

Health Impacts of Climate Change in the Calumet Industrial Corridor

Climate change impacts have profound effects in many areas of the Great Lakes region. Many of these impacts are disproportionately severe in certain areas depending on social and environmental conditions. Populations living in risk-prone areas such as urban heat islands, areas with older infrastructure, or areas with the increased burden of air pollution are most vulnerable to health impacts related to our changing climate.

This document highlights health impacts due to extreme temperature and precipitation as well as impacts related to hazardous air quality. Many of these impacts are disproportionately severe in certain areas depending on social and environmental conditions. Historical observations (1951-2019) of southeastern Chicago and mid-century (2040-2059) projections for northeastern Illinois are available for temperature and precipitation.

Temperature

Local Effects

- Stagnant air masses, such as dry tropical and maritime tropical air, resulted in hot and humid conditions with high overnight temperature associated with the 1995 and 1999 Chicago heat waves.⁴
- The urban heat island (UHI) effect can enhance the impacts of extreme heat events, where temperatures are higher in more densely populated areas.⁴
- Studies suggest future increases in summer temperatures and the frequency of extremely hot summers associated with heatwaves.⁴

Health Impacts

- Extreme heat can cause certain illnesses to occur, such as cardiovascular, respiratory, and renal illnesses.¹
- Increases in temperature and extreme heat events will lead to more outcomes involving heat stroke, cardiovascular disease, respiratory disease, cerebrovascular disease, and kidney disorders.¹
- Hyperthermia, mental health issues, and preterm births occur when certain populations are exposed to extreme

Historical Temperature (1951-2019)			
Annual			
1.9°F			
Winter	Spring		
3.0°F	2.1°F		
Summer	Autumn		
1.4°F	1.3°F		

Table 1: The historical average temperature trends for southern Chicago, IL based on the Chicago-Midway climate station.²

Projected Temperature (2040-2059)			
Annual			
1.8°F to 5.6°F			
Winter	Spring		
2.6°F to 5.2°F	1.9°F to 4.4°F		
Summer	Autumn		
4.8°F to 7.0°F	3.3°F to 6.1°F		

Table 2: Ranges of potential temperature increases for northeastern Illinois based on the UW-RegCM4 mid-century simulations.³

heat conditions.¹

- With the increase in migration to large urban areas, the potential increase in the UHI effect may lead to more heat-related deaths for vulnerable populations.¹

Populations at Risk

- With increasing temperatures, children engaging in outdoor activity may be more vulnerable to dehydration, electrolyte imbalance, heat-induced fevers, heat stress, and hypothermia.¹
- Pregnant women may experience preterm birth due to exposure to extreme heat.¹
- Older adults with preexisting conditions, living alone, and taking medication affecting thermo-regulation are at a higher risk of being affected by heat events.¹
- During extreme heat events, most reports signal respiratory illnesses among the elderly population.¹

Precipitation

Local Effects

- The frequency of annual extreme precipitation events greater than 1 inch has increased in the area by approximately 3 days from 1951-2019.
- More frequent flooding along several roadways forced many Calumet residents to drive along the curbs to avoid the most hazardous areas.⁶

Health Impacts

- Extreme precipitation events can damage stormwater and wastewater treatment infrastructure which increases the risk of exposure to contaminated water.¹
- With a combined sewage system for rainwater runoff, domestic, sewage, and industrial wastewater, the city of Chicago may experience more combined sewage overflow cases during extreme precipitation events.⁵
- More intense precipitation events will cause waste runoff into recreational waters and sources of drinking water leading to more risk of human exposure to water-borne illnesses (e.g., bacteria, viruses, and protozoa).¹
- Gastrointestinal illness cases from contaminated drinking water, recreational waters, and shellfish correlate with extreme precipitation events.¹
- Flooding near recreation waters can expose people to mild to severe flu-like illnesses.¹

Historical Precipitation (1951-2019)			
Annual			
10.8"			
Winter	Spring		
1.9"	3.5"		
Summer	Autumn		
2.3"	3.4"		

Table 3: The historical total precipitation trends for southern Chicago, IL based on the Chicago-Midway climate station.²

Projected Precipitation (2040-2059)			
Annual			
-0.6" to 3.1"			
Winter	Spring		
-0.8" to 2.5"	-1.4" to 2.4"		
Summer	Autumn		
-1.4" to 0.8"	-0.6" to 1.2"		

Table 4: Ranges of total precipitation changes for northeastern Illinois based on the UW-RegCM4 mid-century simulations.³

- Severe extreme precipitation events, flooding, and storm surges may cause greater disruption or failure to water treatment plants that exceed system capacity.¹

Populations at Risk

- Children, older adults, pregnant women, and immunocompromised individuals have a higher risk of severe health outcomes from contact with contaminated water.¹
- Both children and older adults are at higher risk of contracting gastrointestinal illnesses as a result of drinking and exposure to contaminated water.¹

