Chicago Department of Public Health
Wastewater Monitoring Annual Report 2024

What is wastewater monitoring?

The Chicago Department of Public Health (CDPH), in collaboration with Discovery Partners Institute (DPI) at the University of Illinois - Chicago, continues to track the presence and spread (i.e., prevalence and incidence) of various infectious diseases by studying wastewater or sewage throughout Chicago. Wastewater surveillance (WS) can be used to track diseases because the responsible viruses or bacteria are often found in the feces of infected individuals. You can visit City of Chicago :: Wastewater Monitoring to learn more about wastewater monitoring in Chicago and access the publicly available data dashboard for the City's wastewater monitoring program for COVID-19. Chicago wastewater data is submitted to the US Centers for Disease Control and Prevention (CDC) as part of the National Wastewater Surveillance System (NWSS).

The following report summarizes wastewater monitoring activity during the 2024 calendar year.

What is the community impact of wastewater monitoring?

Wastewater monitoring is a powerful tool for Chicagoans that provides real-time insights into the viruses and bacteria circulating across Chicago. It is particularly effective in monitoring communities that have limited access to healthcare, helping ensure that no neighborhood is left out of disease detection and response efforts. In some circumstances, wastewater data can offer a more complete and equitable picture of public health than looking at provider-based laboratory testing alone.

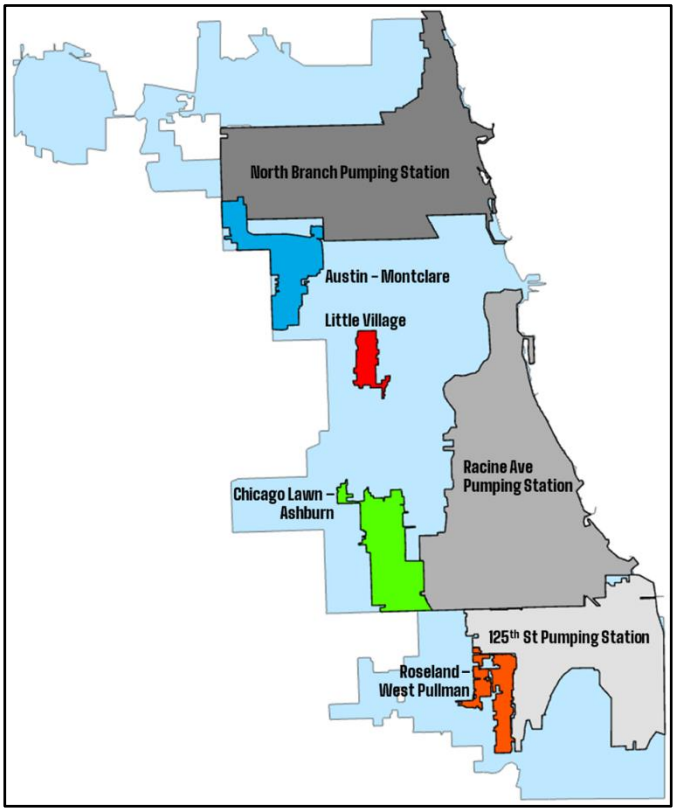
It is essential for the health department to lead these efforts to ensure that disease trends—such as the emergence of new COVID-19 variants—can be monitored even when clinical testing rates are low. Wastewater analysis can also detect early signs of outbreaks, allowing for faster and more targeted deployment of vaccines and enhanced provider awareness. By investing in wastewater monitoring, CDPH demonstrates leadership in proactive, data-driven public health protection.

Where was wastewater collected in 2024?

