NEUNDORFER
PARTICULATE KNOWLEDGE

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Compliance Strategy Guide

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Understanding Cement MACT: What it Means for Portland Cement Kilns

1. Overview

This guide is designed to help make sense of the U.S. Environmental Protection Agency's (EPA) new rules for the Portland cement manufacturing industry. These rules create more stringent national standards for reduction of hazardous air pollutants (HAPs) emitted from new and existing Portland cement kilns.

The revised standards are based on the Maximum Achievable Control Technology (MACT) floor, which sets air pollution emission limits, taking both cost and feasibility into account. The new limits are based on results from sources with the lowest levels of HAPs in raw materials. Plants with higher HAP concentrations in their raw materials (for example, mercury in limestone) must therefore overcome a significant hurdle to comply.

Portland cement kilns are impacted by two EPA regulations: National Emissions Standards for Hazardous Air Pollutants (NESHAP), which applies to *all* kilns (new and existing), and New Source Performance Standards (NSPS), which applies *only* to new kilns. This guide begins by presenting the deadlines for compliance and then explains which rule (if either) applies to a given kiln. Next, the new emissions limits are discussed along with required methods to demonstrate compliance. The remaining sections clarify the addition of new stipulations and the removal of some former provisions. Finally, a summary outlines the best strategy for creating a compliance plan.

The discussion here involves just one group of new MACT rules; other industries, such as industrial boilers, are regulated separately.

2. When Do the New Rules Go Into Effect?

The new rules were published in the Federal Register on September 9, 2010. The final version of these regulations is available at http://www.epa.gov/ttn/atw/pcem/fr09se10.pdf.

Existing sources affected by the new rules have three years to comply. (The deadline is late 2013.) New kilns (defined as those built after May 6, 2009 for NESHAP, or June 18, 2008 for NSPS) must comply within 60 days or at startup.

3. Does This Apply To Me?

The rules discussed here apply to all cement manufacturing plants using Portland kilns, *excluding* kilns that burn hazardous waste (these are regulated by other rules). Some distinctions are made between Major Source or Area Source and Existing Kiln or New Kiln. These subcategories can get a bit confusing; for example, the date used to define a "new kiln" depends on whether the applicable rule is NESHAP or NSPS. Table 1 clarifies whether this regulation applies to a given kiln, and which subcategory the kiln fits into. For specific questions, contact Keith Barnett at the EPA's Office of Air Quality Planning and Standards: (919) 541-5605 or barnett.keith@epa.gov.

Table 1 – How the New Rules Apply to Portland Cement Kilns

	Yes	No
Does the kiln burn hazardous waste?	NESHAP & NSPS rules do not apply. See separate rules for kilns burning hazardous waste.[1]	NESHAP & NSPS rules do apply. Continue reading.
Does the kiln have potential to emit 10 or more tons per year (TPY) of a single pollutant, or 25 TPY or more of a combination of pollutants?	Category: Major Source. Mercury, THC, PM and HCl emission limits apply.	Category: Area Source. Mercury, THC & PM emission limits apply. HCl emission limits do not apply.
Was the kiln built after May 6, 2009?	Under NESHAP rules, considered a New Kiln.	Under NESHAP rules, considered an Existing Kiln.
Was the kiln built after June 16, 2008?	Under NSPS rules, considered a New Kiln. NSPS rules apply.	NSPS does not apply.

Notes

1. National Emission Standards for Hazardous Air Pollutants from Hazardous Waste Combustors, 40 CFR Section 63, Subpart EEE, http://edocket.access.gpo.gov/cfr_2008/julqtr/pdf/40cfr63.1201.pdf

4. What Standards Do I Have To Meet?

4.1 NESHAP Rule

The revised NESHAP rule specifies limits for four pollutant categories: mercury (Hg), total hydrocarbons (THC), particulate matter (PM) and hydrochloric acid (HCl). Regulation of HCl applies *only* to Major Sources; all other limits apply to Major *and* Area Sources. The limits kilns must comply with are summarized in Table 2.

