Pace

MONITORING WASTEWATER FOR SARS-COV-2 AND ITS VARIANTS



Why Monitor Wastewater for COVID-19?

For decades, wastewater testing has been used to track indicators of community health.

Pace[®] now offers wastewater testing services to help monitor the spread of COVID-19 in communities, businesses, and congregate living facilities.



DATA - AND SERVICES - THAT DELIVER.

SARS-CoV-2, the virus that causes COVID-19, is a single-stranded RNA virus and part of a group of viruses referred to as coronaviruses. Infected individuals, even those who are asymptomatic, shed RNA fragments from the virus in their waste. Analyzing wastewater samples for these viral fragments can help officials monitor infection rate trends and identify the variants present in a community.

In 2020, Pace[®] surveyed community health officials who had an active wastewater monitoring program. Those respondents that were correlating levels of RNA fragments to the number of diagnosed cases reported seeing as much as a two-week advanced notice of an increase in diagnosed cases. They used this time to prepare for the increased demand for healthcare services and to make more informed decisions about how to control the spread of COVID-19.

As voluntary individual testing wanes in communities across the country, wastewater monitoring is even more vital. Because wastewater monitoring doesn't require the individual to do anything other than go about their daily routine, it helps to fill in some of the knowledge gaps left by COVID-weary communities. Additional tests to determine which variants are present in a sample can also help community and health officials further understand the transmissibility and threat from these new variants and make data-driven decisions about how to respond.

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The Wastewater Advantage



COVID-19 wastewater monitoring isn't intended to replace individual testing, especially for people showing signs of the disease. That's because wastewater testing monitors the level of infection in a community, not in specific individuals. That said, there are several advantages to wastewater monitoring that make it a perfect complement to individual testing programs.

Less Intrusive

The most common forms of testing, nasal and throat swabs, are not painful, but many people find them uncomfortable. Plus, individual tests require people to go out of their way to get tested. Wastewater testing doesn't require people to do anything except go about their daily routine. In fact, the average person remains unaware that wastewater monitoring is already being conducted in communities across the country.

Protects Individual Privacy

Where there has been pushback against wastewater monitoring, it's often from activist groups objecting to it based on an individual's right to privacy. This has been one of the primary concerns around individual tests as well. Communities have worked hard to ensure they don't run afoul of privacy laws like HIPAA and FERPA. Wastewater testing preserves privacy because tests can't be traced back to a specific individual.

Accounts for Asymptomatic Cases

Unless their employer requires them to be tested regularly, asymptomatic people tend not to know they are infected. But even people who aren't showing signs of being sick shed fragments of SARS-CoV-2 in their stool. Wastewater testing will catch a rise in both symptomatic and asymptomatic cases of COVID-19 infection, allowing officials to better assess community infection rates and the severity and transmissibility of the dominant strains.

Cost Effective

Wastewater testing can be used to monitor results from thousands of people, making it one of the most cost-effectives ways to monitor community health. The results can also be used to make more informed budget decisions. For example, steady or dropping levels can help entities avoid the expense of expanding an individual testing program.



Who Can Benefit?

A COVID-19 wastewater monitoring program can be implemented anywhere an isolated stream of wastewater is available. Since the program began, Pace has helped many different types of organizations monitor the threat from SARS-CoV-2 and its variants.

County and State Health Officials

Whether relaxing or tightening restrictions, county and state health officials take a lot of heat for the decisions they make. COVID-19 wastewater monitoring can help them make more defensible, data-driven decisions to help control the spread.

Municipalities

An estimated 80% of wastewater in the U.S. runs through municipal wastewater systems. Wastewater monitoring allows city officials to identify a rise in cases down to specific areas of the city so they can take appropriate mitigation measures.

Congregate Living Facilities

We've all seen how quickly COVID-19 can burn through communal living facilities like nursing homes, long-term care facilities, and prisons. Wastewater testing and monitoring can help identify an increase in infections before it gets out of hand.

Universities and Colleges

Testing individual students is time-consuming, expensive, and requires more cooperation than some are willing to give. Schools across the country are already using wastewater monitoring of dorms and other building to better assess infection rates on campus.

Businesses

Business leaders need to keep their employees safe and productive. Wastewater monitoring is an unintrusive method of monitoring COVID-19 infection levels in a facility without the time and lost productivity associated with individual testing.

"University campuses especially benefit from wastewater surveillance as a means to avert COVID-19 outbreaks, as they're full of largely asymptomatic populations, and are potential hot spots for transmission that necessitate frequent diagnostic testing."

