



SAND MEASUREMENT IN THE DREDGING INDUSTRY



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Marine & Offshore

“Thanks to the PIOX® S system from Flexim we have a working alternative for nuclear density measurement in our sand mining process.”

Sibelco Belgium



Measuring Task

Test measurements to evaluate the use of PIOX® S ultrasonic measuring systems in a sand dredging application against radiometric density measurements

During the sand winning process, it is important to monitor sand content in the dredged water stream, both to determine yield and to control the height of the dredging head. The conventional solution for this task is a radiometric density measurement. The nuclear source is mounted outside the pipe and emits nuclear gamma radiation through the pipe wall and into the medium. The measured residual amount of radiation is proportional to the content of solids in the medium.

This type of nuclear device requires a lot of safety measures and causes a high administrative and organisational effort: Both the operator and the facility or boat need special permits to use the radioactive source. If mounted on a boat, it may be required to get a permit for the device for each location it sails to. Furthermore, the meter only measures solid content and an auxiliary flowmeter is also needed. Sibelco's engineers therefore looked for a less complex alternative. An additional challenge lies in the high flow velocities in dredging applications (typically ~ 10 – 20 ft/s), which means any insertion into the pipe should be avoided. All in-line instruments wear out extremely fast.



Solution

Flexim's core competency is non-intrusive flow measurement from the outside of the pipe. However, the application range of clamp-on ultrasonic technology is not restricted to flow measurement. It can also be used for analytical purposes such as the determination of concentration and density.

In most binary solutions, the acoustic velocity is in fixed proportion to concentration and density. This makes it possible to determine the concentration and density of a fluid by means of non-intrusive ultrasonic measurement of the speed of sound. Flexim's PIOX® S process analytical systems include an abundant database linking acoustic velocity with concentration and density. However, the sand which is produced in dredging operations is not soluble in the water. The relationship of solid content and speed of sound depends on the specific sand quality and mixture and must be established empirically on site.

One of the main advantages of Flexim's non-intrusive measuring technology is that it never impairs the operability of the respective plant or facility. Therefore, the expert team of Flexim Benelux proposed to arrange an extensive test measurement series on site in order to evaluate the suitability of non-intrusive measuring technology for the task.

The test measurements were both conducted on site at Sibelco's facility in Dessel, Belgium, as well as on a dredging vessel. As the acoustic velocity also depends on the temperature and the temperature of the produced water varies with the dredging depth, the temperature also needs to be recorded. This is also done non-intrusively with a clamp-on Pt100 temperature probe. Through this measuring series, it was possible to establish a good correlation between sound speed and solid content measured by Sibelco's nuclear density meter.

PIOX® S offers different types of communication like Modbus RTU/TCP, RS485, Foundation Fieldbus and Profibus to ensure the right tool within the existing infrastructure. It is possible to connect the PIOX® S system directly to the ship management system or the dredging computer and options like a cross measurement (i.e. the combination of measurement of volume/speed and concentration) are all possible.

Nuclear measurements tend to have an accuracy of around 2.5% without taking into consideration the half-life decay of the radioactive source. This means that a 7 year old system with a half-life of 15 years can be inaccurate up to 35% if not frequently re-calibrated. In contrast, Flexim's ultrasonic measuring technology is based solely on time measurement which provides the same reliability day in, day out. Ultrasonic measurement from the outside of the pipe is not subject to wear and tear, it does not involve any health risks, it does not require any permits and there is no risk of being refused entry into the harbor due to environmental regulations.



Sibelco's production facility in Dessel, Belgium © Sibelco



Complete working measuring point in Sibelco's production hall. The clamp-on ultrasonic transducers of the PIOX® S measuring system are mounted on the pipe next to the existing flow and radiometric density measurements.



Measuring point on the dredging vessel. Typically, the concentration measurement is not done on the vessel due to the restricted space and the high costs of radiometric instrumentation.

Measuring Points and Instrumentation

Pipelines	OD 250 mm, steel, OD 200 mm, polyethylene (PE)
Medium	Mixture of water and silica sand
Measuring Devices	1 stationary PIOX® S721 clamp-on ultrasonic measuring system (dual channel version), 2 pairs of clamp-on ultrasonic transducers type CRK and CRG, mounted in Variofix C, 1 clamp-on Pt100 surface temperature probe

Advantages

- Efficient simultaneous measurement of both volume flow and solid content: Less instruments mean less electrical connections and less space used.
- Cost advantage in comparison to conventional wetted instrumentation: approx. € 25,000 for a complete system without the need for safety documentation and periodic checks due to governmental regulations. Conventional measuring systems can cost up to € 40,000 for flow measurement and over € 100,000 for nuclear measurements.
- Depending on the size of the vessel, the ROI on the ultrasonic measuring system is about 2 to 3 months.
- Maximum flexibility of the measuring system: After decommissioning, the clamp-on device can be reused on other applications or vessels. When the pipe needs to be replaced, a simple service task is sufficient to reinstall the measuring system on the new pipe.

Customer



SCR Sibelco NV, Dessel, Belgium

Sibelco is a global material solutions company. It sources, transforms and distributes specialty industrial minerals – particularly silica, clays, feldspaths and olivine – and is a leader in glass recycling.

Sibelco was founded in 1872 as Sablières et Carrières Réunies (SCR) in order to extract the silica sand layers in Flanders for industrial applications. Today, Sibelco is still a privately owned & family business, operating 118 production sites in 31 countries with a team of over 5,300 people.

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