Although the goal of NESHAP is to reduce emission of harmful pollutants, sometimes it is difficult to measure them directly. To make this easier, other compounds are used in some places as stand-ins. THC is a surrogate for polycyclic organic and polychlorinated biphenyls, and PM is a surrogate for nonvolatile metal HAPs.

Most of the time, the pollutant substitutions work well. However, using THC as a surrogate can sometimes be misleading if benign non-HAP compounds are a significant part of THC emissions. In these cases, an alternative to the general THC limit, known as the "organic HAP limit," is given. This allows organic HAP to be directly measured (minus benign organic material), in order to calculate plant-specific THC levels. This adjustment provides flexibility for measuring high levels of non-harmful components in THC, while still ensuring diminished HAP emissions.

Once limits are established, how do plants demonstrate compliance? The final NESHAP rule requires the addition of continuous emissions monitoring systems (CEMS) for mercury, THC, PM and HCl. This applies to all affected plants. However, caustic scrubbers are exempt from the HCl CEMS requirement. Plants that comingle kiln and clinker cooler exhaust are permitted to make air volume adjustments when measuring pollutants to compensate for increased air flow.

Table 2 – NESHAP Emission Limits

Pollutant	Existing Source Kilns	New Source Kilns
Mercury	55 lbs/million tons of clinker, averaged over 30 days	21 lbs/million tons of clinker, averaged over 30 days
Total Hydrocarbons (THC)	24 parts per million by volume (PPMV) at 7% O_2 (19% O_2 for raw material dryers), averaged over 30 days	24 PPMV at 7% O_2 (19% O_2 for raw material dryers), averaged over 30 days
Organic HAP[1]	9 parts per million dry volume (PPMVD) at 7% O_2 (19% O_2 for raw material dryers), averaged over 30 days	9 PPMVD at 7% O_2 (19% O_2 for raw material dryers), averaged over 30 days
Particulate Matter (PM)[2]	0.04 lbs/ton of clinker, averaged over 30 days	0.01 lbs/ton of clinker, averaged over 30 days
Hydrochloric acid (HCl), *Major Sources only*	3 PPMV at 7% O_2 , averaged over 30 days	3 PPMV, averaged over 30 days

Notes

1. Alternative to THC for plants with high levels of organic non-HAP. See 4.1.
2. Surrogate for toxic metals other than mercury.

4.2 NSPS Rule

The revised NSPS now regulates emission of nitrogen oxides (NO_X), sulfur dioxide (SO_2) and particulate matter. To illustrate compliance, a CEMS is required for each pollutant. NSPS standards apply *only* to New Kilns, defined as those built after June 16, 2008. The limits these kilns must comply with are summarized in Table 3.

Table 3 – NSPS Emission Limits

Pollutant	Emission Limits
NO_X	1.5 lbs/ton of clinker, averaged over 30 days
SO_2	0.4 lbs/ton of clinker, averaged over 30 days, or demonstrate at least 90% reduction of SO_2 emission
Particulate Matter	0.01 lbs/ton of clinker, averaged over 30 days

5. Other Points to Keep In Mind

In addition to emission limits, the new cement MACT rules address leeway for startup and shutdown, regulation of open clinker piles, and the change in measurement from lbs/ton of dry feed to lbs/ton of clinker.

How do the new rules apply during periods of startup, shut-down and malfunction?
During startup and shutdown periods, the same severity of emission limits applies. However, mercury and PM standards are converted to a concentration basis because an insignificant amount of clinker is being produced as the kiln is warming up or cooling down. (THC and HCl are already measured on a concentration basis.) Also, for startup or shutdown periods, oxygen concentration correction factors do not apply and compliance is averaged over only seven days so lower startup concentrations can balance out any momentary peaks that occur before the kiln is in steady state.

There are no separate standards for malfunctions. If failure to comply is the result of a malfunction, the EPA will determine an appropriate response based on the individual situation. Considerations include sincere efforts of the source to minimize emissions during malfunction periods, including preventative and corrective actions.

