

Chicago Department of Public Health Wastewater Monitoring Annual Report 2023

What is wastewater monitoring?

The Chicago Department of Public Health (CDPH), in collaboration with [Discovery Partners Institute \(DPI\)](#) at 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 can be used to track diseases because the responsible viruses or bacteria are often found in the feces of infected individuals. You can click [here](#) 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. All wastewater data is also submitted to the US Centers for Disease Control and Prevention as part of the [National Wastewater Surveillance System \(NWSS\)](#).

The following report summarizes wastewater monitoring activity during the 2023 calendar year.

Where was wastewater collected?

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:

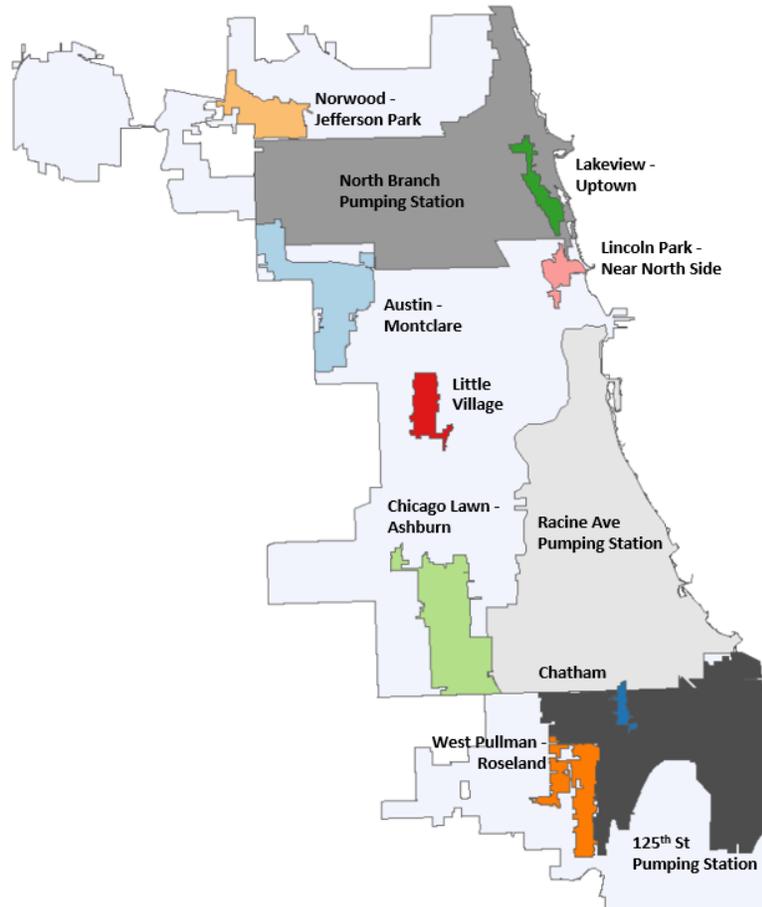
- Four **Wastewater Treatment Plants (WWTP)**, which, combined, captured all of Chicago's wastewater and parts of the surrounding suburbs of Cook County. Each plant served > 1 million residents; sampling was collected in collaboration with the Illinois Department of Public Health. (WWTPs are not reflected in Figure 1, which shows only Chicago-specific sewersheds).
- Three **Pumping Stations (PS)**, which served populations ranging from 126,000 to 721,000 residents. Wastewater monitoring from these sites began in May 2023 and was sampled directly at the pumping station facility.
- Eight **Community Areas (CA)** distributed across the 6 [Healthy Chicago Equity Zones](#), which represented populations ranging from 3,600 to 215,000 residents. Wastewater from these sewersheds was accessed via manholes.

Generally, two samples were collected from each site weekly.

How were wastewater samples analyzed?

