Cement Kilns

FactPack – P040

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Mentoring a Movement

Empowering People

Preventing Harm

About the Center for Health, Environment & Justice

CHEJ mentors a movement building healthier communities by empowering people to prevent harm caused by chemical and toxic threats. We accomplish our work through programs focusing on different types of environmental health threats. CHEJ also works with communities to empower groups by providing the tools, direction, and encouragement they need to advocate for human health, to prevent harm and to work towards environmental integrity.

Following her successful effort to prevent further harm for families living in contaminated Love Canal, Lois Gibbs founded CHEJ in 1981 to continue the journey. To date, CHEJ has assisted over 15,000 groups nationwide. Details on CHEJ's efforts to help families and communities prevent harm can be found on www.chej.org.

Introduction

The Center for Health, Environment and Justice has developed this fact pack on ***Cement Kilns*** in response to the numerous requests for information that we have had on this topic. This fact pack includes four types of information: business practices reports, health effects, governmental regulations, and community actions.

We have included materials from government agencies, consulting companies, newspapers, and journals in an effort to provide a thorough introduction to the issues. The intention of this fact pack is to be used as a tool to assist you in educating yourself and others.

Our hope is that reading this fact pack will be the first step in the process of empowering your community to protect itself from environmental health threats. CHEJ can help with this process. Through experience, we've learned that there are four basic steps you'll need to take:

1. Form a democratic organization that is open to everyone in the community facing the problem.

2. Define your organizational goals and objectives.

3. Identify who can give you what you need to achieve your goals and objectives. Who has the power to shut down the landfill? Do a health study? Get more testing done? It might be the head of the state regulating agency, city council members, or other elected officials.

4. Develop strategies that focus your activities on the decision makers, the people or person who has the power to give you what you are asking for.

CHEJ can help with each of these steps. Our mission is to help communities join together to achieve their goals. We can provide guidance on forming a group, mobilizing a community, defining a strategic plan, and making your case through the media. We can refer you to other groups that are fighting the same problems and can provide technical assistance to help you understand scientific and engineering data and show you how you can use this information to help achieve your goals.

If you want to protect yourself, your family, and your community, you need information, but equally important is the need to organize your community efforts.

Thank you for contacting us.

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Environmental Update #4

Published by the Hazardous Substance Research Centers/South & Southwest Outreach Program

August 2001

Environmental Overview of the Concrete and Cement Industries

The construction boom of the late 1990s brought about an increased use of concrete and cement to construct buildings, roadways, and homes. Manufacture of these materials can release toxic substances into soil, air, and water if proper controls are not implemented. For this reason, government authorities have closely reviewed these materials' potential for degrading environmental quality in communities. This fact sheet provides an overview of the cement and concrete industries, their potential environmental impacts, and the status of a major court case to stop a cement plant from being sited near an environmentally troubled New Jersey community.

What is the difference between concrete and cement?

Cement is a powder produced from several materials, including alumina, silica, limestone, clay, and iron oxides. Cement is used as a binding agent, most often with concrete. *Concrete* is a product formed by mixing aggregate and paste. Aggregate may consist of sand, gravel, crushed stone, or slag. Paste is composed of cement and water, sometimes mixed with air.

What pollution threat is posed by cement manufacturing?

Cement manufacturing produces a variety of solid process wastes, air emissions, and wastewater streams, but most of its contaminants are released in cement kiln dusts (CKD). In 1999, the Environmental Protection Agency (EPA) estimated that the cement industry disposed of an estimated 3.3 million metric tons of CKD from 110 plants in 38 states. The main components in kiln dusts are alumina, silica, clay, and metallic oxides, but they also may contain trace amounts of dioxins and furans, cadmium, lead, selenium, and radionuclides. Cancer risks of concern are mainly caused by exposure to arsenic in CKD, and there is also a possible cancer threat in kiln dusts that contain dioxins.

With proper management, CKD is not hazardous to human health, and EPA believes that these dusts pose little threat to human health through direct ingestion of drinking water. But the agency says that contaminants in kiln dusts can pose indirect threats to human health through air particulates and polluted groundwater. The latter problem occurs when landfills are not adequately lined or CKD is left in open waste piles.

What are the pollution outputs of concrete manufacturing?

Concrete manufacturing generates air particulate emissions from cement and aggregate dusts. The threat of cement dusts is described in the previous section. Other sources of contamination in concrete plants are solvents used in cleaning operations and the application of finishes to completed products. Solvents can threaten water quality in nearby communities when they are released and seep into groundwater.

How have cement and concrete issues been dealt with in court?

Proposals to build new cement or concrete plants near communities have caused considerable controversy. A recent U.S. District Court case involving a New Jersey cement manufacturer and distributor illustrates the strong impact that environmental justice concerns can have, even in the face of economic development benefits.

The Waterfront South Community in Camden, New Jersey, is battling the New Jersey Department of Environmental Protection (NJDEP) and a manufacturer and distributor of cement products over the location of a new cement facility in the neighborhood. This area of 2,100 residents already contains a sewage treatment plant, a trash-to-steam plant, two U.S. EPA Superfund sites, and 15 known contaminated sites identified by the NJDEP. The Technical Outreach Services to Communities (TOSC) program at the Northeast Hazardous Substance Research Center has helped the Waterfront South Community to review technical documents involved in the cement facility siting case.

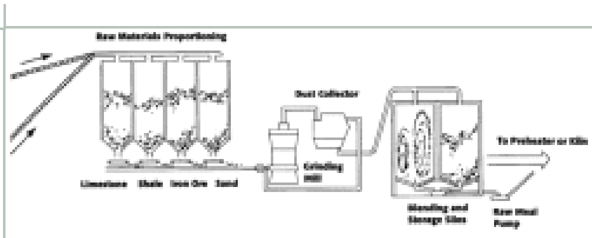
The estimated impact on the community from the new plant is significant: the facility will emit dust, mercury, lead, nitrogen oxides, and volatile organic compounds into the air, and approximately 35,000 inbound truck deliveries and 42,000 outbound truck departures are expected to occur each year. In July 2000, the cement manufacturer received a draft air permit for the facility, and the NJDEP held a public hearing on the permits. After the hearing, the citizens of Waterfront South filed several complaints asking the courts to stop any further activity at the site based on a violation of civil rights law. The complaints stated that, in approving the permits, the NJDEP did not consider the current number of pollutants already in the neighborhood, the existing poor health of the residents, the racial and ethnic composition of the area, or the cumulative environmental burden already shouldered by the citizens. The U.S. District Court agreed with the community group, granting the injunction to stop the cement company from operating its facility and voiding the air permits. However, recent developments in related cases have caused the court dissolve the injunction until additional issues in the case can be decided.

The decision by the court in the cement plant siting case is anxiously awaited. The outcome will have strong potential implications for the environmental justice movement, Waterfront South, and communities facing similar challenges throughout the country. If you or your community have questions about a cement or concrete contamination problem, contact Bob Schmitter, director of the South & Southwest TOSC program, at 404/894-8064 or by e-mail at: bob.schmitter@gtri.gatech.edu.

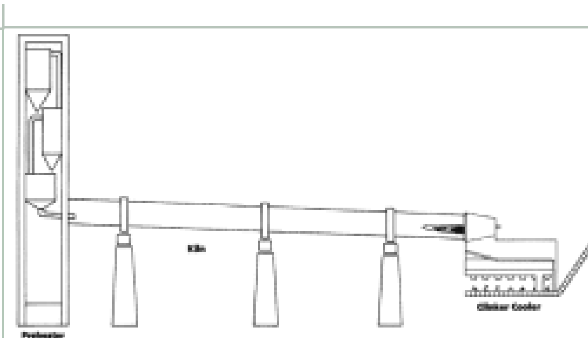
BuildingGreen.com

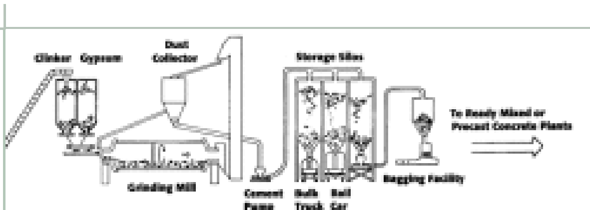
Feature from **Environmental Building News**
March 1, 1993

Cement and Concrete: Environmental Considerations

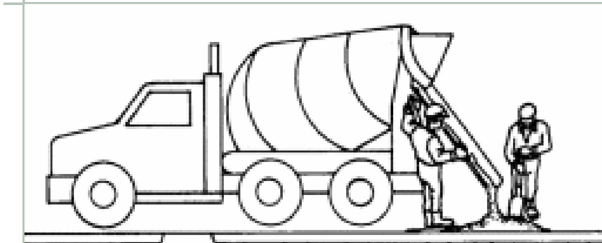


Illustrations courtesy of the Portland Cement Association





Cement and concrete are key components of both commercial and residential construction in North America.



The cement and concrete industries are huge. There are approximately 210 cement plants in the U.S. and 4,000 to 5,000 ready mix plants (where cement is mixed with aggregate and water to produce concrete). The Portland Cement Association estimates that U.S. cement consumption has averaged between 75 and 90 million tons per year during the last decade, and projects that consumption will exceed 100 million tons per year by 1997. Worldwide, cement production totaled 1.25 billion tons in 1991, according to the U.S. Bureau of Mines.

What does this mean in terms of the environment? Are these products good or bad? As builders and designers, should we be looking for alternatives or embracing concrete over competing materials? As with most building issues, the answers are not clear-cut. Concrete and other cementitious materials have both environmental advantages and disadvantages. This article takes a look at how these materials are made, then reviews a number of environmental considerations relating to their production, use, and eventual disposal.

Cement and Concrete Production

Cement is the key ingredient in concrete products. Comprising roughly 12% of the average residential-grade ready mix concrete, cement is the binding agent that holds sand and other aggregates together in a hard, stone-like mass. Portland cement accounts for about 95% of the cement produced in North America. It was patented in England by Joseph Aspdin in 1824 and named after a quarried stone it resembled from the Isle of Portland.

Cement production requires a source of calcium (usually limestone) and a source of silicon (such as clay or sand). Small amounts of bauxite and iron ore are added to provide specific properties. These raw materials are finely ground and mixed, then fed into a rotary cement kiln, which is the largest piece of moving industrial equipment in the world. The kiln is a long, sloping cylinder with zones that get progressively hotter up to about 2700°F (1480°C). The kiln rotates slowly to mix the contents moving through it. In the kiln, the raw materials undergo complex chemical and physical changes required to make them able to react together through hydration. (See illustration, pages 8-11.) The most common type of cement kiln today (accounting for 70% of plants in the U.S.) is a *dry process* kiln, in which the ingredients are mixed dry. Many older kilns use the *wet process*.

The first important reaction to occur is the *calcining* of limestone (calcium carbonate) into lime (calcium oxide) and carbon dioxide, which occurs in the lower-temperature portions of the kiln—up to about 1650°F (900°C). The second reaction is the bonding of calcium oxide and silicates to form dicalcium and tricalcium silicates. Small amounts of tricalcium aluminate and tetracalcium aluminoferrite are also formed. The relative proportions of these four principal compounds determine the key properties of the resultant portland cement and the type classification (Type I, Type II, etc.). These reactions occur at very high temperatures with the ingredients in molten form. As the new compounds cool, they solidify into solid pellet form called *clinker*. The clinker is then ground to a fine powder, a small amount of gypsum is added, and the finished cement is bagged or shipped bulk to ready mix concrete plants.

Concrete is produced by mixing cement with fine aggregate (sand), coarse aggregate (gravel or crushed stone), water, and—often—small amounts of various chemicals called *admixtures* that control such properties as setting time and plasticity. The process of hardening or setting is actually a chemical reaction called *hydration*. When water is added to the cement, it forms a slurry or gel that coats the surfaces of the aggregate and fills the voids to form the solid concrete. The properties of concrete are determined by the type of cement used, the additives, and the overall proportions of cement, aggregate, and water.

Raw Material Use

The raw materials used in cement production are widely available in great quantities. Limestone, marl, and chalk are the most common sources of calcium in cement (converted into lime through calcination). Common sources of silicon include clay, sand, and shale. Certain waste products, such as fly ash, can also be used as a silicon source. The iron and aluminum can be provided as iron ore and bauxite, but recycled metals can also be used. Finally, about 5% of cement by weight is gypsum, a common calcium- and sulfur-based mineral. It takes 3,200 to 3,500 pounds of raw materials to produce one ton (2,000 lbs.) of finished cement, according to the Environmental Research Group at the University of British Colombia (UBC).

Table 1
Typical Concrete Mix

Typical Concrete Mix

Component	Percent by weight
Portland cement	12%
Sand	34%
Crushed stone	48%
Water	6%

The water, sand, and gravel or crushed stone used in concrete production in addition to cement are also abundant (typical proportions of a residential concrete mix are shown in Table 1). With all of these raw materials, the distance and quality of the sources have a big impact on transportation energy use, water use for washing, and dust generation. Some aggregates that have been used in concrete production have turned out to be sources of radon gas. The worst problems were when uranium mine tailings were used as concrete aggregate, but some natural stone also emits radon. If concerned, you might want to have the aggregate tested for radon.

The use of fly ash from coal-fired power plants is beneficial in two ways: it can help with our solid waste problems, and it reduces overall energy use. While fly ash is sometimes used as a source of silica in cement production, a more common use is in concrete mixture as a substitute for some of the cement. Fly ash, or *pozzolan*, can readily be substituted for 15% to 35% of the cement in concrete mixes, according to the U.S. EPA. For some applications fly ash content can be up to 70%. Of the 51 million tons of fly ash produced in 1991, 7.7 million tons were used in cement and concrete products, according to figures from the American Coal Ash Association. Thus, fly ash today accounts for about 9% of the cement mix in concrete.

Fly ash reacts with any free lime left after the hydration to form calcium silicate hydrate, which is similar to the tricalcium and dicalcium silicates formed in cement curing. Through this process, fly ash increases concrete strength, improves sulfate resistance, decreases permeability, reduces the water ratio required, and improves the pumpability and workability of the concrete. Western coal-fired power plants produce better fly ash for concrete than eastern plants, because of lower sulfur and lower carbon content in the ash. (Ash from incinerators cannot be used.)

There are at least a dozen companies providing fly ash to concrete producers. Talk to your concrete supplier and find out if they are willing to add fly ash to the mix. (If your local plant doesn't know where to get the fly ash, a list of companies is available from EBN.) Portland cement with fly ash added is sometimes identified with the letter *P* after the type number (Type IP). The EPA requires fly ash content in concrete used in buildings that receive federal funding (for information call the EPA Procurement Guidelines Hotline at 703/941-4452). Fly ash is widely used in Europe as a major ingredient in autoclaved cellular concrete (ACC); in the U.S., North American Cellular Concrete is developing this technology (see EBN, Vol. 1, No. 2).

Other industrial waste products, including blast furnace slag, cinders, and mill scale are sometimes substituted for some of the aggregate in concrete mixes. Even recycled concrete can be crushed into aggregate that can be reused in the concrete mix—though the irregular surface of aggregate so produced is less effective than sand or crushed stone because it takes more cement slurry to fill all the nooks and crannies. In fact, using crushed concrete as an aggregate might be counterproductive by requiring extra cement—by far the most energy-intensive component of concrete.

Energy

Energy consumption is the biggest environmental concern with cement and concrete production. Cement production is one of the most energy intensive of all industrial manufacturing processes. Including direct fuel use for mining and transporting raw materials, cement production takes about six million Btus for every ton of cement (Table 2). The average fuel mix for cement production in the United States is shown in Table 3. The industry's heavy reliance on coal leads to especially high emission levels of CO_2, nitrous oxide, and sulphur, among other pollutants. A sizeable portion of the electricity used is also generated from coal.

Table 2
Embodied Energy for Cement and Concrete Production

Embodied Energy for Cement and Concrete Production

	% by weight	Btus per ton Materials	Btus per ton Hauling	Btus/yard concrete	Energy %
Cement	12%	5,792,000	504,000	1,574,000	94%
Sand	34%	5,000	37,000	29,000	1.7%
Crushed Stone	48%	46,670	63,000	100,000	5.9%
Water	6%	0	0	0	0%
Concrete	100%	817,600		1,700,000	100%

Notes:

Calculations of energy requirements for cement production based on figures supplied by the Portland Cement Association, 1990 data. Aggregate and hauling energy requirements based on data supplied by PCA and based on the following assumptions:

• Cement hauled 50 miles to ready-mix plant

• Aggregate hauled 10 miles to plant

• Concrete mix hauled 5 miles to building site

• Concrete mix: 500 lbs. cement, 1,400 lbs. sand, 2,000 lbs. crushed stone, 260 lbs. water/yard.

The vast majority of the energy consumed in cement production is used for operating the rotary cement kilns. Newer dry-process kilns are more energy efficient than older wet-process kilns, because energy is not required for driving off moisture. In a modern dry-process kiln, a pre-heater is often used to heat the ingredients using waste heat from the exhaust gases of the kiln burners. A dry-process kiln so adapted can use up to 50% less energy than a wet-process kiln, according to UBC researchers. Some other dry-process kilns use a separate combustion vessel in which the calcining process begins before the ingredients move into the rotary kiln—a technique that can have even higher overall efficiency than a kiln with pre-heater.

In the United States, producing the roughly 80 million tons of cement used in 1992 required about .5 quadrillion Btus or quads (1 quad = 10^{15} Btus). This is roughly .6% of total U.S. energy use, a remarkable amount given the fact that in dollar value, cement represents only about .06% of the gross national product. Thus, cement production is approximately ten times as energy intensive as our economy in general. In some Third World countries, cement production accounts for as much as two-thirds of total energy use, according to the Worldwatch Institute.

Table 3
Fuel Use for Cement Production

While cement manufacturing is extremely energy intensive, the very high temperatures used in a cement kiln have at least one advantage: the potential for burning hazardous waste as a fuel. Waste fuels that can be used in

Fuel Use for Cement Production

Fuel	Thousand Btus per ton of cement	Percent
Petroleum products (diesel, gasoline, LPG)	63.	1.1
Natural gas	476.	8.2
Coal & coke	3,524.	60.8
Waste fuel[1]	286.	4.9
Electricity[2]	1,443.	24.9
Total	5,792.	100.

cement kilns include used motor oil, spent solvents, printing inks, paint residues, cleaning fluids, and scrap tires. These can be burned relatively safely because the extremely high temperatures result in very complete combustion with very low pollution emissions. (Municipal solid waste incinerators operate at considerably lower temperatures.) Indeed, for some chemicals thermal destruction in a cement kiln is the safest method of disposal. A single cement kiln can burn more than a million tires a year, according to the Portland Cement Association. Pound for pound, these tires have a higher fuel content than coal, and iron from the steel belts can be used as an ingredient in the cement manufacturing. Waste fuels comprise a significant (and growing) part of the energy mix for cement plants (see Table 3), and the Canadian Portland Cement Association estimates that waste fuel could eventually supply up to 50% of the energy.

Energy use for concrete production looks considerably better than it does for cement. That's because the other components of concrete—sand, crushed stone, and water—are much less energy intensive. Including energy for hauling, sand and crushed stone have embodied energy values of about 40,000 and 100,000 Btus per ton, respectively. The cement, representing about 12% of concrete, accounts for 92% of the embodied energy, with sand representing a little under 2% and crushed stone just under 6% (see Table 2).

Use of fly ash in concrete already saves about 44 trillion Btus (.04 quads) of energy annually in the U.S. Increasing the rate of fly ash substitution from 9% to 25% would save an additional 75 trillion Btus.

CO_2 Emissions

There are two very different sources of carbon dioxide emissions during cement production. Combustion of fossil fuels to operate the rotary kiln is the largest source: approximately $^3/_4$ tons of CO_2 per ton of cement. But the chemical process of calcining limestone into lime in the cement kiln also produces CO_2:

$CaCO_3$ ’ $CaO + CO_2$ limestone ’ lime + carbon dioxide

This chemical process is responsible for roughly 1/2 ton of CO_2 per ton of cement, according to researchers at Oak Ridge National Laboratory. Combining these two sources, for every ton of cement produced, 1.25 tons of CO_2 is released into the atmosphere (Table 4). In the United States, cement production accounts for approximately 100 million tons of CO_2 emissions, or just under 2% of our total human-generated CO_2. Worldwide, cement production now accounts for more than 1.6 billion tons of CO_2—over 8% of total CO_2 emissions from all human activities.

Table 4
CO_2 Emissions from Cement and Concrete Production

CO_2 Emissions from Cement and Concrete Production

	lbs CO_2 per ton of cement	lbs CO_2 per cu. yd. of concrete	Percent of total CO_2
CO_2 emissions from energy use	1,410	381	60
CO_2 emissions from calcining of limestone	997	250	40
Total CO_2 emissions	2,410	631	100

The most significant way to reduce CO_2 emissions is improving the energy efficiency of the cement kiln operation. Indeed, dramatic reductions in energy use have been realized in recent decades, as discussed above. Switching to lower-CO_2 fuels such as natural gas and agricultural waste (peanut hulls, etc.) can also reduce emissions. Another strategy, which addresses the CO_2 emissions from calcining limestone, is to use waste lime from other industries in the kiln. Substitution of fly ash for some of the cement in concrete can have a very large effect.

Other Air Emissions

Besides CO_2, both cement and concrete production generate considerable quantities of air-pollutant emissions. Dust is usually the most visible of these pollutants. The U.S. EPA (cited by UBC researchers) estimates total particulate (dust) emissions of 360 pounds per ton of cement produced, the majority of which is from the cement kiln. Other sources of dust from cement production are handling raw materials, grinding cement clinker, and packaging or loading finished cement, which is ground to a very fine powder—particles as small as $^1/_{25,000}$ of an inch.

The best way to deal with the dust generated in cement manufacturing would be to collect it and put it back into the process. This is done to some extent, using mechanical collectors, electric precipitators, and fabric filters (baghouses). But recycling the dust is difficult, according to UBC researchers; it first has to be treated to reduce its alkalinity. Some cement kiln dust is used for agricultural soil treatments, and the rest (of that collected) is often landfilled on site. There was investigation into the possibility of using cement kiln dust for treatment of acidified lakes in eastern Canada, but rather than simply buffering the low pH of the water, the dust chemically created a potentially harmful salt.

In addition to dust produced in cement manufacturing, dust is also generated in concrete production and transport. Common sources are sand and aggregate mining, material transfer, storage (wind erosion from piles), mixer loading, and concrete delivery (dust from unpaved roads). Dust emissions can be controlled through water sprays, enclosures, hoods, curtains, and covered chutes.

Other air pollution emissions from cement and concrete production result from fossil fuel burning for process and transportation uses. Air pollutants commonly emitted from cement manufacturing plants include sulfur dioxide (SO_2) and nitrous oxides (NO_X). SO_2 emissions (and to a lesser extent SO_3, sulfuric acid, and hydrogen sulfide) result from sulfur content of both the raw materials and the fuel (especially coal). Strategies to reduce sulfur emissions include use of low-sulfur raw materials, burning low-sulfur coal or other fuels, and collecting the sulfur emissions through state-of-the-art pollution control equipment. Interestingly, lime in the cement kiln acts as a scrubber and absorbs some sulfur.

Nitrous oxide emissions are influenced by fuel type and combustion conditions (including flame temperature, burner type, and material/exhaust gas retention in the burning zone of the kiln). Strategies to reduce nitrogen emissions include altering the burner design, modifying kiln and pre-calciner operation, using alternate fuels, and adding ammonia or urea to the process. The cement industry claims to have reduced overall pollution emissions by 90% in the last 20 years.

Water Pollution

Another environmental issue with cement and concrete production is water pollution. The concern is the greatest at the concrete production phase. “Wash-out water with high pH is the number one environmental issue for the ready mix concrete industry,” according to Richard Morris of the National Ready Mix Concrete Association. Water use varies greatly at different plants, but Environment Canada estimates water use at batching plants at about 500 gallons per truck per day, and the alkalinity levels of washwater can be as high as pH 12. Highly alkaline water is toxic to fish and other aquatic life. Environment Canada has found that rainbow trout exposed to portland cement concentrations of 300, 500, and 1,000 milligrams/liter have 50% mortality times (the time required for 50% of the population in test samples to be killed) of 68, 45, and 29 minutes, respectively.

At the batch plant, washwater from equipment cleaning is often discharged into settling ponds where the solids can settle out. Most plants are required to have process water discharge permits from state, federal, or provincial environmental agencies to dispose of wastewater from these settling ponds. As long as the pH of this wastewater is lower than 12.5, it is not considered a hazardous material by U.S. law. Some returned concrete also gets put into settling ponds to wash off and recover the aggregate. On the positive side, many newer ready mix plants have greatly reduced water use in recent years because of both wastewater disposal issues and drought conditions in some parts of the country. “More companies are going to completely closed-loop systems,” according to Terek Kahn of the National Ready Mix Concrete
Association.

Despite the apparent significance of the wastewater concern, the National Ready Mix Concrete Association to date has not developed standards for member companies on wastewater treatment, including rinsing of trucks and chutes at the building site. John Mullarchy of the association says that procedures are developed on a company-by-company basis. In many areas, environmental regulations dictate procedures relative to wastewater treatment. In more urban areas, the on-site rinse water (for chutes) often has to be collected and treated or disposed of at the plant.

Solid Waste

While the cement and concrete industries can help reduce some of our solid waste problems (burning hazardous waste as cement kiln fuel and using fly ash in concrete mixtures, for example), one cannot overlook the fact that concrete is the largest and most visible component of construction and demolition (C&D) waste. According to estimates presented in the AIA *Environmental Resource Guide*, concrete accounts for up to 67% by weight of C&D waste (53% by volume), with only 5% currently recycled. Of the concrete that is recycled, most is used as a highway substrate or as clean fill around buildings. As more landfills close, including specialized C&D facilities, concrete disposal costs will increase and more concrete demolition debris will be reprocessed into roadbed aggregate and other such uses.

Concrete waste is also created in new construction. Partial truckloads of concrete have long been a disposal problem. Ready mix plants have come up with many innovative solutions through the years to avoid creating waste—such as using return loads to produce concrete retaining wall blocks or highway dividers, or washing the unset concrete to recover the coarse aggregate for reuse. But recently, there have been some dramatic advances in concrete technology that are greatly reducing this waste. Concrete *admixtures* are available that retard the setting of concrete so effectively that a partial load can be brought back to the ready mix plant and held overnight or even over a weekend—then *reactivated* for use.

When it is possible to use pre-cast concrete components instead of poured concrete, doing so may offer advantages in terms of waste generation. Material quantities can be estimated more precisely and excess material can be utilized. Plus, by carefully controlling conditions during manufacture of pre-cast concrete products, higher strengths can be achieved using less material. The Superior Wall foundation system, for example, uses only about a third as much concrete as the typical poured concrete wall it replaces. Waste water run-off can also be more carefully controlled at centralized pre-cast concrete facilities than on jobsites.

Another interesting trend that relates to waste minimization is the idea of producing *reuseable* concrete masonry units. The National Concrete Masonry Association has been working on interlocking blocks called *Formwall*™, designed specifically so that they can be reused. While these blocks are not yet on the market, this type of thinking is a big step forward.

Health Concerns

Working with wet concrete requires a number of precautions, primarily to protect your skin from the high alkalinity. Rubber gloves and boots are typically all that is required to provide protection. *Cement dermatitis*, though relatively uncommon, occasionally occurs among workers in the concrete industry who fail to wear the proper protective clothing.

Once it has hardened, concrete is generally very safe. Traditionally, it has been one of the most inert of our building materials and, thus, very appropriate for chemically sensitive individuals. As concrete production has become higher-tech, however, that is changing. A number of chemicals are now commonly added to concrete to control setting time, plasticity, pumpability, water content, freeze-thaw resistance, strength, and color. Most concrete retarders are relatively innocuous sucrose- (sugar-) based chemicals, added in proportions of .03% to .15%. Workability agents or superplasticizers can include such chemicals as sulfonated melamine-formaldehyde and sulphonated napthalene formaldehyde condensates. Air-entraining admixtures function by incorporating air into the concrete to provide resistance to damage from freeze-thaw cycles and to improve workability. These are usually added to the cement and identified with the letter *A* after the type (Type IA). These materials can include various types of inorganic salts (salts of wood resins and salts of sulphonated lignin, for example), along with more questionable chemicals such as alkyl benzene sulphonates and methyl-ester-derived cocamide diethanolamine. Fungicides, germicides, and insecticides are also added to some concrete.

Because of these chemical admixtures, today’s concrete could conceivably offgas small quantities of formaldehydes and other chemicals into the indoor air. Unfortunately, it is difficult to find out from the manufacturers the actual chemicals in these admixtures. For chemically sensitive clients, it may be advisable to specify concrete with a bare minimum of admixtures, or use a sealer on the finished concrete to minimize offgassing. Asphalt-impregnated expansion joint filler, curing agents that are sometimes applied to the surface of concrete slabs to reduce water evaporation, special oils used on concrete forms, and certain sealants used for treating finished concrete slabs and walls can also cause health problems with some chemically sensitive individuals.

Finally, concrete floors and walls can cause moisture problems and lead to mold and mildew growth, which cause significant health problems in certain individuals. There are two common sources of moisture: moisture wicking through concrete from the surrounding soil; and moisture from the house that may condense on the cold surface of concrete. To eliminate the former, provide good drainage around a foundation, dampproof or waterproof the outside of the foundation walls before backfilling, provide a layer of crushed stone beneath the slab, and install a polyethylene moisture barrier under the slab (protected from the concrete with a layer of sand if possible). To reduce the likelihood of condensation on concrete surfaces, they should be insulated. In northern climates, installing a layer of rigid foam on the outside of the foundation wall and under the slab will generally keep inner surface of the concrete warm enough that condensation will not occur. With interior foundation insulation, provide a vapor barrier to keep moisture from reaching the concrete surface. In southern climates, protecting against condensation may be more difficult.

Summing Up

Cement and concrete are vital components in building construction today. Concrete has many environmental advantages, including durability, longevity, heat storage capability, and (in general) chemical inertness. For passive solar applications, concrete’s ability to function as a structural element while also providing thermal mass makes it a valuable material. In many situations concrete is superior to other materials such as wood and steel. But cement production is very energy intensive—cement is among the most energy-intensive materials used in the construction industry and a major contributor to CO_2 in the atmosphere. To minimize environmental impact, therefore, we should try to reduce the quantity of concrete used in buildings, use alternative types of concrete (with fly ash, for example), and use that concrete wisely. The accompanying checklist provides practical suggestions for accomplishing these goals.

– Alex Wilson

American Coal Ash Association, 1913
I St., NW 6th Floor, Washington, DC 20006; 202/659-2303

The National Concrete Masonry Association, 2302 Horse Pen Rd., Herndon, VA 22071; 703/713-1900

National Ready Mix Concrete Association, 900 Spring St., Silver Spring, MD 20910; 301/587-1400

Portland Cement Association, 5420 Old Orchard Rd., Skokie, IL 60077;
708/966-6200

Superior Walls, Inc., PO Box 427, Ephrata, PA 17522; 717/626-9255.

Sidebar: Using Concrete Wisely: A Checklist for Builders and Designers

Using Concrete Wisely: A Checklist for Builders and Designers

Reduce waste. Carefully estimate quantities of concrete required on the jobsite. For large jobs, hire an *expediter*, who will be on site during pours to estimate exact material requirements.

Consider alternative foundation systems. Pier foundations use far less concrete than poured full-height foundation walls or slab-on-grade foundations (be sure to provide adequate insulation and air sealing details at the floor system). Building a shallow footing and frost walls with horizontal insulation, which effectively reduces the frost depth, can cut concrete use considerably in northern climates.

Consider pre-cast concrete systems. The integrated footer/foundation wall/insulation system produced by Superior Walls, Inc. uses considerably less concrete than conventional poured foundation walls.

Specify minimal admixture use. If your clients have chemical sensitivities, specify minimal use of chemical additives for controlling concrete properties and workability—at least until adequate studies are done to determine whether offgassing might be a realistic concern. Sucrose-based retarders should not pose any problems.

Specify fly ash. Fly ash can be added to most concrete mixtures, usually with an improvement in workability and strength. Proportions up to 15% can be achieved quite easily, and higher levels are possible. Fly ash from western sources is generally better than that from eastern sources.

Avoid on-site environmental damage. On the building site, use care to avoid soil compaction and resultant damage to trees. Make provisions for concrete trucks to reach the building site with a bare minimum of repositioning and turning around. Also avoid driving over tree roots. Plan ahead with these issues in mind.

Control washwater run-off. If washwater from rinsing concrete chutes and trucks is not otherwise regulated, the general contractor should plan with the concrete truck driver exactly where rinsing can be done. Avoid locations where run-off will get into topsoil or flow into surface water.

Use concrete waste as fill. Whenever possible, specify crushed concrete debris as clean fill around buildings or as aggregate under parking lots and driveways.

IMAGE CREDITS:
1. (no credit)
2. (no credit)
3. (no credit)
4. (no credit)
5. (no credit)
6. Source: Based on figures provided by the Ready Mix Concrete Association, personal communication.
7. (no credit)
8. Sources:
9. Notes:

Cement Kiln Dust Waste

How is Cement Made?

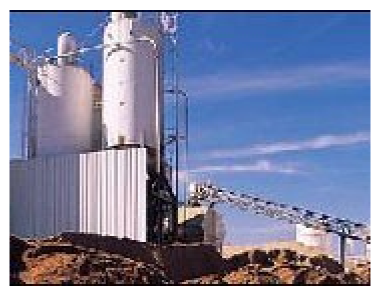
Cement is produced by burning mixtures of limestone, minerals, and other additives at high temperatures in a special rotary kiln. Hot air mixing with the raw materials creates a chemical reaction and produces "clinker," marble-sized pellets and sand-sized particles. The clinker is removed from the kiln, cooled, finished, and ground for bagging.

This Web page provides an outline of the legislative and regulatory history, and current status of the CKD exemption and proposed regulations. Links to key regulatory and technical documents are also provided.

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

Introduction

Cement kiln dust (CKD) is the fine-grained, solid, highly alkaline waste removed from cement kiln exhaust gas by air pollution control devices. Because much of the CKD is actually unreacted raw materials, large amounts of it can and are, recycled back into the production process. Some CKD is reused directly, while some requires treatment prior to reuse. CKD not returned to the production process is typically disposed in land-based disposal units (i.e., landfills, waste piles, or surface impoundments), although some is also sold for beneficial reuse.



CKD is categorized by EPA as a "special waste" and has been temporarily exempted from federal hazardous waste regulations under Subtitle C of the Resource Conservation and Recovery Act (RCRA). EPA is in the process of developing standards for the management of CKD and has published a set of proposed Subtitle D (i.e., non-hazardous, solid waste) regulations to govern CKD management.

Legislative and Regulatory Timeline

- **July 25, 2002**— EPA publishes a notice of data availability (NODA) in the Federal Register (67 FR 48648). In addition to announcing the availability of new data to the public, the NODA explains that EPA is considering a new approach to CKD management whereby it would finalize the proposed CKD management standards as a RCRA Subtitle D (solid waste) rule and temporarily suspend the proposed RCRA Subtitle C (hazardous waste) portion of the proposed rule for 3 to 5 years to assess how CKD management practices and state regulatory programs evolve. Based upon this assessment, EPA will either formally withdraw or promulgate that portion of the 1999 proposed rule. For additional information, see:
    - Additional Data Available on Wastes Studied in the Report to Congress on Cement Kiln Dust, July 25, 2002 (67 FR 48648) | PDF Version (3 pp, 45K)

- Federal Register NODA: Extension of Public Comment Period - November 8, 2002 (67 FR 68130)
- CKD Proposed Rule NODA Comments (PDF) (31 pp, 281K)
  Summary and response to comments on the Cement Kiln Dust Notice of Data Availability.

- **August 20, 1999**—EPA publishes "Standards for the Management of Cement Kiln Dust; Proposed Rule" (64 FR 45632). EPA's proposed approach would allow CKD to remain a non-hazardous waste provided that the specified management standards are met. CKD not managed in compliance with the standards is proposed to be a "listed waste" and would need to comply with tailored RCRA Subtitle C management standards. For additional information, see:
  - Standards for the Management of Cement Kiln Dust; Proposed Rule, August 20, 1999 (64 FR 45632) | PDF Version (67 pp, 506K)
  - Environmental Fact Sheet: Management Standards Proposed for Cement Kiln Dust Waste (EPA530-99-F-023) | PDF Version (2 pp, 16K)
  - Extension of Public Comment Period - October 28, 1999 (64 FR 58022) | PDF Version (1 pg, 13K)
  - CKD Proposed Rule Comments (PDF) (244 pp, 1.9MB)
    Summary and response to comments on the Cement Kiln Dust Proposed Rule.
- **February 7, 1995**—EPA issues its final regulatory determination for CKD in the Federal Register (60 FR 7366). In its determination, EPA states that additional control of CKD is warranted to protect human health and the environment from damage resulting from current disposal practices.
- **December 31, 1993**—EPA submits a Report to Congress on Cement Kiln Dust that addresses the eight study factors required by §8002(o) of RCRA for CKD.
- **June 19, 1991**—In a consent decree, EPA agrees to complete the Report to Congress on CKD by April 30, 1993. The consent decree is later modified to extend the deadline to December 31, 1993.
- **March 8, 1989**—The Environmental Defense Fund files suit against EPA for missing the statutory deadline. The American Petroleum Institute and the Edison Electric Institute intervene in the case.
- **October 31, 1983**—EPA misses the statutory deadline for submitting its CKD Report to Congress.
- **November 11, 1980**—EPA promulgates interim final amendments to the hazardous waste regulations in the Federal Register (45 FR 76618). This FR notice includes an exclusion for cement kiln dust from the definition of hazardous waste (§261.4(b)(8)).
- **October 12, 1980**—Congress enacts the Solid Waste Disposal Act Amendments of 1980 (Public Law 96-482) which amends RCRA. Among the amendments, Section 3001(b)(3)(A)(i-iii)—frequently referred to as the Bevill Amendment—temporarily exempts three special wastes from hazardous waste regulation until further study can be completed. Cement kiln dust is one of the wastes exempted. At the same time, Section 8002(o) requires EPA to study CKD and submit a Report to Congress evaluating the status of its management and potential risk to human health and the environment by October 1983. EPA is also required to make a regulatory determination (within six months of the completing the Report to Congress) as to whether CKD warrants regulation under RCRA Subtitle C or some other set of regulations.
- **December 18, 1978**—EPA publishes the first set of proposed hazardous waste management standards in the Federal Register (43 FR 58946). This FR notice includes a proposal to exempt six categories of "special wastes" from the RCRA Subtitle C regulations until further study can

be completed. Cement kiln dust is included as one of the six special wastes.

- **October 21, 1976**—Congress passes the Resources Conservation and Recovery Act (RCRA) (Public Law 94-580) which requires EPA to develop regulations governing the identification and management of hazardous waste.

Public Docket for Cement Kiln Dust

Dockets contain all publicly available materials used in the development of regulations, such as Federal Register notices and rules, supporting analyses, technical background documents, and comments submitted by the public on Agency reports and rulemakings. EPA dockets are available electronically at Regulations.gov.

To use Regulations.gov:

1. Select Docket Search.
2. Select "Environmental Protection Agency" from the Agency drop-down menu.
3. In the Keyword Box, type "cement kiln dust" and then click the "Submit" button to receive your search results. Be patient; loading the documents can take several minutes.
4. The docket should appear with the docket ID number (e.g., EPA-HQ-RCRA-1994-0072).

For a complete listing of all materials contained in the CKD Docket, refer to RCRA Docket Index Number F-1999-CKDP-FFFFF (Text File) (61 K).

Supporting Technical Documents

Analysis of Groundwater Monitoring Data Submitted by the American Portland Cement Alliance (PDF) (54 pp, 3.6MB)
This 2001 report contains summaries of the information gathered from the document, "Cement Kiln Dust Groundwater Monitoring Summary", produced by the American Portland Cement Alliance (APCA). The document also is available as individual, smaller PDF files:

- Part I - Introduction (PDF) (4 pp, 217K)
- Part II - Two Data Tables (PDF) (2 pp, 1.5MB)
- Part III - Section II (PDF) (48 pp, 501K)

Cement Kiln Dust Groundwater Migration Pathway Report (PDF) (92 pp, 355K)
This 1998 report is the second phase of a two phase work effort to determine migration of contaminants from CKD leachate to receptor wells under high alkalinity conditions.

Risk Assessment for Cement Kiln Dust Used as an Agricultural Soil Amendment; Draft Report (PDF) (324 pp, 1.8MB)
This 1998 report presents the risk assessment methodology used to estimate the incremental increase in individual lifetime risk from the use of CKD as an agricultural soil amendment.

Technical Background Document: Compliance Cost Estimates for the Proposed Land Management Regulation of Cement Kiln Dust (PDF) (67 pp, 282K)
This 1998 report presents EPA's compliance cost estimates for the land management of CKD generated by the Portland Cement Industry in support of the Agency's proposed regulation.

Technical Background Document on Control of Fugitive Dust at Cement Manufacturing Facilities;

Draft (PDF) (54 pp, 260K)
This 1998 document summarizes the basis for EPA's proposed performance standards and technology-based standards for controlling fugitive emissions of CKD.

Technical Background Document on Ground Water Controls at CKD Landfills; Draft (PDF) (199 pp, 723K)
This 1998 document describes EPA's development of proposed performance standards and design and operating criteria for controlling releases to ground water at CKD landfill units.

Evaluation of Metals Migration from Cement Kiln Dust (CKD) Piles Using the EPACMTP Groundwater Model; Draft (PDF) (30 pp, 140K)
This 1997 report documents the results of EPA's additional groundwater analyses using the more complex groundwater model, EPACMTP, to supplement its initial screening-level groundwater modeling to determine whether constituents could leach from the CKD management units to the groundwater and then move to a receptor site.

Examination of Metals Transport under Highly Alkaline Conditions (PDF) (37 pp, 159K)
This 1997 report presents metal adsorption distribution coefficients (Kd values) for the metals barium (Ba), beryllium (Be), cadmium (Cd), chromium(III) (Cr(III)), and lead (Pb) in groundwater under the highly alkaline conditions possible with land disposal of CKD.

Technical Background Document on the Efficiency and Effectiveness of CKD Landfill Design Elements; Draft (PDF) (65 pp, 334K)
This 1997 document presents an evaluation of the landfill design elements being considered by EPA for inclusion in the proposed rule.

Technical Background Document: Population Risks from Indirect Exposure Pathways, and Population Effects from Exposure to Airborne Particles from Cement Kiln Dust Waste
This 1997 document analyzes the extent to which current practices for managing CKD onsite at cement manufacturing plants pose a health risk to nearby, offsite populations.

http://www.epa.gov/osw/nonhaz/industrial/special/ckd/index.htm

Burning Hazardous Wastes in Cement Kilns

Cement kilns in some industrialized countries have begun augmenting or even fully replacing conventional fuels with industrial hazardous waste. However, the FAO recommend against burning chlorinated pesticides in cement kilns in some cases. FAO also warn that disposal of hazardous materials, such as obsolete pesticides, by burning in cement kilns is *"often not applicable in a safe and/or cost-effective manner,"* going on to note as follows:[1]

> *"Many of the older types of cement kilns are not suitable. Only a few of the cement kilns in developing countries meet the technical requirements that, in principle, would make them suitable for incineration of certain groups of pesticides. Expert advice is needed to assess whether kilns can be used and special equipment is required to inject the pesticides into the kiln. Such equipment is expensive and should only be installed and used under expert supervision."*

Performance of Cement Kilns Burning Hazardous Waste

According to the United States Environment Protection Agency (USEPA), the *"conditions inherent in the cement kiln mimic conditions of hazardous waste incineration".*[2] As such, some of the general limitations of hazardous waste incinerators may be equally applicable to cement kilns that burn hazardous wastes. For example, a review of test burns in eight cement kilns found Destruction and Removal Efficiencies (DREs) for a variety of specific chemicals to range from 91.043 to 99.9999 percent, with an average DRE of 99.53 percent.[3] However, as only stack emissions of undestroyed chemicals are considered in determining DREs – the quantities of undestroyed chemicals deposited in Cement Kiln Dust (CKD), clinker and other residues are not taken into consideration – the actual destruction efficiencies were undoubtedly lower.

