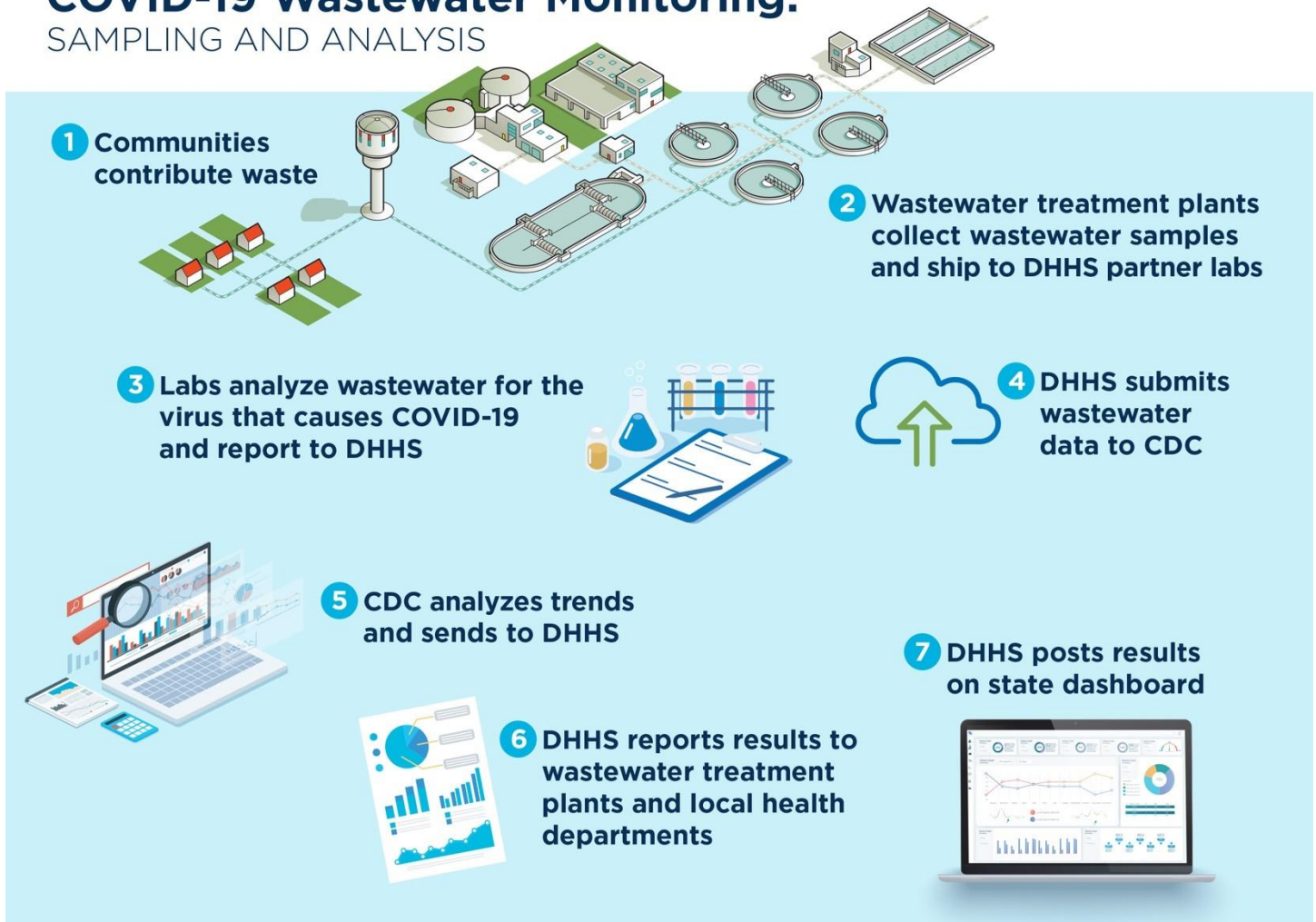


Frequently Asked Questions

COVID-19 Wastewater Monitoring: SAMPLING AND ANALYSIS



1. Why are you measuring the COVID-19 virus in wastewater?

Many individuals infected with COVID-19 shed viral particles in their stool. These viral particles are pieces of the SARS-CoV-2 virus, which causes COVID-19 when still intact. In wastewater, the particles are no longer infectious but can still be measured. Testing wastewater for these viral particles allows us to track COVID-19 trends among people contributing to the wastewater.

