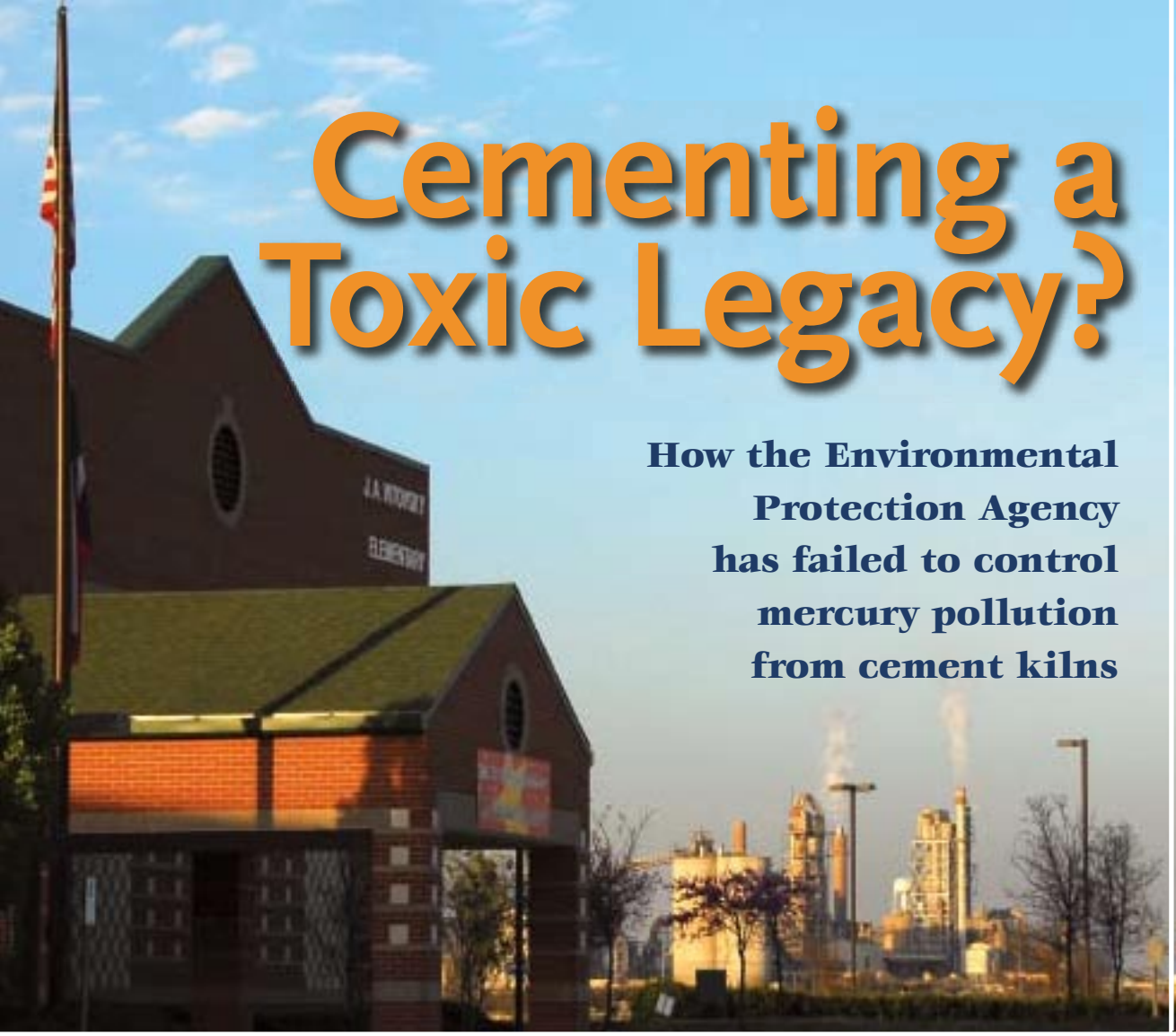
Cementing a Toxic Legacy?

How the Environmental Protection Agency has failed to control mercury pollution from cement kilns



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How the Environmental Protection Agency has failed to control mercury pollution from cement kilns

Earthjustice
Environmental Integrity Project

JULY 2008

EARTHJUSTICE

Earthjustice is a non-profit public interest law firm dedicated to protecting the magnificent places, natural resources, and wildlife of this earth, and to defending the right of all people to a healthy environment. We bring about far-reaching change by enforcing and strengthening environmental laws on behalf of hundreds of organizations, coalitions and communities. We've provided legal representation at no cost to more than 700 clients. For more information, visit www.earthjustice.org.

ENVIRONMENTAL INTEGRITY PROJECT (EIP)

The Environmental Integrity Project is a nonpartisan, nonprofit organization dedicated to more effective enforcement of anti-pollution laws. EIP's research and reports shed light on how environmental laws affect public health. EIP works closely with communities seeking to enforce these laws. For more information, visit www.environmentalintegrity.org.

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For more information, please visit www.earthjustice.org/cement

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Overview

Cement kilns are poisoning our air, water, and food with mercury. For more than a decade, the U.S. Environmental Protection Agency (EPA) has neglected this health threat. Directly defying federal law and multiple court orders, EPA has refused to set standards to control cement kilns' mercury emissions. Now, new data from EPA itself show that the American public is paying a steep price for the agency's recalcitrance with poisoned fish, polluted air and waters, and increased risks to our health and our children's health. Mercury emissions from cement kilns are almost twice as high as the agency has previously acknowledged, and, in many states, kilns are among the worst mercury polluters.

Thanks to EPA's neglect, the cement industry's mercury emissions have not only gone uncontrolled, but also have largely escaped public scrutiny. Having decided in the 1990s that it did not wish to control mercury from cement kilns, EPA has, until now, never attempted to tally mercury emissions from this industry. EPA now estimates that cement kilns emit nearly 23,000 pounds of mercury each year, far more than the Agency's 2006 estimate of 11,995 pounds.[1] Industry-wide emissions may be as high as 27,500 pounds per year.[2]

The process for making clinker — small nodules of cooked rock that are eventually ground into cement — often relies on fuels and raw materials that are high in mercury content. While the large quantity of mercury emissions from cement kilns is not widely known, it is hardly surprising. Just over 150 cement kilns operate in the United States and, each year, they "cook" thousands of tons of

Mercury emissions from cement kilns are almost twice as high as EPA has previously acknowledged, and, in many states, kilns are among the worst polluters.

rock — primarily limestone — at more than 2,600 degrees Fahrenheit. To fuel this cooking process, cement kilns burn primarily coal. Both the rock and the coal contain mercury, a highly volatile metal that evaporates at room temperature. Virtually all the mercury in the coal and limestone is vaporized in the cement production process, and the vast majority of that mercury enters our air through the kilns' smokestacks.

Mercury, an element, does not decompose or otherwise exit the environment once it has been released into the air. Instead it is deposited back to earth where it persists in soil and water and, through the bioaccumulation process, concentrates in fish and wildlife. Just 1/70th of a teaspoon of mercury, or 0.0024 ounces, can contaminate a 20-acre lake and render the fish in that lake unsafe to eat.[3]

People are exposed to mercury primarily through eating fish. Women of childbearing age are often warned to limit their consumption of certain fish contaminated with mercury. The Centers for Disease Control and Prevention reported in 2000 that eight percent of women aged 16 to 49 had mercury levels in their blood that exceeded EPA's own safe levels for unborn children.[4] Because mercury is a potent neurotoxin, babies and children are especially at risk for birth defects, loss of IQ, learning disabilities, and developmental problems.

The purposes of this report are to release the results of EPA's data summary to the public, to highlight the health and environmental threats posed by specific kilns that appear to have especially high mercury emission levels, to expose what appears to be gross under-reporting of mercury emissions from cement kilns, and to call upon EPA to act swiftly to set appropriate standards for this toxic pollutant.[5] The Clean Air Act required EPA to set mercury standards for cement kilns more than a decade ago. A federal court ordered EPA to issue those standards more than seven years ago. Still, we wait.

Key Findings

- EPA has estimated that cement kilns operating in America emit 22,914 pounds of mercury into the air each year.[6] Because this number reflects only non-hazardous waste burning kilns, overall mercury emissions from the cement industry are higher than EPA's estimate of nearly 23,000 pounds.

- EPA sampling shows that large amounts of mercury pass through cement kilns, with some kilns reporting astonishingly high volumes. Absent emission monitoring and emission controls, most of that mercury will be released into the environment.

- A relatively small number of cement plants that use extremely dirty raw materials and fuels are among the worst mercury polluters in their states and, in some cases, in the country. Some cement kilns release as much as or more mercury than coal-fired power plants. For example, a cement kiln in Durkee, Oregon, emitted over 2,500 pounds of mercury in 2006. That same year, according to EPA, the top mercury-polluting power plant emitted 1,700 pounds of mercury into the air.

- Since 1974, cement production has increased 15 percent, but the total number of cement kilns has shrunk from 432 to 178 in 2006. Today, cement production is concentrated in the hands of a relatively small number of large multinational companies. These companies operate larger cement kilns that produce more cement.[7] Rapidly increasing levels of cement production in the U.S. mean that the cement industry's mercury pollution levels will continue to rise if left unregulated.

- Without proper regulation from the federal government, specifically from EPA, mercury pollution from cement kilns will continue and increase, adding to a growing public health problem in the United States.

Recommendations and Opportunities

- EPA must swiftly follow through on its commitments to propose and adopt a mercury standard for cement kilns.

- State regulatory agencies should routinely test cement kiln emissions for mercury.

- Continuous Emissions Monitoring Systems (CEMS) should be installed to measure mercury emissions at every kiln.

- State regulatory agencies should require cement kilns to install mercury pollution control devices.

