



City of Houston

SARS-CoV-2 Wastewater Monitoring

The Houston Health Department led a coalition of city and academic partners to develop the SARS-CoV-2 wastewater surveillance program for the city. The City of Houston acknowledges and is grateful for the scientific leadership and dedication from our academic partners, namely the Stadler, Ensor, and Spatial Studies labs at Rice University, the Taylor Lab at Baylor College of Medicine, and Houston Water to bring this system on board. The current day-to-day operations of the wastewater surveillance system for the City of Houston is maintained by the Houston Health Department, Houston Water, and the labs at Rice University.

The Houston Health Department and its collaborators study samples of wastewater collected from wastewater treatment plants across the city to understand the prevalence of COVID-19 in our community. Individuals infected with COVID-19 shed viral particles in their feces. By testing the wastewater, we can measure the amount of SARS-CoV-2 viral fragments in a community-wide sample and see whether levels of the virus in that community are increasing, decreasing, or staying the same.

For more information on the SARS-CoV-2 wastewater surveillance program please visit our website at <https://hou-wastewater-epi.org/>

The wastewater treatment plant data will be updated on Mondays by 1pm with the school and variant data updated on Tuesdays by 5pm.

Frequently Asked Questions

1. Why are we monitoring wastewater for COVID-19?

Individuals infected with COVID-19 can shed SARS-CoV-2 virus particles in their feces. These virus particles contain RNA fragments of the SARS-CoV-2 virus and can be measured in wastewater samples. These samples are pooled samples of the entire community that contributes to the wastewater, so by measuring these virus particles we can monitor the level of COVID-19 in a community and track its trend. Wastewater surveillance is beneficial for many reasons:

- SARS-CoV-2 can be shed in the feces of both symptomatic and asymptomatic infected individuals, so wastewater surveillance can capture both types of infection.





- Provides a pooled sample for a community on the wastewater treatment plant service area level; therefore, it can provide insights for communities where COVID-19 PCR testing is low or unavailable.
- Tracking COVID-19 PCR test results relies on people taking the tests, but wastewater surveillance can capture results from anyone who uses a restroom in the 39 monitored wastewater treatment plant service areas.

2. How does wastewater monitoring work?

Each week, wastewater entering the wastewater treatment plants is sampled and analyzed for RNA fragments of SARS-CoV-2. The samples collected are 24-hour composite samples of raw (untreated) wastewater and capture wastewater from homes and buildings in a wastewater treatment plant's service area. The samples are analyzed in the laboratory to determine the concentration of SARS-CoV-2 RNA fragments in a sample and is expressed as copies of SARS-CoV-2 virus per liter of wastewater. This concentration and the total flow of wastewater from the sample day are used to estimate the viral load over the 24-hour period, in copies per day, for a given wastewater treatment plant service area.

3. What is the metric "viral gene copies per day"?

On the dashboard, viral gene copies per day (log scale) is the fill color for wastewater treatment plants and zip codes. Viral gene copies per day is the estimate for the number of viral gene copies, also called viral load, over a 24-hour period for a given wastewater treatment plant service area. The number of viral gene copies per day are large numbers and are more easily understood on the log 10 scale. For example, at wastewater treatment plant 69th Street, the sample collected on August 16, 2021 was determined to be 5,020,462,650,265 viral gene copies/day, which is equivalent 12.70 viral gene copies/day on the log 10 scale.

4. What does the "percent of benchmark" mean?

It is the viral load on a certain date as a percentage of the viral load on the benchmark date, July 6, 2020. For example, at wastewater treatment plant 69th Street, the sample collected on August 16, 2021 was determined to be 10,300,352,514,217 viral gene copies/day and the sample collected at wastewater treatment plant 69th Street on the benchmark date, July 6, 2020, had 5,020,462,650,265 viral gene copies/day. Therefore, at wastewater treatment plant 69th Street on August 16, 2021, the viral load compared to July 6, 2020 benchmark was 205%.

5. Why are you using July 6, 2020 as the benchmark date for comparison?





This date corresponds to a wastewater sample collection date at a time when the city of Houston was experiencing high COVID-19 positivity rate. By using this date at the benchmark date, we compare to a time when we know communities faced high COVID-19 burden.