After the samples were collected, laboratory partners at DPI tested each sample for the presence of certain bacteria or viruses. The laboratory then informed CDPH how much of each was present in the sample. These values were adjusted for population served (in other words, the laboratory accounts for the fact that a higher population can lead to a higher concentration value for a given bacteria or virus). Wastewater data files were securely transferred to CDPH servers and data was analyzed by CDPH epidemiologists.

FIGURE 1: Location of Chicago sewershed sites involved in wastewater monitoring during 2023, including 8 community areas (various colors) and 3 pumping stations (greyscale)

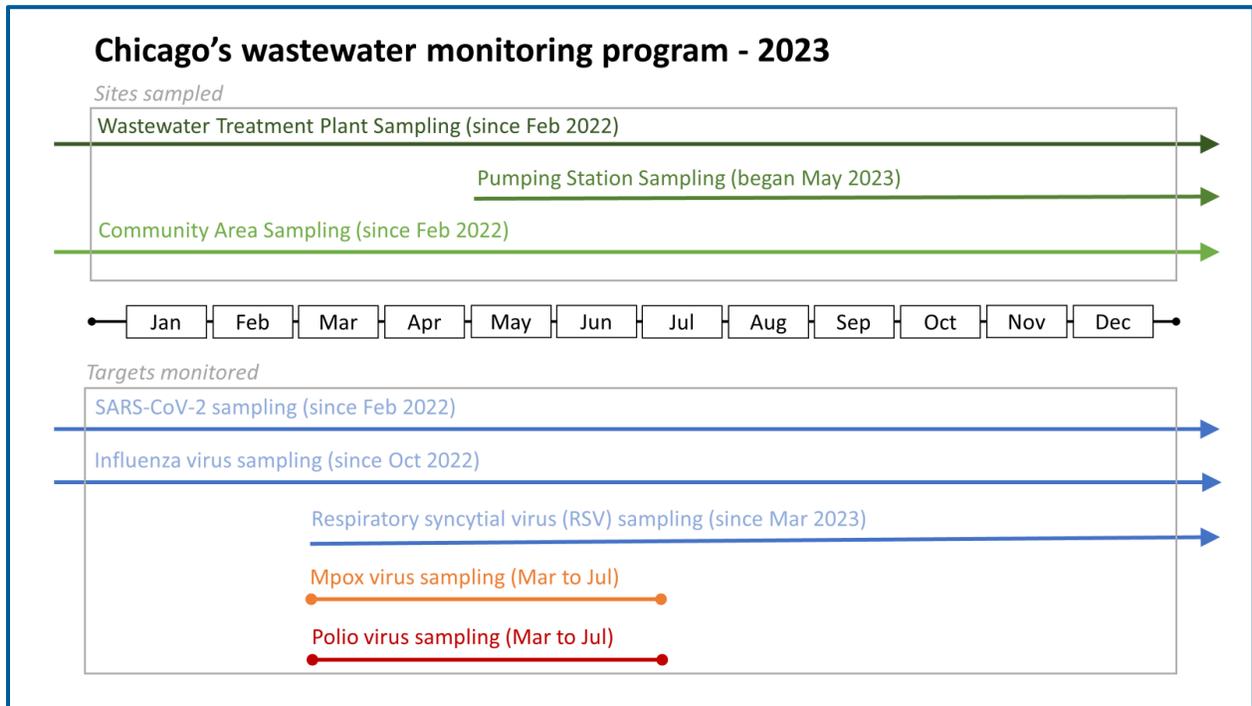


What did CDPH look for?

CDPH based its wastewater monitoring priorities on traditional disease “seasons” and emerging threats (Figure 2). During 2023, CDPH:

- Regularly tested wastewater for the “Big Three” respiratory viruses (influenza, SARS-CoV-2, and Respiratory Syncytial Virus, or RSV),
- Intermittently tested for mpox virus at certain sites, and
- Conducted a time-limited, three-month project to assess the utility of wastewater monitoring to track poliovirus.

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



How will CDPH sustain and grow the program in 2024?