For more than a decade, Earthjustice has been a leader in fighting weak and insufficient regulations that failed to clean up mercury and other toxic air pollutants from industrial and mobile sources nationwide. Our work continues to yield results in cleaning up mercury pollution from some of the nation's biggest industrial sources, including cement kilns, power plants, and incinerators. Along with our partners at the Environmental Integrity Project, we have compiled this report in an effort to emphasize the need for strong regulations that satisfy the long-standing but long-ignored federal mandate to control pollution from the cement manufacturing industry. Earthjustice, on behalf of many national and local non-profit public health and environmental organizations, has filed dozens of legal challenges in federal court and won numerous legal claims resulting in stronger clean air protections. In coordination with groups like the Environmental Integrity Project, we remain committed to fighting toxic air pollution and making our air, water, and lands safer and cleaner for future generations.

To learn more about mercury pollution and the cement industry, please visit **www.earthjustice.org/cement**.

The Mercury Data

Ten years after EPA was required to set standards for cement kilns, EPA requested basic information related to mercury emissions from nine of the major cement kiln companies operating in the U.S.[8] EPA claims that it will use this information to propose mercury standards for cement kilns sometime in the summer or fall of 2008. After a review of EPA's data, industry self-reporting to EPA's annual Toxics Release Inventory (TRI), and the data from the Portland Cement Association, it is clear that EPA must act to regulate an industry that is emitting more mercury than previously reported and continues to spew harmful mercury emissions into our air and water.

EPA currently estimates cement kilns in the United States emit almost 23,000 pounds of mercury each year.

EPA collected data from nine companies and ultimately released data for 51 non-hazardous waste burning kilns currently operating in the United States. EPA released data for all the kilns for which it has data except those owned by CEMEX, which has claimed that the information EPA requested — information directly related to the amount of mercury it releases into our air and waters — is confidential business information. All of the data considered were self-reported by the kiln companies. For a complete discussion of the data sources considered and methodology, please see Appendix B. The 2007 EPA collection requests were sent to the following companies:

- **Ash Grove Cement**
- **CEMEX**
- **California Portland Cement Company**
- **Essroc Cement Corp.**
- **Holcim (US) Inc.**
- **LaFarge North America, Inc.**
- **Lehigh Cement Company**
- **Lonestar/Buzzi Unicem**
- **Texas Industries, Inc.**

Findings

According to EPA's current estimate, cement kilns in the United States emit almost 23,000 pounds of mercury each year. This number is nearly double what the entire cement industry reported to the Toxics Release Inventory in 2006 — 11,995 pounds of mercury released into the environment as air emissions.

Based on the source test data that EPA collected and data self-reported by industry to TRI, the ten worst mercury emitting cement kilns across the country are listed in Table 1: *10 Highest Self-Reported Mercury Polluting Cement Kilns.* The numbers provided in this chart are based on the data set described in Appendix A.[9]

Some cement kilns release as much as or more mercury than coal-fired power plants. As shown in *10 Highest Self-Reported Mercury Polluting Cement Kilns,* based on source tests and industry's own estimates to TRI, several of these kilns emit over 250 pounds of mercury annually.

- The Ash Grove Cement Plant in Durkee, Oregon, has the dubious distinction of being the worst mercury polluter of any kind in the country, emitting more mercury into the air than any power plant, steel mill, or hazardous waste incinerator. In 2006 Ash Grove reported to the EPA's Toxics Release Inventory that it emitted 2,582 pounds of mercury. Based on information Ash Grove submitted to EPA in 2007, however, actual emissions may be as much as 3,788 pounds a year. Note that although it emits the greatest amount of mercury (more than double the amount of the next worst polluter), it has the third smallest production capacity of the kilns on the Top 10 list.[11]

- Lafarge North America, Inc., shows up on the Top 10 Polluting Cement Kiln list twice, at rank four and rank five with its plants in New York and Michigan. By Lafarge's own calculations the

TABLE 1. 10 HIGHEST SELF-REPORTED MERCURY POLLUTING CEMENT KILNS

Rank	Facility Owner	Location	Mercury (lbs/yr)	Basis for Annual Mercury Estimate	Production Capacity (thousand metric tons of clinker/yr)
1	Ash Grove	Durkee, Oregon	3,788	Source Test	894
2	Lehigh	Tehachapi, California	586	TRI	958
3	Hanson Permanente Cement[10]	Cupertino, California	494	TRI	1,497
4	Lafarge	Ravena, New York	400	TRI	1,695
5	Lafarge	Alpena, Michigan	360	Source Test	2,265
6	CEMEX	Victorville, California	271	TRI	2,717
7	National Cement Company Alabama	Ragland, Alabama	208	TRI	907
8	Lehigh	Mason City, Iowa	184	Source Test	731
9	CEMEX	Davenport, California	172	TRI	823
10	Essroc	Nazareth, Pennsylvania	163	TRI	1,280

Note that at the following locations, data provided in this table cover multiple kilns at one site: Ravena, New York – 2 kilns, Alpena, Michigan — 5 kilns, Victorville, California — 2 kilns.

kiln in Ravena, New York, emits 400 pounds of mercury per year.

- Cement kilns in Cupertino, California, and Ragland, Alabama, were wholly omitted from EPA's 2007 data requests. Their mercury emissions data included in this report came directly from the Toxics Release Inventory, which are voluntarily reported by the cement companies. It is possible that mercury emissions at these facilities could be much higher.

EPA sampling shows that large amounts of mercury pass through cement kilns, with some kilns reporting astonishingly high amounts. Absent emission monitoring and emission controls, most of that mercury will be released into the environment.

None of the kilns in Table 2 uses scrubbers or pollution control devices designed to control its mercury emissions.

When the actual mercury content for the kiln inputs (i.e., fuel and feedstock) are compared to the self-reported numbers to TRI, there are often significant gaps between what is coming into the plant and what companies are reporting to EPA as exiting the plant. Companies report data to TRI that includes not only the air emissions from a cement kiln, but also mercury that may be treated, disposed of, or recycled rather than emitted through a smokestack. Yet, for the facilities listed in Table 2: *Mercury Accounting Gaps*, companies consistently reported "n/a" for these other categories, making it impossible for the public to know where the mercury is going.

Some plants have installed scrubbers to control sulfur dioxide, and mercury emissions should decline as a co-benefit of sulfur dioxide controls. However, none of the kilns listed in Table 2 employs scrubbers or pollution control devices designed to control mercury emissions.

- Lehigh kilns at Union Bridge and Tehachapi reported numbers to TRI in 2006 that appear to be grossly lower than their mercury inputs and clearly illustrate the data gap problem.

  The Lehigh cement kiln at Union Bridge reported to TRI in 2006 emitting only 35 pounds of mercury; but the number calculated based on EPA data shows the kiln could be emitting up to 1,539 pounds, an unusually large

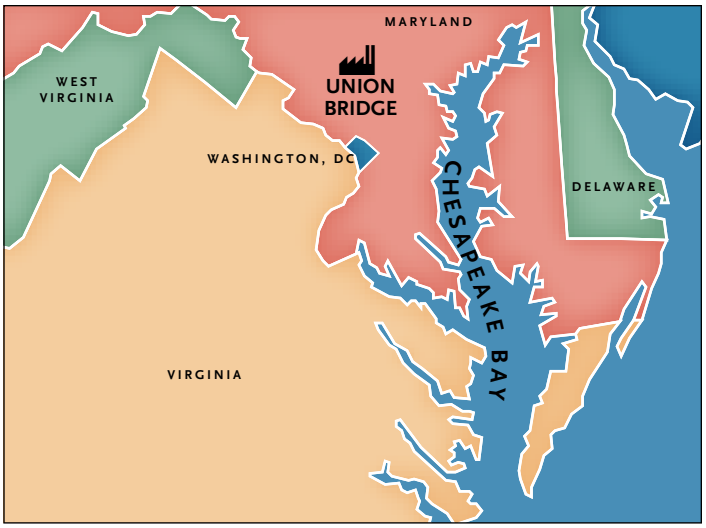
TABLE 2. MERCURY ACCOUNTING GAPS

Facility Owner	Location	Production Capacity (thousand metric tons of clinker/yr)	Mercury Content from Inputs (fuel and feedstock combined in lbs/yr)	TRI Reported Mercury sent to Treatment (lbs/yr)	TRI Reported Mercury sent to Disposal (lbs/yr)	TRI Reported Mercury released to the air (lbs/yr)
Lehigh	Tehachapi, California	958	1,748	Unknown	Unknown	586
Lehigh	Union Bridge, Maryland	1,996	1,539	Unknown	Unknown	35
Lafarge	Calera, Alabama	1,467	258	Unknown	Unknown	36
Lafarge	Harleyville, South Carolina	978	206	Unknown	Unknown	78
Ash Grove	Seattle, Washington	675	52	Unknown	Unknown	12

discrepancy, especially as compared to the entire data set.

It is not entirely clear why there is such a large range. What we do know is: (1) Lehigh reported 35 lbs of mercury emissions to EPA's 2006 TRI; (2) all of Lehigh's reported 2006 TRI mercury emissions were air emissions; there were no reports of on- or off-site mercury waste; (3) in 2007 Lehigh reported an estimated amount of "mass in" of mercury, meaning content of the fuel and feedstock, of 1,539 pounds of mercury in fuel and ingredients. If 1,539 pounds of mercury go into the plant and only 35 pounds come out, what has happened to the rest of the mercury?

Lehigh's Union Bridge, Maryland, plant is located approximately 75 miles northwest of Baltimore. It is the fifth largest cement kiln in the United States, able to produce nearly 2 million tons of clinker annually. This is particularly significant given the plant's proximity to the Chesapeake Bay.



- As indicated in Table 2: *Mercury Accounting Gaps*, the Lafarge Harleyville, South Carolina, plant reported 78 pounds of mercury to TRI in 2006, but reported mercury inputs of just over 200 pounds of mercury on an annual basis. This plant, sited close to the Francis Marion National Forest, is preparing to more than double its current clinker production capacity from about 978,000 tons per year now to over 2.2 million tons per year by 2010. The fish in large sections of South Carolina's water bodies are already contaminated with mercury making them unsafe to eat, according to advisories from the South Carolina Department of Health and Environmental Control.[12]

The cement industry is rapidly expanding. Production capacity gains of nearly 2.5 million metric tons are expected between 2006 and 2010.[13] As the cement industry's capacity increases, the amount of mercury emissions, if unchecked by regulation, will also increase.

