EPA'S PROPOSED NESHAP FOR PORTLAND CEMENT: IGNORING THE RISK-RISK TRADE-OFF

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INTRODUCTION

On May 6, 2009 the U.S. Environmental Protection Agency (EPA) promulgated a proposed rule containing a number of amendments to the National Emission Standards for Hazardous Air Pollutants from the Portland Cement manufacturing industry (NESHAP). In addition to the NESHAP, and as required by statute, EPA also released a regulatory impact analysis (RIA) detailing the economic impact of the proposed amendments on the domestic cement industry as compared to the estimated domestic benefits of the reduced emissions of the relevant pollutants. The RIA concluded that EPA "believes that the benefits are likely to exceed the costs by a substantial margin under this proposal even when taking into account uncertainties in the cost and benefit estimates."[1]

The purpose of this paper is to explore EPA's failure to account for the concept of risk-risk trade-off in either the NESHAP or the RIA. As detailed below, a proper assessment of this trade-off would likely result in a far lower estimate of domestic benefits; largely due to the impact of a large increase in imported cement from foreign markets with fewer environmental regulations and enforcement. Accordingly, EPA's final rule should take proper measures, such as those suggested in this paper, to account for risk-risk and ensure that this regulation does not cause serious harm to a major sector of the domestic economy for a minimal environmental benefit.

I. PORTLAND CEMENT NESHAP

EPA's proposed NESHAP for the Portland Cement industry contains emission standards which are considerably more stringent than the previous "final" NESHAP guidelines published in June 1999. The 1999 NESHAP focused on reducing a number of hazardous air pollutants (HAPs) from cement kilns most notably arsenic, cadmium, beryllium, lead and polychlorinated biphenyls using maximum achievable control technology (MACT). The 1999 NESHAP ruling, however, was not all inclusive. As EPA notes in the 2009 NESHAP:

[1] U.S. Environmental Protection Agency, Office of Air Quality, Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry (2009). at 5-19

> "We did not establish limits for THC [Total Hydrocarbons] for existing sources and non-greenfield new sources, nor for HCI [Hydrochloric acid] or mercury for new or existing sources. We reasoned that emissions of these constituents were a function of raw material concentrations and so were essentially uncontrolled, the result being that there was no level of performance on which a floor could be based. EPA further found that beyond the floor standards for these HAPs were not warranted."[2]

Following EPA's promulgation of the 1999 NESHAP, environmental groups (most notably Sierra Club via the non-profit public interest law firm Earth Justice), a number of special interest groups such as Down Winders at Risk in Texas and the Huron Environmental Activist League from Michigan [also represented by Earth Justice] as well as a number of states, most notably New York, challenged EPA arguing, among other things, that EPA's refusal to regulate mercury emissions from cement kilns was a violation of the Clean Air Act (CAA).

In 2000, the U.S. Court of Appeals for the District of Columbia Circuit (the D.C. Circuit), in *National Lime Ass'n v. EPA*, upheld the petitioners' arguments and concluded that EPA's failure to establish emission standards for mercury, THC, and hydrochloric acid violated the CAA.[3] Additionally, in 2007, the D.C. Circuit, in *Sierra Club v. EPA*, held that:

> "EPA must account for levels of HAP in raw materials and other inputs in establishing MACT floors, and further hold that sources with low HAP emission levels due to low levels of HAP in their raw materials can be considered best performers for establishing MACT floors."[4]

Based on these and other court rulings, EPA initiated a regulatory process that resulted in the proposed NESHAP promulgated in May 2009. The main emphasis of the new proposed limits is to regulate the pollutants that were more or less discounted in 1999. For example, the NESHAP proposes new MACT standards designed to achieve by the year 2013: (1) an 81 percent reduction in mercury pollution from cement kilns by the year 2013, (2) a 75 percent reduction in THCs, (3) a 96 percent reduction in PM, (4) a 94 percent reduction in HCI, and (5) a 90 percent reduction in SO_2.[5]

The proposed rule sets MACT requirements by utilizing a so-called pollutant by pollutant approach that seeks out the best pollutant control technology for each individual pollutant without determining whether all such controls exist within a single existing plant. This is a substantial departure from EPA's normal determination of MACT (e.g. for standards proposed for the steel industry) where requirements are proposed to force industries to adopt the toughest pollution control technologies that are already being used

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[2] 74 Fed. Reg. 21136, 21139 (May 6, 2009).
[3] *See National Lime Ass'n v. EPA*, 233 F.3d 625, 633 (D.C. Cir. 2000).
[4] 74 Fed. Reg. 21136, 21139 (May 6, 2009).
[5] *See Id.*

commercially by the leading corporations in the sector in question. The focus on what is already being achieved in existing plants has also been implemented in Europe.

