Frequently Asked Questions

General Wastewater Monitoring Information

1. What is wastewater monitoring?

Wastewater monitoring is the process of collecting and analyzing samples of wastewater (sewage and other water washed down the drain) to monitor infectious diseases within a given population. Samples are collected from wastewater treatment plants and represent a whole community. Wastewater monitoring is widely used for several diseases, including COVID-19 and influenza.

The North Carolina Wastewater Monitoring Network started measuring COVID-19 in 2021 and now regularly measures COVID-19, influenza A, influenza B, and RSV, as well as diseases during outbreaks, such as mpox and measles. While we have so far focused on monitoring diseases caused by viruses, wastewater monitoring can also be used for diseases caused by other agents, such as bacteria, fungi, or chemicals.

2. Is wastewater the same as tap water?

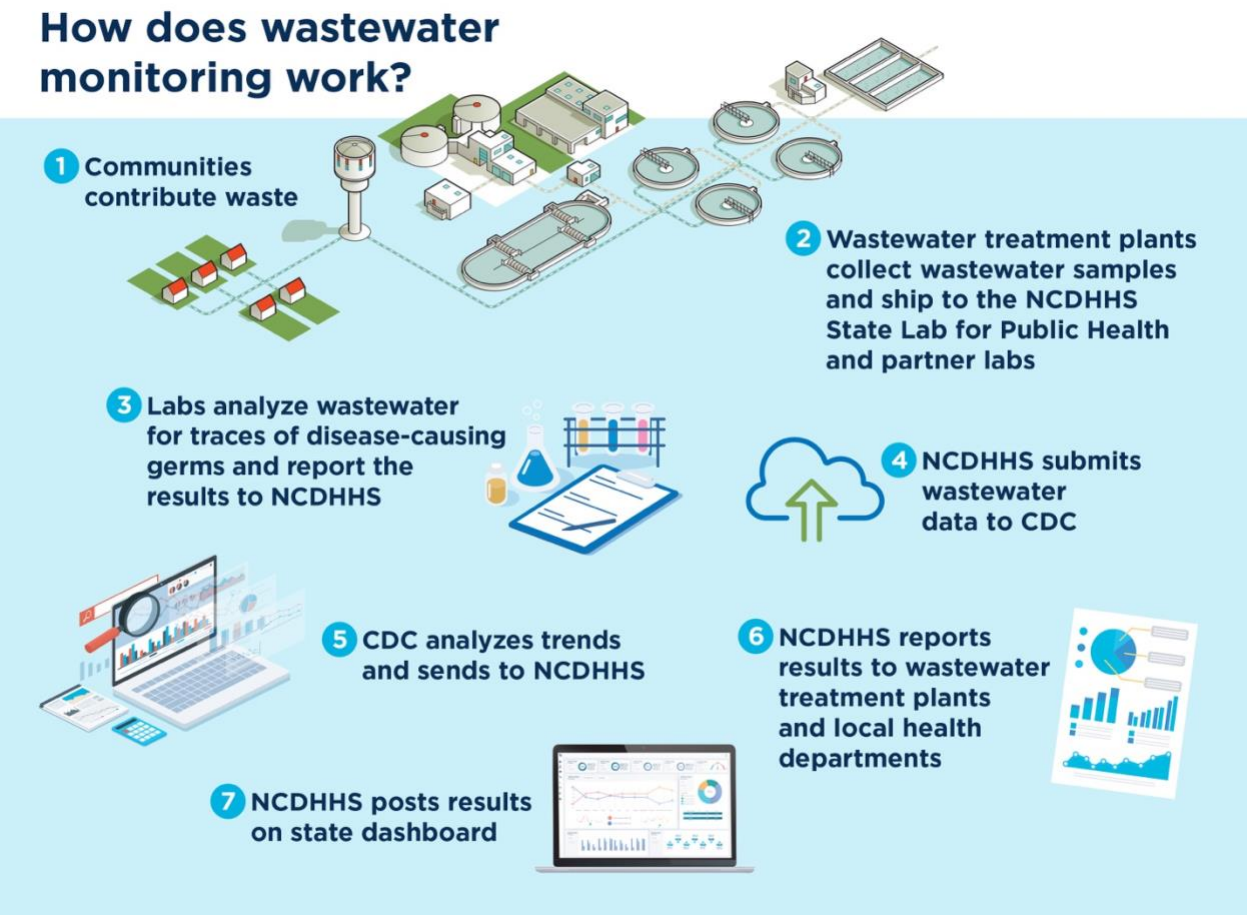
Wastewater is any water that gets washed down the drain. For example, this might be from sewage, sinks after washing hands or dishes, or runoff from rain. This water is separate from the water that comes *into* our homes for drinking or washing, which is called municipal water. In the U.S., municipal water must adhere to EPA standards to ensure it is safe and free of contaminants. Therefore, the pathogens we monitor for would not be found in municipal water.