TABLE 3. MAJOR KILNS IGNORED BY EPA

Company	Kiln Location	Clinker Capacity per Year	Clinker Capacity Rank
Titan America, LLC	Medley, Florida	1,634 tons	8th
Titan America, LLC	Cloverdale, Virginia	1,138 tons	24th
Mitsubishi Cement Corporation	Lucerne Valley, California	1,543 tons	9th
Hanson Permanente Cement	Cupertino, California	1,497 tons	11th
Phoenix Cement Corporation	Clarkdale, Arizona	1,477 tons	13th
St. Mary's Cement, Inc.	Charlevoix, Michigan	1,234 tons	21st

Homes, schools, and nearby farms are located right beside a cement plant in Davenport, CA.

The cement industry continues to avoid public scrutiny as a result of inaction on the part of the U.S. EPA.

- CEMEX is the largest producer of cement in the United States.[14] EPA requested information from CEMEX in its 2007 information requests, but no information on mercury content of the kiln feed or results of mercury stack tests have been turned over by EPA to the public. CEMEX made blanket claims of confidentiality regarding measurements of mercury emissions from its kilns nationwide. No other company made such claims to EPA. CEMEX, like the industry at large, is expanding. It acquired Rinker Materials in 2007 and is expected to bring a massive new plant on-line in New Braunfels, Texas, in 2009.[15]

> ***"We are soccer moms, ranchers, farmers, retired engineers. We are a cross section of America. We are grassroots volunteers. We naively believed that we could band together and government agencies would listen to our concerns. We were wrong."***
>
> **— Becky Bornhorst, Downwinders at Risk, Midlothian, Texas**

- EPA's 2007 data request omitted some of the country's largest individual cement kilns. As shown in Table 3: *Major Kilns Ignored by EPA*, EPA failed to request information from numerous companies with cement kilns that rank in the top 25 for production of clinker.

Certain communities are bearing the brunt of EPA's inaction. Even a small amount of mercury can have adverse environmental and public health impacts. There are several kilns throughout the country that are noteworthy due to their proximity to other kilns and populated areas. In these communities, EPA's failure to control mercury emissions is especially alarming.

- The largest concentration of cement manufacturing in the entire country is just outside of the Dallas/Fort Worth metroplex in Midlothian, Texas. Citizens of Midlothian are burdened by five plants operated by Holcim, Ash Grove, and Texas Industries, all within a 6.5-mile radius of each other. Combined, these plants may emit just under 200 pounds of mercury on an annual basis, and thousands of tons of other dangerous toxic air pollutants.[16]

- Although there are other sites in California, the kilns at Davenport and Cupertino are of particular concern.[17] In the San Francisco Bay Area, Hanson Permanente Cement operates a kiln in Cupertino, California.[18] This kiln is located within a residential area in close proximity to several Cupertino schools. It is also located within five miles of the San Francisco Bay, which is currently contaminated with mercury.[19] The Hanson Permanente kiln reported emitting a staggering 494 pounds of mercury in 2006 to EPA's Toxics Release Inventory. EPA failed to include Hanson Permanente Cement in any of its information requests, leaving

open the possibility that its mercury emissions could be even worse. The CEMEX kiln in Davenport, California, is of similar concern. That kiln, located right beside homes and farms along California's coastline and only 40 miles north of the Monterey Bay Sanctuary, reported emitting 172 pounds of mercury to the Toxics Release Inventory in 2006. The Davenport kiln is one of those for which EPA refuses to release data gathered in 2007.

- The Lafarge site in Alpena, Michigan, is a five-kiln plant, and in 2006 was the nation's third largest cement plant. These kilns collectively reported emitting 360 pounds of mercury in 2006. The Alpena cement plant is of particular concern because it sits on the banks of Lake Huron and is in close proximity to residential areas of Alpena.

Data Sources

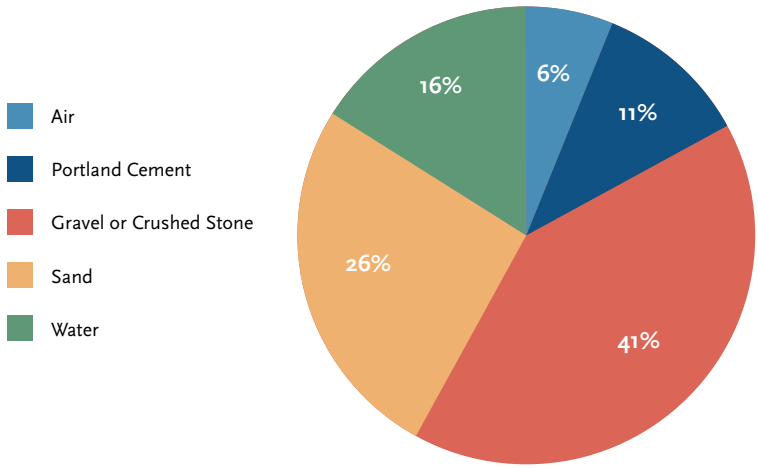
For the analysis in this report, an extensive review of available data on mercury emissions was undertaken. Data were assembled and analyzed from the following sources:

- EPA, Summary of Cement Kiln Mercury Emissions (July 2008).
- Portland Cement Association, *U.S. and Canadian Portland Cement Industry Plant Information Summary* (December 31, 2006).
- EPA list of hazardous-waste burning kilns (2005). These kilns were excluded from the analysis because mercury emissions from hazardous waste-burning kilns are regulated, albeit inadequately.
- EPA-obtained data from several large cement companies in response to a 2007 EPA information collection request. These data generally include: (1) mercury tests and (2) data on mercury content in input (raw materials) for an approximate 30-day period in 2007.
- Data on mercury air emissions submitted to EPA as a part of the 2006 TRI reporting.
- Clean Air Act Title V operating permits for various cement kilns.

Ignored: Mercury Pollution from Cement Kilns

Cement kilns produce cement, the main ingredient in concrete. The terms cement and concrete are often used interchangeably, but cement and concrete are quite different. Cement makes up just over 10 percent of any concrete mix.[20] See Figure 1, *Concrete Composition.* Worldwide, the United States is the third largest producer of cement, behind China and India.[21] Thirty-nine companies produce cement in the United States, and the top five companies produce over one-half of all U.S. cement.[22] In 2002, the United States consumed 103.8 million metric tons of cement.[23]

FIGURE 1. CONCRETE COMPOSITION



Where Do the Mercury Emissions Come from?

Mercury emissions from cement kilns originate from the feed materials (e.g., limestone, clay, shale, fly ash, and sand, among others) and fossil fuels (e.g., coal, oil). In general, the amount of mercury emitted by a cement manufacturing kiln is proportional to the amount of mercury in the fuel and feed materials due to the volatile nature of mercury at the temperatures encountered in a cement kiln.[24]

For a description of the cement manufacturing process, see, Figure 2: *Mercury Emission from Cement Production.*

With regard to limestone, EPA recognizes that:

- A significant portion of kilns' mercury emissions comes from limestone; and
- Limestone's mercury content varies with location.

Similarly, with regard to the fuel sources at cement kilns, EPA recognizes that:

- A significant portion of kilns' mercury emissions comes from the fuel they use;
- Individual kilns use widely different fuels, including different types of coal, petroleum coke, scrap tires, fuel oil, and natural gas; and,
- These fuels have significantly different mercury contents, as do different types of coal.[25]

Many factors can decrease the quantity of mercury emissions produced at a cement kiln. These factors include the use of fuels containing less mercury (e.g., natural gas or coal with low mercury content), cleaner raw materials (e.g., limestone with low mercury content), kiln design (e.g., dry kilns as opposed to wet kilns), and various types of control

FIGURE 2. MERCURY EMISSIONS FROM CEMENT PRODUCTION

technology (e.g., particulate matter control devices, such as baghouses and activated carbon injection).

Some kilns have already reduced their mercury emissions by making changes to either their raw materials or fuels or by using additives.[26] Not only do some kilns have consistently cleaner inputs than others, but some kilns are deploying pollution control equipment that reduces mercury emissions. Yet, EPA has failed to require similar reductions at other plants.

Fly Ash

One potentially significant source of mercury emissions is mercury-laced fly ash from coal-fired power plants. Fly ash is essentially fine coal ash that gets trapped in power plants' pollution controls. Because coal contains mercury, some fly ash is contaminated with mercury as well.

Power plants generate approximately 71 million tons of fly ash each year, and have to find ways to dispose of this waste. One option is to pay cement plants to dispose of it in their kilns, where it mixes with the cement and can replace other raw materials such as shale. Unfortunately, mercury in the fly ash gets vaporized in the cement kiln and emitted as air pollution. According to EPA, 39 cement plants were accepting over three million tons of fly ash in 2005 — a practice that increased the industry's mercury emissions by more than 2,800 pounds that year.*

This problem may grow worse in the future. As power plants begin to control their mercury emissions, the mercury levels in their fly ash will increase and so will mercury pollution from cement kilns using ash. For example, the Lafarge plant in Alpena, Michigan, accepts fly ash from an Ontario power plant that controls its mercury emissions and, as a result, emits an additional 250 pounds of mercury each year — about 60 percent of its total emissions — undermining pollution control efforts by the Canadian plant and further contaminating the Great Lakes that Canada and the United States share.