MACT standards are largely successful where the situation calls for a simple and straight forward technical fix—that is to say by adopting the very best commercial (usually expensive) technology the pollution problem in question is more or less solved. However, with regard to cement this is not necessarily the case. Adopting the very best technology will reduce pollution levels of certain particulates and heavy metals, but with cement the actual raw material (limestone) is an important element. Some types of limestone have higher amounts of mercury in it (which usually vaporises during the calcination process) than other limestone. As cement kilns are built next to limestone quarries that have a minimum lifetime of 70 years, if these quarries have high levels of mercury, the enforced MACT requirements will lead the cement being produced at that plant to be much more costly (and therefore uncompetitive) compared to cement being produced from low mercury limestone, as more mercury have to be removed from these kilns than the ones using "cleaner" limestone to meet EPA's new proposed requirements.[6]

EPA's RIA estimates that these proposed emission reductions from cement kilns will result in benefits between $4.4 and $11 billion dollars (under a 3% discount rate) or $4.0 and $9.7 billion (under a 7% discount rate).[7] To achieve these benefits, EPA estimates the domestic social costs (i.e. the cost to existing and future cement kilns) to be $694 million.[8] It should be noted that the cement industry's own estimate is that they will have to invest at a minimum of $4.7 billion dollars to become compliant with the new standards.[9]

While EPA's estimates account for the cost of compliance, they also acknowledge the proposed rules will lead to a number of kilns being closed.[10] Industry estimates indicate that at least of 30 plants could shut down as a result of the new standards. These new regulatory burdens will, according to the EPA, increase the price of Portland cement by 4 percent, possibly causing a fall in the annual production of cement in the US by 8 percent or some 7 million tons per year, numbers which the PCA feels are too low.[11]

EPA's proposed rule clearly meets a regulatory need. The Agency had to do something with regard to regulating mercury emissions from cement kilns as it had not only lost a string of court cases on the topic but also due to sheer environmental and stakeholder pressure.[12] That said, will the environment in the U.S. necessarily become better from

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[6] *See* Environmental Protection Agency, *supra* note 1, at 3-10.
[7] *See id.* at 5-18.
[8] *See id.*
[9] *See* James Lofton, *"EPA standards could affect Ada's Holcim,"* January 21, 2010 *available at* http://www.allbusiness.com/environment-natural-resources/pollution-environmental/13769002-1.html
[10] *See id.* at 3-10.
[11] *See id*. at 3-6, 3-7.
[12] *E.g.* Earth Justice and Environmental Integrity Project. 2008. Cementing a Toxic Legacy? How the Environmental Protection Agency has failed to control mercury pollution from cement kilns. Washington DC: Earth Justice and Environmental Integrity Project.

the proposed amendments? Have EPA's estimates properly accounted for the "risk-risk tradeoff"?

II. THE RISK-RISK TRADEOFF

The so-called risk-risk tradeoff occurs when a regulator focuses on decreasing one specific risk (e.g. chlorinating drinking water to make it safer) it can then unintentionally increase a risk elsewhere (e.g. human cancers caused by the chlorination). The concept builds on risk-risk analysis put forward by Lester Lave (Lave 1981) and according to Graham and Wiener requires regulators and policy makers to systematically "evaluate in weighing the comparative importance of target risks and countervailing risks when hard choices must be made."[13]

These risk-risk tradeoffs abound all around us. They are referred to as side effects in medicine (e.g. taking a specific pharmaceutical drug may lead to other medical problems), to unintended consequences in the policy domain (e.g. by halting the logging of large tracts in the Pacific Northwest to protect the spotted owl, cellulose is now being imported from less sustainable sources-e.g. cellulose from Brazilian eucalyptus plantations), to collateral damage in the military (e.g. using drones in Afghanistan to kill terrorists also leads to the killing of innocent civilians).

Risk-risk tradeoffs have been and are frequently ignored by regulators be they based in North America, Europe or elsewhere, even though over the years there have been a number of studies from authoritative sources stating that they need to be properly and systematically addressed in the making of regulations.[14] There are a number of reasons why risk-risk tradeoffs have been ignored. One key factor is the result of increased bounded specialisation within regulation.[15] That is, as regulatory issues become increasingly complex, regulators themselves increasingly specialise to deal with the particular risk issue at hand, blinding the policy makers from the risks that may abound outside his/her specialty area.[16] These problems are compounded by the fact that in many cases special interest groups focus on single source pollution end points rather than the broader environmental problem at hand,[17] witnessed, for example, in the ongoing discussions on climate change in Europe and North America.

[13] *See* Graham J.D. and J.B. Wiener. 1995. Risk vs Risk: Tradeoffs in protecting health and the environment. Cambridge, MA: Harvard University Press, at 19.
[14] Adler, J.H. 2002. The precautionary principle's challenge to progress. In R.Bailey ed., Global Warming and other Eco Myths. Los Angeles CA: Prima Publishing; Cross, F. 1996. Paradoxical perils of the precautionary principle. Washington and Lee Law Review, vol.53, at 851-921; Graham and Wiener, *supra* note 8; Keeney, R.L. and D.von Winterfeldt. 1986. Why indirect health risks of regulations should be examined. Interfaces, vol.16, at 13-27; Marchant, G.E. and K.L.Mossman. 2004. Arbitrary and Capricious: The precautionary principle in the European Union courts. Washington DC: American Enterprise Institute; Whipple, C. 1985. Redistributing risk. Regulation, May/June, at 37-44.
[15] Krier, J.E. and M.Brownstein. 1992. On integrated pollution control. Environmental Law, vol.22, at 119-138.
[16] Graham and Wiener, *supra* note 8, at 238.
[17] Viscusi, K. 1998. Rational Risk Policy. Oxford: Oxford University Press.

