzed the impact of the closure of the facility on the quality of the local ambient air, and reached the following conclusions:

Conclusion 1: PADOH concludes that acute (less than 15 days), intermediate (15-364 days), and chronic (365 days or more) exposure to the detected levels of BTEX chemicals is not expected to cause non-cancer health effects.

Basis for conclusion: None of the monitored pre- and post-closure BTEX chemicals exceeded ATSDR non-cancer health guidelines for acute, intermediate, or chronic exposures. Therefore, acute, intermediate, or chronic non-cancer health effects are not expected from exposure to the detected BTEX chemicals.

Conclusion 2: Chronic exposure to the detected benzene levels may have posed a cancer risk that is similar to risks from typical benzene exposure levels in ambient air.

Basis for conclusion: The 95% upper confidence limit of the arithmetic mean (95UCL) levels of benzene at all monitoring locations pre- and post-closure exceeded the ATSDR's inhalation cancer risk evaluation guide (CREG) of 0.13 µg/m^3. The estimated cancer risks based on the 4 community monitors ranged from 1 in a million to 3 in a million for children and adults (1-3 excess cancers among a million exposed individuals). These estimated excess cancer risks from benzene are similar to what would be found in most urban or suburban environments.

Conclusion 3: Current and future exposures to site-related contaminants in air are not likely to harm people's health.

Basis for conclusion: The facility was permanently closed as of December 2019. The U.S. Environmental Protection Agency (EPA) has completed a Time-Critical Removal Action for the site. PADEP has recently finalized the Site Investigation Report (July 2023) that characterizes potential contamination in soil, sediment, surface water, and subsurface soil and groundwater at the site. This report includes recommendations for additional investigation activities. A workplan for these activities is currently under development.

Conclusion 4: PADOH cannot determine whether past exposures to site-related contaminants may have harmed people's health.

Basis for conclusion: There are no site-specific or community exposure data available when the facility was operating at its full capacity prior to 2019 to evaluate for potential health effects from past exposures.

10. Recommendations

1. PADEP restrict community access to the site to prevent exposures to potentially contaminated soil.
2. As a precaution, community members adhere to best gardening practices to reduce potential exposure to chemicals in soil surrounding the site. Some of the best practices include, using raised garden beds and pots filled with clean soil, mixing additional compost into in-ground gardens, and washing produce, peeling root crops, and removing outer leaves of leafy vegetables before eating.
3. Residents monitor the air quality conditions for their location by visiting www.airnow.gov or by using the AirNow mobile app. These resources will provide an air quality index (AQI) for a location, which uses color-coded categories to provide recommendations for outdoor and indoor activity for the general population and sensitive populations.
4. People living in this area consult their healthcare provider if they have any health issues.

Next Steps:

PADEP is collecting additional environmental samples of soil, sediment, surface water, and subsurface soil and groundwater as part of its site remediation. In July 2023 PADEP released a Site Investigation report to assess the level and extent of contaminants in these other media (soil, sediment, surface water, and subsurface soil and groundwater) at the site. The July 2023 PADEP report includes recommendations for additional investigation activities, and PADEP is developing a work plan for those activities, which is tentatively scheduled to begin in the fall of 2023.

Upon request, PADOH will provide technical assistance to site stakeholders, the public, and partner agencies to address community health concerns and will review new environmental data as it becomes available if representative of community exposures.

For more information or inquiries, please contact:

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Bureau of Epidemiology
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11. References

ATSDR (2023). Agency for Toxic Substances and Disease Registry - Public Health Assessment Guidance Manual (PHAGM). Atlanta: U.S. Department of Health and Human Services. https://www.atsdr.cdc.gov/pha-guidance/index.html

ATSDR (2020). Agency for Toxic Substances and Disease Registry - Guidance for Inhalation Exposures, V3. Atlanta, Ga: U.S. Department of Health and Human Services, Public Health Service, December 1, 2020. https://www.atsdr.cdc.gov/pha-guidance/resources/ATSDR-EDG-Inhalation-508.pdf

ATSDR (2019). Agency for Toxic Substances and Disease Registry - Exposure Point Concentration Guidance for Discrete Sampling, V2. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, July 12, 2019. https://www.atsdr.cdc.gov/pha-guidance/resources/EPC-Guidance-for-Discrete-Sampling-508.pdf

ATSDR (2016). Agency for Toxic Substances and Disease Registry - Exposure Dose Guidance for Determining Life Expectancy and Exposure Factor. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Oct 26. https://www.atsdr.cdc.gov/pha-guidance/resources/ATSDR-EDG-Life-Expectancy-Exposure-Factor-508.pdf

ATSDR (2015). Agency for Toxic Substances and Disease Registry - Addendum to the Toxicological Profile for Benzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/toxprofiles/Benzene_Addendum.pdf

ATSDR (2007). Agency for Toxic Substances and Disease Registry - Toxicological Profile for Benzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/ToxProfiles/tp3.pdf

EPA (2023). U.S. Environmental Protection Agency - Toxics Release Inventory (TRI) Program. https://www.epa.gov/toxics-release-inventory-tri-program

