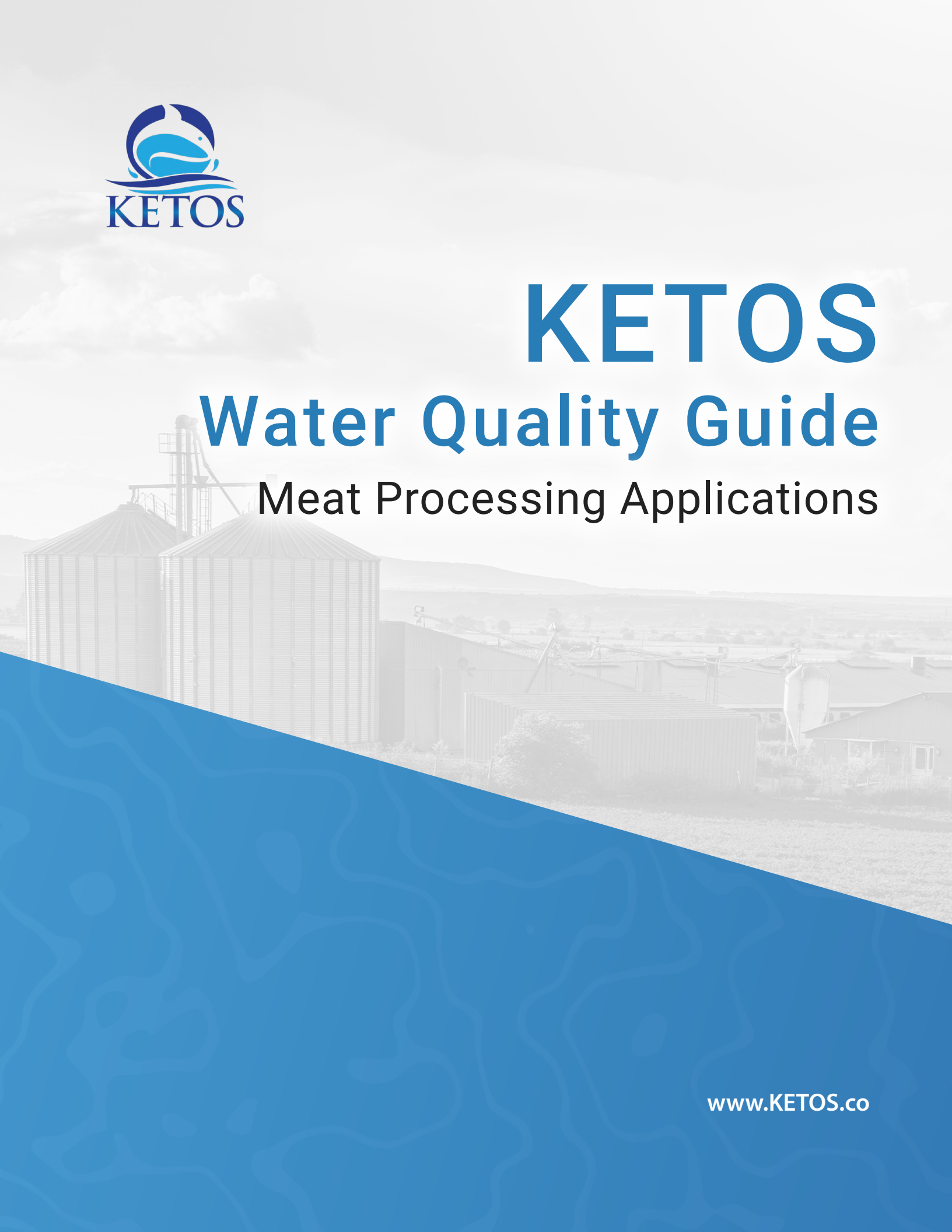


KETOS

Water Quality Guide

Meat Processing Applications

www.KETOS.co

KETOS

Industry Factsheet

FACT SHEET

Meat Processing Industry

Water in meat processing is used for a variety of purposes, including chilling, scalding, washing, cleaning, and waste removal/conveying. As the final product is to be consumed, stringent regulations surround the slaughtering, cleaning, and processing of meat products.

Meat Processing and Water Usage

Water usage to process animals can add up, with an average of 3.5 to 23 gallons/bird (chicken or turkey) and an average of 150-450 gallons/animal (beef). However, when water conservation efforts are adopted, usage can be drastically lowered. In one beef processing operation, for example, water usage was cut from **458 gallons/animal to 187 gallons** once water saving measures were adopted.