Secondly, risk-risk tradeoffs are products of incomplete, and in many cases, unscientific decision making. Regulations are often pushed through too quickly without taking into account all the possible unintended consequences, many times driven by political, media and stakeholder concerns rather than evidence based policy making, sometimes referred to the "risk of the month concern".[18] These incomplete decisions are often made following regulatory scandals, when public's trust in regulators is often low.[19] One classic example is following the BSE ("Mad Cow" disease) scandal in the U.K., the regulators in England decided to ban multiple use surgical equipment for removing tonsils from patients, and instead promote single use surgical equipment as they were concerned about spreading vCjD from patient to patient. During the time the ban was in effect (less than a year), it led to two patients dying and hundreds of excess bleedings and yet no spreading of VCjD between patients.

A third key component to why risk-risk tradeoffs are being ignored by policy makers is due to national regulators focusing primarily, if not solely, on national risk problems, rather than international ones. Today there is a growing globalisation of manufacturing capacity be it cars or cement, yet in the environmental, food, and pharmaceutical areas we either have national or at most regional (e.g. E.U.) regulations and not global ones.[20] In other words, by putting forward tough regulations in one nation onto a certain manufacturing sector, the risk in question is, in many cases, simply exported to another nation and can at times lead to an increased overall risk due to inadequate regulations in that nation,[21] sometimes referred to as a "risk transfer".[22] In some cases, companies may compensate for these risk transfers by pushing for equal standards at all of it manufacturing facilities[23] but in many cases this does not occur. Environmental regulations are tougher, for example, in North America and in Europe than they are in developing nations.[24] As Robert Falkner notes:

> "The globalisation of economic production, consumption and exchange is fuelling environmental destruction while at the same time complicating the search for political solutions."[25]

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[18] Lave, L. and E.Males. 1989. At risk: The framework for regulating toxic substances. Environmental Science and Technology, vol.23, at 386-391.
[19] Lofstedt, R.E. 2005. Risk Management in Post Trust Societies. Basingstoke: Palgrave/MacMillan.
[20] Haas, P.M., R.O.Keohane, and M.A. Levy eds. 1993. Institutions for the Earth: Sources of effective international environmental protection. Cambridge, MA: MIT Press; Majone, G. 1996. Regulating Europe. London: Routledge.
[21] Daley, H. 1993. The perils of free trade. Scientific American, November; Scharpf, F. 1995. Negative and positive integration in the political economy of European welfare states. Jean Monnet Chair Papers 28. Florence: European University Institute.
[22] Graham and Wiener, *supra* note 8.
[23] Garcia-Johnson, R. 2000. Exporting Environmentalism: US multinational chemical corporations in Brazil and Mexico. Cambridge, MA.: MIT University Press.
[24] Scharpf, supra note 20.
[25] Hurrell, A. and B.Kingsbury. 1992. The international politics of the environment: An introduction. In A,Hurrell and B.Kingsbury eds. The International Politics of the Environment: Actors, interests and institutions. Oxford: Clarendon Press; *See* Falkner, R. 2008. Business Power and Conflict in International Environmental Politics. Basingstoke: Palgrave/Macmillan, at 3.

One classic example of a "risk transfer" occurring was the Swedish decision to close down two nuclear reactors in southern Sweden at the Barseback site. Although the nuclear power plants were as safe as any other nuclear plants in Sweden, there was a concern among regulators, partially as a result of international pressure from Denmark which has no nuclear plants, that they were built in the wrong place close to a number of major conurbations most notably Malmo (Sweden's third largest city) and Copenhagen (the capital of Denmark and only 30 minutes away by ferry on the Oresund straight).[26]

The Swedish utilities were highly opposed to the closure of Barseback arguing that it would be better to use the money that the Swedish state would be paying Sydkraft (now part of Eon) to close Barseback to make nuclear power stations in the Baltic area safer (e.g. Ignalina in Lithuania-Chernobyl type reactor). The Swedish state got its way, and as a result, the utility companies built a cable to Poland to make up the electricity shortfall caused by this nuclear plant closure.

The end result of all this is that rather than having 8 or so Terra Watt Hours (TWh) of nuclear power capacity, Sweden is now importing a large amount of this electricity shortfall from coal burning stations in Upper Silesia in Poland, an area where a number of the plants are the largest point sources of hazardous air pollutants in Europe, thereby not only increasing damage to human health in that part of Poland, but also causing further acid rain much of which falls over southern Sweden. In sum, a risk-risk trade off which was not only expensive to fulfil for the Swedish tax payer (closing down two nuclear reactors and then importing electricity), but which will also lead to increased negative consequences not only for humans but the environment as well.[27]

A second, and highly relevant, example occurred in the context of another EPA regulation dealing with the domestic steel industry. In 1990, under the CAA amendments of that year, EPA sought to push for tougher regulations to remove from the coke production process so called "fugitive emissions of hazardous gases," once again under pressure from environmental groups and special (community) interest groups. Just as with the cement sector, EPA was initially reluctant to push for tougher regulation, and only did so following a number of lawsuits ruling against the Agency, which forced it to take action. The outcomes of the tough air pollution regulations were to push industry off shore, or as Hartwell and Graham argue:

> "…preliminary indications are that the EPA's negotiated rule has contributed to a long-term trend of purchasing more coke from other countries rather than producing coke in the United States. The net effect on worldwide emissions from

[26] Lofstedt, R.E. 1996a. Fairness across borders: The Barseback nuclear power plant. Risk: Health, Safety and Environment, vol.7, at 135-144; Lofstedt, R.E. 1996b. Risk communication: The Barseback nuclear plant case. Energy Policy, Vol.24, at 689-696.

