

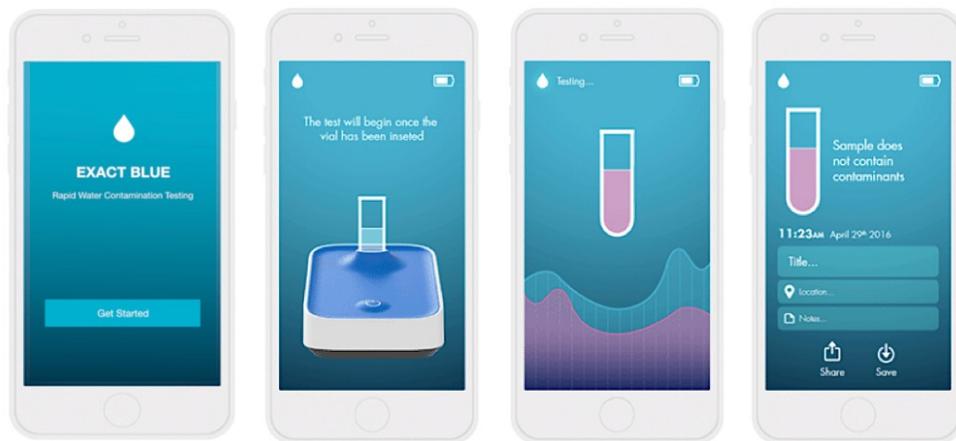


Next Generation Water Security Technology



What is ExactBlue?

ExactBlue is a smartphone-enabled portable rapid microbial detection system ideal for point of use microbial water testing. ExactBlue allows water professionals to assess for total microbial load and determine, within minutes, if a specific water source is safe for its users.



ExactBlue brings together, on one platform, biocidal testing and direct microbial monitoring, making it an indispensable tool for water treatment professionals working on high-risk operations. Some examples are cooling towers, and water distribution systems in healthcare facilities, dental clinics, and hospitality industry.

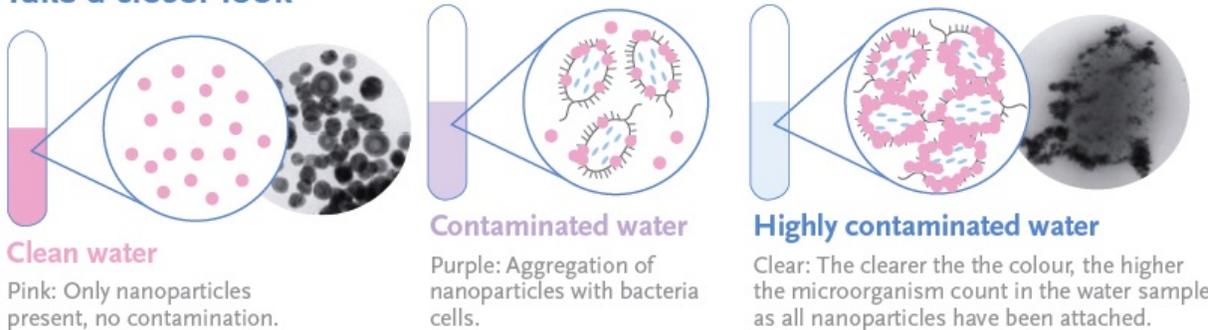
Total Microbial Load

Total Microbial load is a leading indicator of whether pathogens such as Legionella and others may be present in water. According to the Centre for Disease Control (CDC), the guideline for safe drinking water is less than 500 Colony Forming Units (CFU)/ml. Detection of higher microbial load in water help drive treatment decisions, especially if detection can be done through the distribution infrastructure from source to consumption. ExactBlue is designed to detect the presence of microbial load at these low levels enabling a new level of analysis and treatment.

