Comments on EPA's Analysis of Economic Benefits

EPA does not estimate, either quantitatively or qualitatively, the benefits from control of the hazardous air pollutants whose emissions would be reduced by the proposed NESHAP. Instead, EPA estimates the monetized benefits associated with co-control of criteria pollutants. The control measures that kilns would implement in order to meet the standards for HAPs established by the proposed regulation would also control criteria pollutants, and EPA estimates the monetized benefits associated with the reduction in criteria pollutant emissions that would result from these controls.

More specifically, EPA estimates monetized benefits for control of $PM_{2.5}$ and SO_2, a $PM_{2.5}$ – precursor. The estimates depend ultimately on epidemiological studies relating fine particle concentrations to premature mortality and other adverse health impacts. EPA's methodology is as follows:

- Estimate the annual tonnage reductions in cement industry emissions of $PM_{2.5}$ and SO_2 that will result from the proposed NESHAP;

- Draw figures on the nationwide average benefits/ton for reductions in $PM_{2.5}$ and SO_2 emissions, from the recent EPA RIAs for the Ozone and $PM_{2.5}$ NAAQS revisions;

- Multiply the benefits per ton for reductions of each of $PM_{2.5}$ and SO_2 by the tons abated for each pollutant and sum across the two pollutants.

In the benefits analysis for the NESHAP, EPA performs no dispersion modeling, exposure assessment or risk analysis for cement plant emissions. EPA instead relies on the benefit per ton estimates developed in previous RIAs; these benefit per ton estimates reflect the extensive nationwide modeling conducted in the previous RIAs for all the steps from emissions reductions through monetizing the value of the resulting projected reductions in adverse health effects.

About 30% of the benefits that EPA calculates for the proposed NESHAP is attributable to control of direct $PM_{2.5}$ emissions from kilns and 70% is attributable to co-control of SO_2 by scrubbers projected to be installed at kilns to meet the proposed standards for HAPs. SO_2 emission reductions are valued not by reference to the direct effects of SO_2 (e.g., ecological and materials damage from acid precipitation, adverse health effects from inhalation of SO_2, etc.), but instead insofar as SO_2 is a precursor to eventual formation of $PM_{2.5}$. SO_2 emissions lead to formation of sulfate particles which comprise a substantial share of $PM_{2.5}$ in many regions of the country (see EPA's Regulatory Impact Analysis for the $PM_{2.5}$ NAAQS). The benefits per ton figure that EPA accesses and uses for SO_2 for the NESHAP benefits analysis reflects work done in previous RIAs to quantify the relationships between SO_2 emissions, sulfates, and eventual $PM_{2.5}$ concentrations attributable to SO_2.

We repeat that EPA does not estimate for the proposed NESHAP any benefits associated with the projected reductions in HAP emissions. As EPA states in the RIA: "Methodological limitations prevented EPA from quantifying the monetized benefits of emissions reductions from

HAPs." (*Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Indust*ry. Final Report, April 2009.)

In the following sections we provide comments on EPA's benefits estimates for the proposed NESHAP.

1. EPA must estimate the benefits of HAP emission reductions

We disagree that methodological limitations prevent EPA from estimating the monetized benefits of HAP emission reductions from the proposed rule. To the contrary, well developed techniques exist for EPA to conduct multipathway risk assessments for cement kilns for HAP emissions or HAP emissions reductions. EPA and industry have applied these techniques many times, most extensively for risk assessments involving hazardous waste-burning cement kilns as part of the NESHAP EEE rulemaking, but the techniques could be applied similarly for kilns that do not burn hazardous wastes. Several examples of risk assessments for cement kilns exist in the docket for this rulemaking, including, for example, EPA's worst case screening analysis that concludes that an emissions limit of 23 ppmv would result in no health risk to surrounding populations from current cement kiln emissions of HCl.[1] In addition to risk modeling for HAPs, well-accepted methods for estimating the monetary value of changes in HAP risks also exist and have been applied.

Executive Order 12866 requires EPA to conduct a full analysis of benefits and costs, monetized to the extent possible, for any economically significant regulation such as the Portland Cement NESHAP. The Executive Order, subsequent "best practices" guidances and EPA's own *Guidelines for Preparing Economic Analyses* further require analysis of the benefits and costs of both the proposed regulatory requirements and major alternatives. For the Portland Cement NESHAP, some alternatives posed by the Agency in the proposed rule preamble would significantly change the projected balance between emission reductions for HAPs and for criteria pollutants. For example, one major alternative considered by EPA is to address HCl under CAA section 112(d)(4) and to decline to establish a MACT standard for this HAP, based on a finding of no health risk. This alternative would very sharply reduce the amount of SO_2 co-controlled by the NESHAP (scrubbers needed for HCl control are the major reason for projected reductions in SO_2 emissions), leaving a regulation addressing the remaining HAPs that would have a vastly different mix of pollutant reductions (HAPs vs. criteria pollutants) than would result from EPA's proposed regulatory alternative. We believe, in order to fairly compare the proposed regulation against alternatives such as this one (or many others), EPA must analyze the benefits from HAP emissions reductions as well as criteria pollutant emission reductions.