[27] Lofstedt, R.E. 2001. Playing politics with energy policy. The phase-out of nuclear power in Sweden. Environment, Vol.43, n.4, at 20-33.

> coke production is not likely to be favourable, although residents living near US coke plants will have cleaner air to breathe."[28]

This is indeed what occurred. Many U.S. steel companies were forced out of business, partially due to this and other tough environmental laws, but also due to outmoded factories and high priced factory workers[29] with the main benefactor being China, a country now responsible for a third of the world's steel production. The U.S. Steel Corporation, the largest U.S. based steel producer, for example, is today one hundredth of the size of the same company over a hundred years ago.

A third example was the 1977 Clean Air Act which forced all coal burning stations to install desulphurization scrubbers to remove sulphur dioxide from their smoke stacks (one of the main causes of acid rain). The risk-risk tradeoff from this Act was two fold. Firstly, these scrubbers have generated tons of sulphur sludge which must be disposed of somewhere.[30] Secondly, as the scrubbers themselves use considerable amounts of energy, this requires extra fuel (and hence more carbon dioxide emissions) to be consumed to produce the same amount of electricity.[31]

A fourth example surrounds EPA's decision to ban a pesticide (Maneb) a decision which the Agency later reversed partially due to the risk-risk trade-off. What actually happened? In 1987, EPA ordered a review of all ethylene bisdithiocarbamate [EBDC] fungicides because of cancer risk concerns in consumers who could have been exposed to pesticide residues—primarily vegetables.[32] The EBDCs have been used in the US since the 1930s, however, and are seen to be easy to use, are inexpensive and do not have a problem with pest resistance. The fungicide Maneb was used to control downy mildew on lettuce, a fungi which can cause dramatic reduction in crop yields. In December 1989, EPA proposed a ban of Maneb, based on the Agency's calculation that exposure to Maneb via diet could increase consumer's life time cancer risk by 3 in a million (for an excellent discussion regarding this example see Gray and Graham 1995).

EPA, however, did not take into account the risk-risk tradeoffs associated with this ban. One could simply not just ban Maneb and expect lettuce producers to let the downy mildew destroy large amounts of their lettuce crop. One of the replacement pesticides for Maneb was a product called Captan, which in turn had a similar cancer risk profile to Maneb, and if one examined all the toxicological data on Captan, it actually could have a higher cancer risk. In addition, from a risk-risk tradeoff there was a concern that lettuce producers would go back to old (pre 1970s) more toxic pesticides that have yet to

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[28] *See* Hartwell, J.K. and J.D.Graham. 1997. Fewer fumes from coke plants. In J.D.Graham and J.K. Hartwell eds. The Greening of Industry: A risk management approach. Cambridge, MA: Harvard University Press, at 165-166.

[29] National Research Council. 2007. Energy Futures and Urban Air Pollution: Challenges for China and the US. Washington DC: National Academies Press.

[30] Harrington, W. 1989. Acid rain: Science and policy. Washington DC: Resources for the Future.

[31] Dudek, D.J., A. LeBlanc and P.Miller. 1990. Sulphur dioxide and carbon dioxide: Consistent policy making in the greenhouse. New York: Environmental Defence Fund.

[32] Environmental Protection Agency. 1987. Notice of intent to initiate special review of the Ethylene Bisdithiocarbamate (EBDC) pesticides. Federal Register, Vol.52, July 17, at 27172-27177.

undergo rigorous toxicological testing. Finally, from a risk-risk perspective, the use of pesticides on vegetables and fruits have increased yields and hence reduced consumer costs. In turn, studies indicate that restricting pesticides to reduce residues that may be carcinogenic would raise the price of foods significantly and in particular vegetables and fruits.[33] As a result, this could lead to decreases in fruit and vegetable consumption among the poorest households of the U.S., which in turn could lead to greater obesity, type 2 diabetes and cardiovascular diseases. Based on these and similar arguments (e.g. the cancer risks were smaller than initially believed) the EPA reversed its ban on Maleb in 1992.[34]

To be clear, some critics refuse to acknowledge the existence of risk-risk tradeoffs. One recent study analysing 33 cases noted that:

> "in a large number of cases safer alternatives, are and were available at the time decisions were made, providing an opportunity to avoid the countervailing risk."[35]

These critics take the view that in many cases there are no two simple "bad" risk-risk choices, but rather there is a need to be more creative and broader in one's risk analysis to find a preventive way to avoid the tradeoff to begin with. According to these critics, one way to avoid risk-risk tradeoffs, would be to be more proactive in developing risk management measures, and in so doing, improve both the environment and human health.[36] To be clear, everyone active in the risk field would favour proactive risk management strategies, be they proponents or opponents to risk-risk tradeoffs,[37] but to state that risk-risk tradeoffs may not exist appears a bit simplistic. In the Graham and Wiener reply to the Hansen et al 2008 work, they concluded that this research was seriously flawed noting:

> "The problems relate to sampling, definition of categories, asymmetric application of precaution, magnitude of countervailing risks, and misinterpretation of scientific evidence in particular cases."[38]

