



SARS-CoV-2 Wastewater Monitoring

Reliable Detection and Quantification Days Before the Detection of Clinical Cases

Problem

As SARS-CoV-2 clinical testing decreases in many communities, public health officials are encountering significant challenges in their efforts to track the local spread of the virus. Fortunately, wastewater surveillance has emerged as an effective strategy for monitoring SARS-CoV-2 transmission trends in communities. However, the process of sending wastewater samples out for analysis can be both time consuming and costly, making the implementation of wastewater surveillance programs a challenging proposition.



Solution

Cepheid GeneXpert is a fully automated qPCR (quantitative Polymerase Chain Reaction) instrument that provides reliable measurements of SARS-CoV-2 viral load in wastewater. Together with the specially designed cartridge, the Cepheid GeneXpert 1-step workflow makes sensitive, rapid, easy, on-site measurement possible for any community wastewater plant, including remote communities.

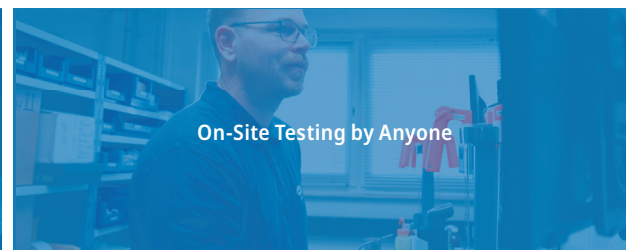
Benefits

The simplicity and reliability of Cepheid GeneXpert enables communities to overcome all traditional limitations of wastewater surveillance programs. Wastewater treatment plants can now collect and analyze wastewater without disrupting their daily work and provide local and national health authorities with the data they need to make informed decisions.

Current WBE* Workflow

					<ul style="list-style-type: none">• Multiple Steps• 2+ Days to Result• 1-4 Hours of Labor per Test• Significant Inter Operator Error• Expensive
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GeneXpert Workflow

			<ul style="list-style-type: none">• 1 Step Sample Prep• <1 Hour to Result• 1-2 Minutes of Labor per Test• Minimal Inter Operator Error• Cost-Effective
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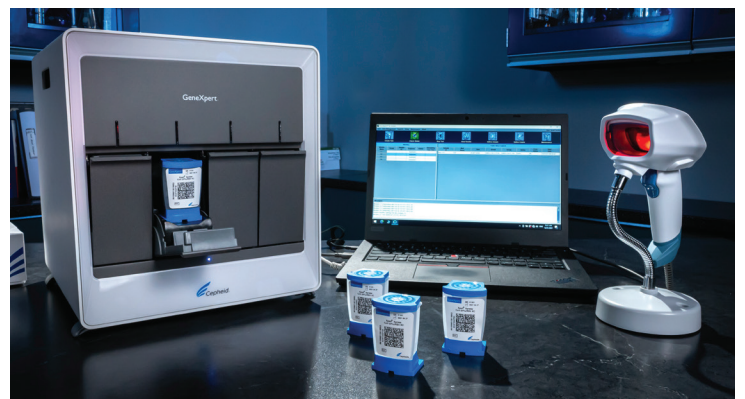
*Wastewater Based Epidemiology

Background

Hach has worked with a consolidated city located in Colorado, USA. This city is part of the Denver-Aurora-Lakewood, CO Metropolitan Statistical Area with a population of approximately 75,000. All the city's wastewater flows through a centralized wastewater treatment facility.

Challenges

Current methods used to quantify SARS-CoV-2 in wastewater require complicated extraction procedures that are performed in centralized laboratories with high-end PCR equipment and centrifuges. It takes at least two days to receive the results, and the programs are expensive.



Cepheid GeneXpert setup: PCR instrument, cartridges, laptop, and scanner.

Each test can cost over \$300 per sample. In addition, results from central labs vary depending on the operator and extraction method. These barriers make it difficult to justify the development of a wastewater monitoring program for SARS-CoV-2.

