Up To *Standard*

ANDY WINSTON, GE ENERGY, USA, POSES QUESTIONS THAT MANY OF OUR READERS WILL BE ASKING, AND OFFERS ANSWERS THAT MAY HELP PLANTS TO MEET THE NEW PARTICULATE EMISSIONS STANDARDS.

New federal regulations that take hold in September 2013 will mean big changes for cement plants. Their biggest and most expensive concern: particulate emissions. Just those new standards alone could spur plants to alter equipment, monitoring, training and their overall approach to operations. And even after such a drastic overhaul, several plants still may be forced to close.

Q. How have the US Environmental Protection Agency (EPA) regulations changed for particulate emissions for cement kiln and clinker cooler air pollution control equipment?

A. In August 2010, the federal government published revisions to the Portland Cement Industry called the National Emission Standards for Hazardous Air Pollutants

(NESHAP). It sets new standards for emissions such as mercury, total hydrocarbons, hydrogen chloride (HCl) and a considerable reduction in the amount of particulate emissions allowed.

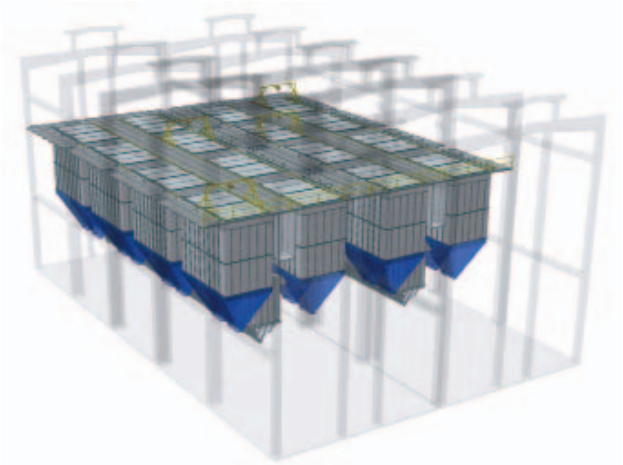
Cement companies insist that particulates are their biggest concern, and their biggest expense.

How much are the particulate emissions standards changing?

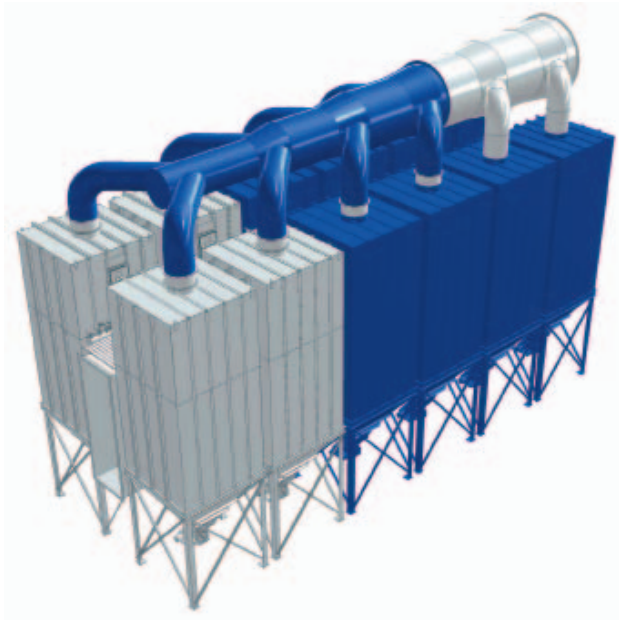
It is dropping considerably, all the way to 0.04 lb/t of clinker for existing plants – down from 0.3/t of kiln feed. That is roughly a 98% reduction. New plants must meet a standard of 0.01 lb/t of clinker. In some cases, equipment has been in place for 40 years and cannot accommodate these requirements. It has made the industry stand up, obviously, and take notice.

What is driving such a significant change?

The 1999 NESHAP regulations were deemed not to be stringent enough. The DC circuit court required the EPA to reconsider the standards. The current emissions limits are based on the average performance of plants within the industry's top 12%. The averages are derived from data that come from stack tests, which provide just a snapshot – not continuous monitoring.



Reverse air dust collector converted to pulse-jet.



Pulse-jet dust collector expansion.

One of the big changes now is that a continuous emissions monitoring system (CEMS) will be required, providing 30-day rolling averages for each pollutant. Everyone now must do opacity numbers in real time. For particulate, we will be looking at a rolling 30-day average that cannot exceed 0.002 grains/actual cubic foot.

While this is achievable in an individual stack test, however, due to process variability, it may be very difficult, if not impossible to achieve continuously.

The first thing we have to determine is where plants are currently on an emissions level and equipment condition. Then we can take a look at the system equipment and see what the options are to meet the new particulate limits.

What are the options for the industry to meet the new emissions limits?

For some plants, this will mean a change in operating philosophy. But in as many as two-thirds of the plants, they will need to make modifications to their equipment to meet the new particulate emissions limits, according to estimates from the Portland Cement Association (PCA). The PCA predicts that the industry will need to spend US$3.4 billion to comply with the rule. As much as a third of that will be spent on particulate control: upgrades, equipment, filters – whatever it takes to make them compliant. For as many as 18 plants, the cost of new equipment will be so high, they could decide they will never get their money back and instead choose to close. It just depends on what equipment they have.