EPA (2020). U.S. Environmental Protection Agency - Erie Coke Action Memo. https://response.epa.gov/sites/14827/files/Erie%20Coke%20Action%20Memorandum.pdf

EPA (2000). U.S. Environmental Protection Agency - Health Effects Notebook for Hazardous Air Pollutants. Coke Oven Emissions Fact Sheet. Washington, DC: U.S. Environmental Protection Agency. https://www.epa.gov/sites/default/files/2016-09/documents/coke-oven-emissions.pdf

EPA (n.d.). U.S. Environmental Protection Agency - Erie Coke Site. https://response.epa.gov/site/site_profile.aspx?site_id=14827

NTP (2021). National Toxicology Program - Coke-Oven Emissions, Report on Carcinogens, Fifteenth Edition. Triangle Park, NC: National Institute of Environmental Health and Safety. https://ntp.niehs.nih.gov/sites/default/files/ntp/roc/content/profiles/cokeovenemissions.pdf

PADEP (2023). Pennsylvania Department of Environmental Protection - Erie Coke Corporation - Site Background. https://www.dep.pa.gov/About/Regional/NorthwestRegion/Community-Information/Pages/Erie-Coke-Corporation.aspx

PADEP (2022). Pennsylvania Department of Environmental Protection - Erie Coke Fact Sheet. https://files.dep.state.pa.us/RegionalResources/NWRO/NWROPortalFiles/Erie_Coke/Erie_Coke_Fact_Sheet.pdf

APPENDICES

Appendix A. EPA's EJ Screen American Community Survey (ACS) Report 2015-2019 for a mile radius surrounding Erie Coke Site, Erie, Pennsylvania

EJSCREEN ACS Summary Report

Location: User-specified point center at 42.143933, -80.069561
Ring (buffer): 1-miles radius
Description:

Summary of ACS Estimates	2015 - 2019
Population	9,082
Population Density (per sq. mile)	4,398
People of Color Population	4,600
% People of Color Population	51%
Households	3,785
Housing Units	4,481
Housing Units Built Before 1950	3,379
Per Capita Income	15,468
Land Area (sq. miles) (Source: SF1)	2.06
% Land Area	69%
Water Area (sq. miles) (Source: SF1)	0.91
% Water Area	31%

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	9,082	100%	504
Population Reporting One Race	8,547	94%	1,029
White	5,162	57%	398
Black	2,489	27%	267
American Indian	4	0%	17
Asian	421	5%	159
Pacific Islander	0	0%	10
Some Other Race	472	5%	178
Population Reporting Two or More Races	534	6%	243
Total Hispanic Population	1,416	16%	300
Total Non-Hispanic Population	7,666		
White Alone	4,481	49%	323
Black Alone	2,255	25%	268
American Indian Alone	4	0%	17
Non-Hispanic Asian Alone	421	5%	159
Pacific Islander Alone	0	0%	10
Other Race Alone	129	1%	153
Two or More Races Alone	374	4%	243
Population by Sex			
Male	4,672	51%	272
Female	4,409	49%	267
Population by Age			
Age 0-4	569	6%	145
Age 0-17	2,436	27%	198
Age 18+	6,646	73%	277
Age 65+	883	10%	91

EJSCREEN ACS Summary Report

Location: User-specified point center at 42.143933, -80.069561
Ring (buffer): 1-miles radius
Description:

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	5,713	100%	310
Less than 9th Grade	441	8%	74
9th - 12th Grade, No Diploma	937	16%	149
High School Graduate	2,349	41%	159
Some College, No Degree	846	15%	157
Associate Degree	558	10%	100
Bachelor's Degree or more	584	10%	206
Population Age 5+ Years by Ability to Speak English			
Total	8,513	100%	401
Speak only English	7,012	82%	311
Non-English at Home[1+2+3+4]	1,501	18%	193
[1]Speak English "very well"	746	9%	183
[2]Speak English "well"	288	3%	84
[3]Speak English "not well"	332	4%	87
[4]Speak English "not at all"	134	2%	66
[3+4]Speak English "less than well"	466	5%	106
[2+3+4]Speak English "less than very well"	755	9%	126
Linguistically Isolated Households*			
Total	257	100%	84
Speak Spanish	102	40%	71
Speak Other Indo-European Languages	85	33%	29
Speak Asian-Pacific Island Languages	23	9%	38
Speak Other Languages	47	18%	53
Households by Household Income			
Household Income Base	3,785	100%	142
< $15,000	866	23%	134
$15,000 - $25,000	922	24%	103
$25,000 - $50,000	1,248	33%	131
$50,000 - $75,000	495	13%	88
$75,000 +	254	7%	78
Occupied Housing Units by Tenure			
Total	3,785	100%	142
Owner Occupied	1,433	38%	105
Renter Occupied	2,352	62%	141
Employed Population Age 16+ Years			
Total	6,919	100%	309
In Labor Force	4,081	59%	236
Civilian Unemployed in Labor Force	489	7%	99
Not In Labor Force	2,837	41%	184

EJSCREEN ACS Summary Report

Location: User-specified point center at 42.143933, -80.069561
Ring (buffer): 1-miles radius
Description:

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	9,100	100%	379
English	7,512	83%	390
Spanish	922	10%	265
French	27	0%	84
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	8	0%	16
Yiddish	N/A	N/A	N/A
Other West Germanic	N/A	N/A	N/A
Scandinavian	N/A	N/A	N/A
Greek	N/A	N/A	N/A
Russian	N/A	N/A	N/A
Polish	N/A	N/A	N/A
Serbo-Croatian	N/A	N/A	N/A
Other Slavic	N/A	N/A	N/A
Armenian	N/A	N/A	N/A
Persian	N/A	N/A	N/A
Gujarathi	N/A	N/A	N/A
Hindi	N/A	N/A	N/A
Urdu	N/A	N/A	N/A
Other Indic	N/A	N/A	N/A
Other Indo-European	237	3%	128
Chinese	0	0%	10
Japanese	N/A	N/A	N/A
Korean	45	0%	64
Mon-Khmer, Cambodian	N/A	N/A	N/A
Hmong	N/A	N/A	N/A
Thai	N/A	N/A	N/A
Laotian	N/A	N/A	N/A
Vietnamese	104	1%	124
Other Asian	0	0%	10
Tagalog	4	0%	16
Other Pacific Island	N/A	N/A	N/A
Navajo	N/A	N/A	N/A
Other Native American	N/A	N/A	N/A
Hungarian	N/A	N/A	N/A
Arabic	33	0%	53
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	142	2%	71
Total Non-English	1,588	17%	544

Data Note: Detail may not sum to totals due to rounding. Hispanic popultion can be of any race.
N/A meansnot available. **Source:** U.S. Census Bureau, American Community Survey (ACS) 2015 - 2019.
*Population by Language Spoken at Home is available at the census tract summary level and up.

Appendix B. EPA's EJ Screen Report (Version 2020) for 1-mile radius surrounding the Erie Coke Site, Erie, Pennsylvania

EJScreen Report (Version 2.0)

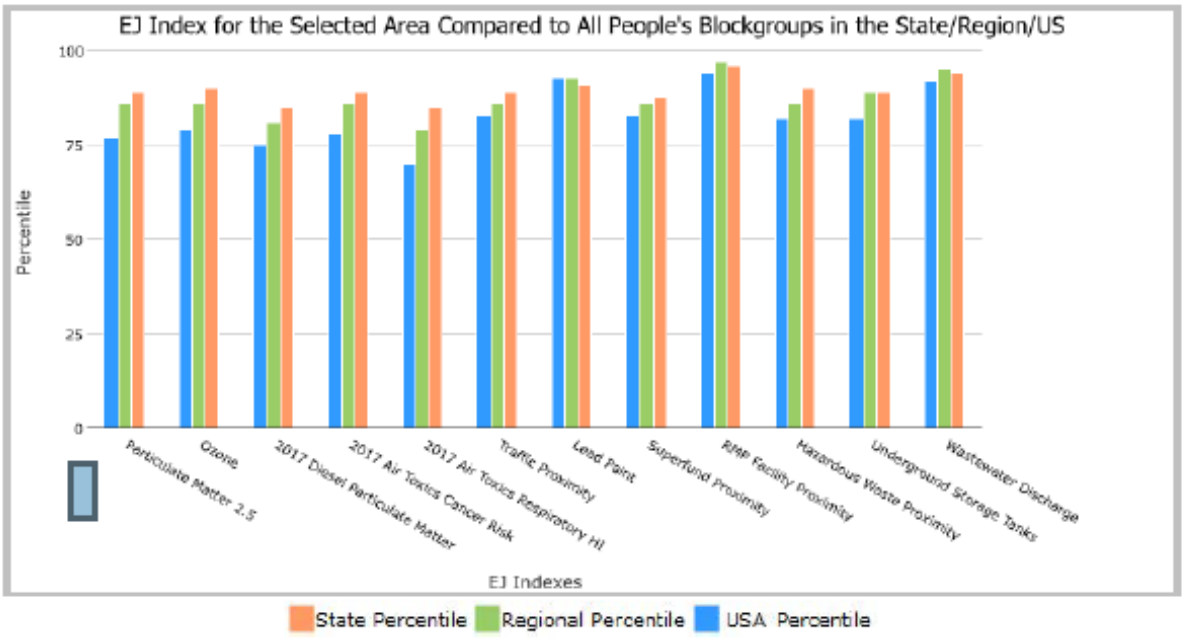
1 mile Ring Centered at 42.143933,-80.069561, PENNSYLVANIA, EPA Region 3

Approximate Population: 9,082

Input Area (sq. miles): 3.14

(The study area contains 1 blockgroup(s) with zero population.)