Impacts of Burning Hazardous Waste in Cement Kilns

The impacts of hazardous waste burning cement kilns can be compared to those of cement kilns that burn conventional fuels, as follows:

- Dioxins are emitted from cement kiln stacks, whether the kiln is fired with conventional fuels or with hazardous waste. However, according to USEPA, cement kilns that burn hazardous waste emit dioxins in their stack gases at rates more than 80 times higher than those of cement kilns that burn conventional fuels.

- Similarly, dioxins are found in CKD from cement kilns that burn conventional fuels as well as those burning hazardous waste. USEPA recently reported that CKD from cement kilns burning hazardous waste carries dioxins at concentrations about 100 times higher than CKD from kilns burning only conventional fuels.[4]

- Cement kilns that burn hazardous waste produce more CKD, as documented by the U.S. Environmental Protection Agency:[5]

> *"Finally, the Agency also found that the burning of hazardous waste is correlated with the volume of dust that is actually disposed. Kilns that burn hazardous waste remove from the kiln system an average of 75 to 104 percent more dust per ton of clinker than kilns that do not burn hazardous waste."*

- From 15 to 90 percent of CKD has a diameter below 10 microns (μm), which is within the respirable range for humans.[6] As these fine particles are carried to the stack, the portion that is not captured by pollution control devices is released directly to the air. Some fraction of the captured CKD also escapes during transfer and disposal. One cement kiln burning 90 tons of hazardous waste per day was found to produce CKD at the rate of 200 tons per day.[7]

- The smaller CKD particles are those most likely to escape capture by pollution control devices or to be resuspended or washed from CKD stored in piles or pits. These particles are also the most likely to lodge deeply in the lungs. Airborne particles smaller than 2 μm have been linked to high rates of pneumonia, pleurisy, bronchitis, and asthma.[8] The American Lung Association drew attention to the issue of CKD as follows:[9]

  "Particulate matter is a health concern because inhaling even relatively low airborne concentrations of dust can cause or aggravate lung diseases such as asthma or emphysema, and is associated with premature death. … Since CKD collected in air pollution control devices typically has a small particle size, poorly managed cement kiln dust handling, transport and disposal has been shown to cause severe fugitive dust and air pollution problems."

- Dioxins have also been found in the clinker from both hazardous and non-hazardous waste facilities.[10]

- Emissions of airborne particulates increased by 66 percent when hazardous wastes were burned in cement and aggregate kilns and by 203 percent when the hazardous wastes also contained chlorine sources.[11]

- When hazardous wastes containing both chlorinated chemicals and metals were burned, metals emissions from cement kilns increased.[12, 13]

- Burning chlorinated chemicals in cement kilns increases the likelihood of upsets, since the presence of additional chlorine encourages the formation of "rings" in the kilns. When the rings detach or break, the sudden release of solids in the kilns can result in upsets which are accompanied by increased emissions of unburned wastes and products of incomplete combustion, or even more severe consequences:[14]

  "In a very severe upset, the flame at the firing end of the kiln can be extinguished. Upsets are not uncommon. The kiln we studied averaged three upsets a month …."

- Fugitive emissions are substances that volatilize or, if adsorbed to particulates, such as CKD, blow or wash into the surrounding environment during waste transfer and storage. At one cement kiln burning hazardous waste, fugitive emissions were reported to be 20,074 pounds per year.[15]

- Spills, both on-site and off-site, are also a concern at cement plants where hazardous materials are burned. A report commissioned by the New York State Legislature on waste-burning in cement kilns assessed the likelihood of repeated spills: [16]

  "[I]t is virtually impossible to completely prevent small spills of hazardous waste during unloading and pumping of waste fuels. These spills may be caused by equipment failures, maintenance operations, or operator error."

Table 1. Dioxin releases from cement kilns [17, 18]

Country	**Emission Factors**	**Reported Concentration Range**
To Air (µg I-TEQ/tonne clinker produced, except Sweden)		**To Air** (ng I-TEQ/m^3)
UK	0.02 to 1.08	0.01 to 0.35
USA	0.27 (Not burning hazardous wastes) 1.04 (burning haz waste and EF <450F) 28.58 (burning haz waste and EF >450F)	0.00029 to 144.08
Canada	-	0.005 to 0.548
Germany	0.0005 to 0.1384	0.000015 to 0.096 (NB. high value of 0.24 ng I-TEQ/m^3 ignored)
Netherlands	-	0.045 to 19.5
EU	0.05 to 5.0	
Sweden	0.03 to 0.56 µg NTEQ/tonne	0.005 to 0.1 ng NTEQ/m^3
Cement Kiln Dust (ng I-TEQ/kg CKD)		
UK	0.001 to 30	
USA	0.03 (Not burning hazardous waste) 35 (burning hazardous waste)	

Table 1 lists reported values for both the estimated emission factors (ie. air emissions of PCDD/Fs per tonne of clinker produced) and the reported concentrations of PCDD/Fs emitted by cement kilns. Also included are values for PCDD/Fs reported in cement kiln dust.

According to the USEPA, the average emission factor for kilns burning hazardous waste is about 90 times greater than that for kilns not burning hazardous waste.[17] A comparison of PCDD/F concentrations in cement kiln dust samples from cement kilns burning and not burning hazardous waste shows a similar relationship (i.e., the cement kiln dust from kilns burning hazardous waste had about 100 times higher PCDD/F TEQ concentration than dust from kilns not burning hazardous waste).

The USEPA also reported the emission factors based on the inlet temperature of the air pollution control devices used at kilns burning hazardous wastes. For those with an inlet temperature greater than 450 F the emission factor was 28.58 ng/kg clinker produced, compared to those with an inlet temperature of less than 450F of 1.04 ng/kg clinker.

The mean PCDD/F concentrations in net CKD generated by the kilns burning hazardous waste are higher (35 ng I-TEQ$_{DF}$ /kg) than in net CKD generated by the facilities not burning hazardous waste (3.0E-02 ng I-TEQ$_{DF}$ /kg).

The recent EU Dioxin inventory did not differentiate emissions from cement kilns burning hazardous wastes and those that do not. However, the comment was made that,[18] *"… there is still substantial uncertainty concerning dioxin emissions. The reason for this is the incineration of different kinds of waste in particular cement plants which might contribute considerably to the national dioxin emission balance or to the local immission situation. Measurements may be recommended at some plants incinerating waste, in particular hazardous waste with chlorinated compounds."*

Recycling or Disposal?
Hazardous Waste Combustion in Cement Kilns

Introduction

The amount of hazardous waste which is incinerated in the United States has increased substantially since the mid-nineteen eighties, when federal regulations began requiring that hazardous waste be treated to render it safe for disposal in landfills. Under ideal conditions, good combustion destroys most of the non-metallic, toxic organic compounds in hazardous waste and leaves ash residues which are easier to dispose than raw, untreated waste.

It may be surprising to learn that only about 40 per cent of the 5 million tons of hazardous waste burned annually is incinerated in licensed hazardous waste incinerators. The other 60 per cent is burned in boilers and industrial furnaces (BIFs) which use waste as an auxiliary fuel. Virtually all BIFs which burn hazardous waste on a commercial basis are cement kilns or lightweight aggregate kilns. By May, 1994, 37 cement and aggregate kilns were authorized to burn hazardous waste. It is estimated that cement kilns now burn about 90% of all commercially incinerated liquid hazardous waste in this country, and a growing percentage of solid hazardous wastes.

Since cement and aggregate kilns currently play such a large role in hazardous waste combustion, the use of hazardous waste in these facilities deserves close scrutiny. Using hazardous waste to fire cement kilns concerns some public health and environmental advocates because it can expose humans and the environment to increased risks from toxic and hazardous metals and chemicals.

Hazardous waste fuels can include paint thinners, paint sludges, waste oil, chemical production process byproducts, spent and off-specification solvents and other petrochemical byproducts. Solids and liquids from the cleanup of past uncontrolled hazardous waste dump sites may also be blended into hazardous waste fuel streams. Some of these types of waste can contain toxic heavy metals such as lead, arsenic, cadmium, mercury and chromium.

Combustion of wastes that contain chlorine, including chlorinated solvents and chlorine containing organic and inorganic chemical compounds, can cause the formation and emission of toxic organic compounds known as poly-chlorinated dibenzo-dioxin (PCDD) and poly-chlorinated dibenzo-furan (PCDF) compounds.

People can be exposed to these hazardous substances, not only from air pollution from waste burning operations at kilns, but also from cement kiln dust (CKD) disposal, reuse and management. Occupational contact with cement products produced by the kilns may also lead to exposure to hazardous substances. There is evidence that kilns which use hazardous waste fuel emit solid particulate matter and chlorinated dioxin compounds at higher stack gas concentrations and in greater volumes than state-of-the-art commercial hazardous waste incinerators, and that cement products and kiln dust from waste burning kilns contain higher concentrations of these hazardous substances than from kilns which burn only conventional fossil fuels.

The potential risks to public health posed by burning hazardous waste in cement kilns may be increased by the location of many of the kilns. Much of the hazardous waste is burned in older wet-process kilns traditionally located in or near to rural and small town population centers. Zoning restrictions are traditionally a matter left to local governments, very few of which have enacted restrictions specifically dealing with hazardous waste combustors. Federal law imposes specific requirements on hazardous waste-burning kilns located within municipalities with populations of at least 500,000, but all kilns currently burning hazardous waste are located in or near far smaller communities.

Congress and the EPA initially exempted BIFs from obtaining hazardous waste operating permits under regulations implementing the Federal Resource Conservation and Recovery Act ("RCRA") issued in 1980. Congress and the EPA believed that the high combustion temperatures of cement kilns and other BIFs made them desirable - and safe - for hazardous waste processing. Allowing BIFs to recover the energy value of hazardous waste would also theoretically conserve fossil fuel.

In addition, Congress exempted cement kiln dust from hazardous waste regulations until after completion of a U.S. Environmental Protection Agency study of the environmental and human health hazards posed by CKD. This gave the cement kilns a significant economic advantage over commercial hazardous waste incinerators, which are required to dispose of process residues in RCRA-licensed hazardous waste landfills with extensive requirements to control fugitive emissions, groundwater contamination and other environmental hazards. EPA's kiln dust study and Report to Congress (RTC) have lead to publication of an EPA decision to regulate cement kiln dust under the hazardous waste authority of the Resource Conservation and Recovery Act, but with a tailored regulation which does not provide all features of full hazardous waste regulation.

The 1984 Hazardous and Solid Waste Amendments (HSWA) to RCRA provided a major stimulus to burning hazardous waste in BIFs by prohibiting the land disposal of many hazardous wastes without treatment to specified standards. Thermal destruction was an obvious method for treatment or destruction of many RCRA regulated wastes. Cement kiln operators were able to offer an inexpensive alternative to RCRA licensed incinerators during the 1980s because kilns were not subjected in practice to the same stringent standards and performance requirements under state and federal regulation that applied to other hazardous waste combustors.

The trend toward sending hazardous waste to cement kilns was also encouraged by EPA's decision to exclude hazardous waste sent to BIFs for use as fuel from the reporting requirements of the Emergency Planning and Community Right to Know Act of 1986. Prior to 1988, hazardous waste generators were required to report wastes shipped off-site for "reuse as fuel/ fuel blending" on EPA's Toxics Release Inventory (TRI) forms. In that year, however, EPA decided that wastes which were "recycled" (including wastes used as fuel) would no longer have to be reported in the TRI forms. Generators could thus ship wastes to BIFs or to fuel blending operations and claim credit for reducing the amount of waste "released" to the environment. This provided a strong incentive to send wastes to BIFs for "reuse as fuel."

The EPA did not issue final regulations covering hazardous waste-burning cement kilns and other BIFs until 1991. Even then, the EPA allowed existing BIFs to seek "interim status" which would authorize them to burn hazardous waste without a federal permit under less stringent overall regulation and performance than what is achieved in practice for fully permitted RCRA hazardous waste burning incinerators under federal and typical state regulations. Waste burning cement kilns were not required to upgrade the performance of their particulate emission controls at these sites to what would generally be achievable by existing hazardous waste incinerators using best available control technology. Waste burning cement kilns were not subjected to stringent discharge "opacity" regulations that applied to most waste incinerators under state and federal requirements. Waste burning cement kilns were not subjected to requirements to immediately report all RCRA violations which may occur at a site that would be required at a permitted facility. Waste-fuel derived cement kiln dust was not subjected to hazardous waste regulation, unlike residues from hazardous waste incinerators which had to be placed in a secure hazardous waste landfill.

Although several waste burning cement kilns have applied for final Part B RCRA permits, none of these facilities has obtained such a federally-required hazardous waste permit. Interim status facilities may continue to burn hazardous waste indefinitely until EPA acts on Part B permit applications.

These regulations and policies have provided major financial benefits to the waste burning cement industry. Instead of paying for all of their fuel, cement and aggregate kilns are now earning large fees for accepting hazardous waste for energy recovery or destruction.

Cement industry trade groups argue that using hazardous waste fuel poses no major environmental problems and is actually more beneficial to the environment than burning coal or oil.

Critics of the current BIF regulations, including environmental and public health groups, community organizations, and representatives of the hazardous waste incineration industry argue that:

- the regulations are not adequate to assure protection of human health and the environment
- that the cement kiln industry has a poor record of compliance with the BIF standards
- that current regulations allow many kilns to receive hazardous waste even though their air pollution controls are antiquated and do not reflect state-of-the-art, best available control technology
- that lax regulation of fuel blending operations allows kilns to receive metal-bearing hazardous wastes with little energy value leading to poorly regulated waste combustion and dispersal of toxic metals to the environment, all disguised as a form of energy recovery.

The U.S. EPA is currently evaluating its BIF regulations as part of a major reassessment of its hazardous waste policy. The EPA has announced it intends to strengthen BIF emissions standards and operating requirements as part of its combustion strategy. EPA has, for example, briefed stakeholders on its intention to issue stringent regulations that would regulate dioxin and furan stack gas emission concentrations in a standard that would be identical for hazardous waste incinerators and hazardous waste-burning cement kilns. In other areas, such as proposals for particulate emission regulation and EPA's long delays in dealing with the fuel blending issue, EPA seems less committed to a level playing field for cement kilns and hazardous waste incinerators. EPA's own attempts to foster pollution prevention and waste minimization policies are undermined by the weste-burning kiln industry's approach to waste management policy whose emphasis on combustion eclipses material re-use and recycling.

Future regulation of hazardous waste-burning cement kilns and industrial boilers and hazardous waste incinerators has important implications for the management of hazardous waste in this country. Stringent regulation of hazardous waste combustion should not only provide increased environmental protection at the site of the combustion unit; such stringent regulation and the resulting increased disposal costs should also create additional incentives for industry to reduce the generation of hazardous waste at the source. In the long run, reducing the amount of hazardous waste generated is the most desirable and environmentally beneficial strategy for dealing with the hazardous waste problem.

United States Environmental Protection Agency
Solid Waste and Emergency Response (5305W)
EPA530-F-99-023
August 1999
www.epa.gov/osw

Office of Solid Waste

Environmental Fact Sheet

MANAGEMENT STANDARDS PROPOSED FOR CEMENT KILN DUST WASTE

The Environmental Protection Agency (EPA) is promoting pollution prevention, recycling, and safer disposal of cement kiln dust (CKD) by pro- posing management standards for this waste. The Agency believes that these management standards are a creative, affordable, and common sense approach that can protect human health and the environment without im- posing unnecessary regulatory burdens on the cement kiln industry. These standards provide a new, tailored framework that safeguards ground water and limits risk from releases of dust to air.

Background

Since 1980, cement kiln dust and certain other wastes have been excluded from otherwise applicable hazardous waste regulations under Subtitle C of the Resource Conservation and Recovery Act (RCRA). As required by RCRA, EPA studied the adverse affects on human health and the environment from the disposal of cement kiln dust. The Agency found that some environmental harm results from CKD waste, and in 1993, reported these and other findings to Congress. Subsequently, Congress required EPA to determine the appropriate regulatory framework for managing cement kiln dust waste.

In 1995, EPA determined that some additional control of cement kiln dust was needed. Although current disposal practices cause some environmental damage, the Agency found that regulating cement kiln dust as a hazardous waste was not appropriate. Since some controls are needed, EPA is proposing a tailored set of standards for managing cement kiln dust waste.

Action

EPA is proposing options to mitigate risk from the mismanagement of cement kiln dust waste. The Agency's preferred option is to provide management standards whereby CKD remains a nonhazardous waste so long as the waste is managed according to the requirements. Cement kiln dust becomes a regulated hazardous waste only if significant violations of the management standards occur.

Under EPA's proposed standards, cement kiln dust is to be managed in landfills designed to meet specific performance requirements that protect ground water from toxic metals. In addition to performance criteria, the Agency is proposing technology-based standards that meet the performance criteria, such as using composite liners in landfills. Requirements for ground-water monitoring, corrective action, closure, and post-closure care also are included.

To control releases of cement kiln dust to air, EPA is proposing a performance standard that requires facility owners and operators to take measures to prevent releases from landfills, handling conveyances, or storage areas. As an alternative to the performance-based standard, the Agency is proposing technology-based standards that require: (1) compacting and periodic wetting of CKD managed in landfills; (2) on-site handling of CKD in closed, covered vehicles and conveyance devices; and (3) keeping cement kiln dust in enclosed tanks, containers, and buildings when temporarily stored for disposal or sale.

Cement kiln dust frequently is used for beneficial agricultural applications. When used for these purposes, the Agency proposes concentration limits for arsenic, cadmium, lead, thallium, and chlorinated dibenzodioxins and dibenzofurans.

Other options discussed for managing cement kiln dust include:

- The development of CKD waste management regulations by individual states. EPA would develop regulations governing cement kiln dust in states without regulatory controls.
- The adoption of EPA's proposed management standards by individual states. If enough states adopt the proposed standards, the Agency would take no further action on cement kiln dust.
- A two-tiered approach in which cement kilns burning hazardous waste are regulated as hazardous waste generators. Kilns that do not burn hazardous waste would only follow the proposed management standards.
- A voluntary operating agreement between the cement kiln industry and EPA in which CKD remains nonhazardous and the industry ensures the safe management of CKD.

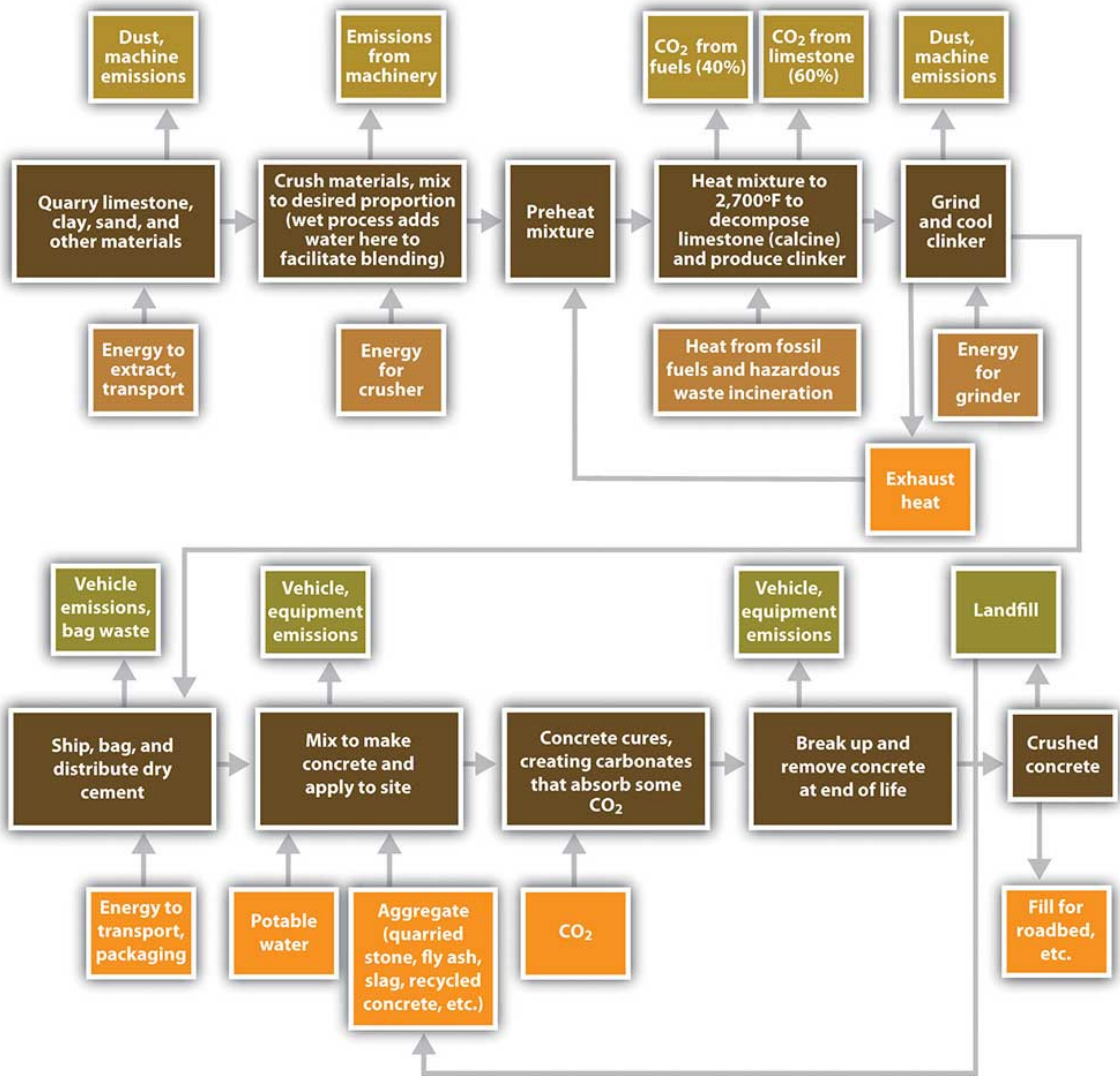
Impact

In 1990, the cement industry generated an estimated 12.7 million metric tons of cement kiln dust from 111 plants in 38 states, 4 million metric tons of which were disposed of in piles, quarries, and landfills. In 1995, the industry disposed of an estimated 3.3 million metric tons of cement kiln dust. Currently, 110 Portland cement plants operate in the United States and Puerto Rico. The chief cement-producing states are California, Texas, Pennsylvania, and Michigan.

For More Information

The *Federal Register* notice, this fact sheet, and other documents related to this action are available in electronic format on the Internet at <http://www.epa.gov/epaoswer/other/ckd/index.htm>. For additional information or to order paper copies of any documents, call the RCRA Hotline. Callers within the Washington Metropolitan Area must dial 703-412-9810 or TDD 703-412-3323 (hearing impaired). Long-distance callers may call 1-800-424-9346 or TDD 1-800-553-7672. The RCRA Hotline operates weekdays, 9:00 a.m. to 6:00 p.m. Address written requests to: RCRA-Docket@epa.gov or RCRA Information Center (5305W), US EPA, 401 M Street, SW, Washington, DC 20460.

The Environmental Impacts of Concrete



CO_2 Emissions Profile of the U.S. Cement Industry

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ABSTRACT

Global carbon dioxide (CO_2) emissions from cement production were approximately 829 million metric tons of CO_2 ($MMTCO_2$) in 2000[1], about 3.4% of global CO_2 emissions from fossil fuel combustion and cement production. The United States is the world's third largest cement producer, with production occurring in 37 states.

Cement production is not only a source of combustion-related CO_2 emissions, but it is also one of the largest sources of industrial process-related emissions in the United States. Between 1990 and 2001, U.S. process-related emissions increased 24%, from 33.3 $TgCO_2$ to 41.4 $TgCO_2$[2]. National estimates of process-related emissions are calculated based on methodologies developed by the Intergovernmental Panel on Climate Change (IPCC)[3,4]. Combustion-related emissions from the U.S. cement industry were estimated at approximately 36 $TgCO_2$ in 2001,[5] accounting for approximately 3.7 percent of combustion-related emissions in the U.S. industrial sector.

This paper explores, on a more disaggregated level, the geographic location of CO_2 emissions sources from the U.S. cement industry. This paper begins by providing a brief overview of the U.S. cement industry, including national level estimates of energy use and carbon emissions. The focus of the paper is on the development of a cement industry profile for the United States. Based on facility-level capacity statistics, a bottom-up analysis was undertaken to identify sources of CO_2 emissions in the U.S. cement industry in order to gain a better understanding of the geographic scope and concentration of this emissions source.

INTRODUCTION

Globally, over 150 countries produce cement and/or clinker, the primary input to cement. In 2001, the United States was the world's third largest producer of cement (90 million metric tons (MMt)), behind China (661 MMt) and India (100 MMt).[6] The United States imported about 25 MMt of cement in 2001, primarily from Canada (20%), Thailand (16%) and China (13%). Less than 1% of domestic production was exported. The primary destinations for export were Canada (82%) and Mexico (6%).

Cement is often considered a key industry for a number of reasons. To begin with, cement is an essential input into the production of concrete, a primary building material for the construction industry. Due to the importance of cement for various construction-related activities such as highways, residential and commercial buildings, tunnels and dams, production trends tend to reflect general economic activity. Furthermore, because of the large demand for cement, the relatively high costs associated with transport of the high-density product, and the wide geographic distribution of limestone, the principal raw material used to produce cement, cement is produced across the United States.

Cement production also is a key source of CO_2 emissions, due in part to the significant reliance on coal and petroleum coke to fuel the kilns for clinker production. Globally, CO_2 emissions from cement production were estimated at 829 $MMTCO_2$ in 2000[7], approximately 3.4% of global CO_2 emissions from fossil fuel combustion and cement production. In addition to combustion-related emissions, cement production also is a source of process-related emissions resulting from the release of CO_2 during the calcination of limestone.

Annually, the United States submits a national inventory of GHG emissions to the United Nations Framework Convention on Climate Change (hereafter referred to as the Inventory). Emission estimates included in the Inventory are based on methodologies developed by the IPCC, as well as some country-specific methodologies consistent with the IPCC. The Inventory estimates U.S. process-related emissions from cement production to be 41.4 $TgCO_2$ in 2001[8]. Due to the nature of the IPCC Guidelines, as well as the way industrial sector emissions are estimated in the United States, combustion-related emissions resulting from the cement industry are not as well characterized. While combustion-related emissions from cement production are incorporated into the Inventory, they are aggregated and presented in the estimate of CO_2 emissions from fossil fuel combustion.

This paper highlights the results of research to explore more in-depth, process and combustion-related emissions from the U.S. cement industry as a whole and on a more disaggregated level. Developing such a profile of the cement industry is important for several reasons, including:

- Development of time-series estimates for combustion-related emissions
- Comparison of bottom-up analyses with publicly available national estimates as a useful quality assurance and quality control activity
- Identifying the structure of the industry. For example, are there relatively few large companies or facilities, or is the industry dispersed across the country? Are companies primarily U.S. or international?
- Identifying the array of technologies and processes utilized in various parts of the country, allowing "typical practice" to be identified and, subsequently, opportunities for achieving emissions reductions
- Identification of local resources available that may be consumed as alternative fuels in existing facilities.

This paper begins by briefly discussing the cement production process, the sources of energy consumed in the process, and the resulting CO_2 emissions. The focus of the paper is on the development of a cement industry profile for the United States. Based on facility-level capacity statistics, a bottom-up analysis was undertaken to identify sources of CO_2 emissions in the industry in order to gain a better understanding of the geographic scope and concentration of this emissions source.

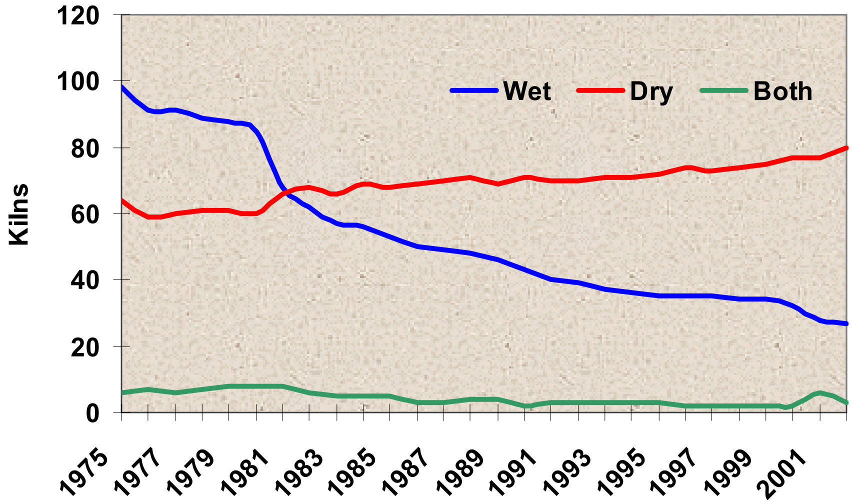
CEMENT PRODUCTION PROCESS

Cement's raw materials, calcium oxide and other minerals (such as silicon, aluminum and iron oxides) are taken from the earth through mining and quarrying. These minerals are crushed into a more manageable aggregate and transported for further processing. The manufacture of clinker and subsequently cement entails three major functions: kiln feed preparation, clinker production, and finish grinding[9].

1) *Kiln Feed Preparation*. Using dry or wet processes, mineral inputs are reduced to ground meal (powders or slurries, respectively) before they are sent to kilns for clinker production. The raw materials are first crushed to a maximum of 6 inches in diameter and then crushed a second time to a maximum of about 3 inches in diameter. In the "dry" process, the crushed

material is fed into the kiln. In the "wet" process, the ground materials are first mixed with water to form a slurry before being fed into the kiln. The use of the dry process for cement production has increased significantly in the last couple of decades (Figure 1), partially due to the lower fuel requirements for the dry process (discussed further below). In 1975, dry kilns comprised 38% of all kilns, whereas in 2001, dry kilns accounted for approximately 70% of all kilns[10].

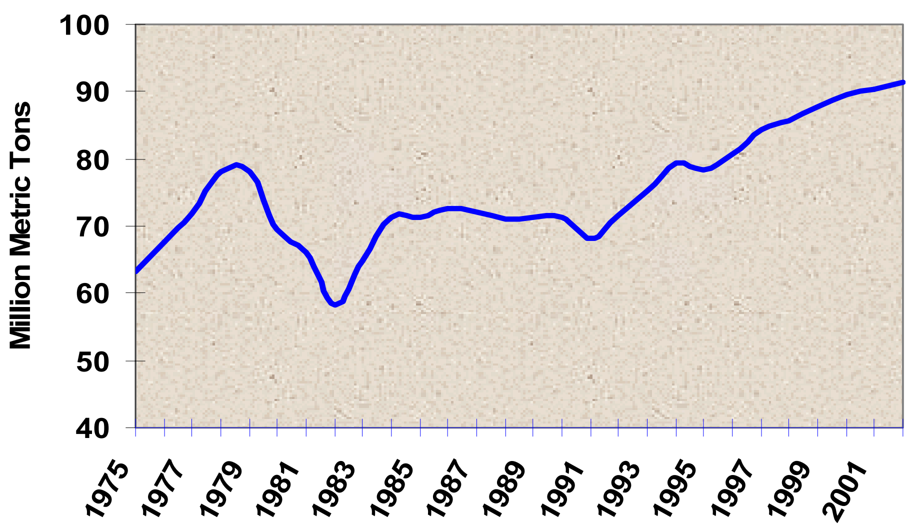
Figure 1. Number of Kilns by Process



Source: USGS Mineral Surveys (data from Surveys in 1975-2002)

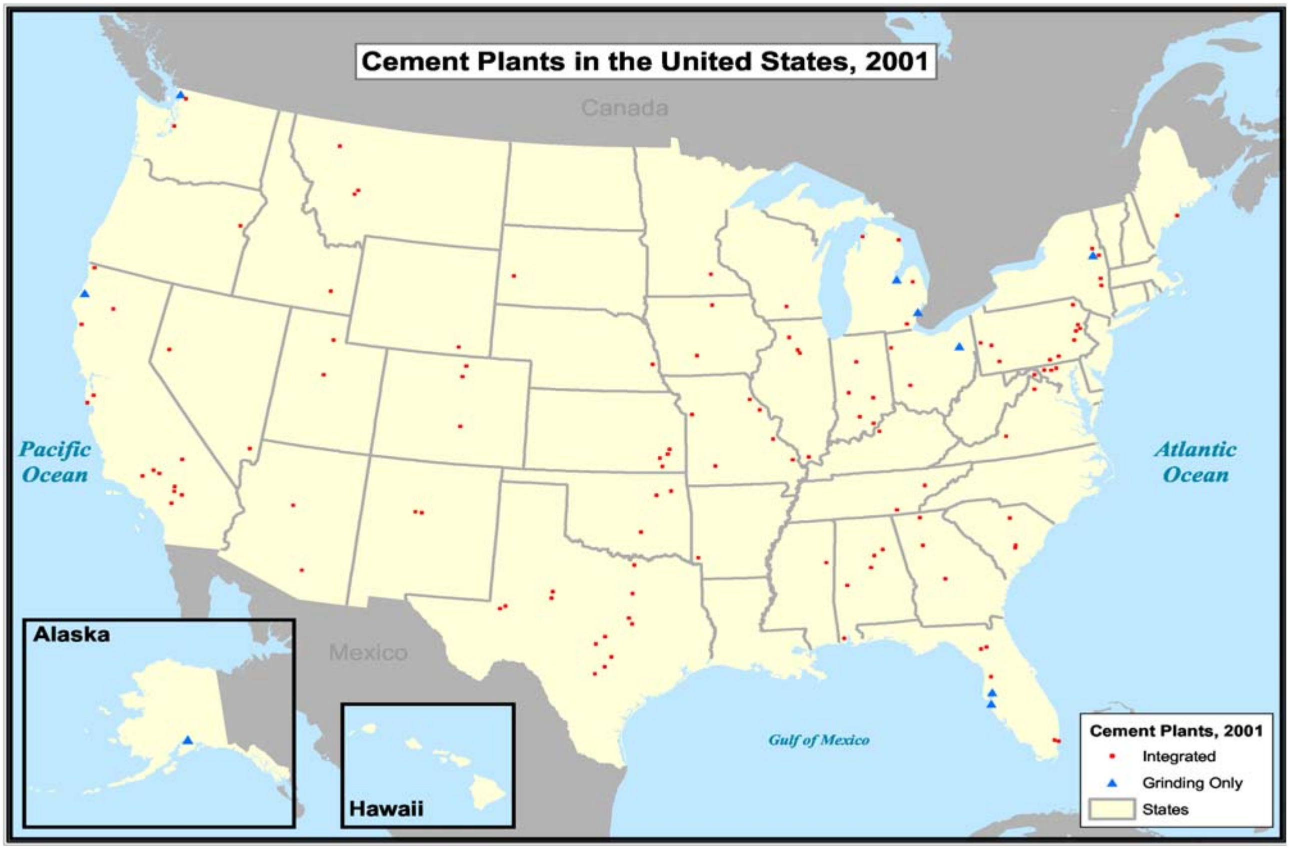
This transition from the wet to the dry process coincided with a decrease in the total number of kilns in operation. Over the same time period production increased from 75 MMt in 1975 to 90 MMt in 2001[11] (Figure 2). The decrease in total number of kilns in operation (wet, dry and both), along with an increase in total production, illustrates that the average capacity of kilns has increased over time.

Figure 2. Total U.S. Cement Production: 1975-2002



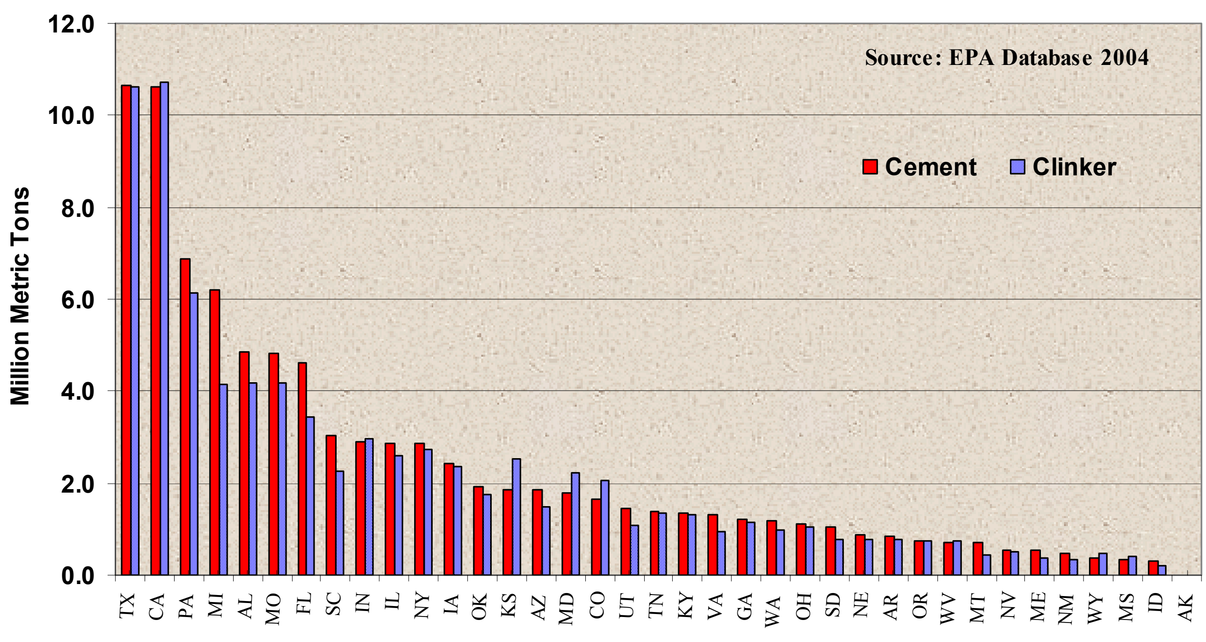
Source:USGS. Various Years (1975-2002). Minerals Yearbook, Vol. 1. Metals and Minerals. U.S. Geological Survey. U.S. Department of the Interior.

Figure 4. Distribution of Cement Plants in the United States, 2001



States with the largest number of production facilities are typically also among those with the highest production capacities and actual production levels of clinker and cement. The states with the largest total production of cement are, in decreasing order, Texas, California, Pennsylvania, Michigan, Alabama, Missouri and Florida (Figure 5).

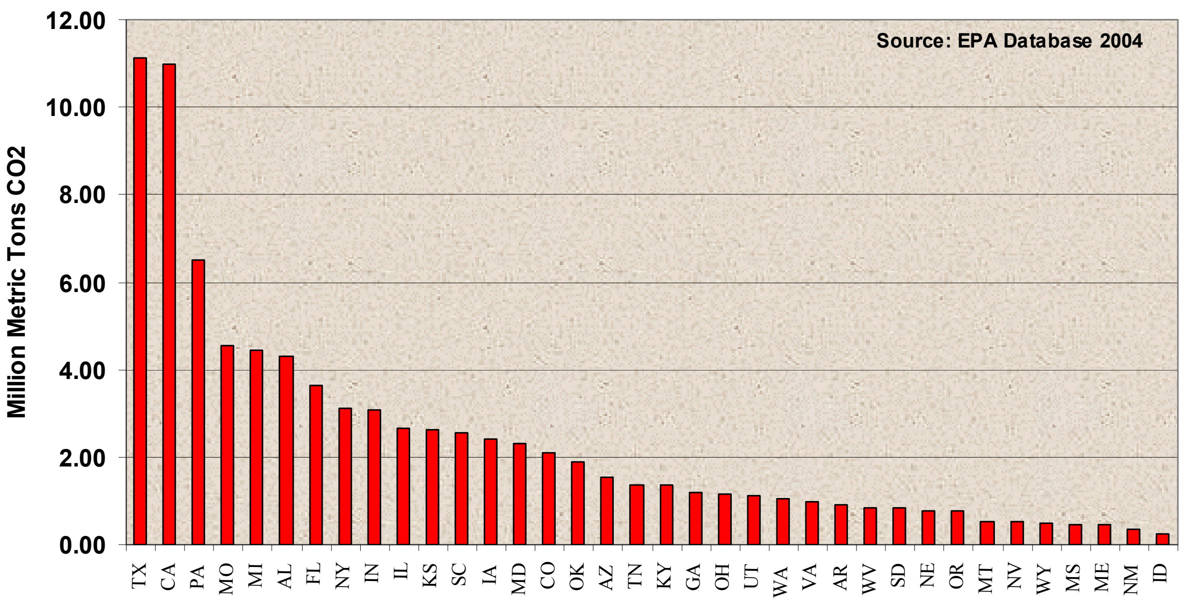
Figure 5. Estimated Annual Production, by State, 2001



State-level Greenhouse Gas Emissions

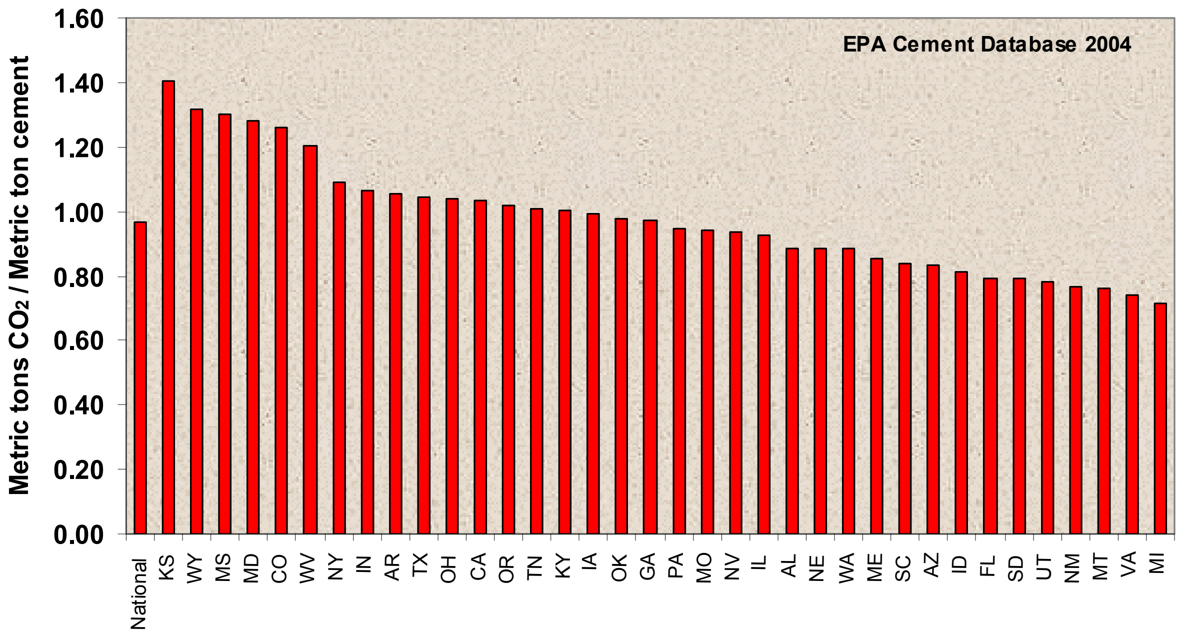
As might be expected, trends for state-level CO_2 emissions from cement manufacturing closely mirror the trends for state level production (Figure 6). Some of this may be an artifact of the methodology used to estimate facility-level CO_2 emissions (i.e., based on production and capacity utilization). This outcome may differ somewhat if the actual fuel consumption for each facility were used as opposed to a national average emissions factors for cement grinding, and wet and dry kilns. However, examining the Major Industrial Plant Database, which includes information on 101 facilities, it appears as though the various states consume a similar mix of fuels for cement manufacturing. With that said, the relative percentage of coal consumed for cement production, according to the MIPD, is less in some of those states designated as the top sources of CO_2, including Texas, California, Alabama and Florida.