Meat Processing and the Environment

When it comes to ensuring the safety and quality of the final product, the quality of water must be monitored to avoid cross contamination and to remove harmful elements from coming in contact with the product itself. However, effluent water leaving processing plants must also be free of contaminants to ensure the surrounding environment or neighbouring communities are not subject to water quality issues.

KETOS: Solving Meat Processing Water Challenges

As a company built on the ethos of conserving water and ensuring the safety of water resources, KETOS is uniquely positioned to assist meat processing operations so that they can ensure the quality of processed meat products. With a unique $0-CAPEX business model and a modular design, KETOS can be placed strategically within operations to monitor for dozens of parameters.

Monitoring is lab-accurate and measured at ppb for precise readings of nutrient levels, pH, dissolved solids and more.

Autonomous testing
(set scheduled tests to meet your organization's unique requirements)

Lab-accurate results
(results range from +/-3% to +/-10% of what a NECLAC lab offers)

Interoperability
(easily plug KETOS into existing technology and infrastructure to centralize data effectively)

Simple analysis
(data collected is compiled in an easy to digest format to help operators read and react to data)

Modular hardware
(allowing companies to monitor from multiple strategic locations at once)

KETOS aims to take the mystery out of analysis by providing customizable dashboard to make reading and reacting to information fast and simple. Users can also set threshold alerts and can monitor water quality in real-time for more effective nutrient application and prevention of contamination of crops which leads to higher yield, healthier plants, and tastier products.

KETOS

SHIELD Whitepaper

WHITE PAPER

Next-Gen Water Monitoring Autonomous and Real-Time Results

KETOS

Background

Municipal, commercial, and industrial water users all face a common issue - how to monitor the quality of the water they use, dispose of, or distribute in a timely, cost-effective manner.

The two common methods determining water quality are the use of grab samples with analysis by internal or external (contract) laboratories or online monitoring for specific contaminants/constituents.

Challenges with Traditional Water Testing Methods

- Typically detect only a few parameters
- Models that are capable of measuring more parameters are costly
- Unable to detect heavy metals
- Time & cost of maintenance, labor, cleaning, & connectivity

Online monitoring and handheld probes have been used for decades to monitor water quality. There are dozens of companies that produce online systems covering many different water quality parameters, primarily environmentals like pH, conductivity, total dissolved solids, turbidity to name a few including individual constituents, multi-parameter approaches, and bulk water quality. However, There has not been a system on the market that detects a combination of several inorganics, environmentals, nutrients and heavy metals.

Typically, only five or six parameters are measured with a single system such as handheld probes or online analyzers for single parameters like chlorine or silica. In addition, it has not been possible to detect heavy metals through online analyzers, and water operators have defaulted to lab analysis as a result.

Typically, the more parameters that are included, the more costly the instruments. In addition to the instrumentation, organizations must account for maintenance and service contracts, in-house labor to maintain device calibrations, instrument cleaning, and ongoing consumable purchases based on the frequency of testing making the entire process cost prohibitive. On top of the equipment and maintenance costs, connectivity fees are often incurred when connecting the device output to supervisory control and data acquisition [SCADA] systems — not to mention the cost (time or resource) associated with the data modeling, analysis, and reporting.

WHITE PAPER

Next-Gen Water Monitoring Autonomous and Real-Time Results

Here's The Problem with The Current Method

Grab sampling and online monitoring often fail to achieve important goals for the user. When collecting grab samples, personnel must travel to the collection point, collect the sample, fill out chain of custody forms, then (if applicable) ship the samples to the contract lab where receiving personnel unpack the samples, log their arrival, and then place them in a sampling queue prior to analysis.

Depending on the lab used and analysis required, the results may not be available for days or weeks, making the data unavailable for use in real-time decision making or process control and making it error prone.

Initial Cost of Online Monitor

+

Cost of Upkeep

+

Cost of Maintenance

=

Expensive Data Points

Grab sampling and online monitoring often fail to achieve important goals for the user. When collecting grab samples, personnel must travel to the collection point, collect the sample, fill out chain of custody forms, then (if applicable) ship the samples to the contract lab where receiving personnel unpack the samples, log their arrival, and then place them in a sampling queue prior to analysis.

Depending on the lab used and analysis required, the results may not be available for days or weeks, making the data unavailable for use in real-time decision making or process control and making it error prone.

