

GUARDIAN **BLUE**[™]

— EARLY WARNING SYSTEM —

**THE FIRST AND ONLY EARLY WARNING SYSTEM FOR DRINKING WATER
CERTIFIED BY THE DEPARTMENT OF HOMELAND SECURITY**



Homeland Security Technologies

INTRODUCING GUARDIANBLUE. THE ONLY WAY TO KNOW THE WATER IS SAFE.

The revolutionary GuardianBlue™ Early Warning System is the first and only early warning system for water utilities that provides them with the information they need to ensure their drinking water is safe.

Its patented* technology lets users:



1. Detect, alert and classify a wide variety of threat contaminants, from cyanide and anthrax to arsenic and pesticides
2. Detect, alert, classify, and learn real-world events, from water main breaks and caustic overfeeds to cross connections and aging infrastructure

GuardianBlue's breakthrough technology also makes it the only early warning system that will detect and alert on unknown water quality deviations. This allows the system to warn operators about foreign agents, unidentified contamination and operational events never previously encountered.

**US Patent number 6999898*

THE FIRST EARLY WARNING SYSTEM TO RECEIVE SAFETY ACT DESIGNATION AND CERTIFICATION.



GuardianBlue is the first and only Early Warning System for drinking water to earn SAFETY Act designation and certification from the Department of Homeland Security. The SAFETY Act provides litigation protection for users and their contractors. SAFETY Act certification signifies the Department of Homeland Security approved the system as anti-terrorist technology. Certification is based on a review of 3 years of test data including government testing using actual warfare agents.



GuardianBlue's Event Monitor, Water Panel and TOC Analyzer have earned Environmental Technology Verification from the EPA for continuous multi-parameter water monitoring in distribution systems. Hach's GuardianBlue Early Warning System detected and alerted on 100% of all contaminants injected into the system, during ETV verification.

A PEEK INSIDE GUARDIANBLUE



Event Monitor

The Event Monitor integrates sensor data from the Water Panel and the TOC Analyzer. Every 60 seconds the system applies a patented algorithm to the sensor measurements, calculating a site's water quality baseline. The system alarms when the trigger signal exceeds a user-set threshold, indicating an "event." The event fingerprint is compared to fingerprints stored in both the Agent Library and the Plant Library, and alerts utility operators when a match is found. If no match is found, utility operators are alerted to an unknown deviation in water quality and the event's fingerprint is stored in the Plant Library for further analysis, identification and classification.

Agent Library

Located within the Event Monitor, the Agent Library is the most technologically advanced analytics software available for water quality monitoring. The Agent Library contains fingerprints for a wide variety of threat contaminants. When the Agent Library matches an event with the fingerprint of a threat contaminant it also provides the degree of confidence in the classification to help operators make appropriate response decisions.

Water Panel

The Water Panel continuously monitors free or total chlorine, conductivity, pH, turbidity, temperature and pressure, which it sends to the Event Monitor via digital transmission. When an event occurs, the Water Panel detects changes in the water quality parameters. The Water Panel is comprised of Hach's leading water quality sensors and has become an industry standard for water quality monitoring.

TOC Analyzer

The TOC Analyzer continuously monitors total organic carbon. The TOC Analyzer uses EPA method 415.1 to obtain its measurements ensuring accurate results. The TOC Analyzer is a key component of GuardianBlue, providing increased sensitivity to organic contaminants.

Automatic Sampler

When the Event Monitor triggers, it instantly signals the Automatic Sampler to capture a real-time water sample at designated monitoring locations. This allows water utilities to conduct additional forensic analysis and testing on actual water samples, prior to initiating a response plan.

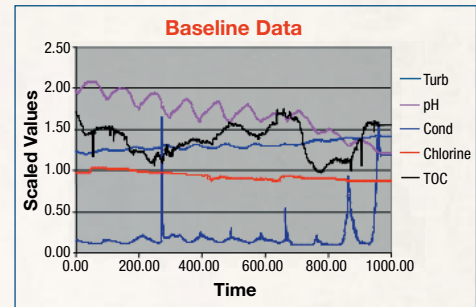
HOW GUARDIANBLUE WORKS

Step 1:

GuardianBlue's Event Monitor analyzes five commonly measured water quality parameters sent from its Water Panel and TOC Analyzer:

1. Chlorine (free or total)
2. pH
3. Turbidity
4. Conductivity
5. Total organic carbon

INPUT FIVE PARAMETER SIGNALS



These parameters enable GuardianBlue to calculate a water distribution system's operating baseline – water quality under normal operating conditions.

