**Re-evaluation of Estimates in USEPA Regulatory Impact Analysis**

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The Regulatory Impact Analysis prepared for the USEPA's proposed regulation of coal combustion residues (CCR RIA) estimates that recycling ash and flue gas desulfurizatation (FGD) byproduct results in annual lifecycle benefits of almost $23 billion.[66] Closer analysis based on data from the USEPA, the US Geological Survey, and the Department of Energy suggests a more realistic estimate of $1.15 billion. The benefits itemized on Table 5C-5 of the RIA are incorrect because they:

- overstate emissions from cement kilns, and double count reductions that EPA has already claimed will occur under Clean Air Act rules adopted in August of 2010;
- mistakenly apply a formula designed to measure fine particle health costs to the reduction of much larger particles from gypsum manufacturers;
- assume unrealistic savings from reducing energy consumption at cement kilns and gypsum plants that contradict data available from the USEPA and other federal agencies.

## Particulate matter emissions

More than three quarters of the benefit attributed to CCR recycling (76%) is based on assumed reductions in particulate matter (PM) from gypsum plants and cement kilns that substitute CCR for raw feed or blend it into the final product.[67]

*PM Reductions at Gypsum Plants*

EPA projects that CCR recycling will yield annual lifecycle benefits of $4.7 billion a year, based on reductions of 9,704 metric tons of "particulate matter" from wallboard manufacturers, at a value of 486,312 per ton (row 7, Table 5C-5).[68] The "dollar per ton" value is based on a 2009 study by Fann, et. al., of health impacts associated with exposure to fine particles smaller than 2.5 microns in diameter, otherwise known as "PM 2.5."[69] The emission reductions assumed in the RIA appear to be based on a 2008 report by EPA's Office of Solid Waste, which estimated a 9.7 billion gram (or 9,700 metric ton) reduction at gypsum wallboard plants due to CCR recycling[70]

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[66] Office of Resource Conservation and Recovery, US Environmental Protection Agency, Regulatory Impact Analysis For EPA's Proposed RCRA Regulation Of Coal Combustion Residues (CCR) Generated by the Electric Utility Industry, Table 5C-5, pp. 155, 156, (April 30, 2010), [hereinafter RCRA RIA].
[67] *Id,*, at 156.
[68] *Id.*
[69] *Id.*, Fann study cited in Note to Table 5C-5, at 156.
[70] Economics, Methods and Risk Analysis Division, Office of Solid Waste, USEPA, Waste and Materials – Flow Benchmark Sector Report: Beneficial Use of Secondary Materials, - Coal Combustion Products, (February, 2008), Table ES-3, at ES-7 [hereinafter Flow Benchmark Sector Report].

But as Table ES-3 of that report makes clear, these estimated reductions concern particles greater than 10 microns in diameter – not the PM 2.5 particles that were the focus of the 2009 study that is the basis for the "dollar per ton" value in the CCR RIA.[71] EPA's risk assessment has generally focused on PM 2.5, given the well established link between the contribution that fine particles make to premature mortality, and the Fann study is concerned with these much smaller particles. Using values meant to estimate the damage from PM 2.5 exposure for particles that are much larger is an obvious error, and row 7 of Table 5-C-5 should be eliminated from the estimated benefits of CCR recycling.

*PM Reductions at Cement Kilns*

The RIA also estimates an additional $12.74 billion in lifecycle benefits due to an assumed reduction of 26,100 metric tons of "unspeciated PM" emissions from cement kilns (Table 5-C-5, row 8).[72] The claimed PM reductions are based on replacement of 15% of cement through blending with fly ash and other coal combustion residues. Emission estimates are once again based on the 2008 Office of Solid Waste study, and the RIA uses the same value ($486,312 per ton) for particulate matter.[73] As noted above, these dollar per ton estimates were developed for PM2.5; the RIA assumes without explaining that all of the "unspeciated PM" emissions are PM 2.5. Even if that is assumption is correct, the RIA is based on numbers that are about seven times higher than emission estimates from the Agency's own Office of Air Quality Planning and Standards.

In August of 2010, EPA published final National Hazardous Emission and New Source Performance Standards for Portland cement manufacturing. The RIA accompanying that rule estimates "baseline" emissions of fine particles <u>from the entire industry</u> totaled no more than 16,758 short tons (15,199 metric tons) in 2005, declining to 15,403 short tons (13,970 metric tons) by 2013 (Table 5-2, p. 5-4).[74] These industry-wide emissions are also expected to drop sharply after the new Clean Air Act rules take full effect, declining by 11,500 short tons (10,430 metric) by 2013.[75]

By that year, EPA expects that total PM 2.5 emissions will not exceed 3,900 short tons (3,540 metric), assuming a 3,900 ton reduction from EPA's projected 2013 baseline estimate of 15,403 short tons of fine particle emissions from all Portland cement manufacturing.[76] It will obviously