KETOS SHIELD Solution

The KETOS SHIELD is a smart water management solution that provides operators with lab accurate results on dozens of parameters including heavy metals, inorganics, and nutrients from a single IoT (internet-aware) modular system. The design philosophy of the KETOS SHIELD has been focused on addressing these fundamental problems lurking in the industry for customers:

WHITE PAPER

Next-Gen Water Monitoring Autonomous and Real-Time Results

- Ability to have a fully automated system that doesn't require manual cleaning, calibration, or maintenance on a daily/weekly basis.
- Precision, sensitivity and data accuracy comparable to 3rd party labs certified as per NELAC standards so that users can leverage the data for applications such as process control, nutrient management, drinking water safety or water reuse.
- Ability to have the data analyzed with actionable insights so users can leverage it in a meaningful manner where it combines a variety of siloed data with the flexibility that's advantageous to the user.

While the underlying scientific principles used to develop the SHIELD technology have been adapted from EPA compliant and defined methodologies, KETOS has conducted extensive research and proprietary development to advance these approaches and allow for the real-time detection, transmission, and analysis of multiple analytes within a single platform. A patented and proprietary robotic system maps the samples to the appropriate methodologies within the SHIELD system. To ensure 10)% automation, mechanisms are in place to ensure 0% data drift while conducting self-calibrations and cleaning within the system. Sample response times are rapid and average 30sec-60sec for environmental & physical parameters. For heavy metals, inorganics, and several nutrients, the samples can be measured every 15 to 30 minutes — depending on the constituent.

In addition to the measurement components, the SHIELD system is coupled with an enterprise-grade cloud-based software analytics platform that can assimilate its own live data along with 3rd party data. Since the SHIELD System allows for unlimited testing, users can configure testing frequencies and receive real-time, actionable, and predictable intelligence with no bearing on solution cost.

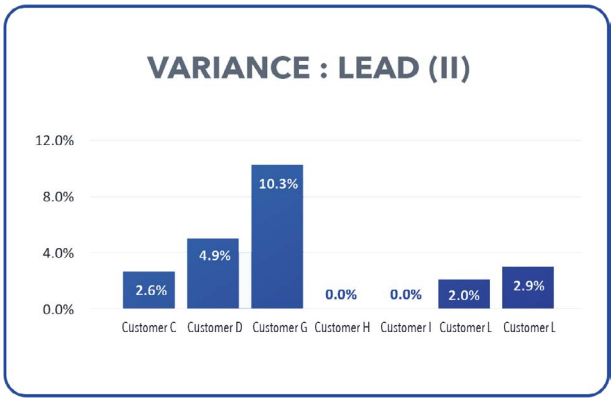
The KETOS SHIELD solution solves for many of the common challenges that operators face. It is autonomous and eliminates the need for grab sampling, manual calibration, and routine system cleaning — without compromising the accuracy, precision, sensitivities demanded for 3rd party validation as per NELAC Lab standards.

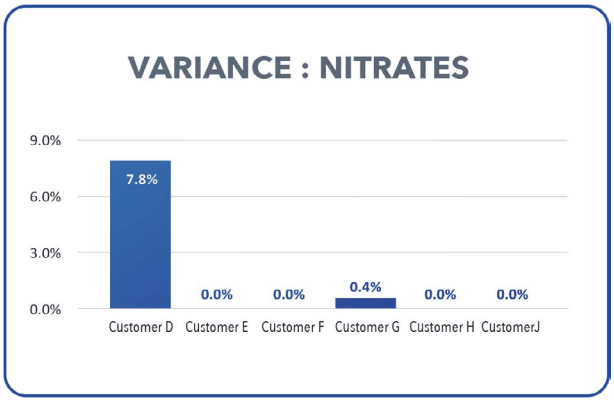
WHITE PAPER

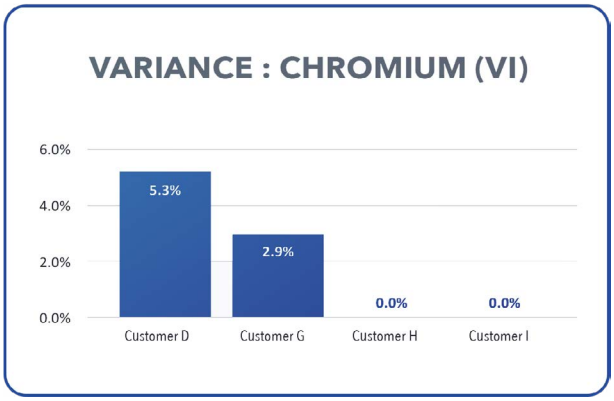
Next-Gen Water Monitoring Autonomous and Real-Time Results