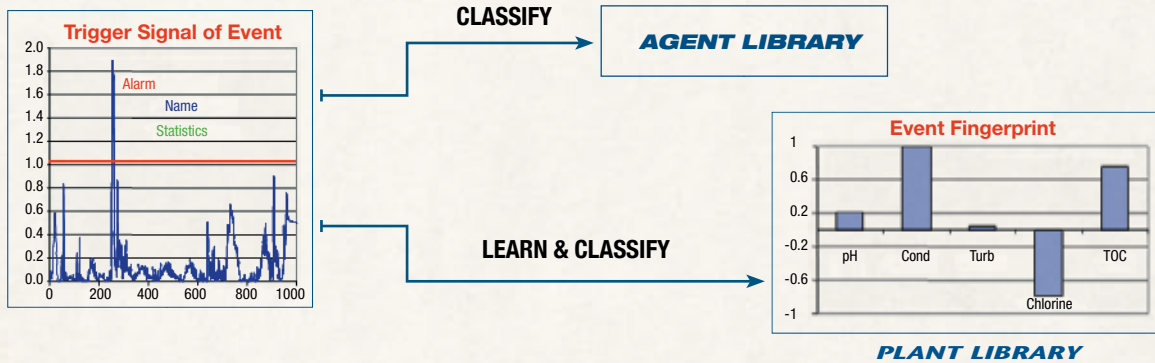
Step 2:

Every 60 seconds the system analyzes sensor data and calculates the trigger signal, which indicates a deviation from the water quality baseline. If significant deviations occur, the trigger signal alarms operators in real-time.

Step 3:

Once a deviation has been detected, the Event Monitor instantly signals the Automatic Sampler to capture a real-time water sample at designated monitoring locations. The system then analyzes both the Agent Library and Plant Library to assess and classify the deviation.

OUTPUT TRIGGER SIGNAL



The Agent Library contains fingerprints for a wide variety of threat contaminants, ranging from VX and ricin to arsenic and herbicides. A subscription service is available offering continual updates with the latest contaminant fingerprints developed by Hach HST.

The Plant Library contains fingerprints for operational and naturally occurring events specific to each unique water distribution system. This capability allows water utilities to detect, alert, classify and learn real-world events such as water main breaks, switching water sources, and caustic overfeeds.

Step 4:

If no match is found in either library, the event fingerprint is stored in the Plant Library for future reference. Water utility operators can identify unknown event fingerprints and assign a severity level, allowing recognition of previous events and decreasing the frequency of unknown events.

INTEGRATED GUARDIANBLUE SYSTEM DIAGRAM

This system diagram illustrates how Hach's GuardianBlue Early Warning System detects and alerts operators to deviations in water quality parameters within a city's drinking water distribution system.



1. GuardianBlue systems are strategically located at key points throughout a city's water distribution system, such as pump stations, water treatment facilities and storage tanks.
2. If a foreign agent is introduced into a water distribution system via a backflow attack, deviations occur in one or more of the measured water quality parameters.
3. Every 60 seconds, GuardianBlue analyzes the city's drinking water for deviations from baseline. The deviation caused by the foreign agent, triggers a system alarm.
4. Operators at the water distribution monitoring facility are alerted to the problem in real-time and track the contamination movement in order to contain the affected water.

Hach HST offers water utilities water security consultative services

For a water utility manager responsible for ensuring the safety of a city's drinking water, deciding how to integrate and network GuardianBlue Early Warning System into your city's water distribution system requires comprehensive analysis and careful consideration. For example, managers must consider a variety of elements that are unique to their system:

- Targeted sites based on Vulnerability Assessments results, such as stadiums and federal buildings, schools and hospitals
- The unique layout of the distribution system including reservoirs, storage tanks, distribution equipment, pressure zones, low-flow areas, water main valves, and aging infrastructure

This is why Hach HST offers water security and monitoring consulting to assist you in developing a water security network customized to the needs of your unique distribution system.