In 2024, CDPH will continue to use wastewater monitoring to better track the Big Three respiratory viruses (influenza, RSV, and COVID-19). Wastewater monitoring will continue to intermittently track the mpox virus. We also plan to add the study of **multi-drug resistant organisms** (MDROs) to our program. We will maintain flexibility and capacity to add to this list should the need arise.

CDPH will also begin to reassess the current sampling strategy and cadence to ensure testing locations are optimized for the expanded testing. Equity will remain at the core of our work. To **ensure equitable representation of all Chicagoans**, sampling sites will remain in each of the six Healthy Chicago Equity Zones. Additionally, we are working towards improving data availability and communication through: (i) **enhanced public wastewater monitoring dashboards** and (ii) videos to better explain the methods and public health benefits of wastewater monitoring.

In the following sections, we briefly summarize the Chicago wastewater testing that occurred in 2023, specific to Chicago sewersheds (i.e., just community areas and pumping stations).

SARS-CoV-2

Why did CDPH monitor wastewater for this virus?

SARS-CoV-2, the virus that causes COVID-19, was the first virus to be monitored in Chicago wastewater (starting in February of 2022). [The disease continues to burden the health of Chicagoans](#), so CDPH continues to monitor wastewater for SARS-CoV-2 to understand where, and how fast, the disease is spreading.

A total of **1,018 wastewater samples** were tested for SARS-CoV-2 during the 2023 calendar year.

What did we find?

Wastewater data suggested that SARS-CoV-2 was prevalent throughout the city in 2023; the virus was [regularly detected in all of Chicago's monitored sewersheds](#).

In all but 1 week during 2023 (MMWR Week 27, 6/4 through 6/11/2023), SARS-CoV-2 was detectable across 100% of the eight Community Area sewersheds.

Generally, across all sites, wastewater concentration of SARS-CoV-2 was highest in January 2023, followed by a slow decline to the lowest recorded values in May. There were two subsequent waves of increasing concentration values, once in mid-August and then a higher wave (matching that of the January levels) in late-November, early-December.

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.

How was this information used?

Concentration values were converted to data visualizations, which were used in [situational updates for respiratory season planning and protocol](#) at CDPH. CDPH teams utilize the information to help hospitals and providers plan for increased visits, support community testing needs. Data was also shared with the CDC's National Wastewater Surveillance System (NWSS) to support national wastewater reporting

Influenza (Flu)

Why did CDPH monitor wastewater for this virus?

CDPH began testing wastewater for influenza A and B virus (IAV and IBV, respectively) in October 2022 and continued in 2023. At date of this report, the 2023-2024 influenza season is currently ongoing, though may have passed peak activity.

A total of **1,018 wastewater samples** were tested for AV and IBV during the 2023 calendar year. Only results for IAV are noted below as this is the type of influenza that [causes the vast majority of illnesses during the influenza season](#) and is the type most often detected in Chicago's wastewater.

What did we find?

IAV was detected in a high proportion of samples (on average, in more than 60% of weekly samples) during the first two weeks of January 2023. This timeframe corresponded to the end of the 2022/23 influenza season. After that, influenza detections occurred sporadically through the summer months until October 2023, when IAV was detected in two consecutive weeks in at least 50% of all weekly samples, after which wastewater concentration levels began to rise markedly. This is **suggestive of a possibly useful “threshold” in wastewater data which could determine the epidemic transition into an influenza season.**

How was this information used?

Data visualizations are used in reports for respiratory season planning and protocol at CDPH. In MMWR Week 46 (11/12 through 11/19/2023), all wastewater indicators (percent positivity, concentration trend lines, and relative intensity) suggested that the influenza “season” had begun. Information was **shared throughout CDPH to encourage the appropriate departments to begin preparing for increased influenza activity.** Subsequent wastewater data (and complementary clinical information) supported this real-time decision at Week 46, **supporting the utility of wastewater data to assist in decision making.**

Respiratory Syncytial Virus (RSV)

Why did CDPH monitor wastewater for this virus?

