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Conquering dust

Process instrumentation and kiln dust's second life

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Aluminum cans, rubber tires, cement kiln dust. Three products out of many others that at one time almost exclusively ended up in landfills—and in staggering amounts.

In the case of kiln dust, an unavoidable byproduct in the cement production process, Siemens process instrumentation helps manage dust in the cement plant and makes reuse and repurposing of the material possible.

From garbage to recycled gold

Previously, cans and tires made their way to landfills—but how times have changed!

In 2011, the US recycled more than 737,000 metric tons of aluminum cans – enough to make nearly 50 billion new ones. And in 2009, Canadians recycled more than nine out of every ten vehicle tires.

Turning to cement kiln dust (CKD), the story is similar: between 1990 and 2006, the cement industry in the US slashed the amount of CKD sent to landfills nearly in half.

In addition to being put to valuable use in the cement plant itself, discussed in greater detail below, CKD can be found in commercial applications such as wastewater treatment, a stabilizing base for pavement and as a soil enhancer.

However, the dust must first be captured.

Key products in the kiln dust process.

Filtering fun with baghouses
Controlling airborne particles inside cement plants and those emitted into the environment, baghouses play a vital role in cement manufacturing.

Dusty air enters the baghouse, where filter bags collect particles of dust created by the 1400 °C kiln. Dust particles drop or are shaken into hoppers in the baghouse, where they are then moved by screw conveyor to process and storage vessels.

Filtering out as much dust as possible is crucial. Government bodies such as the US Environmental Protection Agency (EPA) have strict regulations on the amount of particulate matter that can be discharged into the environment. Violations of the EPA's Clean Air Act have seen cement companies paying into the millions for not complying with regulations.

To ensure compliance, the baghouses at one particular North American cement plant are therefore home to Siemens SITRANS P DSIII differential pressure transmitters, which measure the differential pressure across the filter media inside the baghouse. The differential pressure indicates the buildup and efficiency of the filter media—if a high differential pressure is flagged, then maintenance or a cleaning cycle is required.

A SITRANS AS100 acoustic sensor, connected to a SITRANS CU02 control unit, immediately tells technicians if a filter has been damaged. In the case of damage, the sensor detects the impact noise of the dust particles, and the control unit alarms operators.

A higher level of monitoring
CKD starts to build up in the hopper if the dust is no longer being transported from the baghouse hopper to the screw conveyor. If the dust buildup reaches a very high level, it can severely damage filter bags—requiring costly repairs and production downtime.

Technicians at the North American plant installed Siemens Pointek CLS300 capacitance level switches. Pointek CLS300 was built with the cement industry in mind—a rugged, hardworking device with many years of experience from applications around the world.

The point level device, mounted at the top of each hopper, provides high-level alarming. If dust reaches a certain point in the hopper, an alarm alerts technicians to the problem before buildup reaches a critical level.

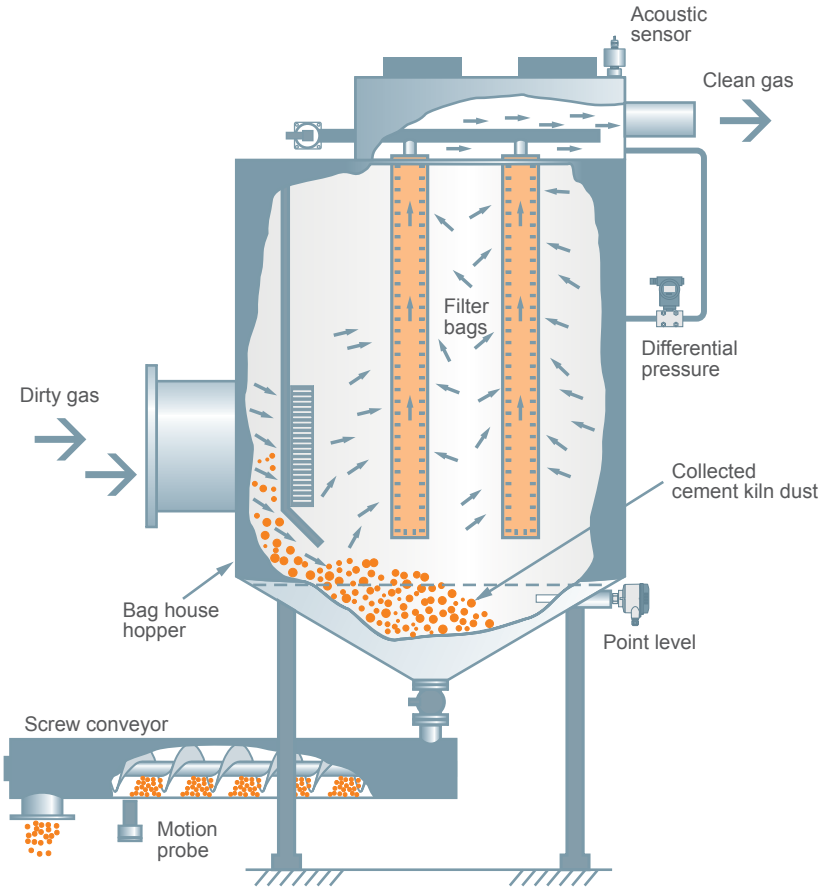
Even the screw conveyors themselves are equipped with cost-saving instrumentation: if a screw conveyor stops, a Siemens Milltronics MSP-12 motion sensor probe, mounted on the outside of the screw conveyor housing, relays information to a Milltronics MFA 4p motion failure alarm. The system detects any changes in the motion and speed of screw rotation, and technicians then can see the alert and remedy the problem.