Hach's onsite strategic consulting services can include:

- **System Evaluation:** Assistance identifying key components and attributes of your distribution system.
- **Site Selection:** A collaborative recommendation based on logistical requirements, vulnerabilities and key concerns.
- **Communication Integration:** Assistance communicating data from remote monitoring locations to a centralized control system or SCADA.
- **Customized Training:** Onsite, multi-day training by Hach engineers for water utility personnel on GuardianBlue Early Warning System.
- **Field Maintenance Support:** Continual training and maintenance support by our local service engineers.
- **Response Planning:** Table-top workshops to assist in the development of a comprehensive response plan.

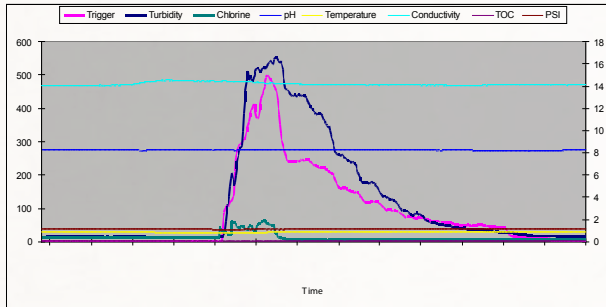
CONTACT HACH HST TODAY.

GuardianBlue Early Warning System can help you keep your constituents safer. And your water distribution system more reliable. So put it to work for your city. Call the Hach HST sales team at 800-604-3493 to schedule a consultative appointment with one of Hach's water security engineers.



REAL-TIME RESULTS: PITTSBURGH CASE STUDY

More than 72,000 hours of real-time data has been collected across a wide variety of water distribution systems. In Pittsburgh, water quality deviations were detected nearly two full days before one of the largest water main breaks in the city's history.



At 10:30a.m. a geyser caused by a severed 36" water line erupted, pouring more than 20 million gallons of water into low-lying areas of downtown Pittsburgh. The event 'fingerprint' is now stored in the Event Monitor's Plant Library allowing the water utility to identify future water line breaks before they occur.

Water Security and Water Quality

GuardianBlue's dual-benefit ability to detect, alert and classify deadly threat contaminants as well as detect, alert, classify and learn real-world events makes it the most comprehensive water distribution security system available today.

GuardianBlue allows water utilities to improve water quality, streamline plant and system operations, reduce system maintenance costs, comply with environmental and quality control requirements, increase customer satisfaction, and ultimately provide real-time notification of intentional or accidental contamination.

Whether you're dealing with a terrorist attack, a broken water main, or an event no one has ever seen before, you can count on GuardianBlue to alert you to it first.



WATER IS OUR MOST IMPORTANT ASSET AND OUR MOST VULNERABLE.

Whether it's the possibility of intentional contamination from terrorists or identifying aging pipes among the thousands of miles of water lines, the challenges water utilities face in the 21st century are daunting.

Water distribution security

Until 9/11 the challenge of detecting intentional contamination of our nation's drinking water system wasn't given much thought. However the tragic events of that day irrevocably changed how the industry perceives drinking water security. Today the terrorist threat to the nation's infrastructure is no secret.



- In 2002 members of Al Qaeda were arrested in Rome, Italy while in the process of orchestrating an attack on the water distribution system in the area of the US embassy.
- In 1999 two juveniles poured a "bright red substance" into a city's water supply forcing the water treatment plant to shut down, denying service to area residents.



Unfortunately, it's a common misperception that gates and fences can protect our drinking water. In fact, these physical security measures do little to protect drinking water once it's entered a distribution system. It would take little more than a trip to a local hardware store to find the equipment necessary to initiate a backflow attack.

Today, water utilities are responsible for securing the nation's drinking water. GuardianBlue can help. It is the most comprehensive water distribution security system available today, providing real-time notification of intentional or accidental contamination in water distribution systems.

Hach's scientists and engineers are the authority on water distribution and security. Chief Scientist Dan Kroll's book, "Securing Our Water Supply: Protecting a Vulnerable Resource," is one of the foremost studies of the threats to our water infrastructure and the ways to protect drinking water. Available now.



Water distribution quality



The demand for drinking water is high; the average American uses 160 gallons of water every day. And delivering it is no easy task; water travels through more than 54,000 water distribution systems in the U.S.