What types of equipment are being used today to vent cement kilns and clinker coolers, and what will be the options for these going forward?

Electrostatic precipitators (ESP), reverse air dust collectors and pulse-jet dust collectors.

For ESPs, there are three options:

- Install a pulse-jet dust collector after the ESP as a polishing unit.
- Convert the ESP to a pulse-jet dust collector if the existing piece of equipment meets the criteria.
- Replace the ESP with a new pulse-jet dust collector.

For reverse air dust collectors, the options are as follows:

- Rebuild the reversing air dust collector with system improvements capable of meeting the new regulation, if possible.
- Install a pulse-jet dust collector after the reverse air dust collector as a polishing unit.
- Convert to a pulse-jet dust collector.
- Replace with a new pulse-jet dust collector.

For existing pulse-jet collectors, the options would be:

- Correct any design or mechanical issue that stands in the way of meeting new regulations.
- If the existing pulse-jet collector is undersized, add an additional unit after the existing one as

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a polishing unit, or if possible, add additional compartments to the existing unit.

All of this comes amid a recession, when activity from the construction industry is down. Once the recession starts to ease, these plants will be operating 24/7 for about 330 days a year. Anytime you convert or rebuild equipment, that is usually a pretty long downtime. When the economy is slow, you have time for equipment installations, but there is no money. When the economy improves, you have money but no time.

How will dust collector design philosophy change?

As mentioned, any new equipment will be a pulse-jet dust collector. The pulse-jet dust collector must be designed with multiple compartments capable of isolating and performing online maintenance or inspections. This is going to be non-negotiable. Any design that does not incorporate this should be a deal-breaker.

To have any chance of meeting the new standards, the dust collector design has to be almost perfect. Some companies will still make purchasing decisions based only on cost, and it is going to take time to change that philosophy. These companies may lose a lot of money and reliability, which equates to production. Cement plants are going to have to change the way they think, otherwise there may be design problems, which will be very expensive to repair, if this is even possible.

It is important to have a unit that is designed and built well. Otherwise, one may end up with something that causes filter bag failure. And filter bag failures mean emissions.

Filter bags should last four or five years, a total of 90 000 to 100 000 flex cycles or cleaning cycles. They should fail from old age, not from poor design or inlet abrasion, bag-to-bag abrasion, bag-to-sidewall abrasion or ineffective operation.

Ductwork design that has the proper velocity is going to be important. Air and dust distribution are critical. Companies should have computational fluid dynamics (CFD) modelling. There are very few OEMs that do the computer modelling. There is a danger that some companies with little or no experience in the cement industry will try to get in on the action due to a lack of qualified dust collector designers.

What filtration fabric options exist?

99% of the equipment would operate on woven fibreglass laminated with ePTFE membrane. A few may be able to operate with aramide and PPS felts, laminated with ePTFE. The membrane is extremely efficient down to the submicron particles of dust. GE has spent the last several years with a large portion of its R&D budget making the membranes more efficient. Laboratory tests show virtually zero emissions. The question is for how long?

The challenge is to make the membranes and substrates more durable so they last longer. Dust collectors need to be designed to put less stress on the filter bags so they do not need to be cleaned as frequently. The less the filter bags are cleaned, while still meeting the desired differential pressure, the longer the filter life.

There is a human element in each aspect of this, from the membrane lamination to the filtration fabric to the machines operated by humans. Humans make mistakes, and for these new standards, mistakes will be costly. There is no filter bag that will meet these standards and help fix the plants' problems. The filter bag is just a component of the dust collector system. All of the aspects of the dust collector operation need to be examined in order to meet the new regulations.

What are some of those other aspects?

Today, the industry is still trying to control the dust collectors with 1960s technology. The industry needs to step into the 21st century, and that means Programmable Logic Controllers (PLC), which help make changes quickly and simply.

It is important to pay closer attention to all aspects of monitoring, including emissions, differential pressure, temperature, compressed air pressure, mechanical equipment reliability and hopper levels.

Corrective action must be defined. Depending on what the problems are, how soon do they need to be fixed? With any increase in emission levels, it needs to be investigated immediately. As soon as any increase in emissions is noted – no matter how small – it is essential to find out where it is and correct it in a matter of hours, not days.

What tools can be used to properly maintain the dust collector equipment?

Companies must have monitoring tools, and should train and retrain their personnel. Everybody who touches that piece of equipment has to understand how it works. Training is going to be an extremely valuable tool.

What is down the road?

Anything that can be done in the system to reduce grain loading before it reaches the dust collectors will help operations. That includes cyclones, knock-out boxes, new inlet duct configurations, even considering the option of hoppers under the inlet plenums of the dust collector, which could result in as much as a 50% reduction in grain loading to the filters.

Reduction in grain loading means less filter bag cleaning, which equates to longer bag life and reduced operating cost.