[71] *The Influence of Location, Source and Emission Type in Estimates of the Human Health Benefits of Reducing a Ton of Air Pollution,* by Neal Fann, Charles Fulcher, and Bryan Hubbell, <u>Air Quality, Atmosphere & Health,</u> Vol. 2, No. 3, (Sept. 2009) , pp.169-176.
[72] <u>CCR RIA</u>, Table 5C-5, Row 8, at 156.
[73] *Id.*
[74] Air Benefits Group, Office of Air Quality Planning and Standards, USEPA, <u>Regulatory Impact Analysis: Amendments to the National Emission Standards for Hazardous Air Pollutants and New Source Performance Standards (NSPS) for the Portland Cement Manufacturing Industry: Final Report</u> (August 2010), Table 5-2 at 5-4 [hereinafter <u>Portland Cement RIA].</u>
[75] *Id*, and USEPA, "Fact Sheet: Final Amendments to National Air Toxics Emission Standards and New Source Performance Standards for Portland Cement Manufacturing," (August 9, 2010), p. 2, available at: http://www.epa.gov/ttncaaa1/t1/fact_sheets/portland_cement_fr_fs_080910.pdf

[76] *Id.* According to USEPA's fact sheet, 11,500 tons represent a 92% reduction, which suggests that industry-wide PM emissions could be as low as 1,000 tons by 2013.

be impossible for CCR recycling that displaces only 15% of total production to reduce fine particles by an amount nearly seven times larger than emissions from the entire industry sector.

Row 8 of Table 5C-5 should be revised to reflect the fact that PM 2.5 emissions from cement kilns are much lower than the CCR RIA assumed, and that most of these emissions will be eliminated within three years through the Clean Air Act Standards adopted in 2010. Accepting EPA's assumption that substitution of fly ash for 15% of cement production would reduce emissions proportionately, it is more reasonable to assume annual lifecycle benefits of $258 million, instead of the $12.74 billion proposed in the RIA for the RCRA CCR proposal:

0.15 recycling rate x 3,540 metric tons per year x 486,321 per ton = $258,012,831

EPA's analysis of benefits includes some PM emission reductions from off-site activities. These are not included in the revised analysis, for reasons explained below.

*Offsite Reductions in PM*

We do not believe that the recycling of CCR will result in significant offsite reductions in PM, e.g, by reducing the cement or gypsum industry's demand for power, or the need for the mining or transportation of virgin feedstock. According to the August, 2010 RIA for the cement kiln NESHAP rule, electricity demand accounts for less than 1% of the annual energy consumption at Portland cement plants.[77] Gypsum plants do not consume significant amounts of electricity from offsite sources, according to Department of Energy data.[78] Any emissions avoided by reducing the need for mining or transportation of virgin materials would have to be weighed against emissions created by the storage, excavation and transportation of fly ash and other combustion residues.

## Energy Benefits

*Cement Kilns*

The RIA prepared for the proposed rule assumes a total savings of $4.88 billion in energy costs, based on the 2008 Industrial Economics report. For cement kilns, EPA assumes that replacing about 15% of cement with fly ash reduces energy consumption for that industry by about 60 million mmbtu, and valued the savings at $1.8 billion. These estimates are based on the avoided cost of electricity, estimated to be about $30 per mmbtu.[79] But as noted earlier, purchased electricity accounts for less than 1% of energy consumption by cement kilns, while coal and petroleum coke account for three quarters of energy consumption at cement kilns, according to the Portland Cement RIA.[80] Consumption of these fuels costs much less than purchased

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[77] Portland Cement RIA, Table 3-12, at 3-24.
[78] The Energy Information Administration, US Dept. of Energy, Fuel Consumption 2006, Table 3.2, revised October 2009, [hereinafter Fuel Consumption 2006] at http://www.eia.doe.gov/emeu/mecs/mecs2006/pdf/Table3_2.pdf.

[79] Flow Materials Report, Exhibit ES-3, at ES-6, and Note g at ES-7.
[80] Portland Cement RIA, Table 3-12 at 3-24.

electricity, averaging $2.77 per mmbtu for coal in 2009, based on data from the Energy Information.[81]

The Portland Cement RIA estimates total energy costs of $1.7 billion for cement kilns.[82] Making the generous assumption that these costs are offset on a one to one basis when fly ash is substituted for cement, total savings would equal $255 million, based on a 15% substitution rate (0.15 x $1.7 billion = $255 million). To the extent this lower estimate does not offset all energy costs associated with cement production (e.g., mining of ore), the Agency needs to document these expenditures and compare them to costs related to the transportation and storage of fly ash.

*Gypsum Products*

Coal fired power plants generate millions of tons of flue gas desulfurization (FGD) waste that can be substituted for gypsum-based products like wallboard or soil conditioner. The RIA assumes that recycling 8.2 million tons of this FGD byproduct into wallboard cuts energy consumption by 98 million mmbtu a year, for a total annual savings of $2.9 billion.[83] That is unlikely, as the entire gypsum products industry consumes an estimated 86 million mmbtu per year, according to the Energy Information Administration.[84] In fact, the US Geological Survey reports that the *entire* value of total US shipments of gypsum products (including both wallboard and agricultural products) was just over $3 billion in 2007, declining to $1.85 billion in 2008 as the housing market slowed.[85]

About 80% of FGD-derived gypsum is processed into wallboard,[86] and requires calcining to remove impurities. The calcining process is energy intensive, but EPA has not demonstrated that substituting FGD byproduct for virgin material reduces these energy costs.