Today however, many distribution systems rely on an aging infrastructure. With pipes in many major cities reaching more than 60 years of service, thousands of miles of pipes will need to be replaced in the next five to ten years. Over the next 20 years, it's estimated that between \$492 billion and \$820 billion will be needed to replace worn-out pipes and equipment.

Ensuring water quality will be a major challenge for water utilities across the country. This is why the EPA has passed regulations and guidelines to ensure the consistent quality of the nation's drinking water.

- The DBPR phase 1 and 2 were designed to improve public health by minimizing exposure to disinfectant byproducts that are believed to cause cancer.
- LT 1 and 2 were designed to minimize exposure to cryptosporidium.
- The Lead and Copper Rule was designed to minimize lead and copper in the distribution system mostly by reducing water corrosivity. Lead and copper enter the water primarily through the pipes, plumbing material and aging infrastructure.
- The Total Coliform Rule was designed to minimize fecal pathogens.

Today, water utilities must comply with these regulations in order to meet the nation's standard for drinking water. GuardianBlue can help by providing insight into water distribution systems. Now cities can adhere to EPA regulations while ensuring safe drinking water.



EVENT MONITOR



The Event Monitor contains Hach's patented water security algorithms and is the brains behind GuardianBlue Early Warning System. It integrates multiple sensor outputs from GuardianBlue's Water Panel and TOC Analyzer. Every 60 seconds the system's patented algorithm analyzes deviations in five water quality parameters and uses the measurements to calculate a site's water quality baseline. The system alarms when the trigger signal exceeds a user-set threshold, indicating a water quality deviation from the system's normal operating baseline parameters.

Agent library

The Event Monitor is equipped with a SAFETY Act designated and certified Agent Library which contains fingerprints of a wide variety of threat contaminants, ranging from cyanide and anthrax to arsenic and pesticides. The Agent Library provides the Event Monitor with the ability to classify contaminants that are nearly impossible to identify using current water quality monitoring techniques.

Customers will be able to update their Agent Library with new fingerprints through a subscription service when they are approved and released by Hach HST, allowing water utilities to take advantage of the latest research and development.

Plant library

If a water quality deviation fingerprint cannot be found in the Agent Library, the Event Monitor is also equipped with the Plant Library which allows GuardianBlue to detect, alert, classify and learn real-world events such as water main breaks and caustic overfeeds in water distribution systems.

Because every water system is unique, the Event Monitor calculates an operating baseline for each monitoring site. Anytime there's an unrecognized water quality event exceeding the user-set trigger threshold, the event's fingerprint is stored in the Plant Library. Water utility managers can label plant events by name and severity level, allowing recognition of recurring events and decreasing the frequency of unknown events.

Greater visibility into your water system

By allowing water utilities to identify 'normal' operational fluctuations, the Plant Library gives water utilities greater understanding and control over their water system by allowing them to streamline operations, reduce costs and labor, and maximize efficiency.

Specifications

Alarms	Trigger signal alarm, High/Low parameter alarms, Frozen parameter alarm, Sensor off-line alarm
Power Requirements	115 Vac, 100 W
Operating Temperature	5 to 40°C
Storage Temperature	-20 to 65°C
Humidity	95% at 40°C max
Environmental	Industrial grade, splashproof, designed to IP62
Communications	RS485 MODBUS®
Dimensions	18" high x 20" wide x 15.5" deep (46 x 51 x 39 cm)
Weight	65 lbs (29 kg)
Enclosure Material	316 Stainless steel
Mounting	Wall mount or rack mount
Display	15" touch screen
Certification	Listed to UL 1010 by ETS
Instrumentation	Interfaces with Hach WDM Panel; astroTOC UV On-line TOC Analyzer; Hach Sigma All-Weather Refrigerated Autosamplers

WATER PANEL

The GuardianBlue Water Panel is Hach's most robust and comprehensive water quality sensor and an integral part of GuardianBlue Early Warning System.

GuardianBlue's Water Panel monitors and detects deviations in water quality by continuously measuring six commonly tested water quality parameters:

Chlorine- CL17 Chlorine Analyzer

Every 2 ½ minutes the instrument obtains a sample, applies a DPD colorimetric method based on an approved USEPA method and gives either a free or total chlorine reading, depending on the reagent in use at the time. You want adequate chlorine residuals to provide a first defense against microorganism contamination, yet excess chlorine can form DBPs in the network.