Smruthi Karthikeyan, Ph. D., UC San Diego School of Medicine Forbes, Aug 16, 2021



Wastewater Test Methods for SARS-CoV-2 and Its Variants

Pace[®] uses Real Time, quantitative Polymerase Chain Reaction (RT-qPCR) to test wastewater samples for SARS-CoV-2. The qPCR test detects RNA, the genetic signature of SARS-CoV-2, in wastewater. The cycle threshold (CT) values obtained are used to quantify the copies of RNA from all strains of SARS-CoV-2 present in the samples. The results are reported as copies of viral RNA/mL.

When implementing a COVID-19 wastewater monitoring program, it's important to understand that every community is likely to have SARS-CoV-2 viral fragments in its wastewater. For this reason, a pass/fail test that only detects the presence of the virus doesn't provide much useful information. Only by measuring the level of fragments over time can you better assess and predict the impact of COVID-19 on a community.

"There will be evidence of SARS-CoV-2 in wastewater every time you test. That's why it's so vital to get time-phased, quantitative data. Pass/fail testing doesn't tell you much of anything."

Johnny Mitchell Chief Technical Officer, Pace Analytical National Center for Testing & Innovation

Like most living organisms, viruses mutate as they spread and multiply. Some of these mutations result in variants that are more transmissible, have more significant health effects, or make the virus less susceptible to antibodies. As of July November 2021, the World Health Organization had named six variants of the SARS-CoV-2 virus a concern to human health: Alpha, Beta, Gamma, Delta, Epsilon, Lambda, and Omicron. It's highly likely that more variants will be identified in the weeks and months ahead as SARS-CoV-2 continues to mutate

The RT-qPCR test method measures the TOTAL viral fragments from all strains of the SARS-CoV-2 virus present in a sample. Pace® offers additional testing services to identify which of the primary variants contribute to the total. This additional information can help prepare communities and health officials for potential spikes and changes in the severity of COVID-19 infections within a population.

Wastewater Sampling Guidance

There are no prescribed methods for collecting wastewater samples for COVID-19 testing. However, there are a few elements to consider.

Sample Types

There are two ways to collect wastewater samples for testing. Both are scientifically valid, but the insights each provides is different. You will want to deploy the method most suited to the goals of your monitoring program.

Grab Sample – Grab samples are the simplest type of sample and a commonly used method. In this method, the sample container is dipped into the raw wastewater flow to collect the sample. Grab samples require less specialized equipment and are useful when monitoring infection rates in a relatively stable population, e.g., a university residence hall or a neighborhood.

Composite Sample – Composite samples are collected by utilizing an automatic sampling device (ISCO, Sigma, etc.) to collect a sample representing a specified period (usually 24 hours) or one that is proportional to the flow. Once the composite sample is pulled, the sampler pours a portion from the large, refrigerated fill jar into the sampling container. Composite sampling equipment can be rented or purchased separately from vendors like Field Environmental Instruments or Pine Environmental.

Composite samples are more helpful than grab samples when the flow is volatile. For example, if you are looking to monitor viral levels at a vacation resort, a composite sample that is proportional to the flow may give you a more accurate picture than a simple grab sample. Likewise, a sample that covers a 24-hour period may be more helpful than a grab sample for high-traffic areas like a shopping mall.





Wastewater Sampling Guidance

Sampling Specifications

Based on our extensive experience sampling wastewater for emerging and regulated contaminants, Pace Analytical[®] recommends the following specifications:

Container: 250ml HDPE Preservation: No chemical preservative. Cool to 6°C Method: qPCR (quantitative) Units: RNA Cop/ml (RNA copies per milliliter) Calibration Range: As low as 2.6 copies/mL

PACE® IS HERE TO HELP

Pace[®] can also provide sample kits for clients. Once collected, samples should immediately be placed back inside the liner bag within the sample cooler. The liner bag is then filled with wet ice around the sample bottle and tied off. Finally, the cooler lid should be closed and taped around the junction between the cooler lid and the cooler. The cooler should then be shipped via overnight carrier to:

Sample Receiving

Pace® National Center for Testing & Innovation 12065 Lebanon Rd. Mt. Juliet, TN 37122 (800) 767-5859

Many factors can influence the type of sampling method you use and how you implement it. Our team of specialists would be happy to discuss your project objectives and recommend sampling methods, parameters, and protocols that will deliver the data you need.





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