, Increasingly, policy makers themselves are acknowledging that risk-risk tradeoffs are out there. In work done on how both to improve the quality of risk management processes in the E.U. as well as enhance the role of scientific policy making in Brussels, Bruce Ballantine of the Brussels based European Policy Centre found that policy makers (particularly European members of parliament) recognised the existence of risk-risk trade

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[33] Zilberman, D., A.Schmitz, G. Sasterline, E.Lichtenberg, and J.Siebert. 1991. The economics of pesticide use and regulation. Science, vol.253, at 518-522.
[34] Environmental Protection Agency 1992. Ethylene Bisdithiocarbamates (EBDCs): Notice of intent to cancel and conclusion of special review. Federal Register, Vol.57, March 2, at 7484-7580.
[35] *See* Hansen, S.F., M.Krayer von Krauss and J.Tickner. 2008. The precautionary principle and risk-risk tradeoffs. Journal of Risk Research, Vol.11, at 424.
[36] *Id*; Tickner, J.A. 2002. The precautionary principle and public health trade-offs: Case study of the West Nile virus. Annals of the American Academy of Political and Social Science, Vol.584, at 69-79.
[37] Graham and Wiener *supra* note 8
[38] *Id*. at 466.

offs and the need to introduce better forms of evidence based policy making to combat it.[39]

To conclude, the topic of risk-risk tradeoffs is one of the most important regulatory policy findings within the risk analysis field for the past forty years. Although there has been a number of studies highlighting the consequences of ignoring risk-risk tradeoffs be it in the loss of life or destruction of environment, regulators in many nations, unless confronted with the term at first hand as we saw with Ballantine's work, tend to ignore the concept for several reasons including "siloing" of decision making, sloppy non-scientific decision making processes or being more or less ignorant of nation to nation risk transfers. Or, as Cass Sunstein, the present Administrator of the Office of Information and Regulatory Affairs in the Office of Management and Budget, wrote a number of years ago in the foreword to the Graham and Wiener 1995 volume:

> "Too frequently, risk regulation has been adversely affected by interest-group pressures, sensationalistic anecdotes, political opportunism, and sheer ignorance. Too often, important voices are left out of the regulatory process, and it is the people who are not heard who suffer. The contributors to this book show that risk-risk tradeoffs are an unavoidable aspect of life and an omnipresent issue for government."[40]

In the remainder of this paper we look at the risk-risk tradeoff inherent in EPA's proposed Portland Cement NESHAP. Of interest is to analyse whether the NESHAP as it is now written will lead to so called "risk superior" outcomes or whether in fact it may cause detrimental effects to human health and the environment and therefore should possibly be re-crafted.

DISCUSSION

From a risk-risk tradeoff perspective the key problem with EPA's proposed Portland Cement NESHAP is risk-transfer (also called offshore leakage). In the rest of the section, we will discuss some of the environmental issues that result from this offshore risk transfer.

I. PORTLAND CEMENT NESHAP WOULD LEAD TO OFF-SHORE LEAKAGE

Over the past twenty years, cement consumption in the United States has increased from 83,667 thousand metric tons per year in 1987 to 114,621 thousand metric tons by 2007.[41] Due to the present recessionary climate in the United States (and thereby cutbacks in private and public sector building) the U.S. Portland Cement Association (PCA)

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[39] Ballantine, B. 2003. Improving the quality of risk management in the European Union: Risk communication. Brussels: European Policy Centre; Ballantine, B. 2005. Enhancing the role of science in the decision-making of the European Union. Brussels: European Policy Centre.
[40] *See* Sunstein, C. 1995. Foreword. In Graham, J.D. and J.B.Wiener eds. Risk vs Risk: Tradeoffs in protecting health and the environment. Cambridge, MA: Harvard University Press, at viii.
[41] PCA. 2008. Annual yearbook. 2008. Skokie, IL: PCA.

estimates that the consumption of cement will decrease to 81 million metric tons in 2010, but then, as the economy once again improves, will increase dramatically to 110,000 million metric tons in 2013, and 137 million metric tons by the year 2020.[42] In other words, although cement consumption is presently decreasing, the long term trends indicate a rapid increase going forward. Where will this cement be coming from? Will it be U.S.-sourced or imported from abroad?

Presently, U.S. cement production capacity is approximately 96 million tons annually. New clinker capacity is now coming on line and it is envisaged that 25 million metric tons will be added by 2013. There are no plans to increase clinker capacity beyond 2013. In addition, due to changes to U.S. specifications associated with fly ash and slag, this could add 4.5 million metric tons a year by 2020. There are, however, some capacity displacements, caused by commissioning delays and economic stress, of which 2.6 million tons will be permanent, as well as reduction in wet kiln clinker capacity which will take out a further 9.2 million tons by the year 2020. In sum, U.S. cement production capacity in a non-NESHAP amendment scenario by the year 2020 will be around 115 million tons annually. It is envisaged that the short fall between national production capacity and cement consumption will be met by imports, primarily from China.