To monitor diseases in Chicago, CDPH analyzed wastewater data from a variety of different sites (Figure 1) which all reflect unique sewersheds (or the geographic boundaries of a certain area in which all wastewater flows to a single point). In descending order of population size served, wastewater was collected from:

- Four **Wastewater Treatment Plants** (WWTP) which, combined, captured all of Chicago's wastewater and parts of the surrounding suburbs of Cook County. Each plant serves > 1 million residents; sampling was collected in collaboration with the Illinois Department of Public Health (WWTPs are not reflected in Figure 1, which shows only Chicago-specific sewersheds).
- Three **Pumping Stations** which serve populations ranging from 119,927 to 704,811 residents. Wastewater monitoring from these sites began in May 2024 and was sampled directly at the pumping station facility.
- Four **Community Areas** distributed across the Healthy Chicago Equity Zones (HCEZ), which represent populations ranging from 3,887 to 82,851 residents. Wastewater from these sewersheds was accessed via manholes. Generally, two samples were collected from each site weekly. Although eight sites were initially sampled at the beginning of 2024, for cost-efficiency reasons (beginning August 1, 2024) CDPH ceased sampling from four of eight Community Areas. CDPH decided to deselect these four sites because they were sampling from HCEZs already represented in wastewater data.

FIGURE 1: Location of Chicago sewershed sites involved in wastewater monitoring as of August 2024, including 4 community areas (various colors) and 3 pumping stations (greyscale)



How were wastewater samples analyzed?

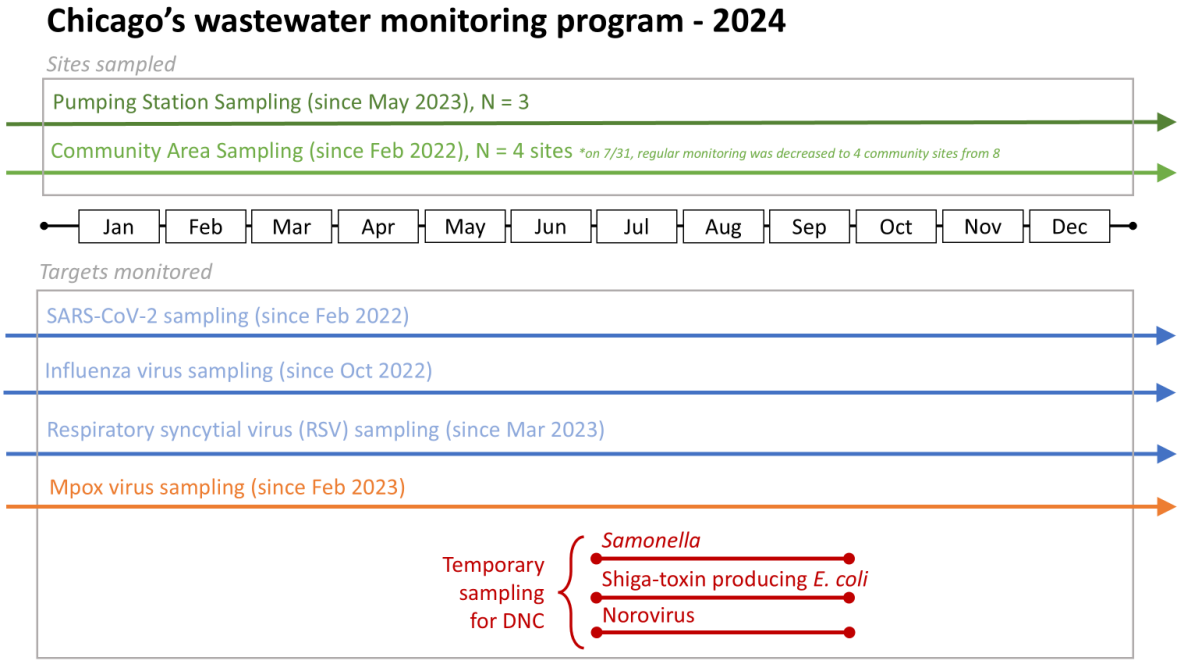
After the samples were collected, laboratory partners at University of Illinois-Chicago tested each sample for the presence of certain bacteria or viruses. The laboratory then informed CDPH about the concertation of each pathogen present in each sample. These values were adjusted for population served to account for the fact that a large population in the catchment area can lead to a higher concentration value of a given bacteria or virus. Wastewater data files were securely transferred to CDPH servers and data was analyzed by CDPH epidemiologists.

What did CDPH look for?

