ELECTRO-CHEMICAL DEVICES, INC.

Turbidity Monitoring in Water Treatment Filter Backwashing Applications

Technical Article

Electro-Chemical Devices, Inc. | 1681 Kettering, Irvine, California 92614 USA
Phone +1-949-336-6060 | +1-800-729-1333 | Fax +1-949-336-6064

ECD Technical Article

By Steve Rupert, Product Manager
Electro-Chemical Devices, Inc.

Turbidity Monitoring in Water Treatment Filter Backwashing Applications

Filter backwashing is a critical part of the drinking water production process (Fig 1). During backwashing, water flow is reversed and increased in order to flush out debris and particles. Filter backwashing has two main objectives: it extends the life of the filter, and it cleans the filter to preserve water quality.

Fig. 1. Water treatment plant

Filter backwashing needs to be performed at the proper intervals and for the proper length of time in order to maximize water treatment plant efficiency. If backwashing is performed too infrequently, filter performance is degraded and water quality suffers. However, backwashing too often or for too long a time period can lead to degraded filter performance. In addition, filter backwash uses a significant percentage of a drinking water plant's clean water supply. Monitoring for turbidity ensures the backwash cycle is performed only as necessary and that the plant's clean water output is maximized, with significant savings to plant operating costs.

In addition to clean water processing, turbidity is monitored to meet environmental guidelines for storm water run-off from construction activity. Dredging activity in lakes and rivers also creates turbid conditions that require turbidity monitoring. Wastewater from industrial processes must be monitored for turbidity as well.

Problem

Turbidity, the cloudiness or haziness of a water sample, is caused by particles suspended in the water, typically clay and silt. Since bacteria and viruses can be attached to these particles, turbidity is a critical indicator of overall water quality. Accurate turbidity measurement is the best way to manage the filter backwash process.

Measuring the turbidity of the water coming out of the filter is the best way to determine when backwashing should occur.

Electro-Chemical Devices, Inc. | 1681 Kettering, Irvine, California 92614 USA
Phone +1-949-336-6060 | +1-800-729-1333 | Fax +1-949-336-6064

A turbidity measurement is also used to monitor the progress of the cleaning process, and when the turbidity returns to a value near the turbidity of the clear well water the backwash cycle is stopped. Accurate turbidity measurement optimizes filter backwashing, optimizing drinking water plant performance and minimizing operating costs.

The filter backwashing process may begin when the effluent reaches 0.1 NTU. According to the American Water Works Association (AWWA) and the US EPA, the backwashing process should be terminated when turbidity is the in range of 10-15 NTU, which leaves enough particulate for effective ripening.

Solution

The precise, low-maintenance Triton TR8 Turbidity Analyzer (Fig 2) from Electro-Chemical Devices (ECD) is ideal for monitoring turbidity in filter backwashing systems, optimizing drinking water plant efficiency. The Triton TR8 Clear Water Sensor is ideal for all phases of drinking water processing including filter backwash. The highly accurate Triton TR8 TA operates over wide measurement range with output available in multiple units: 0.000 to 9999 FNU, or 0.00 to 3000 ppm, or 0.0 to 3.0 g/l, or 0 to 20 percent. The TR8 TA sensor features an error rate of less than 5 percent of reading with repeatability greater than 1 percent of reading.

The Triton TR8's sensor features a unique multi-path optical assembly. The first pathway is inside the sensor to a reference detector that compensates for changes in the LED light source caused by aging or other variables. The second pathway has a short path length through the sample, which is best for high concentration measurements. The third pathway has a longer path length, which is best for lower concentrations.

Fig 2. ECD TR8 Turbidity Analyzer

The Triton TR8 utilizes a highly intelligent microprocessor-based design. Its sensor electronics constantly adjusts suspended solids and turbidity signal readings versus the reference detector for superior measurement accuracy. A built-in digital filter helps to suppress potentially interfering signals while self-monitoring diagnostics assure high reliability.

The Triton TR8's sensor assembly relies on a long-life near infrared LED light

Electro-Chemical Devices, Inc. | 1681 Kettering, Irvine, California 92614 USA
Phone +1-949-336-6060 | +1-800-729-1333 | Fax +1-949-336-6064

source (880 nm), and the 90-degree scattered light method in accordance with ISO 7027 / EN 27027. The sensor is factory calibrated in formazine, FNU (Formazine Nephelometric Units), and is plug-and-play ready for applications. Two nonvolatile memory banks are also available onboard to store user-initiated calibration data.

Featuring an inclined face that is oriented into the liquid flow for optimum self-cleaning, the rugged Triton TR8's sensor assembly greatly reduces plant maintenance requirements to the occasional manual sensor swiping with a soft cloth. An optional automated mechanical wiper also is available for heavy-duty service environments or for difficult-to-reach sensor locations where wiping is inadequate.

Air bubbles in the water reflect light and will interfere with the measurement. Micro air bubbles can form when a water sample is depressurized. Care must be taken to ensure the water sample at the measurement point has a higher head pressure than the incoming sample. Water siphoning out from the measurement point can release dissolved gases in the flow cell and create noisy erratic readings. If air bubbles cannot be removed from the sample then the optional wiper assembly effectively removes air bubbles that form on or cling to the optical window. The de-bubbler flow cell removes air bubbles that are entrained in the sample flow.

The Triton TR8's sensor was developed for rugged water treatment environments, and is designed to operate at ambient temperatures from -5 to 50°C (20-120°F). It withstands pressures up to a maximum of 6 bar at 25°C and 1 bar at 50°C.

The TR8's transmitter digitally communicates with the turbidity sensor and provides a 4-20 mA output and alarm relay. The TR8's controller features ECD's multi-bus architecture, with up to 2 outputs and 4 SPDT relays. It includes a configurable display and HART protocol communication is available as well. The turbidity sensor can be located up to 200 m away from the controller for ease of installation.

Conclusion

Turbidity measurement to optimize drinking water filter backwash cycles is a critical aspect of the water treatment process. Filter backwash needs to occur at the proper intervals and for the proper duration of time to preserve water quality, maintain filter integrity and conserve water resources. The Triton TR8 turbidity sensor from ECD accurately and reliably helps drinking water treatment plants to operate as efficiently as possible.

Electro-Chemical Devices, Inc. | 1681 Kettering, Irvine, California 92614 USA
Phone +1-949-336-6060 | +1-800-729-1333 | Fax +1-949-336-6064