CDPH began sampling for RSV in March 2023. A total of **880 wastewater samples** were tested for RSV since March 7, 2023 during the 2023 calendar year.

What did we find?

From March 2023 through late August 2023, RSV was sporadically detected in weekly wastewater samples (in roughly 25% of samples collected, on average). In mid-October 2023, concentrations of RSV in Chicago sewersheds began to rise and appeared to peak about 2.5 months later in late-December. Once RSV activity began, there was no indication that any Community Area sewershed was associated with a different pattern of RSV wastewater signals compared to the other sewersheds.

How was this information used?

Data were converted to visualizations, which were used in situational updates for respiratory season planning and protocol at CDPH.

In MMWR Week 43 (starting 10/22 through 10/29/2023), wastewater percent positivity, concentration trend lines, and relative intensity indicators all suggested that RSV “season” had begun. Information was **shared throughout CDPH to encourage the appropriate departments to begin preparing for increased RSV activity.** Subsequent wastewater data (and complementary clinical information) supported this real-time decision at Week 43, **supporting the utility of wastewater data to assist in decision making.**

Mpox

Why did CDPH monitor wastewater for this virus?

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

During March 18–June 12, 2023, [an mpox cluster with 40 laboratory-confirmed cases occurred in Chicago](#) after several months during which only a single case had been reported. On May 18, 2023, CDPH began retrospective and prospective monitoring wastewater for mpox virus.

What did we find?

Weekly testing was conducted at all eight Community Areas and the three Pumping Station sites. Lab methodology was only able to detect the presence or absence of mpox virus rather than concentration data. [Over the course of 17 weeks](#) (March 5 through July 1, 2023), [mpox virus was detected in all but 1 week](#). A total of 7 Community Area sewersheds (88%) and all 3 Pumping Station sites were associated with detectable mpox at one point during the study period.

How was this information used?

[Wastewater data supports that mpox illness was likely more widespread than indicated by clinical reports alone](#) given the presence of positive wastewater detections throughout the city in sewersheds. This phenomenon possibly highlighted areas in which cases of a stigmatized disease were [under-reported, or under-detected across the city](#). In response, [CDPH expanded outreach efforts](#) to these specific sites via vaccination campaigns and provider education.

Poliovirus

Why did CDPH monitor wastewater for this virus?

On July 18, 2022, a confirmed case of paralytic poliomyelitis in Rockland County, NY was reported by the New York State Department of Public Health to the Centers for Disease Control and Prevention (CDC). Although no other clinical cases were identified, subsequent wastewater sampling in Rockland and neighboring counties, along with genomic testing of samples, supported a conclusion of community transmission.

Although the [majority of Chicagoans have been vaccinated against polio](#), as the third largest city in the country with an international travel hub through O'Hare airport, the Centers for Disease Control and Prevention and CDPH felt it was important to [utilize the established wastewater monitoring infrastructure to learn if poliovirus was in Chicago's wastewater](#). This work was done in collaboration with IDPH, Metropolitan Water Reclamation District, and the Regional Innovative Public Health Laboratory.

What did we find?

A total of 36 wastewater samples were collected over 17 weeks from the four WWTPs. [Zero samples tested positive for poliovirus](#).

How was this information used?

CDPH demonstrated Chicago could stand up poliovirus testing in response to an emergent outbreak. The ability to initiate this program **underscored our current capacity and the need for maintaining an ongoing wastewater monitoring infrastructure in the city** so that emergent public health threats can be quickly assessed.

This project was used as an **opportunity to plan for how CDPH would respond in the event of a positive detection**. A planning workgroup was formed and consisted of representatives from communications, vaccine preventable diseases, medical directors, epidemiology, testing/laboratory coordination, preparedness, and youth settings. Actions included drafting mock communications to providers and the public, verifying immunization coverage, developing plans for scaling up case and wastewater monitoring efforts and vaccination drives.

Acknowledgements

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Metropolitan Water Reclamation District for their coordination support of sample collection.

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