Reliable lime slurry flow and concentration measurement for coal-fired power plants in Gdansk, Poland

RESULTS

- Eliminated administrative workload and ongoing costs and achieved safety improvements by replacing nucleonic densitometers
- Reduced pumping costs by using low pressure drop Magnetic flow meters
- Reduced plant operating costs and improved the efficiency of the Flue Gas Desulphurization process

Micro Motion Fork Density Meters and Rosemount Magnetic Flow Meters were chosen as safer, lower cost and easier to use solutions to measure the concentration and flow of lime slurry.

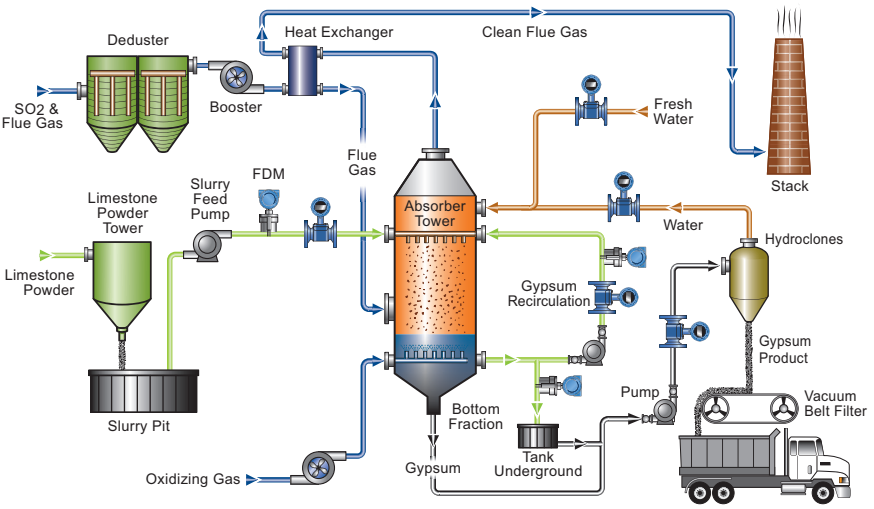
APPLICATION

Concerns over air pollution and increasingly demanding clean-air legislation require coal-fired power plants to remove sulphur dioxide (SO_2) pollutants from the flue gas produced during combustion before being emitted into the environment. This is achieved through the process of flue gas desulphurization (FGD) in a device called a scrubber where the gasses are contacted with an aqueous solution or slurry containing a sorbent such as lime ($Ca(OH)_2$). The reaction of the lime with the sulphur dioxide forms insoluble calcium sulphite ($CaSO_3$) and by further reaction with oxygen, calcium sulphate ($CaSO_4$) or gypsum can be produced, a valuable bi-product utilized in the manufacturing of wall-board used in construction.

An important part of the FGD process is the reliable control of the flow and concentration of the lime slurry. Optimization of this process is key to both the operating costs of the plant and also the efficiency of the scrubbing process to meet environmental protection targets.

CHALLENGE

Due to the nature of a slurry, nucleonic densitometers are often used to measure its concentration. Whereas the use of these non-contact devices have that perceived advantage, they also have a number of significant limitations and drawbacks. From a measurement standpoint, the nucleonic devices have a response time of as long as 30 seconds, making it difficult to tune the slurry concentration for optimum scrubber efficiency. As nucleonic densitometers contain a radioactive source, there are considerable licensing and safety issues and costs associated with their use.



A diagram of the typical process of an FGD system using the wet scrubbing method to remove SO_2 from the flue gases

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In addition to initial and ongoing annual license fees, installation, handling and maintenance can only be undertaken by authorized personnel which carries the associated training costs. A further cost will come at the end of the product's life where strictly controlled disposal is required. Above all of these cost issues are the safety considerations which must be carefully managed and implemented. These issues result in a significant amount of paperwork and administration associated with the ownership and use of nucleonic densitometers.

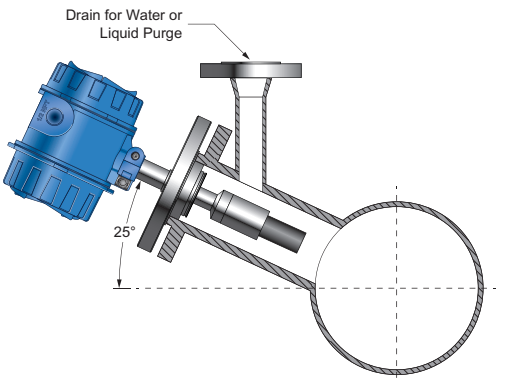
SOLUTION

The power plant in Gdansk, Poland installed multiple Micro Motion Fork Density Meters (FDM) and Rosemount 8700 Magnetic Flow Meters to measure the concentration and flow of the lime slurry feeding the scrubber used in the FGD process.

The end-user chose the FDM as a safer, lower cost and easier to use solution than the nucleonic densitometers. In addition to the elimination of the administrative workload and costs associated with nucleonic devices, the plant was also able to reduce the safety risks that accompany the presence of radioactive material. Furthermore, the fast and reliable measurement of slurry concentration resulted in an improvement in the efficiency of the FGD process and associated reduction in raw material (lime) costs.

In this particular installation, the FDM was installed in a T-piece on a pipe where the flow was vertically upwards. The T-piece was at a slight angle to the pipleline to improve the flow of the slurry around the FDM vibrating fork tines. The fork tines were made of C22 alloy to minimize ersosion due to the abrasive slurry. The T-piece also incorporated a flushing/vent connection to allow for occasional cleaning of the density meter fork sensor wetted parts.

The use of 8700 Magnetic Flow Meters with a protective lining to protect against the abrasive nature of the lime slurry enabled the customer to reduce their pumping costs due to the lower pressure drop that the Magnetic flow meter offers.



An FDM installation drawing of an angled T-piece on a horizontal pipe with a flush connection

Overall the customer received the following benefits:

- Improved quality control of the lime slurry resulting in improved efficiency of the FGD process and reduced raw material costs due to fast and continuous concentration measurement with the FDM
- Reduced pumping costs due to the low pressure drop of the 8700 Magnetic Flow Meter
- Elimination of paperwork and procedures associated with the use of nucleonic density meters, leading to reduction in ongoing operational costs
- Reduction in the risks associated with the presence of a radioactive material and subsequent improvement in overall safety

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