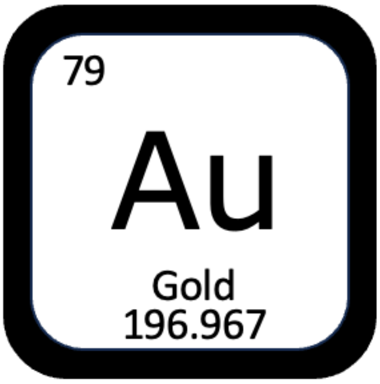


COMPARISSON BETWEEN NDG AND ULTRASONIC DENSITY MEASUREMENT

A CASE STUDY

ARENAL PCS B.V.

Figure 1: Old Radiometric Density meter and Arenal's Ultrasonic Density Meter in Pipeline

INTRODUCTION

Arenal is a hightech company recognized as delivering the best-in-class ultrasonic density meters. With a continous focus on innovation and dedication to excellence.

Tomarok Engineering is a highly regarded company that has built a solid reputation for delivering exceptional services in a range of industries. With a focus on innovation and an unwavering commitment to excellence, Tomarok has established itself as a leader in the field of industrial plant erection, commissioning, and service.

As Tomarok Engineering, we contribute to our projects by following the latest technology in process control instruments that are critical in process development and control. In Industry, while radioactive source density meters have been used for density measurement for many years, Ultrasonic spectroscopy-based ultrasonic density meters are increasingly preferred as a more cost-effective and safe measurement method. Therefore, we compared these two measurement methods with comparative experiments we carried out in the field.

The results we obtain will help you choose the most suitable measurement method for your projects and facilities. This report will highlight the advantages of new technologies based on ultrasonic spectroscopy in density measurement, allowing you to obtain more cost-effective and safety in your business processes.

APPLICATION

This application was implemented within a gold mining process plant specifically designed for the extraction of precious metals from ore. These facilities are essential in converting raw ore into valuable metals such as gold through a sequence of specialized procedures.

The process typically commences with the crushing and grinding of the ore to liberate the valuable minerals. Subsequently, the ore undergoes various chemical and physical treatments to separate and concentrate the precious metals from the ore matrix. These treatments often include washing, flotation, and thickening, among others.

The thickener, a pivotal component in the process plant, assumes a critical role in the concluding stages of ore processing. It functions by increasing the density of the liquid extracted from the ore, thereby enhancing the efficiency of subsequent processes. The thickener ensures the effective separation and concentration of valuable metals before further refinement.

In this application, advanced sensors were integrated into the process control system at the thickener outlet. A comparative study was conducted using both ultrasonic density meters and radioactive density meters installed on the pipeline. These sensors were employed to measure the density of the liquid exiting the thickener.

Figure 2.1: Arenal Ultrasonic Density Meter in Pipeline

Figure 2.2: Arenal Ultrasonic Density Meter in Pipeline

The ultrasonic density meter utilizes sound waves to gauge the density of the liquid, while the radioactive density meter measures density based on the attenuation of gamma rays passing through the liquid. The performance of these two types of sensors was evaluated to ascertain their accuracy, reliability, and suitability for optimizing the thickening process.

FIELD PROPERTIES

Density determination of a liquid/solid slurry in Gold Mining Process.

Pipe diameter	300 mm (12 inch)
Pipe material	Carbon steel alloy (ASTM A53)
Solids	0-10 wt%
Density	1250-1350 g/L
Temperature	30-38 °C

INSTRUMENTS

This study was conducted using Arenal Ultrasonic Density meter and *Radiometric Measurement*.

QT0161-UDT-SPC Ultrasonic Density Transmitter

The Ultrasonic Density Transmitter is an advanced electronic instrument engineered to interface with the Ultrasonic Density Probe and to convert the analog signals generated by the probe's piezoelectric elements into digital data. This device incorporates sophisticated digital signal processing capabilities, facilitated by a Xilinx Spartan-6 FPGA. The transmitter is capable of executing up to 1000 complete measurement cycles per minute, operates at a sampling rate of

100 million samples per second, and achieves an accuracy of 16 bits.