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	89	86	77
EJ Index for Ozone	90	86	79
EJ Index for 2017 Diesel Particulate Matter*	85	81	75
EJ Index for 2017 Air Toxics Cancer Risk*	89	86	78
EJ Index for 2017 Air Toxics Respiratory HI*	85	79	70
EJ Index for Traffic Proximity	89	86	83
EJ Index for Lead Paint	91	93	93
EJ Index for Superfund Proximity	88	86	83
EJ Index for RMP Facility Proximity	96	97	94
EJ Index for Hazardous Waste Proximity	90	86	82
EJ Index for Underground Storage Tanks	89	89	82
EJ Index for Wastewater Discharge	94	95	92



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

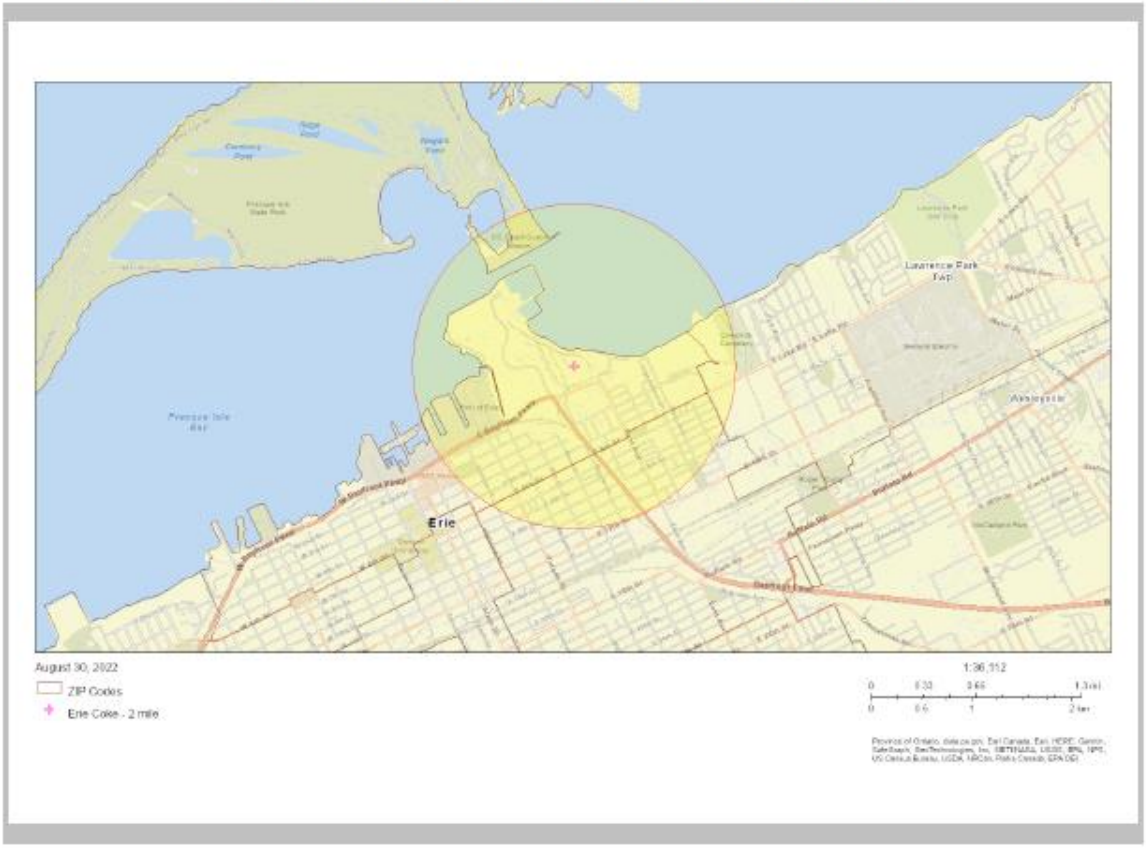
August 30, 2022 1/3

Appendix C. EPA's EJ Screen Report (Version 2020): Map of 1-mile radius surrounding the Erie Coke Site, Erie, Pennsylvania

EJScreen Report (Version 2.0)

1 mile Ring Centered at 42.143933,-80.069561, PENNSYLVANIA, EPA Region 3

Approximate Population: 9,082
Input Area (sq. miles): 3.14
(The study area contains 1 blockgroup(s) with zero population.)



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Appendix D. Environmental & Demographic Indicators for 1-mile radius surrounding the Erie Coke Site, Erie, Pennsylvania

EJScreen Report (Version 2.0)

1 mile Ring Centered at 42.143933,-80.069561, PENNSYLVANIA, EPA Region 3

Approximate Population: 9,082

Input Area (sq. miles): 3.14

(The study area contains 1 blockgroup(s) with zero population.)

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Pollution and Sources							
Particulate Matter 2.5 ($\mu g/m^3$)	8.43	8.72	32	8.2	56	8.74	45
Ozone (ppb)	43.6	42.1	78	41.9	77	42.6	63
2017 Diesel Particulate Matter* ($\mu g/m^3$)	0.214	0.269	36	0.267	<50th	0.295	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	31	31	84	30	80-90th	29	80-90th
2017 Air Toxics Respiratory HI*	0.2	0.32	14	0.34	<50th	0.36	<50th
Traffic Proximity (daily traffic count/distance to road)	650	580	75	680	72	710	74
Lead Paint (% Pre-1960 Housing)	0.85	0.47	88	0.35	92	0.28	95
Superfund Proximity (site count/km distance)	0.12	0.19	56	0.15	64	0.13	71
RMP Facility Proximity (facility count/km distance)	3.2	0.81	96	0.63	97	0.75	96
Hazardous Waste Proximity (facility count/km distance)	1.9	1.4	77	1.9	73	2.2	70
Underground Storage Tanks (count/km^2)	3.8	3.4	73	2.7	78	3.9	72
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.11	66	84	33	87	12	85
Socioeconomic Indicators							
Demographic Index	63%	26%	90	30%	91	36%	84
People of Color	51%	24%	83	33%	73	40%	65
Low Income	75%	28%	96	27%	97	31%	96
Unemployment Rate	12%	5%	89	5%	90	5%	89
Linguistically Isolated	7%	2%	89	3%	87	5%	77
Less Than High School Education	24%	9%	92	10%	92	12%	85
Under Age 5	6%	6%	64	6%	60	6%	56
Over Age 64	10%	18%	16	16%	23	16%	27