We expect that an analysis of the benefits of the proposed NESHAP and alternatives that involves HAPs in contrast to co-controlled criteria pollutants will likely show small, near-zero benefits from reductions in HAP emissions. The risk analyses conducted to date for hazardous waste-burning cement kilns as part of the National risk assessment for the Subpart EEE sources have found risks from current emissions of the HAPs addressed under the Subpart EEE NESHAP to be below thresholds of concern. We believe that hazardous waste-burning cement kilns generally provide a worst case representation for Portland Cement kilns; HAP risks

[1] Derivation of a Health-Based Stack Gas Concentration Limit for HCl in Support of the National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry. April 10, 2009.

associated with Portland Cement kilns will generally be less than or equal to those from hazardous waste-burning kilns. Nevertheless, despite the likelihood that EPA will find minimal health risks from the NESHAP-regulated HAPs from Portland Cement kilns and near-zero benefits from regulatory alternatives that reduce HAP emissions specifically, we think it important that EPA conduct such analysis. In evaluating the proposed NESHAP and alternatives to it, it is very important for both the Agency and the public to have an understanding of what is at stake in terms of benefits involving both HAPs and co-controlled criteria pollutants. Some portions of the proposed NESHAP abate largely HAPs or nearly exclusively HAPs without co-control of criteria pollutants, and these portions of the proposed rule deserve thorough analysis also.

2. EPA overestimates uncontrolled SO_2 emissions from kilns by about 25%

Co-control of SO_2 – a precursor to fine particulates – accounts for about 70% of the monetized benefits that EPA estimates for the NESHAP. EPA estimates SO_2-related benefits as the tonnage of SO_2 emissions abated by the regulation multiplied by a dollar value of benefits per ton, and thus benefits are a linear multiple of the estimated emissions reductions. Emission reductions are estimated on a percentage removal basis (i.e., a wet scrubber is assumed to control 95% of a kiln's uncontrolled SO_2 emissions; see Andover, 2008, and ISIS_inputs.xls for the NESHAP version of ISIS-cement; also see PCA comments on this level of control in item #4 of this section), and thus EPA's estimated benefits ultimately depend linearly on EPA's estimates regarding the uncontrolled rate of SO_2 emissions from cement kilns. We believe that EPA has overestimated the uncontrolled rate of SO_2 emissions by some 25% as a national total. We believe that correcting the Agency's estimates regarding the uncontrolled rate of cement kiln SO_2 emissions would reduce EPA's SO_2-related benefits estimates by approximately 25%. Further reduction in estimated SO_2-related benefits would occur if EPA were to re-estimate the control efficiency of wet scrubbers as we suggest later in this section.

EPA develops its estimates of uncontrolled SO_2 emissions by beginning with 2002 information for cement plants from the 2002 National Emissions Inventory. The Agency then estimates average SO_2 emission rates per ton of clinker by region and by kiln type, apparently collapsing information that existed originally by plant into averages for all the plants within a region (see Andover, 2008, pages 14 – 23 and particularly Tables 8 and 9). EPA then further collapses the different regional averages into a single national average uncontrolled SO_2 emission rate per ton of clinker for each of 4 kiln types (see *Summary of Environmental and Cost Impacts of Proposed Revisions to Portland Cement NESHAP*, page 6, Exhibit 6).[2] From this point, however, it is unclear how EPA proceeds further to estimate total national uncontrolled SO_2 emissions in 2005, the base year for the Agency's analysis. EPA conducts two parallel but different analyses to estimate emissions, emission reductions and costs; the Regulatory Impact Analysis and an analysis using the ISIS-cement model.[3]

[2] Note that the Andover (2008) reference on page 23 recommends that EPA use the *median* (lower) uncontrolled emission rates that the authors developed, but EPA chooses for unexplained reasons to use the *average* (higher) uncontrolled emission rates (see *Summary of Environmental and Cost Impacts…* page 6, Exhibit 6).

[3] *Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry. Final Report*. April, 2009. This RIA relies on estimates developed in EPA's "engineering cost analysis", *Summary of Environmental and Cost Impacts of Proposed Revisions to Portland Cement NESHAP*. April 15, 2009. The ISIS-cement model analysis is described in *Industrial Sector Integrated Solutions Model. Report. National Emission Standards for Hazardous Air Pollutants, Portland Cement Manufacturing Industry*. April, 2009. Further detail on the ISIS-cement data inputs and results are available in the

- **In the RIA.** There is no documentation in the RIA and its backup material on how further calculations are developed. It is not clear how emission rates for 2005 were estimated from data pertaining originally to 2002, nor whether the plant-specific data from NEI for 2002, the region-specific averages, or the national averages were used.

- **In ISIS.** There is likewise insufficient information in the ISIS model documentation to explain how the Agency conducted further calculations. The documentation suggests that the ISIS calculations used the regional *median* values from 2002, in contrast to the RIA calculations which apparently in some manner used the higher, regional *average* values from 2002 (see ISIS documentation report, Table 4-5 on page 23 compared with *Summary of Environmental and Cost Impacts…* page 6, Exhibit 6), but this is not clear. The ISIS model input spreadsheets (ISIS_inputs.xls) show baseline SO_2 emissions for 2005 being estimated in two *different* ways: using the 2002 kiln-by-kiln estimates from NEI inflated by 6% to represent the average national increase in clinker production between 2002 and 2005 (see column AC of the Units worksheet), and using the regional median emission intensity figures from 2002 multiplied by each kiln's estimated 2005 clinker production capacity (see column AH of the Units worksheet).[4] It is not clear, however, which of these two estimates for kiln-by-kiln 2005 SO_2 emissions is then utilized in the actual ISIS-cement NESHAP model run; this information is hidden somewhere in the GAMS model code.

In summary on this point, it is not clear how the Agency estimates total national SO_2 emissions from cement kilns in 2005, either in the RIA and engineering cost analysis (the available documentation is not sufficient to trace the calculations) or in ISIS (two alternative estimates are developed, and it is not clear which estimate is ultimately used in the model).