Figure 6. Cement Industry Carbon Dioxide Emissions, 2001



Carbon dioxide intensity is presented as metric tons of CO_2 emitted per metric ton of cement produced. The range of intensities illustrated in Figure 6 primarily results from the relative share of wet versus dry facilities and the share of clinker versus grinding-only facilities. States with a relatively higher percentage of wet facilities and clinker kilns will have a higher intensity than states with only grinding facilities. The national weighted average carbon intensity for cement production was estimated at 0.97 ton CO_2/ton cement in 2001 (Figure 7). Kansas was the most carbon intensive producer of cement at 1.41 tons/ton, partially reflecting the fact that all cement plants are integrated facilities and the wet process is used at two facilities. Michigan's relatively low carbon intensity of 0.72 tons/ton partially reflects the fact that a number of facilities in Michigan are "grinding only" facilities, which have a comparatively lower carbon intensity than integrated facilities.

Figure 7. Cement Industry Carbon Dioxide Intensity, 2001



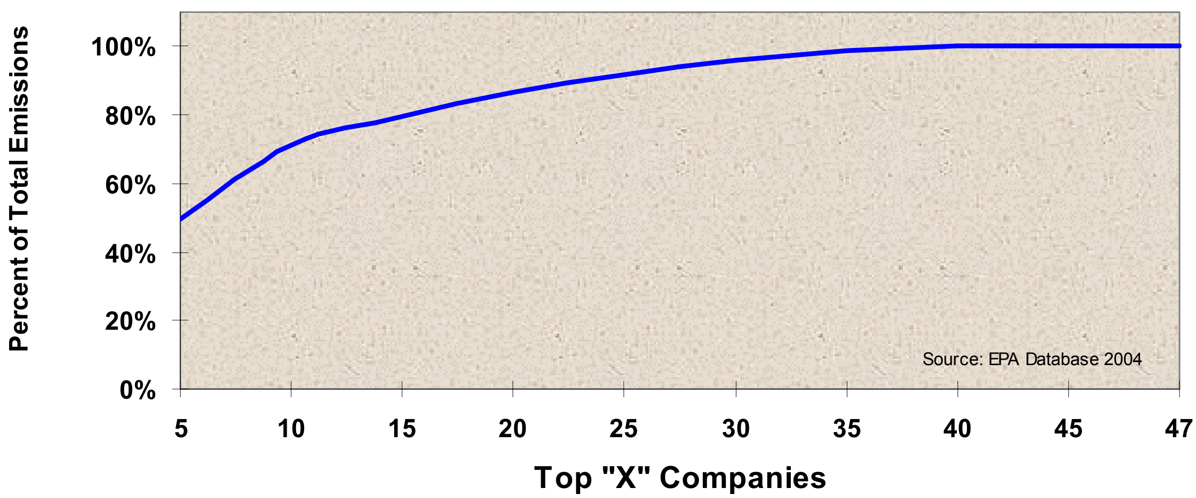
As mentioned above, it is a challenge to attribute carbon emissions, or carbon dioxide intensity, to a particular plant or a particular state due to the confidentiality of energy consumption data. The Portland Cement Association provides information on the primary fuel(s) consumed by various facilities, however, without knowing the exact percentage of each fuel consumed it is difficult to attribute carbon emissions to the facility level. The MIPD does provide some facility-specific fuel consumption data. The appropriateness of this database for estimating facility-specific carbon emissions will be investigated in future work.

Industry Concentration

The cement industry is becoming increasingly concentrated, with a few multinational cement companies assuming ownership of increasing shares of cement manufacturing plants. In 2001, five companies (54 facilities) produced approximately half of all domestic cement, while ten companies (78 facilities) were collectively responsible for more than three-quarters of all production. According to the USGS, if entities with the same parent company are combined under the larger parent company, and if joint ventures are apportioned, the top ten cement companies in 2001, in decreasing order were; Lafarge North America, Inc; Holcim (US) Inc.; CEMEX, S.A. de C.V.; Lehigh Cement Co.; Ash Grove Cement Co.; Essroc Cement Corp.; Lone Star Industries Inc.; RC Cement Co.; Texas Industries Inc. (TXI); and California Portland Cement Co[21].

A similar trend is exhibited for CO_2 emissions. According to preliminary estimates, five companies were responsible for roughly 50% of CO_2 emissions from the U.S. cement industry, whereas the top ten companies were responsible for nearly 70% of emissions.

Figure 8. Company Concentration of CO_2 Emissions



NEXT STEPS AND CONCLUSIONS

This analysis was a first step in examining the U.S. cement industry at a more disaggregated level than is achieved through the Inventory process. Currently, process-related emissions are estimated on the national level, while combustion-related emissions are not separately estimated, rather they are accounted for in the national estimate of CO_2 emissions from fossil fuel combustion.

This work was based on the use of a national average emissions factor for wet processing facilities and a separate national average emissions factor for dry processing facilities. This first step provides a clearer understanding of the concentration of emissions sources throughout the United States, as well as the relative carbon intensity of different regions of the country. Although a clearer picture of the industry has been developed, use of a national average emissions factor could "level the playing field". While the relative mix of fuels used for cement production may be similar throughout the country, the mix is not necessarily the same. An average emissions factor may introduce bias, particularly at the facility level. Further, it is difficult to identify and attribute emissions to the wide variety of solid waste materials used in kilns.

Future work will determine the availability of facility-specific fuel data. As mentioned above, there are a number of challenges with obtaining these data, most significantly perhaps, the fact that these data are typically confidential. Nevertheless, there are some sources available that contain facility-specific fuel data. These databases will be investigated further to determine the comprehensiveness, consistency, and accuracy of that data. If these data are deemed suitable the estimates presented in this study could be refined.

Cement is a key industry in the United States and globally, from both an economic and an environmental perspective. Although the cement industry is a relatively significant industrial source of CO_2 emissions there are a number of opportunities to achieve emissions reductions, including:

- Conversion from the wet process to the dry process,
- Substitution of lower carbon content fuels for coal, coke and petroleum coke,

- Testing different blends of cement, whereby clinker is replaced by various additives, and
- Capture and storage of CO_2 from the flue gases

All of these options require further analysis to determine feasibility, costs, environmental impacts, and the overall effect of the activity on the quality of cement produced. Use of waste fuels in particular, may have environmental effects that should be addressed. The availability of a profile of the U.S. cement industry, in addition to the benefits outlined throughout this paper, can serve as the foundation for such an analysis.

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Global CO_2 emissions from cement production

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Abstract. The global production of cement has grown very rapidly in recent years, and after fossil fuels and land-use change, it is the third-largest source of anthropogenic emissions of carbon dioxide. The required data for estimating emissions from global cement production are poor, and it has been recognised that some global estimates are significantly inflated. Here we assemble a large variety of available datasets and prioritise official data and emission factors, including estimates submitted to the UNFCCC plus new estimates for China and India, to present a new analysis of global process emissions from cement production. We show that global process emissions in 2016 were 1.45 ± 0.20 Gt CO_2, equivalent to about 4 % of emissions from fossil fuels. Cumulative emissions from 1928 to 2016 were 39.3 ± 2.4 Gt CO_2, 66 % of which have occurred since 1990. Emissions in 2015 were 30 % lower than those recently reported by the Global Carbon Project. The data associated with this article can be found at https://doi.org/10.5281/zenodo.831455.

1 Introduction

Anthropogenic emissions of carbon dioxide to the atmosphere come from three main sources: (i) oxidation of fossil fuels, (ii) deforestation and other land-use changes, and (iii) carbonate decomposition. Cement – the largest source of emissions from the decomposition of carbonates – is a binding material that has been used since ancient times. But it was following World War II that the production of cement accelerated rapidly worldwide, with current levels of global production equivalent to more than half a tonne per person per year (Fig. 1). Global cement production has increased more than 30-fold since 1950 and almost 4-fold since 1990, with much more rapid growth than global fossil energy production in the last 2 decades. Since 1990 this growth has largely been because of rapid development in China where cement production has grown by a factor of almost 12 such that 73 % of global growth in cement production since 1990 occurred in China (van Oss, 2017).

There are two aspects of cement production that result in emissions of CO_2. The first is the chemical reaction involved in the production of the main component of cement, clinker, as carbonates (largely limestone, $CaCO_3$) are decomposed into oxides (largely lime, CaO) and CO_2 by the addition of heat. Stoichiometry directly indicates how much CO_2 is released for a given amount of CaO produced. Recent estimates are that these so-called "process" emissions contribute about 5 % of total anthropogenic CO_2 emissions excluding land-use change (Boden et al., 2017). The second source of emissions is the combustion of fossil fuels to generate the significant energy required to heat the raw ingredients to well over 1000 °C, and these "energy" emissions, including those from purchased electricity, could add a further 60 % on top of the process emissions (IEA, 2016). Total emissions from the cement industry could therefore contribute as much as 8 % of global CO_2 emissions. These process (sometimes called "industry" or "industrial process") and energy emissions are most often reported separately in global emissions inventories (Le Quéré et al., 2016, 2017; IPCC, 2006).

The Global Carbon Project annually publishes estimates of global emissions of CO_2 from the use of fossil fuels and cement production, and these estimates are used by the global carbon modelling community as part of the development of the global carbon budget (Le Quéré et al., 2016, 2017). It is therefore important that the emissions estimates are as accurate as possible. This emissions database covers all emissions of CO_2 resulting from the oxidation (not only energy use) of fossil fuels, including those that occur in the IPCC sec-

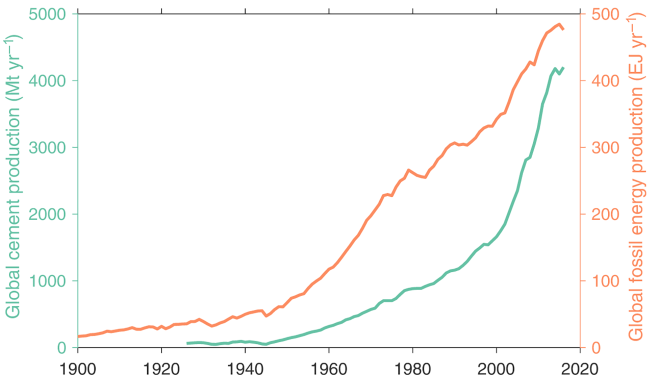


Figure 1. Global cement and fossil energy production to 2016 (USGS, 2014; Mohr et al., 2015).

tor Industrial Processes and Product Use, such that including cement emissions means that the vast majority of CO_2 emissions are covered.

In this work we investigate the process emissions from cement production, develop a new time series for potential use by the Global Carbon Project, and present plans for future continued updates, revisions, and development. The focus on process emissions here is because both direct fossil fuel emissions and electricity emissions are already accounted for in other parts of the global carbon budget.

2 Previous estimates of global cement emissions

Early estimates of emissions from global cement production effectively assumed that almost all cement was of the ordinary Portland cement (OPC) type, which uses a very high proportion of clinker and very small amounts of other ingredients, such as gypsum to control setting time. For at least the first half of the 20th century this assumption was quite reasonable, with the vast majority of cement being produced in industrialised countries, which followed carefully developed and tested standards regarding strength and other important qualities.

In 1970, Baxter and Walton presented estimates of global CO_2 emissions from fossil fuels and cement production for 1860–1969 in which the "mean calcium oxide content of cements was taken to be 60 % … and the carbon content of limestone assumed to be 12 % with 100 % kilning efficiency. Thus the … manufacture of 1 t of cement yields … 4.71×10^5 g of carbon dioxide …" (i.e. 0.471 t CO_2 (t cement)$^{-1}$ (Baxter and Walton, 1970). Assuming that their estimate of global cement production in 1969 was the same as that reported by the USGS (USGS, DS140, etc.), their estimate of emissions from cement production in 1969 would have been 256 Mt CO_2.

In a landmark paper of 1973, Charles Keeling presented a systematic analysis of emissions from fossil fuel combustion for 1860–1969 and cement production for 1949–1969 (Keeling, 1973). Using an average CaO content of cement of 64.1 %, Keeling's emission factor was 0.50 t of CO_2 (t cement)$^{-1}$, giving an estimate for emissions from cement production in 1969 of 272 Mt. While both Keeling (1973) and Baxter and Walton (1970) cited Lea and Desch (1940) as the source for their estimates of the CaO content of cement, they nevertheless used different fractions. Importantly, these fractions were assumed to be time invariant.

Marland and Rotty (1984) presented further estimates for 1950–1982 using a global average CaO content of cement of 63.8 % taken directly from US data for 1975. From this they derived a time-invariant emission factor of 0.50 t CO_2 (t cement)$^{-1}$.

The estimates made by Marland and Rotty (1984) combined with the earlier estimates of Keeling (1973) were included in the archive of the Carbon Dioxide Information Analysis Center (CDIAC) in 1984 (Rotty and Marland, 1984). Later, CDIAC modified the cement emission factor very slightly based on a study by Griffin (1987), who (in turn based on Orchard, 1973) said that "the range of lime (CaO) content in cement is 60–67 %" and based on discussion with experts recommended the use of 63.5 %, which was calculated as the midpoint of the range (Boden et al., 1995). This time-invariant, global emission factor of about 0.50 was still in use in CDIAC's 2016 data release.

CDIAC's method was directly adopted by the Intergovernmental Panel on Climate Change (IPCC) in their 1996 guidelines (Haukås et al., 1997) for cases in which clinker production data were not available. The IPCC subsequently revised its methods for cases in which clinker production are not available in the 2006 guidelines (p. 2.8):

"(I)n the absence of data on carbonate inputs or national clinker production data, cement production data may be used to estimate clinker production by taking into account the amounts and types of cement produced and their clinker contents and including a correction for clinker imports and exports. Accounting for imports and exports of clinker is an important factor in the estimation of emissions from this source."

In addition, the IPCC guidelines now recommend the use of a default clinker ratio of 0.75 when it is known that significant amounts of blended cements are produced.

The Emissions Database for Global Atmospheric Research (EDGAR) presents estimates of CO_2 and other climate-important gases by country. For cement they initially used the emission factor from Marland and Rotty (1984) of 0.50 t CO_2 (t cement)$^{-1}$ (Olivier et al., 1999). With the release of version 4.1 of the database in 2010, they modified their emission factor to account for changing rates of blending (i.e. lower clinker ratios) in cement production in response to work by the World Business Council for Sustainable Development (WBCSD), who released sample-based estimates of the clinker ratio in a range of countries (Anonymous, 2010). In version 4.3.2, EDGAR used official estimates from Annex I parties to the UNFCCC, specific clinker production data for China, and the WBCSD database for all remaining countries (Olivier et al., 2016; Janssens-Maenhout et al., 2017). Since 2003, countries that are listed in Annex 1 of the UN Framework Convention on Climate Change (UNFCCC) have been required to submit annual inventories of greenhouse gas emissions in considerable detail, including estimates of emissions from cement production (UNFCCC, 2017). Other parties to the convention are requested to submit less detailed and less frequent national communications and, more recently, biennial update reports (BURs).

3 Methods

While cement production data are available by country (van Oss, 2017), it is the production of clinker that leads to process CO_2 emissions, and the amount of clinker in cement varies widely. With no available source of clinker production data for all countries, other options must be considered. The direct use of cement production data without adjustment for clinker trade or clinker ratios that vary by country and over time leads to poor emissions estimates (see Appendix A) and should therefore be used only as a last resort. The World Business Council for Sustainable Development (WBCSD), through its Getting the Numbers Right initiative, has collected cement data, including clinker production data, directly from firms, but their survey-based approach leaves many parts of the world poorly sampled (WBCSD, 2014).

The main rationale of our approach, therefore, is to prioritise officially reported emissions, recognising that these generally make use of data and knowledge unavailable elsewhere. Then we use officially reported clinker production data and emission factors, IPCC default emission factors, industry-reported clinker production, and finally survey-based clinker ratios. These are applied to cement production data where no better data are available. Full details are provided in Appendix D and in the associated data files. For the 42 Annex I countries that report their greenhouse gas inventories annually to the UNFCCC, we extract official estimates of cement production emissions from 1990 onwards. Some eastern European countries submit data for years before 1990: Poland and Bulgaria from 1988, Hungary from 1986, and Slovenia from 1987. These are all based on clinker production data and largely use Tier II methods. This dataset covers about 10 % of current global cement production and is available as consistently structured spreadsheet files for each year. In addition, clinker production data were available for the US from 1925 (Hendrik van Oss, USGS, personal communication 2015).

Some non-Annex I parties have begun to include time series of cement emissions in their national communications, national inventory reports, and biennial update reports to the UNFCCC, and these estimates have been used directly. At the time of writing, the following countries reported useable time-series data: Armenia, Azerbaijan, Brazil, Chile, Indonesia, Jamaica, Mexico, Moldova, Namibia, South Africa, and Uzbekistan. In addition, Mauritania reports that all of its clinker is imported.

For China, which currently produces almost 60 % of global cement, clinker production data are available from 1990. China's emission factor is reported by NDRC (2014) as $0.5383\,\mathrm{t\,CO_2\,(t\,clinker)^{-1}}$, and this is used both in the second national communication (NDRC, 2012) and the first biennial update report (NDRC, 2016). Some studies have estimated other emission factors based on factory-level sampling (Liu et al., 2015; Shen et al., 2014), but here we use the officially sanctioned factor until or unless that is changed.

India, the world's second-largest cement producer with about 7 % of global production in recent years, does not officially report clinker production statistics. Data from the Cement Manufacturers' Association (CMA) are useful only until the 2009–2010 financial year when two large producers discontinued membership in the organisation (CMA, 2010). Clinker production data are also reported by business consultancies in their annual overviews of the industry in India. Data on the types of cement produced, combined with their likely clinker contents, can also be used to support this evidence base.

While Jamaica reported cement emissions for 2006–2012, the data source was clearly identified and additional clinker production data have been obtained to cover 1995–2015. Meanwhile, clinker production data for the Republic of Korea were readily available from its cement association for 1991–2015. Emissions estimates from these data matched those reported in official communications to the UNFCCC during overlapping periods.

Finally, for all remaining countries we have used survey-based clinker-ratio data from the WBCSD's Getting the Numbers Right initiative (WBCSD, 2014) combined with historical cement production data from the USGS. In many cases these clinker ratios are presented only for groups of countries but indicate the best available information about clinker ratios in those countries.

Most of these methods provide estimates only back to 1990 at best, and we therefore extrapolate for earlier years using cement production data combined with assumptions about how clinker ratios have changed over time. We make the basic assumption that most countries began their cement industries by producing ordinary Portland cement, a strong and very common cement type with a clinker ratio of 0.95, and over time introduced other types of cements with lower clinker ratios. This assumption reflects available observations. Specifically, the clinker ratio was set to 0.95 in 1970 with the IPCC default emission factor and linearly interpolated to the implied ratio and emission factor in the earliest year for which data are available for each country. For large cement producers covering more than 80 % of global production, USGS provides an estimate of cement production for 2016 (USGS, 2017), and this is used to estimate 2016 emissions for those countries. For other countries, emissions

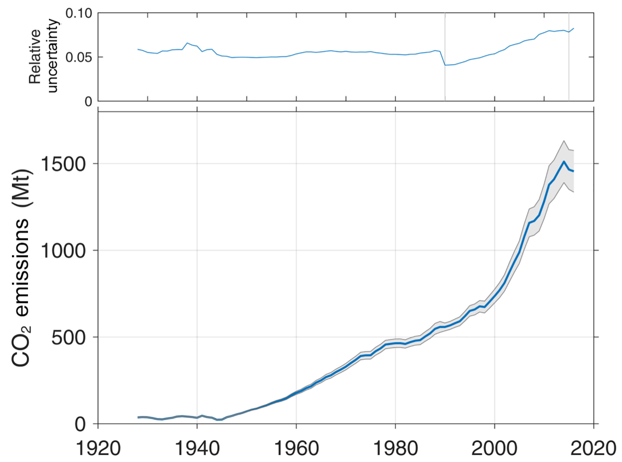


Figure 2. Global process emissions from cement production, with 95 % confidence interval. A step change in uncertainty occurs in 1990, reflecting a significant change in data availability.

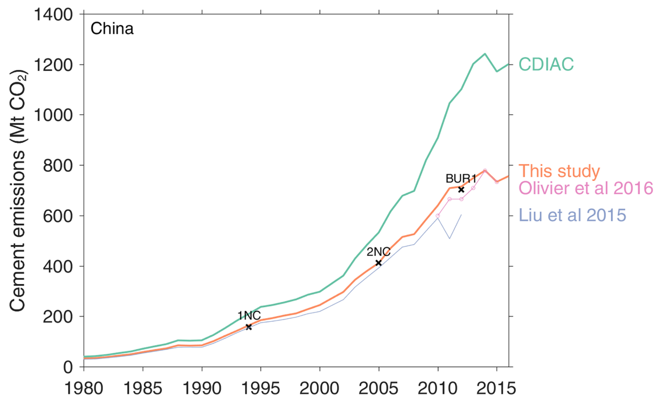


Figure 3. Process emissions from Chinese cement production, 1980–2016. 1NC refers to China's first national communication, 2NC the second, and BUR1 the first biennial update report. Also shown are estimates from CDIAC (Boden et al., 2017), Liu et al. (2015), and EDGAR v4.3.2 FT2015.

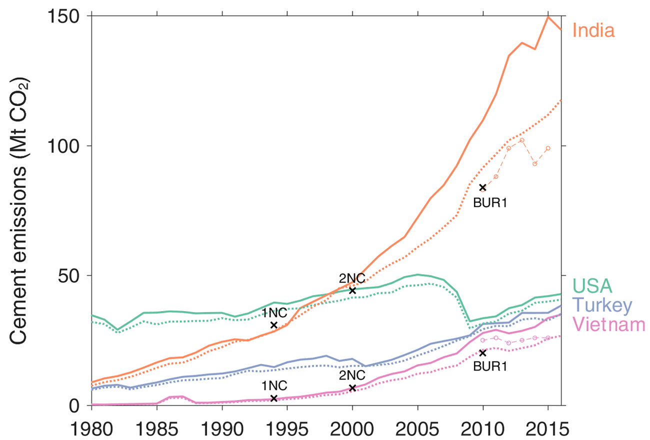


Figure 4. Comparing new cement emissions estimates (dashed lines) for the top four cement producers after China with those from CDIAC (solid lines) and official estimates (crosses, India and Vietnam) as reported to the UNFCCC (see text). The new estimates for the USA and Turkey come directly from national official estimates. Estimates from EDGAR v4.3.2_FT2015 are shown for India and Vietnam with round markers.

are assumed to be the same as in 2015. While this extrapolation is clearly not ideal, not extrapolating would result in very large discontinuities and frustrate any attempt at trend analysis, particularly any assessment of cumulative emissions. Extrapolating necessarily affects derived growth rates, but these growth rates are dominated by the changes in cement production much more than the extrapolation method.

It is clear from this that data quality is significantly higher from 1990 onwards, and estimates before then will have higher uncertainty. However, emissions prior to 1990 are also less important in the global policy debate, and because only about 30 % of historical cement production occurred before 1990, emissions from that period are also of lower importance for global carbon modelling and budget calculations. In addition, the rate of change of technology was much slower before 1990, with most adjustments to, for example, the clinker content of cement occurring in more recent times so that estimates for earlier years are less sensitive to assumptions. We estimate uncertainty in global cement emissions using a Monte Carlo approach, as described in Appendix C.

4 Results

Process emissions from cement production reached a peak in 2014 of $1.51 \pm 0.12\,\mathrm{Gt\,CO_2}$, subsequently declining slightly to $1.46 \pm 0.19\,\mathrm{Gt\,CO_2}$ in 2016 (Fig. 2). In comparison, CDIAC's estimate for 2014 is $2.08\,\mathrm{Gt\,CO_2}$ (Boden et al., 2017). The most recent estimate currently available from EDGAR is for 2015 at $1.44\,\mathrm{Gt\,CO_2}$ (Olivier et al., 2016), which is in very good agreement with our estimate for the same year of $1.47 \pm 0.11\,\mathrm{Gt\,CO_2}$. Cumulative emissions over 1928–2016 were $39.3 \pm 2.4\,\mathrm{Gt\,CO_2}$. The global average clinker ratio has declined from approximately 0.83 in 1990 to 0.66 in 2016 (Fig. E1), which is consistent with an estimate of 0.65 made by the IEA (IEA, 2017).

For China, emissions reached just under $800\,\mathrm{Mt\,CO_2}$ in 2014 (Fig. 3). The emissions estimated here show high agreement with the few official estimates reported, a direct consequence of our use of official data and emission factors. While China produced 57 % of the world's cement in 2016, its emissions were 52 % of the total, a consequence of its clinker ratio being less than 0.60 in recent years, which is below the world average. The results for a number of other countries are presented in the appendices.

Indian emissions are quite uncertain, but the methods used here produce results reasonably close to the few officially reported estimates (Fig. 4). In 2010 there is some divergence from the estimate in India's first biennial update report. In that year the data provided by the Indian Cement Manufacturers' Association are known to be incomplete, while other data sources indicate substantially higher clinker production in that year; this discrepancy is yet to be resolved (see Appendix D).

Aggregate uncertainty is relatively low through most of the historical period (Fig. 2, top panel), partly as a direct consequence of the choice of the Monte Carlo method with symmetric distributions and no correlation: errors tend to cancel. In 1990, with the beginning of most Annex I countries' detailed reporting to the UNFCCC, global uncertainty declines slightly but then gradually increases as more cement production occurs in developing countries where uncertainty is higher.

5 Data availability

All data used in producing this dataset and the resulting dataset itself are available on Zenodo at the following DOI: https://doi.org/10.5281/zenodo.831455.

The exception is the Getting the Numbers Right dataset from WBCSD, which is available from their website at http://www.wbcsdcement.org/GNR-2014/index.html.

6 Conclusions

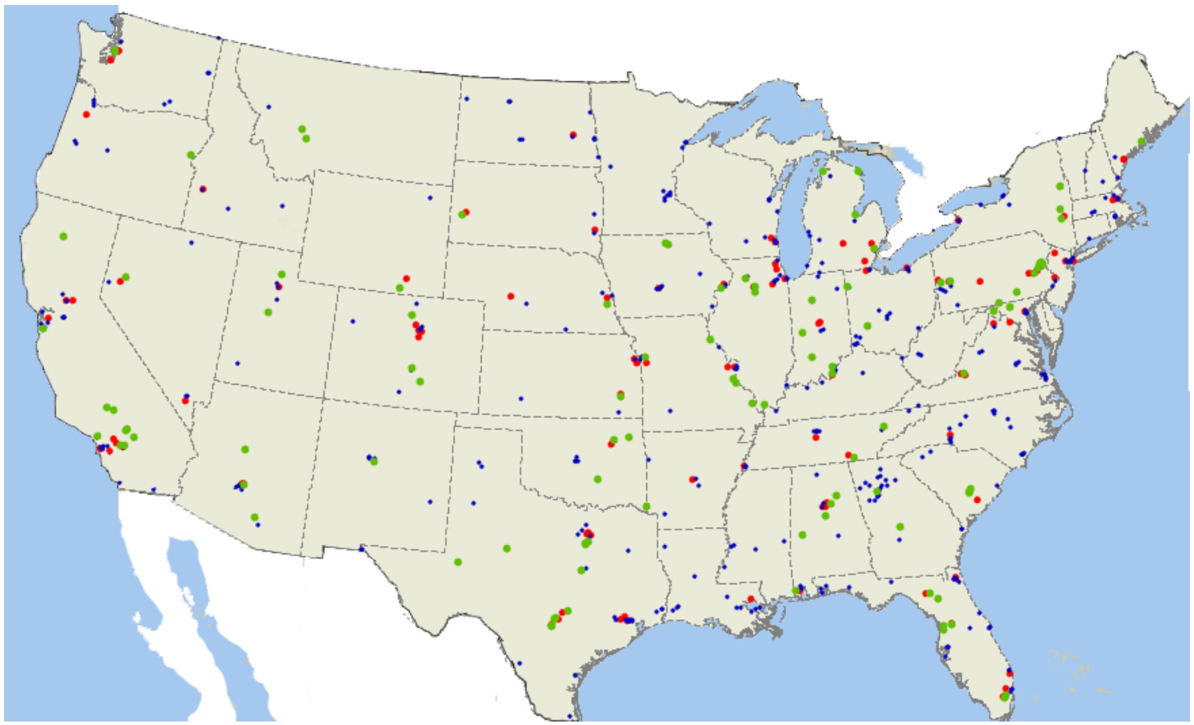
Estimating global process emissions from cement production is fraught with problems of data availability and has always required strong assumptions. Over the last 3 decades, countries around the world have increasingly been producing blended cements with lower clinker ratios, and the use of cement production data with constant emission factors has become untenable.

The new global cement emissions database presented here increases the reliance on official and reliable data sources and reduces the reliance on assumptions compared with previous efforts. It is intended that the database will be used in the global carbon budget and updated annually with both data updates and methodological improvements. As more countries estimate their emissions and report them to the UNFCCC in detail, more data will replace assumptions in producing this dataset. Work is still required in improving estimates of cement emissions from both China and India, in particular, as these are the world's two largest cement producers and official time-series estimates are lacking.

PCA
America's Cement Manufacturers™

UNITED STATES CEMENT AND CONCRETE INDUSTRY

- Offices - 120
- Plants - 104
- Terminals - 362



	Unites States	
	Cement	Cement & Related
Employees	12,229	162,263
Payroll ($)	911,244,000	8,061,570,000
Contribution to State Taxes Revenues ($)	270,813,634	2,395,827,094
Economic Contribution ($)	15,444,948,970	99,728,639,010

- A red dot indicates the location of a cement sales office or headquarters.
- A green dot indicates the location of a plant producing portland cement.
- A blue dot indicates the location of cement distribution terminals and silos.

PORTLAND CEMENT MANUFACTURING AND USE

Portland Cement Association (PCA) represents 92% of US cement manufacturing capacity with over 90 plants in 32 states and distribution facilities in every state in the continental U.S.

Cement and concrete product manufacturing directly or indirectly employs approximately 500,000 people in our country, and our collective industries contribute approximately $100 billion to our economy.

Cement or concrete? Concrete is basically a mixture of aggregates and paste. The aggregates are sand and gravel or crushed stone; the paste is water and cement. Portland cement is not a brand name, but the generic term for the type of cement used in virtually all concrete, just as stainless is a type of steel and sterling a type of silver.

Cement is manufactured by heating lime, silica, alumina, iron, and other materials at high temperature. The resulting substance is a marble-like ball called clinker that is ground, mixed with limestone and gypsum, and used to create concrete.

PCA
America's Cement Manufacturers™

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Washington, DC 20001-2066
202.408.9494 Fax 202.408.0877

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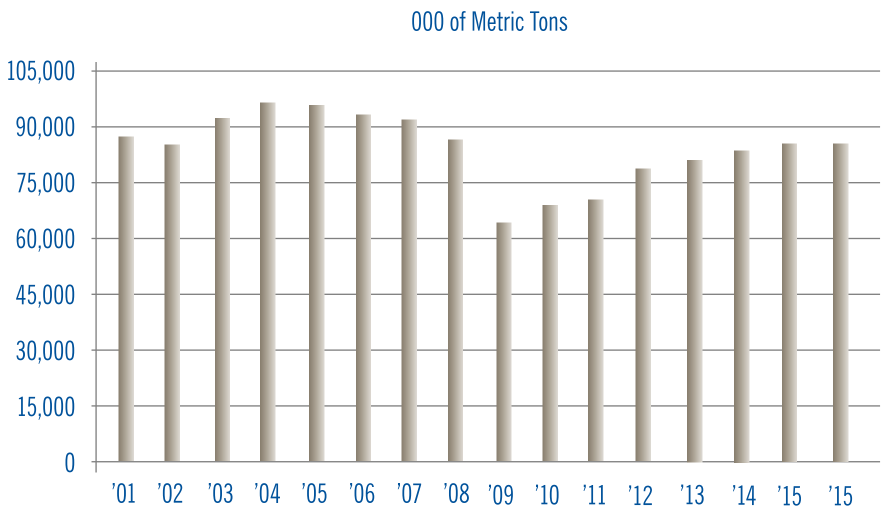
847.966.6200 Fax 847.966.9781
www.cement.org

Building the Foundation of America's Economy

US Cement Production



Source: PCA

U.S. Economic Data

- Clinker capacity: 101.3 million metric tons
- Cement consumption: 94.4 million metric tons
- U.S. cement companies have annual sales valued at approximately $10.7 billion

0022-12-200

Energy and Environment

The U.S. cement industry has long been committed to minimizing emissions, waste, energy consumption, and the use of virgin raw materials. For example, the cement industry began to address climate change in the mid-1990s—one of the first industries to do so. Over the past 40 years, U.S. cement manufacturers have reduced the amount of energy required to produce a ton of cement by over 40 percent. The industry also has reduced its use of traditional fossil fuels by over 15 percent.

Occupational Health and Safety

PCA members place the safety of their employees among their core values. The industry's commitment to safety contributed to the Federal government's recognition of 2015 as the safest year on record for Metal and Nonmetal miners, which includes our industry.

Transportation/Infrastructure

A well-functioning transportation network is the backbone of the U.S. economy and essential for U.S. businesses to compete globally and provide the best value to American consumers. Our nation's core infrastructure should not only be maintained, but also continuously expanded and improved to meet the needs of its citizens. Portland cement is an essential construction material and is uniquely positioned for the rebuilding of American infrastructure.

Benefits to Building with Concrete/Concrete Attributes

The American economy works most efficiently when guided by the market, while taking important public policy considerations, like safety, into consideration. Building owners, builders, architects, and designers have come to recognize that durable concrete public buildings, private homes, and businesses resist damage from natural disasters and reduce the impact entire communities have on our planet. Studies by MIT have shown that homes with concrete walls can use 8 to 15 percent less energy than other homes.

Sustainability and Resiliency

The industry is also a leader in sustainable material use and management, including reuse of industrial products as ingredients to make cement. Cement manufacturers often use alternative raw materials from industrial byproducts, such as those from coal combustion, steel blast furnace slag, and silica fume, keeping a large portion of these materials from being disposed of in landfills.

The durability and resiliency of cement-related products also lower our environmental footprint. Concrete does not rust, rot, or burn, saving energy and resources needed to replace or repair damaged buildings and infrastructure.

- Because of its rigidity, concrete pavement can enhance the fuel efficiency of vehicles that travel on roads when compared to other pavements. If concrete pavements were used by the U.S. road system, fuel consumption is estimated to decrease by 3 percent nationwide, equating to a reduction in fuel consumption of 273 million barrels of crude oil a year, and a corresponding reduction decrease of greenhouse gas emissions by 51.2 million short tons.
- The energy efficiency of buildings also improves when concrete is used. A concrete construction home has been demonstrated to require 6-12 percent less energy than code-compliant wood frame construction.

Section 4.3.1: Applicability

Kilns used in the pyroprocessing of Portland Cement clinker as defined in SIC Code 3241 (a crosswalk with NAICS codes is available at: https://www.census.gov/eos/www/naics/concordances/concordances.html).

Section 4.3.2: Summary Description / Air Emissions Factors

In the United States, the primary cement product is called Portland cement. Portland cement is a fine, grayish powder consisting of a mixture of four basic materials: limestone, silica, alumina, and iron compounds. Cement production involves heating (pyroprocessing) the raw materials (known as raw meal) to a very high temperature in a rotary (rotating) kiln to induce chemical reactions that produce a fused material called clinker. The cement clinker is further ground into a fine powder and mixed with gypsum to form the Portland cement.

The cement kiln is a large, rotating steel cylindrical furnace lined with refractory material. The kiln is aligned on a slight angle, usually a slope of 3°-6°. This allows for the materials to pass through the kiln by gravity. The upper end of the kiln is known as the cold or back end and this is where the raw materials, or meal, is generally fed into the kiln. The lower end of the kiln is known as the “hot” end. The hot end is where the combustion of primary fuels (coal, petroleum coke, natural gas, etc.) transpires to produce a high temperature.

The cement kiln is operated in a counter-current configuration. This means that the hot combustion gases are convected up through the kiln while the raw materials are passing down toward the lower end. The rotation of the kiln induces mixing and the forward progress of mixed materials. As the meal moves through the cement kiln and is heated by the hot combustion gases, water is vaporized and pyroprocessing of materials occurs.

When operating, the cement kiln can be viewed as consisting of three temperature zones necessary to produce clinker. Zone 1 is at the upper end of the kiln where the raw meal is added. Temperatures in this zone typically range from ambient up to 600°C. In this area of the kiln, moisture is evaporated from the raw meal. The second thermal zone is known as the calcining zone. Calcining occurs when the hot combustion gases from the combustion of primary fuels dissociates calcium carbonate from the limestone to form calcium oxide. In this region of the kiln, temperatures are in a range of 600°C to 900°C. The third region of the kiln is known as the burning or sintering zone. The burning zone is the hottest region of the kiln. In this region, temperatures in excess of 1,500°C induce the calcium oxide to react with silicates, iron and aluminum in the raw materials to form clinker. The formation of clinker actually occurs near the lower end of the kiln (close to the combustion of primary fuel) where temperatures are the hottest. The chemical reactions that occur here are referred to as pyroprocessing.

The clinker that leaves the hot end of the kiln is a gray-colored, glass-hard material comprised of dicalcium silicate, tricalcium silicate, calcium aluminate, and tetracalcium aluminoferrite. At this point, the clinker has a temperature of about 1,100°C. The hot clinker is then transferred into the clinker cooler. Once cooled, the clinker is ground into a fine powder and mixed with gypsum to produce Portland cement.

Cement kilns are either wet or dry processes. In the wet process, the raw materials are ground and mixed with water to form a slurry. The meal-water slurry is fed into the kiln through a pump. A greater amount of heat energy is needed in the wet process to evaporate the additional water.

In the dry process, the raw meal is ground to a fine, dry powder prior to entering the kiln. There are three types of dry processes: long-dry, preheater, and preheater/precalciner. Long dry kilns are similar to wet kilns, with the exception of the dry state of the raw materials. In preheater kilns, the raw material is heated prior to entering the kiln. This allows for a shorter kiln and lower combustion fuel use. Precalciners take this a step further by heating the raw feed to a level at which partial calcination takes place prior to entering the kiln. A typical preheater/precalciner kiln consists of a vertical tower containing a series of cyclone-type vessels. Raw meal is added at the top of the tower, and hot kiln exhaust flue gases from the kiln operation are used to preheat the meal prior to being introduced into the kiln. Preheating and precalcining the meal has the advantage of lowering fuel consumption of the kiln.

There are also two primary types of air pollution control devices (APCDs) for the kiln: fabric filters and electrostatic precipitators (ESPs). Either of these can be used on any of the four process types.

Cement manufacturing is an energy intensive manufacturing process. Fossil fuels are the primary sources of fuel. In addition, 15 cement plants in the U.S. currently supplement their fuel needs through the use of energy-bearing hazardous waste. For the last ten years, these facilities have been regulated by the Resource Conservation and Recovery Act's (RCRA) Boiler and Industrial Furnace (BIF) rules. As a result, a database has been developed characterizing emissions from these facilities. Testing and additional studies have contributed significantly to our understanding of dioxin formation in cement plants.

In developing Maximum Achievable Control Technology (MACT) standards for cement plants, EPA "considered both hazardous waste burning cement kiln and non-hazardous waste burning cement kiln data together because both data sets are adequately representative of general dioxin/furan behavior and control in either type of kiln. This similarity is based on our engineering judgement that hazardous waste burning does not have an impact on dioxin/furan formation, dioxin/furan is formed post-combustion." (See 64 FR 52876) APCD air inlet temperature (and the time that the air takes to enter the device) in conjunction with other site-specific elements is the determining factor.

On June 14, 1999, EPA published a National Emission Standard for Hazardous Air Pollutants (NESHAP) for the Portland cement industry in the Federal Register (64 FR 31898). In addition, on September 30, 2000, EPA published a NESHAP for hazardous waste combustors (including cement kilns that recover energy from hazardous wastes) in the Federal Register (64 FR 52828). These rules require, among other things, that all cement plants periodically conduct dioxin/furan testing.

Because only one test report applicable to reference year 2000 was located for a cement kiln burning nonhazardous waste (Bell, 1999), and the results from the tests were similar to the results reported by EPA in 1996 (U.S. EPA, 1996), EPA combined the results from the two data sets (U.S. EPA, 2006). The congener-specific emissions factors are presented in Table 4-7. As an operator/owner of a facility, you may elect to use more current information in the development of an emissions factor, or you may elect to use the EPA default. If you elect to use more current emissions factors, then you will be using Approach 2 (Section 2.1.2) to derive your emission estimate appropriate for your facility.

Table 4-7: Average Emissions Factors (ng/kg of

cement clinker produced) for Estimating Air Releases of Dioxin and Dioxin-like Compounds from Cement Kilns *Not Combusting* Hazardous Waste as Supplemental Fuel

CDD	Emissions Factor (ng/kg clinker)	CDF	Emissions Factor (ng/kg clinker)
2,3,7,8-TCDD	0.01	2,3,7,8-TCDF	0.73
1,2,3,7,8-PeCDD	0.03	1,2,3,7,8-PeCDF	0.10
1,2,3,4,7,8-HxCDD	0.03	2,3,4,7,8-PeCDF	0.22
1,2,3,6,7,8-HxCDD	0.04	1,2,3,4,7,8-HxCDF	0.17
1,2,3,7,8,9-HxCDD	0.04	1,2,3,6,7,8-HxCDF	0.05
1,2,3,4,6,7,8-HpCDD	0.39	1,2,3,7,8,9-HxCDF	0.01
1,2,3,4,6,7,8,9-OCDD	0.64	2,3,4,6,7,8-HxCDF	0.08
		1,2,3,4,6,7,8-HpCDF	0.13
		1,2,3,4,7,8,9-HpCDF	0.00
		1,2,3,4,6,7,8,9-OCDF	0.22
∑ CDD	**1.18**	**∑ CDF**	**1.71**
∑ Dioxin and dioxin-like compounds*		**2.89**	
Source: US EPA (2006)			
* ∑ Dioxin and dioxin-like compounds = ∑ CDD + ∑ CDF			

Sham Recycling-Part II: Burning Hazardous Waste in Cement Kilns

By Stephen Lester, CCHW Science Director

One of the most outrageous violations of environmental justice is the burning of toxics in cement kilns. Huge quantities of hazwaste are being burned in kilns as "supplemental" or "alternative" fuel. And because of a loophole in federal regulations, these kilns are exempt from virtually all laws that apply to burning hazardous waste. As a result, cement kilns operate with virtually no controls, releasing heavy metals and other toxic chemicals into the surrounding community.

This is quite "legal" according to the EPA. As long as a company claims it "recycles" hazardous waste, the waste is exempt from the usual regulations that apply to managing and disposing of hazardous waste. Yet these kilns perform the same function as EPA permitted commercial hazardous waste incinerators. They accept the same waste and they actively solicit for incineration business. But, they meet virtually none of the incineration standards designed to protect public health and the environment, weak as these may be.

Because of increased disposal costs and stricter regulations of licensed hazardous waste incinerators, more and more companies are turning to cement kilns as a place to dispose of their hazardous waste. According to Richard Fortuna of the Hazardous Waste Treatment Council (a pro-incineration lobby group in Washington, DC), each year more than 10 times as much chemical waste is burned in unregulated boilers and cement kilns than in EPA regulated hazardous waste incinerators!

Companies are sending their waste to cement kilns not only to avoid high disposal costs, but also to avoid potential liability. If the waste is not considered hazardous, then no one can come back later and sue them for clean up costs or for health damages as they could if the waste were disposed of in a landfill or licensed incinerator.

There are many problems with using cement kilns to burn hazardous waste. Most fundamentally, cement kilns are designed to cure cement, not destroy hazardous waste. They are different plants. In a cement kiln, a mixture of 80% powdered limestone and 20% clay or shale is burned at temperatures that range from 2250-2700F. At the end of the burning process, a "clinker" or hardened ash is formed which when powdered is cement. Some kilns are designed to make "aggregate" or the material that is added to cement to form mortar, plaster, etc. These kilns are called aggregate kilns.