Turbidity- 1720E Turbidimeter

Continuously flowing sample enters the turbidimeter body and flows through a bubble trap designed to vent any entrained air bubbles from the sample stream. Turbidity is measured by directing a beam of light from the sensor assembly into the sample in the turbidimeter body and measuring the scatter light at 90 degrees with a photocell. The amount of light scattered is proportional to the amount of turbidity in the sample. Corrosion products and biogrowth can elevate the turbidity level in the distribution system above that of the plant effluent. The "E" uses USEPA approved method 180.1.

pH and Conductivity Probes from GLI

A patented differential pH measuring sensor provides information on the acid/base nature of the water. A two electrode conductivity sensor measures the total ionic concentration in the water.

Temperature

Temperature is measured to ensure the probes are measuring correctly and for other generic water quality information.

Sample Pressure

The sample pressure is measured to ensure the sample going to the panel is within the specified range.



These measurements are sent continually via digital transmission to the Event Monitor. The Water Panel is small, light and easy to use. The panel is even small enough to fit down a manhole. The newly designed sensor manifold eliminates flow meters and makes calibrations more convenient and efficient for operators.

The Water Panel is comprised of several of Hach's premier water quality sensors including the CL17 Chlorine Analyzer, 1720 E Turbidimeter, and GLI pH and Conductivity Probes.

Specifications

Solution Types Drinking water, raw and treated <i>Parameter Ranges</i> pH Conductivity Turbidity Chlorine Pressure Temperature	0 to 14 0 to 2000 µS/cm 0.01 to 100 NTU 0 to 5 mg/L 0 to 150 PSI -20 to 200°C
System Specifications Controller Sensor Type(s) Sensor to Controller Distance	sc1000 Digital output 1000 meters, per RS 485
Mechanical Mounting Options Process Connections Sample Inlet Sample Drain Sampler Connection Weight Dimensions Cleaning Method Sample Temperature Rating Sample Pressure Rating Min/Max Flow	Wall or rack mounting 1/2" OD tubing or 3/8" NPT 3/4" NPT or hose barb 1/4" NPT connection on inlet manifold 65 lbs 22" X 51.5" Damp cloth 5 to 40°C 20-125 psi (if your sample pressure is higher than 125 psi, use the optional pressure regulator accessory Prod. No 6846600.) 400-600 mL/min
Enclosure (optional) NEMA Rating Mounting Options	NEMA 4X Wall or rack mounting
Electrical Power AC Voltage Range Max Power	115/230 VAC, 60 Hz for line powered instruments (CL17) 90 VA Max for CL17, 30 VA Max for theother electronics
Display	sc1000 controller display module
Communication Type Protocol	RS485 MODBUS

TOC ANALYZER



The TOC Analyzer is one of Hach HST's most sophisticated water quality sensors. It greatly enhances the detection and classification capabilities of GuardianBlue Early Warning System.

When combined with the Water Panel, the TOC Analyzer exponentially increases the system's sensitivity to organic chemicals, creating one of the industries most unique and innovative early warning systems. Total organic carbon is a crucial part of the fingerprint structure.

The TOC Analyzer combines chemical and ultraviolet oxidation techniques in a low-temperature reactor to deliver direct TOC measurements. It uses a multi-staged UV oxidation reactor and a chemically impervious non-dispersive infrared (NDIR) CO₂ detector system, assuring full compliance with Standard Methods 5310 C and EPA method 415.1.

In the first analysis step, the sample is mixed with acid, converting the total inorganic carbon (TIC) into CO₂. The TIC sparger removes all the CO₂ from the sample solution. Subsequently, the TIC-free sample is mixed with sodium persulfate and routed through the UV reactor, oxidizing the TOC into CO₂. The gas/liquid mixture is transported by the carrier gas into the gas-liquid separator (GLS), where the sample gas is separated and diverted into the NDIR detector for the direct, interference-free CO₂ measurement. The resulting CO₂ concentration measurement is directly proportional to the original TOC concentration found in the sample. The front panel displays the TOC concentration in mg/L.