3. How does wastewater monitoring work?

People infected with certain viral diseases can shed viral particles through their feces or other bodily fluids. Sometimes this shedding occurs before they experience symptoms or even in people who never show symptoms. These pieces of virus travel from the toilet, sink, or other drain through the sewage system.

Participating wastewater utilities collect untreated wastewater samples (24-hour mixture, or composite) twice per week to send to the laboratory. The laboratory analyzes the sample to determine the amount of the virus present. This quantification is based on the virus's genetic material that can be detected by a very sensitive test called polymerase chain reaction, or PCR. If we find sufficient genetic material from a type of virus that causes a disease, we know people contributing to the wastewater have that disease.

An illustration presenting the key steps of wastewater monitoring is on the following page.



4. How do public health officials and members of the public use wastewater monitoring data?

   Public health officials use wastewater monitoring data to inform public health interventions. Depending on the disease, this might include increasing communication about a disease and preventive measures, implementing screening at health care facilities, increasing testing availability through the State Laboratory of Public Health, expanding vaccination efforts, and working with health care providers to stem the spread of disease. Health care professionals can use the data to understand what infections are present in the community and guide decisions about testing and care of patients.

   Members of the public can use wastewater monitoring data to understand the risk to themselves or their family of being infected with a disease at a given time. This knowledge may inform their decisions about when to engage in or avoid certain activities, such as getting vaccinated or attending large gatherings.

5. What are the advantages of using wastewater monitoring to track disease?

   - *Provides a community-wide sample*. Measuring wastewater allows us to approximate infections at a given point in time and monitor trends across a whole community with one sample.

- *Includes symptomatic and asymptomatic cases*. Wastewater includes viral particles from infected people who are both symptomatic (feel sick) and asymptomatic (don't feel sick) even if they are not tested.
- *Cost effective*. This method of estimating disease in a community is more cost effective than conducting many individual tests, although both methods provide valuable, complementary information for understanding disease spread in communities.
- *Can serve as an early warning of increases in disease*. Some viral particles can appear in wastewater before clinical cases are identified. This information can help local communities intervene more quickly with strategies to slow disease spread.

6. What are the limitations of wastewater monitoring?

- *Only covers those who are part of participating sewage systems.* We can only collect information about the portion of the population whose sewage flows to wastewater treatment plants (approximately 60% of the population in North Carolina). Portions of the community served by on-site systems (e.g., septic) or by sewersheds that do not participate are not included in these wastewater samples.
- *There are many unanswered scientific questions.* Scientists are still working to understand how much of different viruses' RNA is shed in the feces by infected individuals and for how long. For example, scientists believe people shed SARS-CoV-2 viral particles for differing amounts of time, ranging from a few days to several weeks, and as many as half of people with COVID-19 don't shed measurable amounts of SARS-CoV-2 RNA in their feces.
- *Cannot currently account for human movement patterns.* For instance, an infected person may live outside a monitored area but work or vacation in one, causing elevated viral levels in wastewater in the work or vacation location and not in their home location. This presents challenges in comparing wastewater detections to clinical cases and directing public health interventions.
- *Cannot determine the source of a detection*. Some viruses can be found in animals or insects in addition to humans and the source of the detection cannot be determined through wastewater monitoring.

7. If we can detect diseases in wastewater, is there a risk of spreading disease through contact with feces or wastewater?

Given how our wastewater systems are designed, risk to the public is generally very low. Additionally, many respiratory pathogens, such as SARS-CoV-2 which causes COVID-19, cannot be transmitted through wastewater. However untreated wastewater can transmit some diseases, so staff collecting samples and conducting laboratory analysis must follow standard safety protocols, including the use of personal protective equipment and good hygiene practices.

8. If someone is vaccinated, can this be detected in wastewater?

Vaccines are generally not included in wastewater monitoring. Certain vaccines, such as the COVID-19 vaccine, do not contain any of the virus that causes the disease. For diseases such as measles, the vaccine contains a weakened version of the virus to build immunity without risk of

illness, and this weakened virus is shed in feces. In this case, we use methods that distinguish between the virus used in the vaccine and the virus causing disease.

NC Wastewater Monitoring Network

9. What is the history of the North Carolina Wastewater Monitoring Network (NCWMN)?

The NCWMN started measuring COVID-19 in wastewater in January 2021. This was part of a national effort coordinated by the CDC's National Wastewater Surveillance System (NWSS), which was launched in September 2020 to track COVID-19 in wastewater. In the summer of 2024, the NCWMN added influenza A, influenza B, and RSV as regularly monitored pathogens. NCWMN also temporarily monitors diseases during outbreaks, such as Hepatitis A, H5N1 avian influenza, mpox, and measles.

In August 2024, CDC NWSS designated North Carolina as a Center of Excellence. This means the NCWMN serves as a leader in wastewater surveillance implementation and coordination for the Southeastern Region. This includes fostering innovation, conducting trainings, and providing technical assistance to other jurisdictions.

