Health Consultation

ANALYSIS OF OUTDOOR AIR CONTAMINANTS

RESERVE MANAGEMENT GROUP

CHICAGO, ILLINOIS

February 17, 2022

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Office of Community Health and Hazard Assessment
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, 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. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared By:

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Abbreviations

ADAF	age dependent adjustment factor
AQG	Air Quality Guidelines
AQI	Air Quality Index
AQS	Air Quality System
ATSDR	Agency for Toxic Substances and Disease Registry
CAA	Clean Air Act
CCDES	Cook County Department of Environment and Sustainability
CDC	Centers for Disease Control and Prevention
CDPH	Chicago Department of Public Health
COPD	Chronic Obstructive Pulmonary Disease
CREG	Cancer Risk Evaluation Guide
CSF	Cancer Slope Factor
CTE	Central Tendency Exposure
EMEG	Environmental Media Evaluation Guide
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
HAP	Hazardous Air Pollutant
HEC	Human Equivalent Concentration
IEPA	Illinois Environmental Protection Agency
ISA	Integrated Science Assessment
IUR	Inhalation Unit Risk
KM	Kaplan-Meier
LOAEL	Lowest Observed Adverse Effect Level

MRL	Minimal Risk Level
$\mu g/m^3$	micrograms per cubic meter
mg/kg/day	milligrams per kilogram per day
NAAQS	National Ambient Air Quality Standard
NCI	National Cancer Institute
NOAEL	No Observed Adverse Effect Level
$PM_{2.5}$	particulate matter smaller than 2.5
PM_{10}	microns particulate matter smaller than 10
POD	microns point of departure
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RMEG	Reference Media Evaluation Guide
RMG	Reserve Management Group
ROE	Report on the Environment
TRI	Toxics Release Inventory
TSP	total suspended particulates
VOC	volatile organic compound
WHO	World Health Organization

1. SUMMARY

Introduction

The Agency for Toxic Substances and Disease Registry (ATSDR) protects communities from harmful health effects related to exposure to natural and man-made hazardous substances. We do this by responding to environmental health emergencies; investigating emerging environmental health threats; conducting research on the health impacts of hazardous waste sites; and building capabilities of and providing actionable guidance to state and local health partners.

On February 8, 2021, federal elected officials from Illinois asked ATSDR to investigate whether the Reserve Marine Terminal and South Shore Recycling facilities are releasing particulate matter (PM) and metals (e.g., arsenic, lead, and nickel) into outdoor air and potentially harming people's health. These two facilities are located at 11600 S. Burley Avenue in southeast Chicago. The property is currently owned by the Reserve Management Group (RMG) and is within the footprint of the former Republic/LTV Steel site. General III, LLC, a subsidiary of RMG, is also located at the RMG property. General III wants to expand its metal shredding and recycling facility by bringing equipment from the General Iron site, which previously operated on the north side of Chicago at 1909 N. Clifton Avenue, to the RMG property under the name Southside Recycling. General III has applied for permits to make this move.

Community groups in this southeast Chicago neighborhood have filed formal complaints with the U.S. Department of Housing and Urban Development (HUD) and with U.S. Environmental Protection Agency (EPA) claiming that federal fair housing and civil right laws were violated by the City of Chicago and the Illinois Environmental Protection Agency (IEPA), respectively, in evaluating permits for Southside Recycling's new location [BCC 2021c]. IEPA has approved the General III construction permit request [BCC 2021b]. EPA recommended that Chicago Department of Public Health (CDPH) complete a detailed environmental analysis before deciding whether to approve an operating permit [Chicago 2021]. ATSDR is not commenting on the Southside Recycling permit application and the facility is not currently operating. Our review looked at possible environmental exposures from past and current recycling activities at RMG and other industrial sources within one mile of the site.

ATSDR reviewed air monitoring data to find out how much pollution is in the air near the RMG facilities. We evaluated PM and metals data collected from 1969 to 2020 by IEPA and the Cook County Department of Environment and Sustainability (CCDES). The data were collected at Washington High School, at 3535 E. 114th Street, as part of the statewide regulatory air monitoring network. Additional data were collected by EPA in their 2015 study at Rowan Park, 11546 S. Avenue L, directly south of Washington High School. The air monitors at Washington High School and Rowan Park, which are generally downwind of the RMG site and less than one-half mile away, were located in an effort to show the highest levels of contaminants in outdoor air that people might be exposed to living in the nearby area. ATSDR found that the levels of contaminants in outdoor air have decreased over several decades until about five years ago when some air contaminant levels began to increase. We were not able to tell if people in the neighborhoods are being exposed to harmful levels of metals in soil which may have been released through the air by local industries over the years, as soil sampling has not been done in the community.

Conclusions

ATSDR looked at PM and metals levels in our review of air quality data collected near the RMG property. We reached three conclusions about health:

Conclusion 1

Based on recent air monitoring data (2016-2020), breathing particles smaller than 10 microns in diameter (PM_{10}) and particles smaller than 2.5 microns in diameter ($PM_{2.5}$) could be harmful for highly sensitive people, especially if they live in the direction that the wind is blowing (or downwind) from RMG and other industrial and commercial sites. Highly sensitive populations are people who have pre-existing heart and lung health conditions like asthma, heart disease, or chronic obstructive pulmonary disease (COPD). Highly sensitive individuals exposed to PM over short periods of time (short-term, 24-hours) and long periods of time (long-term, several months) are susceptible to respiratory symptoms and an exacerbation of lung and heart disease. ATSDR does not expect people without pre-existing lung and heart health conditions living near RMG to develop health problems from breathing PM in the air.

Basis for Conclusion 1

- ATSDR evaluated data from the IEPA site that measured PM from 2016-2020. We first conducted a PM screening analysis by looking at long-term and short-term PM_{10} and $PM_{2.5}$ data and comparing them to ATSDR PM screening values. ATSDR uses the World Health Organization (WHO) Air Quality Guidelines (AQGs) for 24-hour and yearly exposures as PM screening values to determine if PM requires further evaluation. We then compared 24-hour PM_{10} and $PM_{2.5}$ concentrations to EPA's Air Quality Index (AQI), which helps to understand how clean or polluted the air is and what associated health effects might be a concern.
- WHO's AQGs screening values were exceeded for PM_{10}. The long-term average PM_{10} concentration was 23.3 micrograms (one-millionth of a gram) per cubic meter of air, or $\mu g/m^3$, from 2016-2020, exceeding the annual AQG of 15 $\mu g/m^3$. PM_{10} levels have been consistently above the AQG and have increased in recent years: the annual average was 16.0 $\mu g/m^3$ in 2016, 21.6 $\mu g/m^3$ in 2017, 23.1 $\mu g/m^3$ in 2018, 26.8 $\mu g/m^3$ in 2019, and 31.9 $\mu g/m^3$ in 2020. On 7.5% of days during 2016-2020 and 16% of days in 2020, the 24-hour PM_{10} was higher than the 24-hour AQG of 45 $\mu g/m^3$.
- The 24-hour PM_{10} concentrations were within the EPA AQI moderate category (55-154 $\mu g/m^3$) on 3.8% of days in 2016-2020 and 11% of days in 2020. On days with an AQI in the moderate category there is a higher likelihood of respiratory symptoms in highly sensitive groups, i.e., those with pre-existing health conditions that make them more susceptible to health effects from PM and worsening of symptoms in people with pre-existing health conditions that affect the heart and lungs. PM_{10} concentrations were not higher than the AQI moderate category during 2016-2020. People without pre-existing lung and heart heath conditions are not expected to be harmed by breathing PM_{10} in this community. ATSDR's data analyses suggest that elevated PM_{10} exposures may be the result of releases from existing industries and construction activities in the area southwest of the IEPA air monitoring site at Washington High School. $PM_{2.5}$ concentrations have also exceeded the AQGs screening values. The long-term average $PM_{2.5}$ concentration was 9.3 $\mu g/m^3$ from 2016-2020, which is greater than the annual AQG of 5 $\mu g/m^3$. The yearly average has

also shown a modest increase in recent years: 8.9 μg/m^3 in 2016, 9.1 μg/m^3 in 2017, 10.5 μg/m^3 in 2018, 10.7 μg/m^3 in 2019, and 9.7 μg/m^3 in 2020. Between 2016-2020, the 24-hour AQG of 15 μg/m^3 was exceeded on 52 days or 8.8% of days.

- In terms of the EPA AQI for 2016-2020, the 24-hour $PM_{2.5}$ concentrations were within the moderate AQI category (12.1-35.4 μg/m^3) on 122 out of 592 days (21%). The $PM_{2.5}$ levels were not higher than the AQI moderate category during 2016-2020. On days with an AQI in the moderate category there is a higher likelihood of respiratory symptoms in highly sensitive groups, i.e., those with pre-existing health conditions that make them more susceptible to health effects from PM and worsening of symptoms in people with pre-existing health conditions that affect the heart and lungs. People without pre-existing heart and lung conditions are not expected to be harmed by breathing $PM_{2.5}$ in this community.

Conclusion 2

Based on recent air monitoring (2015-2020) and historic data (1982-2015), people living downwind of RMG (now or in the past) are not likely to develop health problems from breathing metals in the air. The metals we looked at include arsenic, cadmium, chromium, lead, manganese, and nickel. It is not likely that people will experience an increased risk of cancer or other health problems from breathing the metals.

Basis for Conclusion 2

- ATSDR's screening evaluation of air monitoring data of metals compared annual average concentrations with cancer and chronic noncancer health-based comparison values (CVs) to identify contaminants that might need to be reviewed further. The air monitoring information was collected between 2016-2020 at the IEPA site and in 2015 by EPA. We also evaluated short-term metals data and compared them to the appropriate intermediate and short-term CVs. Lead concentrations were compared to the National Ambient Air Quality Standard (NAAQS). The same methods were applied to the historic data (1982-2015).
- The chronic CVs for arsenic, cadmium, and chromium were exceeded; these metals are associated with lung cancer in people. However, based on recent air monitoring data (2015-2020) the calculated cancer risk from long-term exposure to these metals (total estimated risk of 7 additional cancer cases per one million people) is not considered by ATSDR to be an elevated cancer risk. ATSDR estimates that the total cancer risk from exposure to these metals during the 1982-2015 period is an additional 18 cancer cases per one million people. Given the health protective nature of the cancer risk evaluation for metals, this estimated cancer risk is also not considered to be a hazard. Note that this is a theoretical estimate of cancer risk that ATSDR uses as a tool for deciding whether public health actions are needed to protect health—it is not an actual estimate of cancer cases in a community.
- Short-term metals concentrations in the current data (2015-2020) were all below their respective intermediate (14-365 days) and acute (1-14 days) duration CVs and lead concentrations were below the NAAQS.
- We found that some metals historically exceeded their respective screening CVs for noncancer health effects. The long-term CV for manganese exposure was exceeded during 1982-1986, when manganese concentrations were highest. Cadmium exceeded its short-term CV on one day between

1982-2015. ATSDR evaluated the toxicological basis for our CVs and determined that historical exposures to manganese and cadmium are not likely to have caused noncancer health effects.

- Most metal concentrations follow a decreasing trend from 1982 to the present. In looking at the past five years, however, ATSDR found that chromium and nickel levels are increasing, as shown in data boxplots in Appendix B; manganese concentrations have leveled off during this period. Despite these recent increases in some air contaminants, ATSDR does not expect that breathing these metals will increase people's risk of cancer or other health effects. Data analyses suggest that these metals are largely from the releases from existing industries and construction activities in the area southwest of the IEPA air monitoring site at Washington High School.

Conclusion 3

ATSDR was not able to evaluate whether exposure to metals in soil could potentially harm people's health because surface soil sampling data in residential areas were not available.

Basis for Conclusion 3

- Metals and other contaminants may have been released by various industrial sources and deposited in residential yards recently and over the long industrial history of the Calumet River area. ATSDR is not aware of any available surface soil sampling data within the residential area potentially impacted by local industries.
- CDPH recently started soil sampling on the RMG property [Chicago 2022]. The results were not available for review at the time that this Health Consultation was drafted.

Limitations

In addition to metals contamination in surface soil, there are also certain air pollutants that are likely to be released by local industries that ATSDR could not review because data were not collected. We were not able to tell the percentage of hexavalent chromium (which is the most toxic form of chromium) in the air from the measurements of chromium concentrations. ATSDR used a conservative assumption that 5% of total chromium in each sample was in the hexavalent form for the evaluation of cancer and noncancer risk for chromium exposure. Air monitoring for different forms of chromium would allow ATSDR to better evaluate hexavalent chromium exposures and cancer risk. VOCs are also potentially released by existing metals recyclers when items containing fuels and oils, such as old cars and storage tanks, are crushed or shredded. VOCs have not previously been monitored at the IEPA site. Ground-level ozone is also not monitored at the IEPA site, however, all of Cook County is currently in nonattainment of the ozone NAAQS based on data from other monitor sites [EPA 2021f].

Next Steps

Following its review of available information, ATSDR recommends:

1. Highly sensitive adults and parents of highly sensitive children with pre-existing health conditions such as heart and lung disease (e.g., asthma, COPD, or cardiovascular disease) should consult the air quality forecast at https://www.airnow.gov/aqi/aqi-basics/. These individuals should avoid strenuous outdoor work or play for long periods of time on days where the AQI is predicted to be in the moderate category. ATSDR will work with Federal health partners and CDPH to promote

awareness of, and steps that people should take to protect themselves from, harmful effects of particle pollution and ground-level ozone.

2. EPA, IEPA, and the City of Chicago are encouraged to continue to work with local industries to identify opportunities to reduce local PM and metals releases. ATSDR recommends that local industries and regulators conduct additional air monitoring for PM and metals to better understand local sources and to help develop potential reduction measures. ATSDR will review any additional air monitoring data collected in the community.
3. ATSDR recommends that regulators assess the amounts of VOCs and hexavalent chromium released from local industries and consider initiating air monitoring for these contaminants. ATSDR will review any additional air monitoring data collected in the community.
4. Regulatory agencies are encouraged to conduct surface soil sampling in areas downwind of the RMG site to evaluate residents' long-term exposures to metals that have been deposited from air releases. ATSDR will review any soil data collected and will collaborate with EPA, IEPA, and the City of Chicago to evaluate the need for mitigation and additional public health actions.
5. ATSDR will provide Federal and local health partners with educational resources to address community stress and mental health issues related to concerns about environmental contamination. Resources for healthcare providers and community members are available on our Community Stress Resource Center website: https://www.atsdr.cdc.gov/stress/index.html

2. BACKGROUND AND STATEMENT OF ISSUES

On February 8, 2021, federal elected officials from Illinois requested ATSDR to conduct a health consultation to review and analyze existing public health hazards posed by PM and metals exposures in outdoor air near Reserve Marine Terminal and South Shore Recycling facilities, located at 11600 S Burley Avenue. This property is within the footprint of the former Republic/LTV Steel and is currently owned by RMG. The site consists of five operating businesses involved in recycling activities: General III, Reserve Marine Terminals, Napuck Salvage of Waupaca, South Shore Recycling, and RSR Partners (Regency Technologies).

General III aims to relocate its metal shredding and recycling facility, previously called General Iron when it operated at 1909 N. Clifton Avenue in Chicago, to the RMG property under the name Southside Recycling. EPA conducted multiple inspections and compliance actions against General Iron at its previous site and entered settlement agreements in 2006 and 2012 to address releases of fugitive dust and VOCs [EPA 2021d]. The company halted operations in late 2020 and committed to decommission the site by the end of March 2021 [BCC 2021a].

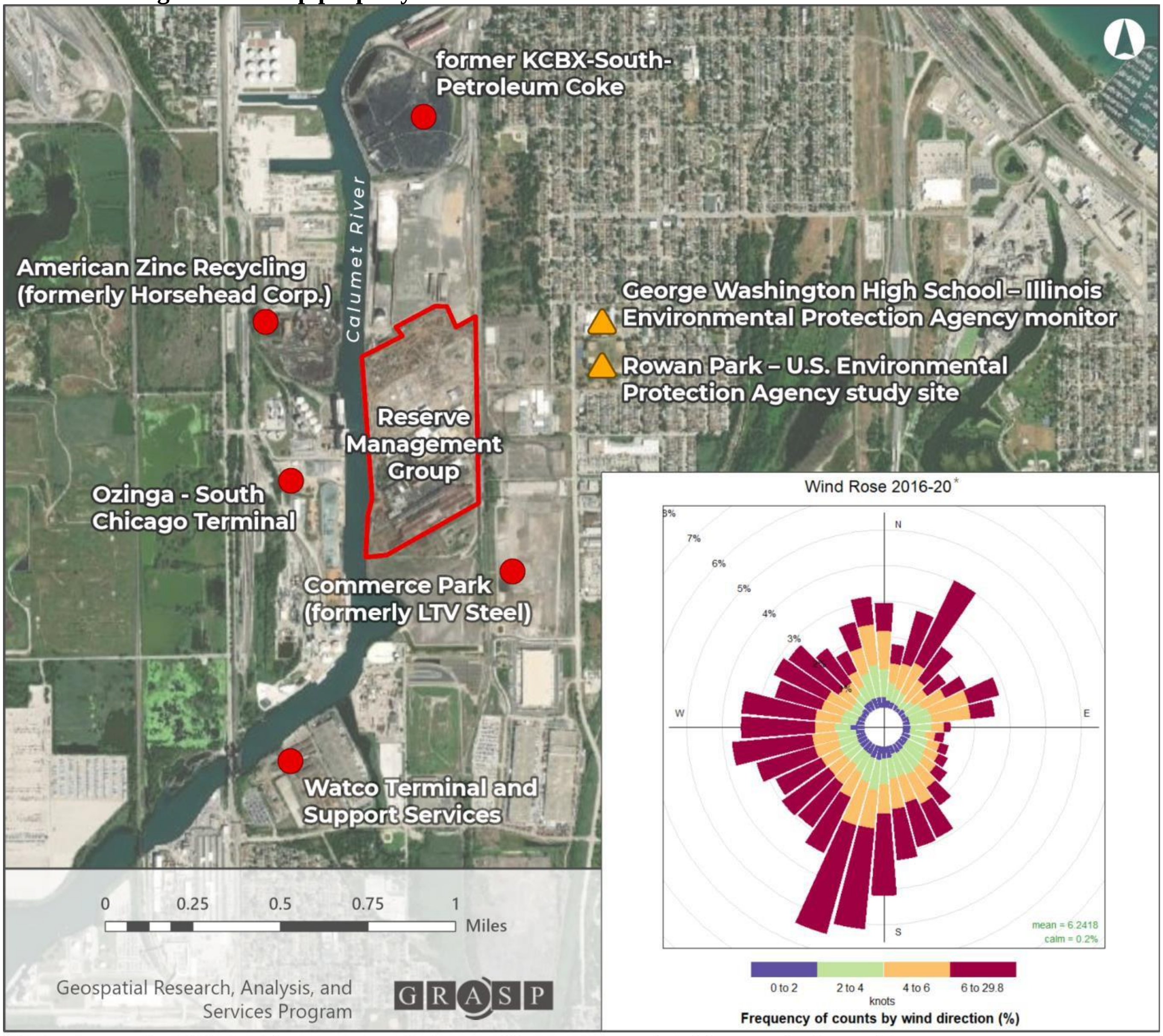
Community groups on Chicago's southeast side filed formal complaints with HUD and with EPA claiming that federal fair housing and civil right laws were violated by relocating General Iron. HUD's Fair Housing and Equal Opportunity office referred the matter to the U.S. Department of Justice in October 2020, requesting that they investigate Chicago's zoning and land use practices. Community groups say that their civil rights are being violated by the City's plans to move General Iron "out of mostly white, affluent Lincoln Park to East Side, which is majority Latino, surrounded by Black communities and already suffers air pollution from many industrial sources [BCC 2021c]." EPA recommended that City of Chicago complete a detailed environmental analysis before deciding whether to approve Southside Recycling's operating permit application. The permit process is on hold pending further review by the City of Chicago [Chicago 2021]. Community organizations have also requested that EPA investigate whether IEPA "discriminated against the predominantly Latino and African American community in southeast Chicago" in issuing its construction permit to Southside Recycling [BCC 2021b].

ATSDR cannot comment on the Southside Recycling permit application. The facility is not currently operating. Our review of environmental conditions includes impacts from the existing recycling operations at RMG and other industrial sources located within about a 1-mile radius.

2.1 Demographics, Environment, and Health Overview

The RMG site, adjacent industries, air monitoring stations, and the affected residential neighborhood are shown in a map on Figure 1. The map also contains a wind rose which indicates that prevailing winds are from the southwest, south, west, and northeast. Regulatory history of key local industries and trends in air monitoring data are described in Section 2.2.