During 2024 (Figure 2), CDPH:

- Regularly tested wastewater for the "Big Three" respiratory viruses (influenza, SARS-CoV-2, and Respiratory Syncytial Virus, or RSV),
- Regularly tested wastewater for mpox clade II virus at certain sites, and
- Conducted time-limited wastewater surveillance during the Democratic National Convention (DNC) hosted in Chicago (August 19—22, 2024). In addition to the three respiratory viruses regularly assessed, CDPH expanded surveillance to three gastrointestinal pathogens given their relevance to large scale events. This was a multiday National Special Security Event, which required intensive coordination with partners at the local, state, and federal levels.

FIGURE 2: Sites and targets involved in Chicago's wastewater monitoring program



How will CDPH sustain the program in 2025?

In 2025, CDPH will continue using wastewater monitoring to improve tracking of the big three respiratory viruses (Influenza viruses A and B, RSV, and COVID-19). Due to the national public health importance of Highly Pathogenic Avian Influenza (HPAI), CDPH has increased its capacity to conduct HPAI wastewater surveillance, specifically through H5 subtyping of isolated influenza A virus.

CDPH will also assess the current sampling strategy and cadence to ensure testing locations are optimized for the expanded testing. Community investment and public health integrity will remain at the core of our work. Representation from Chicago's diverse neighborhoods will remain a priority. To **ensure representation of all Chicagoans**, sampling sites will remain in each of the six Healthy Chicago Equity Zones.

In the following sections, we briefly summarize the Chicago wastewater testing that occurred in 2024, specific to Chicago sewersheds (i.e., community areas and pumping stations).

"Big Three" respiratory viruses

SARS-CoV-2, Influenza (Flu), and Respiratory Syncytial Virus (RSV)

Why did CDPH monitor wastewater for these viruses?

SARS-CoV-2, the virus that causes COVID-19, was the first pathogen to be monitored in Chicago wastewater (starting in February of 2022). In October of 2022, influenza monitoring began and in March 2023, RSV was added to CDPH surveillance targets. CDPH continues wastewater monitoring for these "Big Three" respiratory viruses to understand where and how fast, these diseases are spreading.

There are two benefits to monitoring wastewater for respiratory disease pathogens. First, evidence suggests that wastewater monitoring is able to detect increases in community levels of respiratory viruses before they are detected as illnesses in local hospitals.[1,2,3] This can help public health and clinicians prepare for anticipated surges in illness, which is particularly valuable during late fall and winter months when transmission of these viruses begins to increase. Advanced knowledge of

[1] DeJonge, Peter M., Carly Adams, Ian Pray, Melissa K. Schussman, Rebecca B. Fahney, Martin Shafer, Dagmara S. Antkiewicz, and Adélaïde Roguet. "Wastewater Surveillance Data as a Complement to Emergency Department Visit Data for Tracking Incidence of Influenza A and Respiratory Syncytial Virus — Wisconsin, August 2022–March 2023." *MMWR. Morbidity and Mortality Weekly Report* 72, no. 37 (September 15, 2023): 1005–9. https://doi.org/10.15585/mmwr.mm7237a2.

[2] Faherty, Emily A. G., Deniz Yuce, Colin Korban, Kelley Bemis, Rishi Kowalski, Stephanie Gretsch, Enrique Ramirez, et al. "Correlation of Wastewater Surveillance Data with Traditional Influenza Surveillance Measures in Cook County, Illinois, October 2022-April 2023." *The Science of the Total Environment* 912 (February 20, 2024): 169551. https://doi.org/10.1016/j.scitotenv.2023.169551.

[3] Kitajima, Masaaki, Michio Murakami, Syun-Suke Kadoya, Hiroki Ando, Tomohiro Kuroita, Hiroyuki Katayama, and Seiya Imoto. "Association of SARS-CoV-2 Load in Wastewater With Reported COVID-19 Cases in the Tokyo 2020 Olympic and Paralympic Village From July to September 2021." *JAMA Network Open* 5, no. 8 (August 1, 2022): e2226822. https://doi.org/10.1001/jamanetworkopen.2022.26822.

increased illness transmission can help hospitals prepare staffing, space and therapeutics availability. Second, these viruses can infect people without causing severe illness or any symptoms at all, but these people can still infect others. If we only monitor these viruses by tracking the numbers of associated patients at Chicago hospitals or clinics, we'll miss an important proportion of the infected population. Wastewater data, on the other hand, will still capture any virus these people may be shedding into the sewer system and provides us with data patterns based on an aggregate group of infected persons in Chicago—symptoms or not.