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

EJScreen is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJScreen documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJScreen outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

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Appendices A-D Reference: EPA (2020). Environmental Justice Screening and Mapping Tool (Version 2020). https://ejscreen.epa.gov/mapper/

Appendix E. EJ SCREEN and EJ information around the Erie Coke site

About EJ Screen: EPA has developed EJSCREEN, which is an environmental justice (EJ) mapping and screening tool. All EJSCREEN indicators are publicly available data. The EJSCREEN includes 12 environmental indicators, 8 demographic indicators, and 12 EJ indexes. Each EJ index combines demographic indicators with a single environmental indicator. EPA uses the following 12 primary EJ indices: Particulate Matter$_{2.5}$ ($PM_{2.5}$), ozone, National Air Toxic Assessment (NATA) diesel PM, NATA air toxics cancer risk, NATA respiratory Hazard Index (HI), traffic proximity, lead paint indicator, Superfund proximity, risk management plan proximity, hazardous waste proximity, underground storage tanks, and wastewater discharge proximity, as well as demographic indicators. These EJ indices identify geographic areas that may warrant further consideration or analysis for potential EJ concerns. These EJ indices were ranked (as a percentile) with other communities in Pennsylvania, EPA Region 3 (Pennsylvania, Virginia, West Virginia, District of Columbia, Maryland, and Delaware), and the U.S. A percentile in the EJ screen report is a rough estimate of what percent of the U.S. population lives in a block group that has a lower value. A relatively high percentile (greater than 50th percentile) means the observed EJ index is relatively uncommon in other communities. Anyone using EJSCREEN should note there is substantial uncertainty in demographic and environmental data, particularly when looking at small geographic areas. EJSCREEN is not intended to provide a risk assessment. Also, EJSCREEN does not provide data on every environmental impact and demographic indicator that may be relevant to a particular location, and data may be several years old. Screening results should be supplemented with additional information and local knowledge to get a better understanding of the issues in a selected location. It is important to understand the caveats and limitations when using EJSCREEN.

Historically, Erie, PA has been a manufacturing and industrial hub with many industries, such as ship building, fishing, railroad, steel or coke production, which may play a role in some of the EJ indexes discussed in the main report.

Appendix F. Benzene and Toluene Ambient Air Quality System (AQS) Data

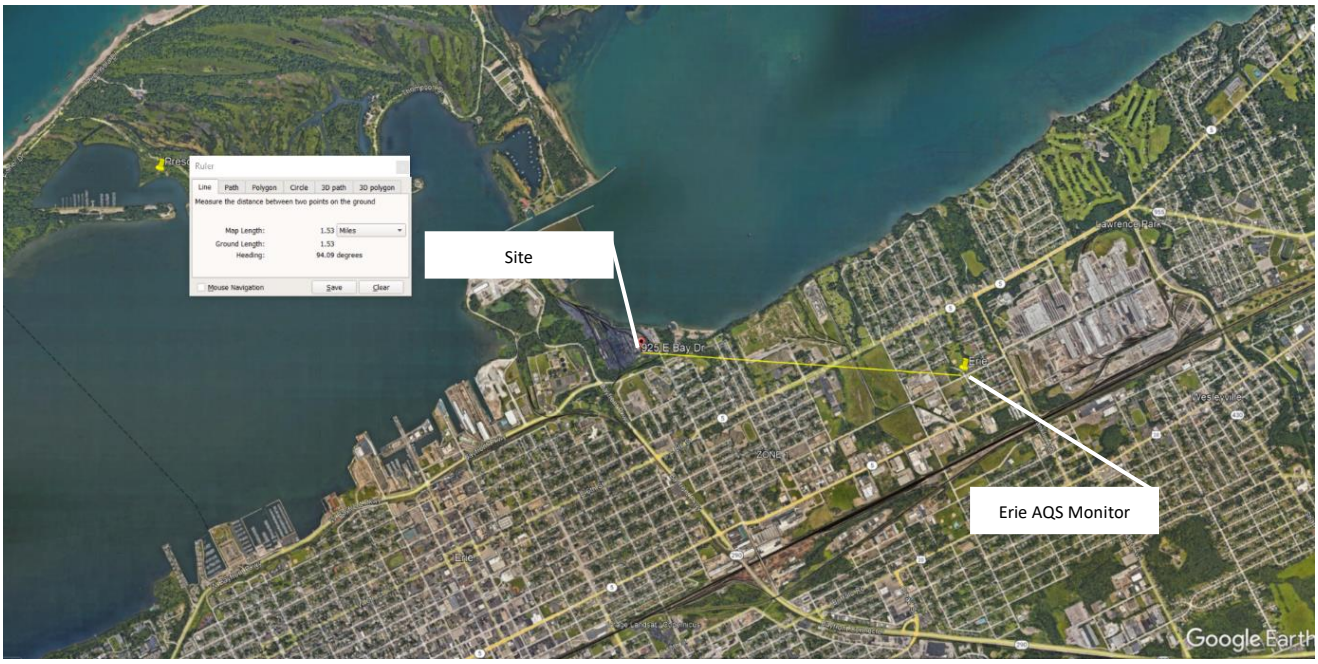
PADOH also reviewed the air quality data collected from nearby Air Quality System (AQS) stations located in Presque Isle and Erie City pre- (August 1st, 2019, to December 5th, 2019) and post-closure (December 6th, 2019, to March 16th, 2020) of the site. PADOH analyzed AQS data for benzene and toluene. As mentioned in the main report (section 2.5) the AQS data is not site-specific due to the AQS monitors' distance from site, wind direction, and other environmental sources of contaminants of concern (e.g., benzene from vehicle exhaust, burning coal or oil for heat, gasoline stations, and tobacco smoke). PADOH examined it to evaluate another indicator of air quality for this general area pre- and post-closure of the site.

