Portland Cement Industry Challenges: Meeting Upcoming Air Requirements

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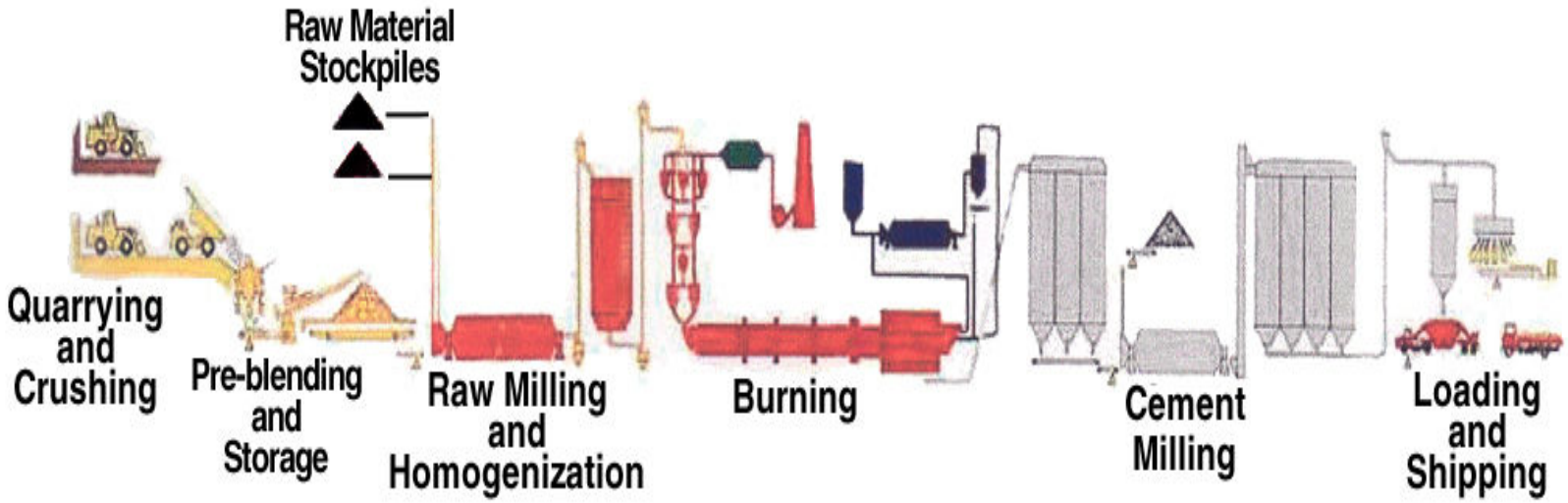
Introduction

- Unique aspects of cement kiln air emissions
  - Raw materials contribute to emissions
  - Kilns are located at dedicated sources of limestone
  - Primary fuels are coal and pet coke
- Context
  - Economy's impact on cement demand and capital plans
  - Multiple pending regulatory actions
  - Uncertainty introduced by legal challenges

Cement Manufacturing Overview



Federal Air Regulatory Drivers

- NSPS
- MACT
- New Source Review Enforcement
- “CAIR II”
- GHG Regulations/Legislation

Revisions to NSPS Standards

- NSPS Timing
  - Revisions proposed June 16, 2008
  - Finalized this summer; coordinated with MACT
- Proposed NSPS Limits
  - Change form of **PM** limit; lower to 0.086 lb/ton of clinker
  - New **NOx** limit of 1.50 lb/ton clinker (30 day average)
  - New **SO2** limit of 1.33 lb/ton clinker (30 day average) or 90% control
- NSPS Controls Outlook
  - PM – Fabric Filters
  - NOx – SNCR
  - SO2 – fuel choice, lime injection, wet scrubber

Revisions to the MACT Standards

- MACT Timing
  - Revisions proposed May 6, 2009
  - Expected to be finalized this summer; coordinated with NSPS revision
  - Existing source compliance deadline will be summer of 2013