If the standards contained in the proposed NESHAP are put into place, the domestic cement situation is fundamentally different. The proposed amendments will further reduce domestic cement production capacity, ranging from 8 percent (EPA's estimate) to more than 15 percent (PCA estimate), ensuring that domestic capacity by the year 2020 is, at most, 100 million tons.[43] So rather than importing 20 million tons of cement per year, the proposed NESHAP will lead to cement imports of more than 48 million tons per year. In other words, by tightening the regulations on U.S. cement kilns, there will be a risk transfer of some 28 million tons of cement offshore, mostly to China. Since domestic demand for cement will not be reduced, Americans will use a greater amount of imported rather than domestic cement. This will not only lead to job losses within the U.S. cement industry, but it will also have adverse effects on the global environment. In the next two sections we discuss some of the impacts of importing this extra amount of cement from overseas.

II. IMPACT OF OFF-SHORE LEAKAGE ON LIFECYCLE GREENHOUSE GAS EMISSIONS

Importing cement requires considerable amount of energy. A sack of cement simply does not appear on one’s door step in the morning. There are several steps involved in moving cement from one place to another. As a significant amount of the cement that the U.S. presently imports is from China[44], and as projections going forward indicate that cement will continue to be imported from China, we use China as the country of origin for the imported cement to illustrate the typical lifecycle emissions involved in cement importation.

[42] PCA Monitor. 2009. Flash Report: Impact of NESHAP emission changes on domestic cement capacity. Skokie, IL: PCA.
[43] *See* Environmental Protection Agency, *supra* note 1, at 3.2.3.1.
[44] *See id*. at 2.4.1.2.

The first step in the importation cycle involves transporting the cement from the site of manufacturing to the coastal port. Once the cement has arrived in port it will have to be unloaded from the truck or train in question and put on a dry bulk carrier, which is fuelled by bunker fuels, a low quality, cheap, low efficient heavy fuel engine oil that is contaminated with everything from sodium, nickel to sulphur. Once the boat arrives in harbour, the cement has to be offloaded and transported to site of use. In a study done by the consultancy firm Environ for the PCA, it calculated that producing the cement in China and shipping it to the United States, added 465 pounds of carbon per metric ton of cement, ensuring that the Chinese cement imported to California (the second largest producer of cement in the U.S. after Texas) will have approximately 25 percent or more CO_2 emissions once the cement is unloaded at a California port, than had the cement been produced in California.[45] The study does not take into account the larger amounts of sulphur dioxide and nitrogen oxide emissions by using bunker fuels and the resulting impact of these on the environment (e.g. acid rain).

III. IMPACT OF OFF-SHORE LEAKAGE ON GLOBAL CEMENT PLANT EMISSIONS

There are at present no global cement plant emission standards. Accordingly, the environmental externalities involved in cement production vary from nation to nation, with differences largely dependent on many factors including, but not limited to: the quality of the lime stone, the source of electricity used to make the cement (high polluting low quality sulphur coal or hydro electricity), or the type of plant in question (shaft or rotary kiln). Of interest in the current rulemaking process is to see whether the majority of the forecasted post-NESHAP amendments 28 million tons of imported cement from China will have less environmental externalities attached to them than U.S. cement. In other words from a global environmental and health perspective whether it is a "risk superior" option to produce cement in China for the U.S. market or to produce this cement in the United States? Will the global environment be better off with the proposed risk transfer or not?

China has been the largest global cement producer since 1985 with an average annual increase in production of 12 percent. In 2008, the Chinese cement industry produced 50 percent of the world's cement, some 1.4 billion metric tons.[46] China is also the largest global cement consumer—having consumed 1.37 billion tons of cement in 2008. Chinese cement is manufactured using primarily two technologies, either shaft or rotary kilns. Shaft kilns are generally small and easy to assemble cement plants, but in turn are inefficient and highly polluting and unless they have been upgraded, produce low quality cement. The shaft kilns, which have been completely phased out in Europe and North America for environmental and efficiency reasons, account for 50 percent of China's

[45] Environ International Corporation. 2008. Technical support document: Leakage in the California Portland cement industry. Los Angeles: Environ International., at 4

[46] Lu, H., E.Masanet and L.Price. 2009. Evaluation of life-cycle assessment studies of Chinese cement production: Challenges and opportunities. Berkeley, CA: Lawrence Berkeley National Laboratory, Proceedings of the 2009 American Council for an Energy Efficient Economy's Summer School on Energy Efficiency in Industry.

cement manufacturing capacity.[47] Rotary kilns, many of them similar to the ones used in the west, are a recent addition to the Chinese cement landscape, most of them being built over the last 10 years or so. These kilns, accounting for approximately 50 percent of China's cement production, take 3 or so years to come on line, but are considerably more efficient and less polluting than the shaft kilns.[48] As DOE's Lawrence Berkeley National Laboratory has pointed out, "Cement produced in China, compared to industrialized countries, is relatively inefficient, with large CO_2 emissions[.]"[49]

Historically, 65-70 percent of the cement exported from China to the United States and elsewhere came from shaft kilns,[50] but with increased demands for higher quality cements (e.g. grades #425 and #525) these will be most likely produced from less polluting rotary kilns. Indeed, the Chinese themselves, concerned about the quality of cement from shaft kilns, demand that only rotary kiln cement can be used for building the nation's skyscrapers.[51] It is therefore envisaged that a majority of the forecast 28 million tons of imported Chinese cement that the U.S. will need to import because of the proposed NESHAP guidelines will come from rotary kilns. This is better, of course, than had this cement come from shaft kilns, but depending on whether the Chinese will continue increasing rotary kiln capacity, it may simply force greater use of shaft kiln cement for local consumption.