Major modifications are needed to convert a normal kiln so it can burn hazardous waste: construction of receiving, storage and handling areas and installation of laboratory testing capacity to identify waste constituents. Modern commercial incinerators often have computers that monitor levels of certain emissions and other conditions. This capability doesn't exist on cement kilns. Toxic emission releases from kilns that burn hazardous waste is a major problem. No incinerator, kilns included, can destroy 100% of the waste, even with "state-of-the-art" pollution controls. Emissions typically include heavy metals such as lead, cadmium, nickel, mercury and chromium, partially burned organic chemicals and newly formed Products of Incomplete Combustion (PICs) that include dioxins and furans.

Emissions tests at a Paulding, Ohio kiln showed many toxic chemicals including toluene, trichloroethane, methylene chloride, methyl ethyl ketone (all in the original waste) as well as newly formed contaminants that included benzene, tetrachloroethylene, chloroform, naphthalene, styrene and xylene.

Several kilns that burn hazardous waste have been under fire. **National Cement** in Lebec, CA exceeded it's permit limits for arsenic, beryllium, cadmium, chromium, lead and mercury and was fined by the state in 1989. Marine Shale in Amelia, LA has recently been shut down by EPA because of air permit violations and has been fined more than $2M.

Some of these problems occurred because the kiln was operated during upset conditions. Upset conditions result when there is an operating or mechanic failure that prevents the kiln from operating properly. EPA estimates that emissions can be as much as 100 times higher during upset conditions.

The most common upset occurs when there is a rapid movement of clinker from the high end of the kiln to the lower end. The clinker often breaks away and falls like an avalanche pushing hot gases to one end of the kiln. This causes a tremendous surge of pressure in that end of the kiln. To prevent an explosion or damage to the kiln, release valves are built into the kiln. The valves open automatically releasing clouds or "puffs" of mostly unburned hazardous waste directly into the surrounding community. These emissions bypass all pollution control equipment and are highly toxic because they have not been completely burned in the kiln. The valves stay open until the problem has been corrected even after the pressure has gone down.

Other problems:

- Bottom ash and fly ash that contain high amounts of heavy metals and other toxic chemicals that can leach from its disposal site.
- Contaminated wastewater containing the same heavy metals and other toxic chemicals found in the stack emissions.
- High turbulence that generates large amounts of particulate.
- Inadequate air pollution controls.
- Potential explosion of incompatible waste.
- Transportation accidents involving trucks or trains carrying Hazardous waste to and from the kiln.
- Leaks and spills from storage tanks.
- Lack of training and experience in handling toxic chemicals.

All the benefits go to the kiln operator who stands to make more profit from burning (and disposing) of hazardous waste than from making cement. The risks fall on the community.

An excellent report written by **Greenpeace** estimates 24 cement kilns and 17 aggregate kilns are burning hazardous waste (sites listed in the report). There may be many more kilns burning hazardous waste since there's no reporting requirements.

For additional information:
"Cement Kiln Fact Pack," CCHW, 1996. Available from CCHW for $7.00.
"Incineration, the Burning Issue," CCHW, 1988. Available from CCHW for CCHW for $8.95.
"Sham Recyclers Part I, Hazardous Waste Incineration in Cement and Aggregate Kilns," Greenpeace, 1989. Available from Greenpeace, 1436 U Street, NW, Washington, DC 20009 for $5.

This article is a reprint, with some modifications, which originally appeared in *Everyone's Backyard,* Vol. 8, No. 5- October 1990

Rachel's Environment & Health News

#174 - Hazardous Waste Incineration In Cement Kilns: 'Recycler's' Paradise

March 27, 1990

The federal Resource Conservation and Recovery Act (RCRA) is supposed to regulate the generation and disposal of hazardous chemical wastes "from cradle to grave."

Unfortunately, Congress built a feature into the law that EPA (U.S. Environmental Protection Agency) has turned into a loophole. Today, enormous quantities of hazardous waste are escaping regulation through this loophole. Specifically, Congress exempted "recycled" chemical wastes from control under RCRA, and EPA ruled that chemical wastes burned as fuel in industrial boilers, industrial furnaces, aggregate kilns and cement kilns are being "recycled" and are thus exempt from RCRA regulation.

According to Richard Fortuna, director of the Hazardous Waste Treatment Council (an incinerator industry group in Washington, DC), 50 billion pounds of chemical wastes are being burned in unregulated boilers and kilns each year, compared to only 5 billion pounds (or less) being burned in RCRA-regulated hazardous waste incinerators.[1]

A recent report from Greenpeace describes the burning of chemical wastes in aggregate kilns and cement kilns. Page numbers in our text, below, refer to this report, SHAM RECYCLERS, PART 1: HAZARDOUS WASTE INCINERATION IN CEMENT AND AGGREGATE KILNS.

Cement is the raw material from which concrete is made. In a cement kiln, powdered limestone and clay are burned at high temperatures to form a "clinker" that is later ground into a fine powder, which is cement; when water is added to this powder, it hardens. Certain "aggregates" can be added to cement to make mortar, plaster, concrete or other similar materials. As with cement, aggregates are formed by firing them in a hightemperature kiln. Thus aggregate kilns and cement kilns seem ready-made for destroying hazardous wastes. They have to be heated to high temperatures with fuel, so why not substitute hazardous wastes for part of the fuel and burn up the wastes while making aggregate or cement? Save on fuel and destroy wastes--what could be better? This was the question Greenpeace's Science Director, Pat Costner, and her colleague Joe Thornton, set out to answer.

There are at least 24 cement kilns and 17 aggregate kilns in the U.S. burning hazardous wastes today (listed on pgs. 31-33). Together, they burn approximately 3 billion pounds of hazardous wastes, and a recent industry analysis says this amount could double between 1989 and by 1992 (pg. 8).

It is difficult to obtain data on destruction of wastes in kilns precisely because kilns are exempt from RCRA; kilns are not required to meet the permit requirements of regular hazardous waste incinerators, nor are they subject to the operation and emissions standards that control regular hazardous waste incinerators. So long as a company claims to be using hazardous waste as a fuel or as a raw material, they are classified as "recyclers," and there is essentially no review process within EPA to check their claims or their operations. Thus a fraudulent company, bent on unregulated waste disposal, has an easy time exploiting this exemption within RCRA. Marine Shale Processors in Amelia, Louisiana, which was recently closed down by EPA after national TV threw a spotlight on them, is a notorious example of a fraudulent waste hauler disguised as a kiln operator.

Even when the intention is not to defraud, destruction of wastes in kilns is highly questionable. As Costner and Thornton make clear, there are about a dozen good reasons for wanting to prevent wastes from entering kilns. Here are some of them:

Typical wastes burned in kilns include paint, ink, and coatings manufacturers' wastes, spent halogenated and non-halogenated solvents generated by a wide variety of manufacturing processes, still bottoms from solvent recovery operations, petroleum industry wastes, and waste oils including crankcase oil, transmission fluid, hydraulic and compressor fluids and coolants. Typically, 1.35% of these wastes are metals (including cadmium, arsenic, chromium, lead, mercury, zinc, and thallium). If 1.35% seems like a small amount, remember that 1.35% of 3 billion pounds is 40.5 million pounds of metals. Metals make trouble in incinerators--they are not destroyed but instead pass through the furnace into the outside environment, often in forms that make them more dangerous than when they first entered the kiln (e.g., attached to fine [extremely small] particles that can readily penetrate human lungs or can leach into groundwater) [see RHWN #131, RHWN #132, RHWN #134, RHWN #136, and RHWN #162].

Kilns burning hazardous wastes emit 66% more particles (soot, smoke, haze) than kilns burning normal fuel. Kilns burning halogenated wastes (containing chlorine, bromine, fluorine or iodine) emit 203% more particles than kilns burning normal fuel (pgs. 12, 26). This increased production of particles provides a pathway for metals to escape the incinerator in a form that is particularly dangerous to humans. The metals become attached to the outside of the fine particles and thus become available for humans to breathe. Costner and Thornton estimate that some 2 million pounds of metals may leave kilns attached to fine particles each year (pg. 23). Measurements at one kiln in California indicated it was releasing 15,000 pounds of metals into the local environment via airborne particles each year; measurements at a Florida kiln revealed airborne releases of 21,000 pounds of metals per year (pg. 23). Tests at an Illinois kiln revealed that burning hazardous wastes increased lead emissions 82%, chromium 167% and zinc 662%, compared to the same kiln burning normal fuel (pg. 23).

The fly ash from kilns is loaded with metals if the kiln burns hazardous wastes. Based on EPA data, Costner and Thornton estimate that 18.6 million pounds of metals enter the U.S. environment in fly ash from kilns each year (pg. 25). These metals are in a particularly leachable form, having a large surface area, and are thus available to enter water and living things (see RHWN #162). The high alkalinity (high pH) of kiln ash makes kiln ash even more leachable than ash from normal hazardous waste incinerators (pg. 25). At least two ash disposal sites for cement kilns are on the Superfund list, and neither kiln is supposed to have burned hazardous waste (pg. 25).

Advocates of hazardous waste incineration in kilns often claim that kilns destroy 100% of the wastes entering the furnace. Unfortunately, available data reveal this is not true by a wide margin. Kilns do operate at high temperatures (2000 to 3000 degrees Fahrenheit), but metals are not destroyed at any temperature. Furthermore, a class of chemicals called "products of incomplete combustion" (PICs, which include dioxins, furans, and a broad range of other organic chemicals) are created in a kiln, not in the furnace itself but in lower- temperature parts of the machine (smoke stack, pollution control devices, or ambient air outside the incinerator) (pgs. 18-21, 27-30).

The production of PICs is enhanced by "upsets," which occur in kilns several times each month, when something goes wrong with the machine. During these periods, puffs of hazardous chemicals are emitted into the local environment (pg. 18).

Another source of problems may be chemical releases resulting from transportation accidents. A typical kiln will burn 1,800 tank-truck loads of hazardous wastes per year. Many such trucks operate dangerously, in violation of applicable laws (pg. 18).

--Peter Montague

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[1] Personal communication March 19, 1990, from Richard Fortuna, executive director of Hazardous Waste Treatment Council, Washington, DC; phone (202) 783-0870.

■ BURNING QUESTION

Cement Companies Go Toxic

JOCK FERGUSON

The growing toxic appetite of U.S. cement makers is one of the best-kept dirty secrets of the Reagan/Bush years. More than a million tons of burnable plastic residue, used oil and waste solvents generated by industry are trucked each year to twenty-two cement kilns across the country to be burned as fuel. Lax environmental rules promulgated in the mid-1980s encouraged makers of the country's primary construction material to become major disposers of toxic chemical wastes. And more cement makers want in on the lucrative toxic-waste trade.

The industry's propaganda is persuasive. It preaches that its sophisticated rotary kiln technology, which can attain 2,000-degree temperatures, totally destroys any chemical wastes it burns. And it claims it is performing a socially valuable function by recycling industry wastes for their fuel value. But in 1992, ten years after the practice began, the Environmental Protection Agency finally got around to testing cement kilns. Not surprisingly, it found that the industry claims were wrong.

Chemical wastes added to coal produce the heat to fuse limestone, clay, iron and aluminum into cement. During this process small amounts of the chemical wastes end up in both the cement and the dust leftovers. Some of the dust blows

Jock Ferguson is a reporter for the Toronto Globe and Mail.

out tall kiln stacks into the air, while most of it goes into landfills. The E.P.A. concluded that burning the wastes produces toxic surprises in finished cement and in the large volumes of dust left over from production. Dioxins, furans (unwanted toxic chemicals produced during incineration), even plutonium were found in recent months by E.P.A. scientists as they completed analysis of their first tests on cement kilns. It is now clear that many Americans living in the vicinity of the nation's 114 cement plants are being exposed to toxic pollutants.

"The fact that we found dioxins, furans and plutonium at all makes the test results significant," said Bill Schoenborn, who heads the E.P.A.'s cement test program. He hastened to add that so far "the E.P.A. has made no assessment of the significance of the data for human health." However, the agency is so concerned with its findings that it rushed out to test another six kilns last month.

Cement makers became toxic junkies because of their insatiable appetite for fuel to generate the high temperatures needed in the large rotating kilns. Instead of having to pay for fuel, cement makers are now earning millions as toxic waste disposers—what the industry calls cement kiln recycling, in which coal, oil and natural gas are replaced by chemical wastes. Imagine the delight of financially strapped cement makers when they were able to eliminate expensive fossil fuel and replace it with highly noxious wastes that other industries paid them to burn. Recently, some companies started blending contaminated solid industrial wastes into the liquids to make the waste trade even more lucrative. The Lafarge Corporation, the country's leading chemical-waste-burning cement maker, is reportedly making as much as $1 million a month in the toxics trade at its plant in Alpena, Michigan, where it has E.P.A. approval to push as much as 17 million gallons of chemical wastes through its kiln each year.

The startling E.P.A. findings on toxic cement have prompted Clinton staff members to consider placing a moratorium on new chemical waste incineration applications until a thorough review of human health and environmental hazards has been completed.

The new First Couple has more than a passing acquaintance with the multinational cement industry. Hillary Rodham Clinton served on the board of directors of Lafarge. She resigned last April after environmentalists and some prominent Clinton supporters succeeded in getting the Texas legislature to turn down Lafarge's proposal to burn hazardous waste in its New Braunfels, Texas, cement plant. Lafarge has recently been the target of both state and E.P.A. investigators. Its Fredonia, Kansas, cement plant is high on the E.P.A.'s list of toxic polluters; the agency found significant quantities of lead, cadmium, chromium, arsenic, dioxin and furan contamination in its cement dust.

In Michigan, state environmental officials detected excessive dioxin and furan air emissions from Lafarge's Alpena plant last July, and then in October cited the Alpena facility for failing to comply with E.P.A. operating rules, the same offense that resulted in Lafarge being fined $1.8 million in September for violating operating rules at its plant in Demopolis, Alabama.

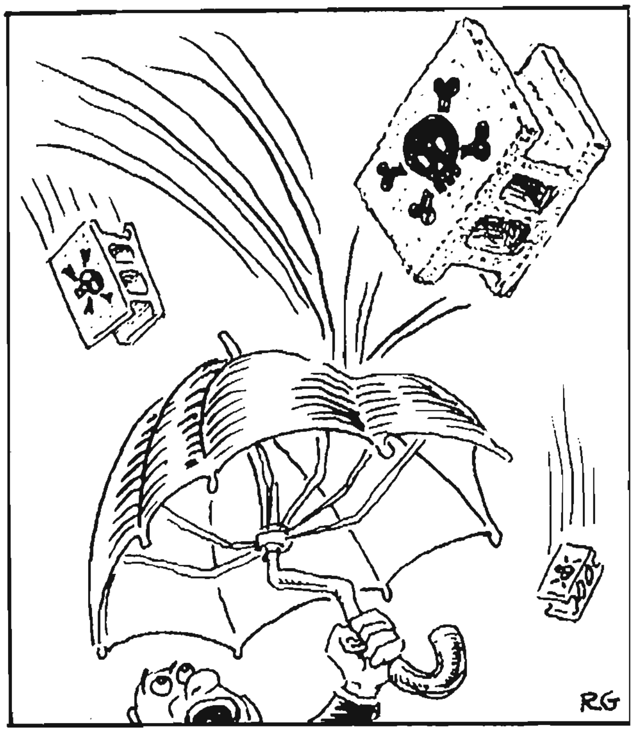
The cement makers' claims of environmental safety were shattered last spring when E.P.A. scientists visited fifteen cement plants across the country and took samples of finished cement and waste cement dust. Eight of the plants were hazardous waste burners, while the other seven used coal, oil or natural gas. The analysis took months to complete, but by November it was clear to government officials that they had a serious problem on their hands.

The most flagrant polluter is River Cement's Festus, Missouri, plant, about thirty miles south of St. Louis. Owned by Italy's prominent Agnelli family, it had by far the largest levels of dioxins and furans in its cement dust, and to a lesser extent in its finished cement. It also had high lead and cancer-causing solvent contamination. In Chanute, Kansas, Ash Grove Cement also had unexpected dioxin and furan readings.

Environmental officials were also alarmed to find low levels of plutonium in three cement plants that are near nuclear facilities: Southdown cement in Lyons, Colorado, near the infamous Rocky Flats nuclear test range; British-owned Blue Circle's Harleyville, South Carolina, plant; and Holnam's Tijeras, New Mexico, plant.

"We're poisoning ourselves through these toxic emissions from cement kilns," said Ed Kleppinger, a Washington consultant critical of lax environmental regulation of cement makers. By his calculation at least 3,500 tons of lead a year are emitted into the air or in waste dust annually from cement kilns. "That's between 5 and 10 percent of all annual lead emissions in the United States," he said.

Toxic contaminants in cement will carry over into concrete and into the concrete pipe used to transport much of the na-



tion's drinking water, he added. But the E.P.A. findings give an incomplete snapshot of the problem; only full-time monitoring of the plants can provide an accurate picture of the cumulative environmental and human-health damage caused by toxic cement kiln emissions.

Even the industry's Washington lobbyists are concerned about the findings. If the E.P.A.'s February tests show more toxic contamination, the industry's lucrative waste-disposal sideline will "have a serious problem," admitted Richard Creighton, executive director of the Cement Kiln Recycling Coalition. He claimed that the industry had no desire to imperil human health or the environment and was committed to doing whatever was necessary to eliminate the toxic residues.

The country's two largest cement makers and chemical waste burners are Lafarge, which is controlled by Lafarge Coppée of France, and Holnam, which is controlled by Holderbank Financière Glaris of Switzerland. They are leading members of an international cement cartel that has rigged cement markets in Europe and Canada and kept cement and concrete prices artificially high [see Ferguson, "The Sultans of Cement," August 3/10, 1992].

The cement industry's cozy dealings with successive Republican administrations have enabled it to operate with little government regulation. The nation's fifty-three commercial hazardous-waste incinerator operators and several environmental groups filed suit against the E.P.A. in June 1991 in an attempt to force the agency to make cement companies operate under the more stringent rules that apply to commercial incinerator operators. Both industries handle many of the same wastes. The E.P.A.'s cement kiln contamination findings are sure to lend impetus to the suit.

Another regulatory loophole allows the cement industry to treat the 6 million tons of contaminated cement kiln dust generated annually as if it were normal household garbage that can be dumped in any sanitary landfill. Unbelievably, 114,000 tons of highly alkaline dust were sold to farmers in 1990 to sweeten acidic soil. Heavy metals, dioxins, furans and even trace amounts of radioactive material were plowed into fields used in food production.

If the E.P.A.'s new round of cement kiln tests shows continued toxic emissions, then Carol Browner, the agency's new Administrator, should curtail agricultural uses of cement dust and consider eliminating the industry's lucrative toxic sideline. It remains to be seen whether the Clinton Administration will place the health of citizens above the profits of industry. □

■ BUSINESS

The cement makers' long, sweet ride

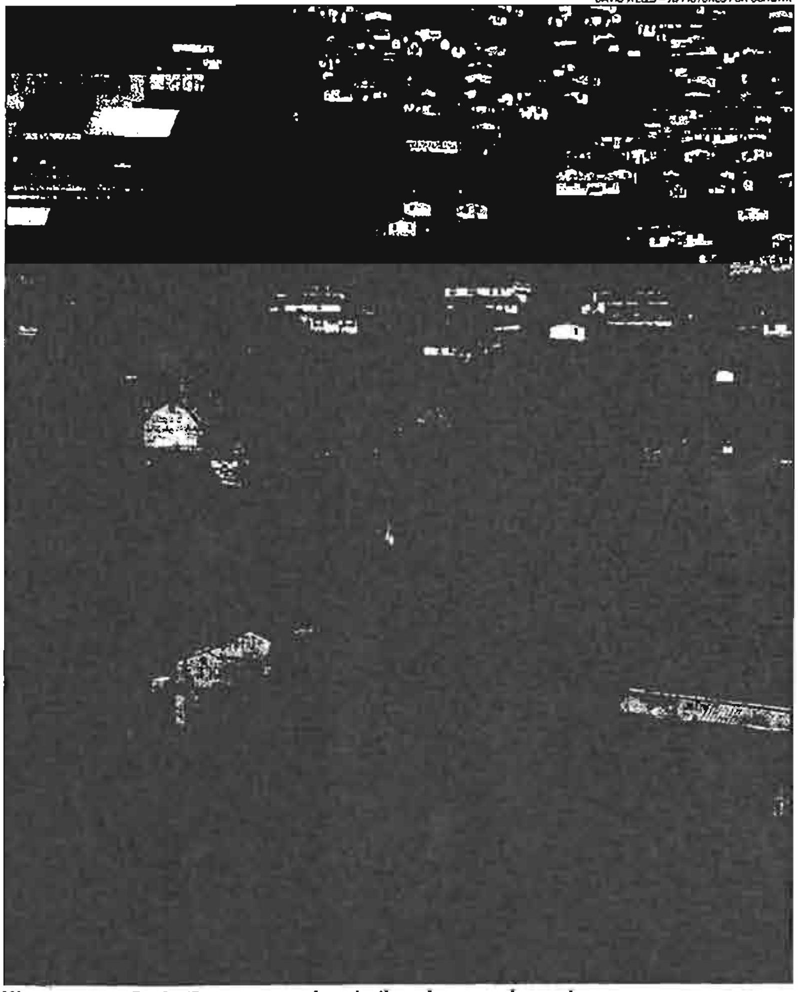
And Washington's new environmental war

U.S. NEWS INVESTIGATIVE REPORT

On flat farmland outside the town of Paulding, Ohio, sits an agglomeration of storage tanks, conveyors and long, rotating kilns that burn 60,000 tons of hazardous waste a year. Yet ask anyone who lives nearby about Ohio's major burners of toxic substances and the Lafarge Corp.'s Paulding cement plant isn't likely to come to mind. What does is the new Waste Technologies Industries incinerator located clear across the state, in East Liverpool.

The newer facility got a lot of attention last December when Vice President-elect Gore threatened to keep it from opening pending a congressional study. But the fact is, more

DAVID WELLS – JB PICTURES FOR USN&WR



Waste not. *A Bath, Pa., cement plant built to burn coal now burns wastes, too.*

BUSINESS

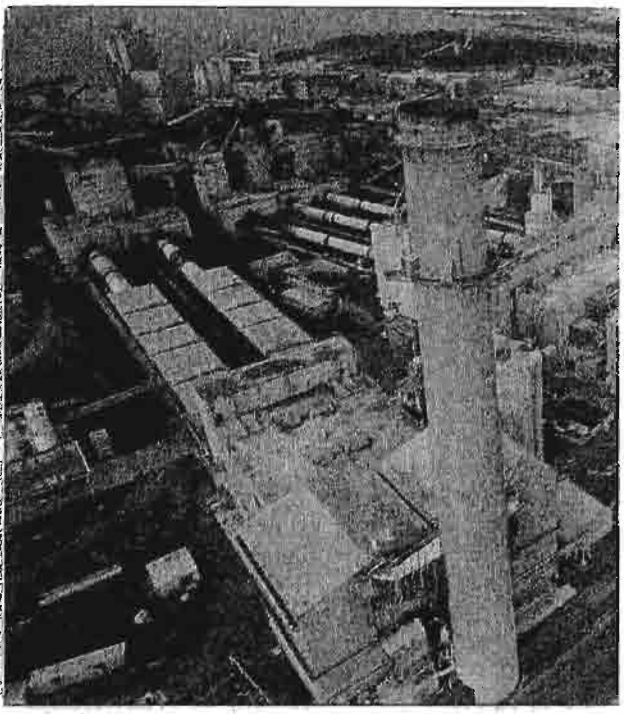
hazardous materials are burned in cement kilns like the one in Paulding than at big commercial incinerators like the one in East Liverpool. Indeed, at least a million tons of industrial solvents, plastic waste and oily sludge from petroleum refineries is burned as fuel each year in more than 20 cement plants scattered around the country.

For the cement industry, burning other people's dangerous waste is a boon. First, the industry saves millions by buying and burning less coal. Second, it charges hazardous-waste generators up to $800 a ton to burn their waste. Since 1984, when Congress decreed that some hazardous wastes could no longer be buried in landfills, cement companies have more than doubled their consumption of such wastes, bolstering their bottom lines in the process.

Poor grades. Combustion of hazardous waste at cement kilns was virtually unregulated until two years ago. Now there are plenty of rules governing how cement plants and other boilers and industrial furnaces burn hazardous materials. But they have been enforced only spottily. An examination of Environmental Protection Agency inspection reports and enforcement found numerous problems. An internal EPA memo obtained by *U.S. News* put the issue in blunt terms: "We are finding violations of basic, longstanding, fundamental requirements." Of the plants inspected recently by the EPA, 20 percent did not adequately train personnel; 56 percent failed to properly analyze waste they burned, and 62 percent failed to comply with rules for feeding waste into the kilns—failures that can result in excessive emissions of toxic substances.

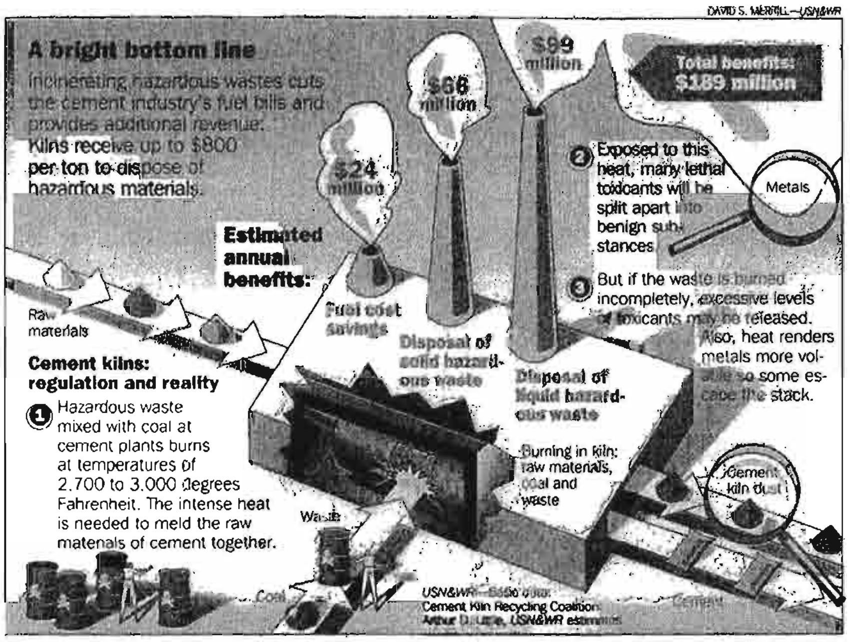
For instance, EPA rules require cement plants to test each batch of incoming waste they burn. Yet at Lafarge's Citadel plant in Demopolis, Ala., inspectors found Lafarge had simply run a pipe between its cement kiln and Systech Environmental Corp. next door, which collects and sells hazardous waste. An EPA enforcement order charged that Lafarge was not getting a detailed analysis of the waste before burning it in the kiln. Lafarge contested the complaint, arguing that its testing was adequate.

In theory, cement kilns are a good choice for disposal of many types of hazardous waste. Typically, the kilns burn at around 2,700 degrees Fahrenheit. The intense heat splits apart many lethal chemicals into more-benign substances. The process is simple: Cement manufacturers add hazardous wastes to the coal they burn ordinarily. The waste and coal generate heat, which then melds clay, limestone, iron ore and sand into small stones called "clinker." The clinker is later ground up with gypsum to make cement.



Toxic fears. *Federal regulators vow to get tough on plants that burn hazardous waste, like this one in Alpena, Mich.*

DAVID S. MERRILL—USN&WR



The trouble with this process is that no one fully understands the health and environmental consequences of burning hazardous waste in cement kilns. EPA officials concede they don't know what the effects are of the hazardous-waste residue left in the cement. Indeed, the agency can't even say for sure how many plants are burning the stuff, although one EPA official says the number is "very, very close to 23."

What EPA scientists do know now is that clinker from kilns that burn hazardous waste can be laced with low levels of toxic substances, including heavy metals and dioxins. Cement made from clinker goes into making everything from hospitals to schools and water mains. The agency is doing further work to determine the source of the contaminants and whether they pose a health threat.

Determining how stack emissions affect public health is similarly difficult. Because there are so many sources of pollution in any community, it is difficult to isolate the impact of the wastes that are burned by kilns. At last May's International Congress on the Health Effects of Hazardous Waste, however, several studies identified respiratory and neurologic problems in people living downwind of facilities that burn hazardous

KEVIN HORAN FOR USN&WR

waste. The studies linked the health problems with exposure to the discharge from these facilities.

Helping hand. Despite such concerns, the cement industry has been largely untroubled by federal overseers. In 1980, the EPA exempted cement kilns, industrial boilers and furnaces that burn hazardous waste as fuel from the restrictions imposed on commercial incinerators, whose sole purpose is to burn waste. That same year, the cement industry got a helping hand from Alabama Rep. Tom Bevill, who introduced an amendment to the federal Resource Conservation and Recovery Act. The amendment exempted dust from cement kilns and ash from coal burning, among other "special wastes," from the act's strict disposal guidelines until after the EPA had determined whether the wastes were hazardous. Today, 13 years later, the agency still has not completed its study; EPA officials promise it will be done by year's end. Owners of commercial incinerators, which have to treat their waste ash as a hazardous material, complain that the loophole for cement kilns puts them at a competitive disadvantage. Bevill, whose district has a cement plant, claims that another congressman inserted the language exempting cement kiln dust: "My father was a coal miner," Bevill says. "My amendment was about coal."

After cement companies jumped into the hazardous-waste business in the early 1980s, Congress did respond. In 1984, the EPA was authorized to begin regulating the burning of hazardous waste at cement kilns. That same year, Dallas–Fort Worth Rep. Martin Frost ensured that only smaller towns would have to contend with the powerful cement industry. Frost inserted language into the RCRA declaring that if a kiln was located in a city of 500,000 or more, it had to meet the tougher guidelines imposed on commercial incinerators. Dallas, at the time, was battling a cement company intent on burning hazardous waste. The unforeseen result? Today, nearly every cement kiln burning hazardous waste is doing so in smaller communities.

The EPA, over the same period, pretty much looked the other way. In amending the RCRA to include the burning of hazardous waste by cement plants, Congress gave the EPA two years to come up with regulations; however, EPA officials took six. "The agency moved forward at a pace that was reasonable," says Bob Holloway, chief of the combustion section in the EPA's Office of Solid Waste. "Just because Congress says something doesn't mean that it's a pressing environmental concern."

Finally unveiled in 1991, the new regulations for the cement industry were still flawed, according to Hugh Kaufman, a frequent internal critic of the EPA. There was no emissions standard for dioxin, for instance. More important, cement companies have been allowed to police themselves in what amounts to an honor system until the EPA or state agencies get around to reviewing them for full operating permits.

Confronted with these findings, EPA chief Carol Browner has declared her intentions to get all hazardous-waste-burning facilities under full permits and rigorous controls as quickly as possible. In the meantime, the EPA will impose tougher standards on existing facilities and freeze all new burning. The Cement Kiln Recycling Coalition, an industry trade group, has accused the EPA of acting precipitously. The coalition claims that the strategy will handicap the industry, and it has challenged the EPA in federal court. Given the friendly treatment it has enjoyed from Washington for the past decade, it is anyone's guess how the industry will respond as the EPA starts cracking the whip. In the meantime, Americans living near cement kilns that continue to burn hazardous wastes can only watch, wait and wonder. ■

BY BETSY CARPENTER
AND DAVID BOWERMASTER

SOME THOUGHTS AND INFORMATION
13 May 1992 Volume III Number 4

The Only Cement Kiln Burning Hazardous Wastes in the U.S. with a Complete Part B RCRA Permit Forced to Shut Down

CANNOT MEET DIOXIN STANDARDS

o St Mary's/Peerless Cement in Detroit is the only fully permitted cement kiln hazardous waste incinerator in the U.S. Because of the Frost Amendment they were forced to get an incinerator permit rather than complying under the weaker BIF-Interim Status rules. They cannot meet their permit. Their chlorinated dioxin and dibenzofuran (PCDDs, PCDFs) levels are reported to be over 50 times their permit.

The St. Mary's data may also be one of the reasons why the U.S.-Canadian International Joint Commission on the Great Lakes has called for a ban on hazardous waste incineration in certain areas near the lakes. Watch out Lafarge in Alpena!

o There is no reason to believe that <u>any cement kiln</u> burning highly chlorinated hazardous wastes will not also produce significant levels of PCDDs and PCDFs. Indeed, since cement kilns are not designed and operated for waste destruction, and there is some level of chlorides and organics in the raw materials and normal fuels, the kiln probably represents a significant source of PCDDs and PCDFs into the community even when not burning hazardous waste. As I have repeatedly said, cement kilns are not that efficient a combustion device. They are designed and operated to be efficient heat transfer devices.

o Lafarge misleads again. **"Formation of [P]CDD's and [P]CDF's will not normally occur in the alkaline cement kiln environment."** [26 June 1990] Lafarge's lack of knowledge would by laughable if they were not engaging in activities which if not properly done will damage the environment and public health. Cement kiln incineration of hazardous wastes under Interim Status is equivalent to allowing the practice of medicine without a license!

o The European standard for hazardous waste incinerators is 0.1 ng/m^3, TCDD equivalents. The Detroit standard is 0.14 ng/m^3. Make sure that your cement kiln incinerator meets or exceeds this standard. Can they? Lafarge states that they are the best technology? Are they willing to meet this standard? Is it a lie or is it the truth? Time will tell. I hope that it is the truth since I believe that cement kilns are not able to meet a real best technology standard, and this means that Lafarge and other cement kilns will be out of the commercial hazardous waste incineration business.

o The Southdown Fairborn, Ohio cement kiln hazardous waste incinerator was tested in April 1991. They did not meet the Detroit PCDD and PCDF standards while burning hazardous wastes. Southdown met the standard on a coal only burn.

o Southdown submitted some data to EPA as part of the BIF rule making. They note a coal burning preheater kiln and a long kiln [wet or dry?] burning coal, and 16% and 37% hazardous waste. The "CDD/CDF" equivalents are reported as 20, 18.7, 0.7 and 0.6 respectively, as compared to the 0.14 Detroit standard. The increased emissions while burning coal only may be due to relative chlorine and raw material organic levels. In any event, none of the four burns reported by Southdown meet the Detroit permit conditions. Note that the one coal only test result is one hundred and fifty times the Detroit standard, and 200 times the incinerator standard.

o The Ash Grove Louisville, Nebraska kiln was tested by EPA in 1990. At least one test run exceeded the Detroit standard.

o The Continental Cement Company kiln in Hannibal, Missouri was tested by EPA in 1990. In the test burn report, TCDD equivalents were calculated. They ran tests while burning coal, coal and solid and liquid hazardous wastes (two tests), and coal and diesel oil. The latter test burn condition was required because the coal they were burning was of such very poor quality. The results were 1.190, 3.323, 5.910, and 3.43 as compared to the Detroit standard of 0.14.

The conclusion is inescapable. If our public health and environmental quality goal in this country is to eliminate by incineration [after minimization and pollution prevention efforts] residual, organic, hazardous wastes and minimize chlorinated dioxin and dibenzofuran emissions, then cement kilns should not be allowed to burn hazardous wastes.

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PLEASE COPY THIS NEWSLETTER AND SEND IT ON TO OTHERS.

INFORMATION IN THIS NEWSLETTER WAS SUPPLIED BY MANY CITIZENS. PLEASE SEND IN YOUR ITEMS ABOUT CEMENT KILN INCINERATION. HELP MAKE THIS NEWSLETTER A MORE USEFUL TOOL FOR ALL OF US.

I HAVE BEEN KNOWN TO MAKE ERRORS. IF ANY INFORMATION IN THIS NEWSLETTER IS THOUGHT TO BE INACCURATE, PLEASE LET ME KNOW.

INCINERATION TECHNOLOGY: CEMENT KILNS INHERENTLY UNSAFE

Cherie Trine 6/91

Incineration is an engineered process using thermal oxidation of a waste material to produce a less bulky and, *in theory*, less toxic material. Thermal oxidation is the combination of a substance with oxygen in the presence of heat, also called combustion. Effective incineration is dependent upon adequate amounts of time, temperature, turbulence, *and* oxygen.

Emission gases contain carbon dioxide (CO_2); water (H_2O); *uncombusted organic compounds* from the waste feed; inorganic compounds such as metals which do not combust; *products of incomplete combustion (PICs)* which form from the breakdown and recombination of the original compounds into new forms; and *new inorganic compounds* formed during combustion, such as carbon monoxide (CO), nitrogen oxides (NO_2), hydrogen chloride (HCL), and oxides of sulphur.[1]

RCRA REGULATED INCINERATORS

A Resource Conservation and Recovery Act (RCRA) permitted commercial incinerator is specially designed and operated for the sole purpose of hazardous waste destruction. [see fig.2] Most of these incinerators are less than five years old, either new or completely rebuilt and modified. In order to meet RCRA standards, they have had to incorporate the best available combustion technology.[2] The principle type of incinerator used today is the rotary kiln equipped with an afterburner, an auxiliary fuel firing system, and continuous emission monitoring systems (CEM's).[3]

An afterburner is operated at temperatures greater than those used in the rotary kiln. The primary function of the kiln is to convert solid hazardous waste into gases that are then burned. The afterburner serves as a gas destruction part of the system prior to gas quenching (cooling) and scrubbing or filtering. An auxiliary fuel firing system brings the kiln up to and maintains the desired operating temperatures using separate or special burners. CEM's help maintain control of the process, which is vital to environmental protection. RCRA permitted incinerators are required to have a variety of CEM's interlocked to automatic waste feed cutoffs when prescribed conditions are not observed.[4]

CEMENT KILN INCINERATORS

Cement kilns are specially designed and operated for the sole purpose of making cement clinker. [see fig.1] A cement kiln is a large steel horizontal tube with a refractory lining (heat resistant brick). The kiln rotates slowly and has a gentle slope to allow solid material to move through the kiln. Fuels are introduced into the "low" end of the kiln and raw materials are introduced into the "high" end. The flow in cement kilns is counter-current; solids travel in one direction and hot gases plus dust emissions travel in the opposite direction.[5]

In a dry process kiln, such as Holnam's, finely crushed raw material is fed into the kiln dry at the upper end, instead of in a slurry of water as in a wet-process kiln. As the raw materials pass through the kiln, they start calcination at 550° C. In the burning zone, 1,500° C temperatures calcine and fuse the raw materials creating clinker. The addition of about 6% gypsum and other additives to milled clinker completes the process of making portland cement.[6] The principle chemical elements required to produce cement are calcium, silicon, aluminum and iron. These are provided by a mix of limestone, clay, shale and/or sand, and iron or steel mill scale.[7]

Dry Process Cement Kiln

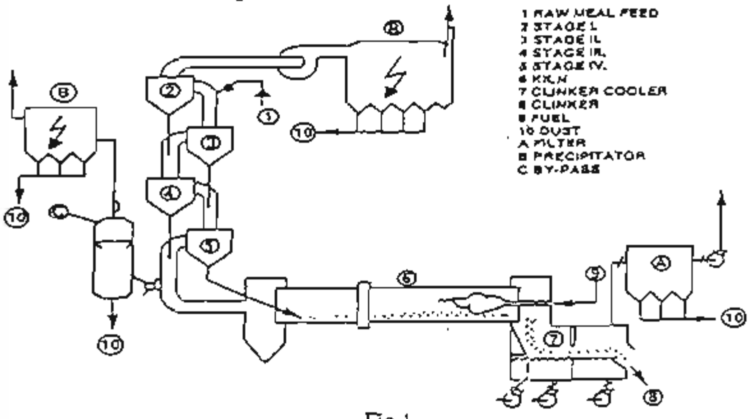


Fig 1

Fuels

Originally, liquid wastes fed to kilns were high Btu wastes with very little ash, chlorine, and BS&W (bottoms, sediment and water); and were as clean or cleaner than the liquid fossil fuels they replaced. Presently, many kilns burn "blended fuel", a mixture of miscellaneous hazardous wastes from a variety of sources, which they get from hazardous waste brokers. These blenders mix solid hazardous wastes with higher Btu liquid hazardous wastes. Cement kilns are burning hazardous wastes from virtually all classes of generators.

Wastes burned now are generally high in solids and in halogen (chlorine). Hazardous waste solids are used because high disposal fees can be charged, and the most money made by cement companies.

As the wastes used by cement kilns become "dirtier", that is contain less heat value and more solids, the combustion efficiency decreases, and the quantities of unburned and partially burned wastes dispersed into the environment increases.[8] Kilns also may blend hazardous wastes with the cement raw materials introduced into the cold end of the kiln, where they either volatilize (vaporize) or are incorporated into the ash and cement.[9]

CEMENT KILN SAFETY PROBLEMS

Cement kilns, by design and operation, have unique problems incinerating hazardous wastes. These problems, which affect the safety of incineration, include *poor combustion efficiency* due to lack of time, turbulence, oxygen and temperature exposure of hazardous wastes; *frequent upsets* or releases of partially or uncombusted organic chemicals; *high emissions of fine particulate matter; lack of monitoring and automatic feed cutoffs; and failure to treat wastes such as fly ash, cement kiln dust, and baghouse filters as hazardous wastes to be disposed in "secure" landfills.*

CEMENT KILN AIR EMISSIONS

Air emissions of metals, products of incomplete combustion, uncombusted organics, and fine particulate matter by cement kiln incineration of hazardous waste are discussed below, including technical backup.

In burning hazardous waste, the desired products are carbon dioxide and water. However, portions of the waste chemicals are emitted uncombusted in their original form, or recombine to form new, high molecular weight and toxic compounds called *Products of incomplete combustion (PICs).* These chemicals, which may be more complex then the original waste chemicals, are *"more difficult to destroy and may be more toxic than the parent compound,"* according to EPA.[10] PICs are released in the kilns' stack gases, fly ash, dust and cement products. Upset conditions in cement kilns are ideally suited for the formation and dispersal of dioxins, furans and other highly toxic PICs.[11]

Repeated studies of RCRA regulated hazardous waste incinerators have identified only 1-10 percent of the PICs known to be present in stack gases.[12] Even fewer of the PICs produced during the burning of hazardous wastes in cement and aggregate kilns have been identified. According to EPA, PIC emissions from the burning of hazardous waste in industrial boilers and furnaces ranged from 0.5 to 5 times the emission rates of unburned waste chemicals.[13]

Some of the most dangerous PICs formed are those of chlorinated dioxins and furans. Their emissions cause concern because of their extreme toxicity, persistence, and tendency to bioaccumulate. Incineration of chlorinated wastes is the major source of polychlorinated dioxins (PCDDs) and furans (PCDFs) in the environment and in human tissues.[14]

Uncombusted organic chemicals are emitted and PICs are formed from inadequate oxygen and/or temperature requirements. These conditions of a cement kiln are discussed below.