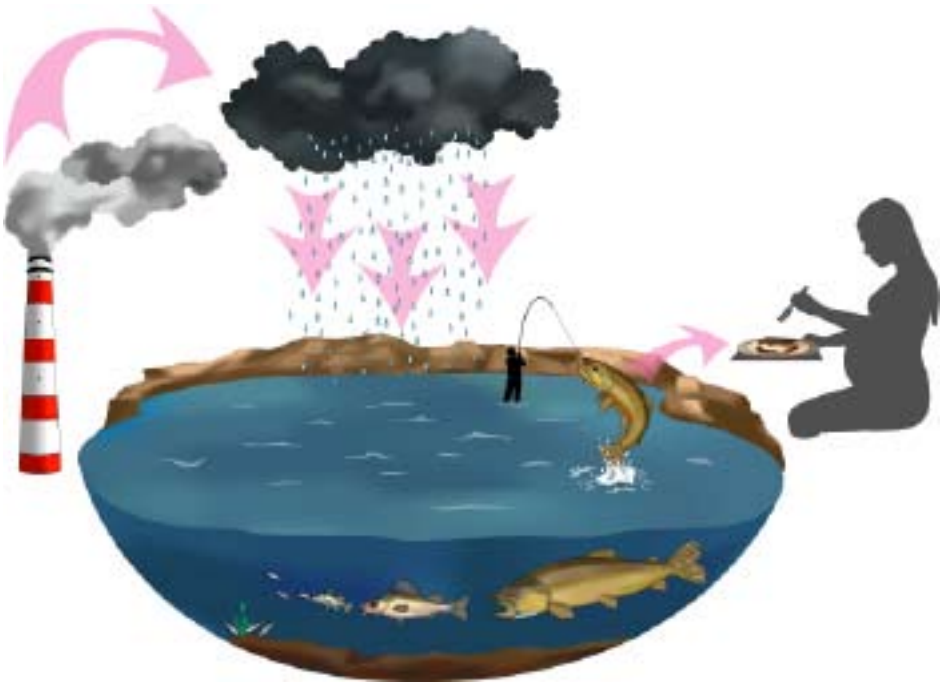
* EPA, Cost and Impacts of Wasting Cement Kiln Dust or Replacing Fly Ash to Reduce Mercury Emissions, December, 2006.

Why Mercury Emissions Matter

People are exposed to unhealthy levels of mercury when they eat mercury-contaminated fish. Figure 3: *Bioaccumulation of Mercury*, depicts how mercury can end up in our food supply.

Three forms of inorganic mercury are emitted into the air by cement kilns — elemental, gas-phase, and particle-bound mercury. The latter two, comprising 50 percent of all mercury emitted, are believed to deposit locally and regionally around the source.[27] Once released into the environment, bacteria convert this inorganic mercury into organic mercury — methylmercury

FIGURE 3. BIOACCUMULATION OF MERCURY



is the most common form — which then accumulates in fish and shellfish.[28] Methylmercury quickly enters the aquatic food chain and accumulates as it is passed from the smallest organisms to those at the top of the food chain, like walleye and bass. (See Figure 3.) Fish at the top of the food chain contain between 10,000 and 100,000 times greater concentrations of methylmercury than that dissolved in the water.[29]

> ***"EPA's mercury strategy allows polluters to contaminate our fisheries with mercury, then warn people off eating fish. Folks who ignore the warning or just don't know are imperiled. Those who avoid fish altogether are eating unhealthy substitutes instead. For Americans, eating fish has become damned-if-you-do and damned-if-you-don't. Only the polluters get let off the hook."***
>
> **—Marti Sinclair, Sierra Club, Cincinnati, OH**

Once in the human body, mercury acts as a neurotoxin, interfering with the brain and nervous system. Exposure to mercury can be particularly hazardous for pregnant women and small children. During the first several years of life, a child's brain is still developing and rapidly absorbing nutrients. Prenatal and infant mercury exposure can cause mental retardation, cerebral palsy, deafness, and blindness. Even in low doses, mercury may affect a child's development, delaying walking and talking, shortening attention span, and causing learning disabilities.[30]

The Centers for Disease Control and Prevention estimate that 8 percent of women of childbearing age have enough mercury in their blood to put a baby at risk of cognitive and developmental damage.[31] The National Academy of Sciences' National Research Council estimated in a 2000 report that approximately 60,000 children per year may be born in the U.S. with neurological problems due to *in utero* exposure to methylmercury.[32]

Mercury poses a threat to adult men, as well as women and children. In adults, mercury poisoning can adversely affect fertility and blood pressure regulation and can cause memory loss, tremors, vision loss, and numbness of the fingers and toes.

A number of studies have found an association between mercury concentrations and heart attacks in adults. In one of those studies, the authors reported a 69 percent greater risk of heart attack and a 93 percent greater risk of premature death in individuals with hair mercury concentrations of 2.0 ppm or more, compared with those with less than 2.0 ppm.[33]

It is well documented that mercury pollution is currently a major problem for many states, with nearly all states having at least some fish consumption warnings for particular waterbodies. Across the United States, in 2006, mercury was known to have contaminated more than 14 million acres of lakes and 882,963 river miles. In 2006, 48 states issued fish consumption advisories, warning citizens to limit how often they eat certain types of fish caught in state waters because they are contaminated with mercury, 23 states issued statewide advisories for mercury in freshwater lakes and/or rivers, and 12 states have statewide advisories for mercury in their coastal waters, including all states on the gulf coast and the majority of the eastern seaboard.[34]

Kilns in close proximity to water bodies are a serious health concern. A study conducted by the Florida Department of Environmental Protection modeled

TABLE 4. CEMENT CAPACITY BY STATE*

State	Percent of Industry
California	13.1 %
Texas	12.2 %
Pennsylvania	6.7 %
Florida	6.3 %
Alabama	5.7 %

* From the U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006.

the contribution of local atmospheric mercury concentrations to measured mercury levels in fish. A correlation was found between levels of mercury found in locally caught fish and recently mandated emission reductions in local municipal and medical waste incinerators. At one location, 92 percent of the observed total mercury deposition could be accounted for by local sources.[35]

Not surprisingly, a disproportionate number of states bear the burden of the industry's capacity. As shown in Table 4: *Where Cement is Made*, in 2006, 44 percent of clinker capacity is found in just five states.[36]

According to the Portland Cement Association, clinker capacity in the United States is expanding and continued growth is expected in the coming years.[37] In 2006, capacity reached an all-time high. Additional gains of nearly 2.5 million metric tons are expected between 2006 and 2010.[38] Unless appropriately regulated, as capacity increases, mercury emissions will also increase.

Earthjustice has advertised in newspapers and on billboards across the country about the dangers of mercury from cement kilns. The ad shown here, which ran in a newspaper in Midlothian, Texas, notified local residents of potential changes to a cement kiln operating permit and the need for public comments. Similar ads appeared in Michigan, New York, Pennsylvania, Florida, and Colorado, telling EPA to clean up mercury from cement kilns.

Alexandra Allred – A Mother's Story

As a martial artist, marathon runner, and former member of the U.S. bobsled team, Alexandra Allred has known hard work and difficult challenges. Yet as she plopped down her tangle of plastic hoses, breathing apparatus, and empty medicine bottles at an EPA public hearing on regulating toxic air pollution, including mercury, from cement kilns in 2006, she began to tell the story of one of the most difficult challenges of her life: how to keep her five-year-old asthmatic son Tommy alive as he grew up in the shadow of three toxic-fume-emitting cement factories.

When we moved to Midlothian, I had a very healthy two-year-old boy, Tommy. Within four months, he got sick — bronchitis, pneumonia, double pneumonia. He was rushed to the hospital several times and we were frantic because we could not figure out what was going on. A doctor at Children's Hospital identified the problem for us: environmental asthma.

It's not like regular asthma where the victim can feel tightness coming on. One minute Tommy is running around like a normal little boy, the next, he is on the floor gasping for air and I'm flying down the back roads trying to get him to the hospital as fast as I can. Not long ago, after he'd collapsed, he asked me if he was going to die. Do you know what it is like to have your baby ask you that question?

I can beat anything but I can't beat this!!

I truly admire the EPA and what it stands for. Even as a kid, I was proud to know that there was an agency that protected the things I loved most — nature, wildlife, and my environment. But today it is very frustrating because the EPA is not doing its job. I'm in a town where people are very sick, people are talking about how poor the air quality is, that when they walk outside at night they can smell strange smells that make their eyes burn.

Tommy is only 48 pounds and yet, this is what a once very healthy boy has to take everyday. My husband and I have to set alarm clocks to make sure he gets round the clock medication to prevent another trip to the hospital. In one month, we visited Emergency three times!

Once, Tommy was taking a breathing treatment and watching as his sisters and their friends ate up all the cookies I had made. Panicked that he would miss out, he pulled off his mask, ran over to the plate and spit on the cookies. While he got in trouble for doing this, it was a brilliant strategy. All the girls went, "Ooooh! Ick! Gross!" No one wanted it.

I guarantee you, that if we were to all go out to dinner and at the last moment, I spit on your food, you would not pick through the food with your fork and say, 'Okay, well, she didn't spit over here.' You'd be so grossed out you would not touch the food. Yet, here we sit, intelligent, reasonable people discussing not IF we should put mercury and other pollutants that are worsening Tommy's asthma into the atmosphere but HOW MUCH.

You need to snap out of it! You need to do what the EPA was designed to do. Protect the environment. Protect the people who live in it. Protect my son. I can't do it. You can.

EPA's Failure to Regulate Mercury Pollution

An Overview of the Federal Regulations

After years of foot-dragging by EPA, Congress identified 189 hazardous air pollutants (HAPs) in the 1990 Amendments to the Clean Air Act. Mercury is one of those Congressionally listed air toxics.[39] Today, the primary way that EPA regulates air toxics such as mercury is through Maximum Achievable Control Technology (MACT) standards.[40]

The Clean Air Act requires EPA to identify categories of facilities that are major sources of these air toxics and to set emission standards for each category, such as cement kilns.[41]

When EPA issues MACT standards for an industrial category, such as cement kilns, it must set standards for each hazardous air pollutant that category emits.[42] For each HAP, these standards must require the maximum reduction in emissions that is achievable considering cost and other factors.[43] Well aware of EPA's tendency to cave to industry pressure and issue weak environmental standards, Congress also included absolute minimum stringency ("floor") provisions in the Clean Air Act that apply without regard to cost or EPA's views about what is achievable.[44] For the existing plants in any category, EPA's standards may not be less stringent than the average emission level achieved by the 12 percent of sources with the lowest emission levels.[45] For new plants, standards may not be less stringent than the emission level achieved by the single lowest emitting source.[46]

Congress enacted this law in 1990, and required EPA to complete its MACT standards for cement kilns no later than 1997. In direct violation of this law — and in defiance of repeated federal

EPA wrongly claimed that because it found no cement plants using control technologies for mercury, it did not have to set a mercury limit.

court orders, EPA has yet to set any mercury standards for existing cement kilns. Thanks to EPA's recalcitrance and neglect, uncontrolled emissions from cement kilns have continued unabated for the last decade, at a rate of approximately 23,000 pounds a year.