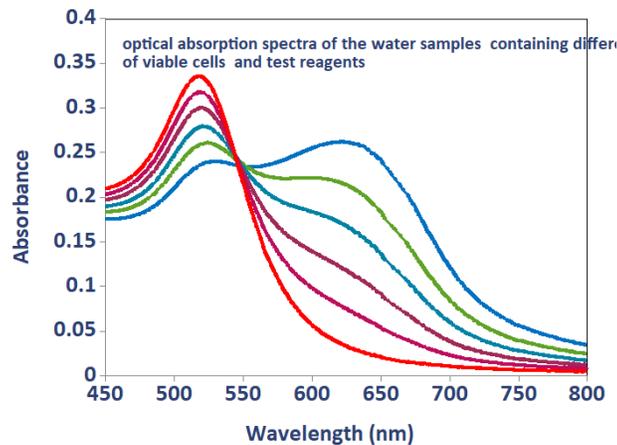
Breakthrough Nanotech

The ExactBlue detection system uses functionalized gold nanoparticles utilizing a property called “Surface Plasmon Resonance” (SPR). The gold nanoparticle’s shape and charge are designed to efficiently attach to the cell membrane of bacteria and other microorganisms. This process produces a measurable color change of the gold nanoparticle solution.

Take a closer look

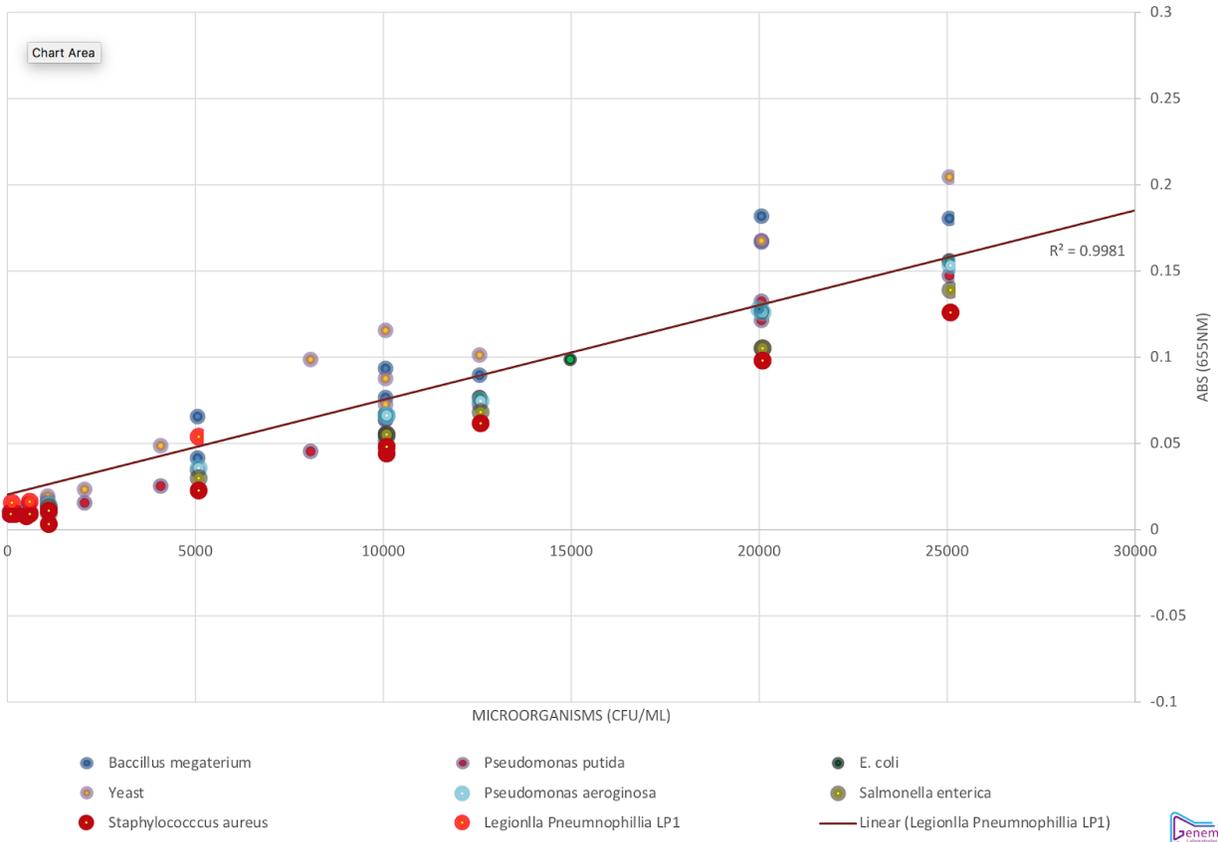


This color shift can be measured and quantified using our ExactBlue mobile sensing device.