Figure 1. Area map showing industrial sites and air monitoring locations in southeast Chicago near Reserve Management Group property



*Wind rose generated by ATSDR using Indiana Department of Environmental Management meteorological data reported at Hammond site

ATSDR developed a series of maps to characterize the community impacted by RMG and other nearby industries, presented in Appendix A. Using U.S. Census data, we estimate that there are 9,970 people who live within a 1-mile radius of the RMG site. Residential areas are located to the east, northeast, and north of the site, i.e., in the predominant downwind direction from local industry. There are 1,799 people who live less that ½-mile away from RMG. The population is 63% White, 3% Black, and 29% other race; residents are 71% Hispanic or Latino. Depending on the census tract, up to 37% of people speak primarily Spanish and speak English "less than very well". Sensitive populations within ½-mile of RMG include students at Washington High School and adjacent Washington Elementary. There is also a daycare and Head Start Program on 118th Street that cares for infants as young as 6 weeks [BKC 2021].

Social vulnerability index

ATSDR also created social vulnerability index (SVI) maps to characterize a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as a toxic chemical spill. As presented in Appendix A, the SVI shows that the community adjacent to RMG is in the top quartile for vulnerability based on 15 census-derived factors, including economic data and data regarding education, family characteristics, housing, language ability, ethnicity, and vehicle access.

Community concerns

In 2016, public health researchers from Kansas State University and University of Illinois at Chicago began an air pollution evaluation project with three diverse communities in Chicago, including the Southeast Environmental Task Force (SETF), which is active in the southeast Chicago area where RMG is located. The researchers report that, "Residents of Environmental Justice (EJ) communities often contend that limited regional air pollutant air monitoring does not adequately report on perceived air pollution from local sources or address the relative health risks of proximity to local sources. [KSU 2021.]" The scientists have equipped partners in southeast Chicago with low-cost PM air sensors under the Shared Air/Shared Action (SA2): Community Empowerment through Low-Cost Air Pollution Monitoring project. They report that community members are concerned about how local air pollution may affect their health [KSU 2020.]

Community members have been protesting since the late 1980s against multiple new and existing sources of air pollution in southeast Chicago [SETF 2021]. SETF and the Southeast Side Coalition to Ban Petcoke organized against the KCBX Terminals site (discussed in detail in Section 2.2), which they said released "thick clouds of black dust blowing across their neighborhoods". Community protests and regulatory actions by EPA and IEPA resulted in the City of Chicago adopting new regulations requiring bulk storage facilities to better control releases of dust [WTTW 2017.]

Community members living with environmental contamination may experience chronic stress, which can be compounded by feeling dismissed, powerless, unheard, or unsupported. In a community like southeast Chicago, stress is a normal reaction to environmental contamination; however, chronic stress can pose physiological health risks on top of the health risks associated with exposure to contaminants [ATSDR 2021b].

2.2 Historical Air Releases and Data Trends

Industrial history

In 1901, Republic Steel acquired the property at 118th Street and the Calumet River. The company initially built open hearth furnaces and a blooming mill. At the start of World War II, a completely integrated electric furnace, coke ovens, blooming and rolling mills were built on the site for the government and operated by Republic Steel. Employment at the steel plant peaked at 6,335 workers in 1970. In 1984, Republic Steel merged with J&L Steel to form LTV Steel. LTV declared bankruptcy several times in the 1980s and 1990s, ultimately closing of all its mills and refineries by the early 2000s [USACE 2015].

The former Republic/LTV site, now owned by RMG, includes these recycling facilities:

1. **General III** recycles scrap and waste materials. The company is permitted under the Clean Air Act (CAA) as a minor source (IL000031600SFX). The facility aims to expands its recycling operations by relocating the former General Iron site to this location under the name Southside Recycling.
2. **Reserve Marine Terminals** operates an indoor foundry sand/scrap recovery process and conducts outdoor scrap processing activities that include sorting, shearing, breakage, and torch cutting. The company has a CAA permit as a minor source (IL000031600GYG).
3. **Napuck Salvage of Waupaca** operates an indoor aluminum and cast-iron recycling process that includes crushing, shredding, screening, and washing. The company has a CAA permit as a minor source (IL000031600GYI).
4. **South Shore Recycling** operates a small indoor/outdoor ferrous/non-ferrous scrap recycling center and processes scrap metal through sorting, shearing, torch cutting and baling. The company is permitted under the Resource Conservation and Recovery Act (RCRA) as a small-quantity generator (ILR000171975).
5. **RSR Partners (Regency Technologies)** conducts manual recycling of electronics, which does not require an EPA permit. [Southside 2020]

EPA inspected Napuck Salvage in June 2019, revealing violations including dry and dusty conditions and holes in the ceiling above mill operations. Workers reported that the shredder "occasionally catches on fire, if, for example, a battery was in the loaded material." [EPA 2019a]

As stated in the Southside Recycling permit application, materials for recycling are delivered to the RMG site via trucks, contract haulers, barge, and rail [Southside 2020]. In its construction permit review, IEPA responded to multiple comments about uncontrolled sources of fugitive PM emissions from the General III site. For example, one commenter stated that the permit application allegedly has "artificially high control assumptions and greatly underestimated emissions for a range of fugitive sources including paved roads, vehicle loading/unlading, and piles"; another commenter stated, "there is little to no discussion of controls to be used for truck, rail, or barge unloading or even confirmation that rail and/or barge loading occurs on the General III property". In response, IEPA has required General III to address fugitive visible emissions in the permit and fugitive particulate operating program [IEPA 2020b].

In addition to LTV Steel several other industrial facilities that emit PM and metals developed along this stretch of the Calumet River. The following facilities are within one mile of RMG.

- **American Zinc Recycling (AZR)**, formerly Horsehead Corporation, is located at 2701 E. 114th Street. The facility, originally built in 1940, recycles wastes from steel production to extract zinc and other metals [Horsehead 2014]. EPA cited the company in 2014 for violations of the Clean Air Act including excess emissions of PM and "Hazardous Air Pollutants (HAPs) including, but not limited to, manganese, lead, and cadmium." EPA reached a settlement in April 2020 where AZR agreed to spend $8 million to improve PM controls [EPA 2020a].

- **Watco Terminal and Port Services**, formerly Kinder Morgan, is a bulk solid material handler located at 2926 E. 126th Street. The materials handled by Watco include manganese-bearing alloys. EPA and City of Chicago have been investigating manganese and other metals in air and deposited to soils around homes adjacent to this facility. In May 2018, EPA required Watco to install PM_{10} and metals air samplers at their fence line; in December 2018 EPA cited the company for violations that "have caused or can cause excess emissions of manganese" [EPA 2018a]. In 2019, EPA ordered Watco to limit storage of manganese-containing materials [EPA 2019b]. Air monitoring data collected between September 2018 and June 2020 show a noticeable decrease in manganese concentrations at the fence line air monitor beginning in May 2019 [EPA 2021c].

- **KCBX Terminals** established facilities at 10730 S. Burley Ave. (about 1 mile north of RMG) and 3259 E. 100th St. (3 miles north) in late 2012 to store and handle petroleum coke, also called petcoke. EPA required KCBX to conduct fence line air monitoring at both sites for PM and metals, resulting in violations of the NAAQS. The City of Chicago issued a new rule requiring large bulk material storage facilities to enclose their operations [EPA 2020b]. KCBX chose to decommission their north site in June 2015 and south site in June 2016 [KCBX 2015]. ATSDR issued a health consultation with the main finding that "blown dust from the KCBX facility poses a public health hazard to residents living adjacent to the piles, especially for sensitive individuals. [ATSDR 2016a]"

- **Ozinga Ready Mix** produces concrete and stores bulk materials at multiple locations in Chicago. The Ozinga South Chicago Terminal at 11701 S. Torrence Avenue is directly south of American Zinc Recycling and across the river from RMG. The facility was last inspected by EPA in October 2018 and no air permit violations identified [EPA 2021a]. The company was cited by EPA for failing to control dust emissions at its 1818 E. 103rd Street facility (about 3 miles northwest of RMG). In June 2016, EPA required the company to reduce PM emissions, to pay a $37,689 penalty, and to buy new, cleaner diesel trucks [EPA 2017].

- **Commerce Park Chicago** is an industrial park currently under construction on the former Republic/LTV site, west along Avenue O between 117th and 122nd Streets. Much of the property is covered in slag, a concrete-like byproduct of steel production which typically contains metals, i.e., impurities from the industrial process. The site was not remediated prior to construction, but rather the developers prepared the ground by a process called dynamic compaction, where large weights were dropped from cranes, and clean soil was placed over the slag [Crain 2019].

Multiple other PM and metal-emitting facilities are found along the Calumet River between one and two miles north of RMG. EPA has ongoing investigations and enforcement actions against S.H. Bell, Skyway Cement Company, Adelman's Truck and Equipment Corporation, and other facilities, as detailed on their Environmental Issues in Southeast Chicago website: https://www.epa.gov/il/environmental-issues-southeast-chicago. This website also describes soil investigations around Watco and at the Schroud Property, a site where slag material from Republic/LTV Steel was historically dumped, located at 12801 S. Burley Avenue (2 miles south of RMG).

Air monitoring history

The CCDES established an ambient air monitoring station at Washington High School, at 3535 E. 114th Street in 1964. This site remains a part of the Illinois state air monitoring network. IEPA reports particulate matter data in the form appropriate to determine attainment of the NAAQS, which has changed over time, beginning in 1969 with total suspended particulates (TSP, i.e., particles smaller than 30 microns), then adding PM_{10} in 1984, and then $PM_{2.5}$ in 1999. The TSP NAAQS is no longer enforced; however, TSP samples continue to be collected and analyzed for metals to determine attainment of the lead NAAQS and to screen for health risks associated with arsenic, cadmium, chromium, manganese, and nickel. CCDES does not operate a ground-level ozone monitor at the Washington High School site. However, all of Cook County is among eleven counties in the metropolitan Chicago area currently in nonattainment of the ozone NAAQS based on data from other monitor sites [EPA 2021f].

The IEPA monitor site was originally intended to characterize community exposures downwind of Republic/LTV Steel. According to General III's permit application, the nearest residences in the downwind direction of the expanded site are at the corner of East 114th Street and South Green Bay Avenue. The residences are 1,150 feet northeast of the proposed Southside Recycling site and Washington High School, i.e., the IEPA air monitor site, is 1,700 feet away [Southside 2020]. The IEPA site is about 2,000 feet (under ½-mile) from the edge of the current recycling operations at RMG. There are residences directly east of RMG that are slightly closer, i.e., homes between 116th and 117th Streets, east of Avenue O, which are about 1,800 feet away.

In addition to various industrial processes, sources of larger PM include unpaved roads, agricultural tilling, aggregate storage piles, and heavy construction operations. Larger particles settle out near the emissions source and smaller particles travel farther before settling out. EPA estimates that particles greater than 100 microns will settle within 20-30 feet of an emissions source, while those between 30-100 microns will travel up to a few hundred feet [EPA 1997]. TSP air samplers capture particles about 30 microns and smaller, i.e., particles which may travel more than a few hundred feet. PM_{10} is expected to stay aloft up to several miles from its sources, and $PM_{2.5}$ can travel hundreds of miles. $PM_{2.5}$ tends to reflect regional air quality, given that particles travel greater distances and because most fine particles are formed indirectly through chemical reactions in the atmosphere; PM_{10} reflects the contributions of local sources [EPA 2019c, 2021f]. Given its proximity to local industry and residential areas, ATSDR expects that the IEPA monitor represents a high-end estimate of community exposures to locally emitted PM and metals. There are likely higher concentrations on the commercial properties between the air monitor and RMG site.

The current air monitoring schedule and objectives for PM and metals at the IEPA site at Washington High School, as noted in the Illinois Ambient Air Monitoring 2021 Network Plan, are presented on Table 1. Spatial scales are used to categorize monitor siting areas and link them to specific monitoring objectives.

The IEPA site is listed as neighborhood spatial scale, which means it represents concentrations within an area 0.5 to 4.0 kilometers (0.3 to 2.5 miles) wide; this is in contrast to micro and middle scale sites that represent smaller geographic areas or urban and regional scales that represent much larger areas. The primary monitoring objective for PM_{10} and lead is "highest concentration", meaning that the site is located to determine the expected peak concentrations of pollutants in the area. The primary objective for $PM_{2.5}$ is "population", i.e., it is in areas characterized by high population density and used to determine the typical pollutant concentrations in a specific area. The secondary objective for both pollutants is "source", i.e., to identify the impact of significant local source(s) [IEPA 2020a].

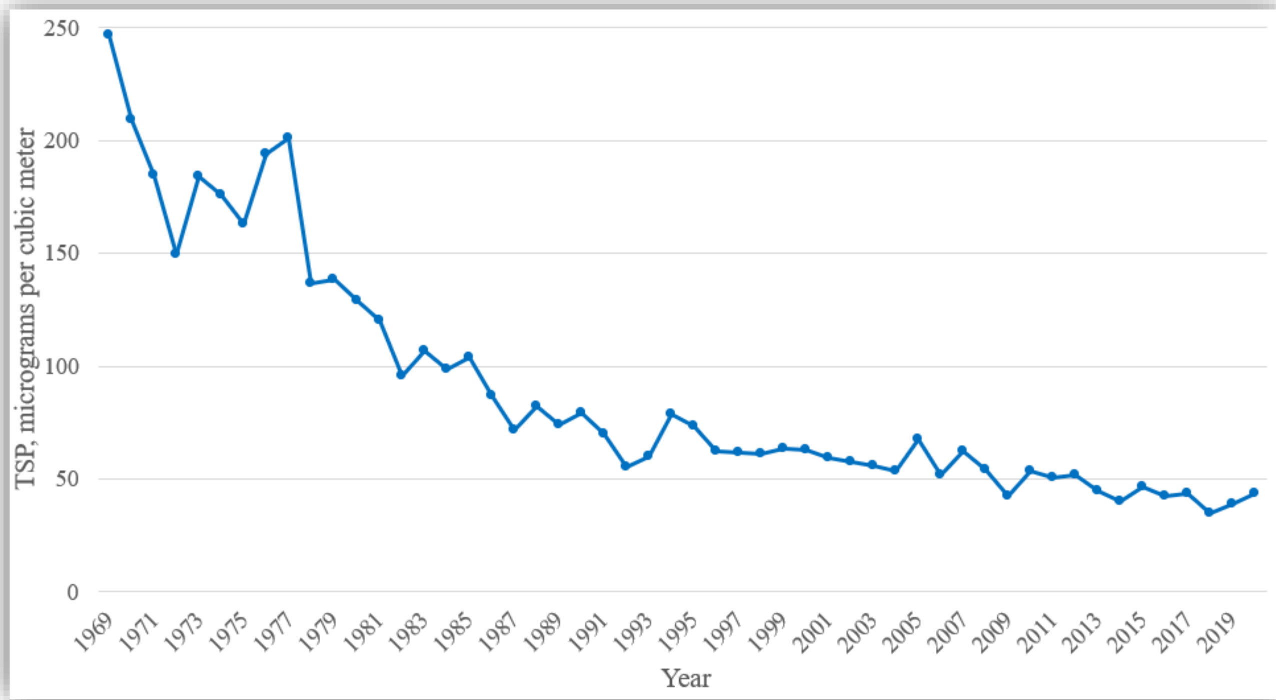
Table 1. Illinois Environmental Protection Agency Washington High School air monitoring site features

Pollutant	Primary Objective*	Secondary Objective	Spatial Scale	Schedule
Particulate matter smaller than 10 microns (PM_{10})	Highest concentration	Source	Neighborhood	Hourly
Particulate matter smaller than 2.5 microns ($PM_{2.5}$)	Population	Source	Neighborhood	1-in-3 days
Lead and other metals as total suspended particulates (TSP)	Highest concentration	n/a	Neighborhood	1-in-6 days

*Monitoring objectives may be "highest concentration" - located to determine the expected peak concentrations of pollutants in the area, "population" - areas characterized by high population density and used to determine the typical pollutant concentrations in a specific area, or "source" – to identify the impact of significant local source(s).

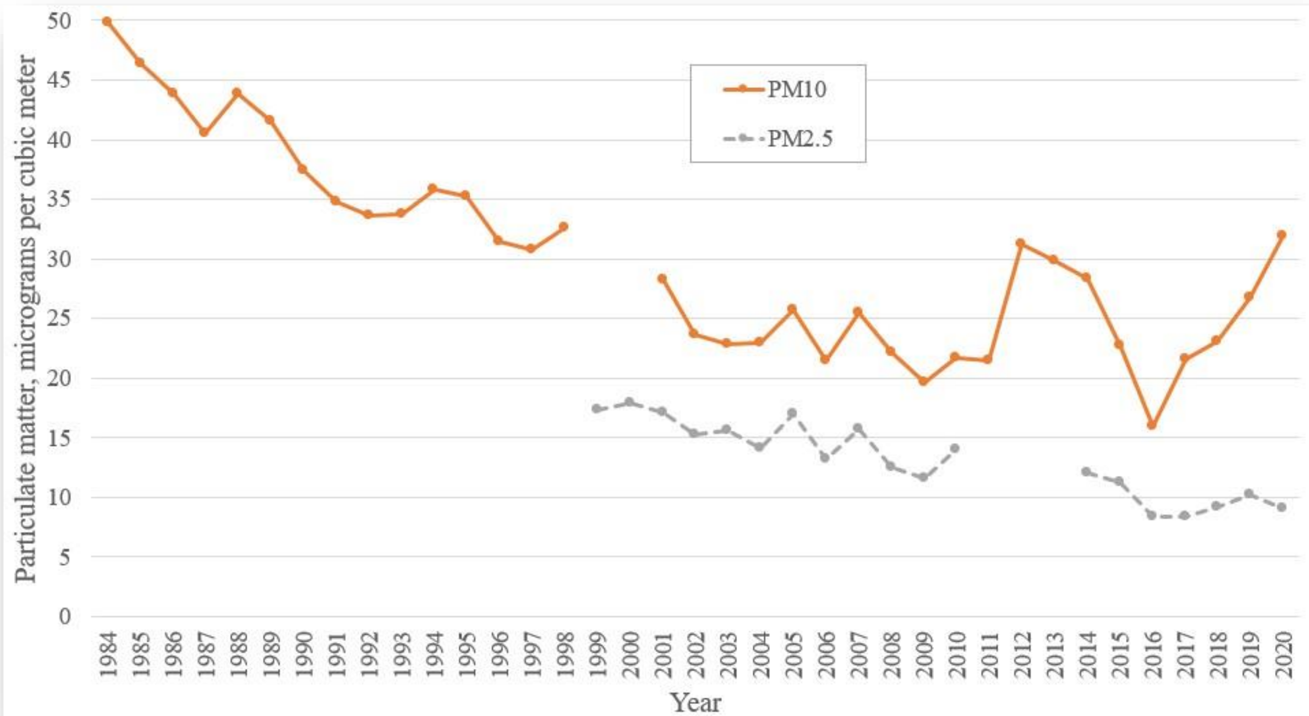
The 50-year trend in annual TSP average concentrations is shown on Figure 2. TSP levels correspond to peak steel production at Republic/LTV in the 1970s, followed by a steep decline in the 1980s and 1990s as LTV gradually closed its operations, then a less pronounced decrease since 2000.

Figure 2. Historical trend in annual averages of total suspended particulates (TSP) at Illinois Environmental Protection Agency Washington High School site, micrograms per cubic meter



PM_{10} and $PM_{2.5}$ annual trends presented on Figure 3 also show a general decrease over time. PM_{10} levels rose and fell during the period when KCBX was in operation (2012-15). The monitor station is not in the downwind location relative to the KCBX South Terminal, however, as noted by EPA, this site did appear to show impacts from the petcoke operations [EPA 2013]. PM_{10} levels have been rising again since 2016.

