



1730 M Street NW
Suite 206
Washington, DC 20036-5603
Telephone 202.457.0911
Fax 202.331.1388

David C. Foerter, *Executive Director*
Email: dfoerter@icac.com

Chad S. Whiteman, *Deputy Director*
Email: cwhiteman@icac.com

September 30, 2008

Honorable Stephen Johnson, Administrator
U.S. Environmental Protection Agency
EPA Docket Center (Air Docket)
Mail Code: 6102T, Room B-108
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Attention: Docket ID Number: EPA-HQ-OAR-2007-0877

Re: New Source Performance Standards (NSPS) for Portland Cement Plants

Dear Administrator Johnson:

The Institute of Clean Air Companies (ICAC) is the national non-profit trade association of companies that supply air pollution control and monitoring systems, equipment, and services for stationary sources. ICAC has promoted the air pollution control industry and encouraged improvement of engineering and technical standards since 1960. Our members include over 90 companies who are leading manufacturers of equipment to monitor and control emissions of particulate matter (PM), volatile organic compounds (VOC), sulfur dioxide (SO₂), nitrogen oxides (NO_x), air toxics and greenhouse gases (GHG). The ICAC members are well positioned to supply the equipment needed to comply with the proposed standards and to provide the solutions and assurances to address the limitations to further control NO_x emissions, identified in EPA's proposed cement industry standards for new sources.

The Institute applauds EPA's efforts to address NO_x, PM, and SO₂ emissions from Portland cement plants. The emission control technologies available to reduce these emissions have continued to develop and improve as this has been the overall trend in the air pollution control industry. As demonstrated in the past for a number of other pollutants, market responses to regulatory requirements provide the single greatest push in the advancement and commercialization of control and measurement technologies. Our experience indicates that most advances in the technologies applicable to cement kilns have occurred in response to state and local emissions control requirements. Currently there are more than 100 cement plants in operation in the U.S. each emitting hazardous air pollutants and often located in heavily populated areas. Technology solutions exist to control emissions from Portland cement plants and can provide meaningful health benefits. ICAC is providing comment on the advances in technology for controlling NO_x emissions from Portland cement plants, and requests EPA fully

consider the technological improvements and their applications when establishing NO_x emission limits for the Portland cement manufacturing industry.

There are a suite of technologies installed to reduce NO_x emissions from various combustion sources. However, for this effort we will restrict our discussion to selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR) systems. SNCR has been applied successfully to cement kilns starting in 1994 with the installation on a plant operated by Ash Grove in Oregon. The kiln achieved a NO_x reduction level of >80 percent (1.0 lb/ton clinker), well below the proposed Portland cement NSPS. Since 1994 SNCR has become deployed domestically and abroad. Appendix 1 offers an excerpt from ICAC's 2007 SNCR Whitepaper documenting some of the recent experience installing SNCR on cement kilns. The urea-based SNCR experience on kilns include preheater (PH) and preheater/precalciner (PH/C) kilns for cement production and a coke calcining kiln for petroleum processing. The cost effectiveness of SNCR deployed on a PH/C cement kiln is \$700 ton/ NO_x removed.

Selective Catalytic Reduction (SCR) technology represents a mature NO_x abatement technology and is an effective technology for reducing NO_x emissions from cement kilns. While there is no domestic experience applying SCR on cement kilns there is a growing body of European experience. SCR can reduce NO_x emissions from cement kilns by greater than 90 percent, which is consistent with the removal efficiencies achieved with SCR in the electricity generation industry. There are over 300 SCR systems installed on coal, oil and natural gas- fired utility boilers and there are many more applications of the technology in other industrial sectors such as nitric acid plants, steel sinter plants, waste incinerators, and refinery heaters. SCR catalysts have been proven to handle high levels of dust from coal combustion. SCR is reliable and durable under severe operating conditions. The typical operating temperatures for an SCR range from 500 to >950°F, which favor its use on cement kilns as the gas temperature between the rotary kiln and the stack are within this range. High temperatures in the rotary kiln create high concentrations of NO_x, making SCR particularly suitable to removing significant levels of NO_x as much as 90 percent or more.

The following discussion outlines SCR's technological capabilities and exemplifies its use with the existing database of field information. SCR is a commercially available technology for cement kiln applications and has achieved high rates of removal at the existing applications. In addition to NO_x reduction capabilities, there are a number of emission reduction co-benefits associated with the installation of SCR, including

- Destruction of the other pollutants e.g. ozone inducing VOCs;
- Reduction of air toxics such as dioxin and furan and benzene;
- Facilitating the removal of mercury (Hg) by catalytic oxidation; and
- Minimization of formation of fine PM by NO_x and ammonia control.

In addition, ICAC will address some of the concerns over SCR and discuss the cost implications for the industry.