A total of 2,014 **wastewater samples** were tested for SARS-CoV-2, Influenza A/B and RSV during the 2024 calendar year (equivalent to nearly 38 samples per week).

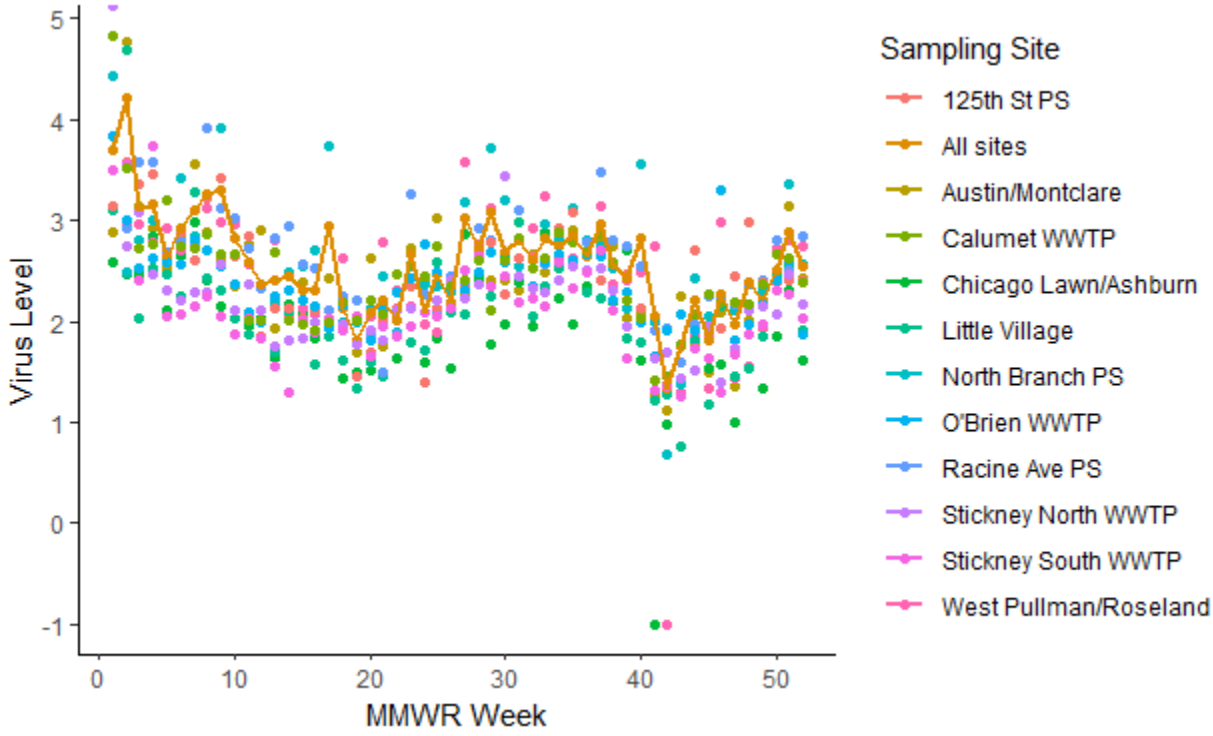
What did we find?

SARS-CoV-2

Wastewater data suggested that SARS-CoV-2 was prevalent throughout the city in 2024; the virus was **regularly detected in all of Chicago's monitored sewersheds**. Generally, across all sites, wastewater concentration of SARS-CoV-2 was highest in early January 2024, followed by a decline into the spring. There were two subsequent waves of increasing concentration values, once in late-August and then a more consistent increase in November through December (Figure 3).

Broadly, the **trajectory of SARS-CoV-2 concentrations was similar across all Community Area sewersheds**; data did not suggest that any one site was associated with notably different concentration level trends over time.

