



CONCENTRATION AND FLOW MEASUREMENT OF SULFURIC ACID



Chemical Industry / Fertilizer

“With Flexim’s non-intrusive measurement technology, we could replace the Annubar flowmeters which had proved inaccurate and unreliable. In addition to that, we have eliminated a safety risk that was caused by an acid leakage with the old measurement technology.”



Kossai FAKIR, responsible for maintaining instrumentation, Jorf Fertilizers Company.



Measuring Task

Measurement of flow and concentration of sulfuric acid on two pipes in the inflow to a HRS tower (Heat Recovery System)

Phosphorus is an essential element for life. However, turning phosphate into valuable products such as phosphoric acid and fertilizer is a resource-intensive process. The most appropriate means of reducing our carbon footprint is without a doubt increasing energy efficiency. OCP has therefore launched an extensive program to increase energy efficiency and introduced an energy management system.

The mineralogical processes involved in the production of artificial fertilizers require the use of large amounts of sulfuric acid. The chemical reactions involved in the production of sulfuric acid are exothermic, with the heat released being recovered in the form of steam (70 psiG / 355 °F). The HRS makes it possible to generate an additional 80 tons of steam per hour in the sulfuric acid plant by using the energy of the warm acid instead of cooling it with seawater as before. The energy recovered in this way allows the production of 8 to 9 MW of electricity and the reduction of seawater consumption by 90,000 ft³/h, which corresponds to a pump power of 1 MW. For the safe and efficient operation of the HRS, the flow rate of the

sulfuric acid must be monitored. Conventional instrumentation consists of differential pressure measurements (Δp). The sulfuric acid is diluted with water before entering the HRS tower. The Δp measurements installed in the two supply lines serve as a safety device. They initially trigger an alarm when a limit value is reached and switch off the system when a second limit value is reached. At the same time, these flow measurements enable the automatic control of the water dosage and, therefore, the yield of the tower.

The Δp measurements regularly caused difficulties, particularly as a result of clogging of the differential pressure transducers with solids. In addition, the process conditions led to the continuous wear of the differential pressure transducers. Added to this are the dangers for the operating personnel, which emanate from possible leaks in the differential pressure lines. The plant operators were therefore looking for a better measurement solution that was as wear-free as possible.



Solution

Flexim's non-intrusive measuring technology proved to be the ideal solution to overcome the challenges posed by process conditions. Flexim measures the flow rate using ultrasonic transducers mounted on the outside of the pipe.

As a result, the measuring system is not subjected to any wear and tear by the medium flowing inside. Since it is not necessary to open the pipeline for installation, a measuring point can be set up with the clamp-on ultrasonic technology without any disruption to production.

If a Δp flow measurement fails due to a clogged differential pressure line, this involves a shutdown of the system and a maintenance call of at least six hours. This type of plant standstill results in a loss of production worth USD 158,000 (production capacity per hour times the market price of the fertilizer). For the operators of the sulfuric acid factory, it is, therefore, a simple economic calculation that is the deciding factor in replacing the fault-prone Δp measurements with non-intrusive measurement technology from Flexim.

Because of the high process temperatures (~ 375 °F), the ultrasonic transducers are installed on the patented WaveInjector® high-temperature mounting device.

Ultrasonic measurement offers another advantage for OCP. In addition to flow, the concentration of sulphuric acid must also be monitored on the heat recovery system.

Although the measuring devices installed for this purpose work, they cause high maintenance costs. This effort, which is also associated with the dangers of handling sulfuric acid, can now be dispensed with: the PIOX® S clamp-on ultrasonic systems from Flexim simultaneously measure the flow and concentration of the sulfuric acid.

Due to the positive experience with Flexim's non-intrusive measuring technology, OCP is increasingly replacing Δp measurements with clamp-on ultrasonic systems.



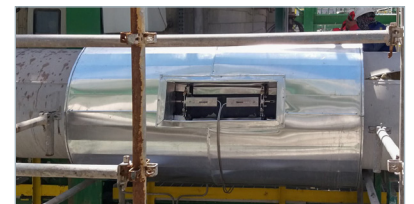
General view of OCP's fertilizer complex in Jorf Lasfar
© OCP



One of OCP's sulfuric acid plants in Jorf Lasfar
© OCP



To set up the measuring point, the insulation only needs to be removed temporarily. The ultrasonic transducers are installed on the hot pipeline during ongoing operation.



Measuring point with ultrasonic transducers integrated into the insulation.



The stationary PIOX® S721 ultrasonic systems are used as measuring transmitters.

Measuring Points and Instrumentation

Pipelines	24", wall thickness 0.2"
Fluid	sulphuric acid H ₂ SO ₄ , 98 wt%, T = ~ 375 °F
Measuring systems	2 clamp-on PIOX® S721 ultrasonic systems (dual-channel version) 4 CDK ultrasonic transducer pairs, mounted on the WaveInjector® high-temperature device

Advantages

- Accurate and long-term stable measurement from the outside of the pipeline
- Simultaneous non-intrusive measurement of flow and concentration
- No wear whatsoever due to the corrosive and hot medium flowing inside the pipeline
- Unimpaired plant availability
- Increase in work and operational safety through a significant reduction in maintenance costs and the associated risks

Customer

OCP S.A., Jorf Lasfar, Morocco

OCP is one of the largest miners of phosphate rock and a major producer of phosphate fertilizers. The OCP Group employs 21,000 people and serves 350 client companies worldwide. OCP was founded in 1920 under the name Office Chérifien des Phosphates as a Moroccan company based in Casablanca. The company's business purpose then as now is the development and use of the country's phosphate deposits.

Located 80 km from Casablanca and 17 km southwest of El Jadida on the Atlantic Coast, the Jorf Lasfar industrial complex is the largest fertilizer site in the world. Since its opening in 1984, the site has been continuously expanded. After the Africa Fertilizer Complex (AFC), which produces specifically for the African market, and Jorf Fertilizers Company 2 (JFC 2), JFC 3 is now the third integrated fertilizer production plant to go into operation.



The Emerson logo is a trademark and service mark of Emerson Electric Co.
Brand logotype are registered trademarks of one of the Emerson family of companies.
All other marks are the property of their respective owners.
© 2024 Emerson Electric Co.
All rights reserved.

For more information, visit
[Emerson.com/Flexim](https://www.emerson.com/flexim)

AR-202122-OCP-US