Specifications

Range	0-25 mg/L TOC
Accuracy	±2% of full scale at 25°C (77°F)
Repeatability	±2% of reading at 25°C (77°F)
Minimum Detection Limit	0.015 mg/L at 25°C (77°F)
Response Time	8 minutes (includes TIC sparging)
Inlet Pressure	0.15-6 bar (2-87 psig)
Flow Rate	25-200 mL/min
Sample Temperature Range	2°C to 70°C (36°F to 158°F)
Operating Temperature Range	5°C to 40°C (41°F to 104°F)
Drain Connection	1 1/2-inch OD standard drain pipe
Sample Inlet/Outlet Connector	1/4-inch OD tube, compression fitting
Carrier Gas	1/8-inch OD tube, compression fitting, clean, CO ₂ -free air or nitrogen at 2.8-6.2 bar (40-90 psig)
Enclosure	Cold Rolled Steel epoxy powder coated Optional Stainless Steel
Dimensions	Approximately 981 mm (38.6 inches) tall, 675 mm (26.6 inches) wide, 220 mm (8.7 inches)
Mounting	Wall mount or rack mount
Shipping Weight	120 lbs. (54 kg)

PURGE GAS GENERATOR
(TO BE USED WITH TOC ANALYZER)



The Purge Gas Generator is a crucial component to maintaining the stability and continual operation of GuardianBlue's TOC Analyzer. The Gas Generator eliminates the hassle, safety risk and ongoing expense of high-pressure gas cylinders.

- Produces ultra-dry, CO₂-free air to less than 1 ppm purity
- Eliminates the trouble, safety risk and ongoing cost of gas cylinders
- Flow capacity to 1 lpm at operating pressures up to 100 psig (user controlled)
- Easy to install, fully automatic and requires limited maintenance on a quarterly basis

Ambient air is drawn through two particulate filters before being compressed to over 100 psig by the oil-less piston compressor. The hot compressed air is then cooled through a radiator-type heat exchanger cooling the compressed air and condensing out moisture. The condensed water and any remaining fine particulates are automatically removed by the particulate/coalescing filter assembly.

The remaining water vapor and carbon dioxide in the compressed air are removed by the miniature gas generator utilizing the Pressure Swing Adsorption (PSA) technology. The ultra-dry, CO₂-free air is then stored in the tank until it is sent to the TOC Analyzer via the flow control valve and pressure regulator-filter assembly.

Specifications

Outlet CO ₂ Concentration	<1 ppm
Outlet Dewpoint	-100°F
Max Outlet Flow Rate	1 lpm at 100 PSIG operating pressure
Operating Temperature	32 to 122°F
Operating Humidity	<95% non-considering
Dimensions	18" W x 13" H x 19" D
Shipping Weight	50 lbs.

Outlet Connections	1/4" female or 1/8" tube
Power Options	120 Volt / 1 phase / 60 Hertz
Filtration	- 5 um particulate filter with auto drain - 0.01 um coalescing filter with auto drain - 5 um particulate filter-regulator assembly
Compressor Type	Oil-less piston
Tank Size	4L (1.1 Gal.)
Duty Cycle	100%

AUTOMATIC SAMPLER



The Automatic Sampler is an integral part of the GuardianBlue Early Warning System.