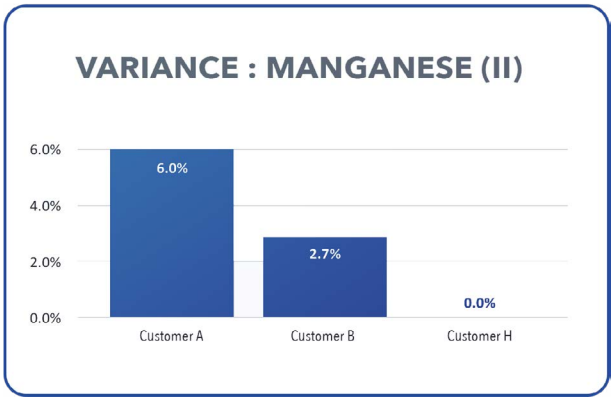
Third Party Lab Validation

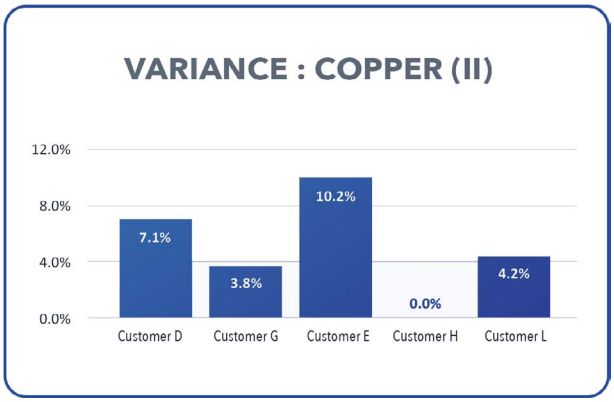
The KETOS SHIELD has undergone extensive 3rd party validation for a variety of analytes. The below graphs show randomly selected examples of analyte tests at various customer installation sites.











Each KETOS Shield sample was validated by a 3rd party lab using several analytical methods including:

- Colorimetric (EPA 352.1)
- Colorimetric (EPA 7196A)
- FAAS (EPA 7000B)
- IC (E300.1)
- ICP-MS (E200.8)
- Spin Touch ™ (Colorimetric)

Next-Gen Water Monitoring Autonomous and Real-Time Results

Operation Of The KETOS SHIELD

Water is supplied to the SHIELD through a 0.25-inch side stream, with at least 20 psi pressure and more than 1 lpm flow. The sample line includes a small 40-micron physical filter upstream at the inlet to remove sediments and prevent them from entering the system. The dimensions of the system are 25 inches long x 16 inches wide x 17,6 inches tall, and it can detect a variety of water sources like surface water, treated water, produced water, ground water, irrigation water and can conduct live calibration as needed.

Once the water enters the system, sub-samples are routed to different internal modules where they undergo customized analysis using procedures adapted from USEPA methods. No preparation or digestion is required. In addition, the SHIELD self-cleans and self-calibrates between samples.

For several water quality parameters, the system measures and records results in as little as 60 seconds. For individual parameters (metals, inorganics, and nutrients), sample frequency can be as little as 10 minutes; typically, samples are measured one to four times per day, but can be set to a higher frequency by the user if they chose to do it hourly.

The system's ability to securely communicate bi-directionally and interact with a user provides several benefits such as scheduling tests weeks in advance, remotely controlling all aspects of the system health, and building water safety grid networks at scale. The solution also allows for easy integration into the customers' data management and/or SCADA systems depending on the holistic architecture and the customer's data strategy needs.

Next-Gen Water Monitoring Autonomous and Real-Time Results

A Cost-Effective and Time-Effective Plan

The KETOS SHIELD solution is offered as a complete end-to-end service for a flat fee. This reduces the complexity of having multiple vendors and integrators for hardware, communications, software, and maintenance. Outside of the monthly cost, there are no additional costs to the customer — whether they use the SHIELD system for one sample per day or operate it in a continuous mode.

