

Lightning Strikes

And the YSI IQ SensorNet System is Still Ticking



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YSI IQ SensorNet
Application Note A628
Cedarburg, Wisconsin

The old adage is that lightning never strikes the same place twice. But if it does, the team at the Cedarburg Wastewater Treatment Plant won't be concerned about their water quality monitoring system. After all, they've seen it before, after a 2014 strike blew out one of their aerator drives and its motor, but required only a reboot of their YSI IQ SensorNet 2020 XT wastewater process monitoring system - to get it up and running again.

"It was a freak thing we'd never had any experience with before," Cedarburg wastewater operator Nick Meurer recalls of the storm, which blew through on August 19, 2014. "It was a pretty good-sized storm—it knocked out communications in one of our buildings. We had a YSI DO [dissolved oxygen] probe in the second ring of an oxidation ditch. The lightning probably struck the channel, spread across the water and collected on the probe."

Lightning bolts can pack 100 million to 1 billion volts and can heat the surrounding air up to 60,000 degrees Fahrenheit. Meurer says the voltage probably traveled from the DO probe to the controller through the network cable, temporarily knocking out the 2020 XT controller. The strike also destroyed the aerator drives in a building 50 yards away.

BACK IN ACTION

The motor and drive for one of Cedarburg's six aeration units were destroyed. But the 2020 XT controller was back up and running promptly and continued to provide reliable data without expensive repairs or replacement. It was likely electroplated during the blast, says Mark Duerr, instrumentation sales manager for Cedarburg-based Mulcahy Shaw Water, who helped the wastewater plant team design and install its YSI system.

The plant had upgraded to the IQ SensorNet a few months before the storm, Duerr says, installing the 2020 XT controller and running six new sensors into it: two optical, luminescence-based FDO® 700 IQ probes to measure dissolved oxygen; two IFL 700 IQ interface
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The FDO (optical dissolved oxygen) probe struck by lightning

Photo Credits: Mark Duerr, Mulcahy Shaw



Team member holding an FDO probe (Optical DO)

Photo Credits: Mark Duerr, Mulcahy Shaw

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sludge blanket level probes, a ViSolid® TSS (total suspended solids) probe and a SensoLyt® ORP (oxidation/reduction potential) probe. In all, the 2020 XT universal controller is capable of networking and controlling up to 20 individual channels, so Cedarburg can easily add additional measurements in the future—all that's required to expand is a new cable and probe.

By replacing traditional-style analog probe/transmitter instruments with the networked, digital IQ SensorNet system, Duerr says, the City of Cedarburg saved money on hardware. As it turns out, they also set themselves up for a quick recovery from a strike from Mother Nature.

"Entering settings into the 2020 XT is easy, Meurer adds. "It's user-friendly," he says. "The user interface of the 2020 XT is easy to navigate, especially compared to the instruments we had from the '90s and early 2000s. It's a graphic interface, it tells you specifically what you're dealing with, and there's a lot more screen to work with."

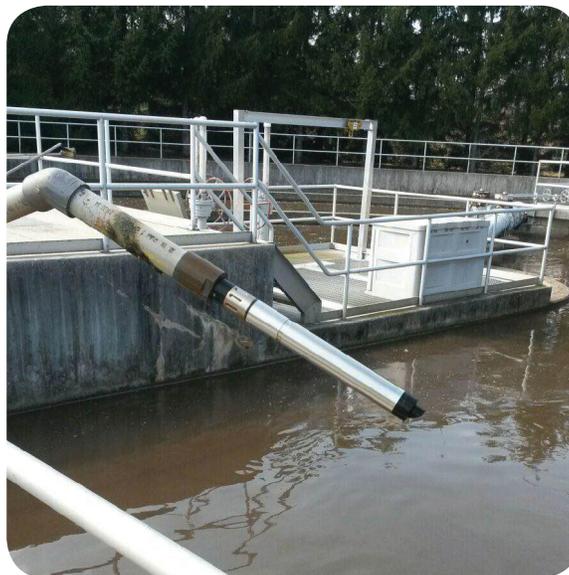
Managing the probes is easy, too. The FDO 700 uses an optical-based sensor so there are no membranes or electrolyte to replace. Instead, the probe uses a sensing cap that has a 2-year warranty. The replaceable cap on the FDO 700 probe sends its coefficients to the 2020 XT controller automatically when it is installed on the sensor probe, so there is no need for calibration or manual entry of calibration coefficients.

Additionally, the unique angled cap design eliminates interferences from aeration bubbles hitting the sensor.

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Also, since the probe is detachable from the cable, the cap can be replaced in seconds, in the comfort of a sheltered location.

In fact, Meurer says he has spent just a little extra time on the lightning-blasted DO probe, checking its calibration a couple of times since the storm to ensure that it's in working order. It's been right on target, he reports.



FDO Dissolved Oxygen Probe
Photo Credit: Mark Duerr, Mulcahy Shaw

Otherwise, the only maintenance he has had to perform on the YSI DO probes has been wiping the sensor caps and membranes with a cloth once a month and periodically changing the caps, which is called for by plant protocol when the warranties expire. (In fact, notes Rob Smith, applications engineer, wastewater process for YSI in Yellow Springs, Ohio, the sensor caps work fine after

the expiration of the warranty period until, at some point, the luminescent material becomes depleted and the probe is no longer functional. That can be verified with a simple sensor test routine. In practice, FDO 700 probe sensor caps have been known to last up to three years, he says.)

LIGHTNING-PROOFED

Despite the dramatic circumstances, the IQ SensorNet system at the Cedarburg plant performed exactly as designed, Smith notes.

YSI recognized the risks faced by probes and controllers in wastewater treatment plants, where they are typically mounted on metal handrails or steel posts and directly wired to thousands of square feet of open water.

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Smith says a fuse in the 2020 XT power supply module protects the controller, but a key element of YSI's lightning protection system is the network cable.

"The YSI network cable is not conventionally grounded—it's a 'floating ground' system," he explains. "Additionally, the conductors are wrapped in a braided metal shield, unlike the foil shields that are popular in third-party cables. That sets the standard for overvoltage protection."

The efficacy of the cable's overvoltage protection is so high that YSI IQ SensorNet systems meet European Union standard EN 61326 as long as they are installed with YSI network cable, Smith says. Duerr adds that YSI's lightning protection is unique in the industry.

The team at the City of Cedarburg's wastewater treatment plant is convinced that they're ready even if lightning does strike twice.

Duerr says the Cedarburg story is still making the rounds among amazed wastewater treatment staffers in the region. But he figures new stories will crop up soon.

"Until you see something like this happen, you say, 'what's the chances?'" Duerr notes. "But then you see it."

These systems are essentially lightning rods out there. You're always in an open tank. You're just waiting for something to happen. Sooner or later, something will."

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Many thanks to Mark Duerr, Mulcahy Shaw, for sharing this story and Steve Werblow, the author.