Years of EPA Delay

Three times in the last ten years, federal courts have ordered EPA to set emission standards to control cement kilns' mercury emissions. But EPA has ignored these orders or sought to evade them.

In 1990 Congress amended the federal Clean Air Act to require EPA to set standards for the emissions of air toxics from cement kilns. The standards were due in 1997, but EPA failed to act, and in 1998 Earthjustice filed suit on behalf of the Sierra Club to force EPA into action.

In 1999 EPA did adopt a rule regulating toxics from cement kilns, but in that rule EPA failed to set a limit for mercury.[47] EPA wrongly claimed that because it found no cement plants using control technologies specifically for mercury, it did not have to set a mercury limit.

EPA's cement kiln regulations were unlawful.[48] In particular, the D.C. Court of Appeals found that EPA's failure to set emission standards for mercury flatly violated the federal Clean Air Act.

Five years after the D.C. Court of Appeals found EPA's failure to regulate

FIGURE 4. TIMELINE OF THE LEGAL ACTIVITY

1990	1997	1998	JUN 1999	AUG 1999
Congress amends the Clean Air Act to require industrial pollution sources to clean up their emissions of toxic air pollutants, including mercury from cement kilns	Cement kiln standards due, EPA fails to act	Earthjustice files deadline suit on behalf of Sierra Club; EPA settles; proposes cement kiln rule. Earthjustice submits comments	EPA publishes final cement kiln rule, but fails to set any limit on kilns' emissions of mercury, hydrochloric acid, and toxic hydrocarbons	On behalf of Sierra Club, Earthjustice challenges EPA's rule in U.S. Court of Appeals for the D.C. Circuit

DEC 2005	FEB 2006	FEB 2006	DEC 2006	FEB 16 2007
EPA publishes proposed response to *National Lime Ass'n*; proposed rule again fails to establish emission standards for mercury, hydrochloric acid or toxic hydrocarbons	Earthjustice files comments on behalf of 13 other organizations and individuals on cement kiln rule; online activists generate 12,000 additional comments for stronger protections	Earthjustice and the Sierra Club give EPA an extension of the consent decree deadline until December 2006	EPA publishes final rule in response to 2000 court order; the new rule contains no emission standards for mercury, hydrochloric acid, or toxic hydrocarbons	On behalf of six environmental groups, Earthjustice challenges new rule in a fourth D.C. Circuit lawsuit; EPA requests that the case be stayed for one year while it reconsiders the new rule

mercury emissions from cement kilns a clear violation of the Clean Air Act, and despite a 2005 court order requiring EPA to propose rules, EPA yet again refused to set regulations to control mercury emissions from this country's existing kilns.[49]

EPA's scofflaw approach to toxic emissions from cement kilns has drawn increasing attention from states that are grappling with their mercury pollution and from citizen groups whose members are affected by this pollution. Nine states and seven environmental groups combined to challenge EPA's most recent refusal to set mercury standards in a 2007 lawsuit before the United States Court of Appeals for the D.C. Circuit.[50]

Under intense pressure from states and local and national environmental and public health groups, the U.S. Environmental Protection Agency finally indicated that it would set mercury emission standards, as stated in papers filed on February 20, 2008, in a fourth case brought by Earthjustice on behalf of Sierra Club, Downwinders at Risk (TX), Friends of Hudson (NY), Montanans Against Toxic Burning, Desert Citizens Against Pollution (CA), and the Huron Environmental Activist League (MI). The States of Michigan, New Jersey, the Pennsylvania Department of Environmental Protection, New York, Connecticut, Delaware, Illinois, Maryland, and Massachusetts also filed suit. EPA's announcement marks a dramatic shift in EPA policy which, until now, had been to resist requiring mercury controls for cement kilns.

DEC 2000

D.C. Circuit finds that EPA's rule violated plain statutory requirement to set standards for each hazardous air pollutant that cement kilns emit, and orders EPA to set the missing standards (case referred to as *National Lime Ass'n v. EPA*)

DEC 2000 TO OCT 2004

EPA ignores court's order

OCT 2004

On behalf of Sierra Club, Earthjustice files second suit in D.C. Circuit to compel EPA to respond to court's 2000 order in *National Lime Ass'n*

OCT 2005

EPA agrees to court-ordered deadline requiring it to respond to court's 2000 order by May 26, 2006

MAR 2007

In separate Earthjustice lawsuit on brick kilns, D.C. Circuit confirms that EPA has plain statutory duty to set emission standards for each hazardous air pollutant that an industry emits

DEC 2007

EPA fails to meet one-year deadline, requests further stay of litigation

MAR 2008

EPA requests further stay of litigation, representing to the court that it will set mercury standards for cement kilns in 2009

JUL 2008

Earthjustice and Environmental Integrity Project release "Cementing a Toxic Legacy?" documenting mercury emissions from cement kilns across the country

Recommendations and Opportunities

EPA must follow through on its commitments. In a recent court document, EPA stated that it would release a proposal for a cement kiln mercury standard.[51] This is the first time that EPA has publicly acknowledged that it will finally abide by court orders requiring it to set a cement kiln standard for mercury and that it will comply with the Clean Air Act. EPA must now follow through on this proposal and release a final rule in 2009. EPA's proposal must not repeat its past litany of complaints as to why such regulation is too complicated. It is not.

States should require specific testing for mercury emissions. Even once a standard is set by EPA, it is incumbent that states implementing permitting programs across the country have access to up-to-date information. Source tests will benefit both the public and permitting authorities. Neighboring residents will be better informed of health risks. Permitting authorities (the states) will have better information with which to set permit limits and take enforcement actions.

Monitoring must be added. Continuous Emissions Monitoring Systems (CEMS) should be required for mercury on all kilns. CEMS will provide real-time data on emissions at the cement kilns. This technology should be promptly installed at kilns nation-wide.

Pollution controls must also be added. State regulatory agencies should not wait for EPA to set standards, but should immediately require the kilns within their jurisdiction to install pollution control devices specifically designed to capture mercury, such as activated carbon injection.

EPA claims that it will propose a standard to limit mercury emissions from cement kilns in 2008. Any failure to issue such standards must be viewed critically by the public and prompt public officials to ask why we must continue to be exposed to this toxic pollution.

Notes

[1] EPA's current regulations distinguish between cement kilns that burn hazardous wastes as a fuel source and those that do not. This report addresses EPA's failure to regulate mercury emissions from non-hazardous waste burning cement kilns. EPA's own Toxics Release Inventory (TRI) does not distinguish between hazardous and non-hazardous waste burning cement kilns. The 2006 figure of 11,995 pounds includes both types of kilns, making the new finding on non-hazardous waste burning kilns at nearly 23,000 pounds all the more significant.

[2] See Appendix A, for this industry-wide emission estimate. As reflected in the appendices, this number is based on a mix of data from TRI, source tests, and input data. While the input data numbers are probably skewed to a high-end, assuming 100 percent pass through of the mercury contained in the kiln fuels and feedstock, it is also likely that emission data reported to TRI and through source tests are in some instances underreported.

[3] Janet Raloff, *Mercurial Risks from Acid's Rain,* 139 SCI. NEWS 152, 153 (1991).

[4] Centers for Disease Control and Prevention, 2003. Second National Report on Human Exposure to Environmental Chemicals. Available at http://www.cdc.gov/nceh/dls/ner.htm. EPA used the CDC data to estimate number of newborns at risk. See Mahaffey, K., et al., 2004. "Blood organic mercury and dietary mercury intake: National Health and Nutrition Examination Survey, 1999 and 2000," *Environ Health Perspect,* 112:562–570. http://ehp.niehs.nih.gov/docs/2003/6587/abstract.html.

[5] Cement kilns are sources of air pollution for mercury and many other toxic air pollutants. Cement kiln systems release numerous hazardous air pollutants into the environment, including acetaldehyde, arsenic, benzene, cadmium, chromium, chlorobenzene, dibenzofurans, formaldehyde, hexane, hydrogen chloride, lead, manganese, mercury, naphthalene, nickel, phenol, polycyclic organic matter, selenium, styrene, 2,3,7,8-tetrachlorodibenzo-p-dioxin, toluene, and xylenes. In addition, the hazardous air pollutants released from other components of the kiln, such as the clinker coolers, raw mills, finish mills, storage bins, conveying system transfer points, bagging systems and bulk loading and unloading systems include arsenic, cadmium, chromium, lead, manganese, mercury, nickel, and selenium. See National Emission Standards for Hazardous Air Pollutants: Proposed Standards for Hazardous Air Pollutants Emissions from the Portland Cement Manufacturing Industry, 63 Fed. Reg. 14,182, 14,183 (Mar. 24, 1998).

[6] See Appendix C, July 2008 EPA data summary. Please note that this reflects non-hazardous waste burning kilns only.

[7] U.S. and Canadian Portland Cement Industry Plant Information Summary, December 31, 2006, pages 2-3. These industry wide numbers reflect both hazardous and non-hazardous waste burning kilns.

[8] See February, 2008 Declaration of Peter Tsirigotis, Director of the Sector Policies and Programs Division of EPA, filed before the D.C. Circuit Court of Appeals in pending Cause No. 07-1046, Consolidated with Nos. 07-1048, 07-1049 and 07-1052.

[9] All production capacity numbers come from the U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, Table 13. See also, Appendix A.

[10] Hanson Permanete Cement is listed in Appendix A as Lehigh—Hanson Permanente Cement. Lehigh purchased this plant in 2007. See, U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, Table 3.

[11] According to the Portland Cement Association, in 2006, this plant ranked 42 out of 112 U.S. cement kilns for capacity to produce clinker. This rank includes hazardous waste-burning kilns. See, U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, Table 13.