2. What are the benefits of wastewater testing for COVID-19?

- **Provides a community-wide sample.** Measuring wastewater for parts of the virus that causes COVID-19 allows us to approximate COVID-19 infection across a whole community with one sample. When we repeat these samples over time, we can see trends similar to what we've observed with case data.
- **Includes symptomatic and asymptomatic cases.** Wastewater includes viral particles from infected people who are both symptomatic (have symptoms) and asymptomatic (don't have symptoms) even if they are not tested.
- **Cost effective.** This method of estimating COVID-19 in a community is more cost effective than conducting community-wide COVID-19 tests, although both methods provide valuable information for understanding COVID-19 in communities.

3. How do you measure COVID-19 trends using particles of the SARS-CoV-2 virus?

SARS-CoV-2 is the virus which causes COVID-19. RNA is genetic material (similar to DNA) which is carried inside each virus. The viral RNA can be detected by a very sensitive test called polymerase chain reaction, or PCR. PCR makes copies of genes so even very small amounts can be detected. If we find sufficient RNA material from the virus that causes COVID-19, we know people contributing to the wastewater have COVID-19. NCDHHS is partnering with multiple laboratories to conduct these analyses, including University of North Carolina System researchers

4. Why are we reporting COVID-19 cases occurring in the sewershed?

A sewershed is the area from which wastewater flows through a network of pipes to a treatment plant. The COVID-19 cases included in the dashboard are cases reported to public health in people who live within the gray sewershed boundary on the map. The data from wastewater testing are meant to supplement existing COVID-19 metrics. Comparing trends for the rate of reported cases within the sewershed to trends in wastewater helps us better understand the amount of disease in a community.

5. Is my city participating in the NC Wastewater Monitoring Network?

We are currently sampling wastewater from 36 sewersheds in North Carolina. Sampling sites were selected to include the monitoring of large, medium, and smaller cities across our state. Additional sites will be added depending on COVID-19 data trends, a North Carolina social vulnerability index, geographic distribution, and the availability/willingness of the town and utility to participate in the sampling effort. Participation in the NC Wastewater Monitoring Network is voluntary, and a wastewater treatment plant's participation in the program may change over time.

6. Why are there different sampling durations for some of the sewersheds?

If a site is no longer actively collecting data, the previously collected data will still be available for the timespan when the site was sampling. Additionally, as NCDHHS is building the network, new sites may begin sampling on different dates.

7. How is wastewater data being used to support the COVID-19 response?

Measuring COVID-19 in wastewater provides another way to track trends in COVID-19 in communities. By measuring the levels of RNA from the virus that causes COVID-19, we may be able to detect increases in the number of people sick with COVID-19 sooner than by clinical testing alone. Measurements of wastewater RNA could serve as an early warning system for increases in COVID-19 in our communities or show the virus is not present at detectable levels.

8. What can local public health officials do if wastewater surveillance shows an increase in COVID-19?

- **Notify.** NCDHHS immediately notifies the local health department and the designated utility representative for the impacted community.
- **Determine actions.** State and local public health officials review the data along with other COVID-19 metrics to determine the need for action, including:
 - Mobilize additional pop-up testing resources in the affected community.
 - Increase public health communication and outreach about how individuals can protect themselves from COVID-19 (social distancing and masking for people who are not fully vaccinated, handwashing, avoiding crowds and enclosed spaces, encouraging vaccination).
 - Alert hospitals, clinics and local physicians that an increase in the virus that causes COVID-19 has been observed, which could indicate an increase in cases.
 - Provide recommendations to community leaders or take direct actions on implementation of additional restrictions (i.e. reducing capacity of businesses, limiting indoor gatherings, etc.).
 - Take steps to increase access to COVID-19 vaccines.
- **Continue monitoring.** State and local health officials continue to monitor trends in wastewater surveillance to assess the magnitude, duration and public health implications of the increasing trend.