How can the lbs/ton of clinker measurement be used if necessary equipment is not available?
Before introduction of the new rules, emission limits were measured in pounds per ton (lbs/ton) of dry feed *input*. Now, the measurement is in lbs/ton of clinker *produced.* This change may be met with uncertainty since most cement plants do not have equipment to accurately measure clinker. The EPA assumes these facilities will use a feed-to-clinker conversion factor to calculate clinker production on whatever time basis is necessary.

How do the new rules apply to open clinker piles?
The new rules include provisions to prevent fugitive dust emissions from open clinker piles. A distinction is made between *active clinker piles* (handling activities occur on a regular basis) and *inactive clinker piles* (no handling has occurred in 30 or more consecutive days). Clinker piles within 1,000 feet of a plant's property line must be completely enclosed. Clinker piles more than 1,000 feet from the property line must be enclosed in a three-sided barrier with a roof, and wind fence on the open side. Inactive clinker piles may alternatively be contained using a tarp, so long as the pile is completely covered at all times and records are kept proving "inactive" status. See Section H on page 20 (Federal Register page #54989) of the final Cement MACT rule. (http://www.epa.gov/ttn/atw/pcem/fr09se10.pdf).

6. What No Longer Applies from the Old Rule?

The NESHAP rule originally issued in 1999, and amended in 2006, contains some stipulations no longer needed due to broader or more stringent terms in the 2010 amendments described here. Four provisions have been removed.

- The operating limit for average hourly recycle rate of cement kiln dust no longer applies. Plants can recycle as long as they are able to meet the emission limits.
- The 50 parts per million volume dry (PPMVD) THC emission limit for new greenfield sources (kilns built after March 24, 1998, at sites where no other kilns previously existed) is annulled; the new limit is more stringent.
- The restriction regarding use of fly ash with increased mercury is replaced by the new mercury emission limits.
- The opacity limits for kilns and clinker coolers no longer applies; the new standards require a PM CEMS, considered a more accurate method of measuring pollutants.

7. Summary

A holistic, scenario planning-based approach is best for complying with new MACT rules. To make smart, educated decisions, it's necessary to understand *all* variables that impact compliance—from the fuel to the stack. The performance of front-end equipment like coal mills and air heaters can have a significant impact on back-end emission control equipment and, ultimately, pollutant levels exiting the stack. Only with an understanding of these connections, based on representative and comparative data, is it possible to define achievable goals and choose the highest performance, lowest-cost, most flexible options.

The first step is baseline testing which, if well-planned and executed, creates linked combustion and efficiency data that can be used in effective compliance scenario planning. This requires data collection beyond the requirements outlined above. Such an approach requires multiple steps which, if followed completely and in order, result in a clear picture of existing conditions, necessary conditions, and how to get there. This process has five phases:

1. Collect representative data about baseline conditions
2. Analyze and compare the meaning of baseline data sets
3. Accurately model the effects of different options
4. Assess the costs and benefits of available options
5. Formulate and execute a plan of action for compliance

The timeframe for compliance is short, and the stakes are high. Good planning and execution during the data collection and analysis phase enable accurate modeling and scenario planning, revealing the most cost-effective compliance strategy.

Comments

We invite you to share your thoughts about boiler MACT in general and this guide in particular. Please send comments to Mae Kowalke, **MaeK@neundorfer.com**.

About the authors

Marlin Anderson, Senior Environmental Consultant, joined Neundorfer in 2007 and has more than 30 years experience in the air pollution control industry. His areas of specialty include gas flow modeling, troubleshooting electrostatic precipitator performance, in situ testing of gas flow distribution, ash resistivity lab testing and process evaluation. He has authored or co-authored papers and reports on the evaluation of new technologies and particulate control devices. Marlin holds a B.A. in physics and mathematics from Huntingdon College and a Ph.D. in physics from Auburn University.

Brittany Shrefler is a junior at Ohio State University's Honors Program, majoring in biomedical engineering. As an intern at Neundorfer for three years, she applied her passion for learning to a variety of projects, including co-authoring a user manual for the company's sulfur (SO_3) injection system. Brittany plans to use the technical knowledge and holistic problem-solving approach learned while working at Neundorfer in her pursuit of a career as a medical doctor.

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