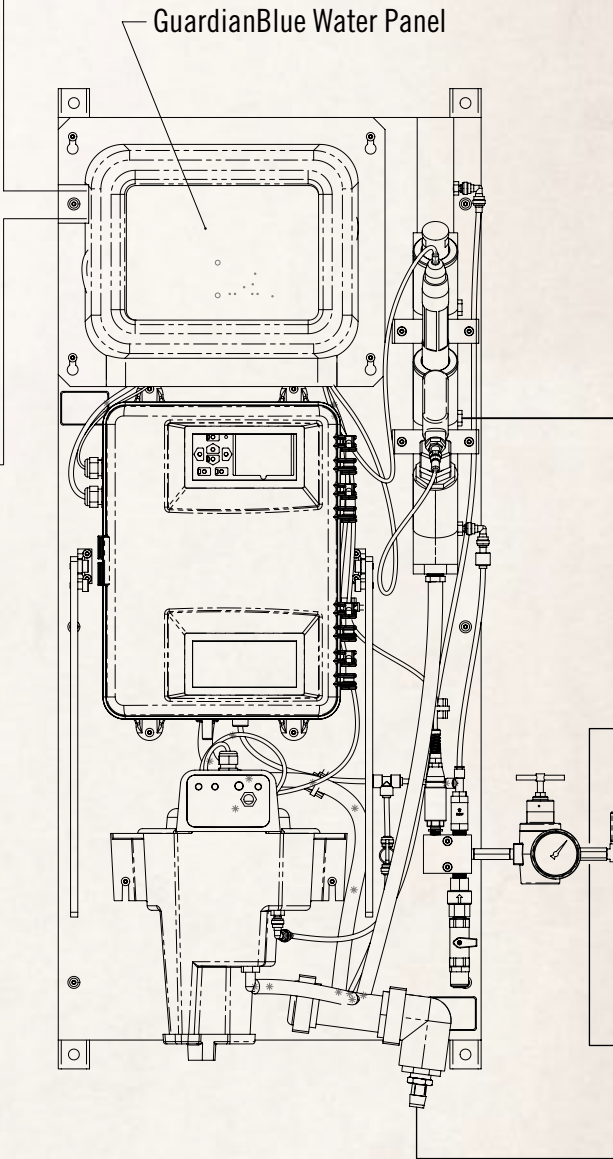
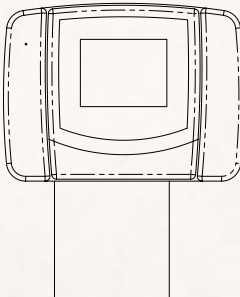
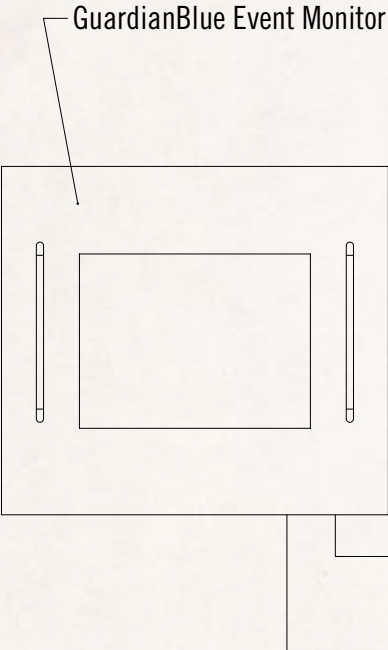
When the Event Monitor triggers on significant water quality deviations, it instantly signals the Sampler to capture a real-time water sample at designated monitoring locations. This allows water utilities to conduct additional forensic analysis and testing on actual water samples, prior to initiating an Emergency Response plan.

