Wireless guided wave radar proves best for challenging wastewater treatment applications

With partially-buried concrete pits integral to their wastewater treatment process, continual maintenance was proving to be both time-consuming as well as costly for Toray Fine Chemicals (TFC). But the main challenge for them was not upgrading the technology they used – it was how they could achieve the best results with advanced instrumentation at efficient cost.

By **Nishimura Kazuo,** Senior Business Development Manager, Japan, Emerson Automation Solutions

When the question of how to reduce costs and improve performance in a wastewater application is brought up, the answer is to use advanced instrumentation frequently. But the question remains, what kind of instrumentation should you choose to provide the best results without adding prohibitive costs?

Such a question arose at Toray Fine Chemicals recently.

Toray Fine Chemicals (TFC) in Chiba, Japan, is the only plant to produce dimethyl sulfoxide (DMSO) as well as polysulfide polymer in the country, using four partially buried concrete pits for the wastewater treatment process.

Wastewater is discharged from each manufacturing process into the pits, which is then biologically treated and discharged to the public water area while the intermediate treatment liquid remains in the pits. As the contents are waste liquid, leakage from the underground pits can contaminate groundwater and soil.

While it is difficult to detect leakage from the bottom of the pit, it's necessary to regularly check the soundness of the pits to prevent environmental damage. Thus, periodic inspections to check on

The Rosemount™ 3308 Wireless Guided Wave Radar installed over the concrete pit

the safety and soundness of the pits are required by Japanese law.

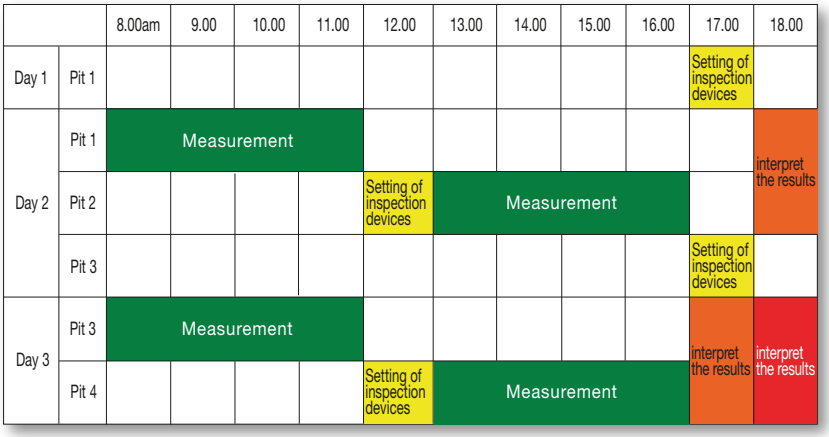
Since emptying the pits to check for abnormalities such as cracks and damage is difficult, TFC carries out regular "water logging" inspections. During these inspections, the pits are filled with water and left for some time, after which any decrease in the water level is measured using a level gauge and recorder.

Level measurement is simply about determining the position of a surface inside a tank. To be more precise, it is the determination of the linear vertical distance between a reference point – usually the base of a holding container – and the surface of a liquid, the top of a solid, or the interface of two liquids.

Precise handling of the level of liquid in a tank is important in process control, inventory management and custody transfer. In the case for TFC, process control was needed to maintain environmental protection and compliance.

During TFC's inspections, some elements of the wastewater treatment process needed to be stopped completely, which delayed production. Therefore, it's vital to carry out the inspection as quickly as possible while not incurring more costs or sacrificing accuracy.

BEFORE



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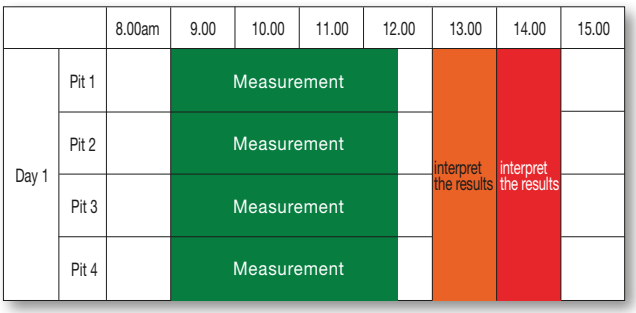

The above illustrates the inspection programme before and after the installation of the Rosemount 3308

Originally, the procedure to inspect the four pits took two full days from start to finish. But the permanent installation of the test measurement devices not only reduced preparation time, but costs as well, as inspections now only need to take place once a year.

Guided wave radar

Because level gauges and recorders had limited performance improvement and cost reduction, TFC installed guided wave radar level devices instead. Based on microwave transmission technology, the guided wave radar is only affected by materials that reflect energy; and temperature variations, dust, pressure, and viscosity do not affect its accuracy – an important factor especially in challenging applications such as wastewater pits.

The device sends a low energy microwave pulse down a probe, and when it hits the media, a significant proportion of the energy is reflected back up. The level is directly proportional to the time of flight, and because a proportion of the emitted pulse will continue along the probe down to the bottom of the tank, an interface level between two liquids can also be detected by the application, if needed.

Guided wave radar is ideal for interface applications as it relies on dielectric differences between two fluids. Examples include oil on water, oil on acid, as well as low dielectric organic solvents on present on water or acid.

However, for interface level measurements in a guided wave radar device, the factors, as shown below, should be considered:

- Lower dielectric fluid must be on the top
- Dielectric difference of two liquids must be at least six
- Upper dielectric must be known and it should be a fixed value
- For interface to be detected, the upper fluid layer must be ≥ 13 cm
- Target applications, upper layer dielectric (< 3) and lower layer dielectric (> 20)

Wireless technology

Easily installed and quickly configured, TFC fitted each tank with a Rosemount™ 3308 Wireless Guided Wave Radar Level Transmitter, and almost immediately, the guided wave radar proved to be a huge improvement over the previous test devices on account of its accuracy.

As guided wave radar devices have no moving parts, they require minimum maintenance. Moreover, because the transmitter is wireless, the original installation costs were low and their locations easily changed, if necessary.

In addition, the WirelessHART technology is unaffected by obstacles – especially important in an unpredictable environment. Designed as a self-organising network based on the IEC 62591 WirelessHART standard, the device is self-healing, secure, robust and infinitely configurable, and the mesh technology featuring a data reliability of more than 99 per cent that ensures an interoperable, adaptive, and flexible approach. For TFC, using a digital signal – rather than 4-20mA analogue – to the DCS improved the repeatability from 5mm to 2mm.

"Installation was possible in a very short time and the resulting measurement was very accurate," Kuroda Takashi, TFC, stated.

The bottom line results for Toray Fine Chemicals were impressive. Inspection time was reduced by 75 per cent, and the cost totalled to less than 50 per cent of the original analogue instrument system, resulting in savings of $9,000. The new system brought down the number of inspectors personnel hours needed from 22 hours down to five and a half hours, and minimised the downtime of the wastewater treatment facility, savings TFC an estimated $27,000 per year.

And it all depended on choosing the right instrumentation for the given application. WWA

About the author

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