The color shift is proportional with the number of cells in the solution and has a maximum variation of about 20% between the various microorganisms (mostly due to variation on microbial cell size).

Correlation of Microorganism Concentration & Absorbption (color) Change:



This method is more convenient than lab testing because the test can be performed at the sample site in minutes, and on as many samples as required. When compared to ATP testing, ExactBlue's patent-pending system is able to provide direct quantified results of total microbial load from 500 CFU/ml to 20,000 CFU/ml. The response of ExactBlue, is significantly more consistent than ATP across microbial species, as it measures the number of viable cells in the sample, rather than their metabolic activity, which can vary based on nutrient availability. Further, our platform can be used to detect disinfectants like Chlorine and Hydrogen Peroxide without the need to use other tests.



Comparison of Traditional Methods

Our proprietary technology allows us to produce engineered nanoparticles with multiple potential applications in diagnostics for both microbiological and chemical detection. Our advantage is the high sensitivity and accuracy of the test, with a relatively quick response time (within minutes), which makes this technology ideal for field application as well as real time inline water monitoring and control.

	ExactBlue	Heterotrophic Plate Count (HPC)	ATP Testing
Sensitivity	High	High	Medium (variable results)
Scope of contamination detection	Total microbial, specific, inorganic	Culturable microorganisms only	Metabolic rate of microorganisms
Speed	Minutes	Days	Minutes
Accuracy	High	Medium- high (underestimates results)	Medium (prone to false negative responses)
Mobility	High	Low	High
Ease of Use	High	Low	Medium
Equipment Cost	Low	High	Medium
Price per test	Low	Medium-High	Low

Compared to current laboratory-based test methods (Heterotrophic Plate Count using R2A), our test has a broader detection range (500 to 20,000 CFU/ml). As HPC results is highly dependant on the cell viability of microorganisms in water sample, samples shipping and storage and even handling during test has a very significant impact. Our test allows the user to perform the test on site, immediately after collecting the samples, thus minimizing the chances for false positive/ false negative results.

Our test also outperforms ATP when used in treated water monitoring due to better correlation between microbial counts and results. In addition, the results do not depend on the metabolic activity of microorganisms in the water sample. It is well documented that the microorganisms found in treated (chlorinated) water can survive at very low metabolic levels when they are



starved, and as a result, both ATP and HPC methods tend to greatly underestimate the level of microbial load in treated water samples, and produce a high rate of false negative results¹.

Risk Mitigation Made Simple

Water treatment professionals rely on biocidal efficacy studies prepared in laboratory conditions to design and establish water treatment systems and use indirect monitoring methods to maintain water quality. One common example is the measurement of free and total chlorine in a chlorine-treated water as an indicator of biocidal efficacy, instead of direct microbial measurement.

However, very often the design of a water system is so complex, that just indirect monitoring techniques cannot offer proper water quality monitoring, especially where it comes to high risk/high liability applications, where lives are at stake.

In complex water systems (cooling towers or large buildings), in-line monitoring of the microbial load of incoming water at point of entry does not provide enough information to keep the system under control, because most complex systems are prone to dead legs and temperature variations which can promote biofilm formation.

ExactBlue provides the tools to create a simple and effective risk management process in three simple steps:

1. **Baseline Analysis:** ExactBlue is a fast and effective tool that allows the user to test ALL sampling points in the building and identify the potential high risk points of use that need to be monitored closely. This allows for a proactive approach to water monitoring and treatment, rather than reactive.
2. **On-going Testing:** Once the high risk points are identified, a regular testing program (weekly, monthly, quarterly or similar) can be implemented to monitor changes in the water infrastructure without having to deploy expensive capital and resources.
3. **Process improvement:** The information collected through the regular testing program can be used to improve the system design and optimize the water treatment processes to prevent biofilm formation and microbial growth.