AQS is EPA's ambient air quality data collected from thousands of monitors across the country. AQS also has information on meteorological data, descriptive details about each monitoring station, its geographic location and its operator, and data quality assurance and quality control. AQS data is used to assess air quality, assist in attainment/non-attainment designations, evaluate State Implementation Plans for non-attainment areas, perform modeling for permit review analysis, and submit reports to Congress as mandated by the Clean Air Act 1970.

PADOH analyzed the EPA's AQS data from the 1) the Presque Isle monitor (2.46 miles northwest of the site, Figure 1), and 2) the Erie City monitor (1.53 miles southeast of the site, Figure 2).

Figure 1. Location of the Presque Isle AQS Monitor, about 2.46 Miles Northwest to the site.

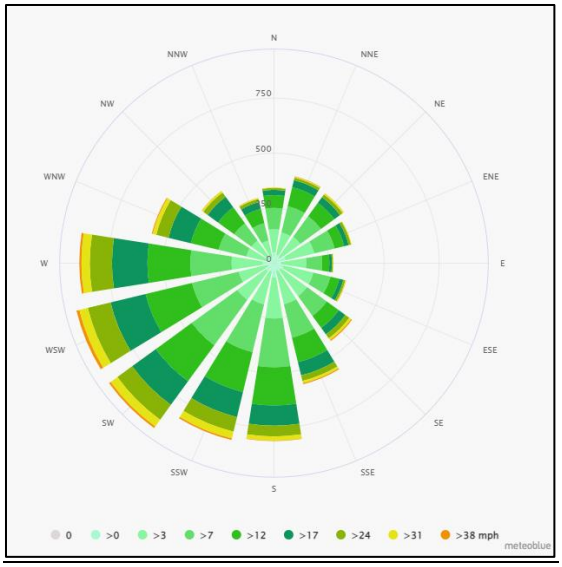
Figure 2. Location of the Erie AQS Monitor, about 1.53 miles Southeast to the site.



The ambient air data from the Erie and Presque Isle monitors are not site-specific or be attributed directly to the site as there are many other emission sources nearby, such as a sewage discharge and treatment plant, a shipbuilding and repair facility, a biofuel corporation, a waste composting facility, traffic and transportation lines, natural gas pipelines, and a recycling facility, that could also be affecting local ambient air quality [PADOH Environmental Health Indicators Map, accessed January 2023]. Additionally, common sources of environmental benzene are likely present, such as vehicle exhaust, burning coal or oil for heat, gasoline stations, and tobacco smoke.

PADOH also investigated prevailing wind by analyzing the wind rose diagram for Erie City. The wind rose diagram below depicts how many hours per year the wind blows from the indicated direction in 2019. The diagram suggests that most of the time the wind direction was from the west to east and southwest to northeast of the Erie Coke facility (Figure 3). The Erie City AQS monitoring station is located southeast of the site and is not typically down-wind of the site when compared to the 2019 wind rose data. The investigation suggests these monitors are not specific to emissions from the site or are not influenced by emissions from the site.

Figure 3. The wind rose for Erie (Erie airport) shows how many hours per year the wind blows from the indicated direction in 2019. Example SW: Wind is blowing from South-West (SW) to North-East (NE). (*Source: https://www.meteoblue.com*)



At both monitors, the post-closure period concentrations of benzene and toluene (12/06/2019 – 03/16/2020) were higher than the pre-closure levels (8/1/2019 – 12/05/2019), especially the benzene concentrations, which were statistically higher ($P<0.05$) at both AQS monitors (Tables 2 and 3). However, these monitors are close to several other emission facilities, plants, and traffic, which might be contributing to the benzene and toluene levels.