9. What do the “Viral Gene Copies per Person (millions)” units mean in the figure and why do you use that as your measurement?

SARS-CoV-2 is the virus which causes COVID-19. The test used to measure viral particles, called PCR, makes copies of genes so even very small amounts can be detected. That’s why we measure SARS-CoV-2 gene copies. We also have to account for several factors when we measure COVID-19 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, which gives us a measure that can be more accurately tracked over time within each sewershed. Prior to 3/24/2022, “Viral Gene Copies per Person (millions)” were calculated utilizing median recovery efficiency, which is a value that describes how well SARS-CoV-2 virus can be extracted from the wastewater sample at each wastewater utility. The formula has been simplified per recommendation from CDC to $(ww \text{ concentration} * \text{flow rate}) / (\text{population served})$ and the wastewater measurements have been adjusted retrospectively.

10. Why are some sites presented differently than others?

Data for eleven sites use different laboratory analysis methods. This produces different absolute virus concentrations that cannot be averaged. These sites are therefore not included in the statewide weekly average viral concentration. These eleven sites, which came online beginning in May 2022, do not include sewershed boundaries (gray areas on the map) or COVID-19 cases in the sewershed. These sites are being analyzed through a CDC contract laboratory.

11. Which site’s wastewater results are included in the statewide weekly average concentration calculation published on the NCDHHS COVID-19 summary page?

Wastewater viral levels from twenty-five wastewater sampling sites are included in the statewide weekly average calculation. These sites are being analyzed by labs using similar methods. Different laboratory methods can result in different concentrations in wastewater that cannot be averaged. The eleven sites added to the dashboard in August 2022 are not part of the statewide weekly average concentration due to differences in laboratory methods, which produce different absolute virus concentrations that cannot be averaged.

12. Can you compare values across communities?

We aren't able to directly compare viral gene copy numbers between communities because of additional factors, but 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.

13. If there is SARS-CoV-2 RNA in wastewater, is there a risk of spreading COVID-19 through contact with feces or wastewater?

There is little evidence that shows people can get COVID-19 from exposure to wastewater or feces. However, good hygiene practices, including frequent hand washing, may reduce a person's risk of developing COVID-19 and are important for controlling the spread of many other diseases.

14. What are the limitations of wastewater monitoring?

First, by measuring viral RNA levels at in wastewater samples, we can only collect information about the portion of the population whose sewage flows to that wastewater treatment plant. Portions of the community served by on-site systems (e.g., septic) are not included in the wastewater samples. Approximately 40% of the population in North Carolina, especially in rural areas, uses septic systems to dispose of their wastewater.

Second, scientists are still working to understand how much SARS-CoV-2 RNA is shed in the feces by infected individuals and for how long. Scientists believe people shed 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.

Third, the testing results may not adequately reflect human movement patterns which may skew the wastewater data. For example, an infected person may commute from their home where there is no wastewater monitoring, to their work, which is in an area where the utility is monitoring the wastewater. The wastewater data may show that there are high levels COVID-19 virus in the wastewater but few cases of COVID-19 in that area. Another example occurs when infected people travel for vacation to a town which is monitoring their wastewater. The town may see a short spike in COVID-19 viral RNA in their wastewater that decreases as visitors leave the area.

15. What are some potential long-term benefits of wastewater surveillance?

- Understanding and predicting the number of COVID-19 infections in communities by comparing wastewater data with other COVID-19 metrics, such as rates or percent positivity.
- Better understanding of factors affecting disease spread.
- Measuring the effectiveness of different interventions like quarantines, face coverings and limits on gatherings.
- Identifying other pathogens like influenza or antibiotic-resistant bacteria in the wastewater.

16. Can you detect the COVID-19 vaccines in wastewater samples?

No. Wastewater monitoring detects SARS-CoV-2, the virus that causes COVID-19. COVID-19 vaccines do not contain SARS-CoV-2.

17. What partners are part of the NC Wastewater Monitoring Network?

- Wastewater Treatment Plant staff
- Local Health Departments
- Research partners at:
 - University of North Carolina System
 - North Carolina State University
 - East Carolina University
 - University of Wisconsin Milwaukee
- Mathematica
- Centers for Disease Control and Prevention (CDC)