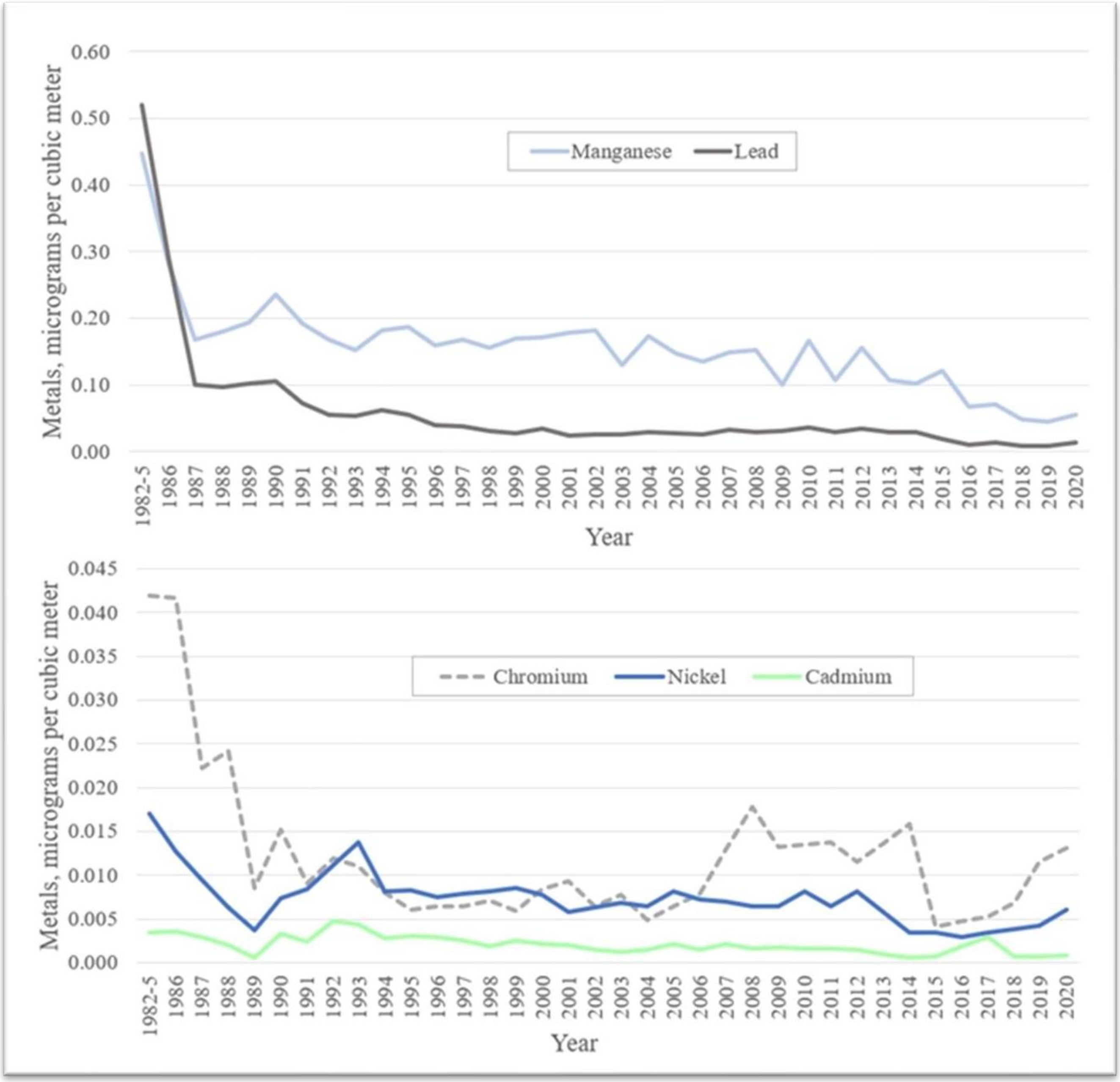
Figure 3. Historical trends in annual averages of particulate matter smaller than 10 microns (PM_{10}) and particulate matter smaller than 2.5 microns ($PM_{2.5}$) at Illinois Environmental Protection Agency Washington High School site, micrograms per cubic meter



PM data trends elsewhere across the U.S. show declining concentrations because, over time, regulatory programs have reduced industrial and vehicle emissions of PM as well as precursor gases that react to form fine particles. EPA's Report on the Environment (ROE) finds that the average of peak 24-hour PM_{10} concentrations at U.S. sites in 2016 was 43% lower than the 1988 average. Between 1999-2016, $PM_{2.5}$ peak 24-hour concentrations decreased 40% and $PM_{2.5}$ annual averages decreased 38% [EPA 2019c].

Concentrations of metals collected as TSP in southeast Chicago have also been declining since 1982, as shown on Figure 4.

Figure 4. Historical trends in annual averages of metals concentrations at Illinois Environmental Protection Agency Washington High School site, micrograms per cubic meter



According to EPA's ROE, average lead concentrations decreased 99 percent nationally between 1980 and 2016. This decrease occurred mostly in the 1980s and early 1990s and is largely attributed to reduced lead content in gasoline, with later decreases attributed to reductions from industrial sources. The ROE also has an indicator for manganese air concentrations specifically in Region 5, which includes 37 trend sites in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. The average annual manganese concentration decreased 40% between 2000 and 2016 and the median of site averages decreased 21%.

The ROE does not have indicators for other metals in air. However, EPA is tracking the total air releases of 187 hazardous air pollutants (HAP), which includes the metals monitored in southeast Chicago, as well as numerous VOCs. HAP emissions in 2014 as compared with the 1990-93 baseline have decreased 71% from stationary sources, 76% from on-road vehicles, and 31% from non-road vehicles [EPA 2019c]. These long-term decreases in HAP emissions are reflected in the ambient metals data in southeast Chicago.

3. DISCUSSION

ATSDR's public health assessments are conducted to determine whether and to what extent people have been, are being, or may be exposed to hazardous substances associated with a contaminated site and, if so, whether that exposure is harmful and should be stopped or reduced. The public health assessment process involves multiple steps but consists of two primary technical components—*the exposure evaluation* and the *health effects evaluation*. These two components lead to making conclusions and recommendations and identifying specific and appropriate public health actions to prevent harmful exposures. Section 3.1 comprises the *exposure evaluation*, where ATSDR identifies likely site-specific exposure situations and answer the questions: Is anyone at a given site exposed to environmental contamination? Under what conditions does this exposure occur? The *health effects evaluation* follows with a screening analysis in Section 3.2 and an in-depth analysis in Section 3.3. The process is further described in these upcoming sections and in ATSDR's Public Health Assessment Guidance Manual [ATSDR 2005.]

3.1 Exposure Pathway Evaluation

To determine whether people are now exposed to contaminants or were exposed in the past, ATSDR examines the path between a contaminant and a person or group of people who could be exposed. Completed exposure pathways have five required elements. ATSDR evaluates a pathway to determine whether all five factors are present. Each of these five factors or elements must be present for a person to be exposed to a contaminant:

1. A contamination source,
2. Transport through an environmental medium,
3. An exposure point,
4. A route to human exposure, and
5. People who may be exposed.

Residents on Chicago's southeast side could potentially be exposed to air and soil contamination associated with RMG and adjacent facilities through several environmental media. These potential routes of exposure are summarized on Table 2 and described in detail below.

Table 2. Exposure pathways from Reserve Management Group site and adjacent facilities to residents

Environmental Medium	Point of Exposure	Route of Exposure	Completed Pathway?
Outdoor air	Air outside homes	Inhalation	Historically and currently complete
Indoor air	Air inside homes	Inhalation	Historically and currently potential
Surface Soil	Residential yards	Ingestion Dermal contact	Historically and currently potential

ATSDR considers exposures to contaminants in outdoor air at some residential properties near RMG to be a completed pathway, both historically and currently. Surface soil and indoor air are also potentially complete exposure pathways; however, data are not available to evaluate potential exposures. These pathways are described in more detail below. Exposures to contaminants in municipal water and surface water are not completed pathways. Residents may have historically been exposed to contaminants in groundwater via private drinking water wells, however this is not currently a completed exposure pathway.

Outdoor air

Outdoor air is known to be affected by emissions from facilities along the Calumet River both currently and historically. For this reason, CCDES established an air monitoring station at Washington High School in 1964 and continues to operate this site. There is a completed exposure pathway for airborne contaminants from the RMG property and adjacent facilities to the southeast side neighborhood.

Indoor Air

Outdoor PM and associated contaminants can migrate indoors. Additional indoor PM can be generated through cooking, combustion activities (e.g., use of fireplaces and cigarette smoking), and some hobbies. In homes without smoking or other strong particle sources, indoor PM would be expected to be the same as, or lower than, outdoor levels [EPA 2020c].

Surface Soil

Emissions of metals and other particle-bound contaminants from various industrial sources may have deposited in residential yards recently and over the long industrial history of the Calumet River area. There are about 1,799 people who live within ½-mile of the RMG property and 9,970 live within one mile (see Appendix A). However, ATSDR is not aware of any available surface soil testing data within this likely zone of impact from local industrial emissions. Therefore, while exposure to contaminants in surface soil is a potential exposure pathway, data are not available for inclusion in this assessment.

3.2 Screening Evaluation of Air Monitoring Data

ATSDR evaluated air monitoring data collected by IEPA at the Washington High School site from 2016-2020 to characterize current conditions. Five years of ambient air data is considered an appropriate representation of "normal" air quality and preferred to shorter time periods [EPA 2018b]. PM_{10} is reported hourly using a continuous monitor, $PM_{2.5}$ is collected as an integrated 24-hour sample on a 1-in-3-day schedule, and metals are collected as TSP on a 1-in-6-day schedule. These data are supplemented with an intensive 7-month study (December 12, 2014-July 23, 2015) conducted by EPA using a continuous monitor stationed in Rowan Park that reported a total of 3,932 hourly concentrations for 23 metals and minerals. Additional metals reported by EPA include arsenic, mercury, and molybdenum [EPA 2015]. Metals that were measured at both the IEPA and EPA sites (cadmium, chromium, manganese, and nickel) had higher concentrations at the Rowan Park site, however the timelines are not the same and the EPA site was closer to commercial and industrial sites. Current summary data and health risk screening are discussed in Section 3.2.1. Historical air monitoring data (1982-2015) are addressed in Section 3.2.2.

The comparison values (CVs) that ATSDR uses for screening analysis are contaminant concentrations in environmental media that are set well below levels that are known or anticipated to result in adverse health effects. ATSDR and other government agencies have developed these values to help health assessors make consistent decisions about what concentrations associated with site exposures might require additional evaluation. CVs are not thresholds of toxicity, and they are not used to predict adverse health effects. Although concentrations at or below the relevant comparison value may reasonably be considered safe, it does not automatically follow that any environmental concentration that exceeds a comparison value would be expected to produce adverse health effects [ATSDR 2005].

For use in screening potential cancer-causing pollutants, ATSDR develops Cancer Risk Evaluation Guides (CREGs). CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million persons exposed during their lifetime. ATSDR's CREGs are calculated from EPA's cancer slope factors (CSFs) for oral exposures or unit risk (IUR) values for inhalation exposures. These values are based on EPA evaluations and assumptions about hypothetical cancer risks at low levels of exposure. Noncancer CVs include Minimal Risk Levels (MRLs) and Environmental Media Evaluation Guides (EMEGs) developed by ATSDR. An MRL is a contaminant concentration that is likely to be without noncarcinogenic health effects during a specified duration of exposure. EMEGs are based on MRLs and conservative assumptions about exposure, such as intake rate, exposure frequency and duration, and body weight. For contaminants that do not have an EMEG, ATSDR derives Reference Dose Media Evaluation Guides (RMEGs) from EPA's reference concentrations [ATSDR 2005].

To screen PM noncancer health effects, ATSDR uses the World Health Organization's (WHO) annual and 24-hour Air Quality Guidelines (AQGs) as CVs. [WHO 2021]. WHO considers increased rates of mortality (all non-accidental causes) to be the most sensitive and robust health endpoint associated with PM_{10} and $PM_{2.5}$ exposures. The annual and 24-hour AQGs for PM_{10} and $PM_{2.5}$ are set at their respective long-term and short-term concentrations associated with increased mortality [WHO 2021].

3.2.1 Current conditions (2016-2020)

ATSDR calculated exposure point concentrations (EPCs) for air contaminants that have CVs for health screening. Some air pollutants have more than one CV depending on the length of exposure time, as well as for cancer and noncancer health effects. Chronic EPCs (one year or longer) for air contaminants and their corresponding most protective (lowest) CV are shown below. The EPC is the 95% upper confidence limit on the arithmetic mean for each respective air contaminant. We calculated the EPC for the full 5-year period for metals (2016-2020). For PM, we determined the EPC for individual years and included the highest one in the table. ATSDR utilizes R programming to calculate this statistic using appropriate methods for imputing values for non-detects [ATSDR 2021a, 2021b].

Long-term exposures (1-year or more)

Data reported at the IEPA site are presented on Table 3 and data reported by EPA at Rowan Park are on Table 4. Measurements of chromium concentrations did not distinguish the percent of chromium in air that is in the most toxic form – hexavalent chromium. In the KCBX health consultation ATSDR discussed that most air monitoring data show hexavalent chromium to make up less than 3.5% of total chromium [ATSDR 2016a]. In this evaluation, ATSDR used a conservative assumption that 5% of total chromium concentration in each sample was in the hexavalent form. For the evaluation of cancer and noncancer risk for chromium exposure, ATSDR used a conservative assumption that 5% of total chromium concentration in each sample was in the hexavalent form. A higher percentage would be appropriate if there were a facility in the area known to emit a large amount of hexavalent chromium. Industrial emissions of chromium are primarily in the less toxic trivalent form, except for certain specific industries including chrome electroplaters, various industrial cooling towers, and chromium chemical manufacturers [ATSDR 2012b]. According to EPA's 2014 National Air Toxics Assessment, there are no significant sources of hexavalent chromium within one mile of the IEPA monitor site [EPA 2018c.]

Table 3. Comparison of annual PM and metals exposure point concentrations (EPCs) to chronic duration health comparison values (CVs); Illinois EPA Washington High School site 2016-2020; micrograms per cubic meter

Contaminant	Number of 24-hr observations	Percent below detection	Long-term EPC*	CV	CV type†
$PM_{2.5}$‡	108	0	10.7 (2019)	5	WHO Annual AQG
PM_{10}‡	219	0	31.9 (2020)	15	WHO Annual AQG
Cadmium	256	54	0.0017	0.00056	CREG
Hexavalent chromium§	251	1.6	0.00043	$5.2x10^{-5}$	CREG
Manganese	256	0.8	0.064	0.30	EMEG/MRL-C
Nickel	256	1.6	0.0030	0.090	EMEG/MRL-C

* EPC is 95% upper confidence limit on the mean derived using lognormal ROS imputed data, except for $PM_{2.5}$, where the bootstrap percentile is used, and PM_{10} where the arithmetic average applied, as appropriate for a continuous measurement. We calculated the EPC for the full 5-year period for metals; for PM we determined the EPC for individual years and included the highest one here, year shown in parentheses.

† World Health Organization Air Quality Guideline (WHO AQG), ATSDR Cancer Risk Evaluation Guide (CREG), ATSDR Environmental Media Evaluation Guide (EMEG), ATSDR Minimal Risk Level (MRL), "C" denotes chronic

‡ Contaminants with EPC above their respective CVs are shaded gray

§ ATSDR assumes 5% of total chromium is in the hexavalent form; data are shown and screened as hexavalent chromium

Table 4. Comparison of annual exposure point concentrations (EPCs) for metals to chronic duration health comparison values (CVs); EPA Rowan Park site 2015; micrograms per cubic meter

Contaminant	Percent below detection	Long-term EPC*	CV	CV type†
Arsenic	73	0.00053	0.00023	CREG
Cadmium	0.3	0.0041	0.00056	CREG
Hexavalent chromium§	11	0.00035	$5.2x10^{-5}$	CREG
Manganese	0.3	0.14	0.30	EMEG/MRL-C
Mercury	39	0.018	0.20	EMEG/MRL-C
Molybdenum	0	0.022	2.0	EMEG/MRL-C
Nickel	1.9	0.0030	0.090	EMEG/MRL-C

*EPC is the 95% upper confidence limit on the mean, derived using lognormal ROS imputed data for all metals except arsenic, where Kaplan-Meier bootstrap used, and molybdenum, where bootstrap percentile applied

† ATSDR Cancer Risk Evaluation Guide (CREG), ATSDR Environmental Media Evaluation Guide (EMEG), ATSDR Minimal Risk Level (MRL), "C" denotes chronic.

‡ Contaminants with EPC above their respective CVs are shaded gray

§ ATSDR assumes 5% of total chromium is in the hexavalent form; data are shown and screened as hexavalent chromium

The chronic CVs for $PM_{2.5}$, PM_{10}, arsenic, cadmium, and chromium are exceeded. Therefore, these contaminants require further evaluation in Section 3.3 to determine the potential for cancer and noncancer health effects related to long-term exposure to these contaminants. The EPC for PM_{10} exceeded the CV every year gradually increasing from 16.0 µg/m^3 in 2016 to 31.9 µg/m^3 in 2020. The EPC for $PM_{2.5}$ also exceeded the CV every year, increasing from 8.9 µg/m^3 in 2016 to 10.7 µg/m^3 in 2019, then down to 9.7 µg/m^3 in 2020. Year-to-year trends in PM and metals are shown on Figures 3 and 4 and discussed in Appendix B. Chronic CVs for manganese, mercury, nickel, and molybdenum are not exceeded. Exposures to these metals are not considered a potential health hazard given current conditions (2016-2020), and they were not further evaluated.

Annual PM levels in southeast Chicago are notably higher than the median concentration among monitor stations across the U.S. ATSDR compared PM levels in southeast Chicago to national trends to put our findings in context; for a discussion of potential health implications, see Section 3.3. The PM_{10} multi-year average concentration for 2016-2020 at the IEPA station was 23.3 µg/m^3. For this same period, there were 3,555 valid monitor-years of PM_{10} data in the US; 60% of these U.S. sites had an annual average above the PM_{10} AQG of 15 µg/m^3. The 75th percentile for national PM_{10} averages was 22 µg/m^3 and the 90th percentile was 30 µg/m^3. The $PM_{2.5}$ multi-year average concentration (2016-2020) in southeast Chicago was 9.3 µg/m^3. At this time, there were 4,238 valid monitor-years of $PM_{2.5}$ data in the U.S.; 92% of U.S. sites had an annual average above the $PM_{2.5}$ AQG. The 75th percentile for these U.S. $PM_{2.5}$ averages was 8.7 µg/m^3 and the 90th percentile was 10 µg/m^3 [EPA 2021b].

EPA summarized PM data from multiple Chicago-area sites in a report published in 2021. Out of twelve monitoring sites, the Illinois EPA station at Washington Park High School had the highest $PM_{2.5}$ 24-hour values. There are only three PM_{10} monitors in the Chicago area. The Southeast Chicago monitor typically had PM_{10} concentrations higher than the suburban Northbrook site. Since 2017 the Southeast Chicago site has been comparable or slightly lower than the McCook Village Hall site; the McCook site is about 1 kilometer downwind (to the northeast) of a rock quarry and adjacent to IL highway 171, i.e., significant sources of PM_{10} [EPA 2021e].

Short-term exposures (less than 1-year)

Intermediate (14-365 days) and acute (1-14 days) EPCs and their corresponding CVs are shown on Table 5 for IEPA data and on Table 6 for EPA data. Lead concentrations are compared to the NAAQS as a 3-month rolling average; ATSDR retrieved 3-month averages from EPA's Air Quality System (AQS) and present the highest average during 2016-2020 as the EPC [EPA 2021b]. $PM_{2.5}$ and PM_{10} both exceed their acute CVs for 8.8% and 7.5% of samples, respectively. Noncancer health effects from PM exposures are evaluated further and discussed in Section 3.3. The evaluated metals – cadmium, chromium, lead, and nickel – did not exceed their acute and intermediate CVs. Exposures to these metals are not considered a potential health hazard given current conditions (2016-2020), and they are not further evaluated.

Looking at the same national set of monitors noted above, ATSDR found 76% of PM_{10} sites and 97% of $PM_{2.5}$ sites in the U.S. exceeded their respective AQG at least once between 2016-2020. The PM_{10} monitor in southeast Chicago exceeded the AQG on 7.5% of sample days; another way to say this is that the 95th percentile concentration at this monitor was equal to the daily AQG. ATSDR found that 34% of PM_{10} monitors nationwide had a 95th percentile above the AQG in one or more years between 2016-2020, i.e., higher than the IEPA site. The 95th percentile $PM_{2.5}$ concentration at the IEPA site was 17.4 µg/m^3; 36% of monitors nationwide had a higher 95th percentile concentration [EPA 2021b].

Table 5. Comparison of highest PM and metals exposure point concentrations (EPCs) to acute and intermediate duration health comparison values (CVs); Illinois EPA Washington High School site 2016-2020; micrograms per cubic meter

Contaminant	Averaging time	Short-term EPC*	CV	CV type†	Number of values over CV
$PM_{2.5}$‡	1-day	36	15	WHO 24-Hr AQG	52/592 (8.8%)
PM_{10}	1-day	96	45	WHO 24-Hr AQG	92/1,226 (7.5%)
Cadmium	1-day	0.025	0.030	EMEG/MRL-A	0
Hexavalent chromium§	14-day	0.0023	0.30	EMEG/MRL-I	0
Lead	3-month	0.02	0.15	EPA NAAQS	0
Nickel	14-day	0.017	0.20	EMEG/MRL-I	0

*Maximum 1-day concentration shown for acute and intermediate (14-day) CVs; 1-in-6-day sampling does not support calculating a 14-day average. Highest 3-month moving average shown for lead per the EPA NAAQS.