The U.S. EPA continues to play a crucial role in encouraging innovation and in mobilizing supply chains to deliver technologies that improve our air quality and environment. A key driver for this improvement is the continued tightening of emission limits. This encourages the industries such as the cement industry to work closely with equipment and component suppliers to ensure significant reductions in emissions in a timely and economical manner. A literature search reveals that new kiln designs, PH and PH/C can achieve levels of at least 1.5 lbs NO_x/ton clinker without any post-combustion control technologies. TXI Kiln 5 in Midlothian, TX achieved 1.46 lb/NO_x clinker with no add-on emissions control equipment. Several other examples of new and existing kilns achieving removal efficiencies below EPA's proposed Portland cement NSPS include Cemex Sta. Cruz facility in Davenport, CA achieving 1.98 lb NO_x /ton with no add-on control equipment. Titan America in Florida, and Giant Cement in South Carolina averaged 1.62-1.88 lb NO_x /ton on new kilns with no add-on control equipment. The addition of SCR systems should be able to remove a significant fraction of this remaining NO_x taking the NO_x emissions below 0.2 lbs/NO_x ton clinker in the above stated cases if an SCR system were designed to achieve 90 percent reductions. For this reason, the new performance standards for emissions from new cement kilns that reflect technology capabilities would be in the range between 0.25 - 0.5lbs NO_x /ton clinker.

Potential of SCR

Selective catalytic reduction (SCR) is one of the leading technologies to effectively reduction of NO_x emissions. In Europe, the technology is recognized by the cement industry and a number of cement plants have installed SCR. The early experiments with SCR in cement kilns have proved very useful in identifying the key issues and more recent installations, for example that of Cementeria di Monselice in Padova Province, Italy (installed in 2006) should be viewed as a significant success. The results from the Cementeria di Monselice plant (PH) kiln demonstrated emission reduction as low as 0.20 lb NO_x/ ton with an SCR. The table below outlines the cement kiln's performance.

Table 1 Results of Selective Catalytic Reduction Tests at Monselice (2006)

<u>Parameter</u>	<u>Units</u>	<u>Design</u>	<u>Actual</u>	
Kiln Capacity	t/day clinker	2,400	1,800	
Gas Flow	m ³ /h norm, wet	160, 000	110,000	
NO _x in	mg/m ³ norm,dry (mg/dscm)	2'260	1'530	1'071
Molar Ratio	NH ₃ /NO _x	0.905	0.89	0.20
NO _x out	mg/dscm @actual O ₂	232	75	612
NO _x stack	mg/dscm @actual O ₂	200	50	408

NO _x removal	Percent (%)	90%	95%	43%
NH ₃ slip	mg/dscm	< 5	< 1	< 1
O ₂ reactor	Percent (%)	2.5%	2.7%	
O ₂ stack	% (Direct Operation)	5.0%	7.1%	
O ₂ stack	% (Compound Operation)	8.8%		
Pressure Drop	millibars	15	< 5	
NH ₄ OH	25% Solution, kg/h	445	204	34
Fuel	Typically 80% petcoke blend with various types of coal as backup fuel			

(Source: *High Dust SCR Succeeds at Cementeria di Monselice*)

The gathering momentum, to recognize the capability of the technology and these recent successes have encouraged organizations such as the European Union Integrated Pollution Prevention and Control Bureau (IPPC) to accept SCR's potential as a "best available technology." The use of SCR will be essential as states strive to meet the National Ambient Air Quality Standards (NAAQS) for ozone and PM_{2.5}. The regulatory impact analysis (RIA) completed for the revised ozone NAAQS recommends the use of SCR to control NO_x emissions from cement kilns.

The US Cement industry now has an opportunity to build on this success and begin the process of incorporating SCR technology, into new or retrofitted cement kilns. In 2007 the EPA established a new air quality standard for ozone and estimated emissions from 69 of the U.S.'s operating kilns. EPA concluded that SCR installation on these kilns would result in the reduction of over 66,000 tons NO_x/yr. ICAC is confident that the air pollution control industry supplying the essential components (e.g. SCR catalysts, ammonia solution dispensing systems) can work with the Portland cement manufacturers and state and federal regulators to dramatically reduce the NO_x produced in cement manufacturing.

SCR Co-Benefits

In any NO_x abatement process it is essential to minimize ammonia slip. The mechanism of SCR can ensure very little ammonia slip, evidenced at Cementeria di Monselice where the pre-commissioning level of ammonia emission (20 – 50mg/m³) was reduced to less than 1mg/m³ through SCR installation (see table above). SCR systems have the potential to reduce ammonia emissions, a hazardous air pollutant and a precursor to PM_{2.5} formation. Further benefits include:

- VOCs in the cement exhaust will react with NO_x across the SCR catalyst destroying potential carcinogens & air toxics, reducing NH₃ consumption.

- The removal of mercury in wet scrubbers and wet ESPs becomes much easier downstream as the SCR can oxidize metallic mercury into ionic forms.

Cost Implications

In the evaluation of SCR's cost effectiveness in removing NO_x from a cement kiln a conservative threshold ranges from \$1,800- \$5,000 per ton of NO_x controlled. ICAC member companies are confident that they can design and deliver SCR systems to achieve NO_x control from cement kilns within this threshold range.