Revisions to the MACT Standards

Proposed MACT Limits:

Pollutant	Form of Standard	Existing Source	New Source
Mercury	lb/MM ton of clinker (30 day average)	43	14
Total Hydrocarbons (THC)	ppmv at 7% oxygen (30 day average)	7	6
PM	lb/ton of clinker	0.085	0.080
HCl	ppmv at 7% oxygen (30 day average)	2	0.1

(Opacity limit to be dropped and Dioxin/Furan limit retained)

Revisions to the MACT Standards

- MACT Controls Outlook
  - PM: Fabric Filters
  - Mercury: Fuel choice, wet scrubber, activated carbon, CKD (dust) wastage
  - HCl: Sorbent injection, wet scrubber
  - THC: activated carbon, RTO

Revisions to the MACT Standards

- EPA and PCA assessment of proposed MACT rule control equipment requirements

Controls	# of Kilns EPA	# of Kilns PCA
Fabric filters	0 – 5	15 (9%)
Scrubbers	125-128	139 (82%)
ACI with fabric filters	141-147	119 (70%)
RTOs	12-21	105 (62%)

New Source Review Enforcement

- EPA Enforcement Initiative:
  - Cement manufacturing industry is designated as a NSR/PSD ”national enforcement priority”
  - “third largest industrial source of pollution”
  - Initiative started in 2008
  - Three settlements to date

NSR Enforcement

- Lafarge NSR Settlement
  - Signed in January of 2010
  - Covers 23 kilns at 13 locations
  - Technology Commitment (number of kilns)
    - SNCR 13
    - SCR 1
    - Dry Sorbent 13
    - Wet Scrubber 4
    - Shutdown 2
  - To be completed by 2014.

GHG Regulation/Legislation

- GHG timing and limits – Who knows?
- Most likely mechanisms:
  - NSR/PSD
  - NSPS
  - Cap and trade
- Kiln GHG Emissions
  - CO2 released in conversion of limestone (50-60% of total)
  - Heat required to support the chemical reaction
  - Suited to the use of waste as fuel and biofuels

GHG Reductions

GHG Control Options

- Most significant measures to reduce GHG emissions do so indirectly:
  - Changes to the composition of cement to reduce its CO2 intensity
  - Measures to reduce electricity use at the cement plant
- Older long kiln wet processes use more fuel. Newer plants have dry feed and incorporate heat recovery methods.

GHG Reductions

- Process technology options
  - Wet versus dry feed kiln design
  - Clinker cooler design
  - Use of a Preheater/Precalciner
- Other thermal efficiency measures
  - Energy management system
  - Seal maintenance
  - Indirect firing
  - Shell heat loss reduction

GHG Reduction (continued)

- Raw material substitution
  - Iron slag and fly ash
  - Supply and regulatory issues
- While biofuels will reduce GHG emissions overall, the impact on kiln emissions are limited. Coal and wood have similar emissions per MMBTU.
- Use of natural gas will reduce GHG emissions, but NOx increases and cost rises dramatically.
- Sequestration: research to isolate CO_2 from kiln exhaust is being pursued

Control Technology Issues

Scrubbers

- Many locations have little or no water
- How well will sorbent injection work for both HCl and SO2?
- How well will wet scrubbing work for HCl and SO2 and mercury at the same time?
- Limited option for incorporation of sludge in product

Carbon Systems

- High level of methane and ethane in kiln THCs
- Design of system to control both organics and mercury.
- How well will a system control both THC and mercury?

Control Technology Issues

RTOs

- Ability to meet very low THC limit, given CEMS based compliance

SNCR

- Ability to control over a range of conditions and configurations

SCR

- Demonstration of performance on commercial kilns

Sequestration methods

- Demonstration of performance on commercial kilns

Performance Guarantees

Emissions Monitoring Systems for Kilns

CEMS:

- SO2
- NOx
- THC
- HCl
- Mercury
- PM

Bag leak detection systems