The RIA/engineering cost analysis never indicates what the Agency ultimately estimates total national baseline SO_2 emissions from cement kilns to be; the analysis provides figures only on the SO_2 emissions reductions expected from the proposed regulation (see page 19, Exhibit 14 in *Summary of Environmental and Cost Impacts…*). ISIS estimates total national SO_2 emissions from cement kilns in 2005 as 177,441 tons by one method (column AC of the Units worksheet summed for all kilns existing in 2005) and as 175,501 tons by the other method (summed column AH of the Units worksheet).

We believe that all of these estimates for 2005 SO_2 emissions are likely to be inaccurate, for some or all of the following reasons (depending on which methods the Agency actually used to develop the estimates):

- Inaccuracies in the data obtained for the 2002 NEI;
- Inaccuracies in collapsing individual plant data into regional averages or medians by kiln type and then into national averages or medians by kiln type;
- Potential inaccuracies in using medians rather than averages;

---

model files recently placed in the docket, including ISIS_inputs.xls and ISIS_outputs.xls for the NESHAP model run.

[4] This latter means of estimating actual SO_2 emissions in 2005 is obviously incorrect. Emissions intensity, however it is estimated, should be multiplied by each kiln's clinker *production* in 2005, not by its clinker *capacity*.

- The error in multiplying emissions intensity (lbs SO_2 per ton of clinker) by clinker capacity in contrast to actual clinker production;
- Errors in updating 2002 emission information for individual kilns to 2005 by inflating each kiln's emissions by the national average production increase from 2002 to 2005 instead of by each kiln's actual production increase over this period;
- The potential error in including SO_2 emissions from hazardous waste-burning kilns in the inventory of 2005 baseline emissions that might be affected by the proposed NESHAP. It is not clear whether EPA made this error or not.

PCA has available a much better quality data base on 2005 SO_2 emissions from cement plants than would result from any of the methods that EPA may have used in the RIA and ISIS.

Every year, PCA (with the assistance of a contractor) surveys all U.S. and Canadian cement plants to obtain information on their labor and energy usage, resulting in an annual *U.S. and Canadian Labor-Energy Survey* publication. Among other information, cement plants report on their total annual SO_2 emissions and provide information on how their SO_2 emissions estimates were prepared. For the year 2005, 75 U.S. cement plants provided full answers to the SO_2 questions. The 75 responding plants account for 84% and 85% respectively of EPA's two estimates in ISIS for total U.S. national cement plant SO_2 emissions.

We compared on a plant-by-plant and national total basis this *Labor-Energy Survey* data on SO_2 emissions against EPA's estimates in ISIS for these 75 plants. For the 75 plants in total, 2005 SO_2 emissions reported in the *Labor-Energy Survey* summed to 119,739 tons, in contrast to 149,533 tons as estimated by EPA in ISIS for these same plants. PCA's total estimate for all responding plants is thus about 20% lower than EPA's total estimate or, put another way, **EPA's estimate is about 25% higher than PCA's** data would suggest.

Viewed on an individual plant basis, the comparison between PCA's data and the EPA/ISIS estimates go either way. The largest variances in each direction are as follows. For one plant, EPA's estimate for SO_2 emissions in 2005 is more than 9,000 tons higher than the plant's response in the *Labor-Energy Survey*, while for another plant their *Labor-Energy Survey* response is about 5,600 tons higher than the EPA estimate.

The individual cement plants reporting this data for the 2005 *Labor-Energy Survey* indicated that their SO_2 emissions estimates were derived from the following sources: CEMs 51%, stack tests 29%, application of AP-42 emission factors 11%, application of other emission factors 9%. We believe this indicates that PCA's data are of far better quality than EPA's estimates.

If EPA wishes, we can provide this better data to EPA to replace the Agency's 2005 estimated baseline SO_2 emissions. Doing so will take some discussion with EPA and some time, as the data from the *Labor-Energy Survey* must be aggregated in various ways to respect the non-disclosure agreements under which it was obtained. *Labor-Energy Survey* data cannot be disclosed for individual plants or companies, and can be reported only in a manner such that each reported quantity reflects an aggregation across at least three companies. We would need to discuss with EPA how best to aggregate the data to meet both the Agency's needs and these constraints. The possibility exists, then, that we could provide EPA with much better data than the Agency currently has regarding, for example, regional average 2005 SO_2 emissions by kiln type.

In any event, we believe that EPA overestimates baseline SO_2 emissions by cement kilns in 2005 by about 25%, and that this factor alone leads EPA to overestimate the projected SO_2-related monetized benefits from the proposed NESHAP by a similar 25%.

3. EPA wrongly credits all projected SO_2 emission reductions in 2013 to the NESHAP

In ISIS modeling for the year 2013, the first year for which EPA projects there to be full compliance with the proposed NESHAP, the Agency estimates "base case" SO_2 emissions from kilns at 102,500 tons. After compliance with the proposed NESHAP, kiln emissions are estimated at 17,400 tons, for a reduction of 85,100 tons estimated as due to the regulation

In the benefits portion of the Regulatory Impact Analysis, however, EPA estimates SO_2 emission reductions of 139,200 tons per year as attributable to the regulation, about 64% higher than the estimate from ISIS. (We cannot find in the RIA documentation or backup any indication of what the RIA estimates baseline emissions to be in 2013 before this 139,200 ton reduction, nor can we find any statement of what emissions would remain uncontrolled in 2013 after compliance with the regulation.)

The RIA estimate assumes, wrongly, that all kilns existing as of 2005 will continue to operate and will meet the NESHAP requirements by 2013, and in addition that there will be some 20 new kilns in operation by 2013 that will meet the NESHAP new source requirements. The RIA claims credit for emission reductions from this projected inventory of kilns as if all of them will still be operating in 2013 and all of them will by then comply with the NESHAP. This is incorrect.