¹ SHAMA, G., MALIK, D.J."The uses and abuses of rapid bioluminescence-based ATP assays", (2013); Staffan Kjelleberg," Starvation in Bacteria", SpringerLink (2019)



Applications

Total microbial load is a useful indicator in a variety of uses and complements standard chemical analysis. For industrial applications, ExactBlue offers the ability to quantify total microbial contamination between 500 and 20,000 CFU/ml, and is particularly useful in optimizing and monitoring biocidal water treatment processes when response time is critical. For example total microbial detection

For instance there are microorganisms that have adapted and are resistant to chlorine treatment (eg. Pseudomonas, Cryptosporidium) or can overcome its biocidal effect (eg. Legionella). Their presence in water is not detected through classical chemical testing and therefore using chemical testing alone without additional microbial testing can lead to inconclusive results with regards to microbial contamination.

Currently, there are well established testing requirements for specific microbial contaminations, such as E coli and coliform, as well as for chemical contamination (heavy metals, pesticides, biocides) and other physical or chemical water characteristics.

ExactBlue brings critical important information in all these applications to complement the current testing requirements and minimize the risk of microbial contamination.

Application	Total Microbial (Nuisance, Pathogens)	Specific Microbial (Ecoli, Coliform)	Heavy Metals (Lead, Mercury, etc)	Pesticides	Disinfectants (Chlorine, H2O2)	Physical Characteristics (pH, Alkalinity, Turbidity, etc)
Farming & Irrigation	X	X	X	X		X
Private Well Water	X	X	X			
Hot Tubs	X				X	
Pools	X				X	
Drinking Water	X	X	X			
Hospitals	X	X			X	
Dental Clinics	X					
Water Distribution Systems	X	X				
Infrastructure Services	X		X			
Travel & Leisure	X		X			
Immunosuppressed	X	X				

Dental Clinics



Dental lines are a perfect environment for bacterial growth. ExactBlue can directly test for bacteria and disinfectant levels and provide immediate diagnosis of whether further treatment is required. Our technology is already in use by dental professionals in Canada and the US for dental waterline monitoring.

Cooling Towers



Legionella bacteria in plumbing systems and cooling towers is responsible for the majority of drinking water disease outbreaks. Total microbial count is a leading indicator



for possible Legionella contamination². ExactBlue technology can help detect biofilm formation and can be used as an early detection system for Legionella outbreaks.

Hospitals



Water supply at water outlets in healthcare facilities are a frequently overlooked yet essential for safe patient care and can be manageable source of infections. Numerous healthcare-associated (HAI) outbreaks have been linked to contaminated water used for patient care particularly maternal and child health, hand washing, and cleaning of medical devices for reprocessing to name but a few. Infection control at healthcare facilities can be made more efficient through the use of ExactBlue as a risk management tool in concert with a microbial identification method.

Long-term care facilities



Many occupants of long-term care facilities have weakened immune systems due to disease, medical treatments or genetic conditions. Checking your water sources quickly to make sure

² LLEWELLYN, A.C., LUCAS, C.E., ROBERTS, S.E., BROWN, E.W., NAYAK, B.S., RAPHAEL, B.H, WINCHELL, J.M. "Distribution of Legionella and bacterial community composition among regionally diverse U.S. cooling towers" (2017) PLoS ONE 12(12):e0189937



they are not exposed to microbial contamination unwittingly is prudent.

Swimming Pools and Hot Tubs



Pools are a significant vector for waterborne disease transmission. According to the CDC, about 60% of public hot tubs are contaminated with bacteria beyond acceptable limits. While applying disinfectants is important, it can be done more effectively. Checking for microbial levels can help balance disinfectant treatments with information on treatment efficacy. ExactBlue can not only monitor the microbacterial levels but also chemicals like hydrogen peroxide and chlorine.

Private Wells



Over 15 million U.S. households obtain drinking water from private wells that are subject to various environmental contaminants including seepage through landfills, failed septic tanks, underground storage tank infection, fertilizers and pesticides³. ExactBlue provides a platform to check for both microbial and disinfectant levels.

³ www.epa.gov/privatewells



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