[12] For a discussion of the planned expansion, see U.S. and Canadian Portland Cement Industry Plant Information Summary, December 31, 2006, page 4.

Information on South Carolina mercury advisories can be found at: http://www.scdhec.net/environment/water/fish/downloads.htm.

[13] U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, page 1.

[14] See U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, page 1.

[15] U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, Tables 2 and 3.

[16] See Appendix A for the following values: 19 lbs. from one TXI kiln, 31 lbs. from three Ash Grove kilns, and 146 lbs. from two Holcim kilns.

[17] Non-hazardous waste burning kiln sites in California include: CEMEX's kilns in Victorville and Davenport, Lehigh's kilns in Tehachapi and Redding, California Portland Cement's kilns in Colton, Rillito, and Mojave, and the Hanson Permanete Cement kiln in Cupertino.

[18] With regard to clinker capacity, this is one of the largest plants in the country. See, U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, Table 13. Note that the capacity ranking includes hazardous waste burning kilns.

[19] http://www.swrcb.ca.gov/sanfranciscobay/water_issues/programs/tmdls/sfbaymercurytmdl.shtml.

[20] Texas Aggregates and Concrete Association, "Frequently Asked Questions" at http://tx-taca.org/uploads/files/Concrete%20and%20cement%20faq.pdf.

[21] Portland Cement Association, "Cement and Concrete Basics" at http://www.cement.org/basics/cementindustry.asp.

[22] Portland Cement Association, "Cement and Concrete Basics" at http://www.cement.org/basics/cementindustry.asp.

[23] Portland Cement Association, "Cement and Concrete Basics" at http://www.cement.org/basics/cementindustry.asp.

[24] 70 Fed. Reg. 72330, 72333 (Dec. 2, 2005).

[25] See Docket A-92-53, Item II-A-46 at App. A.

[26] 70 Fed. Reg. 72330, 72333 (Dec. 2, 2005).

[27] Glenn Rice & James K. Hammitt, Northeast States for Coordinated Air Use Management, Economic Valuation of Human Health Benefits of Controlling Mercury Emission from U.S. Coal-Fired Power plants (2005) [hereinafter "Harvard/NESCAUM study"] at 5.

[28] Washington Department of Health, Statewide Bass Advisory, September 2003, citing EPA. 1999. The National Survey of Mercury Concentrations in Fish. Data Base Summary 1990–1995. U.S. Environmental Protection Agency. Office of Water. September 1999. EPA-823-R-99-014.

[29] Washington Department of Health, Statewide Bass Advisory, September 2003.

[30] http://www.nrdc.org/health/effects/mercury/effects.asp.

[31] Centers for Disease Control and Prevention, 2003. Second National Report on Human Exposure to Environmental Chemicals. Available at http://www.cdc.gov/nceh/dls/ner.htm. EPA used the CDC data to estimate number of newborns at risk. See Mahaffey, K., et al., 2004. "Blood organic mercury and dietary mercury intake: National Health and Nutrition Examination Survey, 1999 and 2000," *Environ Health Perspect,* 112:562–570. http://ehp.niehs.nih.gov/docs/2003/6587/abstract.html.

[32] Palmer, R.F., et al., Proximity to point sources of environmental mercury release as a predictor of autism prevalence. Health & Place 2008), doi:10.1016/j.healthplace.2008.02.001, citing National Academy of Sciences, 2000. Toxicological Effects of Methyl-mercury. National Academy Press, Washington, D.C.

[33] "Harvard/NESCAUM study" at 37–48 (citing Salonen et al., Mercury accumulation and accelerated progression of carotid atherosclerosis: A population-based prospective 4-year follow-up study in men in Eastern Finland, 148 Atherosclerosis 265 (2000)).

[34] U.S. EPA Fact Sheet, 2005/2006 National Listing of Fish Advisories (July 2007). Also at, http://www.epa.gov/waterscience/fish/advisories/2006/tech.pdf.

[35] Florida Department of Environmental Protection, Integrating Atmosphere Mercury Deposition with Aquatic Cycling in South Florida: An approach for conducting a Total Maximum Daily Load Analysis for an atmospherically derived pollutant (2003), pages 56–57.

[36] U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, Table 11. Note that these capacity numbers reflect kilns that also burn hazardous wastes.

[37] U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, Table 2.

[38] U.S. and Canadian Portland Cement Industry, Plant Information Summary, December 31, 2006, Portland Cement Association Economic Research Department, page 1.

[39] See the list of hazardous air pollutants at Clean Air Act § 112(b).

[40] When the EPA sets MACT standards for pollutants at particular sources, these standards are referred to as National Emissions Standards for Hazardous Air Pollutants, or NESHAPs. State and local environmental agencies may obtain approval from the EPA to run programs that administer MACT standards. For a state or locality to run a MACT program, it must demonstrate that the state or local MACT requirements are just as stringent as the federal MACT requirements.

[41] For hazardous air pollutants, the Clean Air Act defines a major source as any stationary source of emissions that has the potential to emit at least ten tons per year of any single hazardous air pollutant or at least 25 tons per year or more of any combination of hazardous air pollutants. Clean Air Act § 112(a)(1). In 1992, EPA published an initial list of major source categories that includes Portland Cement Manufacturing. 57 Fed. Reg. 31576 (July 16, 1992). For the requirement that the EPA set standards for each source category see, Clean Air Act § 112(d)(1) and *Nat'l Lime Ass'n v. EPA*, 233 F.3d 625, 628 (D.C. Cir. 2000), amended on den. of reh'g 2/14/2001.

[42] Clean Air Act § 112(d)(1). See also, *Nat'l Lime Ass'n v. EPA,* 233 F.3d 625, 628 (D.C. Cir. 2000), amended on den. of reh'g 2/14/2001.

[43] Clean Air Act § 112(d)(2).

[44] Clean Air Act § 112(d)(3).

[45] Clean Air Act § 112(d)(3)(A). Note that in source categories where there are fewer than 30 sources, the limit may not be less stringent than the average achieved by the best five performing sources. Clean Air Act § 112(d)(3)(B).

[46] Clean Air Act § 112(d)(3).

[47] EPA published its final rule that failed to set any limits on kilns' emissions of mercury, hydrochloric acid, and toxic hydrocarbons. See, 64 Fed. Reg. 31,898 (June 14, 1999).

[48] *Nat'l Lime Ass'n v. EPA*, 233 F.3d 625 (D.C. Cir. 2000), amended on den. of reh'g 2/14/2001.

[49] 70 Fed. Reg. 72330 (Dec. 2, 2005). The 2006 final rule did contain mercury standards for "new" cement kilns, those for which construction or reconstruction begins after December 2, 2005, but EPA immediately commenced reconsideration proceedings on this aspect of the rule. 71 Fed. Reg. 76518, 76524 (December 20, 2006). Those proceedings are still pending.

[50] See EPA's February 20, 2008 *Motion to Govern* before the D.C. Circuit Court of Appeals in Cause No. 07-1046, Consolidated with Nos. 07-1048, 07-1049 and 07-1052.

[51] See February, 2008 Declaration of Peter Tsirigotis, Director of the Sector Policies and Programs Division of EPA, filed before the D.C. Circuit Court of Appeals in pending Cause No. 07-1046, Consolidated with Nos. 07-1048, 07-1049 and 07-1052.

Appendix A

KILN DATA ANALYSIS

Company	Kiln Location	ST	ZIP	Kiln #	Dry/ Wet	Capacity in 1,000s of metric tons/yr in clinker	2006 TRI Hg (lb/yr)	Study Range-Low Hg (lb/yr)	Study Range-High Hg (lb/yr)	High Basis	Scrubber	EPA Resp?
Armstrong Cement	Cabot	PA	16023	1+2	Wet	132	16					No
Ash Grove	Durkee	OR	97905	1	Dry	894	2,581	2,581	3,788	Test		Yes
Ash Grove	Inkom	ID	83245	1	Wet	114	6	0.5	6	TRI		Yes
Ash Grove	Inkom	ID	83245	2	Wet	144		0.5				Yes
Ash Grove	Louisville	NE	68037	1	Dry	319	24	1.27	24	TRI	Dry Scrub-bing	Yes
Ash Grove	Louisville	NE	68037	2	Dry	551		7.06				Yes
Ash Grove	Clancy (Montana City)	MT	59634	1	Wet	299	No TRI	2	2	Input		Yes
Ash Grove	Nephl (Leamington)	UT	84638	1	Dry	833	153	153	167	Input		Yes
Ash Grove	Seattle	WA	98134	1	Dry	675	12	12	52	Input		Yes
Ash Grove	Midlothian	TX	76065	1	Wet	291	31	1.5	31	TRI		Yes
Ash Grove	Midlothian	TX	76065	2	Wet	291		1.2				Yes
Ash Grove	Midlothian	TX	76065	3	Wet	291		1.7				Yes
Buzzi - Alamo Cement Company	San Antonio	TX	78265	1	Dry	852	25					??
Buzzi	Chattanooga	TN	37405	1	Dry	816	No TRI					??
Buzzi	Fustus	MO	63028	1	Dry	537	145					??
Buzzi	Fustus	MO	63028	2	Dry	537						??
Buzzi	Independence	KS	67301	1	Dry	81	14					??
Buzzi	Independence	KS	67301	2	Dry	81						??
Buzzi	Independence	KS	67301	3	Dry	81						??
Buzzi	Independence	KS	67301	4	Dry	81						??
Buzzi	Oglesby	IL	61348	1	Dry	593	No TRI					No
Buzzi	Pryor	OK	74362	1	Dry	190	2					No
Buzzi	Pryor	OK	74362	2	Dry	189						No
Buzzi	Pryor	OK	74362	3	Dry	274						No
Buzzi	Stockertown	PA	18083	1	Dry	328	9					??
Buzzi	Stockertown	PA	18083	2	Dry	558						??
Buzzi	Maryneal	TX	79535	1	Dry	150	23					No
Buzzi	Maryneal	TX	79535	2	Dry	150						No
Buzzi	Maryneal	TX	79535	3	Dry	163						No
California Portland Cement	Mojave	CA	93502	1	Dry	1,375	13	13	20	Test		Yes