In fact, as projected in ISIS, some of the kilns existing as of 2005 will close or modernize (e.g., convert from wet or long dry to preheater-precalciner, which will reduce SO_2 emissions) by 2013 as a function of cement market dynamics, in the base case and without regard to the NESHAP. Not all of the projected 20 new kilns are in fact likely to come on line, as also projected in ISIS. Some domestic cement production may also be replaced by imports. It is exactly this dynamic ability of ISIS to simulate industry capacity changes in the baseline that is one of the reasons why EPA is devoting substantial effort to developing the model. ISIS offers a significant advantage in this respect over EPA's traditional engineering cost approach, in which capacity changes over time must be assumed exogenously rather than being estimated as a part of the modeling system.

ISIS indicates that some 54,000 tons/year of reduced SO_2 emissions in 2013 that EPA claims in the RIA are due to the NESHAP instead should be attributed to baseline market dynamics (i.e., these 54,000 tons/year of reduced SO_2 emissions are due to kiln retirements, modernization, imports, etc.; they are not due to the NESHAP). The impact of the regulation in reducing SO_2 emissions in 2013 should be estimated at 85,100 tons/year (as in ISIS), not 139,200 tons/year (as in the RIA), 39% lower.

We believe the impact of the two reductions discussed thus far (25% in the previous comment, 39% in this comment) will be multiplicative, hence these two points would result in SO_2 emission reductions from kilns due to the NESHAP in 2013 being only about 46% of what EPA claims in the RIA (0.75 x 0.61 = 0.46). If so, these two reductions would also result in

monetized benefits from SO_2 emissions reductions in 2013 being only about 46% of what EPA estimates in the RIA.

Note that elsewhere in these comments we point out that the NESHAP run of ISIS-cement that EPA has developed and which we have been referencing in this comment is based on outdated projections regarding future U.S. cement consumption and outdated estimates regarding new cement capacity. In essence, the cement consumption and capacity projections that underlie EPA's NESHAP run of ISIS were developed before the severity of the current recession became apparent. Projections that have been developed more recently show a large decline in cement consumption through 2013 and cancellation of many previously planned cement capacity additions. The result, when EPA re-runs ISIS-cement using consumption and capacity projections that accurately reflect the impact of the recession, is that EPA will predict a reduction in kiln emissions of SO_2 in 2013 specifically due to market dynamics that is much greater than the currently estimated figure of 54,000 tons/year. Meanwhile, the reduction in SO_2 emissions in 2013 that the new run of ISIS will attribute to the proposed NESHAP will undoubtedly decline to well below the 85,100 tons that ISIS now estimates as attributable to the regulation. The monetized value of the SO_2 reductions attributable to the proposed NESHAP will decline consistent with this estimated reduction in tons controlled. On the other hand, the costs estimated in ISIS for compliance with the proposed NESHAP may decline also, to the extent that there will be less domestic cement production capacity projected as existing in 2013 that would incur compliance responsibilities.

4. EPA assumes unrealistically high SO_2 removal performance for the scrubbers that will be installed at kilns to comply with the proposed NESHAP

EPA assumes 95% SO_2 removal efficiency for all limestone wet scrubbers (LWS) projected to be installed by kilns to comply with the NESHAP, without regard to the reason for the scrubber (i.e., HCl control vs. protecting an RTO) and without regard to the inlet concentration of SO_2. EPA estimates that the proposed NESHAP will cause 115 existing kilns to install LWS to meet the proposed HCl limits, an additional 8 existing kilns will install LWS to protect an RTO in the course of meeting the proposed limits for THC, and all 20 projected new kilns will install LWS (*Summary of Environmental and Cost Impacts* …, pages 6, 7 and 19). EPA assumes these scrubbers will provide 95% capture efficiency for SO_2, based on an EPA consultant's report that cited removal percentages ranging from 91% to 99% (Andover 2008, page 27).

Communications between cement industry consultant Schreiber, Yonley and Associates (SYA) and scrubber manufacturers indicate that 15 ppm is the lowest SO_2 outlet concentration consistently achievable by wet scrubbers designed for SO_2 capture at cement kilns. In an analysis presented elsewhere in these PCA comments, SYA estimated the industry-wide SO_2 removal that LWS could achieve if applied to all cement kilns, assuming an inventory of kilns and baseline 2005 SO_2 emissions for these kilns as detailed in EPA's NESHAP run of the ISIS-cement model (see ISIS_inputs.xls, "Units" worksheet, column AC). SYA concluded that application of LWS to all of these kilns would reduce industry total SO_2 emissions as follows:

- If 90% control down to 15 ppm is targeted, actual control over the entire SO_2 inventory is estimated to be 88%, based on weighted averages. The simple arithmetic average kiln control is estimated to be 63%.

- If 95% control down to 15 ppm is targeted, actual control over the entire SO_2 inventory is estimated to be 92%, based on weighted averages. The simple arithmetic average kiln control is estimated to be 65%.

None of these estimates for overall projected SO_2 capture efficiency are as high as EPA's assumed efficiency of 95%. An Excel workbook providing SYA's calculations is attached (SO_2 Control Efficiency for ISIS.xls). Note that industry projects that the proposed NESHAP would result in 82% of all kilns needing to install scrubbers. Since it is not known which specific kilns will need scrubbers, the projected control efficiencies shown above would need to be reduced by 18% in order to estimate the percentage reduction in SO_2 that will likely be achieved in practice, in contrast to the potential percentage reduction that would occur if all kilns installed scrubbers.