Each process instrument is a building block of safety and efficiency—without alarming, kiln dust could damage equipment or cause paralyzing production downtime. This can have costly repercussions for cement plants running 24 hours a day.

Reliable and continuous CKD feed to the kiln
Once dust moves from baghouses to vessels, level monitoring helps safeguard a plant's efficiency but also ensures production quality.

As mentioned above, cement kiln dust has many uses outside the cement plant, but it also plays an important role in the plant's own production.

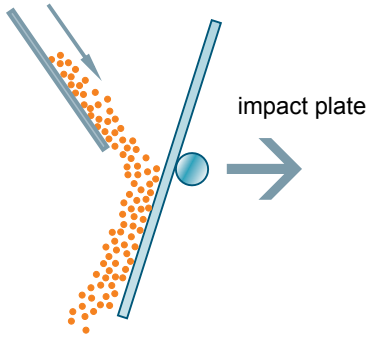
CKD can be reintroduced as raw meal to feed the kiln—a valuable source of material that costs the plant only the infrastructure required to transport and store the material. A medium-sized process vessel stores the dust and instrumentation measures the amount introduced into the kiln as needed. The amount reintroduced saves process energy, however, too much will have a negative impact on the specifications of the cement being produced.



Typical bag house configuration.

Previously, the above-mentioned North American plant was using nuclear technology to measure the flow of CKD from the process vessel into the hot kiln. This nuclear device had become unreliable and ultimately failed.

The company consulted Siemens to find a replacement technology, and Siemens recommended a solids flowmeter. A Siemens SITRANS WF330 solids flowmeter quickly became the plant's preferred choice, as it has reliable, two percent accuracy, and a simple design needing no nuclear approvals.



Impact flowmeters guide material through an infeed pipe and material strikes the flat sensing plate.

Now the plant can rely on a repeatable, simple device that provides a consistent signal to indicate the amount of CKD reintroduced into the kiln. The device's sensing plate is placed in the path of the material flow. The material strikes the sensing plate, and the horizontal force component causes a mechanical deflection, which is then converted into an electrical signal in the sensing head.

Verified vessel levels

SITRANS LR560 radar transmitters measure levels in the process vessel and in storage vessels for CKD that will be used for commercial applications.

The transmitter's high-frequency antenna has no problems with the extremely dusty environment inside either type of vessel and the device's narrow beam allows technicians to install SITRANS LR560 almost anywhere on top of the vessel.

For backup level alarming, Siemens point level devices alert technicians if CKD levels in the vessel are too high or too low. If levels become too high, CKD can damage equipment or overflow out of the vessel. Siemens point level switches alarm if high or low level situations occur so that technicians can quickly resolve the situation.

CKD not used as raw meal supplement is kept in storage vessels, also monitored by SITRANS LR560 and point level devices. Precise level measurements are also crucial here, as technicians need to ensure that CKD is shipped out as efficiently as possible. If there isn't enough kiln dust in a vessel, trucks scheduled to pick up materials may make wasted trips to the cement plant.

Kiln dust: the bottom line

This dusty byproduct when producing cement has become a valuable resource, but one that requires the benefits of process instrumentation to help fully realize its value.

From reducing the waste stream of materials headed to landfills to ensuring environmental regulations are being closely followed, Siemens' wide portfolio of instruments are the eyes and ears of the cement plant. Kiln dust's second life is guaranteed by the precise monitoring of devices that reliably operate in this rugged environment.

SITRANS LR560's highly durable polyetheramide lens antenna (left) can tolerate significant buildup, such as kiln dust

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