FIGURE 3: Weekly average concentrations of SARS-CoV-2 detected across Chicago wastewater sewersheds



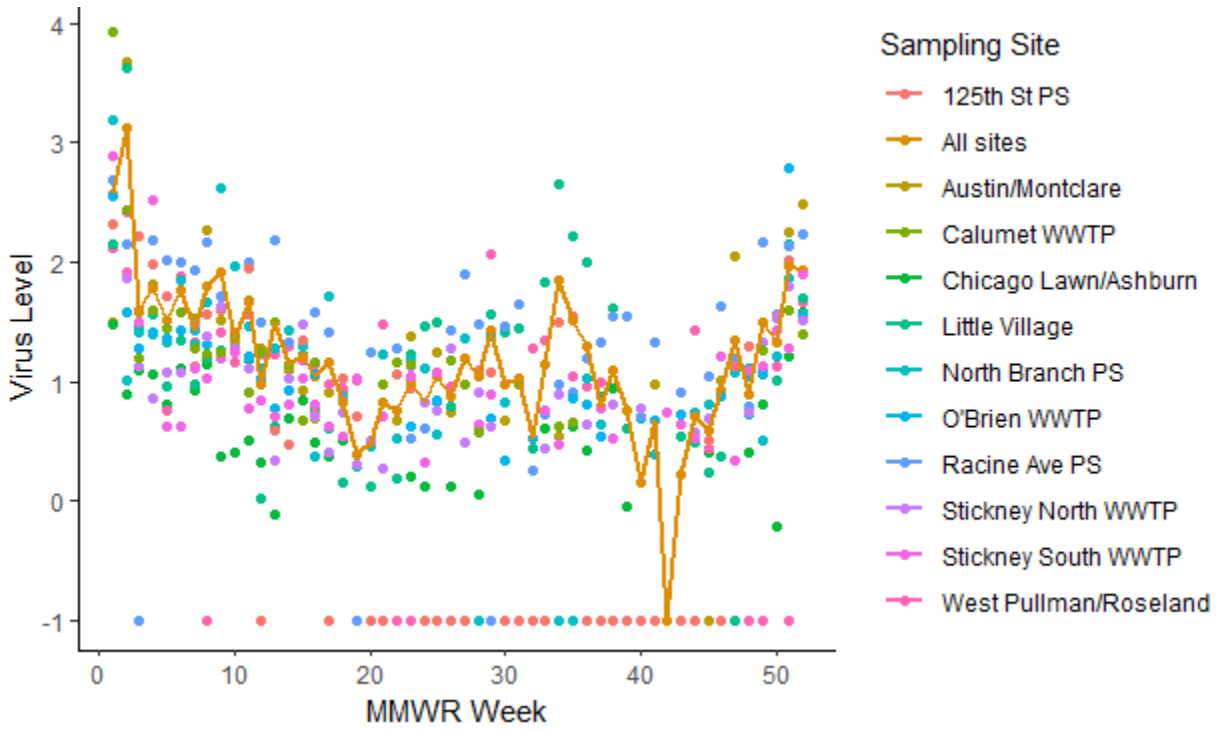
In the above figure, concentrations of the virus are presented on a scatterplot as the weekly average of normalized concentrations detected that week at each site (population-normalized viral gene copies per liter). For ease of viewing, these values are multiplied by 1 million and presented on the log10 scale (i.e., "Virus Level"). A citywide average (i.e., "all sewersheds") is overlaid as an orange line, which reflects the average normalized concentration of all sites across each week. A value of –1 is used as a placeholder on the plot for weeks where no virus was detected.

Influenza (Flu)

Only results for Influenza A (IAV) are noted below as this is the type of influenza that causes the majority of illnesses during the influenza season and is most often detected in Chicago's wastewater.

IAV detection was high during the first two weeks of January 2024 compared to the rest of the year, with Very High Viral Activity levels in more than 25% of samples. After that, influenza detections decreased going into the summer months (Figure 4). This period constituted the back half of the 2023-2024 respiratory season. The 2024-2025 respiratory season began on September 29, 2024. In November 2024, levels started to rise again.