Company	Kiln Location	ST	ZIP	Kiln #	Dry/ Wet	Capacity in 1,000s of metric tons/yr in clinker	2006 TRI Hg (lb/yr)	Study Range-Low Hg (lb/yr)	Study Range-High Hg (lb/yr)	High Basis	Scrubber	EPA Resp?
California Portland Cement	Rillito	AZ	85654	1	Dry	121	0	0	58	Test		Yes
California Portland Cement	Rillito	AZ	85654	2	Dry	121		0	41	Test		Yes
California Portland Cement	Rillito	AZ	85654	3	Dry	121						Yes
California Portland Cement	Rillito	AZ	85654	4	Dry	969						Yes
Capitol Aggregates	San Antonio	TX	78217	1	Wet	254	12					No
Capitol Aggregates	San Antonio	TX	78217	2	Dry	604						No
Cemex	Brooksville	FL	34614	1	Dry	629	0					No
Cemex	Brooksville	FL	34614	2	Dry	629						No
Cemex - Rinker Materials	Brooksville	FL	34614	1	Dry	605	No TRI					No
Cemex	Clinchfield	GA	31013	1	Dry	755	38					No
Cemex	Davenport	CA	95017	1	Dry	823	172					No
Cemex	Demopolis	AL	36732	1	Dry	853	No TRI					No
Cemex	Knoxville	TN	37924	1	Dry	701	0					No
Cemex	Louisville	KY	40272	1	Dry	1,407	36					No
Cemex	Lyons	CO	80540	1	Dry	470	53					No
Cemex - Rinker Materials	Miami	FL	33182	1	Dry	985	25					No
Cemex	Odessa	TX	79766	1	Dry	257	13					No
Cemex	Odessa	TX	79766	2	Dry	287						No
Cemex	Victorville	CA	92394	1	Dry	1,049	271					No
Cemex	Victorville	CA	92394	2	Dry	1,668						No
Cemex	Wampum	PA	16157	1	Dry	251	70					No
Cemex	Wampum	PA	16157	2	Dry	251						No
Cemex	Wampum	PA	16157	3	Dry	269						No
Cemex	Xenia	OH	45385	1	Dry	692	24					No
Dragon Products Company	Thomaston	ME	04861	1	Dry	776	14					No
Eagle Materials	Fernley	NV	89408	1	Dry	226	12					No
Eagle Materials	Fernley	NV	89408	2	Dry	226						No
Eagle Materials	La Salle	IL	61301	1	Dry	602	10					No
Eagle Materials	Laramie	WY	82070	1	Dry	172	31					No
Eagle Materials	Laramie	WY	82070	2	Dry	401						No
Essroc	Bessemer	PA	16112	1	Wet	237	151	45	151	TRI		Yes
Essroc	Bessemer	PA	16112	2	Wet	368		91				Yes

Company	Kiln Location	ST	ZIP	Kiln #	Dry/ Wet	Capacity in 1,000s of metric tons/yr in clinker	2006 TRI Hg (lb/yr)	Study Range-Low Hg (lb/yr)	Study Range-High Hg (lb/yr)	High Basis	Scrubber	EPA Resp?
Essroc	Frederick	MD	21703	1	Wet	154	31	31	31	TRI		Yes
Essroc	Frederick	MD	21703	2	Wet	154						Yes
Essroc	Martinsburg	WV	25401	1	Wet	208	149	2	149	TRI		Yes
Essroc	Martinsburg	WV	25401	2	Wet	208		2				Yes
Essroc	Martinsburg	WV	25401	3	Wet	314		3				Yes
Essroc	Nazareth	PA	18064	1	Dry	1,280	163					No
Essroc	Speed	IN	47172	1	Dry	298	149	27	149	TRI		Yes
Essroc	Speed	IN	47172	2	Dry	621		56				Yes
Florida Rock Industries	Newberry	FL	32669	1	Dry	708	28					No
GCC of America	Rapid City	SD	57702	1	Wet	148	18					No
GCC of America	Rapid City	SD	57702	2	Wet	148						No
GCC of America	Rapid City	SD	57702	3	Dry	602						No
GCC of America	Tijeras	NM	87059	1	Dry	216	11					No
GCC of America	Tijeras	NM	87059	2	Dry	216						No
Giant Cement Holdings	Harleyville	SC	29448	1	Dry	848	33					No
Holcim	Ada	OK	74820	1	Wet	252	65					No
Holcim	Ada	OK	74820	2	Wet	262						No
Holcim - St. Lawrence Cement Company	Catskill	NY	12414	1	Wet	580	51					No
Holcim	Dundee	MI	48131	1	Wet	419	113					No
Holcim	Dundee	MI	48131	1	Wet	411						No
Holcim	Florence	CO	81226	1	Dry	1,542	8	8	49	Test	Wet Lime Scrubber	Yes
Holcim - St. Lawrence Cement Company	Hagerstown	MD	21742	1	Dry	548	48					No
Holcim	Mason City	IA	50401	1	Dry	546	96					No
Holcim	Mason City	IA	50401	2	Dry	350						No
Holcim	Midlothian	TX	50401	1	Dry	987	12	12	34	Test		Yes
Holcim	Midlothian	TX	50401	2	Dry	1,028			112	Test		Yes
Holcim	Morgan	UT	84050	1	Dry	712	11					No
Holcim	Theodore	AL	36582	1	Dry	1,447	73					No
Holcim	Three Forks	MT	59752	1	Wet	277	7					No
Lafarge	Alpena	MI	49707	1	Dry	390	360	360	54	Test		Yes
Lafarge	Alpena	MI	49707	2	Dry	390			37	Test		Yes
Lafarge	Alpena	MI	49707	3	Dry	387			50	Test		Yes
Lafarge	Alpena	MI	4,707	4	Dry	554			129	Test		Yes
Lafarge	Alpena	MI	49707	5	Dry	544			108	Test		Yes
Lafarge	Buffalo	IA	52728	1	Dry	975	22	22	129	Input		Yes
Lafarge	Calera	AL	35040	1	Dry	1,467	36	78	258	Input		Yes

Company	Kiln Location	ST	ZIP	Kiln #	Dry/ Wet	Capacity in 1,000s of metric tons/yr in clinker	2006 TRI Hg (lb/yr)	Study Range-Low Hg (lb/yr)	Study Range-High Hg (lb/yr)	High Basis	Scrubber	EPA Resp?
Lafarge	Grand Chain (Joppa)	IL	62941	1	Dry	418	1	1	77	Input		Yes
Lafarge	Grand Chain (Joppa)	IL	62941	2	Dry	549						Yes
Lafarge	Harleyville	SC	29448	1	Dry	978	78	78	206	Input		Yes
Lafarge	Ravena	NY	12143	1	Wet	847	400					No
Lafarge	Ravena	NY	12143	2	Wet	848						No
Lafarge	Seattle	WA	96106	1	Wet	387	30	30	39	Test		Yes
Lafarge	Sugar Creek	MO	64050	1	Dry	924	24	24	36	Test		Yes
Lafarge	Tulsa	OK	74116	1	Dry	295	2					No
Lafarge	Tulsa	OK	74116	2	Dry	313						No
Lafarge	Whitehall	PA	18052	1	Dry	419	61	24	61	TRI		Yes
Lafarge	Whitehall	PA	18052	2	Dry	283		36				Yes
Lehigh - Texas-Lehigh	Buda	TX	78610	1	Dry	1,134	16					No
Lehigh - Hanson Permanente Cement	Cupertino	CA	95014	1	Dry	1,497	494					No
Lehigh	Fleetwood	PA	19522	1	Dry	533	86	86	66	Test	Lime Injection in BH	Yes
Lehigh	Fleetwood	PA	19522	2	Dry	533			29	Test		Yes
Lehigh	Glen Falls	NY	12801	1	Dry	586	12	12	12	Test/ TRI	Lime Slurry Injection	Yes
Lehigh	Leeds	AL	35094	1	Dry	716	16	16	42	Test		Yes
Lehigh	Mason City	IA	50401	1	Dry	731	184	148	184	Test	FGD	Yes
Lehigh	Mitchell	IN	47446	1	Dry	251	159	33	159	TRI		Yes
Lehigh	Mitchell	IN	47446	2	Dry	251		33				Yes
Lehigh	Mitchell	IN	47446	3	Dry	274		36				Yes
Lehigh	Union Bridge	MD	21791	1	Dry	1,996	35	35	1,539	Input		Yes
Lehigh	Waco	TX	76712	1	Wet	100	No TRI	2	2	Test		Yes
Lehigh	Redding	CA	96003	1	Dry	592	92					No
Lehigh	Tehachapi	CA	93561	1	Dry	958	586	586	1,748	Input		Yes
Mitsubishi Cement Corp.	Lucerne Valley	CA	92356	1	Dry	1,543	160					No
Monarch Cement Company	Humboldt	KS	66748	1	Dry	433	23					No
Monarch Cement Company	Humboldt	KS	66748	2	Dry	449						No
National Cement Co. Alabama	Ragland	AL	35131	1	Dry	907	208					No
National Cement Co. California	Encino Lebec	CA	91436	1	Dry	1,033	59					No