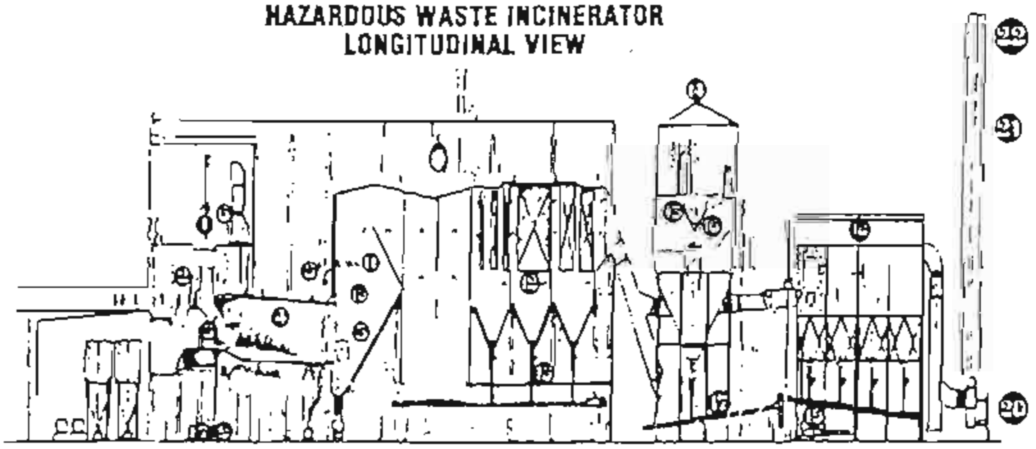
Cement kilns operate with very low excess oxygen to minimize fuel costs, their goal being maximum transfer of heat into product formation, not maximum combustion. This means that alternating "pockets" of combustion gases which are oxygen rich and oxygen starved will form and move up the length of the kiln. Kilns don't attempt to provide a back mixed section to completely mix feed and combustion air. There is no way to avoid this effect in a cement kiln because the atomization pressure will not be great enough to ensure that good mixing will take place in the long, approximately 500 foot length of the kiln.[15]

RCRA regulated hazardous waste incinerators must provide adequate oxygen in order to avoid the problems associated with pyrolysis of organic compounds. (*Pyrolysis is the decomposition of a substance by the action of heat alone, with no access to oxygen).* Results of a study at the University of Dayton Research Institute showed that from one starting compound it was possible to see over fifty pyrolysis products formed (PICs). These compounds are usually more thermally stable and in many cases more toxic than the initial compounds.[16] Pyrolysis conditions can be expected to predominate over large portions of the kiln, even without the added negative effects of feeding hazardous waste solids.[17]

Gas temperatures in a cement kiln are above 2000° F for only 30% of the kiln by length, and well less than 30% of residence time. A U.S. EPA employee said, *"Cement kilns tend to have a long lazy flame that could hardly be described as 'turbulent' compared to a hazardous waste incinerator...[w]hile the total gas residence time may be 3-5 seconds, residence time in the high temperature flame zone is much lower...temperatures do drop off rather quickly..."* [18]

Cement kilns have temperature profiles with lower temperature zones formed down stream from the fuel source. It is in these zones of reduced oxygen, turbulence and temperature that refractory organics (PICs) in the gases and solids will form and be emitted in some fashion.[19]

Refractory organics are high molecular weight and toxic compounds formed by the recombination of smaller organic radical compounds in the lower temperatures far beyond the flame front. The cement kiln design with its ever decreasing temperatures over a long time encourages the production of these compounds. In order to eliminate the formation of these compounds, an incinerator would need to instantaneously quench combustion gases after a long



1. Waste Handling Crane
2. Barrel Feeding Device
3. Front Wall of Rotary Kiln
4. Combustion Chamber
5. After Combustion Burner
6. Primary Air System
7. Cooling of the Rotary Kiln
8. Secondary Air System
9. Discharging System For Residue
10. Waste Oil Burner
11. Waste Water Injection
12. Steam Boiler
13. Fly Ash Transport System
14. Absorption Plant
15. Absorption Chamber
16. Atomizer Wheel
17. Fly Ash Transport System
18. Tube Filter
19. Heating System For Tube Filter
20. Flue Gas Fan
21. Stack
22. Emission Control

Fig. 2

residence time, plug the flow afterburner, which is preceded by a back mixed combustion chamber, none of which is possible in a cement kiln.[20]

Once uncombusted organics have escaped the flame clinker zone at the very front of the kiln, there is no mechanism for capturing them. This escape is enhanced by the practice of mixing high levels of solids with liquids in the kiln. The best combustion efficiencies are obtained when all decomposition to CO_2, water, and HCL occurs in the flame. This does not happen with hazardous waste fuels containing high solids levels.[21]

Even if high temperatures and consistent combustion conditions could be perfectly maintained, kilns acting as hazardous waste incinerators would still emit toxic substances. Metals are not destroyed at any temperature, and PICs, including dioxins and furans, have been shown to form not in the furnace itself but at lower temperatures in other parts of the incinerator, including the smokestack, pollution control devices, and the ambient air outside the incinerator.[22]

An Ontario study found that dioxin/furan (PCDD/PCDF) concentrations were significantly higher in flue gas after passing through pollution control devices than before them. Dioxin measurements were 20 times higher after the incinerator's heat-exchanger than before it, and furan concentrations were 8 times higher. Another study in Canada found that almost no PCDD/PCDFs were leaving the incinerator's furnace, but that significant amounts were forming at the base of the smokestack, occurring at temperatures of 200-500 degrees C.[23]

Metals

Metals are not destroyed or detoxified by fire. As a result, waste-burning kilns only redistribute any metals in the waste through air emissions, fly ash, dust and concrete products. Hazardous wastes burned in cement and aggregate kilns may typically contain as much as 1.35% metals. Cadmium, chromium, lead, nickel, thallium and mercury are known or suspected carcinogens. Lead and zinc are known to cause neurological and pulmonary system damage at low doses. Many metals are reproductive toxicants, affecting human fertility or the development of human embryos. All are both acutely and chronically toxic to aquatic and terrestrial wildlife.[24]

Metals that vaporize at high temperatures such as lead, mercury, cadmium, nickel and zinc, leave the flame zone as gases and condense onto particles as the temperature cools moving up the stack. This process leads to the concentration of these volatile metals in both emitted and captured fly ash. The less volatile metals are concentrated in cement and aggregate products.[25]

Metallic chlorides, which can be formed in the incineration of metals in the presence of chlorine, tend to be even more volatile than the elemental or oxide forms of these metals. As a result, total metal air emissions are increased substantially when wastes containing both metals and chlorinated solvents or other chlorinated wastes are burned.[26]

Particulate Matter Emissions

All cement and aggregate kilns emit particulate matter into the air. Burning hazardous waste, especially halocarbon wastes, in kilns substantially increases particulate emissions (See test burn results). Toxic metals and organics preferentially adsorb onto the smallest available solid particulates. *(Adsorb means to adhere to the surface of a particle without reacting with it)*. These small particles are most likely to escape pollution control devices, including baghouses.

Airborne particulates smaller than 2 microns are the most likely to escape the body's defense mechanisms and lodge deep in the lungs. They have been linked to high rates of pneumonia, pleurisy, bronchitis, and asthma.[27]

Baghouses are cloth filters designed to catch large particulates. They are not effective in the capture of dioxins and furans which are attached to the smallest particles or are in the vapor phase. The smallest particulates (less than 2 microns) may carry up to 90% of particulate-borne metals [28] and elevated, though still unquantified, levels of dioxins and furans. EPA has found that in several emission tests, levels of 2,3,7,8-TCDD (a highly toxic form of dioxin) were higher in the gas phase than on captured particulate matter.[29]

According to a 1990 study by Voland Corporation, *"The efficiency of the particulate control device will therefore also have an influence on the total emission of PCDD and PCDF [dioxins and furans]."* [30] A particulate matter standard of .08 g/dscf (grains per dry standard cubic foot) for cement kilns versus .015 g/dscf for RCRA regulated facilities means that cement kilns will be emitting substantially more metals and PICs than RCRA regulated incinerators.

UPSETS

"Upsets" are caused by sudden variations in waste feedrates, extreme fluctuations in temperature, airflow, pressure, or other factors. One of the most common causes of an upset is the sudden release of accumulated solids in the kiln, an occurrence made more likely by the use of solid wastes and especially chlorinated waste in the kiln. This avalanche of solids through the kiln can force a cloud of unburned gases out of the kiln at the firing end (not the smokestack) into the environment.[31]

An upset can result in the release of large amounts of particulate matter containing organic compounds along with high levels of heavy metals. Combustion upsets while feeding solids can result in the clinker material containing "pockets" of uncombusted hazardous waste solids.[32]

Upsets during the operation of cement kilns are common and can be of such intensity and duration as to lead to explosive gas mixtures going up the stack. Explosions occur.[33] Ten year former employee of Holnam, Larry King stated, *"upsets in the kiln are frequent, the approach to problems was careless, and management sloppy at the Ideal/Holnam plant."* [34]

Because high temperatures are required to form clinker, if an upset occurs, the mass present in the kiln is not amenable to rapid quenching, allowing PICs to form. Sophisticated instrumentation to detect and compensate for combustion upsets is typically not installed in cement kilns burning hazardous waste.[35]

In addition, operators don't shut down kilns if at all possible due to the tremendous economic loss in clinker production for each hour of shut down, and the difficulty of restarting the kiln which contains hundreds of feet of materials in various stages of conversion to clinker.[36]

CEMENT KILN TEST BURN RESULTS

Among the parameters measured by a test burn is the destruction and removal efficiencies (DREs) of certain chosen organic substances, called principle organic hazardous constituents (POHCs). In order to pass a RCRA test burn, the EPA demands all DRE results pass the 99.99% DRE requirement. In contrast EVERY test **burn of cement kilns incinerating hazardous waste as reported in the technical literature fails to meet EPA RCRA standards for** hazardous waste incineration. The following presents several examples.

The EPA tested General Portland Cement of Paulding, Ohio in October of 1983. This is a wet process kiln that had been using solvents as supplemental fuel for three years. The kiln failed to meet DRE (destruction and removal efficiency) standards for methylene chloride (99.975), methylethyl ketone [MEK] (99.978), and Toluene (99.94). Some conclusions reached from this test are:

- Hydrochloric acid (HCL) emissions increase as total chlorine content entering the kiln increases. Acid gas emissions are not neutralized by alkaline materials as the industry claims. Emissions of cadmium, copper, mercury, lead, and selenium increased when the waste fuel was burned.
- The introduction of chlorinated waste into the kiln shifted the lead and zinc distribution so that a greater quantity of both were removed with the waste dust, which is not treated as a hazardous waste like RCRA incinerator dust is.
- Emissions of particulate matter, total hydrocarbons, volatile organics, and products of incomplete combustion were shown to increase during a kiln upset.

In summary, this test failed almost every one of the RCRA required standards developed for environmental protection during hazardous waste incineration.[37]

The EPA next tested Lone Star Industries of Oglesby, Illinois in December 1983. This is a dry-process cement kiln. The DRE results indicate that toluene had a value from one run of 99.987%; and that values for methylene chloride were 99.90%, 99.98%, 99.98%, and 99.97%, with only two results in at the required 99.99% DRE. If this were a RCRA regulated facility, the EPA would have required an immediate retesting and/or cessation of operations. Some conclusions reached from this test are:

- The cement kiln did not meet stationary source emission standards for particulates, but no conclusions were drawn because the ESP (electrostatic precipitator) malfunctioned during the test. (If a commercial hazardous waste incineration facility burned with its gas cleaning equipment malfunctioning, the manager would probably be fined and/or sent to jail.)
- The usage of waste fuel resulted in increased emissions of lead, cadmium, and other heavy metals.
- HCL emissions, chloride in waste dust, and chloride in the recycled dust increased as the total chlorine in the waste fuel increased.
- Waste fuel combustion increased the lead concentration in the clinker, waste dust, and recycled dust.[38]

Alpha Portland Cement, Cementon, New York was tested in 1982 using halogenated waste solvents. There is no mention of DREs. Emission of hydrogen chloride (HCL) was over the 4 lb/hr. required by RCRA standards. The kiln had measured emissions of HCL of 2.4 lb/hr. during baseline burns; and 5.8 lb/hr. during waste incineration. Test results also showed a startling increase in lead emissions over those observed during baseline sampling.[39]

During the stack testing done at Carolina Solite May 1990 by Koogler and Associates, samples of stack emissions were taken and sent to ETS Analytical services in Salem, Virginia for analysis for heavy metals. Seventeen metals were detected in amounts greater than .00001 pounds per hour. Metals detected included arsenic, barium, cadmium, chromium, lead, and mercury among others. In all, the kiln burning coal was found to be emitting an average of .2165 pounds of heavy metals per hour. The kiln burning hazardous waste was emitting 3.609 pounds of heavy metals per hour. The kiln burning hazardous waste emitted 16.66 times more heavy metals than the kiln burning coal during the test. Of the 62,624,600 pounds of waste burned in 1989 at that kiln, 103,000 pounds went up the stacks as heavy metals alone. These tests were done under optimum conditions, immediately after a number of improvements were made to the kilns and the pollution control equipment.[40]

Tests at National Cement's waste-burning kiln in Lebec, CA in 1988 found that the kiln was exceeding its permit limits for the metals arsenic, beryllium, cadmium, chromium, lead, and mercury; as well as for total polycyclic aromatic hydrocarbons and sulfate (SO_4). This kiln has a baghouse filter, and for the tests substituted 40% of its fuel with hazardous wastes.[41]

An EPA review of test burns in eight cement kilns found DREs for a variety of specific chemicals ranging from 91.043 to 99.9999% with an average DRE of 99.53%.[42]

MONITORING AND AUTOMATIC CUTOFFS

Cement kilns must be required to monitor oxygen in the transition between kiln and gas cleaning equipment, carbon monoxide in the stack, draft control at the kiln seals, waste feed rates, stack gas flow rate, opacity, temperature using thermocouples, and to install waste feed cutoffs to control conditions outside of those permitted for environmental and public health protection. Kiln operations should be maintained in accordance with strict operating permit conditions. They should have to pass *all* test burn requirements in order to operate. They should have to install continuous emission monitors and have hard copy data on record for regulators and the public to review. They should have to go through public scrutiny and review of their operations. They should have to better control the combustion process and gas cleaning process to meet the standards of operation that they presently do not meet.[43]

However, cement kilns do not have the flexibility to accept many technology upgrades, even if regulatory agencies require them. For example, the use of oxygen enhancement to improve combustion is a technology upgrade which cannot effectively be used by cement kilns.

Given the lack of process controls and instrumentation, the long lag time, and the lack of secondary combustion chambers and process access points, cement kilns cannot be modified to effectively utilize the new technology. The lack of flexibility of cement kilns is a problem unique to them because they were designed to produce clinker, not to incinerate hazardous wastes.[44]

CEMENT KILN DUST, FLY ASH, PRODUCTS AND FUGITIVE EMISSIONS

A DRE of 99.99% does not mean that 99.99% of that particular chemical was actually destroyed. It means that .01% of that chemical was identified in stack gases after passage through the combustion zone and any pollution capture devices. Large quantities of metals, unburned organic wastes, and products of incomplete combustion are adsorbed onto cement kiln dust, fly ash, and incorporated into cement products.

Cement kiln dust is a waste product that is typically dumped on-site or sold to the agricultural and construction industries. Fly ash is small particulate matter formed during combustion and swept up the stack of the kiln. Some portion is captured by pollution control devices and the remainder escapes into the air.

Kiln operators may return fly ash to the kiln where it reenters the process of combustion and emissions to the air, ash, or cement products. A number of studies have shown that dioxins and furans, and presumably other PICs are produced in part by the catalytic effects of fly ash. Wet-process kilns produce substantially more fly ash than do dry-process.[45]

Both fly ash and cement kiln dust are exempt from RCRA land-disposal standards.

As much as 46% of the metals entering the kiln will be distributed to the fly ash. Metals that volatilize when exposed to high temperatures will condense onto fly ash particles in extremely high concentrations. One study found that as much as 75% of the lead entering the furnace ended up in the fly ash,[46] and total metal emissions are increased substantially when wastes containing both metals and chlorinated wastes are burned.[47]

Dioxins and furans at levels as high as 180 parts per trillion were detected in the fly ash from a cement kiln burning chlorinated wastes, according to EPA's National Dioxin Study.[48] No detailed studies have been conducted to identify other PICs present in fly ash from waste-burning kilns.

An examination of leachability rates for selected metals in cement kiln fly ash found that sequential liquid extractions carried out of the ash as much as 50% of the cadmium, 80% of the zinc, 80% of the chromium, and 70% of the copper. The kiln in question did not burn hazardous wastes.[49]

The heavy metals in the dust would be expected to be water soluble, making them available for transport in the environment. Heavy metals and residual organics will be taken up by vegetation, and enter the food chain, especially when sold as a soil amendment for agriculture.

Ash disposal sites for three cement kilns have been placed on the federal Superfund National Priorities List because contaminated leachate from the sites threatens local groundwater and surface water.[50] None of these kilns are known to have burned hazardous wastes. Some $10,000,000 is being spent to protect human health and the environment at a cement kiln dust site in Salt Lake City, Utah.[51]

Kenneth Rudo, a toxicologist in the environmental epidemiology section of the North Carolina Dept. of Environment, Health and Natural Resources wrote in January of 1990:

"A one in a million additional lifetime cancer risk is a recognized safe level for human exposure. The cancer risk presented by the levels of metals in the dust piles [Carolina Solite Corporation facility in Stanley County] represents greater than a 1 in 62,500 risk for arsenic, greater than a 1 in 10,000 risk for cancer in cadmium, greater than 1 in 500 cancer risk for chromium.... In addition to the long-term cancer risk presented by the metals in the dust piles, short-term health risks also appear to exist."

Rudo traces the toxic metals emissions to the plant's use of hazardous waste as a fuel. His recommendations for removal of the dust piles will be included in a consent order against the Carolina Solite Corporation.[52]

The less volatile metals concentrate in the aggregate or cement clinker. Although lead is a volatile metal, with only 2 percent reported to partition into the aggregate, lead has been found at concentrations as high as 2,850 parts per million at several sites where aggregate from one waste-burning aggregate manufacturer, Marine Shale, has been used in construction.[53]

A Holnam brochure (*Concerns and Facts*) claims *"the metals are tied up in the clinker and dust in a manner similar to the incorporation of lead in fine crystal."* However, the surface area of crystal and clinker are very different. Furthermore, scientists at Columbia University in New York reported in 1991 that tiny amounts of lead began to migrate within a few minutes after they poured wine into many lead crystal decanters, and that they found large amounts of lead in wine that had been stored in decanters. The amounts of lead they found in brandy stored for more than 5 years (21,500 mcg/liter) is 430 times the blood level amounts shown to cause irreversible central nervous system damage in young children.[54]

Hazardous cement used to construct water supplies, schools, homes and public facilities poses a liability issue. Will the public be forced to pay for the removal of contaminated cement and its replacement with clean cement when health problems manifest? Would we choose to buy this cement in the first place? The Texas government is considering legislation requiring that any product manufactured by a cement, lime or aggregate plant burning hazardous or toxic wastes with the intent for later wholesale or retail, must print a written warning that the product *"may contain various amounts of that waste including lead, cadmium and other toxic metals. This waste may leach out of this product and result in environmental contamination for which you may be partially liable. Use at your own risk."*[55]

Holnam has proposed burning solid Superfund wastes, apparently by using an auxiliary kiln to vaporize organics which will be ducted to the kiln hot zone. They plan to incorporate the "sterilized" soils as a raw material in their cement, replacing clay or sand. Unfortunately, a metal is a metal, whether "sterile" or not.

The American Society for Testing and Materials (ASTM), a consensus standards and testing organization, specifications for cement do not allow for adulterants or for testing for specific hazardous waste residues. This should be kept in mind when cement companies say that their cement is tested and held to strict standards. Cement is not routinely tested for residues. Inferior cement made while burning hazardous wastes may soon be the cause of lawsuits such as the one against Lone Star Cement by a number of railroad companies. Lone Star filed for bankruptcy, and now the railroads are suing Lafarge, the supplier, which made the cement at one of its plants burning hazardous wastes.

EPA has said mixing hazardous wastes with cement to stabilize the wastes is inappropriate for organic wastes, which are likely to leach or volatilize out with some rapidity.[56] This practice will only delay the leaching of metals.[57] No data is available about metals that have gone through the kilns with the cement. Construction workers will bear the greatest immediate exposures.

FUGITIVE EMISSIONS OF UNBURNED HAZARDOUS WASTES

EPA's Science Advisory Board cautioned that at RCRA regulated incinerators, *"[F]ugitive emissions and accidental spills may release as much or more toxic material to the environment than the direct emissions from incomplete waste incineration."*[58] A Systech/Lafarge cement kiln burning hazardous waste reported fugitive emissions totaling 20,074 pounds per year, or about 0.04% of the quantity of waste burned in the kiln. Of the 27 chemicals reported, 12 are carcinogens.[59]

A report commissioned by the New York State Legislature on waste-burning in cement kilns assessed the likelihood of repeated spills. *"It is virtually impossible to completely prevent small spills of hazardous waste during unloading and pumping of waste fuels. These spills may be caused by equipment failures, maintenance operations, or* *operator error."* [60] No data are available regarding the frequency and size of on-site spills of hazardous wastes at waste-burning facilities.

Recently, a leaky valve at Kentucky Solite Corporation reportedly "...allowed about 1.5 gallons of a mixture of oil, solvents, alcohols, and other chemicals to drip into a kiln..." The kiln was below combustion temperatures, allowing 10 to 15 pounds of partially combusted hazardous wastes to evaporate into the air. Four people were treated at the hospital after breathing "noxious fumes." [61]

Transport Accidents

The US Office of Technology Assessment reported more than 78,000 incidents involving the release of hazardous materials during transport during 1976-1984.[62] The New Jersey State Police inspected 8700 trucks carrying hazardous materials in 1987. Of that number, about 36% were immediately pulled out of service and not allowed to leave the inspection site without repair or correction of violations.[63] One study in 1984 estimated that operation of an average-sized waste-burning cement kiln was likely to result in one loaded tanker truck accident every five years.[64]

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Folly or Redemption: Can Cement Kilns Really Do the Job?[1]

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ABSTRACT

The future of commercial hazardous waste incineration in the United States is in doubt. The EPA has encouraged commercial incineration:

- by promoting the use of risk assessment;
- by not regulating, (in the case of BIFs);
- by overlooking regulations (for example, Waste Technologies Inc.);
- by generally failing to enforce regulations[b];
- by not emphasizing the importance of management standards; and,
- by not adopting siting and technology standards.

These EPA actions may eventually lead to the very premature end of commercial hazardous waste incineration in this country. In effect, this has been killing with kindness, the practice of commercial incineration, especially in BIFs.

The cement kiln incineration industry has adapted to the EPA's kindness like a drowning person clutching at straws. The cement industry sees burning hazardous wastes as extending the life of energy inefficient, aging, wet kiln technology. The hazardous waste suppliers were generally those entrepreneurs who saw a way of gaining entry into the commercial incineration business with minimal cost. There was also a bonus of still controlling their generator customers.

This paper explores some facets of this problem, develops a strategy for escaping the dilemma, and analyzes where BIFs will have difficulties in following the strategy.

INTRODUCTION

The commercial hazardous waste incineration industry exists only because of regulations, initially under TSCA (PCBs), then RCRA, and now, in addition, CERCLA. These regulations exist and are enforced ultimately as an outcome of public pressure. In effect, the true "customers" of a commercial hazardous waste incinerator are not the generators who are paying the fees. The customers are the regulatory agencies and, finally, the public. Scientists and engineers working in this field find this fact of commercial incineration hard to understand and difficult to accept. Oppelt has recently updated his critical review of hazardous waste incineration and the reader is directed to those extensive articles for more detailed information regarding the technical and regulatory history of hazardous waste incineration.[12]

Twenty-five years ago I learned the three Ts of effective combustion: time, temperature, turbulence, and oxygen. Before that, basic thermodynamics had taught me that there should be 100% destruction of organic molecules in high temperature flames in times well less than 0.1 second. Indeed, we happily used open fired, short, refractory lined barrels with a burner in one end as incinerators less than twenty

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[1] *Presented at the Conference on Waste Combustion in Boilers and Industrial Furnaces Sponsored by the Air & Waste Management Association, 2 March 1993, Clearwater, Florida.*

[b] The exception to this lack of BIF enforcement has been EPA Region IV and perhaps Region III. Region VIII took a very hard line on granting BIF Interim Status.

years ago. But as time has gone on, we have learned that we do not know as much about the combustion process as we thought. Due to this lack of assurance and past incinerator horror stories, there is a tremendous public concern over incineration of wastes in general and hazardous wastes in particular.

I suggest that it is time for scientists and engineers to stop trying to tell the public about safe incineration. It is past time to adopt the mind set of providing the safest incineration possible. There is a very simple reason for this change. The public wants it, and in a democracy they will get it, even if that means no incineration, "not in anybody's backyard."

Cement companies incinerating hazardous wastes have become enmeshed in the incineration debate. Their efforts to suggest that they are really recyclers, just recovering the energy from products typically found under the average housewife's kitchen sink while tying up the resulting non-burnables, like lead in crystal glass, have backfired. The public is aroused. Will cement kilns survive as commercial hazardous waste incinerators? There are several factors unique to the cement kiln hazardous waste incineration industry that suggest that, if the industry survives, it will not be in its present form.

CEMENT KILN PROBLEMS

Open Circuit Heavy Metals

Cement kiln hazardous waste incineration is unique in that 100% of all residues and by-products from the incineration process are redistributed into the environment. Even if cement kiln dust (CKD) were controlled, significant amounts of heavy metals would still be distributed into the environment in clinker, and ultimately, in cement. Ayres, in a recent symposium sponsored by the National Academy of Sciences, points out that if we continue to mine, use, and discard heavy metals into the environment at a faster rate than removal processes work in the environment, we will eventually poison ourselves.[3] He calls this an "open circuit." Recycling then becomes an interdiction step between heavy metals use and environmental distribution, at least partially eliminating the necessity for mining and mobilizing fresh supplies of the heavy metals. In effect, Ayres points out that unless we recycle and eliminate the open circuit, we will poison ourselves.[c] All heavy metals placed into a cement kiln are distributed into the environment, there is no recycling.

There is a lack of information about just what cement kilns are burning in terms of quantity and quality of hazardous wastes. It is impossible to calculate the size of the effect of hazardous waste burning in cement kilns on heavy metals level increases in the environment. It is possible to say that it is significant and, given the proposed future course of the cement kiln incineration industry, the increase will continue rapidly. The significance of the cement industry as a distributor of heavy metals into the environment is found in a comparison of the total heavy metals load into the environment as cited by Ayres[3] to the percent of that load from the entire cement industry. The latter number can be calculated using figures from the Portland Cement Association[4] and an estimate of clinker and CKD produced. Of the heavy metals reported in both references, cement kilns represent 17% of the arsenic, 31% of the cadmium, 54% of the chromium, 6% of the lead, 1330% of the silver, and an insignificant

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[c] Indeed, many reputable scientists argue that we have already reached the generally toxic level of heavy metals and chlorinated organics in the general environment. For example, see the report of the Wingspread Institute. [T.E. Colborn, "Great Lakes Great Legacy?," World Wildlife Fund, Baltimore, Maryland, 1992.

percent of the mercury[d] distributed into the environment in the United States through open circuit uses and disposal of heavy metals.

Of course, some percentage of the open circuit heavy metals load from the cement industry is from coal and raw materials. There are those who have concluded that there is no difference in burning coal and in burning hazardous wastes. This is clearly untrue. No cement company burning hazardous wastes has proposed to limit themselves to heavy metals and halogen loadings approximating coal. Any comparison of hazardous waste quality parameters and typical normal fuel will show the higher levels in hazardous wastes. The cement kiln incineration industry is moving rapidly to burn even more solids, which have higher heavy metals and halogen levels than the hazardous waste liquids that long ago left the marketplace, and so incorporate heavy metals contaminated materials in their raw feeds.

Some 80% of the hazardous wastes burned in cement kilns during 1991 were incinerated in wet process kilns rather than in energy efficient preheater kilns.[5] More energy would be saved if cement were made in preheater kilns solely with coal than the way hazardous wastes were burned in 1991 by the cement kiln incineration industry.[5] This would also significantly reduce the heavy metals load to the environment, if effective recycling were substituted for this type of hazardous waste incineration.

The use of RCRA Subtitle C facilities for CKD from hazardous waste burning kilns will help the situation. That use of these facilities will not resolve the heavy metals problem for the cement kiln hazardous waste incineration industry.

Heat Transfer vs. Thermal Destruction

Cement kiln systems are designed, constructed, and operated to maximize the transfer of heat from the fuel to the raw material while achieving a maximum temperature sufficient to force the clinkering reaction. They are remarkably thermally efficient devices. The cement kiln hazardous waste incineration industry has tried to sell the proposition that this design and operation are also ideally suited to destroy hazardous wastes. It is not. There are several design and operating problems caused by maximizing heat transfer at the expense of assured destruction of organic wastes. These problems include low oxygen levels, high total hydrocarbon (THC) and carbon monoxide (CO) emissions, irreducible emissions of chlorinated products of incomplete production (PICs), low negative drafts, operational upsets associated with mass movement of solids in the kiln, and lack of a fail-safe failure mechanism. Each of these problems is discussed in turn.

<u>Oxygen Levels.</u> Oxidative conditions are necessary, on average, to form clinker in the kiln system.[e] Ideally, a cement kiln operator would try to operate at zero excess air since the energy penalty for having excess oxygen and its associated nitrogen, assuming an ambient air supply, is much greater than the additional energy reclaimed by more thorough combustion of the fuel molecules. This is especially true in a cement kiln system since the flame temperature must be very high to drive the clinkering reaction. Heating excess nitrogen up to flame temperature wastes a lot of energy. Thus, some kilns operate with average oxygen levels in the 0.5% range. Some of the problem could be avoided by using oxygen or oxygen supplemented burners instead of air, but there would still be the tendency to operate at lower

[d] The impact of the more volatile heavy metals, such as mercury, will be skewed low by this analysis since it does not include the heavy metals loading into the atmosphere from stack, area, and fugitive emissions.

[e] Flames in a cement kiln start ten to twenty feet or more into the kiln. Clinker in this kiln zone and on into the clinker cooler will always experience oxidative conditions no matter the amount of excess air.

oxygen levels since this maximizes clinker production. Increasing oxygen by decreasing fuel flow significantly lowers clinker production.

All other factors being equal, the amount of excess oxygen is directly related to the degree of destruction of organic molecules. The real problem for the cement kiln is that low levels of oxygen deprive the kiln system of the ability to deal with step increases in fuel. Research by Cundy and others has shown the effect of step loading of rotary kiln hazardous waste incinerators. [See, for example.[6]] Oxygen transients propagate and are maintained throughout the incineration system under step loading of fuel. These transients can cause an absolute decrease in oxygen concentration of three to six percentage points from a base of 10 to 12 percent. Transients such as these will drive the typical cement kiln anoxic.

Recently, mid kiln systems for the introduction of wastes directly into the calcining zone have become popular. The cement kiln incineration industry sees these systems as a way to feed high revenue solids into the kiln without the problems inherent in blending pumpable mixtures for hot end introduction. They are also increasingly used for burning whole tires. With fuels introduced into the kiln after the clinkering zone, any clinkering reaction problems caused by anoxic conditions are avoided. Kiln thruput can be increased since oxygen levels can be lowered. Unfortunately, the practice increases the risk of PIC production and thus is contraindicative of good incinerator design and operation for destruction.

As a sidelight to the oxygen problem posed by cement kiln operation, it has been common practice in stack emission control standards to adjust oxygen levels to a standard percentage in order to correct for any dilution air. The percentage is typically 7%. Since hazardous waste incinerators typically operate at levels higher than 7% without dilution, they have to achieve lower emission concentration limits than cement kilns, since the latter get an increase in effective concentration because of operating at oxygen levels below 7%. In other words, since cement kilns operate at lower oxygen levels, they have higher actual emission concentrations than hazardous waste incinerators operating to the same standard. The adjustment to 7% oxygen standard encourages cement kilns to operate in a less environmentally desirable mode.

Hydrocarbon and Carbon Monoxide Emissions. THC and CO have two main sources in cement kiln systems. Since there are low oxygen levels and the gas stream constantly decreases in temperature in the kiln system, failure to obtain complete combustion in the hot end of the kiln will result in CO and THC emissions. These emissions can be relatively steady state or transient due to combustion upsets in the kiln. The latter are likely since the kiln system is always operated at the maximum feasible thruput of clinker.

The more difficult problem for the cement kiln operator to deal with is the fact that any organic material in the raw feed will strip off as that feed is heated in the system. This can produce very high THC and CO levels, especially where a kerogen containing shale is used. A consequence for the cement industry in attracting attention to their operations by burning hazardous wastes is the recognition in the environmental community that any cement kiln may be a very significant CO and hydrocarbon emitter. There are only two ways to cure the problem: eliminate all organic material in the raw feed or go to gas treatment, probably with an afterburner.

Chlorinated PICs. A paper presented at this conference last year proved what was predicted by theory, the production of monochlorobenzene in any kiln system is directly proportional to the chlorine input into that system no matter the form of the chlorine.[7] The finding experimentally defined a major problem for cement kilns burning hazardous wastes. Even if 100% destruction of hazardous wastes occurs in the kiln, the burning of hazardous wastes will increase the emissions to the environment of chlorinated PICs, including dioxins and furans, if chlorine levels in the waste exceed those in coal. Coal typically averages 0.1% chlorine wastes as in the 1 to 15% chlorine range, per equivalent Btu value. The report that: "*Dioxins, including 2378 TCDD and 2378 TCDD equivalent congeners were found in samples of* [cement kiln] *dust from all four hazardous waste burning facilities selected for organic analysis...*" simply confirms the problem for cement kilns.[8]

Combustion sources typically do not produce TCDD. However, high levels of CO seem to favor its production.[9] Slow cooling through the dioxin formation temperature window and high particulate levels, especially copper, are also indicators of dioxin generation and are also part of the cement kiln system design and operation parameters.

Low Negative Draft. The BIF regulations require that a negative draft be maintained on the kiln system. Clinker thruput is maximized in a cement kiln system when, among other factors, the fan is pulling the maximum amount of gas at the minimum negative pressure. In the kiln systems that I have seen operating, constant negative draft has not been maintained. The last large hazardous waste burning kilns that I visited had one employee who was sweeping up the blowback from the burner room floor. The blowback was from the face plates and seals on the kilns. Visually, the kilns could be seen to be puffing, particulate matter puffing from the kiln could be felt. However, draft gauges showed that a constant negative draft was being maintained, at least in so far as BIF compliance was concerned.

Lack of Fail Safe Operation. To maximize heat transfer, kiln systems are designed and operated as countercurrent flow. As designed and operated, kiln systems do not fail safe. There is no afterburner to catch the materials that pass the main combustion zone. Automatic shutoffs help the situation but do not solve it. Ironically, the long residence times, cited by cement kiln advocates as an advantage of cement kiln incineration, inhibit the effectiveness of automatic shutoffs.

Cement kilns have operated under the New Source Performance Standards (NSPS) of the Clean Air Act for about 20 years. There has only been one significant change in these standards in those years. The requirement for an opacity continuous emission monitor (CEM) was added over the lawsuits of the cement industry. The NSPS standards are extremely generous concerning compliance, and cover only particulate matter. For example, if CEM readings showing non compliance are reported to authorities, they cannot be used for enforcement purposes. Only visual, calibrated eyeball observations by a regulatory official can be used for enforcement. Even evidence of excess emissions obtained with a calibrated eyeball can only be used for enforcement, if the kiln is operating "normally." This is a remarkably forgiving regulation and is a reflection of two factors. Cement kilns have historically been perceived as environmentally benign except for nuisance dust. In the face of upsets, cement kilns are extremely difficult to shut down without causing a major financial impact and significant mechanical and technical problems. Thus, cement kiln standards and regulations have typically been drawn to allow the continued operation of kilns even during major upset conditions. However, these are not the type of standards and regulations that the public wants applied to facilities commercially incinerating hazardous wastes.

High Temperature

Cement kiln hazardous waste incineration advocates contrast the higher maximum temperatures of cement kilns, as compared to specially designed hazardous waste incinerators, as a way of suggesting that cement kilns are therefore better. All other factors being equal, this is true. But, from a practical thermodynamic perspective, since organic decomposition is so rapid at any elevated flame temperature, the relatively high cement kiln flame temperature makes little effective difference.

The problems posed by the high temperature in a cement kiln regarding destroying hazardous wastes are three fold. As noted earlier, the high temperature is in exactly the wrong place in the kiln incineration system. The high temperature fail safe needs to be at the gas exhaust end of the system. This is a clearly impossible arrangement in order to operate as a fail safe device and still make clinker. Research on hazardous waste incineration systems has shown that much more effective combustion is obtained by lowering the initial temperatures in the system.[6,10] At high temperatures, combustion is too rapid. This creates zones of depleted oxygen that ultimately leads to an increased production of chlorinated PICs. The only two ways around this problem are to lower the temperature and increase to the oxygen level. These fixes are denied the cement kiln operator as long as they still want to make clinker at an economic rate.

There is another reason cement kilns cannot increase oxygen levels. All other factors being equal, the formation of oxides of nitrogen (NOx) in a combustion system is directly related to the flame temperature and the available oxygen, assuming an air flame. In fact, the relationship tends to be practically exponential. Thus, in order to add oxygen, unless using a pure oxygen system with non nitrogen containing wastes, the cement kiln operator must be able to increase NOx emissions or add NOx controls.

High Gas Flows

Exhaust gas flow rate from a cement kiln are typically five to ten times higher than those of a hazardous waste incinerator burning the same amount of hazardous waste. There are two factors. Most kilns do not burn 100% hazardous waste. As calcium carbonate is calcined, carbon dioxide is generated. This adds to the gas flow.

The problem that this poses for the cement kiln hazardous waste incinerator is simple and there is a fix, albeit relatively expensive. The capital and operating costs of controlling stack emissions are generally related to the volume of gas to be cleaned. If stack emission standards for hazardous waste incineration are tightened, the cement kiln incinerator is placed at an economic disadvantage by the high stack gas flows.

The high gas flow also means that for a given amount of hazardous waste burned either in a cement kiln or a specially designed incinerator with both achieving the same stack emission standard, uncorrected for oxygen percentage, the cement kiln will be five to ten times more environmentally harmful on an absolute amount basis.

Management

The management of two disparate businesses by common management is a very difficult act to accomplish. This is especially true when one of those businesses requires 100% compliance to very difficult standards and the other is a "plain vanilla" commodity business not accustomed to complying with rigorous standards. The cement kiln incineration industry has attempted to handle the management problem, and to limit and control liability, by either setting up separate waste handling companies, the Lafarge/Systech model, or by using independent companies, the Holnam/Safety Kleen model.[f]

Even companies that have specialized in environmental services have found overwhelming management problems at hazardous waste incinerators. A specific example is the problems faced by Waste Management Inc. at its Chicago incinerator.

Another factor that cement kiln management has not full appreciated is the fact that becoming a hazardous waste incinerator considerably raises the environmental profile of the facility and, also, that of the cement industry. Cement kiln management has looked at the benefits and at the high profit

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[f] Holnam does own 49% of hazardous waste blender Cemtech.

margins for them in the hazardous waste business but has not understood the problems behind those seemingly high profit margins.[8] Earlier in this paper the fact that cement kilns were now becoming targets for CO and THC controls was cited. Past disposal of CKD is also a problem for most kilns. Southdown in Ohio has had to respond to the problems posed by one of eleven old landfills solely because of citizen pressure on the regulatory officials.

Product Labeling

Because of the fact that when cement kilns burn hazardous wastes, residues are found in the clinker, there has been a push to require the labeling of cement so made or even the banning the use of same. Generally these activities have occurred at the local and county levels of government, for example the ban on the use of cement derived from hazardous waste burning by Allegheny County, Pennsylvania. These activities have generally derived from the endeavors of local citizen groups opposed to cement kiln incineration of hazardous wastes. However, the process has advanced far enough for bills to have been introduced into several state legislatures. The Attorney General of each state also can enforce labeling requirements.

Cement companies have vigorously fought labeling requirements as well as bans, so it can be assumed that the cement kiln hazardous waste incineration industry sees these bans and labeling requirements as a negative impact on their business. It is unclear if a labeling requirement would stop a cement company from burning hazardous wastes. A widespread ban on the sale of their product would.

Siting Standards

Another problem for a cement kiln trying to burn hazardous wastes is that it already exists. It is sited. Therefore it may or may not meet siting standards. Cement kilns in Utah were stopped from burning when they were brought under existing hazardous waste incineration siting laws. Texas now has a half mile siting standard for commercial facilities and it has stopped Lafarge from burning hazardous wastes.

Siting requirement legislation will continue to grow at the state level and may be inevitable at the federal level. It is interesting that Waste Technologies Industries in East Liverpool, Ohio could not meet the Ohio siting standards that went into effect after a RCRA permit was issued but before the facility was constructed.

The oldest cement kilns are the ones most needing hazardous waste burning to remain economically viable. They are also the ones most typically located near schools and homes and most threatened by siting standards.

Credibility

Unless the public trusts the operation of the commercial incinerator, it cannot survive in the end. That trust derives from several sources. There is a basic public trust in the regulatory agency to do the "right thing" and protect their health and environment. The second is a public trust in the company to do right. The public now often believes that their trust has been violated.

The EPA is seen by the public as writing regulations in concert with the regulated industry and at their direction. BIF regulations were only issued after a court ordered the EPA to do so, many years after the passage of RCRA, after the promulgation of Subpart O, and after Congress ordered it. Then we have the spectacle of the EPA issuing two rounds of technical amendments. I call them loopholes

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[8] After all, as the Second Law of Thermodynamics tells us, there is no such thing as a free lunch.

to the loopholes. The last amendments were issued with zero public participation. Under the EPA guidance, free Interim Status (IS) permits were to be given to most kilns that asked, even those that had merely thought about incinerating hazardous waste. This action was taken even after the EPA's horrendous experience with IS Subpart O incinerators. Caldwell Systems anyone? A few of the EPA Regions, particularly III and VIII took a hard line on IS.

Now we have the BIF regulations and two rounds of loopholes, and there is no enforcement, except in Region IV. The kilns in other regions run by the same companies with the same procedures and disregard for the BIF regulations have not been cited as they were in Region IV. Three kilns are presently operating under BIF exemptions. If the EPA wants to restore its public credibility, then withdraw their Interim Status, now. The EPA is killing the practice of incineration with kindness. The surest way for a regulatory agency to destroy a technology is to give it favored treatment at what the public perceives is the expense of their public health and the environment.

State regulatory agencies have followed the EPA's lead in destroying their credibility. I note that the California Health Department asked the EPA Region to "stretch its regulations" to accommodate cement kiln hazardous waste burning. The Montana state environmental agency director, on leaving the state agency, got a lobbyist job from the cement kilns trying to burn hazardous waste.

The cement kiln hazardous waste incineration industry has now, for the most part, destroyed its store of public credibility. Cement kilns were already in communities. They lived there and so what if a little cement dust got on the cars. They had it made. Tell your public what you are going to do and get on with it. Stop it if the public says no. Unfortunately for the cement kiln hazardous waste incineration industry, they decided not to try the less trod path of truth.

The EPA did not require a RCRA permit so the community did not have to be told the truth. The basic mistake that the cement kiln hazardous waste incineration industry made was in not telling the truth. They sold commercial hazardous waste burning to communities as recycling, as an alternate fuel, as only hazardous because it is flammable like gasoline in your car, as products from under the kitchen sink, as locally generated wastes, as safer than peanut butter, with the residues tied up in the clinker like lead in crystal glass. Cement kilns were sold as long and hot and good for America and highly alkaline and that could not possibly create problems like chlorinated dioxins and dibenzofurans. High CO was simply as a result of the high temperatures disassociating the high CO_2 levels in the kiln gas. All of it is public relations hype and untrue. The public has been sold a bill of goods, most of them now know it[h] and they are angry.

In order for there to be a future for commercial incineration in general, and commercial BIFs in particular, credibility has to be restored. It will not be easy and it will involve painful decisions. Will the EPA shut down the three kilns not even meeting BIF or will they be seen as bowing to the cement kiln hazardous waste incineration industry threat that this represents 25% of capacity and they cannot be shut down?[11] Will the cement kiln incineration industry petition the EPA to shut these kilns down to help save the rest of the industry? So far no one at the EPA or the Cement Kiln Recycling Coalition has made any hard, painful decisions that will help preserve the commercial cement kiln hazardous waste incineration industry.[i]

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[h] Kansas, Missouri, and Nebraska are slow in getting the news but it will happen eventually if the present situation continues.

[i] One cement company is reportedly ready to file a rule making petition with the EPA to set the equivalent of Subtitle C standards for cement kiln dust. A correct but a "day late and a dollar short" step.

