

Updated 8/31/21 for fall 2021

What is wastewater testing?

Wastewater testing is a method of sampling untreated sewage and testing for the presence of infectious disease. Samples of wastewater are periodically collected from the sewer system before reaching a treatment facility. This public health measure has a proven record in tracking community shedding of viruses such as polio, hepatitis A and norovirus. The use of wastewater testing to measure community health has been successfully applied locally and internationally for detecting SARS-CoV-2, the virus that causes COVID-19.

Why test wastewater for SARS-CoV-2?

Recent research indicates that concentrations of SARS-CoV-2 virus fragments found in wastewater tend to increase before individuals in the community show signs or symptoms of COVID-19. This can help to provide an early warning of an increase in the number of infected people within a specific community, including those who are infected but don't develop symptoms. Wastewater monitoring works because infected people may start shedding virus in their stool a few days before they show any symptoms of disease, or even if they never show symptoms.

Wastewater testing complements other testing methods, such as individual testing. It allows for regular surveillance of a large portion of the population, yet can sometimes be sensitive enough to detect just a few cases. When wastewater testing is conducted frequently and results are analyzed alongside current data on known cases, it can help identify changing prevalence and inform response efforts.

Wastewater testing is increasingly being used to understand the spread of COVID-19 in specific communities. The Centers for Disease Control and Prevention (CDC) and the US Department of Health and Human Services (HHS), in collaboration with agencies throughout the federal government, initiated a National Wastewater Surveillance System in response to the COVID-19 pandemic.

[More information on that effort and additional background information on wastewater surveillance \(External Site\).](#)

How frequently are you sampling and testing, and what is the process?

During the fall semester, we plan to sample and test wastewater twice per week on four University of Maine campuses – Orono, Fort Kent, Presque Isle and the USM Gorham campus, as well as municipal wastewater from the towns of Orono and Farmington. On campuses, representative sewage samples are collected over a 24-hour period from locations that receive flow from campus buildings, including dormitories, as well as teaching, research and administrative buildings. For municipalities, samples are collected at the local wastewater treatment facility. After collection, each sample is

tested for the presence of SARS-CoV-2 by Dr. Robert Wheeler's laboratory at the University of Maine. The test uses a reverse transcription polymerase chain reaction (RT-qPCR) process that detects specific genetic fragments from the SARS-CoV-2 virus. By testing twice weekly, we can track changes in the amount of virus over time.

Who does the testing?

Samples from all four campuses are analyzed in the lab of University of Maine Associate Professor of Microbiology Dr. Robert Wheeler. Samples are concentrated using Nanotrap magnetic beads and then are analyzed using a combination of the IDEXX Wastewater Testing Kit and a standard set of testing reagents from Integrated DNA Technologies and ThermoFisher Scientific that we have carefully selected and optimized ourselves.

This testing protocol relies upon the RT-qPCR process that detects specific genetic markers from the SARS-CoV-2 virus.

How long does it take to get the results back?

The current turnaround time is usually less than 48 hours from the time we finish collecting a sample to the time we get the result. The University of Maine System moved sample analysis to Dr. Wheeler's lab and optimized sample concentration protocols to facilitate faster processing.

Who is interpreting the results?

The [University of Maine System Science Advisory Board](#) and Wastewater Testing Group work closely with officials from each campus to interpret the results and determine what actions, if any, are needed. The Science Advisory Board is made up of UMaine and USM faculty members and provides evidence-based information on the COVID-19 pandemic and serves as an expert resource to inform University of Maine System planning efforts. The Wastewater Testing Group includes additional faculty members with experience in wastewater and other types of environmental analysis, as well as representatives from Facilities Management and campus Incident Commanders.

If you find virus in the wastewater, what does that mean in terms of infections on campus?

We report levels (positive, indeterminate, or negative) based on the limit of detection. The limit of detection is 5,000 virus equivalents per liter (vE/L), which means that readings below this level are not as certain due to the way the RT-qPCR test works. Indeterminate levels of virus in a sample indicate the presence of the virus but do not allow reliable calculation of virus concentrations. If levels are above the limit of detection and increase from week to week or day to day, this could mean that there are more

SARS-CoV2-infected people on campus. Finding the virus in the wastewater indicates that it is present on campus. It is not possible to identify infected individuals through this type of testing because the sample comes from many people, but it can help us see overall infection trends and target our response.

What actions will you take if you find virus in the wastewater?

Wastewater testing serves as an early warning system that will allow campus Incident Commanders to increase their alert levels and may trigger additional actions such as increased testing of people on-campus who do not show any symptoms of infection. These results will be monitored by the Wastewater Testing Group, in conjunction with Incident Commanders, the Science Advisory Board and the Safe Return Committee to determine what resources are necessary to take additional actions to prevent sustained community spread of COVID-19.

How is wastewater testing information released to the public?

Results are announced weekly as part of the University of Maine System's regular COVID reporting and posted online at <https://www.maine.edu/together/>.

Why aren't you testing the wastewater on all University of Maine campuses?

Wastewater testing requires a strategy to be able to measure a specifically defined population. In reviewing all University of Maine campuses, we found that some specific campus sewer systems are not set up in a way to facilitate sampling of campus wastewater before it mixes with wastewater from the surrounding communities. Sampling of these systems would produce results that would not be specific to a campus community. This would make the information less useful to monitor a campus community's health. We are exploring the possibility of expanding sampling and testing to other campuses where we can identify ways to appropriately isolate wastewater streams that would provide an accurate picture of results specific to that campus community.

To complement our campus-limited testing, we test wastewater collected at the Farmington Wastewater Treatment Facility (which receives contributions from the University of Maine Farmington, as well as the rest of the town), and wastewater collected at the Orono Water Pollution Control Facility (accounting for contributions from the UMaine campus and also the off-campus housing complexes where UMaine students live, as well as the rest of the town).

When did you first start testing wastewater? What has changed?

We began testing wastewater in August 2020. Initially, we partnered with CES, Inc., a Bangor-based engineering, environmental sciences and survey firm founded in 1978 by two students from the University of Maine, to collect wastewater for the fall semester. CES (now called Haley Ward) collected the samples on three of our campuses (University of Maine, University of Maine at Fort Kent, and University of Southern Maine), then sent them to an environmental genetic testing laboratory for analysis. Haley Ward collected samples on University of Maine System campuses through the end of the fall semester in 2020, although the sample analysis was moved into Dr. Wheeler's lab in October 2020.

Throughout the fall and spring semesters during the 2020-21 academic year, we relied on composite sampling using ISCO composite water samplers. Toward the end of the spring semester, we successfully tested a passive sampling method with cotton swabs. Our analysis suggests that cotton swabs are an inexpensive, simpler alternative to the samplers, and that their use does not compromise our testing quality. Since mid-May 2021, cotton swabs have been used as the primary sampling method, and, among ongoing efforts to reduce cost, we switched qPCR testing kits.

Do you test wastewater anywhere else?

In addition to testing partnerships with the towns of Orono and Farmington, the University of Maine has worked with municipalities and other organizations in Maine to assist with surveillance testing in the past and expects to continue to do so in the future.

What are the limitations of wastewater testing?

Wastewater testing cannot specifically define the number of infected people in a community. Different people are known to shed virus at different rates. Some people may not shed virus into wastewater at all. In addition, wastewater testing results are influenced by other flows into the wastewater system such as rainwater, wash water, and water associated with other campus processes.

Wastewater testing cannot identify any single person with a case of COVID-19. However, wastewater testing provides an insight into the health of a community. When measured frequently and carefully interpreted, the information can be a tool to alert us to unknown infections before they spread throughout a community.