Air Quality

Local Effects

- The main health concerns for Calumet residents include respiratory diseases (i.e., asthma and chronic obstructive pulmonary disease [COPD]) and lung cancer due to the air quality and noxious odors in the community.⁶
- Many Calumet residents stated they have had respiratory diseases caused by air pollution from surrounding industries.⁶
- Community members attribute health problems to high winds transporting sediments from river salt piles along 106th Street.⁶

Health Impacts

- After prolonged exposure to power plants, industrial facilities, and fossil-fuel emissions, certain health impacts like asthma, lung disease, and cancer can occur or worsen in a community.^{1, 6, 7}
- Ground-level ozone (O₃) and particulate matter (PM_{2.5}) are air pollutants most commonly linked to health impacts.¹
- Ozone is the result of emitted pollutants and meteorological conditions such as air temperature,

humidity, precipitation, and wind trajectory.¹

- Densely populated areas are most likely to experience high levels of O₃ during the warm summers.⁴
- Future ozone-related health impacts will lead to more cases of premature deaths and acute respiratory illness throughout the United States.¹
- Particulate matter arises from both natural and human sources as a mixture of solid and liquid substances, and PM_{2.5} consists of aerosols with diameters lesser than 2.5 microns.¹
- Increased humidity, stagnant air, and biogenic emissions lead to increases in PM_{2.5} levels.¹
- Serious chronic and acute health effects, such as lung cancer, cardiovascular disease, and asthma are linked to PM_{2.5} exposure.¹

Populations at Risk

- Children, older adults, and immunocompromised people are more vulnerable to indoor air pollutants than the general population.^{1, 7}
- People with pre-existing conditions, such as hypertension, diabetes, and COPD, are at greater risk for outdoor air pollution-related health effects.⁷

Data Sources and References

¹This document uses information from the United States Global Change Research Program (USGCRP) 2016 Climate and Health Assessment. The following [link](#) provides the online landing page, and the recommended citation is given below:

- USGCRP, 2016: The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp.

²Historical analysis utilizes the Global Historical Climatology Network Daily (GHCN-D) station observations from the National Centers for Environmental Information (NCEI). The GHCN-D station near Chicago-Midway International Airport provides the data due to its proximity to the Calumet Industrial Corridor.

³The future analysis utilizes the dynamically downscaled data set of the Regional Climate Model Version 4 (RegCM4) from the University of Wisconsin Nelson Institute Center for Climatic Research. The data set comprises of six dynamically-downscaled models that represent a variety of variables changes for mid-century (2040-2059). The summarized projections focus on the region of northeastern Illinois. The regional data and maps of changes are available at the following link: <https://nelson.wisc.edu/ccr/resources/dynamical-downscaling/index.php>

⁴Hellman J., Lesht B., Nadelhoffer K. (2010). Climate Change and Chicago: Chapter 4 - Health. City of Chicago. <https://www.chicago.gov/content/dam/city/progs/env/CCAP/Chicago_climate_impacts_report_Chapter_4_Health.pdf>

⁵Keenan M.B., Shankar S., Haas P. (2019). Assessing Disparities of Urban Flood Risk for Households of Color in Chicago. *Illinois Municipal Policy Journal*.

⁶Herbet-Beirne J., Grant A., Magana D., Lee E., Maldonado J., Jagai J., Machuca N., Bautista O. (2020). Calumet Connect Qualitative Community Needs Assessment. University of Illinois-Chicago School of Public Health.

⁷Chicago Department of Health. (2020). The City of Chicago Air Quality and Health Report 2020. City of Chicago. <https://www.chicago.gov/content/dam/city/depts/cdph/statistics_and_reports/Air_Quality_Health_doc_FINALv4.pdf>

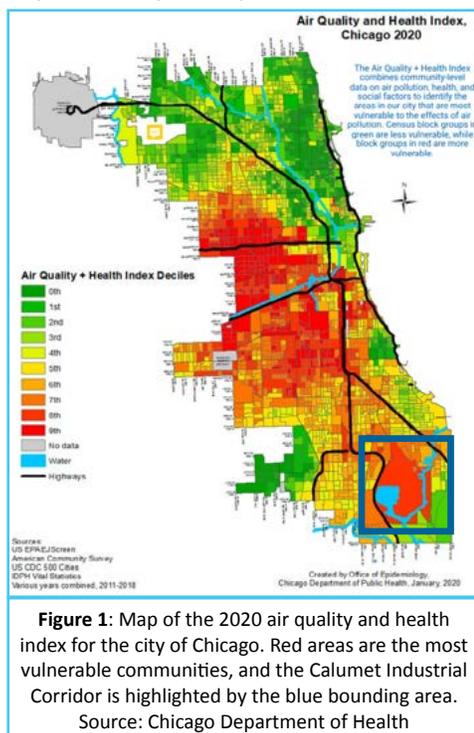


Figure 1: Map of the 2020 air quality and health index for the city of Chicago. Red areas are the most vulnerable communities, and the Calumet Industrial Corridor is highlighted by the blue bounding area. Source: Chicago Department of Health