Setup

In July 2021, Hach started a pilot program with this city to establish a wastewater surveillance program to help monitor SARS-CoV-2 in the community.

Results

After 18 months, the pilot program has demonstrated reliable detection of SARS-CoV-2 in wastewater several days before clinical

cases were detected (see Figure 1). In 2021, when participation in clinical testing was high, Cepheid GeneXpert results showed a very high correlation between wastewater viral load and actual case numbers.

Cepheid GeneXpert’s true value to the community, however, came in 2022, when community testing declined while COVID-19 cases increased. National and local health authorities had no way of tracking the spread of the virus or predicting another viral surge in the community. Central labs were expensive and provided delayed data, making Cepheid GeneXpert the only choice for facilities that wanted real-time data while minimizing the budget impact.

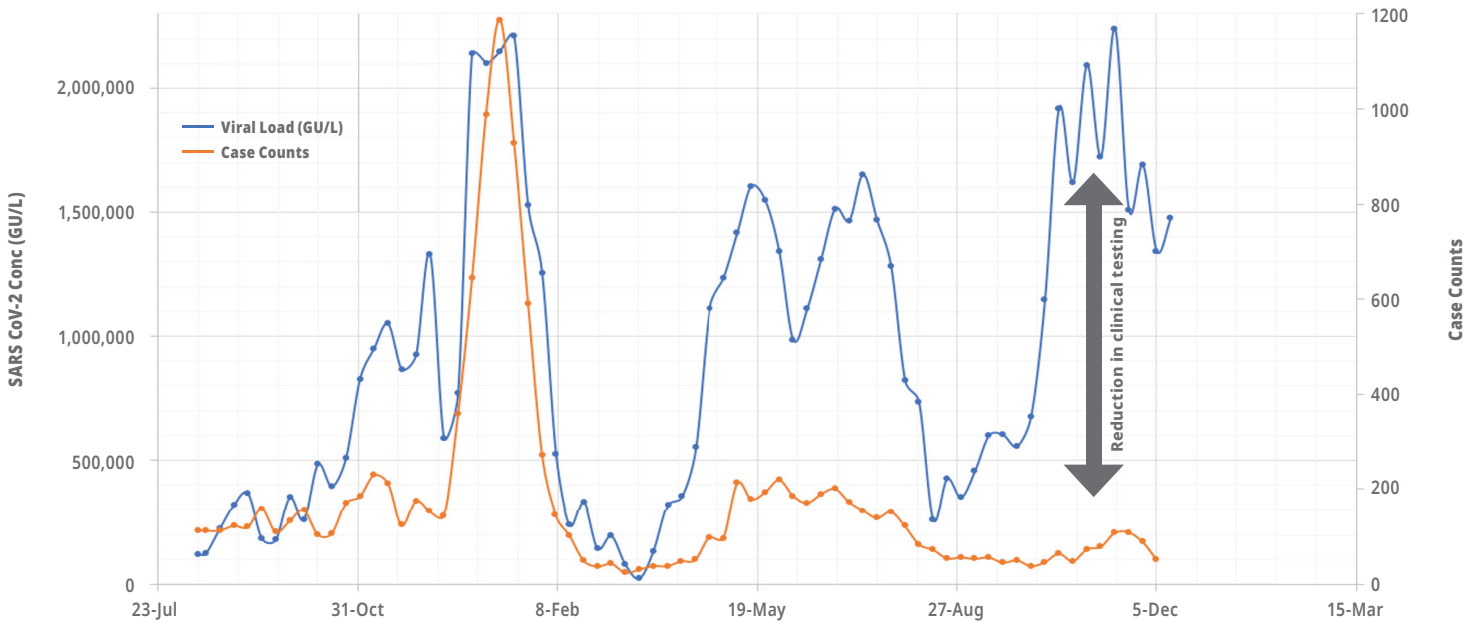


Figure 1. 2021-2022 Cepheid GeneXpert SARS-CoV-2 Case Study (city in Colorado, USA)

The Cepheid GeneXpert offers the advantage of minimizing inter-operator error irrespective of the operator’s educational background or experience, as demonstrated in Figure 3, where its performance is independent of the operator, in contrast to traditional sample preparation methods, as described in a published scientific study** (Brian et al) shown in Figure 2.