Emissions Monitoring

The Institute of Clean Air Companies comprises air pollution control equipment providers as well as emissions measurement suppliers which offer various types of continuous emission monitoring systems (CEMS). CEMS are widely deployed in the electric utility and industrial sectors to assure compliance with the appropriate state and or federal air quality requirements. ICAC supports the proposal to allow facilities to install particulate matter (PM) CEMS as there are several types of emissions measuring techniques that can be applied to combustion processes. One PM CEMS technology, beta attenuation based systems, can be used for both wet and dry stack situations and the installed costs are in the range from \$120,000 to \$140,000. PM CEMS have been applied to coal-fired power plants with almost a dozen systems installed to date and more than a dozen required at recently permitted boilers. PM CEMS have also been applied to pulp mill recovery boilers with one application having three years of data, and also applied to incinerators with one application having two years of operating data. A second PM measurement technology, optical-based technology, uses a light scattering technology for dry stacks and the installed costs are approximately \$25,000 for the equipment and another \$20,000 – \$40,000 to perform the stack test that develops the correlation curve to match instrument readings to the amount of particulate emissions.

The EPA's long history of setting challenging targets, inducing innovation continues to be beneficial to our environment. It is well documented that each time the EPA has considered new clean air standards; it has been met with claims that cleaner, healthier air was not feasible, practical or affordable. During the debate over the 1990 amendments to the Clean Air Act, representatives of industry repeatedly claimed the costs of the new programs would be excessive and the societal benefits minimal. In response, Congress instructed EPA to prepare a detailed analysis of the costs and benefits of the new legislation. EPA valued the total monetized health benefits achieved through 1990 at \$22.2 trillion and the total compliance costs over the same years at \$0.5 trillion. The resulting net monetary benefits of \$21.7 trillion make the Clean Air Act one of the most cost effective regulatory programs in American history.

In conclusion, EPA has a strong record of encouraging technological innovation through the implementation of clean air rules that protect human health and the environment. In light of the revisions to the ozone and PM_{2.5} NAAQS and the vacatur of the Clean Air Interstate Rule (CAIR) states will increasingly seek to achieve the maximum emission reduction possible by utilizing the complete suite of NO_x reduction technologies available. SCR offers the potential of removing up to 95 percent of NO_x emissions and the co-benefit of oxidizing a significant amount of the mercury emissions

for downstream capture. ICAC and its members stand ready to support the cement industry by providing them with the appropriately designed SCR system to meet EPA NSPS standards.

Sincerely Yours,

A handwritten signature in cursive script that reads "Carolyn Slaughter". The signature is written in black ink on a white background.

Carolyn Slaughter
ICAC, Program Development Manager

Appendix 1: SNCR Experience on Cement Kilns

Location	Unit Type	Size (MMBtu/hr)	Fuel	NOx Baseline (ppm)	Reduction %
Ash Grove Cement Seattle, WA	Cement Kiln/ Pre-Calciner	160 tons solids/hr	Coal, Gas	350 - 600#/hr	> 80
Korean Cement Dong Yang Cement, Korea	New Suspension Calciner		Coal	1.27 lb/MMBtu	45
Lehigh Portland Cement Mason City, IA	Cement Kiln/ Pre-Calciner	368	Coal, Gas	0.95-1.35 lb/MMBtu	25 - 35
Plant Name & Location Confidential				1500 mg/Nm3 @ 11% O2	45
Taiwan Cement Units #3, #5, & #6	Cement Kiln/ Pre-Calciner	260 697 658	Coal Coal Coal	1.29 1.58 0.92	50 45 25
Wulfrath Cement Germany	Cement Kiln	140	Lignite	1000 mg/Nm3 500	90

(Source: ICAC 2007 SNCR Whitepaper)

References

1. Koucky W., Merrill R., Gossman D., Miller G., Miller G. Assessment of NOx Emissions Reduction Strategies for Cement Kilns – Ellis County, Final Report. TCEQ Contract No. 582-04-65589. July 14, 2006
2. High Dust SCR Succeeds at Cementeria di Monselice Ulrich Leibacher, ELEX, Schwerzenbach, Switzerland; Clemente Bellin, Cementeria di Monselice SpA, Italy; A.A. Linero, P.E., Tallahassee.
3. Linero A. Trip Report on SCR Experiences at Solnhofer Portland Zementwerke, Cementeria di Monselice, and ASM Brescia Waste-to-Energy Plant." July 31, 2006.
4. Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants
5. <http://www.arb.ca.gov/html/brochure/history.htm>
6. <http://www.cleanairtrust.org/nepa2cercla.html>
7. <http://www.epa.gov/oar/caa/caa202.txt>
8. http://www.environmentaldefense.org/documents/4936_caa35.pdf
9. <http://www.aqmd.gov/news1/archives/history/marchcov.html>
10. <http://www.platinummetalsreview.com/pdf/pmr-v43-i4-168-171.pdf>
11. Linero A. Private communication
<http://www.epa.gov/ttn/ecas/regdata/RIAs/3-ozoneriachapter3appendix.pdf>
13. ICAC 2007 Selective Non-Catalytic Reduction (SNCR) Whitepaper