

Wireless Temperature Monitoring Prevents Cement Chute Clogging

Wireless Temperature Sushi Sensor | XS550 + XS110A

Automated wireless temperature monitoring at cement plants, lime kilns, and asphalt plants prevents expensive chute clogging issues.

A major cement company operates over ten cement plants and nearly 130 cement terminals, producing more than 20 million tons of cement every year across North America. Throughout each plant, raw materials, including limestone, travel from kilns through multiple chutes to other areas of the plant.

Overtime, these chutes can become blocked and clogged with product, causing a kiln backup and reduced flow to other plant areas. The manufacturer required an automated wireless system to determine when specific chutes were beginning to clog to replace the manual operator rounds in use today.



Cement plant gas furnace (rotary clinker kiln)

Challenges

In the cement production process, agitators keep the product moving. Ground limestone, other raw materials, and fuels are fed into the kiln and heated to over 2,600 degrees Fahrenheit. The intermediate material, sometimes known as “clinker,” works its way from the kiln down multiple chutes per kiln, which distribute the product to various places in the plant. This cement plant has five kilns, and each kiln has 13 chutes.

A common occurrence at these chutes is clogging, as clinker begins to build up and block the chute. This cannot be seen visually, as the entire process is enclosed, but a change in the chute’s surface temperature can be measured as a clog begins to form. Plant personnel were using hand-held infrared thermometers **once per day** to manually check the temperature of each of these 65 chutes across the plant, with a certain temperature range indicating a clogged chute. This manual process could take several hours due to the expansive nature of the plant.

With its thick concrete walls, the cement plant's infrastructure was similar to a parking deck. Pair that with the sprawling distance between facility kilns, a wireless sensing network seemed to be a daunting task for the manufacturer.

Cost pressures at the facility were also critical. Instrumentation costs needed to be kept low, and the plant personnel's time was always a scarcity.

Solutions

[The wireless temperature Sushi Sensor XS550](#) was installed at each of the 65 chutes. Temperature measurements were taken by a thermocouple connected to each Sushi Sensor. The Sushi Sensor installation process was simple and non-intrusive to the process. Each chute was secured with 18 bolts. One bolt was removed, and the spring-loaded thermocouple inserted, yielding good contact and an accurate temperature reading.

The large distance between kilns paired with thick concrete walls caused concern for how well wireless technology would work in the plant. The Sushi Sensor solution's long-range LoRaWAN® network provided coverage for the entire facility with a single gateway located centrally in an analytical shelter with an antennae extending from the shelter. Due to eliminating the need for repeaters, the long-range capabilities of LoRaWAN® enabled the network to be established easily and at much lower cost than other wireless networks.

The temperature data is sent back to Yokogawa's [GA10 Data Logging Software](#) (Fig 1), which is running on a computer, also located in the plant's analytical shelter. From here, plant personnel can check each chute's temperature at any given time.

Using GA10, an alarm has been created for anytime a chute's temperature drops below a certain threshold, automatically informing the correct personnel of a clogged chute.



Fig 1 – GA10 Data Logging Software

To upgrade the solution, the plant is considering taking their data to the Yokogawa cloud to enable remote monitoring dashboards of their equipment. Vibration sensors are also being considered for the many rotating pieces of equipment throughout the plant. With the LoRaWAN® network already established, adding vibration sensors later will be simple.

Key Benefits

The sensor supports 2 inputs of IEC standard thermocouples (any of 9 types including Type B, E, J).

- **Hazardous location installation**
 - Zone 1 areas, such as petrochemical plants, paint plants, steel plants, where flammable gas or vapor may exist.
- **Long distance communication**
 - LoRaWAN® has excellent sensitivity reception, good radio interference resistance, and offers a communication distance of six miles (10 km) or more in ideal conditions. This sensor can be installed anywhere needed, even over vast areas.
- **Excellent environmental resistance and battery powered**
 - The XS110A supplies power to the XS550 via a built-in replaceable battery that can last up to 10 years. This waterproof, dust-proof, and explosion-proof wireless pressure monitor can operate in harsh environments and can be installed anywhere in a plant (no power cables required).
- **Monitoring via on-premise server, cloud server, or a smartphone**



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