FIGURE 4: Weekly average concentrations of influenza A virus detected across Chicago wastewater sewersheds



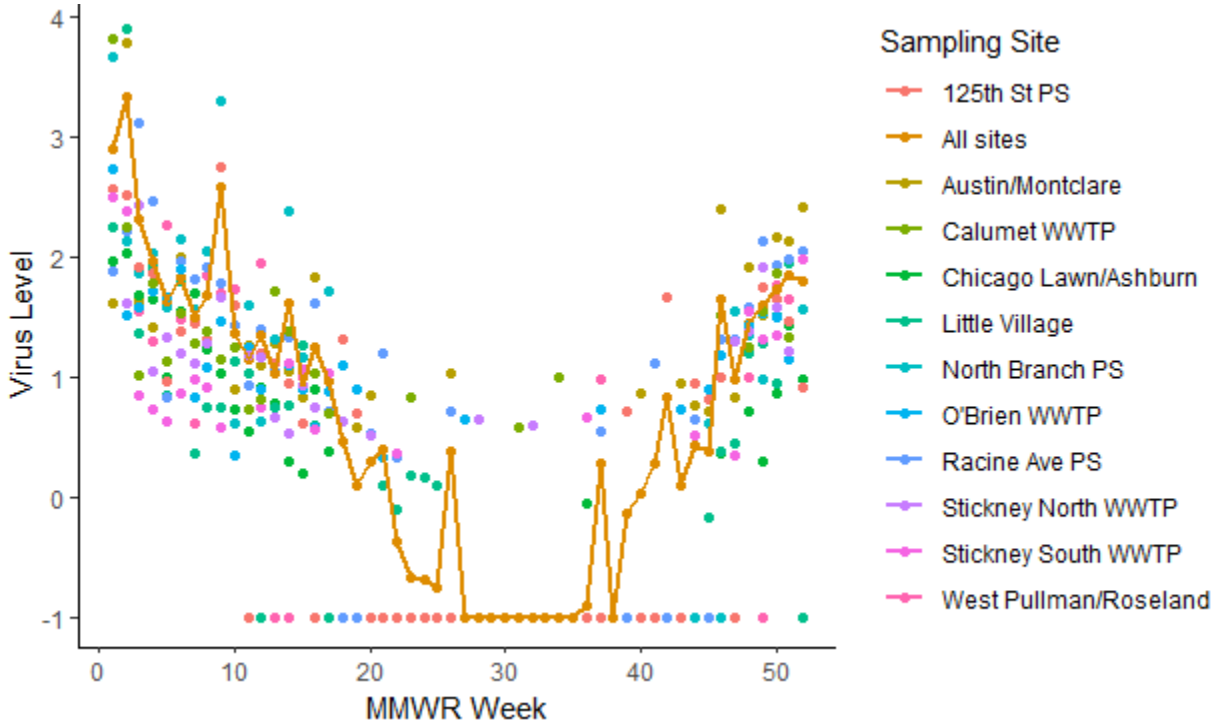
In the above figure, concentrations of the virus are presented on a scatterplot as the weekly average of normalized concentrations detected that week at each site (population-normalized viral gene copies per liter). For ease of viewing, these values are multiplied by 1 million and presented on the log10 scale (i.e., "Virus Level"). A citywide average (i.e., "all sewersheds") is overlaid as an orange line, which reflects the average normalized concentration of all sites across each week. A value of –1 is used as a placeholder on the plot for weeks where no virus was detected.

RSV

From January 2024 through late June 2024, RSV levels steadily decreased in weekly wastewater samples. Through July and August RSV was mostly undetected in wastewater samples (Figure 5). This period constituted the back half of the 2023-2024 respiratory season. The 2024-2025 respiratory season began on September 29, 2024.

In late-September 2024, concentrations of RSV in Chicago sewersheds began to rise through the end of the year. This preceded a subsequent rise in RSV clinical cases and RSV positive laboratory test results (starting in early November 2024), both of which were more reflective of the typical RSV season timing in pre-pandemic respiratory seasons (e.g., 2019-2020).