Risk Assessment

The former EPA Administrator who brought the practice of risk assessment to the EPA is often quoted as saying that the technique is like interrogating prisoners of war, torture them enough and they will tell you whatever you want to know. Risk assessment is a tool. Unfortunately the EPA and the commercial incineration industry have used the tool to drive the process rather than as a tool to analyze the process. An example is the EPA's development of the Tier I emission standards allowing risk assessment to drive the process. A mercury emission of up to 6,000 grams per hour is allowed under Tier I of the BIF. That is a ton per week, an amount far exceeding all of the source emissions of mercury in Ohio, the top mercury emission state. I call these mathematical, hypothetical calculations "no brainers." They allow the regulatory official and the incineration company to make decisions based upon some hypothetical number. "It is more risk than 1E-6, so you cannot." "It is less risk than 1E-5, so you can." These are no-brainers. All of this is OK until the public figures out what is being done and then risk assessment becomes a liability.

Another problem for risk assessment and hazardous waste incineration is the growing public recognition that the BIF, and the RCRA §3005 enforced, emission levels were derived by only considering the inhalation route of exposure. For chlorinated PICs indirect routes of exposure are much more significant. See, for example[12].

The public understands that risk assessment is based upon many layers of assumptions. The public does not want their risks assessed. They want their risks minimized. Risk assessment makes assumptions about the risks that the public will face, the public health and environmental costs, but ignores the fundamental problem that the public ultimately bears the costs while the commercial incinerator gets the benefits. Whose costs and whose benefits? That is the question concerning the public. A member of the public recently commented: "The difference between a risk assessor and a prostitute is that the prostitute sells their body while the risk assessor sells yours and mine .

"The public understands that management of a technology is more important than what that technology will do under ideal circumstances.[j] Was there anything technically wrong with Three Mile Island? The public understands that there is no way to verify a risk assessment. The risks could really be 1E-3 instead of 1E-6 and no one could tell before the damage was done and probably not afterward either.[k] Our environmental epidemiology tools are not good enough to tell if it is 1E-3 or 1E-6.[13]

There are two additional problems with the use of risk assessment to drive public acceptability. The burden of proof that something is or will be wrong is necessarily placed on the public. A negative cannot be proved. The public will always refuse to accept that the burden is theirs. A paper at this conference will describe a massive sampling study around some cement kilns that have or are burning hazardous wastes. No problems will be found. Risks will be seen as acceptable. But go talk to some people near these kilns. You will hear reports of problems with horses. Mares are exhibiting male behavior. Multiple follicles are found in the mares. Twins are reported in the cattle at a seemingly high level and bulling is reported. Scientific? No. Reflected in the risk assessment? No. Of concern to the public? Yes. Connected to the hazardous waste burning? Will we ever know? Will the public allow a technology to operate with open questions such as these? Probably not.

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[j] Also known as the test burn fallacy. Certainly the judge in the recent Vertac decision was not impressed with the EPA's test burn/POHC/risk assessment regulatory strategy.

[k] The calculation is simple. At a risk of 1E-3, an exposed population of 10,000, average for an incinerator, will see an increased death rate of 10 over 70 years or one per seven years, an undetectable number. Undetectable would say the public, unless you are the one.

COMMERCIAL INCINERATION SURVIVAL STRATEGY

On the burn side we have commercial incinerators generally supported by the EPA and state regulatory agencies trying to make a profit burning hazardous wastes. On the other side we have the "unsafe at any speed," "not in anybody's backyard" crowd. The latter are winning, largely because of industry and regulatory agency mistakes. The time is running out to stake out a middle ground. Until very recently, no one on the burn side has been willing to admit that a middle ground is necessary for survival. I can see only one possible middle ground. The sooner that the middle ground is adopted, the better is the chance of survival of the commercial incineration industry.

The elements of a middle ground strategy are very simple. There must be recognition that commercial incineration facilities have to be regulated in a different and much more aggressive manner than on site generator operated incinerators. Texas has done this. The reasons are that a commercial facility will always be more difficult to operate due to the widely varying nature of the waste load, the profit incentive, and the ever present possibility of the generator/blender slipping something into the mix.

For commercial hazardous waste incinerators the policy must be established and carried out that *only the best shall burn*. If the affected public demands, the applicant for a permit or renewal of the same must prove that they are using the best technology and the best management. If the best incinerator is doing 0.005gr/dscf, than that is the best technology that everyone must meet. If one burner has round-the-clock inspectors, then that is the best management for all.

Commercial incinerators of any kind will not survive unless they can accurately represent to the public that they are using the best technology and the best management that they can and the public believes them, being allowed to verify this trust.

CONCLUSIONS

The survival of commercial BIFs is dependent upon whether incineration survives the next ten years as a commercial waste treatment option. Any survival will belong to the best. Cement kilns are going to face a long and difficult time in upgrading their operations. Because of the factors inherent in the cement kiln hazardous waste incineration industry, such as high gas flows, low oxygen, and organics in the raw feed, upgrading will be much more expensive for cement kilns than hazardous waste incinerators. This will close the gap in economic advantages presently enjoyed by cement kilns *vis a vis* hazardous waste incinerators. It may be that the economic gap will open in the reverse direction. Cement kilns may find it more advantageous to abandon clinker production all together and optimize incineration performance. One model for what may happen is Marine Shale Processors that, notwithstanding the legal niceties, has converted a lime kiln into a straight incinerator. Given the economic input necessary to upgrade a cement kiln to the best technology and the best management, survival will probably be the province of the largest hazardous waste burners. Small kilns need not apply. The cement kiln hazardous waste incineration industry's strategy of prolonging the life of energy inefficient wet kiln technology will have to be abandoned.

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SIERRA CLUB CENTENNIAL

LONE STAR CHAPTER

Box 1931
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To: Lois M. Gibbs

From: Neil Carman, Ph.D., Clean Air Program Director, August 22, 1994

Subject: Petition for Rulemaking to EPA to close a nationwide loophole on lack of Toxic Cement Labeling

Attached is a Petition for Rulemaking. I urge your support by signing onto p. 2 as a petitioner. No fees or legal commitment is required on a Petition for Rulemaking. Just add your organization's support and supply the information requested on p. 2. EPA will either act on it positively to adopt labeling rules for toxic cement or reject it.

If interested, please contact Jim Schermbeck at (214) 942-6300; fax (214) 942-6353, 401 Wynnewood Village (Suite 138), Dallas, Tx. 75224. Or call me at (512) 472-1767, Sierra Club, Austin, Tx. Time is limited to sign up as a petitioner since it will likely be submitted to EPA in early September.

The following facts will help explain the significance of the petition in addition to reading it. Cement is used everywhere! Unlabeled toxic cement encourages "sham recycling" for energy recovery, yet hazardous waste burning cement kilns actually produce more tons of waste ash than tons of hazardous waste burned.

1) Cement kilns nationwide currently burn more than 1,000,000 tons of hazardous waste a year containing significant quantities of **chromium**, **lead**, **arsensic**, **mercury**, **barium**, **antimony** and a host of other metals and toxic substances. Dioxins and dioxin-like compounds are also produced in higher concentrations than in hazardous waste incinerators.

2) Metals do not burn. In cement kilns, they are either a) vaporized out of the stacks, b) go into waste ash called cement kiln dust (ash) and dumped in unlined quarries, or c) end up accumlating in the clinker product.

3) Increasing federal regulation of air emissions and cement kiln dust (ash) are gradually limiting concentrations of toxics in those two environmental pathways. Regulation means the clinker product is becoming the cheapest way to dispose of the greatest volume of toxic metals because the cement is essentially unregulated.

4) Toxic metals and substances inevitably end up in the clinker in varying concentrations. Clinker is simply chunks of cement before grinding and mixing it with gypsum for the final product. Fly ash may also be added to the clinker.

5) No routine testing is required for hazardous waste contaminants in toxic cement on the market and the public's right-to-know has been denied for over a decade.

6) Clinker or cement sold on the market contains no label warning to inform a buyer it may contain toxic metals such as chromium etc. and was made burning hazardous waste.

7) Many cement companies are making more profit burning hazardous waste than making cement. One result is they can afford to bulk transport their toxic cement product relatively long distances far more than non-hazardous waste burning cement kilns. For instance, Texas Industries, Inc. near Dallas, Tx. shipped toxic cement to the site of Denver's new International airport. Ironically, Colorado cement kilns were prevented from hazardous waste burning by citizen activists.

8) Metals can leach out over time. Cement deteriorates over time allowing more toxic metal release to the environment. Demolition of buildings and structures such as after the Los Angeles 1993 earthquake sent large clouds of cement dust into the air. What metals became airborne and in what concentrations? Chromium is the primary metal to be released into the environment contaminating ecosystems and foodchains, eventually people.

9) P. 16 notes there is environmental justice factor since "public housing demolition raises additional environmental justice concerns because it involves exposures in low-income areas."

10) Studies are revealing that hazardous waste burning cement kilns prefer poor communities and people of color areas having the least resistance to oppose their tactics to dump on poor citizens. Data is being submitted to EPA to document the environmental justice facts on cement kilns.

11) Cement kilns burn hazardous waste under a much weaker set of regulatory standards than hazardous waste incinerators pushing emission standards backwards. More hazardous waste in being burned annually in cement kilns than in hazardous waste incinerators, and some major incinerator companies are laying off and cutting back. While this may be seen as positive, the fact is that the operating and emission standards for the cement kilns are so bad compared to incinerators that the regulation is going <u>backwards!</u>

12) Cement kilns are allowed to begin burning hazardous waste without any public notice, public hearing or public participation unlike incinerators which must go through permitting and public notice. Cement kilns in your backyard can literally begin burning hazardous waste overnight without your knowledge or consent.

13) Finally, hazardous waste incineration even by cement kilns is deplorable because it supports the whole toxic cycle of waste production from generators to disposal, and this discourages pollution prevention measures. In every poor and people of color community where chemical and manufacturing plants generate their waste, they routinely dump poisons onto the whole community. From the mining operations and oil fields to refinieres to petrochemical, chemical manufacturing facilities and eventually incinerators and cement kilns, hazardous waste is dumped throughout the whole toxic cycle.

Labeling of toxic cement products is a very important step in pushing pollution prevention and improving protection of all communities being dumped on by industrial plants and operations. Without the public's right-to-know about what is in toxic cement and how it is produced, the same patterns of corporate greed and irresponsibility will continue to encourage dumping especially on the poor neighborhoods and people of color coommunities.

EARTHJUSTICE
Because the earth needs a good lawyer

EPA Adopts Strong Protections Against Air Pollution from Cement Kilns

Mercury, other toxic air pollutants reduced up to 92%
August 9, 2010
Washington, D.C.
Mercury, other toxic air pollutants reduced up to 92%
Washington, D.C.
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August 9, 2010

Environmental Protection Agency Administrator Lisa Jackson today announced the nation's strongest air pollution rules for over 100 cement kilns across the country. The move will result in significant pollution reductions of mercury, fine particle pollution, hydrochloric acid, and total hydrocarbons from the cement manufacturing industry. The EPA was under a settlement agreement to finalize the rule by Aug. 6 after environmental groups won a challenge in federal court to the agency's previously weak emission standard.

The EPA estimates that cutting air pollution from cement kilns could result in up to 2,500 premature deaths avoided each year. The EPA also estimates benefits from cutting this air pollution of up to $18 billion annually, starting in 2013 when the rule takes effect.

Some cement kilns are huge mercury polluters. In 2008, the Ash Grove Cement Co. in Durkee, OR, reported emitting over 1,500 pounds of mercury from its stacks, making it the 5th biggest mercury air polluter in the country.

According to the EPA, today's rule:

- Cuts 16,600 pounds of mercury, roughly 92%
- Cuts 11,500 pounds of particulate matter, roughly 92%

- Cuts 5,800 pounds of hydrogen chloride, roughly 97%
- Cuts 10,600 pounds of total hydrocarbons, roughly 83%

Mercury is a dangerous neurotoxin that interferes with the brain and nervous systems, resulting in birth defects, loss of IQ and developmental problems. Particulate matter causes serious health impacts on lungs and breathing, including decreased lung function, aggravated asthma, irritation of the airways, coughing or difficulty in breathing. Hydrogen chloride also causes respiratory problems such as coughing, irritated nose and throat, and heart problems.

Additionally, the EPA also announced that it was moving towards proposing limits on greenhouse gas pollution from cement kilns. This effort will move forward separately from today's announcement to clean up mercury and other toxic air pollution from these kilns. The agency said that cement kilns are the 3rd largest industrial emitters of greenhouse gases and that there appear to be cost-effective technologies to curb those emissions.

Modernizing older cement kilns with technologies such as scrubbers and activated carbon injection will help to create more jobs for the cement industry and will help preserve jobs in existing communities. The1990 amendments to the Clean Air Act mandated that major air polluters such as cement kilns must limit toxic air pollutants such as mercury, hydrogen chloride, and organic hazardous air pollutants, among others. In a decision issued during the Bush administration, the U.S. District Court for the District of Columbia found that EPA had been "grossly negligent" in making efforts to comply with the Clean Air Act's air toxics requirements.

"We're glad that EPA saw fit to write a single strict standard for these pollutants that will apply to every cement kiln in the U.S.," said Jim Schermbeck, with the Dallas, Texas-based group Downwinders At Risk. "All Americans deserve the same level of protection from toxic emissions from these facilities, regardless of where they live."

"Parents across the nation should be pleased that the EPA issued rules today significantly reducing pollution from cement kilns. Many of those pollutants have severe adverse impacts on kids' health: lead, mercury, and particulate matter all impact young children's neurological development and breathing. Kudos to the EPA for putting children's health over the profits of the cement industry," said Jane Williams, longtime activist on cement kiln pollution and chair of the Sierra Club air toxics task force.

"We've been living with the pollution from the Lafarge Cement plant in Alpena for decades," said Bill Freese, Director for Huron Environmental Activist League. "Cleaning up toxic air pollution from this cement plant and dozens more just like it across the country will mean cleaner air, fewer hospital visits, and better living for all."

“For years, the cement industry has gotten a free pass to pollute our air and water,” said Earthjustice attorney James Pew. “Previous administrations ignored the law and turned a blind eye towards the cost of pollution on our health and environment. Under Lisa Jackson, the EPA has taken the necessary steps to finally curtail some of the biggest polluters and clean up our air and water. Today’s announcement will save lives and prevent suffering from cement kiln pollution’s devastating health effects for thousands of Americans.”

“We urge EPA to adopt protective limits on greenhouse gas emissions from cement kilns in a speedy and efficient manner,” said Earthjustice attorney Tim Ballo. "As legislation in Congress to curb greenhouse gases stalls, EPA must commit to use its authority under the Clean Air Act and set a firm timeline that ensures cleanup of major stationary greenhouse gas sources."

Regional Kiln Information

- According to the EPA’s own Toxics Release Inventory, the Ash Grove Cement Co. facility in **Durkee, Oregon**, spewed 1,508 pounds of mercury from its stack in 2008 alone, making it the largest mercury-emitting cement kiln, and the 5th biggest mercury polluter of any kind in the country.
- The Lehigh Southwest Cement Co. in **Tehachapi, California** pumped 945 pounds of mercury into the air in 2008, according to the Toxics Release Inventory.
- The Lafarge site in **Alpena, Michigan** is a five-kiln plant, and in 2008 emitted 359 pounds of mercury, according to the latest data from EPA’s Toxics Release Inventory. The Alpena cement plant is of particular concern because it sits on the banks of **Lake Huron** and in close proximity to residential areas of Alpena.
- In the San Francisco Bay Area, Lehigh Southwest Cement Co. operates a kiln in **Cupertino, California**. The kiln reported emitting a staggering 587 pounds of mercury pollution in 2008 to the EPA’s Toxic Release Inventory, making it the nation’s 4th worst mercury-emitting cement kiln. This kiln is located within a major 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.

To see a map of all the nation's cement kilns, please visit: http://www.earthjustice.org/features/interactive-cement-kiln-map

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HEALTH EFFECTS OF REGULATED AIR POLLUTANTS FROM TOXIC WASTE BURNING CEMENT KILNS

Hazardous Air Pollutants - Health Concerns

1. Lead:
Retardation and brain damage, especially in children. Learning disabilities. Endocrine-disrupting and reproductive effects, Anemia, Nervous system, Hearing loss, Joint pain, Kidney diseases, Heart, Spontaneous abortions, Vomiting, Weight loss, Nervousness, Irritability, Sudden infant deaths, Decreased thyroid function, Headaches, Immune system damage, Chromosome mutations.

2. Particulate Matter (PM2.5 & PM10):
Eye and throat irritation, Bronchitis, Lung damage, Increased mortality rates, Increased heart attack risk. Increased respiratory problems, increased asthma, Increased emergency room visits, increased use of inhalers and medications.

The particulate matter is harmful due to the presence of dozens of toxic substances carried on the tiny particles like a sponge absorbs water. The PM10 and PM2.5 are carrying numerous carcinogens, mutagens, teratogens, immunotoxins, respiratory toxins, neurological toxins, developmental toxins, circulatory toxins, and others.

B. Hazardous Air Pollutants - Metals with Health Concerns

1. Arsenic:
Cancer, Birth defects, Respiratory problems, Suspected mutagen (DNA damage), Heart problems, Gastrointestinal, Headaches, Impaired memory, Nervous system problems, Sexual dysfunction.

2. Beryllium:

Cancer, Primary lung disease, although also affects the Liver, Spleen, Kidneys, and Lymph glands. Enlarged heart, Conjunctivitis, Adrenal gland congestion, Cell mediated immune response, Ricketts, Osteoporosis.

3. Cadmium:
Cancer, Destroys bones by decalcification, Kidneys. Endocrine-disrupting and Reproductive effects. Lung and Gastrointestinal irritation, Behavior problems, Liver, Destruction of cell membrane, Pulmonary edema, Osteoporosis, Immune system problems, Brain and nerve cell damage, Birth Defects, Genetic mutations, Altered libido.

4. Chromium Compounds*:
Cancer, Pulmonary problems, Birth defects, Liver, DNA-Chromosome changes, Headaches, Immune system - problems, Blood changes, Nose bleeds, Low birth weight babies, Nervous system problems, Kidneys.

*Chromium VI and chromium III

5. Dioxin - Organochlorine compounds:
Cancer, Endometriosis, Immune System depressed resulting in increased susceptibility to infections; Immune system hyper-stimulation leading to scleroderma, Graves' disease, Addison's disease, arthritis, asthma, Type I diabetes, Hashimoto's disease, Myasthenia gravis, Lymphocytic adenohypophysitis, and Thyroid diseases; Human Fetal Development, Birth Defects, Sterility, Reduced Liver Function, Decreased size of human reproductive organs, Endocrine system impaired, lower IQ, fatigue, reduced glucose tolerance, emotional problems, and Heart disease.

6. Mercury:
Target organs like the brain, kidneys, central nervous system, eyes, skin, respiratory system and bowels affected, Birth defects, Neurological damage. Endocrine-disrupting and reproductive effects, Emotional disturbances, Headaches, Spontaneous abortions, Immune system damage.

Other Toxic Metals: Selenium, Nickel, Thallium, Antimony, Vanadium likely present in emissions.

7. HCL:
Hydrochloric acid is an eye, skin and lung irritant that damages the mucous membrane promoting complications.

8. Several hundred Volatile Organic Chemicals from incomplete combustion of hazardous waste such as numerous Polycyclic Aromatic Hydrocarbons (PAHs like benzo-a-pyrene) and PCBs (Polychlorinated Biphenyls):

Includes numerous carcinogens, mutagens, teratogens, immunotoxins, respiratory toxins, neurological toxins, developmental toxins, circulatory toxins, and others.

Dangers from Cement Kilns serving as Toxic Waste Incinerators

At least ten general areas of dangers exist (excluding global warming from lareg CO2 emissions) to human health and the environment from the two cement plant's hazardous waste incineration activities:

1). **Air pollution** transported over the nearby region that is produced by cement kiln's stack and fugitive emissions involving various contaminants such as metals, products of incomplete combustion, particulate matter, sulfur compounds, hydrochloric acid/hydrogen chloride gas, radioactive materials, and miscellaneous contaminants. This includes emissions of ozone precursors such as NOx and VOCs. Also emissions of various sulfates and nitrates that contribute to acid rain impacts.

2). **Ground water pollution** on and off-site produced by cement kiln's toxic emissions, especially metals but also products of incomplete combustion such as dioxins and furans as well as other products of incomplete combustion, particulate matter, sulfur compounds, hydrochloric acid/hydrogen chloride gas, radioactive materials, and any other miscellaneous contaminants that may be cause for concern.

3). **Soil contamination** on and off-site from airborne fallout produced by cement kiln's stack and fugitive emissions involving metals, dioxins, furans and other products of incomplete combustion, particulate matter, sulfur compounds, radioactive materials, and any other miscellaneous contaminants that may be cause for concern.

4). **Drinking water pollution** in the nearby regional area and its lakes, ponds and rivers produced by cement kiln's toxic emissions, especially metals but also products of incomplete combustion such as dioxins and furans, radioactive materials, as well as any other miscellaneous contaminants that may be cause for concern.

5). **Surface water pollution** in the nearby regional area recreational waters produced by cement kiln's toxic emissions, especially metals but also products of incomplete combustion such as dioxins and furans, radioactive materials, as well as any other miscellaneous contaminants that may be cause for concern.

6). **Agricultural contamination** and damage in the nearby regions produced by the cement kiln's stack and fugitive emissions involving various contaminants such as metals, products of incomplete combustion such as dioxins and furans as well as other products of incomplete combustion, particulate matter, sulfur compounds, hydrochloric acid/hydrogen chloride gas, radioactive materials, and any other miscellaneous contaminants that may be cause for concern.

7. **Toxic cement product** made from cement kiln's hazardous waste firing in its cement kilns; such cement may contain metals, products of incomplete combustion, toxic particulate matter, sulfur compounds, radioactive materials, and miscellaneous contaminants.

8. **Hazardous waste transportation by truck** through the nearby regional area and large scale volume storage, handling and processing (blending) at cement kiln.

9. **Accidents**: Potential for fires, explosions and other accidents at cement kiln involving hazardous waste activities.

10. **Cumulative or aggregate pollution impacts** produced by combining cement kiln's emissions with other polluting manufacturing plants in the nearby regional area.

Why are children so vulnerable to air pollution? Some of the reasons include the following:

1. Children breathe more rapidly than adults, taking in significantly more pollution per body weight than do adults. A resting infant, for example, inhales twice as much air, relative to size, as does a resting adult.
2. Children spend more time outdoors. National data [in the USA] show that children spend an average of about 50% more time outdoors than adults.
3. Children spend more time outdoors in summer when pollution levels are generally highest.
4. Children are more active while outdoors than adults, spending three times as much time engaged in sports and other vigorous activities. Increased activity raises breathing rates and pollution exposure significantly.

5. Children's airways are narrower than those of adults, thus enhancing the inflammatory effect of air pollution.
6. Children are prone to mouth breathing, which significantly increases the dose of pollution reaching the lungs.
7. In adults, respiratory symptoms such as coughing and shortness of breath serve as signals of air pollution exposure and warnings to move indoors or curtail exercise. Children often fail to exhibit these symptoms, making them less likely to reduce exposure (i.e., stop exercising or move indoors).
8. Children are closest to the ground, where air pollutants, especially pesticides and lead, are generally most concentrated.
9. Children are also particularly vulnerable to toxic substances because their bodies are immature and rapidly growing. Children do not have a fully developed immune system, liver, or kidneys to help protect them from the damaging effects of many chemicals. Immature lungs are unable to remove or neutralize contaminants adequately, and developing brains and neural pathways are particularly vulnerable to toxins. In addition, some chemicals affect the endocrine system, potentially disturbing neural, reproductive, and immune development.
10. Airborne carcinogens and mutagens appear to have a greater effect on children, possibly because rapidly growing tissues are less differentiated and more "suggestible" than mature tissues.
11. Children exposed to carcinogens have a longer expected life span over which carcinogenic action may occur.
12. Children of parents exposed to toxic chemicals appear to have a higher incidence of cancer, possibly because they inherit damaged genetic material; additional exposure may then precipitate malignancy in these genetically susceptible children.
13. Fetuses are exposed during gestation to environmental pollutants stored in the mother's body; newborns are further exposed to environmental pollutants excreted in human breast milk. Children of mothers with higher levels of environmental pollutants in their body display an increased incidence of developmental and other adverse health effects.

In addition to these risk factors common to all children, some children, especially those who lack adequate medical care, who are undernourished or malnourished, or who live in crowded or unsanitary conditions, are at even greater risk. Other children at increased risk include those who live close to hazardous waste sites, incinerators, industrial emissions, or heavy traffic, or who are exposed to cigarette smoke or pesticides around the home. Studies have also shown that communities of color are disproportionately exposed to air toxics.

Example of Kinds of Problems Known to Occur in Cement Kilns

Solid Ring Formation Upset Kiln Condition will increase emissions

Solid ring formation ("thick coating") inside the rotary cement kiln (slowly rotating at an angle) is a common problem in most cement kilns, especially the older ones. It's like cookie batter sticking to a pan until it's all clogged up. In this case, the super-hot 3,000 degree F. flowing clinker/pre-cement material becomes sticky and highly viscous on the inside of the kiln where there are refractory bricks forming a protective lining so the outer solid steel shell will not suffer a kiln meltdown. It's easy for the fluidized clinker to start to stick to the refractory lining and a SOLID RING of material begins to form across the whole 8-9 foot diameter of the kiln. This is very, very bad since it totally stops clinker formation! Nothing flows down the kiln. Proper clinker formation will not occur under this condition. This is real bad news for cement kilns.

Another simpler way to think of this problem is when your kitchen sink drain plugs up...nothing flows until you unplug it. A cement kiln is basically a giant pipe with fluidized, 3,000 degree F clinker rolling, flowing down hill as it forms. The solid ring forms on the hotter end and I used to see the cement plants with a 10 or 12-gauge shotgun mounted onto a large stationary turret and they would fire hundreds of shotgun shells into the SOLID RING in order to break it up. The floor would be covered with hundreds of empty shotgun shells. I observed this every single year I inspected cement kilns for the state of Texas from 1980-1992 and it's fairly standard at many cement kilns, but the public will never see it.

Cement kiln operators are supposed to be watching 24/7/365 the interior of the kiln for solid ring formation buildup.

<u>Cement Kilns emit more Criteria and Toxic Air Pollutants than Hazardous Waste Incinerators</u>

Plant	Total Annual Emissions	Difference
TXI* =	**23,995 tpy**	**12X higher than all 3 Commercial HWI combined**
AEI* =	**744 tpy**	**32X lower than TXI**
LAI* =	**645 tpy**	**37X lower than TXI**
CWM* =	**598 tpy**	**40X lower than TXI**

TPY = tons per year

Hazardous waste incinerator data is 1995 annual tons; TXI's is 1997 draft air permit.

* TXI is Texas Industries Inc. Midlothian, Texas Cement Kiln Complex. Data from draft TNRCC air permit. Permit approved as proposed.

* AEI is American EnviroTech's commercial hazardous waste incinerator in Channelview, Harris County, Texas that was permitted by TNRCC but never built. Data

from final TNRCC air permit.

* LAI is Laidlaw's (formerly Rollins Environmental Services) commercial hazardous waste incinerator in Deer Park, Harris County, Texas. Now called Safety-Kleen. Data from final TNRCC air permit.

* CWM is Chemical Waste Management's commercial hazardous waste incinerator at Port Arthur, Jefferson County, Texas. Data from final TNRCC air permit.

Why Cement Kilns are typically more dangerous than incinerators

1. Air Pollution Differences between HW burning Cement Kilns & Incinerators (HWI)

* Cement Kilns typically emit higher dioxin levels and have higher food chain impacts.
* Chlorinated waste burned in cement kilns leads to the creation of far more harmful compounds than in original HW waste due to inherent plant design and operation.
* Cement Kilns have no secondary afterburner (unlike HWI) to try to get better waste destruction with longer residence burn time. HWI's burn in two chambers in sequence & so combustion upsets can be better handled in the afterburner.
* Combustion upsets. Unlike commercial incinerators, Cement Kilns must run a kiln thru each combustion upset (due to very hot raw mix present: shale, limestone, etc.) and thru process malfunctions, thereby making it impossible to contain products of incomplete combustion. This poses a significant risk to the community because upset emissions have been proven to be more toxic than the original waste to be burned, by creating more harmful products of incomplete combustion like dioxin.
* Cement Kilns run at low oxygen concentrations needed for complete combustion, because oxygen (as excess air) is costly to heat to 3,000 oF and excess air is kept as low as possible.
* Higher respirable PM10, total particulate emissions and stack opacity allowing more public health, nuisance and property damage from airborne cement dust.
* Frequently higher toxic heavy metal emissions and off-site contamination.
* Frequently higher total hydrocarbons & volatile products of incomplete combustion.
* Frequently higher hydrochloric acid emissions with no HCl scrubbers required and more corrosion, vegetation damage and health effects observed due to acidic gases.
* Higher carbon monoxide (CO) emissions are another sign of poor combustion.
* Higher acid gas emissions of sulfur oxides, nitrogen oxides and hydrogen sulfide.
* Higher air flow volumes thru the Cement Kilns allow higher mass emission rates.

2. Waste Ash and Cement Kiln Dust Differences between HWI and Cement Kilns

* No EPA restrictions on CKD disposal (exempted by Bevill amendment) while HWI must ship ash to RCRA approved landfills; EPA proposing some CKD rules.
* CKD is used as sham fertilizers on farmland and as inert ingredient in livestock feed
& pet foods, without warning public that HW byproducts are present.
* CKD is causing ground water contamination and runoff pollution near waste piles.
* Inadequate testing of blended HW routinely burned (some probably illegally).

* Produce more tons of waste CKD than actual tons of HW burned, which is not true recycling or true energy recovery. (burning does not reduce the metals).

3. Permitting Differences (RCRA Part B permits are being required):

* Cement Kilns are older existing plants seeking back doors permits to burn HW as a fuel substitute by minimum retrofitting, whereas HWI are new plants seeking front door permits to construct units specifically designed from the ground up to burn HW with more controls and with new technology.
* Less restrictive provisions on upsets & malfunctions since plants make cement.
* Cement Kilns usually do Trial Burns in only 1 of 2, 3, or 4 similar kilns.
* Cement factories may burn HW in multiple kilns without siting scrutiny giving consideration to area impacts and higher concentrations.
* No Public Hearing opportunity prior to burning HW under interim status. Unlike commercial HWI going through public notice before construction and operation, existing neighborhood Cement Kilns can start burning HW virtually over night without public scrutiny.
* Fuel blending allows low Btu HW, sludges, PCBs, etc. to be blended with high Btu HW so a toxic cocktail can be burned in Cement Kilns, allowing tons of unburnable HW to be disposed of like toxic heavy metals (lead, chromium, cadmium, mercury, etc.).

4. Product Differences:
* No warning label required on cement products made with hazardous waste.

Interim recommendations for living near a cement kiln to reduce toxic chemical exposure

Avoid breathing the outside air as much as possible when the wind is blowing from the cement factory
toward your home and so be sure to observe local wind conditions. Avoid exercise outdoors at these times or higher volumes of air breathed during the physical exercise activity will expose you to greater concentrations of harmful air pollution. When outside, it's appropriate for children and persons with respiratory conditions to wear at least a paper mask and even better is a gas mask to prevent exposures of harmful air contaminants.

People living near cement kilns need to be exceptionally cautious about allowing harmful cement kiln air pollution and tracking in dangerous cement dust particles into their homes where they can accumulate. Once inside the homes, the toxic dust can be inhaled or ingested, especially by young children who are prone to put their fingers in their mouths from the floor. Children are at the greatest risk. Children have rapidly developing nervous systems, lungs, brains, hearts and organs that are all exceptionally vulnerable to the toxic insults from air pollution.

Best to keep all windows and doors closed as much as possible. Homes need HEPA air filtration systems to capture even the tiniest dust particles which cement kilns emit in large quantities and it is recommended that all shoes be thoroughly cleaned before being worn into the house or leaving them outside to avoid tracking in toxic cement dust. Homes must be kept exceptionally clean or the toxic cement dust particles will be ingested and inhaled by family members.

Be careful about eating vegetables from your garden as they may contain harmful metals from the cement kiln dust blowing from the cement kiln. Cement kiln dust particles include microscopic PM2.5 sized particulate matter that is invisible to the human eye.

Avoid eating local animal, dairy and fruits and vegetables that have been grown directly downwind of the cement kilns. The meat and dairy products will potentially contain the highest concentrations of toxins like dioxins, furans, PCBs and others due to bioaccumulation through the food chain. Cows are consuming huge quantities of grass every day and the dioxins are collected from the grass they fed on.

It's tragic and unfortunate that any families should be exposed to the harmful gases and toxic dust pollution wafting out of cement kilns when they are burning hazardous waste. The cement companies are irresponsible. They generally can not meet or comply with new standards for toxic waste incinerators, even though none of us like the incinerators either. What I am saying is that cement kiln toxic waste incinerators are even worse and many times dirtier than modern dual-chambered incinerators, which have their own problems.

Bottom line: Nothing emitted by the cement kiln into the community air supply is safe to breathe. Zero emissions is the only safe level of pollution.

FINAL
Analysis of Groundwater Monitoring Data Submitted by the American Portland Cement Alliance

Response to EPA Contract No. 68-W-99-001
WA 231

Submitted to:

Eastern Research Group
2200 Wilson Blvd, Suite 400
Arlington, VA 22201

Submitted by:

Tetra Tech EM Inc.
1881 Campus Commons Drive
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Analysis of Groundwater Monitoring Data Submitted by the American Portland Cement Alliance

I. Introduction

This report contains summaries of the information gathered from the document *Cement Kiln Dust Groundwater Monitoring Summary*, produced by the American Portland Cement Alliance (APCA), dated October 2001.

A. Overview

Eighteen reports were evaluated. Tetra Tech EM Inc. (Tetra Tech) attempted to determine whether claims made within each facility report were justified by the data and methods found within. Tetra Tech also looked for general characteristics of groundwater quality related to potential influences from cement kiln dust (CKD) activities at each facility. This process consisted of detailed review of geographical information (i.e., site maps and descriptions), geological/hydrogeological investigations, historical information, sampling methods, analytical methods and analytical result interpretation.

The cement kiln dust groundwater reports reviewed herein include 18 facilities owned by 10 companies, spanning 10 states. The purpose of this review is to determine, if possible, the relative influence CKD landfill facilities have on groundwater. Tetra Tech reviewed groundwater data and compared them to government MCL and HBN regulatory values. In most cases, the reports submitted by the APCA were not detailed enough to make any meaningful determinations. However, Tetra Tech has provided a descriptive summary of all available data. The following summaries include information pertaining to:

- Groundwater constituents measured
- Instances where groundwater concentrations exceeded MCL and HBN standards
- Background information of individual site (if available)
- Overall quality of available report (content, evidence to justify conclusions, etc.)

In general, a reasonable review/assessment of the influence of CKD facilities cannot be made with respect to these file reports. In order to provide reasonable reviews of groundwater studies at CKD facilities, Tetra Tech recommends that the submitted investigative reports include, at minimum, the following:

- Site map with monitoring well and source area locations should be included with the report
- Groundwater flow direction or groundwater elevations
- Geologic information
- Monitoring well information – i.e., depths screened, specifics of construction
- Brief site history is suggested – historical property use, use of surrounding area, past environmental assessments conducted, regulatory history
- Lab and field QC samples (MS/MSD, duplicate samples, rinsate samples, blank samples) should be collected and results listed
- Analytical methods stated and should be EPA approved methods (SW 846)

- Sample collection methods should be stated
- Filtered or not filtered metals samples collected should be stated
- Detection limits should be considerably less than the MCLs
- There should be a consistent list of base line substances to analyze so there is some consistency between sites. Some sites are not analyzing for substances they perhaps should be.
- If statistical models are being used there should be support of the models and not a conclusion statement alone
- If there were soil samples collected from the sources areas one the property the data should presented to determine and assess the groundwater analyses

Examples of reports that did meet most or all of these criteria include Lebec, California and Midlothian, Texas. The remaining reports appeared to be either partial sections or abstracts with data tables. More information is required to adequately review these documents.

Based on the limited information available, Tetra Tech can report the following observations:

- Several facilities indicated elevated levels of antimony, arsenic, beryllium, cadmium, lead, selenium, thallium and some others
- A significant number of the reports are inconsistent with regard to sampled constituent (i.e., parameter)
- A number of reports do not include parameters of potential interest to the EPA (various metals and inorganics)

B. Summary of Available Data

The following tables show how the available data compare across all facilities. Because adequate information was not made available, there is no comparison between background (or upgradient) constituent concentrations and downgradient samples. Some comparisons are made within individual site reports (next section). These tables also indicate what constituents were sampled at each site (shown by “NA”).

Table 1. MCL Summary. This table reports all exceedances by facility, each constituent that was not sampled, and those that were sampled but were found to be below MCL standards. Note that in some cases analytical detection limits are greater than MCL standards.

Table 2. HBN Summary. This table reports all exceedances by facility, each constituent that was not sampled, and those that were sampled but were found to be below HBN standards. Note that in some cases analytical detection limits are greater than HBN standards.

Table 1. MCL Summary

	Alkalinity	Aluminum	Ammonia-N	Antimony	Arsenic	Barium	Beryllium	Bicarbonate	Cadmium	Calcium	Carbonate	Chloride	Chromium (total)	Copper	Fluoride	Iron	Lead	Magnesium	Manganese	Mercury (inorganic)	Nickel	Nitrate (as nitrogen)	Nitrite (as nitrogen)	Potassium	Selenium	Silver	Sodium	Sulfate	Thallium	Vanadium	Zinc
Ash Grove Cement Company - Chanute, KS	NA	NL	NA	80**	0	0	2	NA	0	NL	NL	NL	1	0	NA	NL	6	NL	NL	0	3	NA	NA	NL	0	2	NL	NL	0	NL	NL
Ash grove Cement Company – Montana City, Montana	0	NA	NA	2	0	0	NA	NL	0	NA	NA	NL	0	0	NA	NL	3	NL	NA	0	0	0	0	NL	0	0	NA	NL	NA	NA	NL
CEMEX., Inc. - Charlevoix, Michigan	NA	NA	NA	NA	5	0	NA	NA	1	NA	NA	NA	0	0	NA	NA	0	NA	NA	0	NA	NA	NA	NL	14	0	NL	NA	NA	NA	NL
CEMEX., Inc. – Lyons, Colorado	NA	NL	NA	0	0	0	0	NL	0	NL	NL	NL	0	0	0	NL	0	NL	NL	0	1	0	0	NL	1	0	NL	NL	0	NL	NL
Essroc - Logansport, Indiana	NA	NA	NA	0	0	0	0	NA	0	NA	NA	NA	NA	NA	NA	NA	0	NA	NA	0	0	NA	NA	NA	0	0	NA	NA	NA	NA	NA
Holnam - Ada, Oklahoma	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Holnam – Clarksville, Missouri	NA	NA	NA	0	0	0	0	NA	0	NA	NA	NL	0	NA	NA	NA	1	NA	Na	0	1	NA	NA	NL	0	0	NL	NL	0	NL	NL
Holnam - Florence, Colorado	55**	NL	NL	21**	1**	0	21**	NL	2**	NL	NL	NL	NA	NA	NL	NL	5**	NL	NL	2**	0	0	NA	NL	6**	0	NL	NL	21**	NA	NA
Holnam - Laporte, Colorado	NA	NA	NA	NA	1	0	NA	NA	NA	NA	NA	NL	0	0	NL	NL	0	NA	NL	NA	NA	0	0	NA	2	NA	NA	NL	0	NA	NA
Holnam - Three Rivers, Montana	NA	NA	NA	0	0	0	0	NA	0	NA	NA	NL	0	0	NL	NL	0	NA	NA	0	NL	NA	NA	NA	0	0	NA	NL	0	NL	NL
Lafarge – Paulding, Ohio	NL	NA	NA	NA	0	0	NA	NA	0	NL	NA	NL	0	0	NA	NL	0	NL	NL	0	NA	NA	NA	NA	0	0	NL	NL	NA	NA	NA
Lafarge Midwest, Inc. – Alpena, Michigan	NL	NA	NL	0	0	0	NA	NL	0	NL	NL	NL	0	0	NL	NL	3	NL	NL	0	NL	0	NL	NL	0	0	NL	NL	0	NL	NL
Lehigh Portland Cement Company – Mitchell, Indiana	NL	NA	NA	NA	40	0	NA	NL	0	NL	NL	NL	0	0	NL	NL	0	NL	NL	0	NA	NA	NA	NL	0	0	NL	NL	NA	NA	NL
Lone Star Industries, Inc. - Cape Girardeau, Missouri	NA	NA	NA	6**	3	0	3	NA	7	NA	NA	NA	0	0	NA	NL	NL	NL	NL	0	0	NA	NA	NA	1	0	NA	NL	0	NL	NL
Lone Star Industries, Inc. - Greencastle, Indiana	NA	NA	NA	1	1	0	0	NL	0	NA	NA	NA	0	0	NA	NL	0	NA	NL	0	0	NA	NA	NA	1	0	NL	NL	1	NA	NA
Lone Star Industries, Inc. - Pryor, Oklahoma	NA	NA	NA	1	4	0	0	NA	0	NA	NA	NL	0	0	NL	NL	1	NA	NL	NA	0	NA	NA	NA	0	0	NA	NL	7	NA	NA
National Cement Company of California – Lebec, California	NL	NA	NA	NA	NA	NA	NA	NA	NA	NL	NA	NL	NA	NA	NA	NA	17	NL	NA	NA	NA	0	NA	NL	NA	NA	NL	NL	0	NA	NA
North Texas Cement Company – Midlothian, Texas	NA	NA	NA	0	0	0	0	NA	0	NA	NA	NA	0	NA	NA	NA	0	NA	NA	0	NA	NA	NA	NA	0	0	NA	NA	0	NA	NL
Webster Facility - Pontotoc County, Oklahoma	NL	NA	NA	0	NA	NA	NA	NL	NA	NL	NL	NL	0	NA	NA	NA	NA	NL	NA	NA	NA	NA	NA	NL	NA	NA	NL	NL	NA	NA	NL

NA = Not Analyzed
NL = Analyzed but not listed criteria
0 = No greater than criteria
** Detection limit is greater than requlatory value

Table 2. HBN Summary

	Alkalinity	Aluminum	Ammonia-N	Antimony	Arsenic	Barium	Beryllium	Bicarbonate	Cadmium	Calcium	Carbonate	Chloride	Chromium (total)	Copper	Fluoride	Iron	Lead	Magnesium	Manganese	Mercury (inorganic)	Nickel	Nitrate (as nitrogen)	Nitrite (as nitrogen)	Potassium	Selenium	Silver	Sodium	Sulfate	Thallium	Vanadium	Zinc
Ash Grove Cement Company - Chanute, KS	NL	NL	NA	60**	72**	NL	55**	NA	NL	NL	NL	NL	0	0	NA	NL	6	NL	NL	0	NL	NL	NL	NL	0	2	NL	NL	NL	0	0
Ash grove Cement Company – Montana City, Montana	NL	NA	NA	2	7	NL	NA	NL	NL	NA	NA	NL	0	0	NA	NL	3	NL	NA	0	NL	NL	NL	NL	0	0	NA	NL	NL	NA	0
CEMEX, Inc. - Charlevoix, Michigan	NL	NA	NA	NA	89	NL	NA	NA	NL	NA	NA	NA	0	0	NA	NA	0	NA	NA	0	NL	NL	NL	NL	4	0	0	NA	NL	NA	0
CEMEX, Inc. – Lyons, Colorado	NL	NL	NA	0	1	NL	0	NL	NL	NL	NL	NL	0	0	NL	NL	0	NL	NL	0	NL	NL	NL	NL	0	0	NL	NL	NL	0	0
Essroc - Logansport, Indiana	NA	NA	NA	0	11	NL	0	NA	NL	NA	NA	NA	NA	NA	NA	NA	0	NA	NA	0	NL	NA	NA	NA	0	0	NA	NA	NA	NA	NA
Holnam - Ada, Oklahoma	NA	NA	NA	0	0	NL	0	NA	NL	NA	NA	NA	NA	NA	NA	NA	0	NA	NA	0	NL	NA	NA	NA	0	0	NA	NA	NA	NA	NA
Holnam – Clarksville, Missouri	NA	NA	NA	0	1	NL	0	NA	NL	NA	NA	NL	0	NA	NA	NA	1	NA	NA	0	NL	NA	NA	NL	0	0	NL	NL	NL	NA	NA
Holnam - Florence, Colorado	NL	NL	NL	7**	21**	NL	21**	NL	NL	NL	NL	NL	NA	NA	NL	NL	5**	NL	NL	0	NL	NL	NA	NL	0	0	NL	NL	NL	NA	NA
Holnam - Laporte, Colorado	NA	NA	NA	NA	9	NL	NA	NA	NA	NA	NA	NL	0	0	NL	NL	0	NA	NL	NA	NA	NL	NL	NA	0	NA	NA	NL	NL	NA	NA
Holnam - Three Rivers, Montana	NA	NA	NA	0	13**	NL	0	NA	NL	NA	NA	NL	0	0	NL	NL	0	NA	NA	0	NL	NA	NA	NA	0	0	NA	NL	NL	0	0
Lafarge – Paulding, Ohio	NL	NA	NA	NA	2**	NL	NA	NA	NL	NL	NA	NL	0	0	NA	NL	0	NL	NL	0	NA	NA	NA	NA	0	0	NL	NL	NA	NA	NA
Lafarge Midwest, Inc. – Alpena, Michigan	NL	NA	NL	0	0	NL	NA	NL	NL	NL	NL	NL	0	0	NL	NL	3	NL	NL	0	NL	NL	NL	NL	0	0	NL	NL	NL	0	0
Lehigh Portland Cement Company – Mitchell, Indiana	NL	NA	NA	NA	110**	NL	NA	NL	NL	NL	NL	NL	0	0	NL	NL	0	NL	NL	0	NA	NA	NA	NL	0	0	NL	NL	NA	NA	0
Lone Star Industries, Inc. - Cape Girardeau, Missouri	NA	NA	NA	6**	44**	NL	3	NA	NL	NA	NA	NA	0	0	NA	NL	13**	NL	NL	0	NL	NA	NA	NA	0	0	NA	NL	NL	0	0
Lone Star Industries, Inc. - Greencastle, Indiana	NA	NA	NA	1	13**	NL	0	NA	NL	NA	NA	NA	0	0	NA	NL	0	NA	NL	0	NL	NA	NA	NA	0	0	NA	NL	NL	NA	0
Lone Star Industries, Inc. - Pryor, Oklahoma	NA	NA	NA	0	5**	NL	0	NA	NL	NA	NA	NL	0	0	NL	NL	1	NA	NL	NA	NL	NA	NA	NA	0	0	NA	0	0	NA	NA
National Cement Company of California – Lebec, California	NL	NA	NA	NA	NA	NA	NA	NA	NA	NL	NA	NL	NA	NA	NA	NA	17	NL	NA	NA	NA	NL	NA	NL	NA	NA	NL	NL	NL	NA	NA
North Texas Cement Company – Midlothian, Texas	NA	NA	NA	0	6**	NL	0	NA	NL	NA	NA	NA	0	NA	NA	NA	0	NA	NA	0	NA	NA	NA	NA	0	0	NA	NA	NL	NA	0
Webster Facility - Pontotoc County, Oklahoma	NL	NA	NA	0	NA	NA	NA	NL	NA	NL	NL	NL	0	NA	NA	NA	NA	NL	NA	NA	NA	NA	NA	NL	NA	NA	NL	NL	NA	NA	5

NA = Not Analyzed
NL = Analyzed but not listed criteria
0 = No greater than criteria
** Detection limit is greater than regulatory value

Mercury Pollution from Cement Kilns Double Previous Estimates

Author: Earthjustice
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WASHINGTON, D.C. July 23, 2008 - For more than a decade after Congress told it to curb dangerous mercury pollution from cement kilns across the nation, the U.S. Environmental Protection Agency (EPA) refused to take action. Now, a new study from Earthjustice and the Environmental Integrity Project (EIP) documents the consequences of the EPA's failure: Cement kilns emit mercury pollution - a threat to the health of pregnant women and children - at more than twice the level estimated as recently as 2006 by the EPA, which only started to collect data on the problem in 2007.