It is not clear that the wet scrubbers actually installed at cement kilns to meet the proposed NESHAP requirements – either to control HCl or to protect an RTO installed to control THC – will achieve the performance discussed above that is expected of scrubbers intended to address SO_2. The industry has no experience with wet scrubbers intended specifically to control HCl to very low levels, and very little experience with scrubbers intended to protect an RTO. A discussion to be found elsewhere in the PCA comments indicates that scrubbers designed specifically for intensive HCl control as would be required to meet the proposed NESHAP use NaOH as the scrubbing medium. However, NaOH would appear to be an unreasonable choice for cement industry scrubbers aimed at removing low concentrations of HCl from flue gas that has a high SO_2 concentration. SO_2 scrubbers in cement industry applications generally use limestone as a scrubbing medium (lower-cost than NaOH and resulting usually in recoverable gypsum and little in the way of solid waste disposal cost), with a corresponding pH set point. It is not known exactly how a scrubber would best be designed for removal of low concentrations of HCl in the presence of high SO_2 concentrations, nor whether the SO_2 removal performance of such an HCl-optimized scrubber would differ significantly from the typical performance (discussed above) of SO_2-optimized scrubbers.

5. Scrubbers to control acid gas emissions from kilns with already low concentrations of SO_2 are not cost-effective

EPA discusses in the preamble the Agency's decision to propose a MACT standard for HCl at 2 ppmv rather a health-based standard presumably at 23 ppmv:[5]

> The choice to propose a MACT standard, and not a health-based standard, is based on the fact that, in addition to the direct effect of reducing HCl emissions, setting a MACT standard for HCl is anticipated to result in a significant amount of control for other pollutants emitted by cement kilns, most notably SO_2 and other acid gases … For example, the additional reductions of SO_2 alone attributable to the proposed MACT standard for HCl are estimated to be 126,000 tpy in the fifth year following promulgation of the HCl standard. These are substantial reductions … (74 F.R. No. 86, page 21154)

In fact, the great majority of the monetized benefits that EPA estimates for the entire proposed regulation derive from co-control of SO_2 by kilns that are projected to install scrubbers to meet the proposed HCl standard.

[5] An emission limit of 23 ppmv or less would result in no projected exceedances by any kiln of the RfC for HCl, with a margin of safety.

We do not believe that the SO_2 co-benefits from controlling HCl can provide a valid reason for HCl control requirements unless controlling SO_2 itself is shown to be cost-effective. We believe, for at least those cement kilns having already low concentrations of SO_2, that control of these emissions via LWS is not cost-effective. Consider the following example for a representative low- SO_2 kiln.

According to SYA's analysis of EPA's projected baseline SO_2 emissions from cement kilns shown in ISIS (see SO_2 Control Efficiency for ISIS.xls, attached) 48 of the 166 cement kilns with data provided have baseline SO_2 emissions with concentrations between 15 and 100 ppmv. Another 37 of the kilns have baseline SO_2 concentrations of less than 15 ppmv. Thus, in our view, 85 of the kilns that EPA analyzes in ISIS -- slightly more than half -- would obtain reductions in SO_2 concentrations of less than the 91 – 99 % range that EPA cites from installation of a LWS. We believe that installation of LWS for SO_2 control would not be cost-effective for these lower- SO_2 concentration kilns.

Consider a representative kiln from among this set of lower-emitting kilns. This preheater-precalciner kiln had baseline emissions of about 220 tons of SO_2 and produced about 750,000 tons of clinker in the base year of 2005, according to ISIS. This kiln thus had an emission rate of 0.59 lbs SO_2 per ton of clinker, a figure about 33% below the national median of 0.88 lbs/ton that EPA estimated for all preheater-precalciner kilns.[6] This kiln thus appears reasonably representative of lower-emitting preheater-precalciner kilns. The SYA analysis on SO_2 percentage removal that we referred to in the previous comments uses EPA gas flow volume relationships, and estimates that this particular kiln will have a stack outlet SO_2 concentration of about 40 ppm on a dry basis.

A LWS installed at this kiln would reduce the outlet SO_2 concentration to the lowest consistently achievable level of approximately 15 ppm, as discussed earlier. The LWS would thus control 62.5% of this kiln's baseline SO_2 emissions (40 ppm down to 15 ppm = 62.5% control), or roughly 137.5 tons per year. We estimate that a LWS installed at this kiln would cost approximately $24 million in capital cost and $5 million in total annual cost (including capital recovery), based on the BACT analysis cost estimate for LWS at a similar size (785,000 tpy) preheater-precalciner kiln cited in the section of PCA's comments reviewing EPA's control technology cost and performance estimates.[7] $5 million per year for control of 137.5 tons per year of SO_2 represents a **cost of more than $36,000 per ton of SO_2 controlled**. This figure is far above the level that might be considered to be cost-effective for SO_2 control:

- From a benefits perspective, in the RIA for the proposed NESHAP, EPA estimates the monetized benefit of controlling SO_2 from the Portland Cement industry to be only $15,000/ton to $32,000/ton. (Note that we believe this range substantially overestimates the value per ton of controlling SO_2 from cement plants, as we will discuss in the next section of these benefits comments).

[6] See Andover, 2008, page 18, Table 9; or *Industrial Sector Integrated Solutions Model: Report …*, April 2009, page 23, Table 4-5.

[7] The cost for LWS for our representative lower-emitting kiln might be lower than for the BACT analysis kiln because the BACT kiln is slightly larger. On the other hand, the BACT cost analysis was prepared in 2003, and inflation to 2005 dollars would raise costs somewhat. Also, many LWS installations will incur costs for gas reheat, sludge disposal and/or limestone preparation plants, none of which were included in the cost estimate for LWS at the BACT kiln.