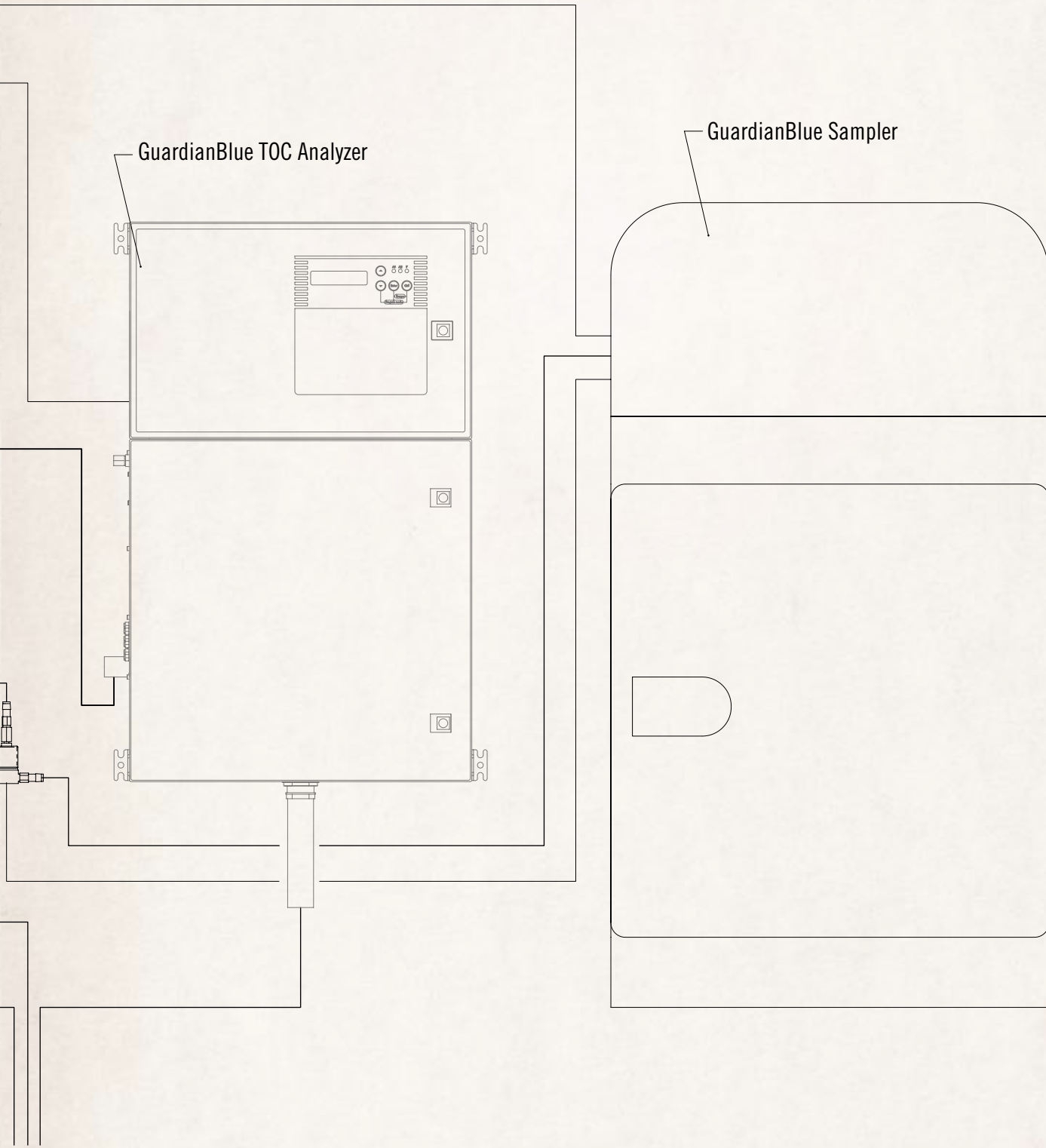
The GuardianBlue Early Warning System uses the Sigma 900 Max All-Weather Refrigerated Sampler to ensure maximum flexibility and dependability and allow water utilities to meet all sampling requirements.

Specifications

Dimensions	Width 28" (71 cm), Depth 28" (71 cm), Height 49" (125 cm), Weight 175 lbs. (79 kg).
Sample Containers	Polyethylene: (24) 1 liter (other sample containers available)
Power Requirements	115 VAC, 60 Hz (230 and 100 VAC optional). Compressor Running Amperage 1.5-2.0 A. Locked rotor current 12 Amps. Overload Protection: 5 amp DC line fuse for Pump, 1 amp DC line fuse (AC power converter); Compressor: thermal overload relay opens at 230°F (110°C).
Sampler Enclosure	Controller Housing: high impact injection molded ABS; submersible, watertight, dust tight, corrosion & ice resistant; NEMA 4X,6 Sampler Housing: fiberglass reinforced plastic with beige, UV-inhibited, polymer laminate.
Sample Cooling	Refrigeration: Top mounted compressor and fan-forced air cooled condenser; 3-sided wrap-around evaporator plate; 2" rigid foam insulation; microprocessor controlled thermostat maintains sample liquid at 4°C (1°C); frost free; non-CFC R134A refrigerant; compression gasket door seal; refrigeration components and plumbing are corrosion protected with conformal coating. Recovery Time with door open: 1 min. in 75°F (24°C) ambient and 4°C sample temperature, 5 minutes. Pull Down Time: from 75°F (24°C) to 39°F (4°C), 15 minutes.
Temperature Range	General use: -20° to 122°F (-29° to +50°C); with optional controller compartment heater, -40° to 122°F, (-40° to +50°C). Liquid Crystal Display: operating -14° to 158°F, (-10° to 70°C); storage -40° to 176°F, (-40° to 80°C).

GUARDIANBLUE SYSTEM DIAGRAM





GuardianBlue TOC Analyzer

GuardianBlue Sampler

HACH COMPANY WORLD HEADQUARTERS • P.O. BOX 389 • LOVELAND, COLORADO 80539-0389 • USA
TELEPHONE: 800.604.3493 • FAX: 970.669.2932 • EMAIL: ORDERS@HACH.COM • WWW.HACH.COM



Homeland Security Technologies