The unregulated pollution from cement kilns is emitted in or nearby many major U.S. urban areas and also within a few miles of such major bodies of water as the Chesapeake Bay, Lake Huron and the San Francisco Bay. Mercury pollution already has impaired rivers, lakes, and streams throughout the United States, making certain fish unsafe to eat. According to the Centers for Disease Control and Prevention, 8 percent of women of childbearing age in America already have mercury in their bodies at levels high enough to put their babies at risk of birth defects, loss of IQ, learning disabilities and developmental problems.

Entitled "Cementing a Toxic Legacy? How EPA Has Failed to Control Mercury Pollution From Cement Kilns," the Earthjustice/EIP report outlines specific recommendations for EPA and state agency action based on the following key conclusions:

* 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. 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.

* 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. For example, some cement kilns release as much or more mercury as coal fired power plants.

* Since 1974, cement production has increased 15 percent, and further increases are projected for the future. Rising levels of cement production in the U.S. mean that the cement industry's mercury pollution will grow even worse if left unregulated.

"EPA's new data confirm that cement plants are among the worst mercury polluters in this country," said James Pew, Earthjustice staff attorney. "EPA has refused to acknowledge this problem for more than a decade, and the mercury contamination in our food and waters has grown worse every year as a result. It is high time for EPA to do its job and make this industry clean up its toxic emissions."

"Action by the EPA is long overdue and America's health and public waters have suffered needlessly due to this foot dragging," said Environmental Integrity Project Director Eric Schaeffer. "Ten years after it was required to set standards for cement kilns, EPA finally got around to requesting basic information related to mercury emissions from nine of the major cement kiln companies operating in the U.S. EPA claims that it will use this information to finally propose mercury standards for cement kilns sometime in the summer or fall of 2008, but confidence in that timeline is low given all of the agency's stalling to date. Based on our new review of available data, it is now long past time for EPA to regulate an industry that releases nearly twice as much mercury into the air as the agency previously reported."

Marti Sinclair, chairperson, Sierra Club National Air Committee (Cincinnati, OH), said, "EPA's mercury strategy has allowed 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."

In 2007, EPA collected data from nine companies and released data for 51 non-hazardous waste burning kilns currently operating in the United States. The 2007 EPA collection requests were sent to the following companies: Ash Grove Cement Company (Overland Park, KS); CEMEX, (Houston, TX); California Portland Cement Company, (Glendora, CA); Essroc Cement Corp., (Nazareth, PA); Holcim (US) Inc., (Dundee, MI); LaFarge North America, Inc. , (Herndon, VA); Lehigh Cement Company, (Allentown, PA); Lonestar/Buzzi Unicem, (Bethlehem, PA.); and Texas Industries, Inc., (Dallas, TX).

Kiln-specific findings from across the U.S. include the following:

* 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 Toxic 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 Polluting Cement Kiln list.

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

* 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. The Lehigh cement kiln at Union Bridge reported to TRI in 2006 emitting only 35 pounds of mercury pollution; but the data show that this kiln also has the capacity to emit as much as 1,539 pounds of mercury a year. This is particularly significant given the plant's proximity to the Chesapeake Bay.

* 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 emit just under 200 pounds of mercury on an annual basis, and thousands of tons of other dangerous toxic air pollutants.

* In the San Francisco Bay Area, Hanson Permanente Cement operates a kiln in Cupertino, California. This kiln is located within a major 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. The Hanson Permanente kiln reported emitting a staggering 494 pounds of mercury pollution in 2006 to the EPA's Toxic 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 pollution to the Toxic 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 in close proximity to residential areas of Alpena.

In a clear sign of the limitations of the initial EPA data, the federal agency released no data on one cement industry leader, 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 reviewed by the EPA was self-reported by the kiln companies.

The process for making 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 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 is a dangerous 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. 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 US with neurological problems due to in utero exposure to methylmercury. 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.

Report: http://www.earthjustice.org/our_work/campaigns/cement-kilns.html

AMERICAN LUNG ASSOCIATION.

Stop Hydrochloric Acid Pollution from Cement Kilns NOW!

Campaign Launched: February 17, 2006

Across the United States, 118 cement plants in 38 states spew a continuous stream of toxic pollutants into the air we breathe. As they burn coal to produce cement, the kilns in these plants also release huge amounts of toxic hydrogen chloride or hydrochloric acid (HCl) into the air. The U.S. Environmental Protection Agency (EPA) estimates that these cement kilns also known as cement plants emit more than 15,000 tons of HCl into our air each year.

HCl is irritating and corrosive to any tissue it contacts. It can cause health problems ranging from throat irritation to swelling and spasm of the throat and lung tissues, leading to suffocation and even death. Children may be more vulnerable to hydrochloric acid because of the smaller diameter of their airways.

In December 2005, the EPA announced a proposed rule governing emissions of hazardous air pollutants. The proposal is too weak because it includes no limits on hydrochloric acid pollution from coal-fired cement-making facilities.

Send your letter today to EPA Administrator Stephen Johnson, urging him to comply with the Clean Air Act and protect Americans from toxic air pollution from cement plants. You deserve to breathe clean air.

Sample Letter for Campaign

Subject: Stop Hydrochloric Acid Pollution from Cement Kilns NOW!

Dear *[Decision Maker]* ,

Across the United States, 118 cement plants in 38 states spew a continuous stream of toxic pollutants into the air we breathe. As they burn coal to produce cement, the kilns in these plants also release into our air huge amounts of toxic hydrochloric acid (HCl), which is a powerful threat to lung health.

Hydrochloric acid is irritating and corrosive to any tissue it contacts. Brief exposure to low levels causes throat irritation. Exposure to higher levels can cause swelling and spasm of the throat and lung tissues, leading to suffocation and even death. Some people may develop an inflammatory reaction called reactive airways dysfunction syndrome (RADS), a type of asthma. Children may be more vulnerable to corrosive agents like hydrochloric acid because of the smaller diameter of their airways.

In December 2005, the U.S. Environmental Protection Agency announced a proposed rule governing emissions of hazardous air pollutants. The proposal includes no limits on hydrochloric acid pollution from coal-fired cement-making facilities. Meanwhile, these plants continue to reap enormous profits, polluting our air while the federal agency charged with protecting the environment and the public health is doing nothing.

I implore the EPA to rewrite this rule to include limits on toxic pollution, like hydrochloric acid, from cement kilns, as required by the Clean Air Act. For far too long, cement manufacturers have poisoned our air with toxic pollution. It is time for the EPA to do its job by protecting our health and our environment.

Thank you for considering - and sharing - my concerns for the lung health of all Americans. We deserve to breathe clean air.

Sincerely,

Background Information

Hydrogen chloride or hydrochloric acid (HCl) is irritating and corrosive to tissue. Inhaling HCl can irritate the throat, cause respiratory problems and worsen asthma and other lung diseases. Children may be more vulnerable to corrosive agents like hydrochloric acid because of the smaller diameter of their airways. When high concentrations of HCL gas are inhaled, as during an accidental spill, serious damage to the lungs may occur resulting in the reactive airways dysfunction syndrome [RADS] which acts like severe persistent asthma.

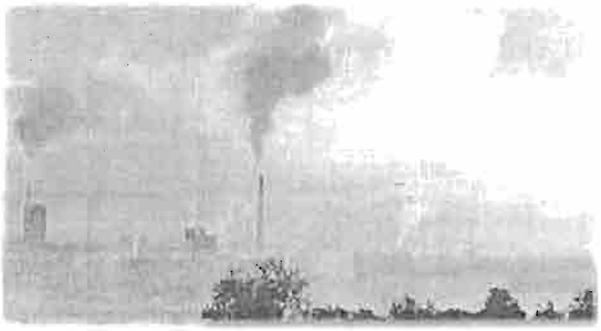
The cement manufacturing industry is a significant source of hazardous air pollutants, including HCl. The industry operates 118 facilities in 38 states, spanning every region of the country. Cement kilns release toxins during the cement manufacturing process, which involves burning both fossil fuels and various types of waste-derived fuels. The U.S. Environmental Protection Agency's (EPA) own estimates reveal that the nation's cement kilns emit more than 15,000 tons of hydrogen chloride each year. But monitoring and reporting requirements are woefully inadequate; and without any regulations requiring the monitoring of these emissions, it is difficult to know for sure exactly how much HCl and other pollutants these facilities emit. Experts believe that the true amount of hazardous pollution generated by cement kilns could be many times greater than the amount being reported by the industry.

After years of inaction by the EPA, in December 2000, the federal Court of Appeals for the D.C. Circuit ordered the agency to issue regulations required under the Clean Air Act to limit the amount of hydrogen chloride and other hazardous air pollutants from cement kilns. Even after being ordered to do so, the EPA has refused to enact regulations to limit hazardous emissions from kilns. The refusal to issue these regulations has resulted in virtually unregulated toxic emissions of hydrogen chloride and other hazardous pollutants from the nation's coal-burning cement kilns.

Legal action filed on October 28, 2004 by Earthjustice on behalf of the Sierra Club asked the D.C. Circuit to compel the EPA to obey the court order and control toxic emissions from cement kilns. On September 21, 2005, the U. S. Court of Appeals for the District of Columbia Circuit approved an agreement between the EPA and Sierra Club to issue regulations that will limit harmful toxic emissions from cement kilns nationwide. The agreement was intended to clean the air for millions of Americans living near these facilities and bring the EPA into compliance with federal law. The agreement required the EPA to adopt regulations for these pollutants no later than May 26, 2006.

On December 2, 2005, EPA published a rule in the Federal Register that once again ignored the court's order and offered no emission limits for hydrogen chloride and other hazardous air pollutants. This flagrant disregard for public health and the law allows the threat posed by cement kiln pollution to continue.

ICHETUCKNEE.ORG help save the ichetucknee river



Health and Environmental Threat Associated with Tire-Burning Cement Kilns

Research worldwide indicates that tire burning kilns have a serious detrimental impact on community health and the integrity of the surrounding environment.

Kiln emmissions have been found to cause cancer and respiratory illness. Environmental degredation ranges from physical alteration to heavy metal,mercury, and chemical contamination.

Chemicals from the air and ground water entering the river, can accumulate to toxic quantities in wildlife and degrade the river ecosystem. As the river becomes polluted the entire ecosystem is at risk: human health is compromised, wildlife is threatened and the environment is in peril.

Below are listed 10 points that substantiate this view and can be supported by medical research, primarily commissioned by Environmental Protection Agencies (EPA).

1. **Dioxins**
   Dioxins are among emissions from tire-burning kiln. The World Health Organization (WHO) has recently classified the most toxic dioxins as the worst known human carcinogens (cancer causing agents).

   Dioxins also affect the immune system, fertility, and the unborn child. Because of this, the USA has reduced their safety levels for Dioxins repeatedly. The EPA concluded, "Exposure to Dioxins, even at minute levels, poses cancer risks and health concerns wider than previously suspected".

2. **Particulates**
Particulates are extremely small particles that enter the lungs directly, as they are too small to be filtered out.

In August 1995 the official monitoring of particulates at Castle Cement Plant in Clithroe, England was 70mg/m³ whereas an independent monitoring showed 490mg/m³ at a school downwind from the plant. At this school 22% of 8 - 9 year olds used inhalers, compared with an upwind school where only 3% of children used them. Castle Cement's predicted particulate emissions are 63 tons p.a. (Castle Cement's Environmental Statement).

No matter what the company says will come out of the stack, studies worldwide have shown that real emissions are considerably greater and subject to sporadic events of particularly high concentrations.

3. **Unpredictability of Plume**
No one can guarantee where the plume from the tower will land. Plumes from high stacks can travel considerable distances depending on wind conditions (direction and intensity).

Studies have shown that a plume from a tall stack drops its particulates within a minimum radius of 11 miles to 47 miles from the stack. The volume of particulates can be quite large and may actually travel considerably larger distances (100's of miles) in any direction with the wind.

This is also the reason that acid rain originating from smoke stacks in the Midwest falls to the ground in Maine. The health effects of this kiln will reach to Tallahassee and Jacksonville in small amounts.

Again, company predictions of the plume emission volumes and trajectories are not realistic. Mercury and a myriad of other chemical pollutants will fall in the Ichetucknee, Santa Fe and Suwannee rivers.

Regions such as The San Francisco Bay Area and the state of Maine have already limited mercury emissions to below what will come out of this plant.

4. **Heavy Metals and Mercury**
EPA studies have documented that heavy metals do not incinerate and emissions from incinerators pose a significant health risk. The new cement kiln would be generating heavy metal emissions and most of them are toxic to humans.

Worldwide studies have revealed that mercury entering an aquatic system will accumulate in the food chain. Fish are particularly susceptible to accumulating high amounts of these toxins in their tissues, which can then accumulate in the tissues of the birds and

Cement Kiln PP 101

mammals who eat them. And ultimately, in humans who eat the contaminated fish and animals.

The kiln will release 129 pounds of mercury more than allowed by any state or agency concerned with environmental health.

5. **General Health Problems**
A study conducted on illnesses related to tire burning cement plants in Texas showed a 50% to 100% increase in coughing, phlegm, sore throats, and eye irritation in people near the incinerators.

A similar study concluded that a substantially greater incidence of larynx cancer occurred in a community within 2 km of a commercial hazardous waste incinerator.

Double blind studies reveal that people who live within five miles of a tire burning kiln in Texas are sicker, it is that simple.

6. **Lack of Research**
For the vast majority of chemicals, we have little or no long term toxicity data. Fewer that 2% of chemicals have been tested.

Tires are not made of rubber, they are complex chemical mixtures that will release thousands of chemicals in mixtures that will create new ones, the health hazards of this are unknown. As a cancer researcher I know that mixtures of chemicals in low doses are cancer causing in humans, even if the individual chemical is not.

WHO reports recent evidence that 10,000 people in England and Wales die prematurely each year from respiratory or heart conditions due to particulates. MAFF (Ministry of Agriculture, Food & Fisheries) showed dioxin levels to be 4 times higher than normal at Clitheroe Cement Kiln where prescriptions for asthma have risen 50% since they started burning chemicals and tires.

7. **Cement Kilns are prone to Upsets and Trips**
Dr Rickard (Professor of Environmental Health) states that

> "cement kilns do not have the necessary reliability and safeguards to ensure complete destruction of hazardous wastes".

Castle Cement in UK has had many such 'trips' in the past, as do the kilns in Texas and the rest of the USA. By previous experience, there will be mistakes often and they result in odor, and chemical releases far above the listed values.

8. **Hidden Costs**
I urge you to consider the economic impact that heavy industry will

have on the surrounding community

a. The visual blight and resulting drop in property values
b. People leaving the area - there is already evidence for this
c. The deterrent to firms who might otherwise have moved to this area
d. Lowering of living standards and quality of life
e. Noise and Diesel truck emissions

9. **Threat to Employment**
The area in Northern Florida between the three rivers is a pristine environmental area whose whole future depends on tourism and vacation and retirement housing. All this will stop with the kiln, we trade 80 jobs for thousands.

10. **Stress**
With the increase in noise, traffic on local roads and respiratory and other health problems, there is likely to be an increase is stress related illnesses in the local population.

Recommendations

As elected representatives you shoulder the responsibility for our health and well being. If you approve this application you are giving permission for a tire incinerator to be built in our community with the associated long-term health risks not only to the present generation but also to generations to come. I, therefore, strongly urge you to consider the following objectives and do something to stop this kiln.

Objectives

1. Stop the mining around the rivers because it will degrade the rivers. The mine should not be a hostage. Since you know the mine is a hazard, stop it without any tie to the kiln which is another issue.

2. Do not permit the plant do to health reasons. Dioxins, mercury, mixed chemicals not reported to DEP are enough of a justification. Health studies worldwide prove beyond a doubt the kiln will cause cancer and lung disease. A tire-burning kiln is not good for a community.

3. Certainly do not permit this kiln in an agricultural environmentally sensitive area. If it must exist put it in an industrial area. However, my personal view is that a tire burning cement plant is a health hazard anywhere it is built.

Adapted from The Campaign Against the New Kiln, a site dedicated to stopping a tire-burning kiln in the UK.

Feds Have Another Go in Midlothian to Investigate Cement Kilns

Posted on January 21st, 2010 9:30am by Tim Rogers
Filed under Environment

The Agency for Toxic Substances and Disease Registry, the investigative arm of the Centers for Disease Control, will hold a meeting at the Midlothian Community Center tonight to explain what it plans to do in the "Cement Capitol of Texas." Why should you care? As the press release from Downwinders at Risk says: "According to state industrial inventories, Midlothian's cement plants account for half of all industrial pollution in North Texas." (Full release after the jump.) Not only are the cement kilns there endangering children's lives in Midlothian, but they're choking us up here, too. For more on this, I point you to Julie and Tom Boyle's fine story about their experience living in Midlothian.

MIDLOTHIAN — Less than a year after being taken to the woodshed by a Congressional

Committee for its first attempt to find out if there are unusual rates of illness in Midlothian, a federal agency is back in town for another try.

The Agency for Toxic Substances and Disease Registry (ATSDR), the investigative arm of the Centers for Disease Control, will be holding an "informational meeting" at the Midlothian Community Center tonight to explain how its approaching its mission the second time around in the "Cement Capitol of Texas."

Although recent reports have spotlighted the dangers of toxic gases from Barnett Shale gas production in North Texas, concern over being exposed to thousands of tons of toxic air pollution from the nation's largest concentration of cement kilns has been bubbling in Midlothian since 1986. That's when hazardous waste started being burned for fuel and profit in some of the kilns. By the mid-1990's, Midlothian hosted the largest hazardous waste incinerators in the state.

Using the same data the cement plants submit to the state and EPA, UNT students reported the town's three cement plants and steel mill released approximately one billion pounds of air pollution from 1990 to 2006. According to state industrial inventories, Midlothian's cement plants account for half of all industrial pollution in North Texas.

Five years ago, Midlothian resident and former CDC employee Sal Mier organized a grassroots petition drive to bring the ATSDR to town to investigate higher rates of certain birth defects and cancers, as well as respiratory illness and other potential pollution-related diseases he had observed. But after the agency responded by punting the effort to state agencies that relied on old data and ignored interviews, Mier ended up testifying against ATSDR in front of the Congressional Committee on Science and Technology last March.

In June, 2009, ATSDR announced it would go back into Midlothian, this time taking the lead itself. But even this 2.0 version got off to a shaky start when complaints from citizens led to the abandonment of an official "Community Assistance Panel" late last year that was supposed to provide feedback. Out of 18 members, seven started out with a connection to one of Midlothian's cement plants.

Tonight's meeting is part of a revamped public relations strategy that decided to scrap that selected Panel in favor of open public meetings.

Based on its track record, activists remain skeptical of the ATSDR's ability to find anything wrong in Midlothian, no matter how obvious the public health impacts. But they're also encouraging people to attend to show their concern that the feds get it right this time and support Mier's hard work.

"There's are lots of good reasons to do a well-researched and thorough health study in and around Midlothian," said Jim Schermbeck, Director of Downwinders at Risk, "But it remains to be seen if ATSDR can do one."

"Nevertheless, we're urging folks to go to the meeting so that the ATSDR knows there's plenty of support for getting answers, as well as honoring Sal's persistence. He's been a great role model for all of us."

http://www.earthjustice.org/library/reports/ej_eip_kilns_web.pdf

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]

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.

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

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 child-bearing 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.

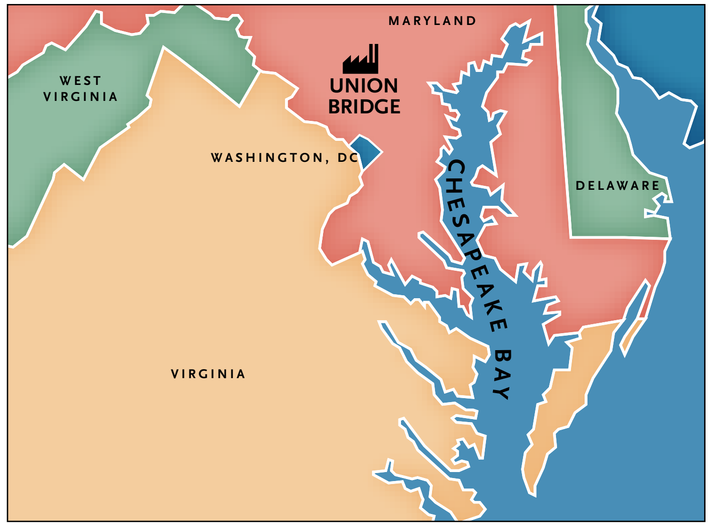
  The Lehigh cement kiln at Union Bridge reported to TRI in 2006 emitting only 35 pounds of mercury; but the number calculated based on EPA data shows the kiln could be emitting up to 1,539 pounds, an unusually large

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.

EARTHJUSTICE
Because the earth needs a good lawyer

Press Release

Federal Government Cracks Down on Mercury Pollution From Cement Kilns

Air pollution rules from new administration will cut mercury pollution by between 81 and 93 percent

April 21, 2009

Washington, DC -- The federal government is proposing, for the first time, to reduce airborne mercury pollution from cement kilns with new rules issued today. The new standards will cut mercury pollution from the nation's more than 150 cement kilns between 11,600 and 16,250 pounds (or a reduction of 81 to 93 percent), according to the US Environmental Protection Agency.

Led by Lisa Jackson, the EPA Administrator newly appointed by President Obama, EPA is proposing first time standards for cement kilns of mercury, hydrochloric acid, and toxic organic pollutants such as benzene. In addition, the agency is strengthening the outdated standards for particulate matter to better control kilns' emissions of lead, arsenic, and other toxic metals.

Local and national environmental and public health advocates cheered the news, which follows a decade of delay and represents a hard-fought victory for those who have long pushed for these mercury limits. The new standards are being proposed as part of a court settlement reached between the US Environmental Protection Agency, the nonprofit environmental law firm Earthjustice representing Sierra Club and community groups in New York, Michigan, Montana, California and Texas, and the states of Connecticut, Delaware, Illinois, Maryland, Massachusetts, Michigan, New Jersey, New York and Pennsylvania.

Earthjustice prevailed in a string of lawsuits aimed at forcing EPA to set limits for airborne mercury pollution from cement kilns for nearly a decade. Such limits were due under the federal Clean Air Act in 1997.

"This is great news and is a promising sign that the new leadership at EPA and in the White House is serious about protecting public health and the environment," said Earthjustice attorney Jim Pew. "By stopping pollution at its source, we can keep mercury from poisoning the fish we eat. Bit by bit, we can reclaim our nation's waters and protect our children's health and our environment from dangerous mercury pollution."

Although cement kilns have avoided controlling their mercury pollution until now, they are one of the largest sources of mercury emissions nationwide and the worst mercury polluters in some states. But kilns can curb their mercury emissions by using cleaner raw materials, cleaner fuels, and readily available technology like scrubbers and activated carbon injection.

In addition to requiring kilns to cut their mercury emissions, the proposed rules also limit, for the first time, kilns' emissions of the acid gas hydrochloric acid which acts as a lung irritant and other highly toxic pollutants such as benzene. In addition, they will significantly reduce cement kilns' emissions of particulate (PM) and sulfur dioxide (SO2) pollution, pollutants which damage heart and lung function.

"The Obama EPA is waking up to community voices which have been calling for years for protection from the cement industry's toxic spew" said Marti Sinclair, Chair of the Sierra Club's Clean Air Team. "The spell which has enthralled EPA to corporate interests has been broken by the dogged persistence of Americans fighting for what is right."

The new rules would also require cement kilns to monitor their mercury emissions for the first time. In the past, the industry has been notoriously lax about reporting these emissions: a study last summer from Earthjustice and the Environmental Integrity Project (EIP) found that cement kilns emit mercury pollution at more than twice the level estimated as recently as 2006 by the EPA, which only started to collect data on the problem in 2007.

The report -- titled "Cementing a Toxic Legacy?" -- drew on the latest EPA data, which found that the nation's 151 cement plants generate 22,918 pounds of airborne mercury each year. Previously, EPA believed that cement kilns accounted for about 11,995 pounds of annual mercury emissions.

Mercury is dangerous in even very small doses; one-seventieth of one teaspoon of mercury can contaminate a 20-acre lake and make the lake's fish unsafe to eat. But a study by the University of Florida found that when mercury pollution is reduced, ecosystems can indeed bounce back, documented by reduced mercury levels in fish and certain bird species within just a few years.

A dangerous neurotoxin, mercury interferes with the brain and nervous system. According to the Centers for Disease Control and Prevention, eight percent of American women of childbearing age have mercury in their bodies at levels high enough to put their babies at risk of birth defects, loss of IQ, learning disabilities and developmental problems. The build up of mercury in aquatic systems and the resulting fish contamination undercuts the million-job industry supported by the nation's 45 million recreational fishers and renders a portion of the hard-won catch unfit for human consumption.

Additional Resources:

- For an interactive map showing the locations of cement kilns nationwide, including kiln-specific information, please visit: http://www.earthjustice.org/library/features/cement-kilns/interactive-map-of-featured-cement-kilns.html
- For an interactive web feature illustrating how cement manufacturing creates mercury pollution, please visit: http://www.earthjustice.org/library/features/cement-kilns/mercury-emissions-from-cement-production.html
- For an interactive web feature illustrating how mercury impacts humans, please visit: http://www.earthjustice.org/library/features/cement-kilns/mercury-and-bioaccumulation.html
- For a report documenting the recreation fishing economic engine, please visit Sportfishing in America: An Economic Engine and Conservation Powerhouse

Contact:

Jim Pew, Earthjustice, (202) 667-4500

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10 March 2008

The 27 Worst Cement Kilns for Mercury Pollution

EPA, Finally, Will Crack Down on Major Polluters

By Dan Shapley

Photo: Thaddeus Robertson

After years of litigation, it appears that environmental groups and states have won a victory against the Environmental Protection Agency, which had refused for 10 years to set mercury emissions limits on cement kilns, one of the largest sources of pollution in the country. The news came to us from Earthjustice, the group that has, in collaboration with national and local environmental groups, led the legal fight to see this mercury pollution reined in.

The EPA had cracked down on mercury from power plants in recent years, though that regulation was recently tossed by the courts. But the EPA had refused, despite four court decisions stating that the Clean Air Act required mercury regulation from major industrial sources like cement manufacturing plants, to set first-ever limits.

The cement industry is heavily consolidated and controlled by international companies that are, in many cases, based outside the United States. While the U.S. economy demands cement, the pollution is dumped domestically while the profits are exported. Mercury fallout from burning coal and processing limestone contaminates lakes, rivers and reservoirs, where elemental mercury is transformed into toxic methymercury. That neurotoxin enters the food chain and can damage the brains of fetuses and young children who eat, or whose mothers eat, contaminated fish.

Here's a list of the 27 cement kilns that emitted more than 100 pounds of mercury in 2006. (View all 100 in the EPA's Toxic Release Inventory.

Note, however, this caveat from Earthjustice: "The TRI depends on voluntary emissions estimates that may significantly understate kilns' actual pollution levels. Individual cement kilns in New York, Michigan and Oregon routinely understated their emissions until being required by state officials to conduct emissions tests – at which point it was evident that their actual emissions were approximately ten times higher than previously reported. The Lafarge kiln in Ravena, New York previously reported mercury emissions of only 40 pounds. It now acknowledges emitting more than 400 pounds per year."

Biggest Cement Kiln Mercury Polluters, 2006

Pounds – Facility, Location

1. 2,582 – Ash Grove Cement Co., Durkee, Baker County, Ore.
2. 654 – California Portland Cement Co., Colton, San Bernardino County, Calif.
3. 586 – Lehigh Southwest Cement Co., Tehachapi, Kern County, Calif.
4. 522 – Ash Grove Cement Co., Chanute, Neosho, Kan.
5. 496 – Hanson Permanente Cement, Cupertino, Santa Clara County, Calif.
6. 472 – Ash Grove Cement Co., Foreman, Little River County, Ark.
7. 417 – LaFarge Midwest Inc., Alpena, Alpena County, Mich.
8. 416 – LaFarge Building Materials Inc., Ravena, Albany County, N.Y.
9. 271 – Cemex California Cement LLC, Victorville, San Bernardino County, Calif.
10. 252 – River Cement Co., Festus, Jefferson County, Mo.
11. 241 – Cemex Cement of Texas LP, New Braunfels, Comal County, Texas
12. 225 – Cemex de Puerto Rico Inc., Ponce, Ponce County, Puerto Rico
13. 208 – National Cement Co. of Alabama, Ragland, St. Clair County, Ala.
14. 190 – Lehigh Cement Co., Mason City, Cerro Gordo County, Iowa

15. 176 – Essroc Cement Corp., Speed, Clark County, Ind.
16. 172 – RMC Pacific Materials, Davenport, Santa Cruz County, Calif.
17. 163 – Essroc Cement Corp., Nazareth, Northampton County, Penn.
18. 161 – Mitsubishi Cement Corp., Lucerne Valley, San Bernardino County, Calif.
19. 160 – Buzzi Unicem USA, Cape Girardeau, Cape Girardeau County, Mo.
20. 159 – Lehigh Cement Co., Mitchel, Lawrence County, Ind.
21. 153 – Ash Grove Cement, Leamington, Leamington County, Utah
22. 151 – Essroc Cement Corp., Bessemer, Lawrence County, Penn.
23. 149 – Capitol Cement Corp., Martinsburg, Berkeley, W.Va.
24. 130 – Buzzi Unicem USA, Greencastle, Putnam County, Ind.
25. 120 – Holcim (US), Dundee, Monroe County, Mich.
26. 106 – Holcim U.S. Inc., Clarksville, Pike County, Mo.
27. 105 – Keystone Cement Co., Bath, Northampton, Penn.

http://www.groundwork.org.za/Cement/EPA%20finally%20will%20crack%20down.pdf

Boise Weekly

FEATURES » FEATURES February 03, 2010

Mountains of Mercury

The pollution costs of cement production

by Jeremy Miller

The whole matter of the missing mercury might have slipped by unnoticed. But Patty Jacobs, a permit writer for the Oregon Department of Environmental Quality, decided to check the math.

In 2005, after a federal mercury-reduction rule was passed (since vacated by the U.S. Court of Appeals), Jacobs and the nation's other regulators began paying attention to coal-fired power plants, a major source of the mercury building up in the nation's waterways. The Boardman, Ore., plant, a coal-fired facility 160 miles east of Portland, reported that it had put 281 pounds of toxic metal into the air that year. That ostensibly made the plant the largest mercury source in Jacobs' territory, which covered much of central and eastern Oregon.

ADAM ROSENLUND

Even small amounts of mercury can cause harm. Once the metal is deposited in a lake or river, bacteria convert it to an organic form called methylmercury. From there, it works its way upward through aquatic microorganisms and insects, intensifying in the tissue of fish and, eventually, in the animals and people that consume them. Exposure to high levels of mercury causes reproductive declines and developmental problems in wildlife. Human babies exposed in utero suffer an increased risk of neurological disorders, including attention deficit and impaired coordination. In adults, mercury consumption has been linked to memory loss, muscle tremors and impaired vision.

To learn more about other mercury sources in her territory, Jacobs dug into the Environmental Protection Agency's Toxic Release Inventory, a public repository of emissions data. She learned that in 2005, the Ash Grove cement plant, located in the town of Durkee in eastern Oregon, reported emitting 631 pounds of mercury--more than twice the amount reported by the Boardman power plant.

To Jacobs, a self-described "numbers geek," that was a red flag. Checking the T.R.I. figures against Durkee's 2005 air-quality permit, she estimated that the plant's total mercury emissions should have been closer to 1,400 pounds.

Jacobs contacted the company to double-check her findings. Ash Grove performed its own tests and found that its actual emissions were even higher—about 2,500 pounds per year.

That firmly established the Durkee facility as the nation's dirtiest cement plant in terms of mercury, responsible for 10 percent of the mercury emitted by the 101 Portland cement plants across the country (24 are located in Western states). Perhaps more startling, this amount was 800 pounds greater than the amount of mercury reported by the nation's top mercury-emitting coal plant in the same year.

Mercury released from the Durkee plant during the last 30 years has been deposited both regionally and globally. Yet the attendant ecological and health effects are just now beginning to be understood. The story of Ash Grove's vast and underreported emissions offers insight into an industry that has operated for years with little federal oversight and no accounting for several of its most toxic byproducts. It also illustrates the critical and prolonged failure of the EPA to apply the Clean Air Act to one of the nation's largest and dirtiest industrial sectors.

The Durkee facility, Oregon's only cement plant, is operated by the largest U.S.-owned cement company, Ash Grove Cement. In 2008, the company reported $1.2 billion in sales. That same year, it also reached an agreement with the state of Oregon to cut its mercury emissions by installing a carbon injection system.

I visited Durkee in November, hoping to see the new $20 million mercury control system, reportedly in the initial phases of construction. But my request for a tour was denied. Jacqueline Clark, Ash Grove's head of public relations, e-mailed me that the Durkee plant was facing imminent layoffs and could not accommodate a tour. Indeed, a few months earlier, Ash Grove announced plans to halt production at its nine U.S. plants, including Durkee. (In early December, the company temporarily ceased production and laid off more than half of the plant's 115 workers.) Company officials said they might close the facility altogether if proposed federal regulations on mercury are enacted next year.

Although Ash Grove refused to allow a visit, Justin Hayes, program director of the Boise-based Idaho Conservation League, suggested that a look at the facility's exterior might be instructive. So we made the hour-and-a-half drive from Boise on a warm afternoon. The plant itself is situated on the west side of Interstate 84, tucked into a steep-sided valley along a bend in the Burnt River.

Hayes has been key in the regional fight against mercury pollution. He has negotiated mercury reductions with large industrial players such as Monsanto, and his scientific sleuthing helped to reveal massive emissions from northern Nevada gold mines. Hayes is particularly concerned about the Durkee plant because metropolitan Boise, with its rapidly growing suburbs, sits less than 100 miles downwind. An avid fisherman, Hayes also bemoans the fact that many of the area's world-class fisheries have become mercury repositories.

On the way to Durkee, we passed the husk of the old cement plant at Lime, Ore., which operated from 1922 to 1980. Hayes commented that it would make a good set for a post-apocalyptic, Mad Max-type action film. He's right, but the site is unlikely to be used for anything anytime soon. According to the Oregon Department of Environmental Quality, its soil is heavily contaminated with PCBs, arsenic, residual petroleum and hydrocarbons--the toxic byproducts of six decades of cement manufacturing.

A little past Lime, we pulled into a dirt parking lot outside the Durkee plant's main gate. Above us, a high-pitched metallic whine emanated from a conveyer chute: crushed limestone being transported from quarry to kiln. A layer of light gray cement dust—4 or 5 inches deep—coated a concrete highway divider. Hayes scooped up a handful and let it pour out of his fist. "The dust control could be better here," he said. "Don't you think?"

Mixed with gravel, sand and water, cement becomes concrete, a material as ubiquitous and seemingly benign as you will find in the built landscape. It is fundamental to growth--strengthening structures, hardening highways and sidewalks, underlying our cities like synthetic bedrock. In 2008, American plants supplied a staggering 189 billion pounds of raw cement and clinker, a cement precursor. Although that figure represents a 30 percent decline from 2006, when construction was still surging, enough cement was made in the United States last year to spackle an area roughly the size of Delaware in pavement one-quarter inch thick.

Portland cement, the light gray powder found in everything from concrete to stucco, accounts for more than 95 percent of the cement produced in the United States. The recipe has changed little in 150 years. It still requires mountains of calcium carbonate or limestone, which, in eastern Oregon, tends to be loaded with mercury derived from the region's volcanic history. Volkswagen-sized chunks of the rock are blasted loose, hauled in goliath front-end loaders and fed into a series of crushers. Then the limestone fragments are powdered and mixed with metal oxides that help determine the cement's compressive strength and hardening time.

This mixture is then sent to massive kilns—some as long as football fields—which reach temperatures of at least 2,500 degrees F. During heating, the limestone is chemically transformed into "clinker," pebble-like pellets that are mixed with a little gypsum and ground into the fine flour we know as cement. The process releases large quantities of carbon dioxide and—in the case of Durkee—vast amounts of mercury vapor. Mercury is also released from the coal burned as fuel in the kiln, but the amount is minuscule compared to what's baked out of the limestone.

The mercury leaves the stack in one of three forms—as an elemental gas, a divalent gas or as a sort of varnish coating dust particles. Elemental mercury rises high into the atmosphere, merging with an ethereal "global pool" of mercury. It can remain aloft for a year or more before falling out of the atmosphere. The divalent and dust-bound mercury is heavier and tends to precipitate nearby. Canadian studies suggest that recently deposited divalent mercury is more "reactive" than elemental mercury and therefore more readily transformed to methylmercury.

This heavier, more reactive mercury shows up in high concentrations in the Burnt River, which roils blue and chalky past the plant. Twenty-five miles downstream, it merges with the Snake River at

Brownlee Reservoir, on the Oregon–Idaho border. Mercury advisories are listed for all species of sport fish caught there. But the undisputed hotspot along Brownlee's 58-mile length is the Burnt River inlet, where the river slows and the mercury carried from the Durkee plant settles out. Tissue samples collected from smallmouth bass and catfish here contained twice as much mercury as the next most contaminated Brownlee sample, exceeding the Food and Drug Administration's mercury "action level" of one part per million by 40 percent.

The Powder River Watershed, 20 miles to the north, has also received heavy doses of Durkee mercury. The EPA estimates that of the 231 pounds of mercury deposited annually in the watershed, a full 150 pounds comes from Durkee. Most of the rest comes from the global pool, generated largely by Asian factories.

Since the passage of the Clean Air Act in 1970, the nation's cement plants have functioned in a regulatory blind spot. In 1990, the Clean Air Act was amended to require emitters—including cement kilns—to meet standards for a host of nearly 200 pollutants, including mercury. Rules were issued for coal-fired power plants, hazardous waste incinerators and other emitters, but the EPA failed to set rules for cement kilns by the 1997 deadline.

In 1999, the U.S. District Court for the District of Columbia found the EPA in violation of the Clean Air Act and gave the agency two years to issue new rules for cement kilns. It was a deadline the EPA failed—and would repeatedly fail—to meet.

"Over the last 12 years, we sued EPA over and over, and we won over and over," says James Pew, an attorney with Earthjustice, the environmental law firm that headed the campaign for regulation. "There's a long string of court decisions saying, 'EPA, you're doing this wrong ...' They weren't terribly interested in what the courts said or what the law said."

Then, last April, the EPA reversed course, announcing its determination to make cement plants comply with the Clean Air Act. (Many attribute that decision to a pro-regulation shift at the agency after the 2008 presidential election.) The proposed new rules—expected to be finalized this year—are part of the EPA's National Emissions Standards for Hazardous Air Pollutants, or NESHAP, program and cover an array of pollutants including sulfur dioxide, particulates, hydrocarbons, hydrochloric acid and mercury. Separate EPA reports estimate that curbing emissions from cement plants nationwide, including an 81 percent cut in mercury, will prevent between 620 and 1,600 deaths a year and reduce national health costs by between $4.4 billion and $11 billion.

But it's difficult to assess the ecological and health effects of past emissions from the nation's cement plants. Until 2000, the EPA did not even require the plants to report their hazardous emissions to its Toxics Release Inventory database. Because of the lack of reliable data, estimates of the amount of mercury vary wildly. In 2006, for example, the EPA doubled an estimate from earlier that year—from 12,000 to nearly 23,000 pounds annually—after it found evidence of widespread underreporting. As of 2007, according to the agency, 8,500 waterways in 43 states were listed as "impaired" with mercury.

Even if the laws could be tightened tomorrow—and mercury emissions could be "turned off" like water from a tap—the problems would persist for decades, says Don Essig, a water quality specialist with the Idaho Department of Environmental Quality. Like carbon dioxide in the atmosphere, mercury remains in aquatic ecosystems for a long time.