QT65-TMT Thermal Mass-flow Transmitter

The Thermal Mass-flow Transmitter is engineered to measure the volumetric flow rate of slurries. The principle of operation is predicated on the observation that an increase in the slurry's flow velocity results in a heightened cooling effect on the sensor.

The thermal mass flow transmitter quantifies this cooling effect, which occurs within the pipeline, by detecting the temperature differential caused by the flowing slurry. It is crucial to recognize that the cooling effect is also influenced by the thermal conductivity of the slurry. Given that the thermal conductivity of the slurry exhibits a linear relationship with its density, the Model TMT incorporates a Slurry Density Probe to measure the slurry density more accurately.
Thermal Mass-flow Transmitters (TMT) and *Ultrasonic Density Transmitters (UDT)* are pivotal components in the efficient operation of pipelines. These devices are strategically interconnected to facilitate seamless communication and data management.
Thermal Mass-flow Transmitters (TMT) are deployed at critical points along the pipeline to monitor parameters such as temperature and flow rates. They gather precise data which is then transmitted to *Ultrasonic Density Transmitters (UDT)*, serving as central hubs for data aggregation and distribution.
Ultrasonic Density Transmitters (UDT) analyze incoming data to detect anomalies or trends, providing actionable insights to control centers and other connected devices. This real-time communication network enables continuous monitoring and swift responses to operational changes or emergencies.
The integration of *Thermal Mass-flow Transmitters (TMT)* and *Ultrasonic Density Transmitters (UDT)* optimizes pipeline performance, enhances safety measures, and reduces downtime. Their collaborative functionality underscores their critical role in upholding the integrity and efficiency of pipeline operations.

Radiometric Measurement

Radiometric level measurement with source container and Radiometric Measurement provide reliable measurement values where other measuring principles cannot be used anymore due to extreme process conditions or because of mechanical, geometric or construction conditions. Gamma devices are made for non-contact point level detection, continuous level, interface and density measurement in liquids, solids, suspensions or sludges.

SOLUTION

In the gold mining facility where this case study was conducted, a radioactive density meter had been utilized for an extended period. However, the limitations of this technology—such as high operational costs, significant safety risks, and complex calibration procedures—have rendered it increasingly impractical over time.

The introduction of the ultrasonic density meter presents several advantages, positioning it as an alternative for industrial applications. The key benefits of ultrasonic measurements include cost-effectiveness, enhanced safety, simplified calibration processes, ease of maintenance and commissioning, and reduced environmental impact.

The ultrasonic density meter stands out as the preferred option for these several reasons:

- *Cost-Effectiveness:* Ultrasonic density meters offer a 40% reduction in costs compared to their radioactive counterparts, encompassing both initial acquisition and ongoing maintenance expenditures. This financial advantage translates into considerable long-term savings for the facility.

- *Enhanced Safety:* Unlike radioactive density meters, ultrasonic counterparts do not involve hazardous materials, thereby mitigating risks to personnel safety and environmental integrity. The elimination of special certifications and the necessity for certified personnel further enhance operational safety while reducing administrative burdens.

Simplified Calibration: Calibration procedures for ultrasonic density meters are straightforward and do not necessitate involvement from external authorized entities. This simplicity ensures heightened accuracy