† World Health Organization Air Quality Guideline (WHO AQG), ATSDR Environmental Media Evaluation Guide (EMEG), ATSDR Minimal Risk Level (MRL), "A" denotes acute, "I" denotes intermediate.

‡ Contaminants with EPC above their respective CVs are shaded gray

§ ATSDR assumes 5% of total chromium is in the hexavalent form; data are shown and screened as hexavalent chromium

Table 6. Comparison of metals exposure point concentrations (EPCs) to intermediate and acute duration health comparison values (CVs); EPA Rowan Park site 2015; micrograms per cubic meter

Contaminant	Averaging time	Short-term EPC*	CV	CV type†	Number of values over CV
Cadmium	24-hours	0.0057	0.030	EMEG/MRL-A	0
Hexavalent chromium‡	14-day	0.0010	0.30	EMEG/MRL-I	0
Nickel	14-day	0.0049	0.20	EMEG/MRL-I	0

* Maximum running 24-hour average concentration shown for acute CVs; maximum running 14-day (336 hour) average shown for intermediate CVs.

† ATSDR Environmental Media Evaluation Guide (EMEG), ATSDR Minimal Risk Level (MRL), "A" denotes acute, "I" denotes intermediate.

‡ ATSDR assumes 5% of total chromium is in the hexavalent form; data are shown and screened as hexavalent chromium

3.2.2 Historical conditions (1982-2015)

Long-term exposures (1-year or more)

ATSDR reviewed metals data collected at the IEPA site dating back to 1982 to evaluate potential effects from long-term exposures [EPA 2021b]. EPCs and CVs are presented on Table 7. Metals concentrations were higher in the past compared to current conditions. The historical chronic (multi-year) arsenic, cadmium, and chromium concentrations exceed ATSDR's conservative cancer screening levels - the CREGs. These data require further evaluation in Section 3.3.2 to determine whether there is an elevated cancer risk; potential noncancer risks for these metals are also reviewed in Section 3.3.1. Noncancer CVs for manganese and nickel were not exceeded during this period; these exposures are not likely to pose a health hazard and are not further evaluated.

Table 7. Comparison of metals exposure point concentrations (EPCs) to chronic duration health comparison values (CVs); Illinois EPA Washington High School site 1982-2015; micrograms per cubic meter

Contaminant	Number of 24-hr observations	Percent below detection	Long-term EPC*	CV	CV type†
Arsenic‡	130	70	0.0050	0.00023	CREG
Cadmium	1,744	7.6	0.0023	0.00056	CREG
Hexavalent chromium§	1,744	1.5	0.00063	5.2×10^{-5}	CREG
Manganese	1,786	0	0.19	0.30	EMEG/MRL-C
Nickel	1,745	2.5	0.0081	0.090	EMEG/MRL-C

* EPC is the 95% upper confidence limit on the mean, derived using lognormal ROS imputed data for all metals except arsenic, where Kaplan-Meier bootstrap used, and manganese, where bootstrap percentile applied

† ATSDR Cancer Risk Evaluation Guide (CREG), ATSDR Environmental Media Evaluation Guide (EMEG), ATSDR Minimal Risk Level (MRL), "C" denotes chronic

‡ Contaminants with EPC above their respective CVs are shaded gray and require further public health evaluation

§ ATSDR assumes 5% of total chromium is in the hexavalent form; data are shown and screened as hexavalent chromium

As discussed in Section 2.2, PM and lead concentrations have decreased over the decades. These changes are attributable to several different regulatory programs which reduced air emissions from both industrial sources like Republic/LTV Steel, as well as on-road and off-road engines. The NAAQS have also evolved over the years, with new health research prompting EPA to lower the acceptable limits for PM and lead. Similarly, the WHO limits have been lowered over time; however, ATSDR did not formally adopt the WHO AQGs for PM until 2020.

ATSDR reviewed historic data (1982-2015) in southeast Chicago and compared 3-month rolling averages to the current NAAQS. Lead levels were consistently above the current NAAQS through 1986 and declined after that (see Figure 4), with the highest level in February-April 1985 of 1.2 µg/m^3. These concentrations did not exceed the applicable NAAQS at the time and were not unusually high given that the U.S. widely used lead in gasoline, as discussed in Section 2.2. To put these findings into context of national trends: the peak concentrations in southeast Chicago in 1985 were between the median and average (1.11 and 1.40 µg/m^3, respectively) for U.S. trend sites [EPA 2019c].

As shown on Figure 3, PM_{10} concentrations have been decreasing since monitoring began in 1984; however, the yearly averages have been higher than the PM_{10} annual AQG (15 µg/m^3) every year. $PM_{2.5}$ has also been declining since monitoring was established in 1999, but the yearly averages remain above the $PM_{2.5}$ annual AQG (5 µg/m^3).

ATSDR also considered noncancer health effects from chronic (multi-year) metals exposures (greater than 365 days) during historical peak periods. Metals concentrations were the highest in the early 1980s. However, data were not collected in 1984, and the number of samples per year was fewer than now: IEPA collected on a 1-in-12-day schedule between 1982 and 1989 and did not always report for a full calendar year. We calculated EPCs for the period of 1982-86 (which did not include any samples in 1984) for each metal with a noncancer chronic CV. EPCs for this peak exposure period and CVs are presented on Table 8. Chronic manganese exposures during this time exceeded the CV. Noncancer health effects from long-term manganese exposures are evaluated further and discussed in Section 3.3. Noncancer CVs for cadmium, chromium, and nickel were not exceeded during this period; these exposures are not likely to pose a health hazard and are not evaluated further.

Short-term exposures (less than 1-year)

EPCs and CVs for intermediate and acute historical metals exposures are presented in Table 9. Cadmium exceeded its acute CV on one day between 1982-2015. Noncancer health effects are evaluated further and discussed in Section 3.3. The noncancer CV for chromium and nickel was not exceeded; these metals are not likely to pose a health hazard and potential noncancer health effects are not further evaluated.

Table 8. Comparison of metals exposure point concentrations (EPCs) during historical peak period (1982-1986) to chronic duration health comparison values (CVs); Illinois EPA Washington High School site; micrograms per cubic meter

Contaminant	Number of 24-hr observations	Percent below detection	Long-term EPC*	CV	CV type†
Cadmium	103	5.8	0.0040	0.010	EMEG/MRL-C
Hexavalent chromium‡	103	2.9	0.0025	0.10	RMEG
Manganese§	144	0	0.49	0.30	EMEG/MRL-C
Nickel	103	1.9	0.017	0.090	EMEG/MRL-C

* EPC is the 95% upper confidence limit on the mean, derived using lognormal ROS imputed data for all metals except manganese, where bootstrap percentile applied

† ATSDR Environmental Media Evaluation Guide (EMEG), ATSDR Minimal Risk Level (MRL), “C” denotes chronic, Reference Media Evaluation Guide (RMEG)

‡ ATSDR assumes 5% of total chromium is in the hexavalent form; data are shown and screened as hexavalent chromium

§ Contaminants with EPC above their respective CVs are shaded gray

Table 9. Comparison of metals exposure dose concentrations (EPCs) to intermediate and acute health comparison values (CVs); Illinois EPA Washington High School site 1982-2015; micrograms per cubic meter

Contaminant	Averaging time	Short-term EPC*	CV	CV type†	Number of values over CV
Cadmium	1-day	0.12	0.030	EMEG/MRL-A	1/1,744 (0.06%)
Hexavalent chromium§	14-day	0.0072	0.30	EMEG/MRL-I	0
Nickel	14-day	0.09	0.20	MRL-I	0

*Maximum 1-day concentration shown for acute and intermediate (14-day) CVs because 1-in-6-day sampling does not support calculating a 14-day average.

† World Health Organization Air Quality Guideline (WHO AQG), ATSDR Environmental Media Evaluation Guide (EMEG), ATSDR Minimal Risk Level (MRL), “A” denotes acute, “I” denotes intermediate.

‡ Contaminants with EPC above their respective CVs are shaded gray

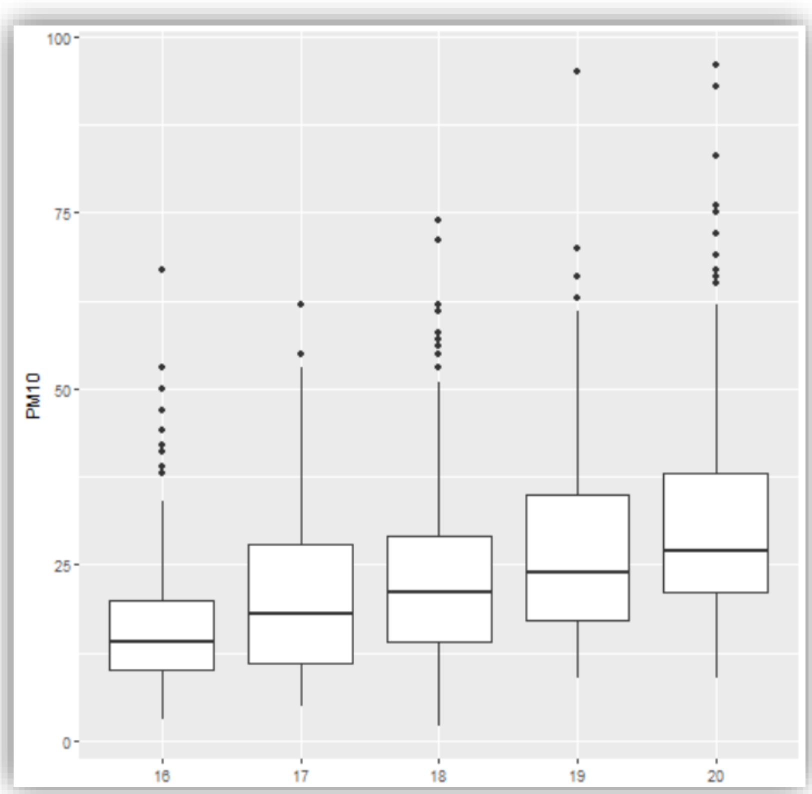
§ ATSDR assumes 5% of total chromium is in the hexavalent form; data are shown and screened as hexavalent chromium

3.2.3 Recent air data trends and source areas of emissions

ATSDR evaluated temporal and spatial trends in the recent PM and metals data (2015-2020) to better understand potential contributing sources of air contaminants. PM and metals measured at the IEPA air monitoring site have multiple possible sources, and these source areas have changed over time. As discussed in Section 2, EPA identified Watco as a local source of manganese emissions and AZR as an emitter of lead [EPA 2018a, 2019b, 2020a]. ATSDR determined that petcoke dust from KCBX contained nickel [ATSDR 2016a]. The specific content of emissions from metals recyclers like those at RMG depends on the type of scrap metal being processed; in general, releases are likely to contain iron, chromium, manganese, and nickel [Han 2020]. Operations that shred ferrous metals – steel and iron products – are associated with manganese and iron emissions. Operations involving non-ferrous metal recycling release a more diverse group of contaminants, including copper, brass, and aluminum, which may contain traces of nickel, chromium, and lead. Air pollutant day-of-week patterns are presented in Appendix B, showing that PM_{10} and industry-associated metals in air tend to follow workday temporal patterns.

As noted in Section 2, PM_{10} concentrations declined in the 1980s, 1990s, and 2000s; however, levels have been increasing since 2016. This trend is shown more clearly in the yearly boxplots presented below on Figure 5. The annual average increased from 16 µg/m^3 in 2016 to 32 µg/m^3 in 2020. Trends for various metals are shown in Appendix B.

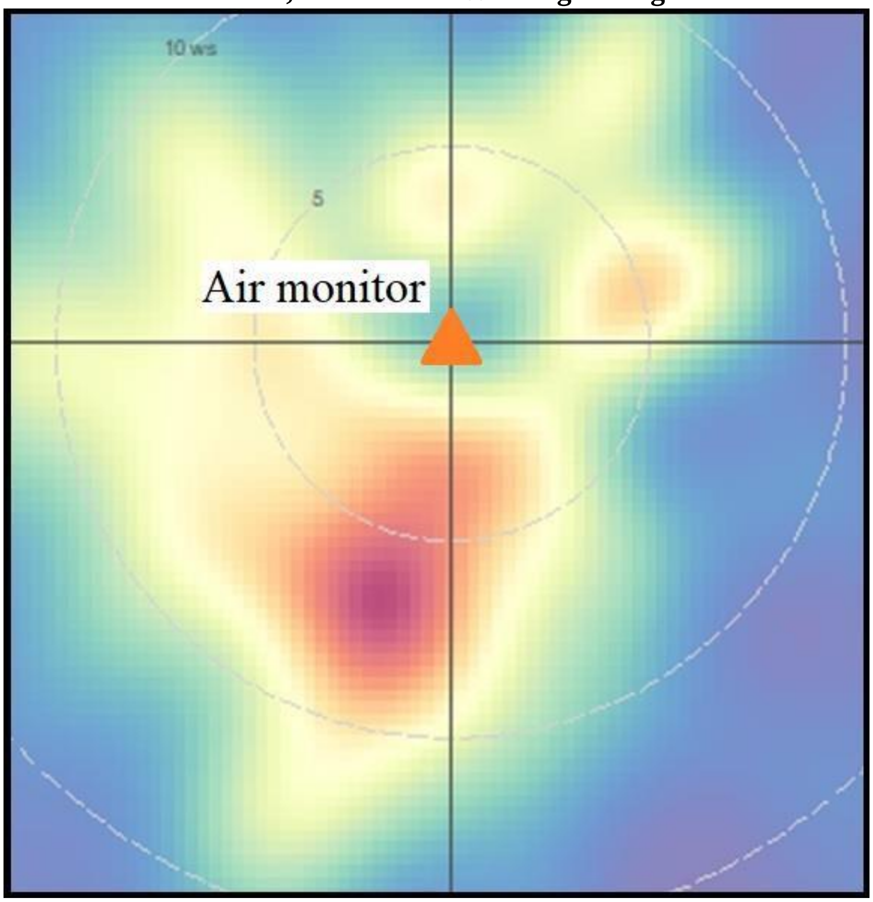
Figure 5. Annual boxplots for particulate matter smaller than 10 microns (PM_{10}), Illinois EPA Washington High School site 2016-2020, microns per cubic meter



ATSDR developed graphics to display air pollutants during 2015-2020 using polar coordinates that show their concentration by wind speed and direction; these figures give an indication of the direction of contaminant source areas relative to the monitor location. Mean concentrations are calculated for wind speed-direction bins and smoothed with a generalized additive model using the Polar Plot function in the R openair package [Carslaw 2019].

PM_{10} concentrations, which have been increasing in recent years, seem to emanate from the area southwest of the air monitor site (see Figure 6).

Figure 6. Polar plot showing direction of source areas of particles smaller than 10 microns (PM_{10}) relative to air monitor location, Illinois EPA Washington High School site 2016-2020



As noted in Section 2.2 there are multiple industrial sources of air emissions southwest of the IEPA air monitor station on the former LTV site and along the Calumet River. In addition to industrial sites, wind-blown releases of contaminated soils from the former LTV site may be a historic and current source of PM and metals in air. These releases may have increased in recent years due to earthmoving, construction, and increased vehicle traffic on dusty, unpaved roads. Construction at the Commerce Park site began in 2019, the first new building was completed in September 2020, and active construction continues with the plan to lease three more buildings in 2022 [CT 2020, PRN 2020, CPC 2021].

Appendix B includes a series of polar plots (Figure B7 through B12) which show the direction of each metal's contributing sources in 2015 compared with more recent conditions (2016-2020). As described in

Section 2, Watco was previously a significant source of local manganese, and EPA has required the facility to limit its emissions in recent years. Figure B6 in Appendix B displays the contrast between the 2015 polar plot and recent conditions for manganese, showing that the influence from Watco has diminished and emissions are coming from industrial and construction zones closer to the air monitoring site. Other recycling-related metals – iron, chromium, and nickel – are also contributed from the industrial and construction sites southwest of the IEPA air monitor. These figures should be viewed as a qualitative indication of pollutant sources areas.

3.3 Health Evaluation of PM and Metal Exposures

Air contaminants identified in ATSDR's data screening in Section 3.2 are further evaluated in this Section. We review the toxicological basis for health-based CVs to determine whether observed air concentrations have the potential to cause noncancer and cancer health effects from short-term and long-term inhalation exposures. ATSDR assumes a reasonable maximum exposure, which is the highest exposure that is likely to be experienced in the community.

3.3.1 Noncancer health effects

Particulate Matter (PM) Exposure Evaluation

As detailed in Section 3.2, ATSDR's screening CVs were exceeded by PM_{10} and $PM_{2.5}$ for acute and chronic exposures.

ATSDR also evaluated short-term (24-hour) PM data in terms of EPA's AQI. The AQI is a color-coded index designed to communicate to the public, in real-time, whether air quality is healthy for people and whether they should take steps to protect their health. The AQI categories are scaled to EPA's NAAQS and are higher than the AQGs used by ATSDR to screen contaminants. However, they are based on much of the same health research and are helpful to identify at-risk populations as PM concentrations increase.

WHO and EPA maintain separate AQGs and AQI categories for both PM_{10} and $PM_{2.5}$ because they do not have all the same health effects. The two PM fractions are distinct in that they deposit at different locations in the respiratory tract, have different sources and composition, act through partly different biological mechanisms, and result in different health outcomes [WHO 2013]. PM_{10} represents the particle mass that enters the respiratory tract and, moreover, it includes both the coarse (particle size between 2.5 and 10 microns) and fine particles (measuring less than 2.5 microns, $PM_{2.5}$) that are considered to contribute to the health effects observed in urban environments. The former is primarily produced by mechanical processes such as construction activities, road dust re-suspension and wind, whereas the latter originates primarily from combustion sources. In most urban environments, both coarse and fine particles are present, but the proportion of particles in these two size ranges is likely to vary substantially between cities around the world, depending on local geography, meteorology, and specific PM sources [ATSDR 2020].

Acute short-term (24-hour) PM exposure

PM_{10}

In terms of the EPA AQI, PM_{10} concentrations were in the moderate category (55-154 µg/m^3) on 46 out of 1,226 (3.8%) of days. Looking at 2020 alone, this rate was 24 of 219, or 11%, of days in the moderate category. On days with PM_{10} concentrations in AQI moderate category, PM_{10} exposures are of greater risk to highly sensitive individuals. Exposures in this range can cause respiratory symptoms in highly sensitive individuals with pre-existing health conditions that make them more susceptible to adverse health outcomes. Exacerbation of cardiopulmonary disease is also possible in individuals with a pre-existing condition. People without pre-existing cardiopulmonary disease are not expected to be harmed by breathing PM_{10} in this community.

PM_{10} concentrations during this period (2016-2020) exceeded the PM_{10} acute CV on 63 days out of 1,226 days with reported data in the last 5 year, or 7.5% of days. As reflected in the time trends in Section 4, these elevated concentrations have become more frequent in recent years; in 2020 there were 29 days (out of 219 with reported data) above the CV, or 16% of days.

<u>$PM_{2.5}$</u>

Between 2016-2020, $PM_{2.5}$ concentrations were in the EPA AQI moderate category (12.1-35.4 µg/m^3) on 122 of 592 days (21%). On days with $PM_{2.5}$ concentrations in the AQI moderate AQI category, $PM_{2.5}$ exposures can cause an increased likelihood of respiratory symptoms in highly sensitive groups, i.e., those with pre-existing health conditions that make them more susceptible to health effects from PM, and exacerbation of symptoms in people with pre-existing cardiopulmonary disease. $PM_{2.5}$ concentrations did not exceed the Moderate AQI category between 2016-2020.

Short-term exposure to elevated concentrations of $PM_{2.5}$ could harm highly sensitive individuals with pre-existing respiratory or cardiovascular disease. ATSDR does not expect acute $PM_{2.5}$ exposures in this community to harm people without pre-existing respiratory or cardiovascular disease.

Chronic long-term (annual) PM exposure

PM_{10}

Data reported by IEPA between 2016-2020 show that the PM_{10} EPC in 2020 was 31.9 µg/m^3, compared to the WHO annual AQG for PM_{10} of 15 µg/m^3. The annual EPC for PM_{10} exceeded the AQG every year during the current study period, gradually increasing from 16.0 µg/m^3 in 2016 to 31.9 µg/m^3 in 2020. PM_{10} concentrations increased over time and $PM_{2.5}$ rose to a lesser extent at the southeast Chicago site, thus the $PM_{10}/PM_{2.5}$ ratio increased from 2:1 in 2016 to greater than 3:1 in 2020. This change suggests a greater influence from local PM sources in recent years.

