Biobot Analytics

August 2022 (v1.0)

# Brief: Understanding Covid-19 Risk Levels for Facilities

Key points

- **Covid-19 Risk Levels are an evidence-based algorithm to alert customers when they are at an increased risk** for sustained, elevated Covid-19 activity in their facility.

- Risk is defined as a **short-term forecast of a high Covid-19 concentration** (>1,000,000 c/L) at the time of a facility's next wastewater sample.

- Biobot analyzed patterns of wastewater concentration trends from **more than 3,500 samples in our historical database, representing more than 50 facilities** to develop the algorithm.

- Covid-19 Risk Levels make wastewater data more **accessible, informative, and actionable for executive leadership.** This knowledge **can help guide decision making on mitigation measures**, based on existing facility policies.

- **More frequent sampling** improves the accuracy of Covid-19 Risk Levels.

Covid-19 Risk Levels provide a simple, informative alert system

Disease trends in a facility's wastewater can guide mitigation response efforts and prevent localized Covid-19 outbreaks. However, understanding these data and trends can be challenging for decision makers. Covid-19 Risk Levels provide a simplified interpretation of a facility's wastewater data to help customers prepare for changes in Covid-19 activity. This algorithm turns data from recent wastewater samples into a simple and informative alert that categorizes the probability a facility will see sustained, elevated Covid-19 activity in the near future.

Covid-19 Risk Level Algorithm

Today's Sample

Past Samples

LOW   MEDIUM   HIGH

RISK

DATA   ALGORITHM   COVID-19 RISK
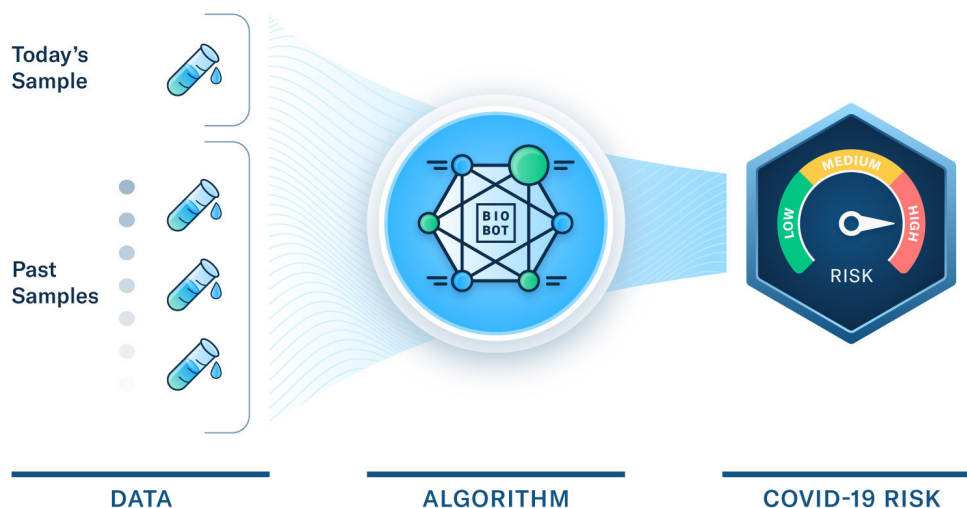
What do Covid-19 Risk Levels mean?

Biobot's Risk Levels measure the likelihood of having many infected individuals in a facility, which is indicated by a high SARS-CoV-2 concentration (>1,000,000 c/L) in a facility's wastewater sample. When a facility is at **High Risk**, there is a substantial amount of Covid-19 present in the wastewater sample, and the facility is susceptible to sustained, elevated virus concentrations. **Moderate Risk** indicates Covid-19 activity is present in the building and there is a 10-20% chance of seeing a high virus concentration in the next wastewater sample. When at **Low Risk**, virus concentrations are low or the virus is absent. This low virus concentration may mirror low disease prevalence in the surrounding community or it may be a result of effective infection prevention measures in place at the facility.