Table 2. Concentrations of benzene and toluene detected at the EPA's ambient air monitoring station in Erie City, Pennsylvania – Southeast side of the site

Ambient Air Concentration for Benzene and Toluene	Pre-closure Average ± Standard Deviation Concentration	Post-closure Average ± Standard Deviation Concentration	Pre-closure 95UCL Concentration	Post-closure 95UCL Concentration	Pre-closure Highest Concentration (24-hour average)	Post-closure Highest Concentration (24-hour average)
Benzene in µg/m³	0.28±0.13	0.40±0.13*	0.34	0.47*	0.69	0.68
Toluene in µg/m³	0.49±0.32	0.54±0.32	0.56	0.72	1.73	1.38

Pre-closure period (8/1/2019 – 12/05/2019); post-closure period (12/06/2019 – 03/16/2020); the Erie Coke facility was closed on 12/05/20219; *Significant difference from pre-closure value (P<0.05).

Table 3. Concentrations of benzene and toluene detected at the EPA's ambient air monitoring station in Presque Isle, Erie, Pennsylvania – Northwest side of the site

Ambient Air Concentration for Benzene and Toluene	Pre-closure Average ± Standard Deviation Concentration	Post-closure Average ± Standard Deviation Concentration	Pre-closure 95UCL Concentration	Post-closure 95UCL Concentration	Pre-closure Highest Concentration (24-hour average)	Post-closure Highest Concentration (24-hour average)
Benzene in µg/m³	0.28±0.13	0.45±0.24*	0.34	0.61*	0.69	1.14
Toluene in µg/m³	0.47±0.31	0.48±0.33	0.63	0.70	1.34	1.41

Pre-closure period (8/1/2019 – 12/05/2019); post-closure period (12/06/2019 – 03/16/2020); the Erie Coke facility was closed on 12/05/2019; *Significant difference from pre-closure value (P<0.05).

AQS Data for annual averages of benzene: PADOH also reviewed the available benzene EPA AQS data from year 2007 to 2022 from the nearby AQS monitoring station at Presque-Isle located 2.46 miles northwest of the site on the Presque Isle Island (Figure 1). The annual averages of benzene at this location were higher in years 2007-2008 at around 0.64 µg/m^3, with no data for years 2009-2012, and then were lower at around 0.32-0.42 µg/m^3 from years 2013-2020. No data are available for years 2021-2022.

Appendix G. Range of benzene, toluene, ethylbenzene, xylene (BTEX) concentrations ($\mu g/m^3$) at monitoring stations

Monitor ID / Location	Min & Max	Benzene Pre-closure	Benzene Post-closure	Toluene Pre-closure	Toluene Post-closure	Ethyl benzene Pre-closure	Ethyl benzene Post-closure	o-Xylene Pre-closure	o-Xylene Post-closure	m,p-Xylene Pre-closure	m,p-Xylene Post-closure
DEP01	Min	0.98	0.28	0.69	0.36 J	0.27 U	0.26 U	0.27 U	0.26 U	0.29 J	0.33 J
	Max	3.30	**2.90**	1.20	1.30	0.28 U	0.49 U	0.28 U	0.49 U	0.44 J	0.48 J
DEP02	Min	0.98	0.30	0.64	0.33 J	0.27 U	0.26 U	0.27 U	0.26 U	0.29 J	0.32 J
	Max	1.70	2.30	0.91	1.20	0.28 U	0.49 U	0.28 U	0.49 U	0.38 J	0.38 J
DEP03	Min	0.52	0.28	0.49	0.38 J	0.27 U	0.26 U	0.27 U	0.26 U	0.27 J	0.27 U
	Max	1.20	2.00	1.00	0.92	0.28 U	0.49 U	0.28 U	0.49 U	0.44 J	0.28 J
DEP04	Min	0.91	0.33	0.68	0.32 J	0.27 U	0.26 U	0.27 U	0.26 U	0.36 J	0.27 U
	Max	**6.40**	1.00	**2.20**	0.83	0.28 U	0.49 U	0.28 U	0.49 U	**0.64**	0.30 J
DEP05	Min	0.94	0.30	0.60	0.36 J	0.27 U	0.26 U	0.27 U	0.26 U	0.32 J	0.27 U
	Max	3.40	0.92	1.30	0.90	0.28 U	0.49 U	0.28 U	0.49 U	0.40 J	0.30 J
DEP06	Min	0.58	0.32	0.56	0.38 J	0.27 U	0.26 U	0.27 U	0.26 U	0.28 J	0.27 U
	Max	1.30	1.40	0.84	0.89	0.28 U	0.49 U	0.28 U	0.49 U	0.40 J	0.33 J
DEP07	Min	0.40	0.31	0.55	0.32 J	0.27 U	0.26 U	0.27 U	0.26 U	0.29 J	0.28 J
	Max	1.30	0.99	0.67	0.81	0.28 U	0.49 U	0.28 U	0.49 U	0.32 J	0.34 J
DEP08	Min	0.43	0.30	0.50	0.27 J	0.27 U	0.26 U	0.27 U	0.26 U	0.27 U	0.27 U
	Max	0.73	0.65	0.68	0.67	0.28 U	0.49 U	0.28 U	0.49 U	0.29 J	0.30 U
DEP09	Min	0.42	0.32	0.52	0.29 J	0.27 U	0.26 U	0.27 U	0.26 U	0.28 J	0.29 J
	Max	0.67	0.55	1.00	**1.40**	0.28 U	0.49 U	0.28 U	0.49 U	0.57	**0.79**
DEP10	Min	0.49	0.29	0.51	0.35 J	0.27 U	0.26 U	0.27 U	0.26 U	0.27 U	0.29 J
	Max	1.40	0.96	0.84	0.84	0.28 U	0.49 U	0.28 U	0.49 U	0.32 J	0.30 U
DEP11	Min	0.50	0.29	0.54	0.39 J	0.27 U	0.26 U	0.27 U	0.26 U	0.27 U	0.30 U
	Max	0.98	1.30	0.78	0.74	0.28 U	0.49 U	0.28 U	0.49 U	0.31 J	0.30 J
DEP12	Min	0.43	0.30	0.50	0.33 J	0.27 U	0.26 U	0.27 U	0.26 U	0.27 U	0.27 U
	Max	0.80	1.20	0.74	0.70	0.28 U	0.49 U	0.28 U	0.49 U	0.28 U	0.30 U
DEP13	Min	0.40	0.33	0.53	0.33 J	0.27 U	0.26 U	0.27 U	0.26 U	0.32 J	0.30 J
	Max	0.70	0.75	0.76	1.10	0.28 U	0.49 U	0.28 U	0.49 U	0.37 J	0.54