$PM_{2.5}$

Data reported by IEPA in southeast Chicago between 2016-2020 show that the annual EPC for $PM_{2.5}$ in 2019 was 10.7 µg/m^3, compared to the WHO annual AQG of 5 µg/m^3. Concentrations were lower in other years: the long-term average $PM_{2.5}$ concentration was 9.3 µg/m^3 from 2016-2020, and the annual average gradually increased from 8.9 µg/m^3 in 2016, 9.1 µg/m^3 in 2017, 10.5 µg/m^3 in 2018, 10.7 µg/m^3 in 2019, then lower with 9.7 µg/m^3 in 2020. The EPA Integrated Science Assessment (ISA) for Particulate Matter summarizes the short-term health effects from $PM_{2.5}$ exposures. According to the ISA, the most significant health effects associated with short-term $PM_{2.5}$ exposures are mortality (cardiovascular, respiratory, and lung cancer) and cardiovascular effects (coronary events, coronary heart disease, and stroke) [EPA 2019d].

Long-term exposures to $PM_{2.5}$ may slightly increase the likelihood of harm for individuals with pre-existing health conditions, such as cardiopulmonary disease. ATSDR does not expect that people without pre-existing cardiopulmonary disease to be harmed by breathing $PM_{2.5}$ in this community.

Metals Exposure Evaluation

Manganese - Historical air monitoring data in southeast Chicago showed that manganese air concentrations exceeded the ATSDR chronic inhalation MRL during the peak period of 1982-86 (See Table 8). The MRL is based on a study of workers at a dry alkaline battery plant who were, on average, exposed for 5.3 years to a total manganese dust concentration of 948 µg/m^3 and respirable manganese concentration of 215 µg/m^3. Exposed workers performed significantly worse than unexposed workers on neurobehavioral tests, most notably on measures of simple reaction time, eye-hand coordination, and hand steadiness. The EPC for manganese in southeast Chicago between 1982-1986 (0.49 µg/m^3) is about 70 times lower than the ATSDR derived point of departure (POD) which was associated with a health effect level in the critical study [ATSDR 2012c]. Therefore, ATSDR does not consider it likely that health effects would be seen at these levels of manganese exposure.

Arsenic - Human and animal studies suggest that inhaling inorganic arsenic may contribute to respiratory, dermal, or immunologic effects. However, there are not suitable studies that ATSDR could use to develop CVs for noncancer effects. Arsenic is a human carcinogen, and cancer risk is further evaluated in Section 3.3.2.

Cadmium - Historical air monitoring data showed that the cadmium short-term EPC exceeded the ATSDR acute inhalation MRL during the peak period of 1982-86 (See Table 9). ATSDR's acute (14-day exposure) MRL was derived from a study where rats were exposed to cadmium oxide 6.2 hours per day, 5 days per week, over 2 weeks. The critical health effect in the rat study was alterations to the respiratory tract: alveolar histiocytic infiltrate and focal inflammation and minimal fibrosis in alveolar septa that occurred at the lowest observed adverse effect level (LOAEL) of 88 µg/m^3. The human equivalent concentration (HEC) of this critical health effect exposure level 10 µg/m^3 [ATSDR 2012a]. The HEC is 83 times greater than the cadmium EPC of 0.12 µg/m^3 reported in southeast Chicago during 1982-86. Therefore, ATSDR does not expect health effects to occur at this exposure level.

ATSDR also derived a chronic (long-term) inhalation MRL for cadmium (0.01 µg/m^3) based on several studies where workers' respiratory tract and kidneys were affected. The cadmium long-term EPCs for current and historical exposures (See Tables 3, 4, 7, and 8) do not exceed this CV. Therefore, ATSDR does not expect chronic noncancer health effects to occur and are not further considered in this document. Cadmium is also a human carcinogen, and cancer risk is further evaluated in Section 3.3.2.

3.3.2 Cancer risk assessment

As explained in Section 3.2, arsenic, cadmium, and chromium were measured above ATSDR CREGs in the evaluated air monitoring datasets.

Human health studies provide evidence that inhalation exposure to arsenic increases the risk of lung cancer. Several studies evaluated workers at copper smelters, mines, and chemical plants who were exposed to inorganic forms of arsenic. Respiratory cancer mortality rates were also found to increase with higher concentration exposures [ATSDR 2007]. Occupational cadmium exposure studies also provide evidence of increased risk of lung cancer in workers at cadmium recovery facilities [ATSDR 2012a]. Occupational exposure to hexavalent chromium in various industries has been associated with increased risk of respiratory system cancers, primarily bronchogenic and nasal. The studied workers include those engaged in chromate pigment production and use, chrome plating, stainless steel welding, ferrochromium alloy production, and leather tanning [ATSDR 2012b].

ATSDR quantifies lifetime cancer risk from carcinogens in air by multiplying the IUR by an estimate of lifetime exposure [ATSDR 2021c]. ATSDR assumes that residential inhalation exposures occur over a 33-year period [ATSDR 2016b]. Further, hexavalent chromium exposures in air are also adjusted with Age-Dependent Adjustment Factors (ADAFs) to quantify early-life exposures in the residential scenario.

The formula used for cancer calculations for inhalation is described below.

Age-specific cancer risk = EPC x IUR x (ED/78) where,

EPC = exposure point concentration (µg/m^3)

IUR = inhalation unit risk [(mg/m^3)$^{-1}$]

ED = age-specific duration in years

The respective IURs for arsenic, cadmium, and hexavalent chromium are 4.3E-03, 1.8E-03, and 1.2E-02 (µg/m^3)$^{-1}$. All cadmium and chromium data are reported from the IEPA site. ATSDR used EPA 2015 data arsenic data for current conditions, as IEPA stopped reporting arsenic in 1989; arsenic data are available to characterize historical conditions (1982-89). ATSDR considers residential exposures to occur for 33 years, the 95th percentile residential occupancy default. Cancer risk is summed from birth to age 21 plus 12 additional years during adulthood for a total of 33 years. Since hexavalent chromium have been designated as a mutagen, ATSDR incorporated ADAFs to address early-life susceptibility. ADAFs reflect a greater risk of cancer with early life exposures. To calculate cancer from hexavalent chromium exposures, the above formula is multiplied by a factor of 10 for ages birth to two years and a factor of 3 for ages 2 to 16.

Estimated cancer risks were summed for the three metals. Results for current and historical exposures are summarized on Table 10 below. The total cancer risk is 7-in-1-million for current conditions and 18-in-1-million for historical exposures. Given the conservative nature of the cancer risk evaluation for these metals, this is not considered an elevated cancer risk. Note that this is a theoretical estimate of cancer risk that ATSDR uses as a tool for deciding whether public health actions are needed to protect health—it is not an actual estimate of cancer cases in a community.

Table 10. Exposure dose concentration and estimated excess cancer risk for metals in current and historical conditions

Metal	Exposure dose concentration*, current conditions (2016-2020)	Cancer risk (per million) †, current conditions	Exposure dose concentration, historic conditions (1982-2015)	Cancer risk (per million), historical conditions
Arsenic	0.00053	1	0.0050	9
Cadmium	0.0017	1	0.0023	2
Hexavalent chromium‡	0.00043	5	0.00063	8
TOTAL	**-**	**7**	**-**	**18**

*Concentrations in micrograms per cubic meter

† "Risk" refers to the number of estimated excess cancer cases per million exposed individuals.

‡ ATSDR assumes 5% of total chromium is in the hexavalent form; cancer risk estimates are for hexavalent chromium

3.4 Limitations

Data were not available for all environmental media or for all potential contaminants of concern in southeast Chicago. Residential soil contaminant data were also not available for ATSDR to review, despite the possibility that this is a completed exposure pathway for residents. Emissions of metals and other particle-bound contaminants from various industrial sources may have deposited in residential yards recently and over the long industrial history of the area.

Measurements of chromium in air did not distinguish the percent of chromium that is in the most toxic form – hexavalent chromium. For the evaluation of cancer and noncancer risk for chromium exposure, ATSDR used a conservative assumption that 5% of total chromium concentration in each sample was in the hexavalent form. A higher percentage would be appropriate if there were a facility in the area known to emit a large amount of hexavalent chromium. ATSDR could have done a more precise health evaluation for chromium compounds if speciated air data were available.

VOCs have not previously been monitored at the IEPA site. VOCs are emitted at the RMG site and other operations. Metals recyclers could also potentially release these contaminants when items containing residual fuels and oils, such as old cars and storage tanks, are crushed or shredded. In 2018 and 2021, EPA cited General Iron for failing to control emissions of volatile organic matter from its shredder at its north side location [EPA 2021i].

Ground-level ozone is also not monitored at the IEPA site, however, all of Cook County is currently in nonattainment of the ozone NAAQS based on data from other monitor sites [EPA 2021f].

4 CONCLUSIONS

ATSDR looked at PM and metals levels in our review of air quality data collected near the RMG property. We reached three conclusions about health:

Conclusion 1

Based on recent air monitoring data (2016-2020), breathing particles smaller than 10 microns in diameter (PM_{10}) and particles smaller than 2.5 microns in diameter ($PM_{2.5}$) could be harmful for highly sensitive people, especially if they live in the direction that the wind is blowing (or downwind) from RMG and other industrial and commercial sites. Highly sensitive populations are people who have pre-existing heart and lung health conditions like asthma, heart disease, or chronic obstructive pulmonary disease (COPD). Highly sensitive individuals exposed to PM over short periods of time (short-term, 24-hours) and long periods of time (long-term, several months) are susceptible to respiratory symptoms and an exacerbation of lung and heart disease. ATSDR does not expect people without pre-existing lung and heart health conditions living near RMG to develop health problems from breathing PM in the air.

Basis for Conclusion 1

- ATSDR evaluated data from the IEPA site that measured PM from 2016-2020. We first conducted a PM screening analysis by looking at long-term and short-term PM_{10} and $PM_{2.5}$ data and comparing them to ATSDR PM screening values. ATSDR uses the World Health Organization (WHO) Air Quality Guidelines (AQGs) for 24-hour and yearly exposures as PM screening values to determine if PM requires further evaluation. We then compared 24-hour PM_{10} and $PM_{2.5}$ concentrations to EPA's Air Quality Index (AQI), which helps to understand how clean or polluted the air is and what associated health effects might be a concern.
- WHO's AQGs screening values were exceeded for PM_{10}. The long-term average PM_{10} concentration was 23.3 micrograms (one-millionth of a gram) per cubic meter of air, or µg/m^3, from 2016-2020, exceeding the annual AQG of 15 µg/m^3. PM_{10} levels have been consistently above the AQG and have increased in recent years: the annual average was 16.0 µg/m^3 in 2016, 21.6 µg/m^3 in 2017, 23.1 µg/m^3 in 2018, 26.8 µg/m^3 in 2019, and 31.9 µg/m^3 in 2020. On 7.5% of days during 2016-2020 and 16% of days in 2020, the 24-hour PM_{10} was higher than the 24-hour AQG of 45 µg/m^3.
- The 24-hour PM_{10} concentrations were within the EPA AQI moderate category (55-154 µg/m^3) on 3.8% of days in 2016-2020 and 11% of days in 2020. On days with an AQI in the moderate category there is a higher likelihood of respiratory symptoms in highly sensitive groups, i.e., those with pre-existing health conditions that make them more susceptible to health effects from PM and worsening of symptoms in people with pre-existing health conditions that affect the heart and lungs. PM_{10} concentrations were not higher than the AQI moderate category during 2016-2020. People without pre-existing lung and heart heath conditions are not expected to be harmed by breathing PM_{10} in this community. ATSDR's data analyses suggest that elevated PM_{10} exposures may be the result of releases from existing industries and construction activities in the area southwest of the IEPA air monitoring site at Washington High School. $PM_{2.5}$ concentrations have also exceeded the AQGs screening values. The long-term average $PM_{2.5}$ concentration was 9.3 µg/m^3 from 2016-2020, which is greater than the annual AQG of 5 µg/m^3. The yearly average has

also shown a modest increase in recent years: 8.9 µg/m^3 in 2016, 9.1 µg/m^3 in 2017, 10.5 µg/m^3 in 2018, 10.7 µg/m^3 in 2019, and 9.7 µg/m^3 in 2020. Between 2016-2020, the 24-hour AQG of 15 µg/m^3 was exceeded on 52 days or 8.8% of days.

- In terms of the EPA AQI for 2016-2020, the 24-hour $PM_{2.5}$ concentrations were within the moderate AQI category (12.1-35.4 µg/m^3) on 122 out of 592 days (21%). The $PM_{2.5}$ levels were not higher than the AQI moderate category during 2016-2020. On days with an AQI in the moderate category there is a higher likelihood of respiratory symptoms in highly sensitive groups, i.e., those with pre-existing health conditions that make them more susceptible to health effects from PM and worsening of symptoms in people with pre-existing health conditions that affect the heart and lungs. People without pre-existing heart and lung conditions are not expected to be harmed by breathing $PM_{2.5}$ in this community.

Conclusion 2

Based on recent air monitoring (2015-2020) and historic data (1982-2015), people living downwind of RMG (now or in the past) are not likely to develop health problems from breathing metals in the air. The metals we looked at include arsenic, cadmium, chromium, lead, manganese, and nickel. It is not likely that people will experience an increased risk of cancer or other health problems from breathing the metals.

Basis for Conclusion 2

- ATSDR's screening evaluation of air monitoring data of metals compared annual average concentrations with cancer and chronic noncancer health-based comparison values (CVs) to identify contaminants that might need to be reviewed further. The air monitoring information was collected between 2016-2020 at the IEPA site and in 2015 by EPA. We also evaluated short-term metals data and compared them to the appropriate intermediate and short-term CVs. Lead concentrations were compared to the National Ambient Air Quality Standard (NAAQS). The same methods were applied to the historic data (1982-2015).
- The chronic CVs for arsenic, cadmium, and chromium were exceeded; these metals are associated with lung cancer in people. However, based on recent air monitoring data (2015-2020) the calculated cancer risk from long-term exposure to these metals (total estimated risk of 7 additional cancer cases per one million people) is not considered by ATSDR to be an elevated cancer risk. ATSDR estimates that the total cancer risk from exposure to these metals during the 1982-2015 period is an additional 18 cancer cases per one million people. Given the health protective nature of the cancer risk evaluation for metals, this estimated cancer risk is also not considered to be a hazard. Note that this is a theoretical estimate of cancer risk that ATSDR uses as a tool for deciding whether public health actions are needed to protect health—it is not an actual estimate of cancer cases in a community.
- Short-term metals concentrations in the current data (2015-2020) were all below their respective intermediate (14-365 days) and acute (1-14 days) duration CVs and lead concentrations were below the NAAQS.
- We found that some metals historically exceeded their respective screening CVs for noncancer health effects. The long-term CV for manganese exposure was exceeded during 1982-1986, when manganese concentrations were highest. Cadmium exceeded its short-term CV on one day between

1982-2015. ATSDR evaluated the toxicological basis for our CVs and determined that historical exposures to manganese and cadmium are not likely to have caused noncancer health effects.

- Most metals concentrations follow a decreasing trend from 1982 to the present. In looking at the past five years, however, ATSDR found that chromium and nickel levels are increasing, as shown in data boxplots in Appendix B; manganese concentrations have leveled off during this period. Despite these recent increases in some air contaminants, ATSDR does not expect that breathing these metals will increase people's risk of cancer or other health effects. Data analyses suggest that these metals are largely from the releases from existing industries and construction activities in the area southwest of the IEPA air monitor site at Washington High School.

Conclusion 3

ATSDR was not able to evaluate whether exposure to metals in soil could potentially harm people's health because surface soil sampling data in residential areas were not available.

Basis for Conclusion 3

- Metals and other contaminants may have been released by various industrial sources and deposited in residential yards recently and over the long industrial history of the Calumet River area. ATSDR is not aware of any available surface soil sampling data within the residential area potentially impacted by local industries.
- CDPH recently started soil sampling on the RMG property [Chicago 2022]. The results were not available for review at the time that this Health Consultation was drafted.

5 RECOMMENDATIONS

Following its review of available information, ATSDR recommends:

1. Highly sensitive adults and parents of highly sensitive children with pre-existing health conditions such heart and lung disease (e.g., asthma, COPD, or cardiovascular disease) should consult the air quality forecast at https://www.airnow.gov/aqi/aqi-basics/. These individuals should avoid strenuous outdoor work or play for long periods of time on days where AQI is predicted to be in the moderate category.
2. EPA, IEPA, and the City of Chicago are encouraged to continue to work with local industries to identify opportunities to reduce local PM and metals releases. ATSDR recommends that local industries and regulators conduct additional air monitoring for PM and metals to better understand local sources and to help develop potential reduction measures. ATSDR will review any additional air monitoring data collected in the community.
3. ATSDR recommends that regulators assess the amount of VOCs and hexavalent chromium released from local industries and consider initiating air monitoring for these contaminants. ATSDR will review any additional air monitoring data collected in the community.
4. Regulatory agencies are encouraged to conduct surface soil sampling in areas downwind of the RMG site to evaluate residents' long-term exposures to metals that have been deposited from air releases. ATSDR will review any soil data collected and will cooperate with EPA, IEPA, and the City of Chicago to evaluate the need for mitigation and additional public health actions.
5. ATSDR will provide Federal and local health partners with educational resources to address

community stress and mental health issues related to concerns about environmental contamination. Resources for healthcare providers and community members are available on our Community Stress Resource Center website: https://www.atsdr.cdc.gov/stress/index.html

6 PUBLIC HEALTH ACTION PLAN

To achieve the above recommendations, the following actions will be implemented:

1. ATSDR will work with Federal and local health partners to promote awareness of, and steps that people should take to protect themselves from, harmful effects of particle pollution and ozone.
2. ATSDR will provide Federal and local health partners with educational resources to address community stress and mental health issues related to concerns about environmental contamination.
3. ATSDR will evaluate any new soil and air data collected in the area to evaluate potential health effects to exposed residents. Based on any potential new health concerns identified, ATSDR will collaborate with other health agencies to determine the need for additional public health actions in this community.

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Agency for Toxic Substances and Disease Registry

Appendix A – Community Characteristics and Social Vulnerability

Figure A1. Site and demographic snapshot

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Chicago, Cook County, IL

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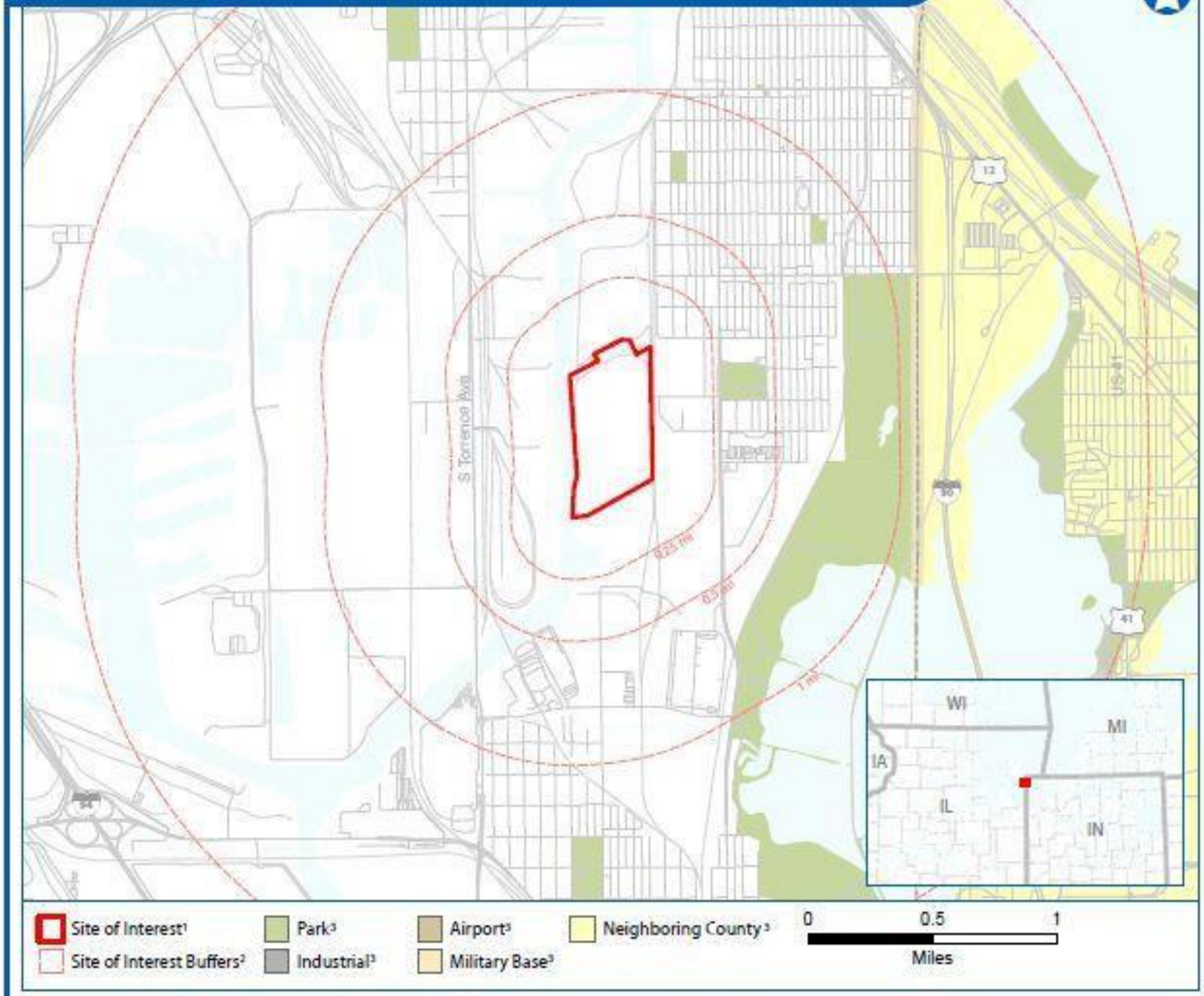
SITE AND DEMOGRAPHIC SNAPSHOT



Demographic Statistics[4,5]

Within 1 Miles buffer of site boundary

Measure	2000	2010	Change	Measure	2000	2010	Change
Total Population	9,584	9,970	+4%	Two or More Races	287	381	+32%
White Alone	6,116	6,240	+2%	Hispanic or Latino[6]	5,404	7,092	+31%
Black Alone	134	298	+122%	Children Aged 6 and Younger	1,031	1,064	+3%
Am. Indian & AK Native Alone	67	78	+16%	Adults Aged 65 and Older	1,302	1,199	-7%
Asian Alone	28	58	+107%	Females Aged 15 to 44	2,009	1,982	-1%
Native Hawaiian & Other Pacific Islander Alone	3	1	-66%	Housing Units	3,237	3,311	+2%
Some Other Race Alone	2,954	2,921	-1%	Housing Units Pre 1950	3,954	2,234	-43%

Data Sources: [1]ATSDR GRASP Hazardous Waste Site Boundary Database. [2]ATSDR GRASP. [3]TomTom 2019Q1. [4]US Census 2010.
Notes: [5]Calculated using area-proportion spatial analysis method. [6]Individuals identifying origin as Hispanic or Latino may be of any race.
Projection: .