Covid-19 Risk Level	Probability of Future High Virus Concentration	Potential Response Actions
High Risk	>20%	• File incident report and notify leadership to determine if mitigation actions should be taken based on existing facility policies • Contextualize High Risk Level report in conjunction with local community wastewater and case data • Investigate whether there have been any potential super-spreader events in the facility, such as an employee event or party, or conference travel
Moderate Risk	10-20%	Monitor future samples and ensure facility policies have been defined for what to do if a High Risk report is received
Low Risk	<10%	Continue business as usual

How can Covid-19 Risk Levels be used?

Infection prevention measures should be decided according to an organization's specific risk tolerance, resource availability, population served, and nature of services. Buildings and facilities do not operate in a vacuum; people who enter and leave a facility are also moving about and interacting with the local community. Therefore, while the Covid-19 Risk Levels provide a specific snapshot within your facility, they should be used in conjunction with community Covid-19 activity and transmission rates. Biobot's website provides regional and national wastewater trends as well as reported clinical case data.

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An analogy: Covid-19 Risk Levels are like a Tornado Alert System

Tornadoes typically begin as a rotating thunderstorm known as a supercell. When a supercell drops to the ground, it becomes a tornado. Tornado early alert systems signal when a supercell has formed and the risk of a tornado is high. Similarly, Biobot's Covid-19 Risk Levels alert facilities to times when concentrations of Covid-19 are elevated and a facility outbreak is more likely.

A tornado warning merits different responses, depending on a community's susceptibility to the impact of a tornado. For instance, people who live in mobile homes might take more serious measures in response to a tornado warning, compared to people living in a concrete apartment complex. Similarly, certain types of facilities may be more susceptible to a Covid-19 outbreak than others. A High Risk Level report in a congregate living setting may be more concerning than in an office setting where mask-wearing is required.

Just as a tornado plan can help prevent loss of life and property, a Covid-19 mitigation plan that is tailored to a specific facility's needs and ready to deploy in response to Covid-19 Risk Levels can help prevent or lessen the impact of a Covid-19 outbreak. Covid-19 Risk Levels allow facilities to remain alert and poised to implement mitigation actions should a change in Covid-19 activity occur.

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Covid-19 Risk Level Methodology

Biobot used historical facility sampling data to analyze patterns of wastewater concentration trends, expressed as Wastewater Concentration Tiers. The analysis examined >3,500 samples from >50 facilities. Covid-19 Risk Levels perform best with recent and frequently collected sampling data. Our analyses suggest that samples older than two weeks do not provide reliable information for prediction. Therefore, any facility sampling at least once a week may generate Covid-19 Risk Levels. Consistent and frequent wastewater monitoring is the best way to stay abreast of current Covid-19 risk.

Linear and logistic regression models were used to determine the features associated with obtaining a future high Covid-19 concentration. The feature variables selected for use in the Covid-19 Risk Level algorithm correctly predicted future high Covid-19 events 90% of the time (positive predictive value). Positive predictive performance improved by 12 percentage points between locations that sample once a week and those that sample multiple times per week. The finalized tool focuses on the probability of future high Covid-19 activity, and the thresholds for each Risk Level are determined based on the distribution of past samples.

The Covid-19 Risk Level algorithm utilizes the two most recent samples from a location. The effective concentration of these two samples is converted into the appropriate Wastewater Concentration Tier. The four Wastewater Tiers are quantitative tiers based on the effective concentration of virus found in each wastewater sample, and defined as follows: Tier 1, *less than 10,000 c/L*; Tier 2, *10,000-100,000 c/L*; Tier 3, *100,000 to 1,000,000 c/L*, and Tier 4, *greater than 1,000,000 c/L*. Covid-19 Risk Levels are then based on the fraction of each two-sample Wastewater Tier pattern (e.g., 1-1, 2-2, 4-4, 2-4) that reached a high wastewater concentration (Tier 4) in their next sample.