The annual plate service fee covers the following for the complete contract term:

- Hardware Lease
- Warranty
- Replacement Parts & Consumables (as needed)
- Maintenance
- Cellular or Local Customer Network Setup
- Cellular connectivity charges
- Cloud hosting and storage management
- Enterprise-Grade, Interactive platform access for real-time alerts
- Actionable analytics w/location-based mapping
- Unlimited user licenses within an organization
- Role based access for secure control of data
- Remote 24x7 Monitoring
- 8x5 Normal Business Hours Support
- Unlimited software upgrades included
- Modular adds to the system of roadmap parameters
- Unlimited testing/sampling (as supported by the site)
- Access to Online Platform (web portal)/Mobile

Sample Case Study

In high-frequency testing scenarios, the Shield solution can dramatically reduce the cost per sample. The Shield solution can be configured to operate in continuous mode or with a scheduled number of samples per day. Thus, for a utility measuring six parameters (pH, Conductivity, Total Dissolved Solids, Salinity, Dissolved Oxygen, Temperature)at one-minute intervals and 9-10 parameters (Arsenic, Cadmium, Calcium, Chromium, Copper, Nitrates, Total Hardness, Free Chlorine, and Residual Chlorine) measured twice per day. Using this sample schedule and the monthly cost of the Shield, the sample cost can be calculated at ~$0.01 per sample.

The savings are 50x of an online analyzer or 500x the savings of a lab comparison.

KETOS

Case Study

CASE STUDY

Proactive Water Monitoring in Real-time and Maintaining Compliance with the KETOS SHIELD

Fortune 500 Food Company Leverages the KETOS SHIELD to Stabilize Water Quality, Reduce Chemical Costs, and Ensure Compliance with Proactive Water Quality Monitoring.

Background

A leading global food producer, this Fortune 500 company serves customers in 100 countries across six continents. It is the number one beef and poultry producer in the world - and the number two pork producer globally.

The KETOS SHIELD was installed at various production locations across the United States to monitor water quality parameter levels critical to compliance and overall process control.

Challenge

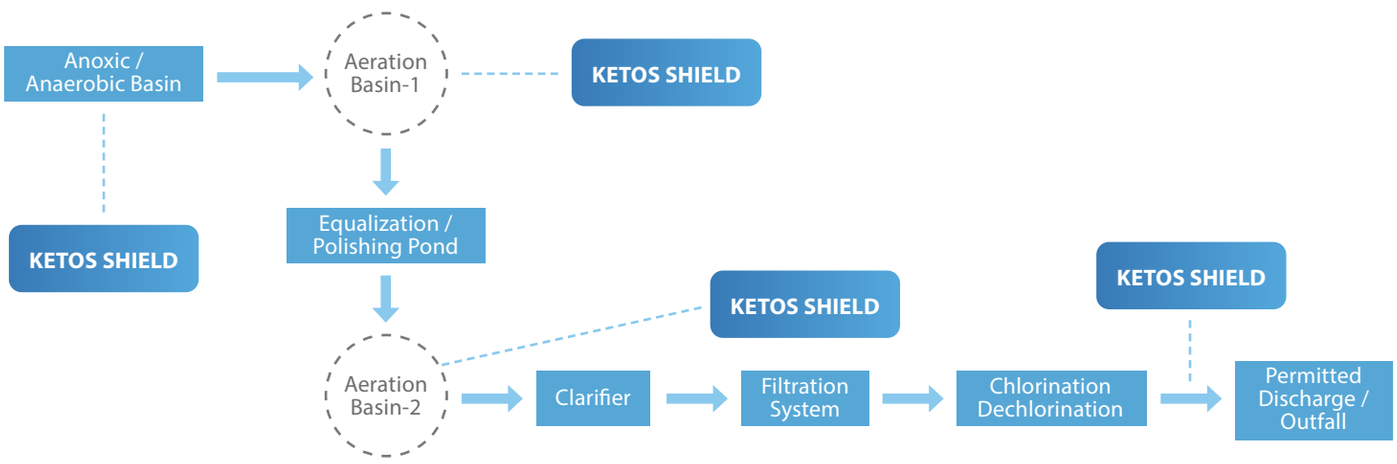
The existing water treatment process was a multi-step process that included an anoxic/anaerobic basin, two aeration basins, an equalization/polishing pond, clarifier, filtrations system, and chlorination - dechlorination. For a variety of reasons, like weather events, for example, dramatic swings in water quality were not uncommon.

