Wastewater Data Interpretation at the Sewershed Level

About the Colorado Wastewater Surveillance Program:

The Colorado Department of Public Health and Environment (CDPHE) collaborates with wastewater utilities statewide to test wastewater for SARS-CoV-2, the virus that causes COVID-19. SARS-CoV-2 can be shed in stool before someone shows symptoms or tests positive for COVID-19 and therefore can be found in our wastewater. Testing wastewater can give health officials early warning signs about COVID-19 trends in our communities without solely relying on access to viral testing within a population.

Interpreting Viral Concentration in Wastewater:

Polymerase chain reaction, or PCR, is the primary laboratory method for detecting **SARS-CoV-2 concentration in the wastewater,** which is measured in viral gene copies per liter.

There are three key considerations to keep in mind when interpreting wastewater data based on the viral concentration levels:

→ Viral concentration levels are used as a base metric for interpreting wastewater data, and can be normalized by the flow rate of wastewater at the time of collection and the sewershed population.

→ Viral concentrations alone do not provide a full picture of the COVID-19 status in communities due to variance and noise in the data. Therefore, trend analyses are an important tool used to determine changes of viral shedding in our communities over time.

→ Viral concentration levels are best interpreted in conjunction with other relevant measures to better understand exposure risk and prevalence of COVID-19 in a community. These include clinical measures such as COVID-19 cases, hospitalization rates, and the percent positivity of COVID-19 tests in a region, as well as indicators of emerging variants.

Wastewater Trend Analysis in Colorado:

Trends for each utility are estimated with a Bayesian Structural Time Series (BSTS) Model and local linear models to determine the trend direction for each new sample received. Classifications of the two most recent samples are used to characterize the direction and magnitude of the trend, reflecting a statistically significant increase or decrease. A plateau is designated if there is no statistically significant change in viral concentrations of the two most recent samples from that utility. Trend classifications are assigned as follows:

Most Recent Sample Classification	2nd Most Recent Sample Classification	Classification
"Increasing"	"Increasing"	**Steady Increase**
"Increasing"	"Plateau"	**Simple Increase**
"Plateau"	"Plateau"	**Steady Plateau**
"Decreasing"	"Plateau"	**Simple Decrease**
"Decreasing"	"Decreasing"	**Steady Decrease**
<2 samples in past 15 days OR insufficient # of recent data points for trend classification		**Insufficient Data**

Results are published weekly to *Colorado COVID Wastewater Monitoring Data Trends*, found **here**.

Omicron Variant Detection in Wastewater:

In addition to trend analyses, the analysis of detection patterns of Omicron Variants in wastewater data allows CDPHE to create heatmaps and helps gauge which variant may be driving trend results (*Omicron Detection Heatmap* can be found **here**). "**Detected**" and "**Not Detected**" classifications are determined for each sample based on the presence of the SARS-CoV-2 variant in the sample, "**Insufficient Signal**" marks a sample with inconclusive results, and "**No Sample**" is assigned when a sample was not received from a utility during that period of time. As two samples are collected each week from participating utilities, the results of each sample are combined using the following classification scheme:

Weekly Sample 1	Weekly Sample 2	Classification
"Detection"	"Detection", "No Detection", "Insufficient Signal", or "No Sample"	**Detected**
"Insufficient Signal"	"Insufficient Signal", "No Detection", or "No Sample"	**Insufficient Signal**
"Not Detected"	"Not Detected" or "No Sample"	**Not Detected**
"No Sample"	"No Sample"	**No Sample**

Omicron Detection Heatmap results are posted weekly to the dashboard for the preceding week and may be updated as additional data becomes available. If the laboratory is currently working on processing the samples, the dashboard will state "**samples still processing**" for that utility and will be updated once the results are received. Once the results are posted, we recommend working with your communications team to provide the appropriate public health message that suits the result shown for your community.

Wastewater data is one important surveillance tool in our tool box in determining COVID-19 status and risk within a region. When used in conjunction with other metrics like clinical case and emerging variant data, officials are better equipped to identify early warning of COVID-19 trend increases in our community.