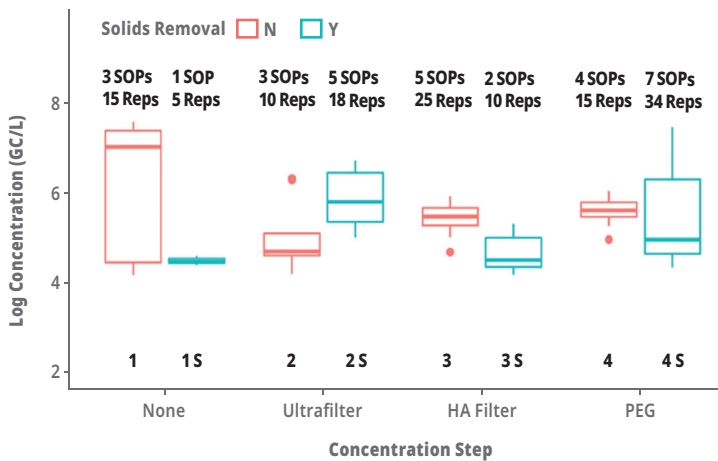


Figure 2. Reproducibility of 36 methods (SOPs) to quantify SARS-CoV-2 in raw wastewater

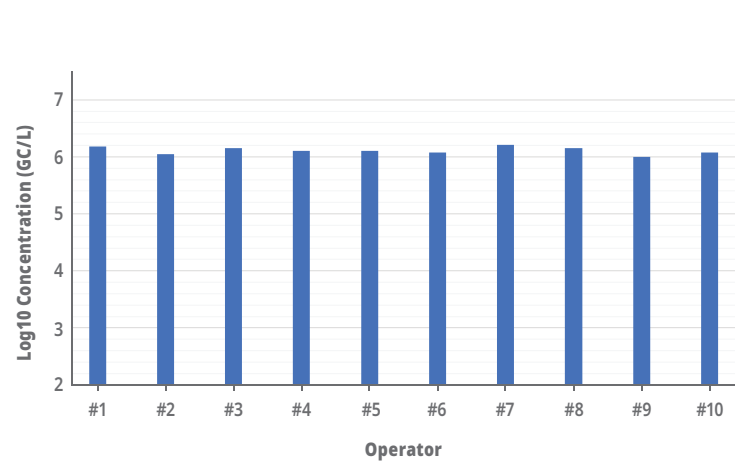


Figure 3. Reproducibility of Cepheid GeneXpert between different users to quantify SARS-CoV-2 in raw wastewater

Conclusion

Cepheid's GeneXpert reliably detects SARS-CoV-2 in wastewater and provides results in less than an hour, enabling health authorities and wastewater treatment plants to act quickly.

Sample preparation requires only one simple step, eliminating the need for complicated and manual extraction procedures and expensive equipment.

The test is so simple that anyone can perform it, with minimal operator error and inter-user variability, producing reliable comparison of results.

*** Pecson BM, Darby E, Haas CN, Amha YM, Bartolo M, Danielson R, Dearborn Y, Di Giovanni G, Ferguson C, Fevig S, Gaddis E, Gray D, Lukasik G, Mull B, Olivas L, Olivieri A, Qu Y; SARS-CoV-2 Interlaboratory Consortium. Reproducibility and sensitivity of 36 methods to quantify the SARS-CoV-2 genetic signal in raw wastewater: findings from an interlaboratory methods evaluation in the U.S. Environ Sci (Camb). 2021 Jan 20;7:504-520. doi: 10.1039/d0ew00946f. PMID: 34017594; PMCID: PMC8129921.*



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