Ensuring higher availability in cement plants

with continuous blockage detection using radiometric measurement

What are cyclones and where are they used?

A cement plant typically consists of a rotary kiln (a long cylindrical rotating drum) which is used to heat a mixture of limestone and clay (raw feed) at temperatures ranging from 1,400°C to 1,500°C (2,550°F to 2,730°F). In order to have a thermally efficient plant, a series of cyclones are implemented which use the hot gas originating from the rotary kiln to pre-heat the raw feed up to 900°C (1,650°F), thereby saving a lot of energy. A cyclone is a conical vessel in which hot gases enter from the bottom of the vessel and raw feed enters from the top. The gas heats solids on its way out of the top of the cyclone while the heated solids fall to the bottom. A typical schematic is depicted below.

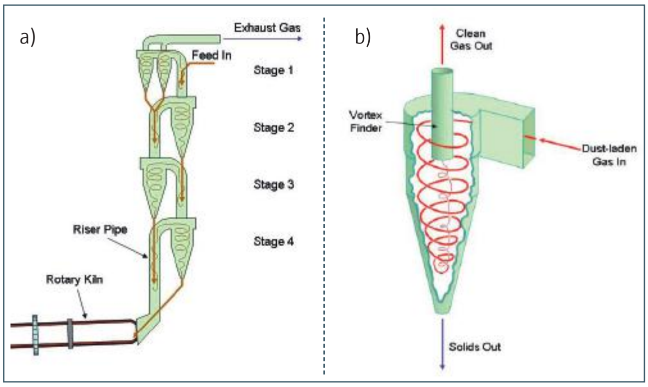

Figure 1: a) Schematic of a typical preheater arrangement
b) Working of a cyclone [1]

Process challenges in a cyclone

As efficient as cyclones might be, they tend to block up. Salts, such as the sulphate and chloride of sodium and potassium, tend to evaporate in the burning zone of the kiln. They are carried back in vapor form and re-condense when a sufficiently low temperature is encountered. Condensation usually occurs in the cyclone, and a sticky deposit of liquid salts glues dusty raw mix into a hard deposit, typically on surfaces against which the gas-flow is impacting. This can choke the cyclone to the point that the air-flow can no longer be maintained in the kiln. It is then necessary to interrupt the process and manually break the build-up away. Therefore, it is imperative that cyclone blockages are always monitored. [1]

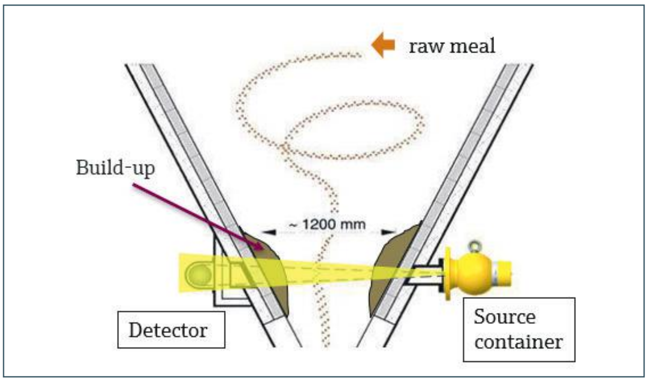

Figure 2: Schematic of build-up measurement

Measurement challenge for blockage detection

- Process temperature up to 800°C (1,470°F)
- High build-up and abrasion due to vaporized alkali from the kiln.
- Ambient temperature exceeding 60°C (140°F)
- Thick brick and steel walls