Does this mean that the 28 million tons of Chinese rotary kiln cement is equivalent to the equal amount of U..S based rotary kiln cement? No, it is not. Aside from the transport issues discussed earlier, there are three primary concerns: that of the less efficient cement production processes in China vis-à-vis the United States, the issue of sub-western pollution controls on Chinese cement plants and finally the issue of lax environmental regulation. These forms of direct international comparisons are starting to get regulatory and academic attention. For example, it is a topic that the officials at the Oregon State Department of Environmental Quality recently highlighted when they asked EPA to do an environmental comparison between keeping the Ash Grove Cement plant in Eastern Oregon open with importing the equivalent amount of cement from China.[52]

One concern is that the cement production facilities in China, even those for export purposes (rotary kiln) are less efficient than American ones. In a study by Environ for the PCA, the consultancy company found that that California cement facilities use 7 percent less carbon dioxide in their manufacturing processes than Chinese rotary kilns and are overall 13 percent more efficient on an energy basis.[53] In its calculation, Environ assumes that 70 percent of the electricity generated in China comes from conventional

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[47] China Cement Association. 2008. China Cement Almanac 2008. Beijing: China Cement Association.
[48] *Id*; Price, L. and C.Galitsky. 2006. Opportunities for improving energy and environmental performance of China's cement kilns. Berkeley, CA: Lawrence Berkeley National Laboratory.
[49] Lu, Masanet and Price, *supra* note 43.
[50] Battelle. 2002. Toward a sustainable cement industry: Trends, challenges and opportunities in China's cement industry. Geneva: World Business Council for Sustainable Development.
[51] *Id.*
[52] Zaitz, L. 2009. Ash Grove cement plant in Oregon shutting down, cutting 68 jobs. Aggregate Research, 1st October.
[53] Environ, *supra* note 35.

coal thermal sources. This is a rather "nice" calculation as it does not take into account that the majority of the coal used for electricity generation in China is poor quality and high in sulphur, compounded by the fact that less than 15 percent of the coal electricity generation plants have desulphurization systems attached to them and that the dominant technology is coal pulverization, rather than the more advanced integrated gasification combined cycle (IGCC).

A second key factor is the poor pollution controls on the country's cement kilns. Although many of the Chinese environmental laws and public health laws are modelled on U.S. and European regulation, the Chinese laws are considerably less stringent. For example, ten years ago particulate emission limits were set at 100 milligrams per cubic meter exhaust in China, while European cement plants have a limit of 50 milligrams.[54] Some observers point out that the Chinese are at least two decades behind Europe and the United States when it comes to environmental legislation.[55]

The crucial factor, however, is the lax enforcement of environmental regulations in China. Historically, most of the power with regard to enforcing environmental legislation in China has been with the local environmental protection bureau (EPB), which is expected to enforce the environmental legislation coming from the Chinese State Environmental Protection Bureau (SEPA) in Beijing. However, as EPBs budgets do not come from the central authority but from local councils, and hence the EPBs do not necessarily share the views of SEPA in promoting tougher environmental pollution control, in many cases favouring economic growth over pollution control. Or as Srini Sitaraman argues:

> "…ironically, it is not the lack of formal laws that prevents the Chinese government from stemming its growing environmental troubles, but rather the political unwillingness to undertake strong enforcement measures and prioritise environmental protection ahead of economic growth."[56]

In one recent study Professor Wang Canfa, from Beijing's China University estimated that only 10 percent of China's environmental laws are actually enforced.[57]
Based on this one cannot simply state that rotary kiln cement is the same from wherever it comes from, it is not.

CONCLUSION AND RECOMMENDATIONS

I. OFFSHORE LEAKAGE NEGATES THE ENVIRONMENTAL BENEFITS OF THE NESHAP

[54] Batelle, supra note 47.
[55] Sitaraman, S. 2007. Regulating the belching dragon: Rule of law, politics of enforcement, and pollution prevention in post Mao industrial China. Colorado Journal of International Environmental Law and Policy, Vol.18, at 267-335.
[56] *Id*. at 274-275)
[57] Canfa, W. 2005. China improves enforcement of environmental laws. In Embassy of China, available at, http://www.chinese-embassy.org.uk/engt/zt/Features/t214565.htm.

In sum, it is likely that overall environmental and health benefits of the proposed NESHAP guidelines will be negligible. In fact, if looked at from a global environment perspective, the proposed NESHAP will arguably make the global environmental situation worse, due to the reasons highlighted above.