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Figure A2. Population density

Reserve Management Group

Chicago, Cook County, IL

POPULATION DENSITY

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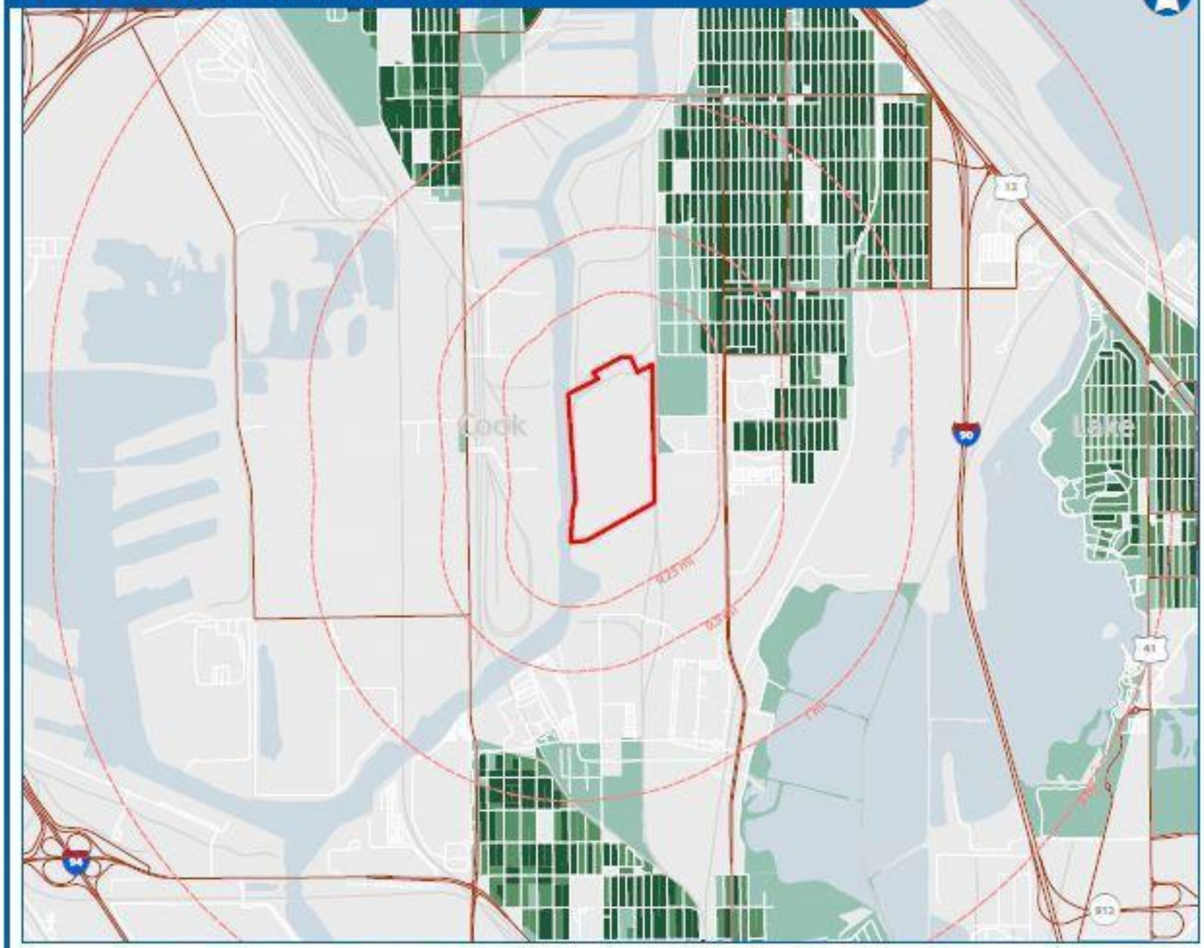

0 0.13 0.25 0.5 0.75 1 1.25 1.5
Miles

The **Population Density Map** depicts the site of interest and the distribution and number of people residing in the surrounding community. The distribution of population in and around a site is critical to understanding a community's potential for exposure to hazardous substances.

Based on US Census 2010 statistics, **326,803** individuals reside within a **5-mile buffer** of the site of interest.

Site of Interest

- Site of Interest[1]
- Site of Interest Buffers[2]

Population Density by Census Block[3] (No. per sq. mi.)

- Zero
- 0 to 5,000
- 5,000 to 10,000
- > 10,000

Healthcare Facilities

- Hospitals[4]
- Urgent Care[5]

Total Population[3,6]
Within specified distance of site boundary

Distance	2000	2010	Change
0.25 mile	40	115	+187%
0.50 mile	1,533	1,799	+17%
1 mile	9,584	9,970	+4%
3 miles[7]	80,617	73,348	-9%
5 miles[7]	373,812	326,803	-12%

Data Sources: [1]ATSDR GRASP Hazardous Waste Site Boundary Database. [2]ATSDR GRASP. [3]US Census 2010. [4]HERE North America 2018R2. [5]Oak Ridge National Laboratory 2017.
Notes: [6]Calculated using area-proportion spatial analysis method. [7]Buffer not shown.
Projection: NAD 1983 StatePlane Illinois East FIPS 1201 Feet.

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Figure A3. Sensitive population: children 6 years and younger

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Chicago, Cook County, IL

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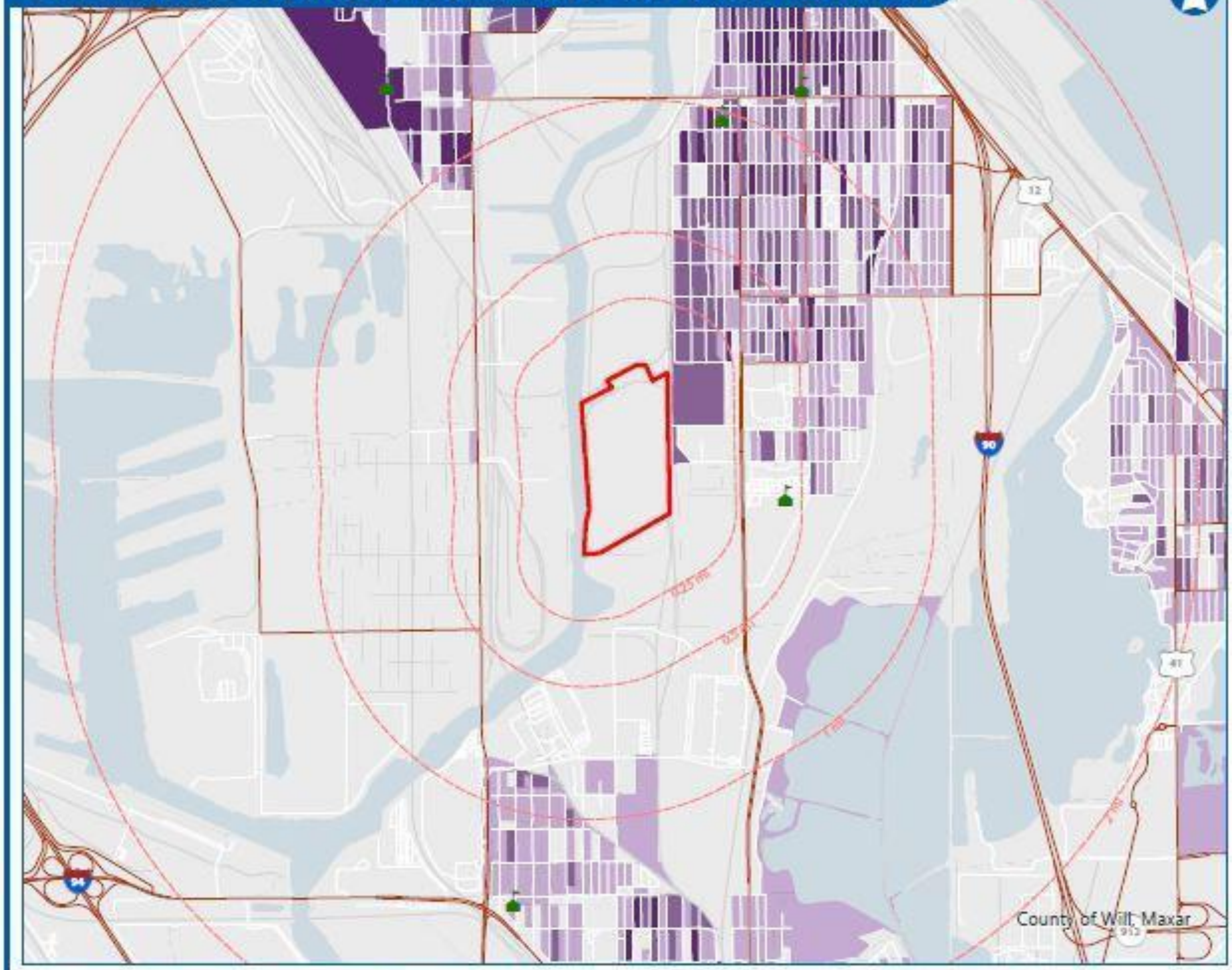
SENSITIVE POPULATION: CHILDREN 6 YRS AND YOUNGER



The **Children Aged 6 Years and Younger Map** depicts the site of interest and the distribution and number of children residing in the surrounding community. The distribution of sensitive populations in and around a site is critical to understanding a community's potential for exposure to hazardous substances.

Within a **5-mile buffer** of this site are located **31,863** children 6 years and younger.

Site of Interest

- Site of Interest[1]
- Site of Interest Buffers[2]

Number of Children 6 Yrs & Younger by Census Block[3]

- Zero
- 1 to 5
- 6 to 10
- > 10

Community Resources

- Hospitals[4]
- Day Care Centers[5]

0 0.5 1
Miles

Children 6 Years and Younger[3,6]
Within specified distance of site boundary

Distance	2000	2010	Change
0.25 mile	4	16	+300%
0.50 mile	171	189	+10%
1 mile	1,031	1,064	+3%
3 miles[7]	9,105	7,561	-16%
5 miles[7]	43,076	31,863	-26%

Data Sources: [1]ATSDR GRASP Hazardous Waste Site Boundary Database. [2]ATSDR GRASP. [3]US Census 2010. [4]HERE North America 2018R2. [5]ORNL 2017.
Notes: [6]Calculated using area-proportion spatial analysis method. [7]Buffer not shown.
Projection: NAD 1983 StatePlane Illinois East FIPS 1201 Feet.

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Figure A4. Sensitive population: adults 65 years and older

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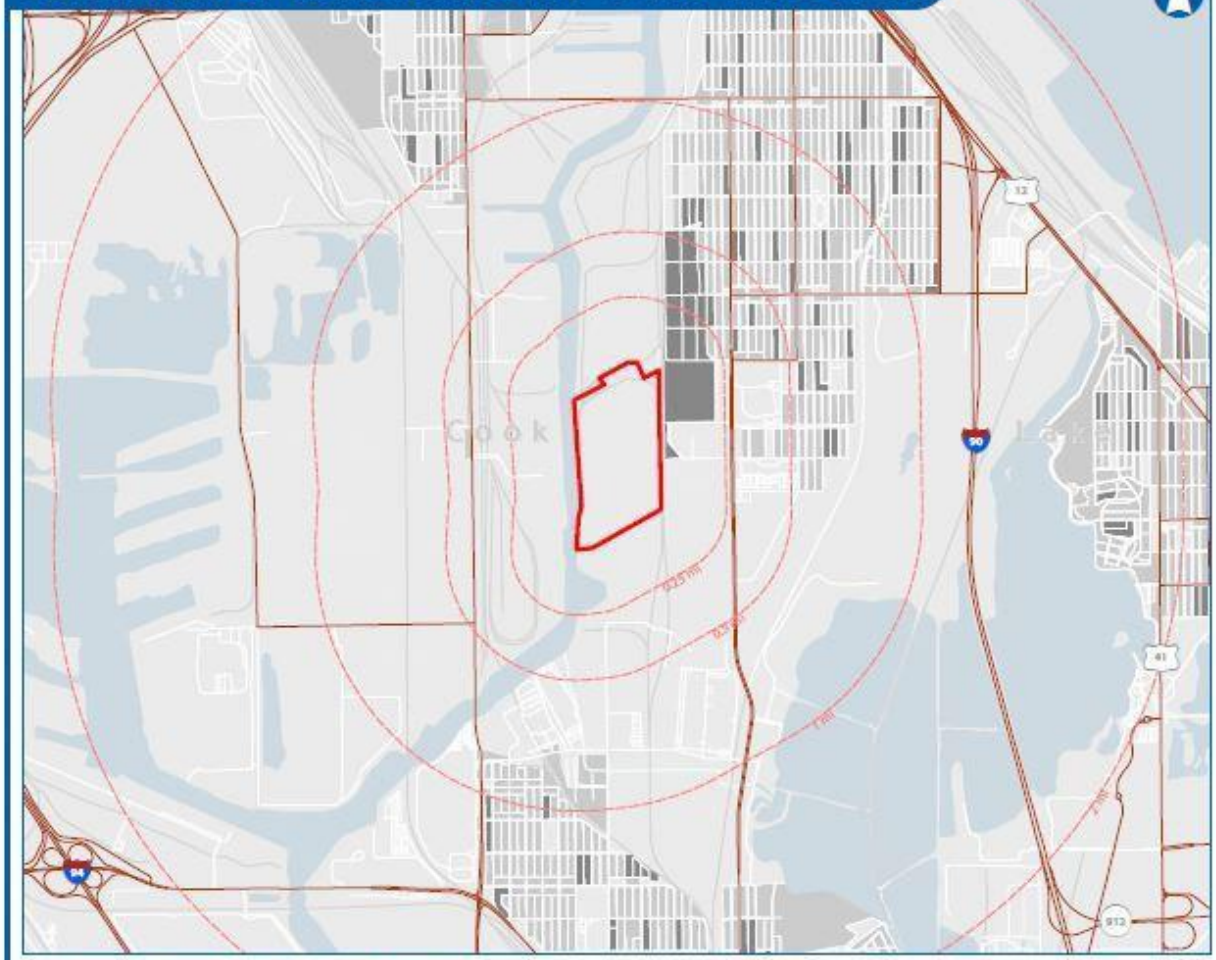
Chicago, Cook County, IL

SENSITIVE POPULATION: ADULTS 65 YRS AND OLDER

INTRODUCTORY MAP SERIES



The **Adults Aged 65 Years and Older Map** depicts the site of interest and the distribution and number of adults residing in the surrounding community. The distribution of sensitive populations in and around a site is critical to understanding a community's potential for exposure to hazardous substances.

Within a **5-mile buffer** of this site are located **43,087** adults 65 years and older.

Site of Interest

- Site of Interest[1]
- Site of Interest Buffers[2]

Number of Adults 65 Yrs & Older by Census Block[3]

- Zero
- 1 to 10
- 11 to 100
- > 100

Healthcare and Elderly Facilities

- Hospitals[4]
- Nursing Homes[5]

0 0.5 1 Miles

Adults 65 Years and Older[3,6]

Within specified distance of site boundary

Distance	2000	2010	Change
0.25 mile	7	19	+171%
0.50 mile	179	214	+19%
1 mile	1,302	1,199	-7%
3 miles[7]	10,392	9,447	-9%
5 miles[7]	44,074	43,087	-2%

Data Sources: [1]ATSDR GRASP Hazardous Waste Site Boundary Database. [2]ATSDR GRASP. [3]US Census 2010. [4]HERE North America 2018R2. [5]CMS 2018.
Notes: [6]Calculated using area-proportion spatial analysis method. [7]Buffer not shown.
Projection: NAD 1983 StatePlane Illinois East FIPS 1201 Feet.

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Figure A5. Community facility points of interest

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Chicago, Cook County, IL

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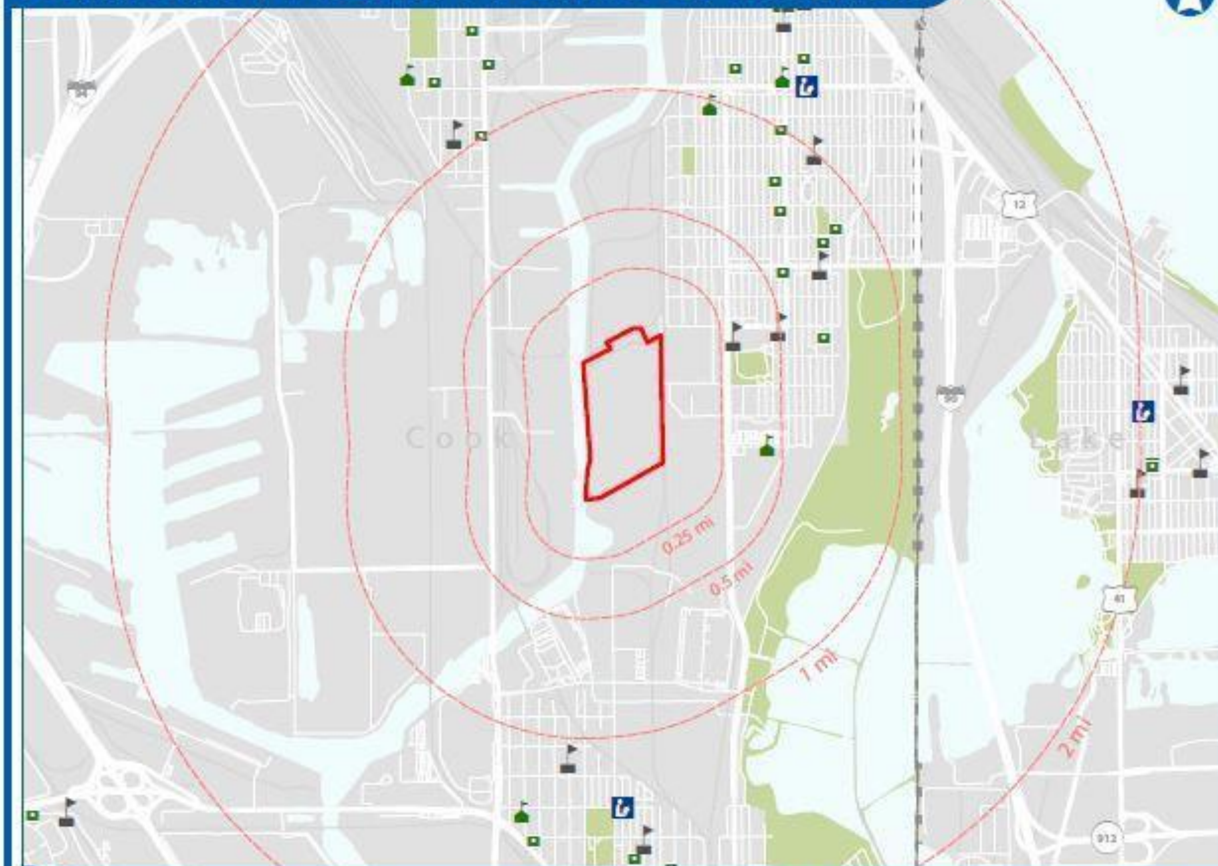
COMMUNITY FACILITY POINTS OF INTEREST



Site of Interest[1]
Site of Interest Buffers[2]
Park[4]
Industrial[4]
Airport[4]
Military Base[4]

0 0.13 0.25 0.5 0.75 1 1.25 1.5 1.75
Miles

The **Community Facility Points of Interest Map** depicts the site of interest and community gathering centers in the local area. Information on number, type, and distribution of these facilities is important to efforts to communicate findings to the local population.