To monitor water quality, the team used traditional testing methods including handheld devices and lab tests. As a result, operators could only act as quickly as they had access to data which meant waiting days or weeks for lab results, or it required an operator to be on-site to test the water with a handheld device. Since the location was not staffed 24/7, events that took place during off-hours or weekends created a particular challenge. Unfortunately, because the team used traditional testing methods the team had to be reactive to sudden upsets in water quality, and they often used more water treatment chemicals than necessary which dramatically increased chemical costs and extended overall treatment times.

Additionally, the team wasn't able to proactively address potential water quality swings which put them at risk regarding permit violations and reporting.

Solution

The plant manager implemented the KETOS SHIELD and the KETOS Smart Water Intelligence Platform at four different points in the treatment process (see image below) including, the anoxic/anaerobic basin, both aeration basins, and post chlorination - dechlorination stages.



The KETOS Solution was configured to automatically test the following parameters at varying intervals and provide real-time insight into each of these parameters 24/7.

Every 60 Seconds	Three Times Daily
Total Dissolved Solids (TDS)	Nitrates-N
Temperature	Orthophosphates-P
Conductivity (EC)	Silica (Dissolved)
Salinity	Boron (Dissolved)
pH	Alkalinity
Dissolved Oxygen (DO)	Total Ammonia Nitrogen
Oxidation Reduction Potential (ORP)	

Of particular importance were Nitrates, DO, ORP, pH, and Alkalinity. Stable levels across each of these parameters was critical to maintaining optimal process control and efficiency across the entire treatment process. Targets for critical parameter measurements were:

- **Nitrates** - Zero NO3 leaving the basin
- **Dissolved Oxygen** - Needs to be low to maintain an anoxic environment
- **ORP** - Should be -50 mV
- **pH** - Balance important to maintain processes
- **Alkalinity** - Maintain steady alkalinity levels

In addition, the KETOS software platform was configured to provide threshold- based alerts in real-time (via email or SMS) if any of these measurements reached unacceptable levels.

SHIELD Installation Location:
Aeration Basin #1

Benefit/Outcome

After installing the KETOS SHIELD and configuring the KETOS Smart Water Intelligence Platform, operators benefited from 24/7 insight into critical water quality parameters.

Rather than waiting days or weeks for lab results, or relying on labor-intensive processes like manual sampling, the team can monitor water quality remotely and receive threshold-based alerts in real-time when water quality measurements exceed acceptable levels. Now operators can be proactive in how they address water quality issues.

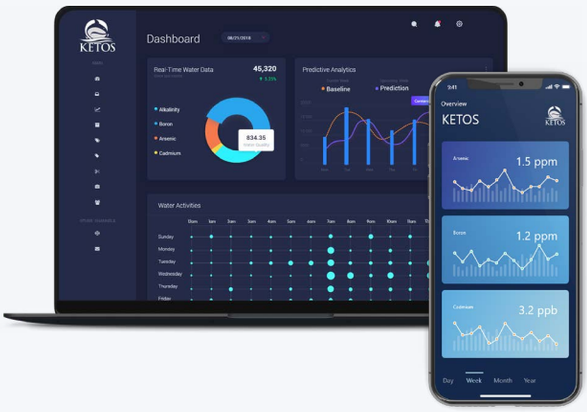
For example, in the first 40 days after installation, the SHIELD ran over 1,000 hours and saved 120 hours of manual sample collection time, In addition, the team identified several variances that would not have been not been caught with prior testing intervals and methods including:

- Two NO3 spikes 10 - 20x higher than average levels
- Three DO spikes >3 mg/L from the 0 mg/L maintenance value
- Two Alkalinity spikes that read over 2x of stable values

Because the SHIELD identified these spikes in real-time, the team was able to proactively optimize chemical treatment and reduce chemical spend by more than $100,000.

Understanding variances from one step to the next, also helps operators be better prepared for subsequent treatment steps - saving them the time and cost associated with prior methods. As a result, the overall efficiency of the process improved and the team is now able to ensure water sent to the city is below permit levels.

Finally, the SHIELD is also now installed in several other locations and as those devices come on board, operators and management will have a comprehensive, real-time view of the entire system all in a single dashboard.



About KETOS

KETOS is a fully integrated platform that combines hardware, software, connectivity, automated reporting, predictive analytics, and maintenance to automate water monitoring and testing. KETOS enables water operators to identify and solve mission-critical water efficiency and quality challenges in real-time, or before they happen through predictive algorithms, to ensure that water meets specific quality and safety standards.

LEARN MORE

Proactively Solving Problems with KETOS Analytics

REQUEST A DEMO

CONNECT WITH US