Company	Kiln Location	ST	ZIP	Kiln #	Dry/ Wet	Capacity in 1,000s of metric tons/yr in clinker	2006 TRI Hg (lb/yr)	Study Range-Low Hg (lb/yr)	Study Range-High Hg (lb/yr)	High Basis	Scrubber	EPA Resp?
Phoenix Cement Company	Clarkdale	AZ	86324	1	Dry	187	41					No
Phoenix Cement Company	Clarkdale	AZ	86324	2	Dry	187						No
Phoenix Cement Company	Clarkdale	AZ	86324	3	Dry	187						No
Phoenix Cement Company	Clarkdale	AZ	86324	4	Dry	912						No
St. Marys Cement	Charlevoix	MI	49720	1	Dry	1,234	55					No
St. Marys Cement	Dixon	IL	61021	1	Dry	161	15					No
St. Marys Cement	Dixon	IL	61021	2	Dry	161						No
St. Marys Cement	Dixon	IL	61021	3	Dry	161						No
St. Marys Cement	Dixon	IL	61021	4	Dry	161						No
Suwanee American Cement	Branford	FL	32008	1	Dry	820	55					No
TXI	Midlothian	TX	76065	5	Dry	1,964	19				Wet Lime Scrubber	No
TXI	New Braunfels	TX	78132	1	Dry	780	87					No
TXI	Oro Grande	CA	92368	1	Dry	161	73					No
TXI	Oro Grande	CA	92368	2	Dry	161						No
TXI	Oro Grande	CA	92368	3	Dry	161						No
TXI	Oro Grande	CA	92368	4	Dry	161						No
TXI	Oro Grande	CA	92368	5	Dry	161						No
TXI	Oro Grande	CA	92368	6	Dry	161						No
TXI	Oro Grande	CA	92368	7	Dry	155						No
TXI	Riverside	CA	92509	1	Dry	43	12					No
TXI	Riverside	CA	92509	2	Dry	43						No
Titan America	Troutville	VA	24175	1	Dry	1,138	6					No
Titan America	Medley	FL	33178	1	Dry	1,634	90					No
Totals				**151**		**81,512**		**4,692**	**9,829**			
								13,132	**27,511**			

Notes

1. Two plants in Puerto Rico not included. Total number of kilns = 151. Total clinker capacity = 81,512,000 metric tons/yr.
2. Data other than TRI was available for kilns with roughly 35 percent of the clinker capacity of non-hazardous waste kilns.
3. TRI data do not appear to be reliable.
4. Current best estimate for national (48-state) mercury emissions from non-hazardous waste kilns is between 6–13 tons/year.
5. Analysis is based on best available data; however, significant data gaps exist.

Apendix B

Kiln Data Analysis Methodology

Data Sources Considered and Methodology

Data on mercury emissions were assembled and estimated from a review of the following sources:

a. U.S. and Canadian Portland Cement Industry Plant Information Summary, December 31, 2006, which provided lists of U.S. cement plants and kilns, including clinker production capacities. This report also identified certain kilns as burning only waste and these were excluded from the analysis;

b. List of hazardous waste burning kilns from EPA (2005). These kilns were excluded from the analysis.

c. Data obtained from EPA on several large cement company kilns in response to EPA's information collection request. These data generally included:

   (i) source test reports including mercury tests. However, in many cases, source test data were over five years old. Only source tests that were no more than five years old were considered. In the vast majority of cases, clinker production during source test time periods were not provided and mercury emissions were reported on a direct mass rate basis (i.e., lb/hr, etc.). The methods used to test for mercury also varied. Older tests generally used EPA Method 29 while some of the more recent tests used the Ontario Hydro or similar methods. Representativeness of test data, extrapolated to annual operating periods, is often questionable. All of these issues notwithstanding, source test data, where available, were used to estimate annual emissions, assuming that kilns operated for 90 percent of all hours in the year. If separate emissions rates were measured with raw mills on and off, these were accounted for in the calculation.

   (ii) data on mercury content in input (raw) materials to kilns for an approximate 30-day period during 2007. Although the mercury speciation data for 30 days was provided in several cases, in many cases, actual mercury values were noted as Non-Detect. These data often could not be used since corresponding detection limits were often not noted. Also, in most cases, the mercury speciation of the clinker or baghouse dust was not available.

d. Data on mercury air emissions submitted to the EPA as part of the TRI Form R reporting. TRI data were used only if additional (i.e., mass input or source test) data were also available. The calculation methodology for TRI air emissions data are not readily apparent. In some cases, there were obvious problems with the TRI data (such as air emissions reported as zero, while source test data indicated non-zero values).

e. Title V air operating permits for various operating kilns. These were reviewed to determine if there were specific mercury limits for particular kilns. With almost no exceptions, current Title V permits for kilns considered in this study do not contain limits on mercury emissions.

Uncertainties

Data from these various sources, wherever comparable were not generally consistent. Therefore, to provide an idea of the uncertainties in emissions estimates, low and high ranges for expected annual mercury emissions are provided. While, in some cases, the spread between the high and low values is not significant, in a few notable cases, this spread is exceptionally large, reflecting large uncertainties as to underlying data or kiln operational details. All emissions data are reported as total mercury emissions; however, it should be noted that based on the test methods used, it is not clear if all mercury species were completely measured. Thus, one area of possible uncertainty is the fraction of mercury emissions emitted that are actually measured.

Separate from emissions uncertainty, a couple of additional areas of uncertainty include:

- Kiln size (clinker capacity) was not always consistent considering similar data in the PCA report and that submitted to EPA (even accounting for the fact that PCA report capacities are in metric tons and data reported to EPA was in either metric or U.S. customary (short) tons).

- Whether or not a particular kiln burns hazardous waste was, in some cases ambiguous. To the extent possible, the analysis attempts to conservatively exclude any kiln that may burn hazardous waste from this analysis.

Overall, mercury emissions data, subject to the caveat relating to speciation, were estimated for roughly 35 percent of kilns (based on clinker capacity). The emissions for the universe of kilns in the U.S. (excluding two kilns in Puerto Rico) were then extrapolated using clinker capacity. While this extrapolation or scaling is admittedly a rough attempt to estimate the U.S. kiln mercury emissions, at this time, there does not appear to be a more reliable method to prepare this estimate, other than relying on TRI data which has some clear flaws and therefore seems unreliable.

Recommendations

Recommendations for improving the mercury emissions estimates include the following:

a. Clear identification of kilns that burn hazardous versus non-hazardous wastes;

b. Completion of source tests under documented representative conditions, using standard methods that account for all species of mercury likely to be emitted; such source tests should also document the underlying production levels at the time of the test(s);

c. Obtaining the data above from all kilns in the U.S. EPA's attempt to focus on the larger, national cement companies, while a good start, left out many companies that may be smaller or regional but still operate very large kilns;

d. Inclusion of requirements to conduct source tests in facility operating permits such as Title V permits;

e. Increase standardization and transparency of TRI data submittals;

f. Improve the ability to conduct mass balance calculations by inclusion of mercury data in all input and output streams from the pyro-processing system, over time periods that reflect representative, relatively steady-state, operations of the system. If mercury is not detected in a particular stream, the appropriate detection limit should also be reported.

Appendix C

NORMALIZED MERCURY EMISSIONS FOR EXISTING AND NEW CEMENT KILNS*

FacID	KilnID	Hg Emissions (lb/1,000,000 tons total feed)	Kiln Capacity (tpy)	Kiln Type	Alkali Bypass	CKD Wasted
5	3	2.02	323,847	wet		
6	2	2.35	156,236	wet		
6	1	2.37	128,694	wet		
26	1	2.43	340,956	preheater		
5	2	2.50	318,485	wet		
5	1	2.65	334,161	wet		
29	1	3.78	301,206	wet		
26	2	7.55	602,434	preheater/calciner		
25	K1	7.76	633,282	long dry		X
36	Kiln 1	12.36	652,568	preheater		
39	Kiln 1	23.87	420,480	long dry		X
39	Kiln 2	23.87	420,480	long dry		X
32	Kiln 1	24.02	169,756	wet		X
32	Kiln 2	24.71	169,756	wet		X
14	White Cement Kiln	29.72	148,811	wet		X
18	3	34.37	1,028,570	preheater/calciner	X	X
16	2	37.66	321,875	preheater		X
34	Kiln 7	37.78	229,281	wet		X
34	Kiln 9	40.54	346,126	wet		X
22	2	43.74	1,125,746	wet long	X	X
2	Kiln1	47.59	600,000	preheater		
2	Kiln2	47.59	600,000	preheater		
30	1	47.97	670,863	precalciner		
34	Kiln 8	48.01	229,281	wet		X
22	1	48.21	1,093,961	wet long	X	X
37	Kiln 1	51.16	328,489	long dry		
12	39	52.22	132,276	wet		
35	Kiln 1	53.29	1,410,958	preheater		
38	19	54.16	425,853	long dry		X
38	22	54.16	768,048	long dry		X
38	23	54.16	766,202	long dry		X
38	20	54.16	440,857	long dry		X
38	21	54.16	451,509	long dry		X
37	Kiln 2	58.79	684,535	preheater	X	
25	K2	62.80	757,605	long dry		X
10	1	66.39	600,000	preheater		

* Consist of data for 54 kilns where no claim of confidentiality was made by the submitting company.

Note: EPA provided the data included in Appendix C, identifying particular kilns by their Facility ID number only, referenced here as "FacID."

FacID	KilnID	Hg Emissions (lb/1,000,000 tons total feed)	Kiln Capacity (tpy)	Kiln Type	Alkali Bypass	CKD Wasted
24	Kiln 3	66.50	381,016	preheater		
24	Kiln 2	66.59	540,744	preheater		
20	K1	69.48	1,273,120	preheater/calciner	X	X
31	Kiln 1	76.92	218,258	wet		X
16	3	78.56	376,680	preheater		X
31	Kiln 2	82.00	218,258	wet		X
16	1	83.12	321,875	preheater		X
19	1	83.83	1,095,000	preheater/calciner		
11	1	88.20	661,521	preheater		
21	5	88.33	1,560,000	preheater/calciner		
33	Kiln 4	98.63	261,248	wet		X
23	Kiln 1	108.15	511,374	wet		
27	1	120.50	962,265	preheater/calciner		
13	E02-001	120.88	2,220,914	preheater/calciner		
33	Kiiln 5	135.68	405,650	wet		X
9	8	220.44	985,732	preheater/calciner	X	X
15	Kiln	1,289.19	992,080	preheater/calciner		
28	1	1,982.01	966,692	precalciner		

Total Capacity (tpy clinker)	32,085,614
Total Mercury Emissions (lb/yr)	7,770.00
Mercury Emission Factor (lb/tpy capacity)	0.000
Estimated Nationwide Mercury Emissions (lb/yr)	22,918

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