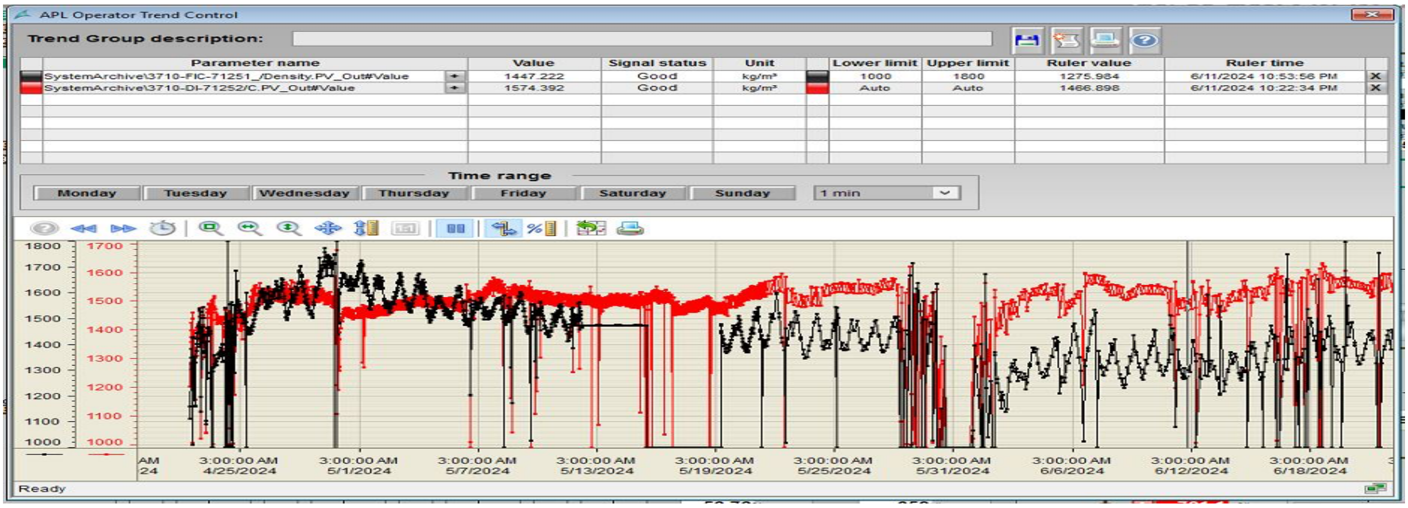
- and consistency in measurements, concurrently minimizing downtime and associated costs.

- *Ease of Maintenance and Commissioning:* Maintenance and commissioning tasks for ultrasonic density meters can be efficiently executed internally, eliminating the dependency on external agencies required for radioactive meter upkeep. This operational flexibility enhances efficiency while reducing service-related expenditures.

- *Environmental Advantages*: By circumventing the use of radioactive materials, ultrasonic density meters alleviate concerns associated with the disposal and management of hazardous substances. This environmental conscientiousness aligns with sustainable operational practices, underscoring the facility's commitment to ecological stewardship.

Comparative Analysis Findings

To substantiate the efficacy of the ultrasonic density meter, a rigorous comparison was conducted against the radioactive density meter. The results, visually represented in the accompanying graph, reveal a close correlation between measurements obtained from both devices. This alignment underscores the ultrasonic density meter's capability to deliver measurements of comparable precision to its radioactive counterpart, validating its suitability as a reliable replacement.



Graph 1: Graphical Representation of Measurement (Red: Radiometric Density Transmitter, Black: Ultrasonic Density Transmitter

The adoption of the ultrasonic density meter was driven by its superior cost-effectiveness and reliability, despite the comparable measurement accuracy observed in the analysis.

Implementation and Implications

The successful integration of ultrasonic density meters within the gold mining facility signifies a pivotal transition from conventional radioactive methods to advanced technological solutions.

This implementation yielded significant operational benefits, including:

- Substantial cost savings attributed to reduced acquisition and maintenance outlays.
- Enhanced safety protocols, safeguarding personnel and minimizing environmental impact.
- Enhanced measurement precision facilitated by simplified calibration processes.
- Increased operational efficiency through streamlined maintenance procedures.

The outcomes of this case study underscore the pragmatic advantages of adopting ultrasonic density measurement technology. As such, ultrasonic density meters are poised to set a new standard across diverse industrial applications, offering a dependable, economically feasible, and environmentally conscientious alternative.

CONCLUSION

In conclusion, the detailed comparative analysis underscores the practical advantages of adopting ultrasonic density meters over traditional radioactive methods. By offering precise measurements with lower risks and operational costs, ultrasonic technology presents a logical and efficient choice for enhancing industrial measurement capabilities.

Summary

Our solution is based on measuring with ultrasonic technology. This eliminates all the time, costs, hassle and potentially hazardous situations that come with the use of radiation-based density meters.

Our solution repeatedly and constantly provides accurate and reliable information about your processes.

We are looking forward to meeting you and learn more about your applications.

You can contact us via our distributors or directly via

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Thank you,

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