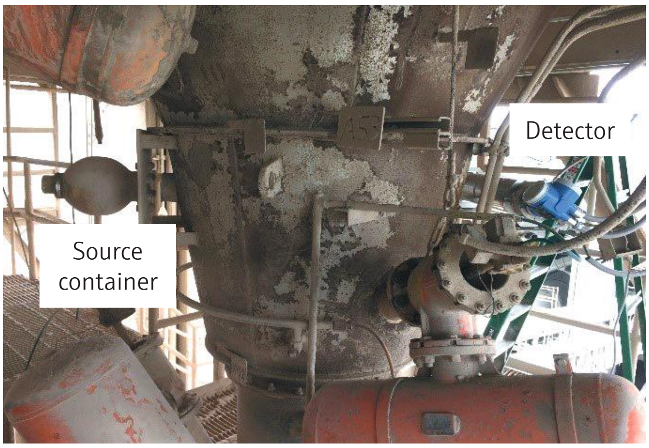

Figure 3: Actual installation on site

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Conventional solution

Extreme process temperatures, high abrasion and heavy build-up rule out all measurement technologies that are directly exposed to the process. In this scenario, radiometric measurement provides a convenient alternative wherein a gamma source is used to penetrate the thick walls of the vessel and a detector is employed to detect the absorption of the gamma radiation by the process. The absorption of gamma radiation indicates the build-up present in the beam path. However, the high ambient temperatures around the cyclone affect the performance of the detector as well. Plant owners therefore provide a large piping network so that water can circulate around the detector to maintain its temperature. The additional water jacket around the detector also mandates a higher source activity so that the radiation is beyond the minimum threshold of the detector.

Minimizing maintenance effort

The new Gammapilot FMG50 from Endress+Hauser offers a significant upgrade compared to conventional radiometric solutions. As the first 2-wire loop-powered compact transmitter, the Gammapilot reduces engineering and installation efforts. The high temperature sensor technology allows the use of the device without additional water cooling up to 80°C (176°F) which leads to savings in installation and operation. The device is also equipped with **Bluetooth®** wireless technology which ensures an easy operation out of the radiation beam and at a distance to high ambient temperatures.

Thoroughly tested for your application

To test the high temperature stability of the new Gammapilot, field tests were conducted in cyclones across the world and sensor and ambient temperatures were consistently monitored. All the field tests reported stable and consistent performance by the device.
The device is currently successfully in operation in UAE where, in addition to the process induced high temperature, an ambient temperature exceeding 45°C (113°F) is observed.

Gammapilot FMG50 – Savings for you

- OPEX savings of up to 3,000 EUR (3,400 USD) per annum or water savings of up to 240 l/h or 1.2 Mio l/annum per instrument.
- Additional CAPEX savings on piping infrastructure and valves.
- Savings of 600 to 800 EUR (650 to 900 USD) on cabling and power consumption compared to a 4-wire device.
- Easy accessibility of data with **Bluetooth®** wireless technology.

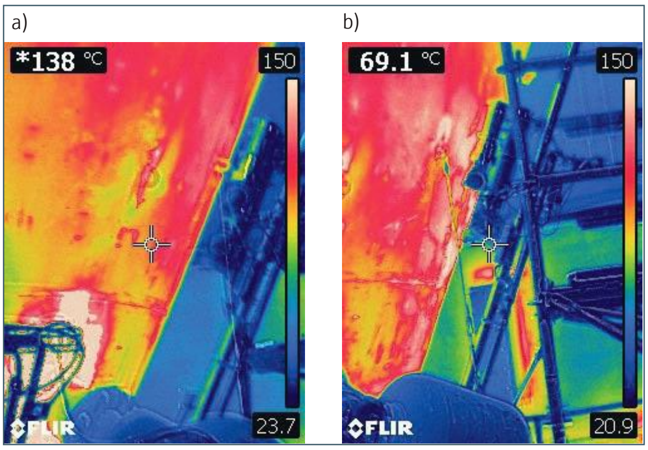

Figure 4: Field test results
a) Temperature on the exterior of cyclone ~138°C (280°F)
b) Surface temperature on the FMG50 150mm (5.9”) away from the cyclone~69°C (156°F).

Figure 5: Field test results
Parallel installation of the Gammapilot FMG50 and a water-cooled detector

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More Information? For more information or to discuss your requirements contact us at instrumentation.au.sc@endress.com or call 1300 363 707

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