Within a **5-mile buffer** of this site are located **948** community gathering centers of which **56%** are designated as places of worship.

Community Facility Points of Interest

Within specified distance of site boundary. Not all buffers may be shown on map

Facility	0.25 mile	0.5 mile	1 mile	3 miles	5 miles
Libraries[3]	0	0	0	8	17
Schools[3]	0	2	3	31	161
Colleges/Universities[4]	0	0	0	4	5
City Halls[3]	0	0	0	1	5
Civic Centers[3]	0	0	0	0	0
Court Houses[4]	0	0	0	2	4
Places of Worship[4]	0	0	6	86	537
Day Care Centers[5]	0	1	2	21	128
Parks[4]	0	1	5	38	91

Data Sources: [1]ATSDR GRASP Hazardous Waste Site Boundary Database. [2]ATSDR GRASP. [3]HERE NorthAmerica 2018R2. [4]TomTom 2019Q1. [5]ORNL 2018
Projection: NAD 1983 StatePlane Illinois East FIPS 1201 Feet.

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Figure A6. Social vulnerability index

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Chicago, Cook County, IL

SOCIAL VULNERABILITY INDEX (SVI 2018)

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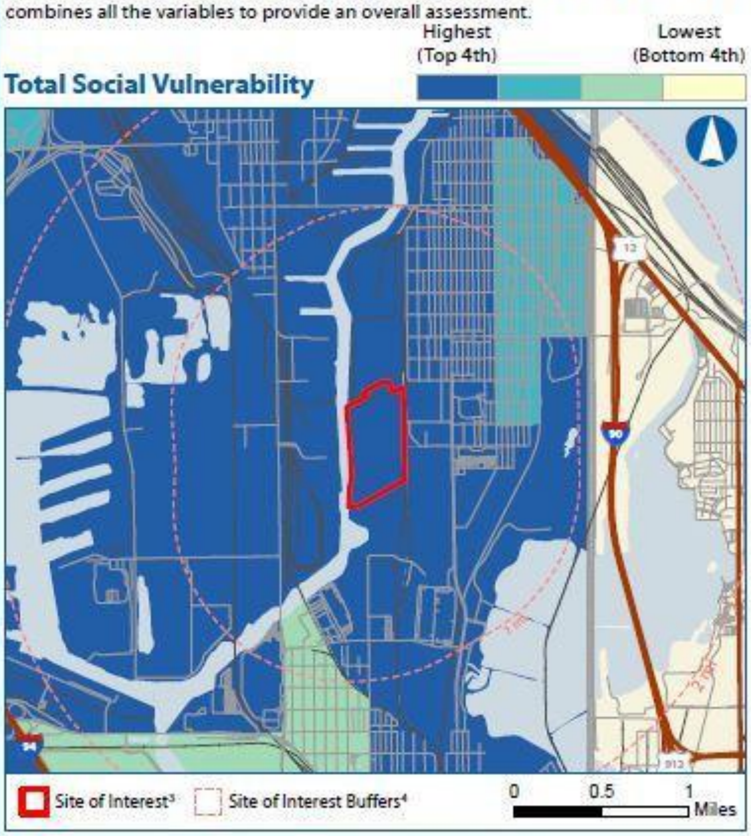
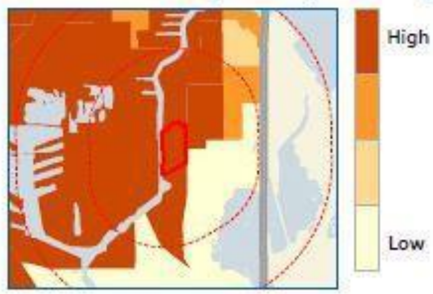
Social vulnerability characterizes a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as a toxic chemical spills. The **Social Vulnerability Index (SVI 2018)**[1] **Map** depicts the vulnerability of communities near the hazardous waste site of interest. The SVI 2018 groups **fifteen census-derived (American Community Survey) factors** into **four themes**[2] that summarize the extent to which the area is socially vulnerable to disaster. The factors include economic data as well as data regarding education, family characteristics, housing, language ability, ethnicity, and vehicle access. Total Social Vulnerability combines all the variables to provide an overall assessment.

Total Social Vulnerability

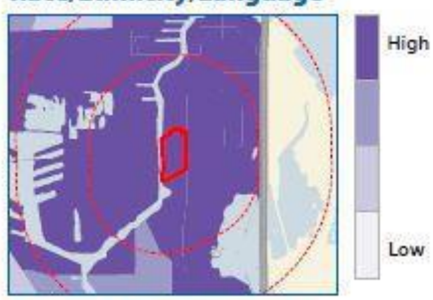


Socioeconomic Status

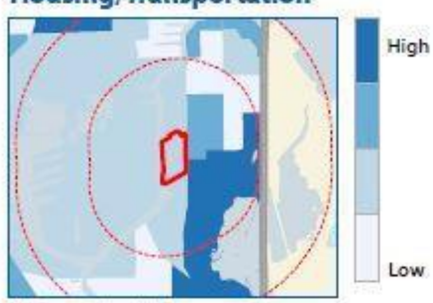
Household Composition/Disability



Race/Ethnicity/Language



Housing/Transportation



Population in Highest Vulnerability Class[5]

By SVI theme, in specified buffer areas. Not all buffers may be shown on map.

Measure	1 mile	2 miles	5 miles
Total Social Vulnerability	6,593	23,878	174,351
Socioeconomic Status	5,901	22,414	209,168
Household Composition	5,857	16,165	193,219
Race/Ethnicity/Language	9,423	31,238	104,860
Housing/Transportation	736	6,443	88,370

Data Sources: [3]ATSDR GRASP Haz. Waste Site Boundary Database. [4]ATSDR GRASP. **Notes:** [1]ATSDR GRASP. [2]SVI domains combine percentile rankings of US Census American Community Survey 2014-2018 variables. Socioeconomic Status: Poverty, Unemployed, Per Capita Income, No H. School Diploma. Household Comp: Aged 65+Over, Aged 17+Younger, Single-parent Household. Race/Ethnicity/Language: Minority, Limited English Speaking. Housing/Trans: Multi-unit, Mobile Homes, Crowding, No Vehicle, Group Quarters. [5]Calculated using area-proportion spatial analysis method. **Reference:** Flanagan, B.E., et al.. *A Social Vulnerability Index for Disaster Management*. Journal of Homeland Security and Emergency Management, 2011. 8(1

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Figure A7. Spanish speakers

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Chicago, Cook County, IL

Spanish Speakers

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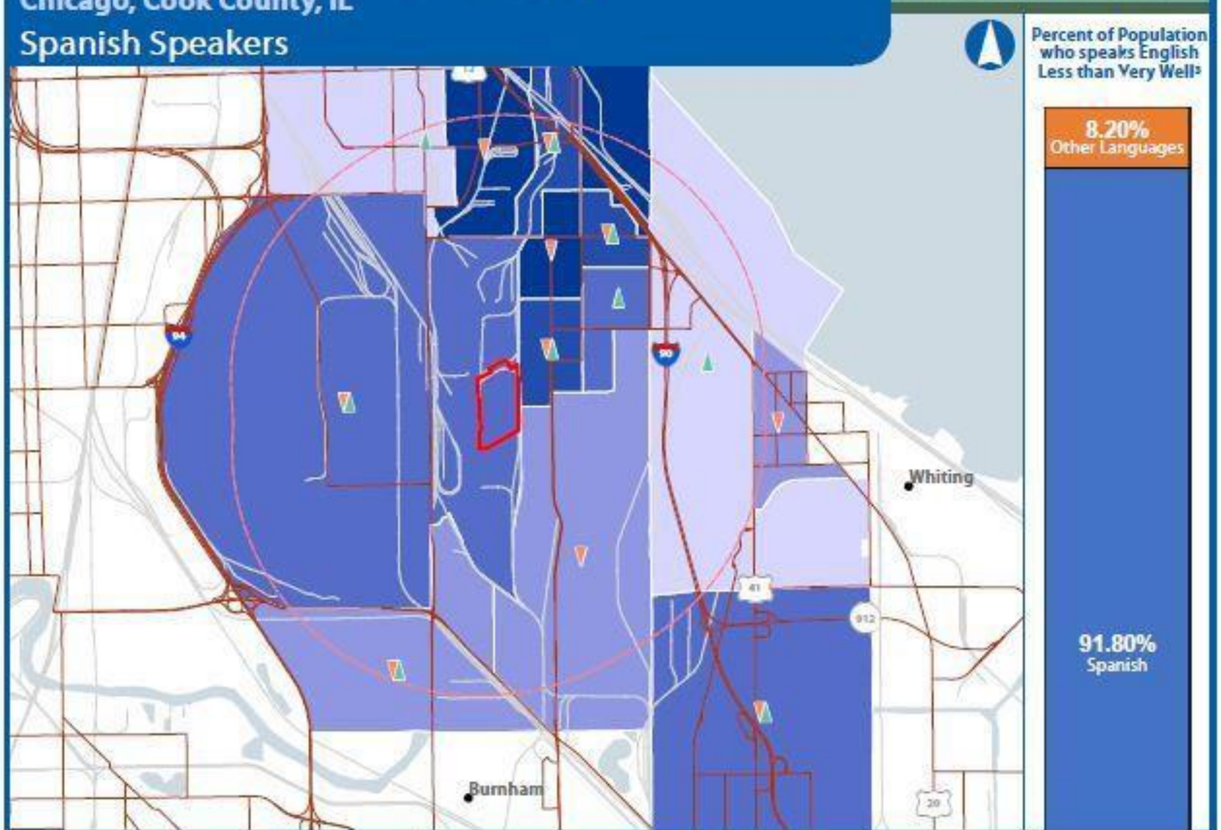

The Most Prevalent Language Spoken Other Than English Map depicts the distribution of the estimated percent of the population aged 5 and older who speak **Spanish** and also speak English less than very well residing in the surrounding community near the site of interest. The distribution of languages spoken in and around a site is critical to effective health communication.

Due to relatively small sample sizes in the ACS, the **Margin of Error (MOE)** can be quite large, especially for small geographic areas such as census tracts, block groups, and even many small towns. In many instances the MOE can be larger than the actual estimate. Another potential issue is the time span over which the five-year ACS samples are collected.

Percent of People 5 Yrs & Older Who Speak Spanish and Speak English Less Than Very Well by Census Tract[3]

- 0.34% - 6.28%
- 6.29% - 12.06%
- 12.07% - 18.13%
- 18.14% - 24.31%
- 24.32% - 37.05%

Potential Change in Class Due To Margin of Error

- Higher data class
- Higher or lower data class
- Lower data class

Site of Interest

- Site of Interest[1]
- Site of Interest buffer

0 0.5 1 2 Miles

Most Predominant Languages Spoken among those who Speak English Less Than Very Well[3]

Census tracts intersecting 2 mile buffer around site of interest boundary

Language	Estimate (± MOE)
Spanish	8,520 (± 781)
Serbo-Croatian	382 (± 193)
Polish	80 (± 81)
French Creole	58 (± 83)
French	51 (± 86)
Greek	37 (± 53)

Data Sources: [1]ATSDR GRASP Hazardous Waste Site Boundary Database.[2]ATSDR GRASP. [3]US Census American Community Survey 5 Year Estimates 2012. **Notes:** MOE calculated using Aggregated count method **Projection:** NAD 1983 StatePlane Illinois East FIPS 1201 Feet.

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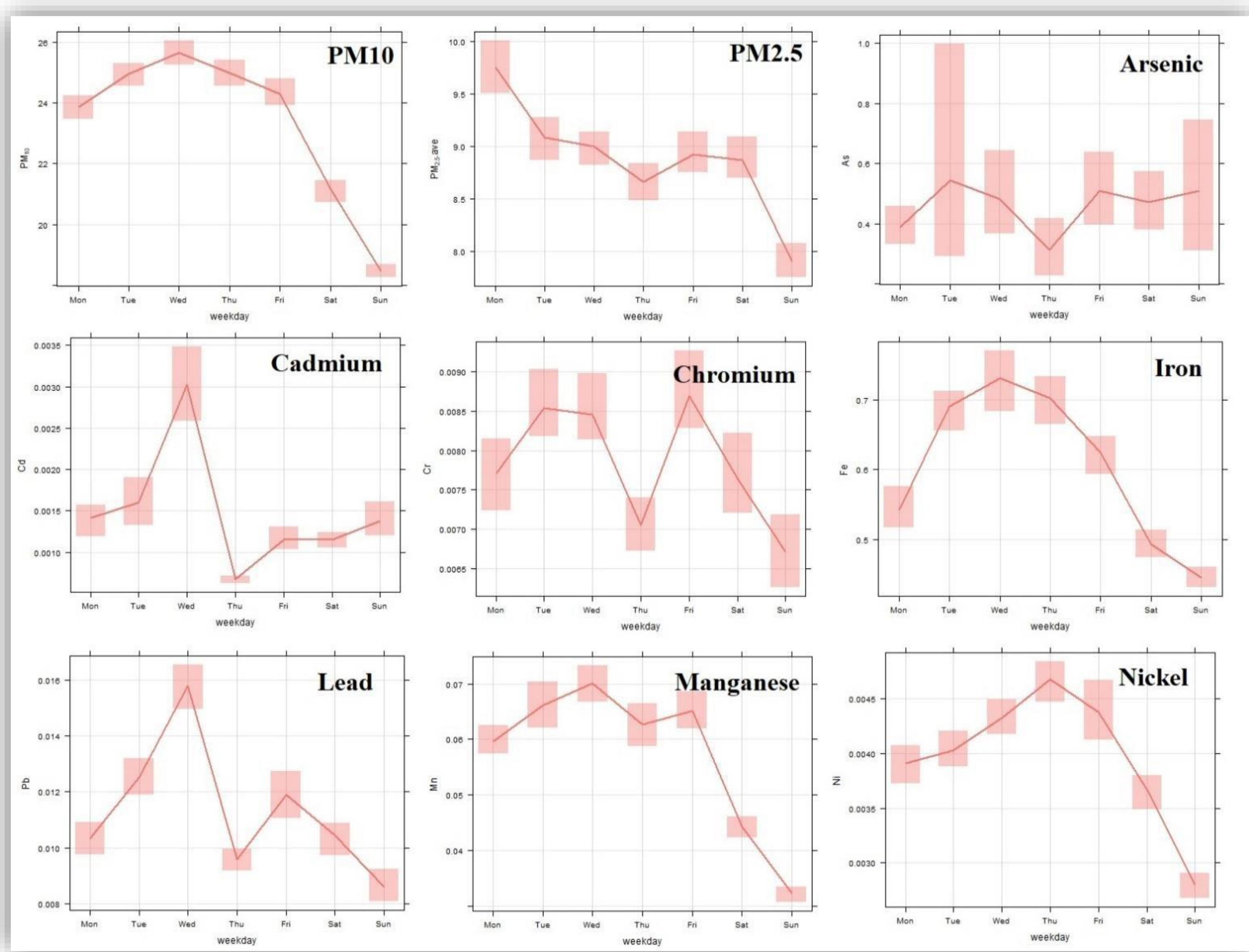
Appendix B - Air Contaminant Temporal and Spatial Trends

Day-of-week data trends show that PM and several metals are notably higher on weekdays and lower on weekends. See Figure B1. This pattern is consistent with emissions and re-entrained dust from industrial and commercial sources and associated vehicle traffic on business days. The metals noted in Section 3.2.3 as being associated with local industry – chromium, iron, lead, manganese, and nickel – follow this day-of-week pattern. Arsenic and cadmium do not seem to share this pattern, which could indicate that they are associated with non-industrial sources or may reflect their very low concentrations and high rates of non-detects.

Figure B1. Day-of-week averages, micrograms per cubic meter, for air contaminants in southeast Chicago, EPA 2015 data for arsenic, Illinois EPA data 2016-2020 for other contaminants.



During the period that PM_{10} has been increasing (2016-2020), air concentrations of ferrous metals (manganese and iron) have remained stable, and some non-ferrous metals (nickel and chromium) have increased. The annual averages of iron and manganese are not notably different between 2016 and 2020. Chromium and nickel concentrations doubled in this time. An increase in concentration does not necessarily imply an elevated health risk. Nickel is below ATSDR's short-term and long-term CVs (see Section 3.2.1) and health effects are not expected. Chromium does exceed long-term CVs and its potential noncancer and cancer health effects are assessed in Section 3.3. Trends for $PM_{2.5}$ and other metals are shown on the next page.

Figure B2. Annual boxplots for contaminants associated with ferrous metal recycling, 2016-2020, micrograms per cubic meter

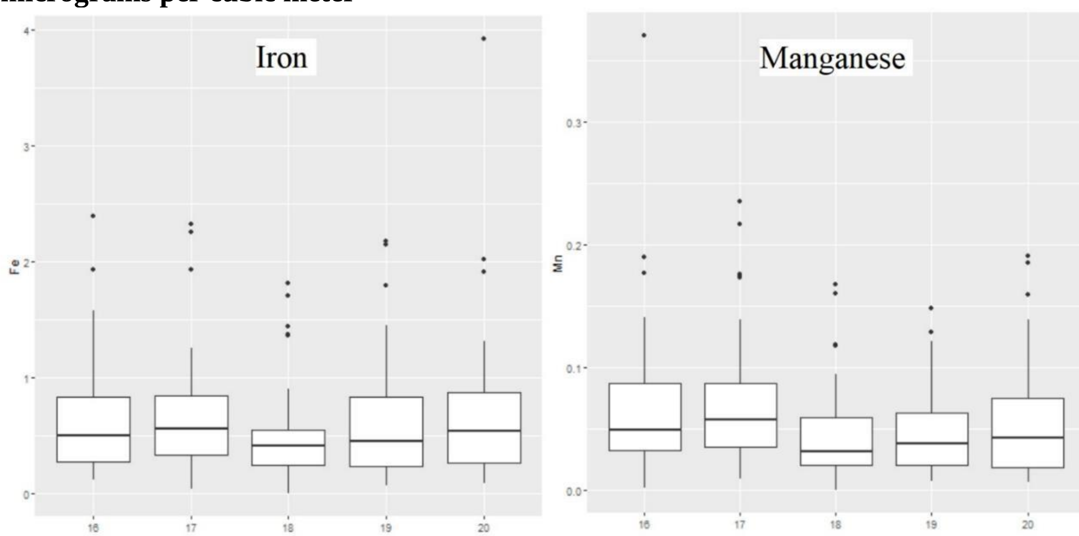


Figure B3. Annual boxplots for contaminants associated with non-ferrous metal recycling, 2016-2020, micrograms per cubic meter

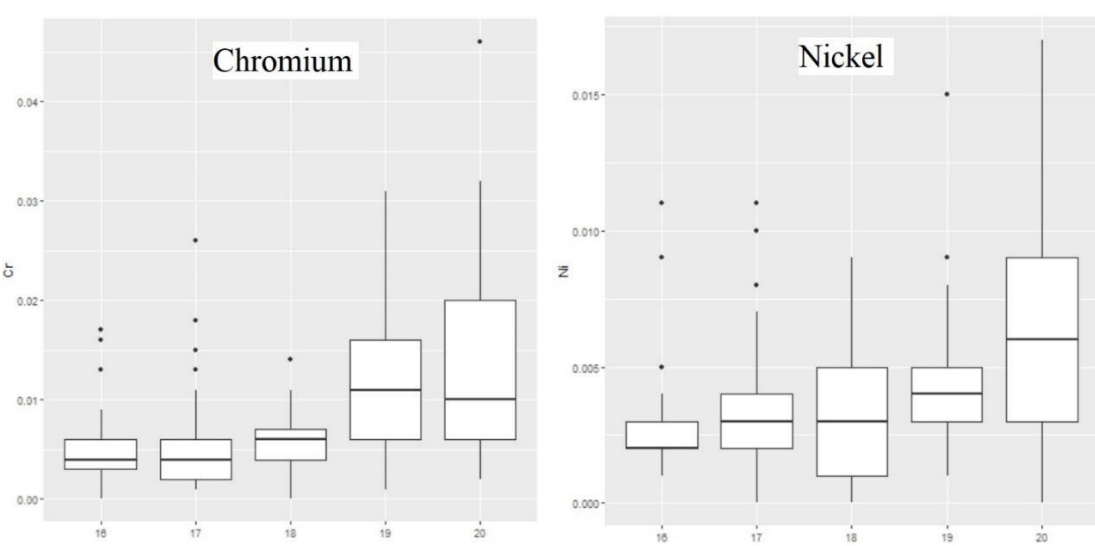


Figure B4. Annual boxplots for particulate matter smaller than 2.5 microns ($PM_{2.5}$), Illinois EPA site 2016-2020, microns per cubic meter

