APPLICATION NOTE

Water & Wastewater

Open channel flow monitoring at the outlet of a wastewater treatment plant

- Reliable measurement of volumetric flow rate of treated effluent from secondary clarifiers
- Use of 80 GHz radar level transmitters upstream of trapezoidal-throated flumes
- On-site monitoring and process control through configurable control units

1. Background

A sewage treatment plant operator in Poland discharges treated wastewater from different secondary sedimentation tanks via an open channel system at the plant outlet. The effluent is directed through twin open channels with overflows (flumes) into a single gravity line leading to adjacent waters.

2. Measurement requirements

For purposes of water balancing and plant performance monitoring, the effluent must be continuously monitored. The trapezoidal-throated flumes of the twin open channels allow volume flow monitoring in accordance with ISO 4359. The water level upstream of the flume overflow can be used to calculate the volume flow passing through the contraction of the flume. Each trapezoidal flume has an average flow rate of 600 m^3/h. Subcritical flow upstream of the flume must be maintained at all times.

The client had previously used an ultrasonic level probe for several years. The instrument had become unreliable, providing unrealistic readings that showed flow rate spikes and other irregularities that did not match comparison measurements downstream of the flumes. Fluctuating ambient temperatures and windy conditions can disturb measurement and cause ultrasonic level transmitters to fail over time. Temperature variations and atmospheric pressure always have an impact on ultrasonic level sensors and cannot be fully compensated for. The company was therefore searching for a cost-effective, yet significantly more robust and reliable alternative that would fit within the budget.

3. KROHNE solution

The plant operator opted for a combined solution consisting of the OPTIWAVE 1540 radar level transmitter and the SHD 200 control unit. The cost-effective and compact 80 GHz radar was installed upstream the trapezoidal-throated flumes. The non-contact radar features a robust PVDF housing and antenna, designed to withstand

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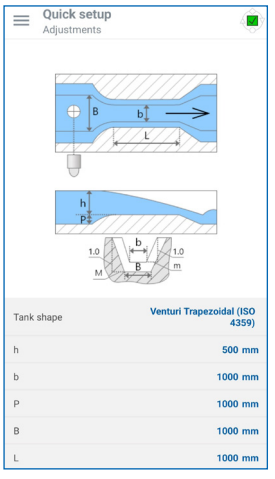
the harsh conditions present in the outdoor environments of water and wastewater treatment plants. In this application, the IP68-rated version was selected to ensure long-term durability and protection against potential flooding and heavy rainfall.

The high accuracy and repeatability of the radar makes it ideal for volumetric flow measurement in open-channel applications involving trapezoidal-, rectangular-throated and other types of flumes. The 80 GHz radar was quickly parameterised and commissioned via Bluetooth® using the user-friendly installation wizard of the OPTICHECK Level Mobile app. A template for trapezoidal-throated flume applications is already stored in the app, requiring only basic parameters such as flume size and dimensions to be entered for quick set-up. Commissioning was carried out by KROHNE service, although the app is designed to enable straightforward setup even for service technicians with limited experience in level transmitter parameterisation. Once installed, the level transmitter calculates and outputs the flow rate based on the measured overflow height. The OPTIWAVE 1540 transmits the readings to the SHD 200 control units.



Trapezoidal-throated flume template displayed in the OPTICHECK Level Mobile app

The SHD 200 is a loop-powered device that enables on-site monitoring of a wide range of measurement and diagnostic values via analogue output and HART® communication. These include the current flow rate, totalised flow, measured level distance or diagnostic values such as radar signal strength and loop current. All parameters are clearly displayed on the unit's backlit screen. The SHD 200 also offers trend graphs for selected parameters and two configurable relays for status indication, alarms or control of limit values.

Open channel flow measurement with the OPTIWAVE 1540

4. Customer benefits

The KROHNE radar level transmitter provides cost-effective and reliable monitoring of volumetric flow rates discharged from the second clarifiers. Unlike ultrasonic level sensors, the level radar is unaffected by wind and weather conditions and operates reliably even in the event of condensation. With a maximum measurement error of only ±2 mm / ±0.08 in, the 80 GHz radar offers high accuracy while remaining well within the customer's budget constraints. As with all OPTIWAVE 1540 devices, the level transmitter was delivered with a calibration certificate ex works, demonstrating its stated accuracy.

The 80 GHz radar features OPTICHECK technology built-in, providing far more than just basic measurement values. It offers a wide range of application and device diagnostics for enhanced process stability. This also includes the ability to wirelessly perform on-site verification at the push of a button, checking device health without opening the housing or working directly in the installation environment of the flumes. The SHD 200 serves as a remote local display, providing clear visibility of measurement parameters and diagnostics from a safe distance. It also enables quick response and process control in the event of threshold exceedance.

5. Products used

OPTIWAVE 1540

- Compact 80 GHz radar level transmitter for flow in open channels

SHD 200

- Control unit for 4...20 mA/HART® field devices

Contact

Would you like further information about these or other applications?
Do you require technical advice for your application?
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