FGD gypsum may help to reduce costs associated with the mining or initial processing of virgin gypsum. But these energy savings are not reflected in price: FGD gypsum was actually slightly more expensive than mined gypsum in 2008, according to the USGS. Because mined gypsum is such a low value product (less than $9 per ton in 2008, with $125 million in total US sales) its replacement with synthetic gypsum will not yield significant savings in raw material costs.[87] No doubt some transportation expenses can be avoided for gypsum manufacturers close to a reliable source of high quality FGD gypsum, but EPA has not documented those. Until USEPA can better quantify how recycling FGD gypsum cuts energy costs, these savings should be excluded from the CCR RIA.

[81] The Energy Information Administration, Electric Power Monthly, Table 4.5, October 2010, http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html.
[82] Portland Cement RIA, at 2-4.
[83] Flow Materials Report, Exhibit ES-3, at ES-6.
[84] The Energy Information Administration, Fuel Consumption 2006, Table 3.2, revised October 2009, available online at http://www.eia.doe.gov/emeu/mecs/mecs2006/pdf/Table3_2.pdf.
[85] United States Geological Survey, Department of the Interior, 2008 USGS Minerals Yearbook: Gypsum [Advance Release], (July 2010), Table 1 at 33.6, available online at: http://minerals.usgs.gov/minerals/pubs/commodity/gypsum/myb1-2008-gypsu.pdf.

[86] *Id.*, at 33.1
[87] *Id.*, at 33.1, and Table 1, at 33.6. USGS Minerals Yearbook reports 9.7 million tons of synthetic FGD gypsum sold in 2008 at an estimated value of $84.6 million, or $8.72 per ton (p. 33.1). The same year, 14,400 tons of mined gypsum sold at an estimated value of $125 million, or $8.68 per ton. (Table 1 at 33.6).

The following table provides a summary of proposed changes to the life cycle benefits that appear in Table 5C-5 of the RCRA RIA:

**CCR: Revisions to Annual Life Cycle Benefits**
**($Million/Year)**

| *Category* | *CCR RIA* | *Revised* | *Explanation* |
|---|---|---|---|
| Energy Consumption | 4,880 | $255 | Revised estimate for cement kilns based on energy consumption, cost data from August 2010 cement kiln NESHAP; gypsum wallboard savings eliminated due to conflicting EIA and USGS data, lack of support in RIA. |
| Water Consumption | $81 | $81 | Not evaluated. |
| NOx Emissions | $312 | $312 | Based on 30,400 metric tons avoided, consistent with Portland Cement RIA. |
| PM – Particulate Matter | $4,719 | 0 | RIA assumes reduction of 9704 metric tons of large particles (greater than 10 microns) at $483,312 per ton. Revised to eliminate benefits, since RIA incorrectly applies dollar per ton estimates developed for fine particles (2.5 microns or less) to reduced emissions of much larger particles. |
| PM – Unspeciated | $12,741 | $258 | RIA assumes reduction 26,100 metric tons of fine particles from cement kilns. Revised to reflect Portland Cement RIA, which projects much lower industry-wide emissions by 2013 (3,540 metric tons). |
| GHG – Greenhouse Gas Emissions | $239 | $239 | Not evaluated. |
| ***Total*** | $22972<br>$474/ton | $1145<br>$24/ton | Does not include benefit of avoided disposal costs, which EPA estimates at $2.9 billion per year. |


Sources:

Office of Resource Conservation and Recovery, US Environmental Protection Agency, Regulatory Impact Analysis For EPA's Proposed RCRA Regulation Of Coal Combustion Residues (CCR) Generated by the Electric Utility Industry, (April 2010).

Economics, Methods and Risk Analysis Division, Office of Solid Waste, USEPA, Waste and Materials – Flow Benchmark Sector Report: Beneficial Use of Secondary Materials, - Coal Combustion Products, (February, 2008).

*The Influence of Location, Source and Emission Type in Estimates of the Human Health Benefits of Reducing a Ton of Air Pollution*, by Neal Fann, Charles Fulcher, and Bryan Hubbell, Air Quality, Atmosphere & Health, Vol. 2, No. 3, (Sept. 2009).

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The Energy Information Administration, US Dept. of Energy, Fuel Consumption 2006, Table 3.2, revised October 2009, http://www.eia.doe.gov/emeu/mecs/mecs2006/pdf/Table3_2.pdf.

The Energy Information Administration, Electric Power Monthly, Table 4.5, October 2010, http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html.

United States Geological Survey, Department of the Interior, 2008 USGS Minerals Yearbook: Gypsum [Advance Release, (July (2010), available online at: http://minerals.usgs.gov/minerals/pubs/commodity/gypsum/myb1-2008-gypsu.pdf.