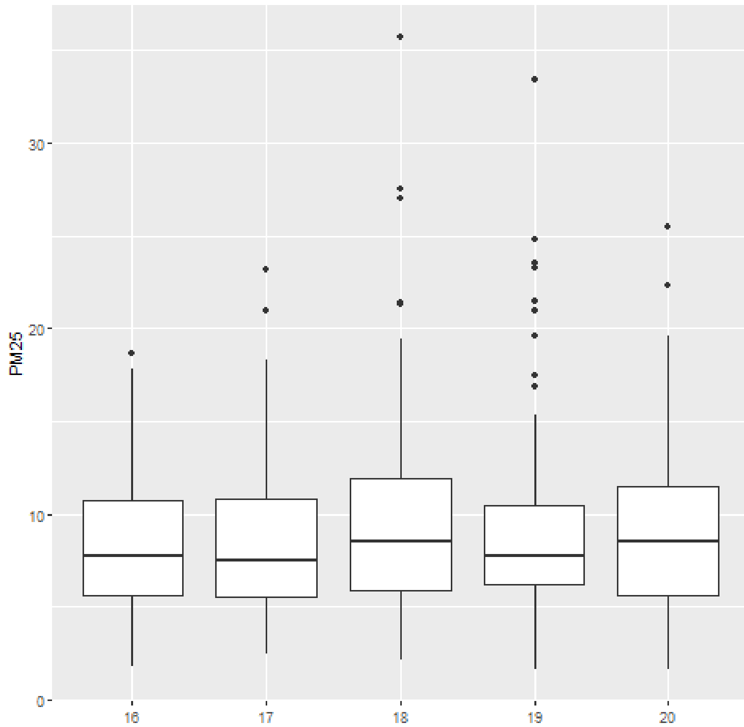


Figure B5. Annual boxplots for cadmium and lead, Illinois EPA site 2016-2020, microns per cubic meter

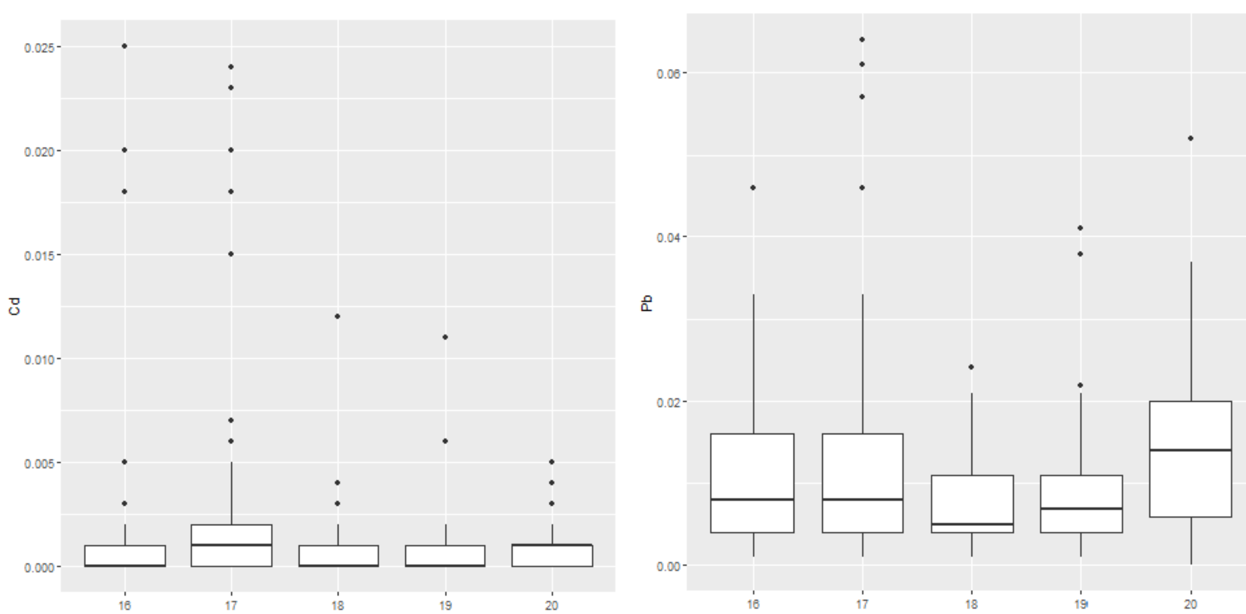


Figure B6. Polar plots showing direction of source areas of manganese relative to air monitor location in 2015 and recent conditions (2016-2020)

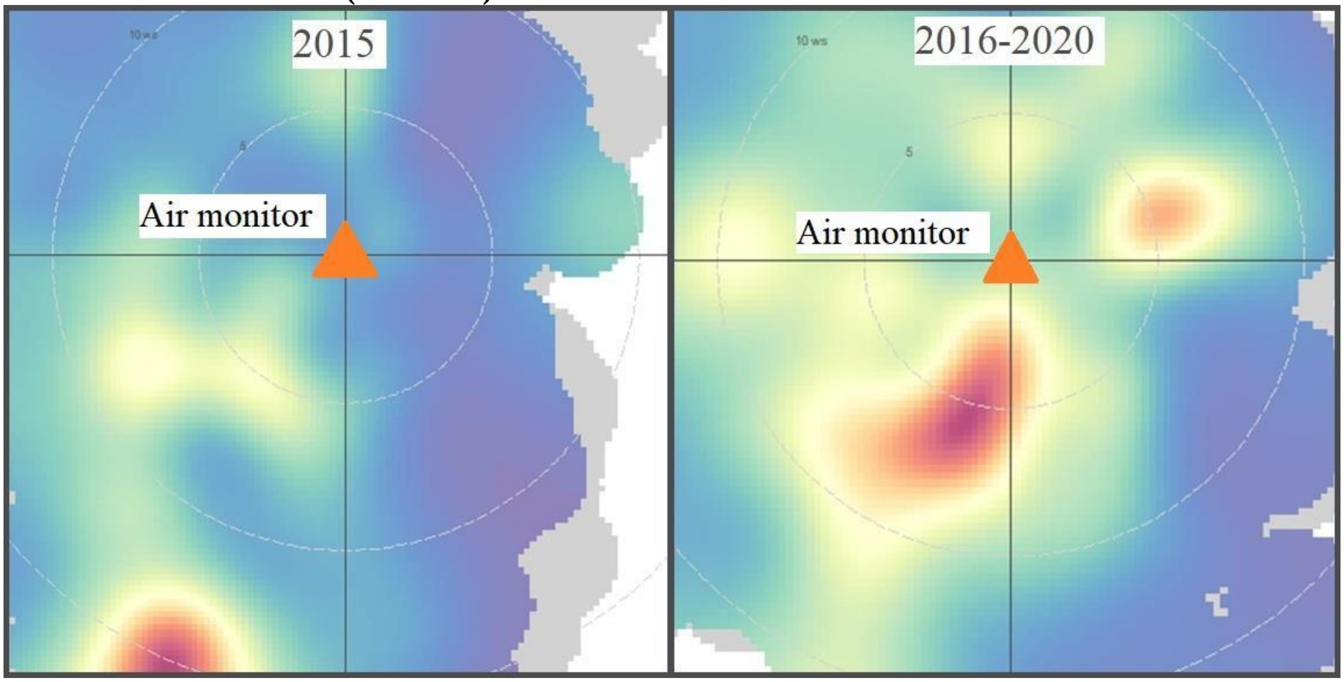


Figure B7. Polar plots showing direction of source areas of cadmium relative to air monitor location in 2015 and recent conditions (2016-2020)

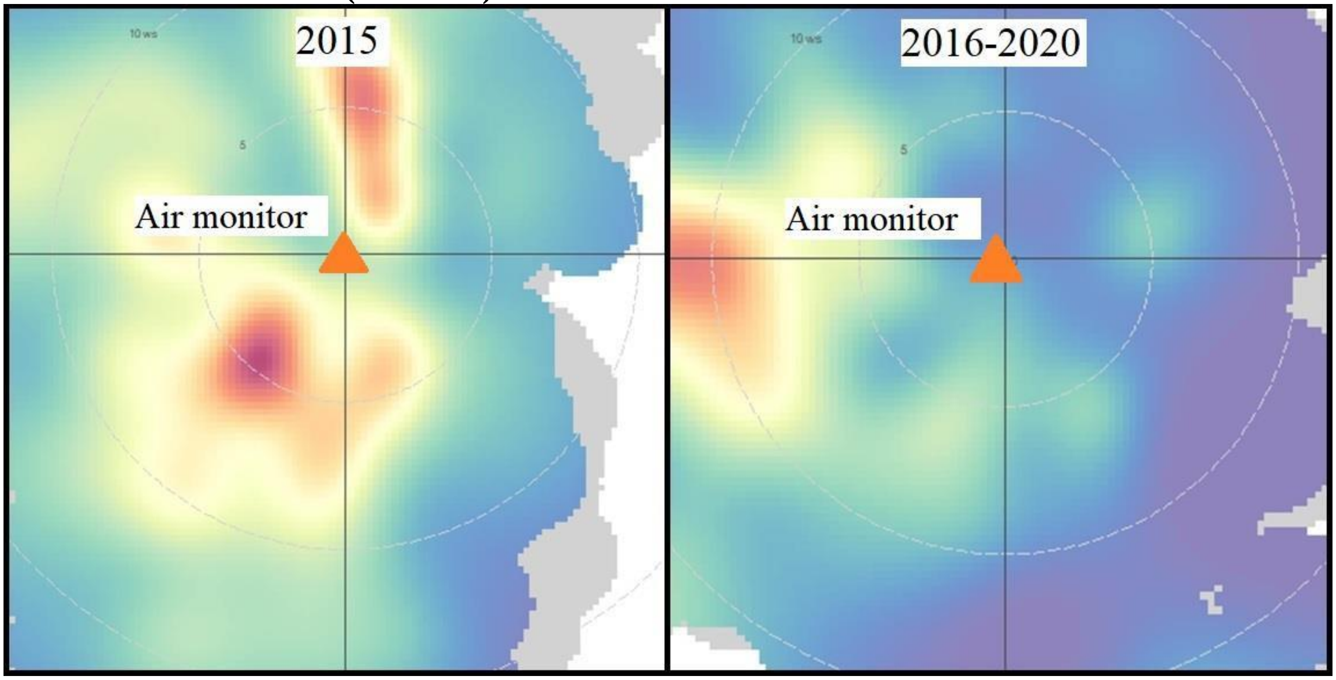


Figure B8. Polar plots showing direction of source areas of chromium relative to air monitor location in 2015 and recent conditions (2016-2020)

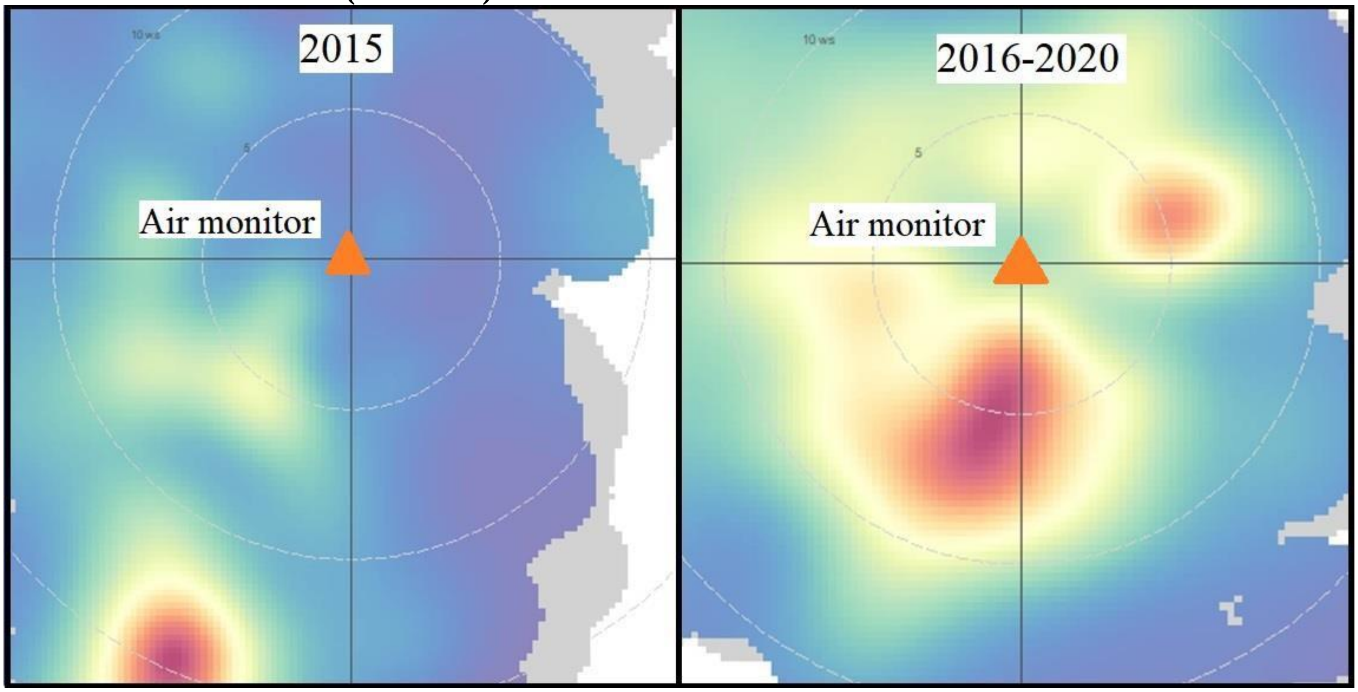


Figure B9. Polar plots showing direction of source areas of iron relative to air monitor location in 2015 and recent conditions (2016-2020)

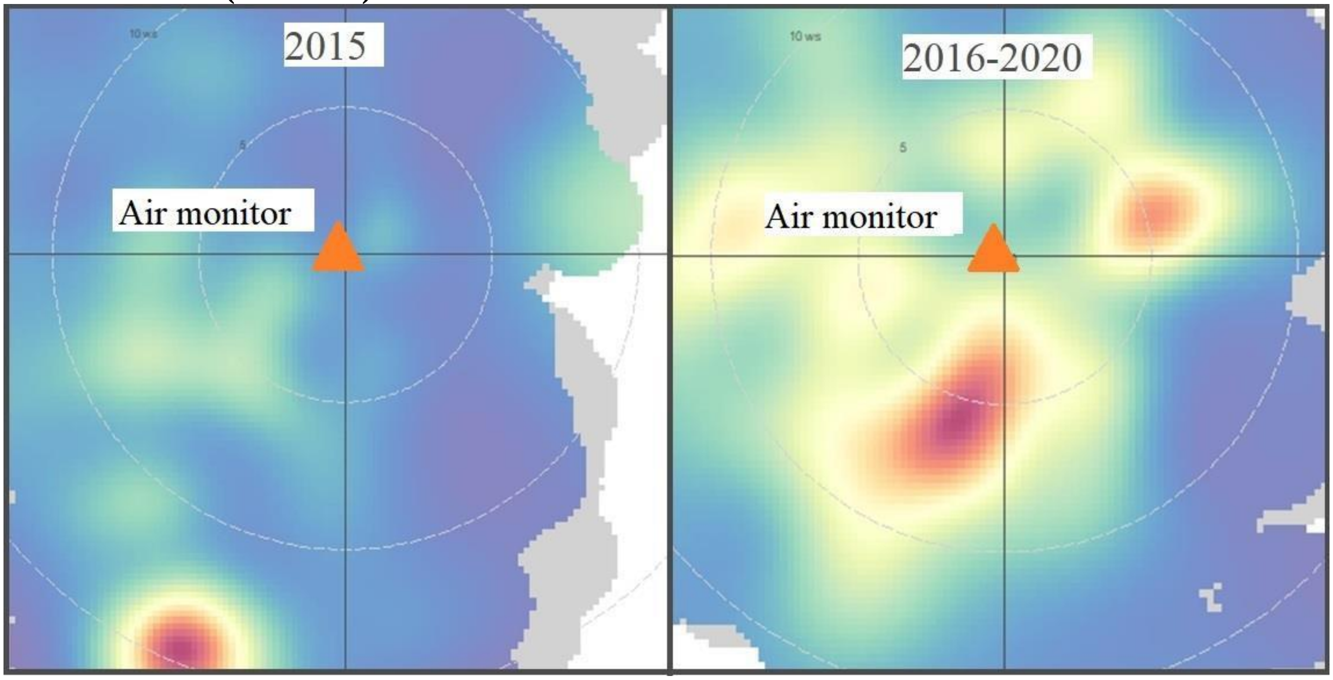


Figure B10. Polar plots showing direction of source areas of lead relative to air monitor location in 2015 and recent conditions (2016-2020)

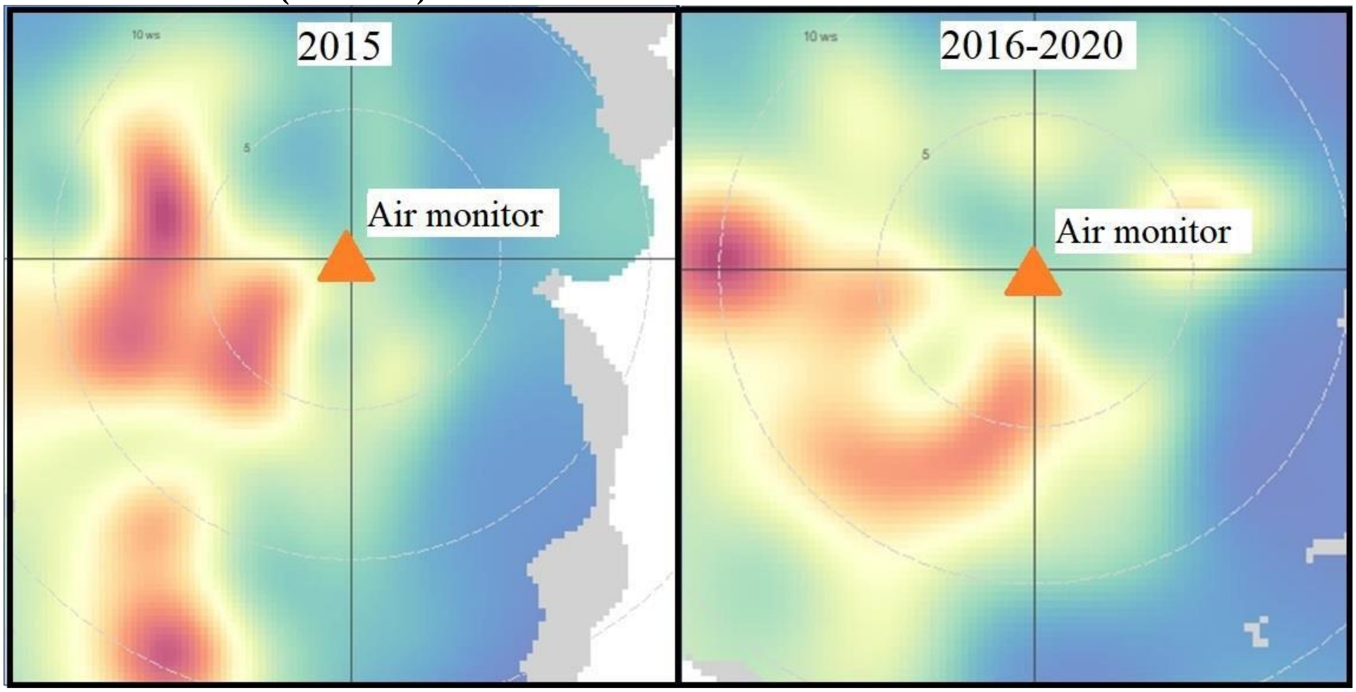


Figure B11. Polar plots showing direction of source areas of nickel relative to air monitor location in 2015 and recent conditions (2016-2020)