- From a cost perspective, other means are available for reducing SO_2 emissions at a cost per ton far lower than $55,000. The price of SO_2 allowances -- which roughly reflect the cost of SO_2 emissions abatement -- varied between $500/ton and $1,600/ton between May, 2005 and July, 2007 (after promulgation of CAIR and before the vacatur), and has since fallen to less than $100 per ton.[8]

From either a benefits point of view or by considering comparative costs of control, in neither respect does it appear to be a "good buy" for EPA to cause cement kilns with relatively low-concentration SO_2 emissions to install LWS. We have tried to demonstrate this with reference to a single representative kiln. If need be, we could perform a similar analysis for all kilns in EPA's ISIS database with SO_2 emissions concentrations below about 100 ppm on a dry basis, and we expect the conclusions would be similar: SO_2 control via wet scrubbers for lower-emitting cement kilns is not cost-effective.

6. EPA's benefits analysis assumes, in effect, that exposure to and risk from fine particle and precursor emissions from Portland cement plant emissions is similar on average to exposure and risk from fine particle and precursor emissions from all other point sources. This is likely not true; cement kiln emissions likely cause less exposure on average and are less potent.

In the Agency's benefits analysis for the proposed NESHAP, EPA values controlling a ton of direct $PM_{2.5}$ emitted from a cement kiln at $150,000 - $320,000. This range (with some adjustments, to be discussed) represents the value as calculated in the recent RIA for the Ozone NAAQS for controlling the average ton of direct $PM_{2.5}$ emitted from all point sources. All point sources in this case are defined to include electrical generating units (EGUs) plus other point sources.

In the benefits analysis, EPA also values controlling a ton of SO_2 emitted from a cement kiln at $15,000 - $32,000, one-tenth as much as a ton of direct $PM_{2.5}$.[9] This range also is derived from the Ozone RIA, representing (again with some adjustments) the average value of controlling a ton of SO_2 emitted from all point sources, but this time excluding EGUs from the point sources considered. SO_2 emissions are valued in the Ozone NAAQS RIA calculations as a precursor to $PM_{2.5}$ concentrations; SO_2 emissions are modeled as contributing to sulfate particle concentrations, which in turn contribute to $PM_{2.5}$ concentrations.

The value ascribed to a ton of controlled SO_2 is thus one-tenth the value ascribed to a ton of controlled direct $PM_{2.5}$, but since EPA's estimated NESHAP abatement of SO_2 is about 23 times greater than the abatement of direct $PM_{2.5}$, SO_2 abatement accounts for roughly 70% of the calculated total benefits for the proposed NESHAP.

---

[8] See Kenneth R. Meade, Wilmer Cutler Pickering Hale and Dorr LLP. "CAIR: A Journey Revisited – Part II". February 27, 2009.

[9] EPA's value-per-ton figures are cited on page 5-11 in *Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry*, April, 2009. Detail on how the value-per-ton figures were developed for the Ozone NAAQS RIA is provided in *Technical Support Document: Calculating Benefit Per-Ton Estimates*. Ozone NAAQS Docket #EPA-HQ-OAR-2007-022500284.

For both SO_2 and directly emitted $PM_{2.5}$, EPA takes value-per-ton benefits estimates for nationwide aggregates of these pollutants that were developed in the Ozone NAAQS RIA and applies these values specifically to the quantities of cement plant emissions that will be controlled by the NESHAP. This represents an instance of what economists term "benefits transfer"; taking a benefit estimate developed in one context and applying it in another. A major question in evaluating all such benefits transfers is the degree to which the new context is similar to the one from which the benefits estimate is drawn. We believe that these situations are not similar and that the benefits transfers are not appropriate, for reasons having to do with both exposure and potency.

Exposure as a factor affecting benefits per ton

Cement plants are predominantly located in rural areas, far from significant concentrations of population. A ton of $PM_{2.5}$ directly emitted by a cement plant typically exposes a much smaller population than does a ton of $PM_{2.5}$ directly emitted by the other sorts of sources from which EPA draws the $PM_{2.5}$ value per ton in the Ozone RIA. The same is true for SO_2; a ton of SO_2 emitted by a cement plant typically exposes a much smaller population than does a ton of SO_2 emitted by the other sorts of sources from which EPA draws the SO_2 value per ton. We believe that more people will likely be exposed to a ton of $PM_{2.5}$/ SO_2 emitted by the average source than will be exposed to a ton emitted by a cement kiln, and thus that the value per ton estimated by EPA for other sources overestimates the value per ton from controlling cement kiln $PM_{2.5}$/ SO_2.

Note that we are not arguing that emissions from cement plants are unimportant because most plants are located in sparsely populated areas, nor are we arguing that residents of such areas are in any way less important than residents of urban areas. What we are arguing is that monetized benefits per ton, which depend to a large degree on the number of people that will be exposed to a ton of emissions from the sources being compared, will be higher for sources that affect highly populated areas than they will be for sources that affect sparsely populated areas.

To investigate this issue, we analyzed emissions data by county drawn from EPA's 2005 National Emissions Inventory (NEI). We drew information for all U.S. counties from NEI on: 1) Emissions of filterable $PM_{2.5}$ and of SO_2 from cement plants; and 2) Emissions of filterable $PM_{2.5}$ from all point sources including EGUs and of SO_2 from point sources excluding EGUs.[10] We also obtained information from the Census on population density for every county. We then compared the population density of the counties within which cement plant emissions occur against the population density of the counties within which the emissions giving rise to the value-per-ton estimates occur. We found, for both directly emitted $PM_{2.5}$ and for SO_2, that emissions from cement plants occurred generally in counties with much lower population densities than did emissions from the sources from which EPA drew the average value-per-ton estimates. We found specifically that:

[10] These groupings represent the sets of sources from which EPA drew the value-per-ton figures that were applied to cement kiln emissions. In valuing direct PM2.5 emissions from cement kilns, EPA drew the average value-per-ton figure developed in the Ozone NAAQS RIA for all point sources including EGUs. In valuing SO2 emissions from cement kilns, EPA drew the average value-per-ton figure developed in the Ozone NAAQS RIA for all point sources except for EGUs. EPA provided no explanation in the Portland Cement NESHAP RIA for why value-per-ton figures were drawn from different sets of sources for the two pollutants.

