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ISSUES ASSOCIATED WITH THE USE OF ACTIVATED CARBON FOR MERCURY CONTROL IN CEMENT KILNS

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Proposed NESHAP for the Portland Cement Industry

- Issued In May 2009 by the U.S. Environmental Protection Agency (EPA).
- Designed specifically to promulgate new or replace existing limits for mercury, HCl, particulate matter, and total hydrocarbons.
- Public comments were solicited, and EPA is currently evaluating the comments it received. It is expected that a final rule will be issued by June 6, 2010.
- As required by the Clean Air Act of 1990, EPA is using the maximum achievable control technology (MACT) approach to setting limits for each regulated hazardous air pollutant.

Proposed Mercury Regulatory Requirements

- The proposed mercury limits for cement kilns or in-line kilns/raw mills is 43 lb/million (MM) tons of clinker for existing sources and 14 lb/MM tons of clinker for new sources.
- Both limits will be based on a 30-day rolling average.
- Depending on the operating size of the plant and volume of flue gas, these limits translate into a range of 5–10 µg/dscm for existing sources and 2–5 µg/dscm for new sources, substantially less than the 41 µg/dscm that was proposed in 2006.

Proposed Mercury Regulatory Requirements

- EPA is also proposing to eliminate the restrictions on the use of fly ash from sources that have installed activated carbon (AC) for mercury control.
- To ensure that these requirements are being met, EPA is proposing that all affected cement plants would be required to install continuous mercury monitors. This monitoring requirement can be met either using sorbent traps (PS-12B) or instrumental monitors (PS-12A).

Comparison of Mercury Emission Concentrations

Source	Typical Mercury Emissions, µg/m^3
Gas-Fired Boilers	Low – at or below detection limits
Oil-Fired Boilers	0.2 to 1.8
Cement Plants	8.4 median, 27.8 average, 67.2 standard deviation
Bituminous Coal-Fired Boilers	6.8 to 24.0
Subbituminous Coal-Fired Boilers	0.8 to 17.5
Lignite Coal-Fired Boilers	17.8 to 25.5
Municipal/Medical Waste Incinerators	39 to 700

Source: Richards, John, *Capabilities and Limitations of Available Control Technologies for Mercury Emissions from Cement Kilns*, R&D Serial No. 2748a, Portland Cement Association, Skokie, Illinois, 2005, p. 11.

Mercury Concentrations Measured for a Select Number of Cement Plants

Plant	Kiln Type	Raw Mill On, µg/dscm	Raw Mill Off, µg/dscm	No In-Line Raw Mill, µg/dscm
1	PH/PC*	2.52	87.24	
2	PH/PC	237.00	2802.00	
3	PH/PC	0.28	11.37	
4	PH/PC	16.62	793.65	
5	Wet			5.10
6	Wet			3.35
7	Wet			24.10
8	Long dry			26.13
9	Long dry			6.64
10	Long dry			11.06

*preheater/precalciner.

Factors Affecting Mercury Emissions

- The concentration of mercury in the limestone used by the plant.
- Type of kiln that is being used in the manufacturing process.
- Age of the plant.
- Fuel being burned.
- Handling and fate of cement kiln dust (CKD) and/or baghouse dust.

Factors Affecting Mercury Emissions

- Air pollution control devices currently installed.
- Form of mercury being generated (elemental or oxidized).

Factors Affecting Mercury Control with AC

- Mercury speciation (oxidized, elemental, particulate-bound).
- Temperature profile.
- Residence time of the particulate control device used to capture the AC.
- Type of AC used.
- Flue gas composition (particularly, the presence or absence of SO_3 and halogens).

Impact of AC Injection (ACI) on CKD/Baghouse Dust

- If AC is added to the primary particulate collection device, the baghouse dust could no longer be recycled back to an in-line kiln/raw mill.
  - Result in reemission of the mercury captured by the AC.
  - Depending on the required AC add rate, it may limit if not prevent other beneficial uses as well.
- To ensure the quality of baghouse dust and to maintain the ability to recycle the dust back to the system, it may be necessary to install a polishing baghouse.
- The installation of a polishing fabric filter would increase the capital cost of Hg control on the order of 10 to 15 times compared to an ACI system alone.

Conclusions

- Mercury emissions from cement plants are highly variable both in terms of concentration and speciation.
- The effectiveness of any type of ACI (treated or untreated) for mercury control will be very site-specific.
- For many plants, to preserve the value of CKD/baghouse dust the use of AC will require the installation of a polishing baghouse, greatly impacting cost.

Conclusions

- Most likely, the proposed mercury emission limit will result in the closure of several plants because they will not be able to meet the limit without resorting to extraordinary measures such as changing their source of raw materials or substantially altering their process.