6. Is there a way to compare the wastewater virus load level to the PCR positivity rate?

This information is conveyed in the Virus Level x Positivity Rate plot at the bottom of the dashboard. This plot compares virus load trend, in green, to the positivity rate trend, in blue. As an example, if you select wastewater treatment plant Sagemont, the green line shows the measured virus load amount each week at Sagemont compared to the July 6, 2020 virus load amount at Sagemont. The blue line shows the positivity rate for PCR cases of people living in the Sagemont wastewater treatment plant service area. The y-axis for the virus load trend, the green line, is on the left, and the y-axis for the positivity rate trend, the blue line, is on the right. It is important to note that the amount of virus measured in the wastewater is not equivalent to the total number of cases.

7. How do you capture the trend of the wastewater treatment plants?

The trend is based on the percent change in virus load levels relative to the week prior. This week-to-week trend is displayed on the dashboard as arrow symbols on the wastewater treatment plans. To see the overall trend, open the tab at the bottom of the dashboard to display the Virus Level x Positivity Rate plot and see the virus level over time.

8. How does school monitoring work?

Much like wastewater treatment plant monitoring, a composite wastewater sample is collected and analyzed for RNA fragments of SARS-CoV-2. For the school sampling level, the sample is an 8-hour composite (covering school hours) and is collected from a manhole that carries wastewater that is only from the school. The samples are analyzed in the laboratory to determine if SARS-CoV-2 fragments can be detected in a sample. If sufficient SARS-CoV-2 fragments are detected in all samples for the school that week, then the school is designated as positive. If insufficient or no SARS-CoV-2 fragments are detected in all samples for the school that week, then the school is designated as negative. If sufficient SARS-CoV-2 fragments are detected in some samples for the school but insufficient or no SARS-CoV-2 fragments are detected in the other samples for the school, then the school is designated as unclear.

9. Why was my school selected?





Schools selections were made in December 2020 from Houston communities that had experienced high SARS-CoV-2 burden from the beginning of the pandemic to December 2020. Once these communities were identified, schools with viable manholes to sample were then selected. A viable manhole for sampling is a manhole that carries wastewater that is only from the school and has enough flow for sampling.

10. How does variant monitoring work?

Each week the wastewater samples from the 39 wastewater treatment plants are sequenced for SARS-CoV-2 mutations. A single SARS-CoV-2 variant can be associated with multiple SARS-CoV-2 mutations, so the more mutations detected that are associated with a variant, the more likely that variant is present in the wastewater sample. The heatmap on the dashboard represents the number of mutations that are associated with the variant that were detected in the wastewater samples. In some cases, lack of detection can occur due to technical challenges in sample treatment, and as such might not be indicative of the lack of the variant in the sample. Lastly, SARS-CoV-2 variant detection in wastewater is an emerging field, so the list of mutations associated with a variant can change as more data are collected.

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

No, according to the CDC there is no information to date that anyone has become sick with COVID-19 because of direct exposure to treated or untreated wastewater.

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

No, wastewater monitoring detects virus fragments of SARS-CoV-2. The COVID-19 vaccines do not contain SARS-CoV-2 nor do they contain virus fragments of SARS-CoV-2.

13. Can you calculate the number of cases based on the amount of virus load detected in the wastewater?

No, the amount of virus measured in the wastewater is not equivalent to the total number of cases, so case counts cannot be directly calculated from wastewater virus load amounts.

Additional Resources: [National Wastewater Surveillance System \(NWSS\)](#)



**HOUSTON HEALTH
DEPARTMENT**

Collaborative Teams:



**HOUSTON HEALTH
DEPARTMENT**



RICE

**Baylor
College of
Medicine**

Special Thank You to Center for Research Computing's [Spatial Studies Lab](#) at Rice University for developing and managing the dashboard



RICE | CRC
Spatial Studies Lab

Document Last Updated: 5/16/2022



**HOUSTON HEALTH
DEPARTMENT**

8000 North Stadium Drive
Houston, TX 77054
832-393-5169



**HOUSTON HEALTH
DEPARTMENT**