- For SO_2, the emissions-weighted average population density[11] of counties within which cement plant emissions occur was about half of that for the counties within which the emissions occur that EPA used for benefit-per-ton values. For $PM_{2.5}$, the emissions-weighted average population density of cement emission counties was about 65% of that for the counties with emissions from the sources that EPA used for the benefit-per-ton values.

Emissions-Weighted Population Density (people/sq mile)
For Areas (Counties) Affected by Cement Plant Emissions
vs. Areas Affected by Emissions From Other Point Sources

		Density
SO2	Cement	254
	All Point Sources - EGUs	518
PM2.5-FIL	Cement	258
	All Point Sources	394

- Or, in another way of looking at this data, we can compare the percentage of cement plant emissions that affect densely populated counties against the percentage of other point source emissions that affect densely populated counties. Cement plant emissions affect densely populated counties (e.g., with population density exceeding 1,000 people per square mile) much less frequently than do point source emissions generally (the aggregation of emission sources from which EPA draws the value-per-ton estimates).[12]

Percent of Emissions Occurring in Counties
With Density Exceeding X People per Square Mile

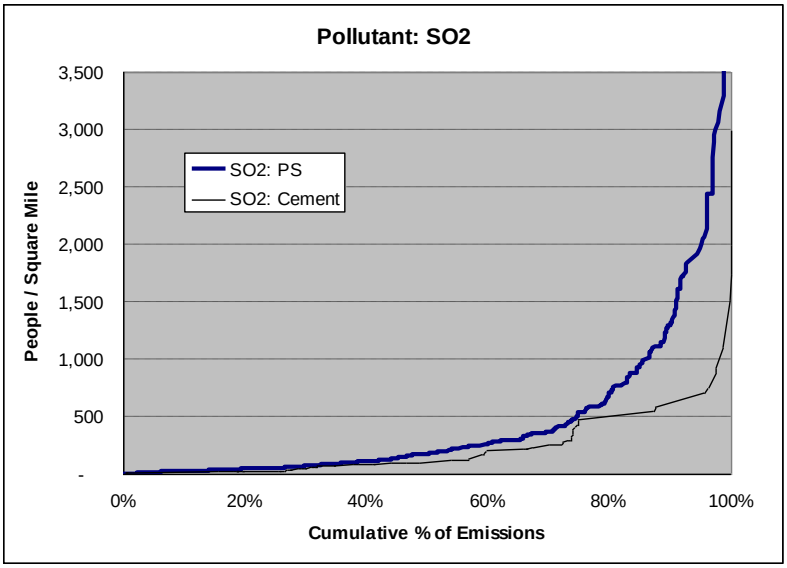
		People / Square Mile		
		300	600	1,000
SO2	Cement	26%	12%	2%
	All Point Sources - EGUs	35%	21%	15%
PM2.5-FIL	Cement	22%	11%	4%
	All Point Sources	24%	14%	9%

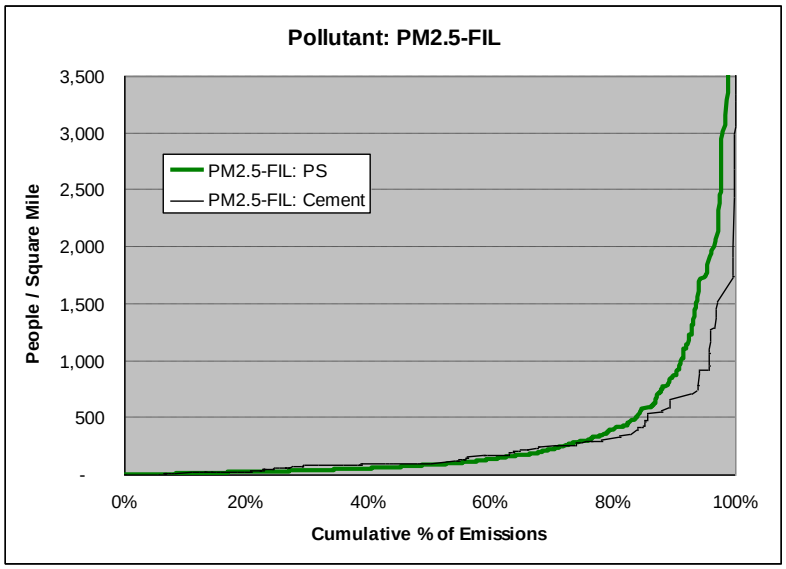
The following figures show the cumulative distributions that give rise to these tables.

[11] Emissions-weighted average population density can be thought of as follows. Let's say there are only two counties within which cement plant emissions occur: 20% of emissions occur in a county with 200 people per square mile, and 80% of emissions occur in another county that has a density of 1000 people per square mile. The emissions-weighted average population density of these two counties is (0.2 x 200) x (0.8 x 1,000) = 840 people per square mile. If one were to assume that emissions from a plant disperse only within the airshed of the surrounding county, the average ton of cement plant emissions affects an area with a population density of 840 people per square mile. We then estimate, for comparison, the emissions-weighted average population density of the areas affected by emissions from the other sorts of sources – the sorts of sources from which EPA drew the value-per-ton estimates.