FIGURE 5: Weekly average concentrations of influenza A virus detected across Chicago wastewater sewersheds



In the above figure, concentrations of the virus are presented on a scatterplot as the weekly average of normalized concentrations detected that week at each site (population-normalized viral gene copies per liter). For ease of viewing, these values are multiplied by 1 million and presented on the log10 scale (i.e., "Virus Level"). A citywide average (i.e., "all sewersheds") is overlaid as an orange line, which reflects the average normalized concentration of all sites across each week. A value of –1 is used as a placeholder on the plot for weeks where no virus was detected.

How was this information used?

Data visualizations were used in reports for respiratory season planning and protocol at CDPH. At the beginning of the 2024-2025 respiratory season, as influenza and RSV levels in wastewater began to increase, this information was **shared throughout the Disease Control Bureau and Immunization Bureau to support the preparations for influenza activity**. Data and plots were incorporated into the public CDPH respiratory illness dashboard. Data was also shared with the CDC's NWSS to support national wastewater reporting

Mpox virus (MPXV)

Why did CDPH monitor wastewater for this virus?

MPXV caused a global outbreak in 2022 after previously causing only rare instances of human-to-human transmission. While cases in 2024 were much lower than were recorded in 2022, MPXV continued to cause sporadic outbreak events in Chicago and therefore remained of interest to public health.

Wastewater monitoring will continue to track the mpox clade II virus, the clade responsible for the 2022 mpox outbreak. There have been cases or outbreaks of clade I mpox in several countries in Central and East Africa, Europe, Asia and first appeared in the US in California in November 2024. No cases of clade I mpox have been identified to date in Illinois. Beginning February 3rd, 2025, mpox clade I virus testing started at the following sites: North Branch, Racine Avenue, and 125th Street pumping stations, four community sites: Austin/Montclare, Little Village, Chicago Lawn, Roseland/West Pullman, and one facility O'Hare Internal Airport. We will maintain flexibility and capacity to onboard new sites for mpox clade I should the need arise.

What did we find?

2024 MPXV levels stayed relatively low throughout the year. Each week, the proportion of sites with detectable MPXV was never more than 50%, suggesting that the prevalence of mpox illness in Chicago is sporadic rather than widespread. The highest levels were seen in February 2024 (weeks 5-8 on plot below); no MPXV was detected in Chicago sewersheds sampled from October through December.

How was this information used?

An internal dashboard was created for CDPH stakeholders from the Disease Control and Syndemics Bureaus to have real-time access to WS data. This information was used to monitor disease activity in the City of Chicago. This work also allowed CDPH to apply for and receive special CDC-funding to initiate clade-specific wastewater surveillance in January 2025. In 2025, this work will be incorporated into SENTRII to provide a comprehensive mpox surveillance dashboard including wastewater, genomic and case-based surveillance.

The 2024 Democratic National Convention (DNC)

Why did CDPH monitor wastewater for this event?

The City of Chicago hosted the 2024 Democratic National Convention (DNC) in August 2024. CDPH was responsible for developing an enhanced public health surveillance plan for the event as part of a comprehensive strategy to ensure rapid detection and assessment of potential public health threats. CDPH was asked to contribute surveillance data from the existing WS program. Prior to the event, CDPH expanded the WS program by expanding to two new sampling sitesto capture effluent wastewater from key DNC locations including McCormick Place and the United Center. Additionally, we worked with laboratory partners to expand surveillance capability to three additional gastrointestinal pathogens (norovirus, *Salmonella* species bacteria, and Shiga-toxin producing *E. coli*), which are of particular concern at mass gatherings.

What did we find?

Overall, CDPH did not detect any signals pointing to an outbreak of concern for any of the pathogens assessed. Daily pathogen concentrations during the event broadly mirrored the baseline concentrations collected prior to the event.

How was this information used?

Epidemiologists in the Surveillance Branch of the Public Health Emergency Operations Center (PHEOC) at CDPH monitored daily results. Results and trends were analyzed and reported to local, state, and federal agencies. WS data was reviewed and analyzed alongside other pre-defined public health surveillance metrics, including emergency department patient visits, citywide ambulance runs, public restaurant complaints called into city operators, and visits to medial aid stations within DNC venues.

Acknowledgements

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