10. Who partners with NCDHHS on the NC Wastewater Monitoring Network?

- Wastewater Treatment Plants
- Local Health Departments
- Research partners at the University of North Carolina Chapel Hill
- Centers for Disease Control and Prevention (CDC)
- WastewaterScan and Verily Life Sciences
- Past partners include:
    - Mathematica
    - North Carolina State University
    - East Carolina University
    - University of Wisconsin

11. Is my area participating in the NC Wastewater Monitoring Network?

You can see if your area is participating in wastewater monitoring by checking the map and dropdown menu titled "Select Wastewater Treatment Plant" on the NCDHHS Wastewater Monitoring Dashboard. Sampling sites were selected to include the monitoring of large, medium, and smaller cities across North Carolina.

Additional sites may be added depending on changing disease trends, geographic distribution, the availability/willingness of the town and utility to participate in the sampling effort, and to ensure representativeness of North Carolinians. Participation in the NC Wastewater Monitoring Network is voluntary, and a wastewater treatment plant's participation in the program may change over time.

12. Why do sites have data for different periods of time?

A wastewater treatment plant's participation in the program may change over time depending on their capacity to collect and send samples. If a site is no longer actively collecting data, the previously collected data will still be available from when the site was sampling. Additionally, as NCDHHS is building the network, new sites will begin sampling from the date of their entry.

13. Why are some sites labeled as "CDC contract"?

Samples from some sites are analyzed through a CDC contract laboratory, as opposed to the state laboratory or our academic partners. This is one way that CDC helps us increase sites in our testing network. Data from these sites may use different laboratory analysis methods. These sites, which came online beginning in May 2022, do not include sewershed boundaries, or service areas, on our map (indicated by gray areas).

Interpreting Wastewater Data

14. What are levels and trends?

Levels and trends are two metrics used to evaluate wastewater monitoring data. Levels reflect how much of a virus is present in wastewater at the current moment. Trends tell us how the amount of virus in wastewater is changing over time, i.e. if it's increasing, decreasing, or staying the same. Both metrics are valuable for informing public health decision-making. For example, an increasing trend may mean public health action is warranted, even if levels are low.

15. What do the percentages on the COVID-19 tab of the wastewater dashboard mean? Why are these not shown for influenza or RSV?

For levels, the percentages reflect the SARS-CoV-2 measurement relative to historic measurements collected at that site over the previous 12 months. For trends, the percentages reflect the change in concentrations over a 15-day period. These percentages are not shown for influenza or RSV because we haven't been monitoring them for as long as COVID-19 and therefore don't have enough historical data to produce reliable percentages.

16. What do the "Viral Gene Copies per Person (millions)" units mean in the wastewater dashboard figures and why do you use that as your measurement?

The way we quantify the amount of virus in wastewater is based on the concentration of its genetic material, which is related to the number of viral particles in the wastewater. That's why we show "viral gene copies".

We also must account for several factors when we measure virus in wastewater:

- *Wastewater flow*. The flow of wastewater received at a treatment plant changes based on water usage, the age of the system and external factors like precipitation. To account for these changes, the number of gene copies detected per liter measured at each sampling location is multiplied by the total flow measured at the plant on the sampling day.

- *Population*. Different wastewater treatment plants serve different population sizes. The population variations are partially accounted for by dividing the viral load on each sample day by the estimated population served in the sewershed.

Calculating the number of "viral gene copies per person (millions)" accounts for these factors using the formula (ww concentration * flow rate) / (population served), which gives us a measure that can be more accurately tracked over time within each sewershed.

We are not able to directly compare viral gene copy numbers between sites because of additional factors, such as differences in the ways the samples are analyzed by different laboratories, and/or differences in wastewater treatment plant inputs including large inflows of wastewater from industrial sources or large commuter populations. However, reviewing the trend in a specific community can be used to help understand whether cases or hospitalizations are likely to increase, as well as to help confirm declining trends in infections.

17. What is the "wastewater viral activity level" unit used on the respiratory virus summary dashboard and why is a different measure used than the wastewater dashboard?

Unlike "viral gene copies per person (millions)," the "wastewater viral activity level" (WVAL) allows wastewater data to be aggregated across sites to observe trends at state/territorial, regional, or national levels. The WVAL can also be classified as very low, low, moderate, high, or very high using thresholds determined by the CDC.

WVAL is calculated as the number of standard deviations above the baseline, transformed to the linear scale. More details on how the WVAL is calculated can be found here: https://www.cdc.gov/nwss/about-data.html#data-method.

While the WVAL allows wastewater data to be aggregated across sites, it is a less easily interpretable unit than the "viral gene copies per person (millions)." This is why we use "viral gene copies per person (millions)" on the wastewater dashboard, where data is presented by site, and the WVAL on the respiratory virus summary dashboard, where data is presented for the whole state.