[12] Here's an example of how to read the following table. 2% of cement plant SO2 emissions occur in counties with a population density exceeding 1,000 people per square mile. EPA applies to cement plant SO2 emissions a benefit-per-ton figure that was developed in the Ozone NAAQS RIA as a nationwide average for all SO2 emissions from all point sources less EGUs. For this category of sources (all point sources less EGUs), 15% of all SO2 emissions occur in counties with a population density exceeding 1,000 people per square mile.

Population Density vs. Cumulative Percent of Emissions





We believe that this analysis suggest that cement plant emissions affect areas with lower average population densities than do emissions from the source types from which EPA drew the value-per-ton figures. The actual value per ton for abating cement plant emissions is thus likely to be less than the value per ton that EPA has assigned.

Potency as a factor affecting benefits per ton

In addition to believing that a ton of cement plant emissions results on average in less population exposure than a ton of emissions from the source types from which EPA drew per-ton values, we also believe that EPA has likely overstated the typical potency of cement plant emissions with the per-ton value for direct $PM_{2.5}$ that EPA has chosen. (We have no issue from a potency point of view with the per-ton value that EPA chooses for SO_2. We have no reason to believe that a

ton of SO_2 emitted from a cement plant has any different proclivity to form $PM_{2.5}$ as does a ton of SO_2 emitted from any other source type.)

EPA assigns for cement plant direct $PM_{2.5}$ emissions the value per ton figure that is developed in the Ozone NAAQS RIA specifically for POC/PEC point source (EGU and Non-EGU) emissions, defined as "elemental carbon and organic carbon IPM EGU point source and IPM non-EGU point source emissions."[13] We believe that this category of emissions – elemental carbon and organic carbon – from this category of sources – EGUs plus other point sources – is likely more potent on average than are direct $PM_{2.5}$ emissions from cement plants.

Much of direct $PM_{2.5}$ emissions from cement plants is crustal material, not elemental or organic carbon. Cement plant PM is largely unprocessed or partially calcined raw materials: calcium oxide, limestone, and sodium and potassium salts. Cement plant hydrocarbons are largely products of raw material desorption and fractionation, mostly methane and ethane rather than long chain organics and products of incomplete combustion (as discussed elsewhere in these comments). In contrast, most fine PM emissions from other point sources, and particularly that from EGUs, consists of elemental and organic carbon from combustion of organic fuels. The mix of substances comprising elemental carbon and organic carbon $PM_{2.5}$ emissions from EGUs and other point sources is likely to be more potent than the mix of substances comprising directly emitted $PM_{2.5}$ from cement kilns.

7. For the Portland Cement NESHAP RIA, EPA has abandoned the Agency's traditional assumption to the effect that there may be a threshold in the concentration-response function relating exposure to $PM_{2.5}$ and premature mortality. EPA should not make this change until it has been recommended by CASAC and adopted as final agency policy.

For its RIAs involving particulate matter in recent years (e.g., the PM and Ozone NAAQS RIAs), EPA has performed its benefits analyses assuming that there may not be benefits from reducing $PM_{2.5}$ below the lowest levels at which long term epidemiological studies have found a relationship between $PM_{2.5}$ exposure and health risk. Recent RIAs have included either a preferred estimate or a prominently presented case where it is assumed that there is no health benefit from further reducing $PM_{2.5}$ concentrations in areas where concentrations are already low.

For reasons that are not fully explained, for the Portland Cement NESHAP EPA has not included either a primary estimate or a prominently presented sensitivity analysis that reflects an assumed threshold in the concentration-response function for $PM_{2.5}$. If EPA were to assume a threshold at 10 ug/m^3 as has been done in recent RIAs, estimated benefits would be some 20 – 40% lower than what the agency now calculates in the Portland Cement NESHAP RIA.[14] We do not believe the Agency should change its approach on this important issue until such a shift has been recommended by CASAC and adopted as final agency policy.

[13] EPA does not state directly that this is the particular pollutant/source combination from which the per-ton value for direct cement plant PM2.5 emissions is drawn. However, this can be deduced by comparing the dollar value per ton of cement direct PM2.5 cited in the Portland Cement NESHAP RIA (page 5-11) with the tables of dollar values estimated for different pollutant/source combinations in the TSD for Calculating Benefit Per-Ton Estimates.

[14] Based on the figures provided in the text and footnote on page 5-1 of the RIA. Note that the figures for benefits assuming a threshold that are presented in the footnote appear to differ from those in Table 5-5 on page 5-16.

8. EPA makes two other smaller changes in adapting previous benefit-per-ton values for application to the cement NESHAP, but doesn't anywhere explain in detail what these changes are.

EPA should explain these two "technical updates" so that the public can assess them. The two changes include "a new population dataset" and an "expanded geographic scope of the benefit-per-ton calculation" (RIA, page 5-9). These two changes evidently serve to increase the estimated benefits-per-ton by about 1/3 as much as the increase due to abandonment of the assumed threshold in the concentration-response function for $PM_{2.5}$. The changes thus have a non-trivial impact.

9. The various comments we provide regarding EPA's benefits analysis would sum to a significant reduction in EPA's calculated values.

EPA currently estimates monetized benefits for the proposed NESHAP to be some 7 to 20 times larger than the costs of the rule. It is unlikely that changes in benefits estimation to reflect the issue we raise would bring monetized benefits down to the level of the costs that EPA estimates, but our benefits suggestions might perhaps bring benefits down to near the level of costs that industry is estimating.