In its recent proposed rulemaking to establish greenhouse gas emission standards for vehicles, EPA stated that, in the case of climate change, it was breaking from the traditional model of calculating only the domestic benefits of proposed environmental regulations.[58] This decision was encompassed in EPA's calculation of the global social value of reducing a ton of carbon (the "social cost of carbon"). In explaining this decision, EPA stated the following:

> "Because of the distinctive nature of the climate change problem, we present both a global [social cost of carbon] and a fraction of that value that represents impacts that may occur within the borders of the U.S. alone, or a ‘‘domestic’’ [social cost of carbon], but fix our attention on the global measure. This approach represents a departure from past practices, which relied, for the most part, on domestic measures. As a matter of law, both global and domestic values are permissible; the relevant statutory provisions are ambiguous and allow selection of either measure. It is true that under OMB guidance, analysis from the domestic perspective is required, while analysis from the international perspective is optional. The domestic decisions of one nation are not typically based on a judgment about the effects of those decisions on other nations. But the climate change problem is highly unusual in the sense that it involves (a) a global public good in which (b) the emissions of one nation may inflict significant damages on other nations and (c) the United States is actively engaged in promoting an international agreement to reduce worldwide emissions. In these circumstances, we believe that the global measure is preferred. Use of a global measure reflects the reality of the problem and is ***consistent with the continuing efforts of the United States to ensure that emissions reductions occur in many nations***."[59] (emphasis added)

As recognized in its CAFE regulations, the U.S. EPA needs to realise that the Portland Cement NESHAP also poses potential global environmental problems including climate change, acid rain, etc. Some researchers point out that already today 25 percent of the atmospheric pollution on the west coast of the United States originates from China.[60] Mercury pollution, the main target for the proposed rule making,[61] is also global. Mercury deposits are now found in the Arctic, and computer modelling studies show that elemental mercury can travel long distances, even across continents.[62] Sixty five percent

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[58] *See* 74 Fed. Reg. 49612 (Sept. 28, 2009).
[59] *See Id.*
[60] Yardley, J. 2005. Dirty clouds forms over rising China; Pollution threatens economic triumphs. New York Times, 31st October, at 4.
[61] Earth Justice and Environmental Integrity Project, *supra* note 11.
[62] Banic C.M., S.Beauchamp, R.Tordon et al. Vertical distribution of gaseous elemental mercury in Canada. Journal of Geophysical Research, vol.108, at 4624.; Dastoor, A.P and Y.Larocque. 2004. Global circulation of atmospheric mercury: A modelling study. Atmospheric Environment. Vol.38, at 147-161.;

of the mercury emitted by U.S. sources more or less joins a "global mercury pool" and is deposited internationally in countries such as Canada.[63] As a result 65 percent of the mercury deposited in the United States originated elsewhere. Seigneur et al estimated that by 1998, 21 percent of the total mercury deposition in the United States originated from Asia,[64] a number that over the past decade has increased to some 33 percent of which most is Chinese.[65] A large amount of that deposited mercury comes from Chinese cement production, where total emission estimates has increased from 19.9 tons in 1995 to 35 tons by 2003.[66] Arguably, by further off-shoring cement production to China, the percentage of imported mercury pollution to the U.S. will increase even more.

It would be highly irregular and illogical for EPA to make a decision in some rules to consider global consequences and not in others. With this in mind, it is imperative that EPA's Portland Cement NESHAP consider the effects of the increase in global emissions of pollutants from cement plants overseas resulting from the imposition of stringent domestic standards.

II. RECOMMENDATIONS FOR FINAL NESHAP

Prior to promulgating the final Portland Cement NESHAP, the EPA needs to account for the risk-risk trade off in the regulations. As discussed above, the proposed NESHAP guidelines, putting forward stringent regulation on the U.S. cement industry, will lead to a risk transfer from the United States to offshore (most notably China), leading to negligible environmental improvements for the United States and the global community. The following are some pathways for EPA to account for this result in the final rulemaking:

- Conduct a study comparing the environmental impacts of keeping open the U.S. cement kilns slated to close if NESHAP goes forward (such as Ash Grove) vis-à-vis having the cement produced in and shipped from China to the United States;
- Work with Chinese regulatory officials on how to best increase the funding and capacity of SEPA—most notably making it a more prestigious and powerful authority, so as it can hire a substantial amount of new environmental regulators. SEPA has only 300 staff at the moment while the EPA has 17,000 full time equivalents;[67]
- Work in a less adversarial way with U.S. cement producers to help them reduce mercury emissions. The first focus should be on high mercury polluters such as

Seigneur C., P.Karamchandani, K.Lohman et al 2001. Multiscale modelling of the atmospheric fate and transport of mercury. Journal of Geophysical Research, Vol.106, at 27,975-27,809.
[63] EPRI. 2006. Sources of mercury depositing in the United States. Palo Alto: EPRI; EPRI. 2009. Sources of mercury depositing in the United States. Paolo Alto: EPRI.
[64] Seigneur C., K.Vijayaraghavan, K.Lohman et al. 2004. Global source attribution for mercury deposition in the United States. Environmental Science and Technology, Vol.38, at 555-569.
[65] EPRI 2006 and 2009 *supra* note 51.
[66] Wu, Y., S.Wang, D.Streets, J.Hao, M.Chan, and J.Jiang. 2006. Trends in anthropogenic mercury emissions in China from 1995 to 2003. Environmental Science and Technology, vol.40, at 5312-5318.
[67] Sitaraman, *supra* note 35.

Ashgrove in Oregon, who are voluntarily spending $20 million to attempt to capture 75 percent of their mercury emissions;

- Develop an internal risk-risk function to ensure that policies put forward by the Agency are properly vetted, ensuring that the proposed regulations are "risk superior" and do not lead to simple "risk-transfers."
- Ensure that the Agency learns from its past decisions when it incorporated risk-risk tradeoffs to reverse legislative decisions as with the case of the pesticide Maneb.

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