DEP = Station Monitor Number - DEPs 10, 11, 12 and 13 are community monitors. Bold = highest detected value for each contaminant and time period. J = value is estimated, above the lab method detection limit but below the reporting limit; Max = maximum; Min = Minimum; U = Not Detected; concentration shown is the method detection limit. *Ethylbenzene and o-xylenes were not detected above the method detection limit, and the levels provided are the method detection limits for each compound at each monitor. Data represents the highest concentration detected across all samples collected, where samples were collected in passive tubes that sampled for 24 hours a day, 7 days a week for 2 weeks and collected for analysis.

Appendix H. Potential Contaminant of Concern – Benzene

Benzene is a colorless liquid with a sweet odor and recognizable as benzene at air concentrations around 319,000 µg/m^3. Sources of benzene are both industrial and natural. Benzene is widely used and ranks among the top 20 chemicals produced by volume in the U.S. Industries use benzene to make chemicals (including styrene, cumene, and cyclohexane), lubricants, dyes, detergents, drugs, and pesticides. It is a component of crude oil and gasoline and is present in cigarette smoke. Benzene is commonly found in the environment and can present in outdoor urban air from the emissions of burning coal and oil, waste and storage operations, motor vehicle exhaust, and evaporation from gasoline service stations. Once in air, benzene reacts with other chemicals and breaks down within a few days. Air benzene can also be deposited on the ground by rain or snow [ATSDR 2007]. Benzene has also been identified indoors; tobacco smoke is a notable source of indoor benzene.

In the U.S., benzene in outdoor air ranged from 0.06 to 109 µg/m^3 [ATSDR 2007] and have varied in several cities, as discussed in the main report. People are exposed to benzene mainly through inhalation of contaminated air, such as in areas of heavy traffic and around gas stations, and through inhalation of tobacco smoke from both active and passive smoking [ATSDR 2007]. People living near hazardous waste sites, petroleum refining operations, petrochemical manufacturing sites, or gas stations may be exposed to higher levels of benzene. Also, people living in cities or industrial areas are generally exposed to higher levels of benzene in air than those living in rural areas [ATSDR 2007].

Everyone is exposed to a small amount of benzene each day in the outdoor environment, in the workplace, or in the home [ATSDR 2007]. Once in the body, about half of inhaled benzene passes through the lungs and enters the bloodstream, where it can travel throughout the body and be temporarily stored in bone marrow and fat. In the liver and bone marrow, benzene is converted into metabolites, some of which are harmful. Most benzene metabolites are excreted by urine within 48 hours after exposure.

Among workers, employees of industries that make or use benzene may be exposed to higher levels. Such industries include benzene production (petrochemicals, petroleum refining, and coke and coal chemical manufacturing), rubber tire manufacturing, and storage or transport of benzene and petroleum products containing benzene. Other workers, like coke oven workers in the steel industry, printers and rubber workers, shoemakers, laboratory technicians, firefighters, and gas station employees may also be exposed to high levels of benzene. An estimated 238,000 workers may be occupationally exposed to benzene in the U.S. [ATSDR 2007].

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myeloid leukemia (AML). The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

Symptoms such as confusion, dizziness, drowsiness, headache, rapid heart rate, tremors, and unconsciousness may occur at very high levels (>2 million µg/m^3) of benzene. These symptoms usually subside once the exposure is eliminated. The major effect of benzene from long-term exposure is on the blood and benzene can cause a decrease in red blood cells, excessive bleeding, or affect the immune system [ATSDR 2007].

Reference

ATSDR (2007). Agency for Toxic Substances and Disease Registry – Toxicological Profile for Benzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/ToxProfiles/tp3.pdf