And mercury is not the only dangerous pollutant coming from the nation's cement plants. Worldwide, cement production contributes significantly to climate change, with cement plants accounting for roughly 5 percent of manmade carbon dioxide emissions. Coal and petroleum coke are the most common fuel sources, but a number of plants are permitted to burn "alternative" fuels, including slaughterhouse waste, old tires and railroad ties. (Cement kilns permitted to burn "hazardous wastes," including ink solvents and petroleum residues, have been regulated under NESHAP since 1999.) Industry representatives say that these materials would otherwise clog landfills, and the high heat within the kilns prevents the formation of potentially harmful constituents. But critics argue that plants that burn such fuels release particulates, dioxins, furans and heavy metals, and should be regulated as waste incinerators. (None of those pollutants would be controlled under the new NESHAP rules.) In addition, fly ash from coal-fired power plants and slag from iron blast furnaces are often mixed into the cement as strengtheners and can significantly increase the metal content of emissions.

The Durkee plant's new mercury-control system is supposed to be completed in July 2010, according to the company. A scaled-down prototype of the filtration system—which uses powdered carbon to trap mercury in the exhaust stream—cut mercury by 70 to 95 percent in test runs.

The mercury reduction agreement reached between the company and state in 2008 requires an 85 percent cut in emissions. However, that will be overridden if the EPA rules go into effect next year, says Douglas Welch, an engineer with the Oregon State Department of Environmental Quality. The new federal rules would require the Durkee plant to cut mercury by about 98 percent by 2013, a goal Welch doubts is attainable. "At a certain point, you inject more and more carbon and you get diminishing returns on mercury," Welch says.

He is also unsure whether the reductions achieved in the scaled-down tests can be duplicated when applied to the entire system. "In the worst case," says Welch, "it's conceivable that they'd have to close up shop for good."

Not surprisingly, cement industry representatives fiercely oppose the new standards. Andy O'Hare of the Portland Cement Association, a Skokie, Ill.-based industry group, has even questioned their legality, saying that new emissions standards must be "demonstrable and achievable." The ability of any one facility to simultaneously reduce mercury, sulfur dioxide, particulate matter, hydrocarbons and hydrochloric acid to the levels specified under the new standards, he says, has not been demonstrated.

The potential loss of Durkee foreshadows an ominous trend, O'Hare warns: the mass outsourcing of U.S. cement production. Compounding the economic loss would be an increase in overall global emissions because cement would be made in countries with lax environmental standards, such as Venezuela, Indonesia and China. "We're working closely with EPA to ensure that whatever rules are passed next year allow us to keep these high-paying jobs in the U.S.," says O'Hare.

Ash Grove is pushing for a regulatory "subcategory" at Durkee—a special designation that would allow the plant to emit more mercury than stipulated under the new rules. "We have strong community support to create a subcategory for our Durkee plant based on the high level of naturally occurring mercury in the limestone," Ash Grove spokeswoman Jacqueline Clark wrote in an e-mail. "We have also garnered the support of area community elected officials, state elected officials and federal elected officials."

Hayes, however, prefers to frame the issue of mercury pollution in moral terms—as an affront to his young children as well as to future generations of anglers. "No matter what anyone says, I'm not against industry," says Hayes. "But if Ash Grove can't make their cement without putting poison into the air and into the water and into the fish, then they should absolutely go out of business."

This story first appeared in High Country News.

Cement Manufacturing Enforcement Initiative

The cement manufacturing industry was an EPA New Source Review/Prevention of Significant Deterioration (NSR/PSD) national enforcement initiative in fiscal years 2008-2010 and was continued as a Reducing Air Pollution from the Largest Sources national enforcement initiative for fiscal years 2011-2013. The cement sector is the third largest industrial source of pollution, emitting more than 500,000 tons per year of sulfur dioxide, nitrogen oxide, and carbon monoxide. Beginning in 2008, EPA has pursued a coordinated, integrated compliance and enforcement strategy to address Clean Air Act New Source Review compliance issues at the nation's cement manufacturing facilities.

On this page:

Health and Environmental Effects of Cement Plant Emissions

Cement plants are a significant source of sulfur dioxide, nitrogen oxide and carbon monoxide, which are associated with the following health and environmental impacts:

- Nitrogen oxide (NO_x) can cause or contribute to a variety of health problems and adverse environmental impacts, such as ground-level ozone, acid rain, global warming, water quality deterioration, and visual impairment. Affected populations include children, people with lung diseases such as asthma, and exposure to these conditions can cause damage to lung tissue for people who work or exercise outside.

- Sulfur dioxide (SO_2) in high concentrations can affect breathing and may aggravate existing respiratory and cardiovascular disease. Sensitive populations include asthmatics, individuals with bronchitis or emphysema, children, and the elderly. SO_2 is also a primary contributor to acid deposition, or acid rain.

- Carbon monoxide (CO) can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues, as well as adverse effects on the cardiovascular and central nervous systems. CO also contributes to the formation of smog (ground-level ozone), which can cause respiratory problems.

Cement Plant Settlements

- Lone Star Industries, Inc. (Buzzi) (8/01/16)
- Cemex, Inc., (07/27/16)
- Ash Grove (6/19/13)
- Holcim Hagerstown Maryland (7/11/13)
- Cemex Inc. (Lyons) (4/19/13)
- Essroc Cement Company (12/29/11)
- California Portland Cement Company (12/15/11)
- CEMEX Fairborn Plant (2/10/11)
- Lafarge North America, Inc. (1/21/10)
- Cemex (California) (1/15/09)
- St. Mary's Cement (Illinois) (9/08/08)

Dallas Morning News

Tuesday, January 24, 2006

EPA, Clean up our air!

North Texas homemaker will attend today's hearing on kilns, but many Americans can't

by Becky Bornhorst

Every night I walk down my street, I can see the tall smoke stacks rising up into the sky. What I can't see, but I know is there, is the pollution coming out of these stacks as a result of cement manufacturing. The Environmental Protection Agency has reported that cement kilns nationwide emitted nearly 13,000 pounds of mercury in 2002. Mercury results when coal is burned to heat kilns in the cement making process; it is released into the air where it travels into streams, lakes and rivers and eventually into our fish supplies.

But although EPA knows cement kilns are a dangerous source of mercury, they continue to give the industry a pass when it comes to cleaning up this pollution. On Dec. 2, 2005, EPA announced that although cement kilns are responsible for mercury pollution, EPA decided it was unnecessary to require limits on mercury from these coal-fired kilns. Mercury is most dangerous to women of childbearing age, young children, babies and even fetuses. Exposure can cause nervous system damage, and possibly delay learning motor functions like walking, talking and speaking.

After the rule came out in December, EPA said it would hold a public hearing at its facility in Research Triangle Park, just outside Raleigh, North Carolina, on January 24. As interest in the hearing began to grow and more and more people from across the country began to organize, including myself and other members of Downwinders at Risk, we realized not everyone could afford the plane ticket to get to Raleigh. People living next to cement kilns know how dirty they can be and that something needs to be done to curb this pollution. Many people wanted to take part in the hearing but just couldn't afford the time and cost to go. This hearing is taking place in a state where no cement kilns exist, so local attendance will likely be low. We want EPA to realize this is an important issue to many people all over the country.

We asked EPA to set up a call-in number, where people could at least listen to what was being done to protect our health, the air we breathe and our environment. Initially, EPA said they would try to get something set up. But unexpectedly, EPA said in an email, "We will not be able to offer a phone line to submit testimony at the public hearing for the proposed amendments to the Portland Cement NESHAP. If you wish to submit testimony during the public hearing you must attend in person."

There are over 100 cement kilns across the country. In Midlothian alone, there are three cement makers operating a total of ten kilns. California and Texas have 11 cement kilns each, Florida has nine and Pennsylvania has ten. While people in these states and in dozens of other states are forced to breathe dirty air from these facilities, EPA cannot even provide a telephone line that these people can call in to tell EPA, "Clean up our air!" Forty states currently have warnings about eating mercury-contaminated fish caught in streams, rivers and lakes. Every American has the right to tell EPA to stop this pollution, but EPA says that in order to exercise that right, you'd better be ready to pay the cost to travel to their offices on their schedule.

It is a shame that EPA has taken such a relaxed approached at limiting mercury pollution from cement kilns. It is a shame that my daughter and son, and the children of Midlothian and Gainesville and Pittsburgh are routinely forced to breathe this dirty air when they play outside. It is a shame that the federal agency that is supposed to protect our health and our environment is doing such a poor job. But most of all, it is a shame that EPA does not see the importance of allowing everyone to have the chance to speak. A simple phone number for people to call in was all we asked. Instead, EPA shamed it self again, and many Americans will not have the chance to tell EPA to start cleaning up the air we all breathe.

Becky Bornhorst is a native Texan and a homemaker who volunteers for the nonprofit group Downwinders at Risk. She and at least ten other citizens from across the country will travel to North Carolina January 24 to testify at the EPA hearing.

http://downwindersatriskarticles.blogspot.com/2006/01/epa-clean-up-our-air.html

Press Release

For Immediate Release
March 15, 2004
Contact:
Jay Burgess,
(845) 473-4440, ext. 222; jburgess@scenichudson.org

Dutchess County Research Group Wants Stronger Look at Cement Plant Project

(DUTCHESS COUNTY) - The Dutchess County Environmental Management Council (EMC) is calling for the state to be more aggressive in reviewing a proposal to build a mammoth coal-fired cement production and mining operation eight miles from the county's northern border. Citing strong environmental and economic concerns, the group wants the Dutchess County Legislature and all other branches of Dutchess County government to request a more rigorous examination of the full range of impacts the proposed facility would have on neighboring communities.

The EMC's recommendation to the county legislature came in the form of a task force report requested in 2003 by Bradford Kendall, chairman of the Dutchess County Legislature, and Ed Haas, former county legislator. Issued today the report results from an in-depth research investigation by a specially formed task force that comprises a diverse volunteer group of business people, educators and environmentalists. The group spent eight months rigorously reviewing the St. Lawrence Cement Co.'s (SLC) draft environmental impact statement (DEIS) for an 1,800-acre industrial complex it proposes for the City of Hudson and Town of Greenport, Columbia County.

"With a project of this immense size -- one of the largest facilities of its kind in the country -- a regional look makes clear sense," said Alix Gerosa, director of Scenic Hudson's Environmental Quality program and a member of the EMC task force. "The EMC is pushing for a justifiably expanded analysis of this proposal."

Strong Concerns Expressed
In its report the task force expresses strong concerns that the large-scale project's potential impacts on Dutchess County thus far have not been considered in the state's permitting process. The task force wants regional effects of the SLC project to thoroughly be examined before SLC receives any of the 17 permits required for its project. This approach would enable county and valley residents to understand the public health, economic and environmental ramifications this project might have on the Hudson Valley.

For that reason, the EMC will urge the Dutchess County Legislature and other county government branches to request that the New York State Department of Environmental Conservation (DEC) proceed with a comprehensive review of the SLC project. In a strong move, the EMC also calls for a change in how the DEC measures the plant's potential air pollution fallout. The group wants meteorological data from the proposed plant site to be used rather than information gathered at Albany International Airport, 35 miles away.

"Surface land features in the valley channel wind currents up and down the Hudson River corridor. The closer you are to the river, the more pronounced this effect becomes," said Ms. Gerosa. "Albany Airport is not the same as the City of Hudson. Collecting data from the proposed plant site will much more accurately predict how much of 20 million pounds of annual pollution produced by the facility would land in Dutchess County. Considering that pollution from a coal-burning plant such as this has been linked to heart attacks, cancer and other health threats -- this is a big deal."

Request for Dutchess County Action on SLC

Cement Kiln FP 126

In its task force report, the EMC recommends that Dutchess County:

Request that DEC Commissioner Erin M. Crotty rescind her earlier ruling allowing the use of Albany meteorological data and instead require that on-site data at Hudson/Greenport be collected, quality assured and used in all pollution dispersion modeling for SLC's project.

Support the DEC in moving forward with adjudicatory hearings on a variety of air pollution issues including:

- Limiting emissions of nitrogen oxides (NOx) and volatile organic compounds (VOCs) to the lowest amount possible, as these ozone-causing pollutants will further degrade the Hudson Valley's already dismal air quality; and

- Determing whether SLC used suitable air modeling and background air quality data in order to make an accurate assessment and mitigation of health impacts on the regional population from PM 2.5 emissions.

Request that the Army Corps of Engineers oversee any dredging that may occur if the proposal is approved to ensure water quality in downriver communities that take their drinking water from the river.

Request for Dutchess County Action Beyond SLC project
The EMC additionally recommends that Dutchess County:

Proactively establish a protocol to monitor proposed industrial and commercial developments in the region, thus ensuring Dutchess County's early and appropriate involvement in project reviews.

Request that the Hudson River Valley Greenway, as a regional planning agency, initiate a process of project evaluation with local governments to directly address the environmental implications of industrial proposals for the Hudson River Valley.

United Opposition to SLC from Citizens and Community Groups
The leading environmental groups of the Hudson Valley and numerous organizations from nearby Connecticut and Massachusetts are battling together to defeat this proposed project. The Hudson Valley Preservation Coalition (HVPC) is opposing the plant, and its membership includes Citizens' Environmental Coalition; Citizens for a Healthy Environment; Citizens for the Hudson Valley; Clover Reach; Concerned Women of Claverack; Environmental Advocates; Environmental Defense; Friends of Clermont; Germantown Neighbors Association; Historic Hudson, Inc.; Historic Hudson Valley, Hudson Antiques Dealers Association; Hudson River Heritage; Hudson River Sloop Clearwater; Natural Resources Defense Council; New York League of Conservation Voters; Riverkeeper; Scenic America; Scenic Hudson; and Sierra Club Atlantic Chapter.

Also working collaboratively against the plant are Friends of Hudson, The Olana Partnership, The National Trust for Historic Preservation and Preservation League of New York State. HVPC, of which Scenic Hudson is a founding member; The Olana Partnership; and Friends of Hudson all have full party status in New York State's review of SLC's permit applications for the proposed industrial and mining complex.

Background on the Proposed Plant
SLC is attempting to build one of the country's largest coal-fired cement plants on the border of Hudson and Greenport and if allowed would create a new industrial city. It would operate seven days per week, 24 hours per day on an 1,800-acre site -- an area larger than the City of Hudson -- with a 1,200-acre open-pit mine and 40 acres of buildings. Other facets would include a 400-foot smokestack with a plume as long as six miles and a two-mile conveyor belt linking production facilities with a major waterfront dock and storage area. This plant, to be located 300 feet above the Hudson River, would become the dominant and discordant feature in one of our country's most famous viewsheds -- the landscape surrounding Frederic Church's Olana. If permitted, the effects of this reindustrialization would be far-reaching. Materials such as fly ash and potentially hazardous fuels would come to the region via barge and truck, while cement and its heavy-metal byproducts will be shipped out. The resulting traffic would be overwhelming, and the plant would spark more industrial sprawl, undercutting the Hudson Valley's quality of life for generations. Most of SLC's North

American plants burn or have applied to burn hazardous waste, tires and medical waste, which creates highly toxic pollutants. SLC has refused to rule out this practice at the proposed Hudson/Greenport facility, and this further increases air pollution and local transportation of hazardous materials

EDITORS NOTE: A copy of the Dutchess County Environmental Management SLC Task Force Report is available by fax or e-mail (pdf file attachment). Please contact Jay Burgess, Scenic Hudson, (845) 473-4440, ext. 222, or jburgess@scenichudson.org.

Scenic Hudson works to protect and restore the Hudson River and its majestic landscape as an irreplaceable national treasure and a vital resource for residents and visitors A crusader for the valley since 1963, we are credited with saving fabled Storm King Mountain from a destructive industrial project and launching the modern grass-roots environmental movement. Today with more than 10,000 ardent supporters, we are the largest environmental group focused on the Hudson River Valley. Our team of experts combines land acquisition, support for agriculture, citizen-based advocacy and sophisticated planning tools to create environmentally healthy communities, champion smart economic growth, open up riverfronts to the public and preserve the valley's inspiring beauty and natural resources www.scenichudson.org

Trust gone toxic

Tire-burning issue heats up as state investigates cement plant

by Pamela White

Cement kiln dust from Cemex, a cement plant, creates a smoke-like haze in the countryside southeast of Lyons.

At its core it's a matter of lost trust. A Lyons cement plant wants permission from Boulder County to burn tires as fuel in its cement kiln. Boulder County, which is set to green light the plant's plan, claims burning tires in the kiln poses no risk to people or to the environment.

But neighbors of the plant say they trust neither Cemex nor the county government to give them straight answers about burning tires or to do the right thing when it comes to public health and the environment. They say Cemex has demonstrated poor management and an inability to comply with environmental laws thus far without the added challenge of burning tires. And they accuse the county of giving preferential treatment to Cemex, which has donated land to the county, out of a hunger for open-space land.

The allegations mark the latest round in a six-year conflict between the plant–formerly owned by Southdown and Southwestern Portland Cement–and its neighbors. The conflict originally arose over concerns about emissions of cement kiln dust and has grown to include a host of issues–and three separate neighborhood groups.

The neighbors' concerns are fueled by continued problems with cement kiln dust emissions, which have drawn the attention of the state health department and the state attorney general's office. Cemex is currently in negotiations with the state over alleged air quality violations regarding its dust emissions.

But residents' fears have been heightened by the recent discovery of county documents that show the plant, as Southwestern Portland Cement, burned almost 90 million gallons of toxic solvents and waste oils without a permit between 1975 and 1991–and that county and state officials knew of the illegal burning, but failed to take action against the company.

"There is no trust anymore," says Ken Dobbs, who lives across Highway 66 from Cemex with his wife Mary Dobbs. "I have no trust in Cemex and no trust in our county government anymore."

Dust in the wind

Richard Cargill, executive director of the St. Vrain Watchdogs, remembers a time when those living near the cement plant could not open their windows.

"There were days when you couldn't even see the trees," he says, gesturing toward a line of trees east of Cemex and north of his home on Hygiene Road. "All of this was just white with dust."

Cement kiln dust can contain arsenic, silicon, dioxins and furans–all hazardous to human health–and is considered a form of particulate pollution.

Concerned for their health and that of their neighbors, the Watchdogs, together with the Environmental Justice Project, worked with Southdown, which was eventually bought by Mexican company Cemex, on reducing its toxic dust emissions. Since then, emissions have dropped by 80 percent.

But there are still problems. Neighbors have reported several instances of fugitive dust emissions in 2003. On one instance when Boulder Weekly drove to the plant, the columns of white dust rose higher into the air than the plant's smokestacks.

"It happens all the time," says Cargill.

The situation is serious enough to have drawn the attention of state air pollution officials, who conducted several surprise inspections at the plant this spring and earlier this summer, each time finding alleged violations.

"We are in negotiations (with Cemex) right now, so unfortunately we are not at liberty to discuss the nature or outcome of these negotiations," says Christopher Dann, spokesman for the Colorado Department of Heath and Environment.

Once negotiations are complete, the information about the inspections will become public, Dann says.

Cemex officials did not respond to Boulder Weekly's request for an interview by press time.

Cargill, Ken and Mary Dobbs and other community members believe Cemex should not be allowed to burn tires because they haven't managed to clean up their act with regard to cement kiln dust yet.

"Will Cemex be able to manage tire combustion any better than it can manage fugitive dust?" asks Cargill. "What assurances are there that management of tire combustion will be any better than management of fugitive dust? There could be serious consequences for citizens in at least five surrounding communities if process controls fail."

A recent environment impact statement prepared by a CU environment design class states, "Cemex has a poor environmental track record for compliance with the Environmental Protection Agency (EPA). Safety issues are amplified due to the possibility of wide-scale negative consequences... Improper incineration and the release of additional emissions could put large populations at risk."

But Cemex officials say they have cleaned up their operation and claim that their burning tires might do the environment some good.

The third largest cement company in the world, Cemex consumes 100,000 tons of coal each year at its Lyons plant. Coal mining and combustion have both come under attack by environmentalists for their negative impact on the environment. While coal mining can ravage the landscape and release toxins into water and soil, burning coal produces sulfur dioxides, which, when combined with moisture, produce nitric and sulfuric acids–the ingredients of acid rain.

Cemex representatives have argued that burning tires–essentially a petroleum product–will reduce destructive coal mining while "recycling" a resource that has already been extracted from the land. With millions of scrap tires around the state, tires constitute an abundant fuel source, they claim. And while coal produces 11,000 to 12,000 BTUs per pound, tires burn hotter at 15,000 BTUs per pound.

Burning tires will also save the company a lot of money. But burning tires carries risks. Tires are toxic, and when they are burned those toxins are released. A 1997 study of tire-burning by the EPA indicates that tires could be safely burned in high-tech incinerators but that results from incinerators could not be applied to burning tires in cement kilns. Results from test burns in cement kilns show that emissions vary from kiln to kiln based on the available technology and on management practices.

In November 2002, the plant conducted a test burn of tires with a host of county and state health officials present, and the county concluded that burning tires poses no serious health hazards.

The county asked the Agency for Toxic Substance and Disease Registry (ATSDR)–an agency of the U.S. Department of Health and Human Services–to perform a thorough evaluation of potential health impacts resulting from emissions from tire burning.

ATSDR also concluded that emissions posed "no public health hazard," but noted concern over a test sample that showed contamination from acetones and had been discarded.

"The only concern we have is why an entire run was thrown out because of high acetone values," the ATSDR report states.

But opponents of tire burning point out that, while ATSDR and Boulder County were quick to dismiss any significant public health risk, the test burn did show an increase in the release of many toxic substances, including persistent bioaccumulative toxins (PBTs) like mercury.

According to the EPA, PBTs are of special concern because they last in the environment and concentrate in living tissue, passing up the food chain. In addition, they transfer easily from air to water to land. They pose a significant risk to human health and ecosystems and endure in the environment for generations.

Toxins that showed an increase in the tire test burn include: lead, mercury, arsenic, chromium VI, cadmium, barium, zinc and benzene. Even with the increases, the levels present during the test were well within EPA limits.

But opponents of tire burning dispute the conclusion that the increases pose no health threat. They say there is no such thing as a safe increase when it comes to PBTs. Ken Dobbs points to the higher amount of mercury, which he says will result in an additional 2,145 grams of mercury making its way into the environment annually, where it will stay for decades. He cites an EPA report that states one gram of mercury can contaminate a 20-acre lake.

"That's enough to contaminate more than 2,000 20-acre lakes each year," he says.

He also claims the test results are the product of a test burn conducted under the best possible conditions and that, given Cemex's history, the results are bound to deteriorate when state officials are not watching.

Lawsuit landmine

Whether Cemex is allowed to burn tires is up to Boulder County, at least initially. It's a decision county officials perhaps wish they didn't have to face.

In 1989, the county issued a special use permit to the plant to allow it to burn scrap tires, which the plant did between 1990 and 1993. The company has not burned tires since then.

In Sept. 1996, the county revised land use codes to make any special use permit that has not been used for a period of five years invalid. Those who oppose tire burning say Cemex's special use permit expired in Sept. 2001, five years after the code revision was passed.

But Cemex argues the permit is still valid. In a letter to the county land use department, Cemex representatives claim that Cemex's intention to use tires as fuel, its corporate planning regarding the burning of tires and its consulting on the issue ought to be enough to keep the permit alive.

The letter, dated April 10, also makes it clear that Cemex could sue the county should county officials declare the permit expired.

County Commissioner Paul Danish says the permit issue will likely end up in court.

"There will probably be a lawsuit from citizens if we find the permit has not lapsed, and there will probably be a lawsuit from Cemex if we find that it has," he says. "This is a fine example of why land use isn't rocket science, it's just hard."

The permit question has already been the subject of one as-yet unresolved lawsuit. In October 2002, the Sierra Club sued the county land use department, arguing that land use officials violated state law and county land-use codes by allowing tire burning at Cemex. District Court Judge Roxanne Bailin ruled that, if Cemex truly had not burned tires for a five-year period, the permit had lapsed. She remanded the case to the County Board of Adjustments, which will decide on Sept. 3 whether a five-year period of inactivity took place.

Ken Dobbs and Cargill say they're suspicious of the county's motives in supporting Cemex's position on the special use permit.

"Knowing everything the cement plant has done in the past, why is it (Cemex) continues to get everything it asks for from the county and the state?" Dobbs asks. "I don't know what to call that but preferential treatment."

The county's alleged motive for such preferential treatment is open-space land, Cargill and Dobbs say.

They point to a couple of key transactions as evidence. The first occurred in 1989, shortly before Cemex, then Southdown, applied for the original permit to burn tires. At that time, the company donated a 480-acre parcel, called Indian Mountain, to the county.

Then, shortly after the cement plant announced its plans to begin burning tires again, it finally concluded a deal with the county over 1,600 acres known as Dow Flats. A county official was quoted in a local paper at the time as saying the county had been trying for a long time to purchase the land but hadn't been able to work out the details.

"They apply for a permit, and all of a sudden this deal that's been difficult to work out falls into place," Dobbs says. "It's very interesting timing."

Cargill agrees.

"Boulder County has a vested interest in acquiring land from the cement plant," he says. "We don't think they're being objective about the burning."

Ron Stewart, a long-time county commissioner and director of Parks and Open Space, says Dobbs' and Cargill's theory are completely off the mark.

"I think that's just bunk," he says. "Would they prefer we hadn't added the land as open space?"

Stewart says the county's mission to acquire land does not impact its regulatory responsibilities or judgment.

But neighborhood activists say they have proof the county doesn't always do its job where the cement plant is concerned.

County land use documents unearthed by Ken and Mary Dobbs reveal that the plant, when owned by Southwestern Portland Cement, informed county officials in August 1988 that it wanted to burn waste oil and solvents for fuel, together with tires. According to the memo, plant officials were told they would need to apply for a special-use permit.

In December 1990, a concerned county official wrote to the Colorado Department of Health to inform them that the plant was burning waste oil, solvents and other contaminants as fuel–without the required permit. Plant representatives were again told they needed to get a permit.

Two months later, the company submitted an incomplete permit application, omitting data on the amount of waste oil being burned and estimated emissions. A memo states that the county had learned the plant had been burning waste oil and solvents as far back as 1975 for an estimated total of almost 90 million gallons.

The issue was brought to the attention of numerous county officials in March 1991 by a concerned citizen, who sent letters to the county commissioners, state senators and representatives, the county attorney and land use officials. Yet no action was taken against the plant.

Rather than complete the permit process, the plant ceased burning waste oil after discovering the 100,000-gallon tank they used to store the toxic liquids was leaking.

"That's a tremendous amount of gallons," Ken Dobbs says. "How can all of this be done and the state and county know about it and nothing be done?"

The government's inaction is the smoking gun that proves state and county officials can't be trusted to keep tabs on Cemex, he says.

"It has ended up in the lap of the community to protect itself," he says. "I don't have faith in our county government at this point."

Mary Dobbs says she'd be only too happy to see this six-year battle come to an end. Confronting the cement plant has turned her and her husband and neighbors into part-time investigators and has eaten up literally thousands of hours, she says.

A row of file cabinets in Cargill's living room testify to the amount of documentation he and other neighborhood activists have acquired over the years.

"We don't want to be doing this," says Ken Dobbs. "We have lives to live, and this consumes our lives. (Cemex) has a vested interest in burning tires. They're going to save millions of dollars. All we're trying to do is protect our health."

Respond: letters@boulderweekly.com

Montanans Against Toxic Burning

News Alert!

Press Release

April 8, 2003

For further information contact:
Anne Hedges (MEIC) 594-2457 or 443-2520
www.NoToxicBurning.org

Study Finds State Health Assessment Inadequate

The State of Montana has failed to adequately assess the health effects of tire burning at the Holcim, Inc. cement plant near Three Forks, according to a recent study by a professor at the Boston University School of Public Health.

The study's conclusions have prompted citizen groups to request the state to conduct a more complete assessment of the hazards of tire burning. "In light of these findings and the serious health risks dioxins pose, the state needs to complete an Environmental Impact Statement on Holcim's tire burning plan." said Anne Hedges of the Montana Environmental Information Center (MEIC).

The Montana Department of Environmental Quality (DEQ) recently issued Holcim, Inc. a Draft Air Quality Permit to burn whole waste tires. The draft permit would allow the cement plant to burn up to 1,137,539 tires per year or approximately 3100 per day.

Cement plants are among the largest producers of dioxin in the United States. Studies show that burning tires in cement kilns leads to significantly increased emissions of dioxins, furans and heavy metals. Many health problems are associated with these substances including reproductive impairment, developmental delay, and cancer.

Montanans Against Toxic Burning and the *Montana Environmental Information Center* contracted with Dr. Tom Webster of Boston University's School of Public Health to review the health risk assessment of the proposed tire burning. Dr. Webster, D.Sc., is one of the country's leading experts on dioxins, and has served on the USEPA's Dioxin Peer Review/Risk Characterization Committee. Dr. Webster conclusions were:

1. The scope of the assessment is much too small and the uncertainty of the risks is underestimated.
2. Lifetime cancer risks from dioxin exceed the limit for negligible risk.
3. Background exposure to dioxins is not properly taken into account in examining non-cancer health effects of dioxins.
4. Risks from dioxin in beef and milk are significantly underestimated.

Despite the health risks, DEQ has classified the potential physical and biological effects on air quality as "minor". They have classified the social and economic effects on human health and agricultural production as "minor". And at this point, they have recommended against completing an Environmental Impact Statement (EIS).

"The Draft Air Quality Permit has some serious weaknesses. The state has ignored most of the comments and concerns voiced by citizens, health professionals, engineers and others over the past year. This report confirms that some of these health-related concerns are well founded," said Kris Thomas of MATB.

The Webster report clearly shows that Holcim failed to adequately assess the health risks. DEQ accepted the assessment without a thorough review and issued a draft permit on the basis of this flawed information. And to complicate the matter, the air dispersion modeling, which is the foundation for the health risk assessment, used weather data from the Great Falls Airport and does not accurately reflect air dispersion at Trident and in the Gallatin Valley.

The DEQ will be accepting public comment on the draft permit through Friday, May 9th. They will be also holding a public hearing on this issue on Tuesday, April 29th, 7 p.m. at the Manhattan School.

Click Here to read the full report, "Review of the Health Risk Assessment for the Holcim, Inc. Cement Plant at Trident, Montana by Thomas F. Webster, D.Sc., Assistant Professor of Environmental Health at Boston University School of Public Health. (It is a 122K Acrobat .pdf file)

-End-

Montanas Against Toxic Burning (MATB)

PO Box 1082, Bozeman, MT 59771 www.NoToxicBurning.org message phone 585-4217

Environmental News Service

http://www.ens-newswire.com/ens/feb2007/2007-02-20-09.asp

States, Enviros Sue EPA Over Cement Factory Emissions

ALBANY, New York, February 20, 2007 (ENS) - New York Attorney General Andrew Cuomo today announced a multi-state legal challenge to the U.S. Environmental Protection Agency, EPA, for adopting a rule that refuses to regulate mercury and other pollutants from existing portland cement plants.

The states seek to have a federal court overturn the rule by finding that it violates the Clean Air Act.

A petition, signed by nine states, was filed today in the U.S. Court of Appeals for the District of Columbia Circuit. The states joining New York in the petition are Connecticut, Delaware, Illinois, Maryland, Massachusetts, Michigan, New Jersey, and Pennsylvania.

Portland cement is the primary cement used in building projects and road construction. It is produced throughout the United States. Collectively, these cement plants are a major source of mercury emissions nationwide.

The federal Clean Air Act requires the EPA to set standards for various hazardous air pollutants, including mercury, based on the performance of the cleanest 12 percent of existing plants.

The EPA's rule would exempt existing portland cement plants from having to do anything to lower their emissions of mercury and other hazardous air pollutants.

The Environmental Protection Agency's (EPA) refusal to set emission standards for portland cement plants leaves a significant source of mercury pollution in the United States unregulated.

Mercury in the environment is blamed for neurological disorders, learning disabilities, and, in certain high dosage cases, even death. Recent studies suggest that mercury exposure may also contribute to adult cardiovascular problems. In addition, mercury contamination in many water bodies has led to the issuance of fish consumption advisories across New York State.

This will be the second time that the EPA has been challenged over its failure to set mercury pollution standards for the portland cement industry. In 2000, the U.S. Court of Appeals for the District of Columbia Circuit directed the EPA to set mercury standards. The EPA has since ignored the court's ruling.

"It is shameful that the Bush Administration's EPA continues to abdicate its responsibility to protect public health and the environment. This coalition of states is resorting to the federal courts in an effort to compel the EPA to follow the law and establish limits for the most dangerous pollutants," said Cuomo.

"This is just another instance in a long line of examples of the Bush Administration caving to industry lobbyists at the expense of the health concerns of ordinary citizens."

On Friday in the same court, environmentalists brought their own lawsuit against the EPA for its latest refusal to limit cement kilns' mercury emissions.

Earthjustice is representing Sierra Club, the Texas group Downwinders At Risk, the Huron Environmental Activist League from Michigan, Friends of Hudson from New York, California's Desert Citizens Against Pollution, and Montanans Against Toxic Burning in the lawsuit.

"Once again the EPA has failed to put public health first," said Carl Pope, Sierra Club executive director. "The agency ignored the law. They have ignored the courts and they have ignored public health for too long."

The agency estimates that 118 cement kilns emit over 11,000 pounds of mercury each year, making cement kilns one of the largest sources of mercury pollution.

The nation's single largest mercury polluter of any kind is a cement kiln in southern California, which emitted over 2,500 pounds of mercury in 2004.

Environmental News Service

http://ens-newswire.com/ens/apr2001/2001-04-24-06.asp

Environmental Justice Issues Force Cement Plant to Close

By Cat Lazaroff

CAMDEN, New Jersey, April 24, 2001 (ENS) - In a precedent setting environmental justice decision, a federal judge has halted operations at a New Jersey cement plant, saying toxic emissions from the facility would harm nearby residents and violate their civil rights. The plant was officially dedicated last March by U.S. Environmental Protection Agency Administrator Christie Whitman, then New Jersey's governor.

On April 19, Federal District Court Judge Stephen Orlofsky granted a motion for a temporary injunction prohibiting St. Lawrence Cement Co. from beginning operations of its $50 million cement manufacturing facility in Camden, New Jersey.

The Court found that the New Jersey Department of Environmental Protection (DEP) had violated the civil rights of the African-American and Hispanic residents, who comprise 90 percent of the residents in the census tract where the SLC facility is located, when the agency issued a permit to the plant.

Orlofsky also said the state DEP failed to consider the cumulative threat posed by pollution from industrial sources already located in the primarily minority community.

"Much of what this case is about is what the NJDEP failed to consider," Orlofsky wrote. "It did not consider the pre-existing poor health of the residents of Waterfront South, nor did it consider the cumulative environmental burden already borne by this impoverished community. Finally, and perhaps most importantly, the NJDEP failed to consider the racial and ethnic composition of the population of Waterfront South."

Orlofsky's 120 page ruling orders the plant, built by the St. Lawrence Cement Group of Montreal, to be closed for 30 days, during which the DEP must complete a full review of the air pollution permits issued to the facility. The closure is projected to cost St. Lawrence up to $200,000 a week.

Amy Collings, spokeswoman for the DEP, said the department will review the decision with the help of the state attorney general's office before deciding whether to appeal the decision.

St. Lawrence Cement said in a statement that it will appeal the judge's ruling..

"We are confident in our investment and proud of the integrity with which our company submitted to extensive environmental review, engaged in substantial outreach and responded to community concerns," said Patrick Doberge, president of St. Lawrence, in the statement.

The ruling came in a case filed February 14 by South Camden Citizens in Action, a community group formed by local residents who worried that the cement plant would increase their health risks by adding to the already polluted air in the region.

The Waterfront South neighborhood that houses the plant also contains the region's largest trash incinerator, a power plant, Camden County's sewage treatment plant, and two Superfund sites, including one contaminated with radioactive thorium.

The neighborhood's 2,100 residents earn a median household income of $15,000, less than one fourth of the $67,000 statewide median. About 90 percent of the residents are from racial or ethnic minorities.

Despite the pollution burden the region is already carrying, the DEP awarded St. Lawrence permits to emit 60 tons of air pollution each year. That amount does not include the emissions from an estimated 77,000 trucks expected to visit the plant each year.

In his ruling, Orlofsky said the state failed to follow its own rules about locating polluting industries in poor or minority neighborhoods. The DEP also violated permitting rules established under Title VI of the federal Civil Rights Act.

"It is the Court's understanding that none of the policies or procedures referred to [by lawyers for the State] have been implemented," Orlofsky wrote. "Indeed, when asked if she had any understanding of New Jersey's Environmental Equity Program, Dr. [Iclal] Atay, chief of the NJDEP's Bureau of Air Quality Control and Hearing Officer for the SLC permit, stated that she had 'none.'"

Olga Pomar, the Camden Legal Services attorney who filed the suit on behalf of 10 Waterfront South residents, called the judge's opinion "unprecedented." Legal experts said the case is the first to overturn pollution permits on the basis of environmental justice principles, which state that polluting industries should not be overly represented in minority or poor communities.

The case could set a legal precedent requiring environmental regulators to consider the cumulative impacts of polluting industries, as well as the traffic they will draw, before issuing emissions permits.

In making his decision, Orlofsky cited a study that concluded that largely minority neighborhoods in New Jersey contain twice as many polluting industries as white communities.

"In the state of New Jersey there is 'a strong, highly statistically significant, and disturbing pattern of association between the racial and ethnic composition of communities, the number of EPA regulated facilities, and the number of facilities with air permits,'" said Orlofsky, quoting a passage from the study by Michel Gelobter.

Orlofsky's decision could reflect badly on the environmental record of EPA Administrator Christie Whitman, who attended the plant's groundbreaking in March 2000 as governor of New Jersey. In her new position, Whitman has touted her record of reducing pollutant emissions in the state.

Questions about her commitment to environmental justice were raised in her Senate confirmation hearings by Senator Harry Reid, a Nevada Democrat. Whitman told the Senate's Environment and Public Works Committee that no community should be "singled out" to be "dumped on."

But Reid said after the hearing that Whitman had been "very non-committal" on the environmental justice issue, and "gave herself lots of wiggle room."

EPA spokeswoman Mary Helen Cervantes said Whitman has not yet commented on the ruling.

1 of 1 DOCUMENT

News and Observer (Raleigh, NC)

July 24, 1997 Thursday, FINAL EDITION

Plant's permit revoked

BYLINE: JAMES ELI SHIFFER, STAFF WRITER

SECTION: NEWS; Pg. A3

LENGTH: 501 words

State regulators have revoked an environmental permit for Carolina Solite - the state's largest burner of hazardous waste - after learning there is much less land separating neighbors from the plant's smokestacks than inspectors had been led to believe.

Alan Klimek, director of the state's Division of Air Quality, informed Carolina Solite in a letter Tuesday that it had 60 days to shut down its factory in Stanly County or file an appeal. The state's action came after revelations that Carolina Solite's state air emissions permit issued June 13 was based on a map that showed the plant's property to be twice as large as it really is.

Jon Jewett, Solite Corp.'s vice president for legal and regulatory affairs, said the discrepancy was the mistake of a surveyor who bungled some data entry seven years ago. The company plans to submit correct data to receive an updated permit, he said.

In the meantime, the public faces no risk from the plant, because its emissions are far lower than what even its state permit allows, he said.

"It would take a very unlikely concurrence of events in order to have any actual health risk," Jewett said.

But the mistake means that over 700 acres of property adjoining the plant, situated in a rural area about 50 miles east of Charlotte, have been subject to air emissions that were supposed to be contained within the boundaries of the company's property, state officials said. And some environmentalists Wednesday urged the state to stop the plant from burning more waste.

State officials said Wednesday they did not know whether residents there have been exposed to any elevated levels of pollutants from the plant's smokestacks.

Owned by the Richmond, Va.-based Solite Corp., the Carolina Solite plant has manufactured a construction aggregate used in highway foundations and cinder blocks since 1953. Fourteen years ago, it started substituting industrial solvents and other hazardous waste for some of its fuel - a type of incineration that is allowed under current federal guidelines, even though it releases toxins such as mercury, arsenic and cadmium into the air.

"I do applaud the state for taking this action and ... [requiring] this facility to be responsible for their actions," said Joann Almond, a local property owner who leads a Stanly County citizens' group fighting the plant. Almond and others say that emissions have sickened some of the plant's neighbors, a claim the company has denied.

"To me this situation is far too serious to take chances of making a mistake of this magnitude and putting the citizens' health at further risk and damaging the environment is just totally unacceptable," she said.

The N.C. Waste Awareness and Reduction Network, said Wednesday that it would continue its legal efforts to end Solite's burning of hazardous waste.

Jewett said that despite Tuesday's setback, the company would appeal the permit revocation. "We will obviously do what's necessary to keep the plant in operation," he said.

LOAD-DATE: July 24, 1997

LANGUAGE: ENGLISH

A Citizens' Newspaper On the Incineration of Hazardous Waste In Cement and Aggregate Kilns:

The Carolina Solite Tragedy

"Stop the Burn"

Cement Kiln FP 144

Published by the Clean Water Fund of North Carolina

Spring, 1993

Fighting the Incinerator

Health, Safety, and a Clean Environment

"I have smelled it. I know how it tastes. I've seen it fall in my yard, in my garden, on my cars. I've seen children waiting for the school bus while black clouds billowed from the company stacks. You can call it hazardous waste. I call it black death," says Joann Almond of Aquadale, NC. She has good reasons to be concerned.

Sometime after 1980, Carolina Solite began to burn large amounts of hazardous waste in aggregate kilns near Aquadale. Soon, waste generators across the country were paying Solite's subsidiary Oldover to collect their waste.

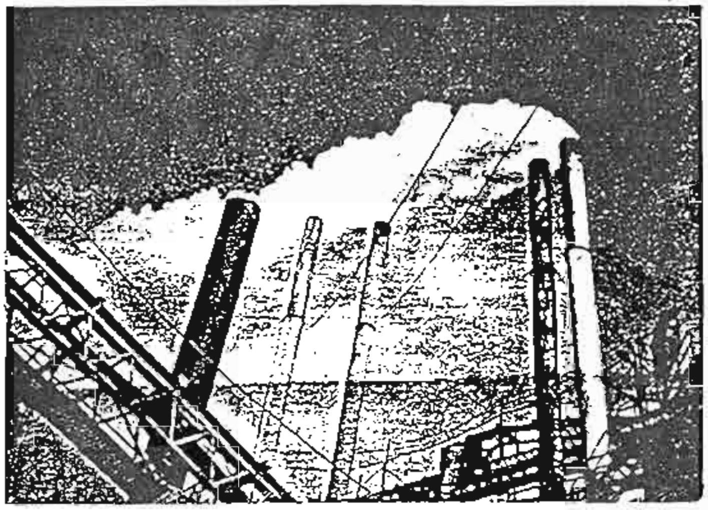
Oldover "resells" the waste to Carolina Solite as "fuel." Solite profits from this. Still, what is good for Solite might not be good for the countryside.

Safety of local residents doesn't seem to be a company priority. Residents of Aquadale complain that ash fallout from Solite has left oily residues on garden vegetables and damaged automobile paint, that odors from Solite keep them awake, and that they suffer from headaches, nausea, or allergies when exposed to the fumes. And since Solite has contaminated groundwater under its site, some citizens now worry about their wells.

Worker safety doesn't seem to be a company priority either. At Oldover in 1990, state inspectors discovered that a shower and eyewash station for emergency decontamination of employees had not been properly tested or maintained and did not work properly. Inspectors also discovered that Oldover had no emergency evacuation plan for employees and could not produce records of required employee training.

Solite's employees have complained that hoses broke and sprayed them with the "fuel," that the "fuel" burned their skin, that their stomach gas began to smell like the "fuel," and that mist from Solite's stacks caused blisters.

The NC labor department thinks that kiln operators are exposed to high levels of heavy metals. And in 1989, the Federal Mining Safety and Health Administration cited the company for at least 51 safety violations and issued at least four stopwork orders. "This place is a mess," inspectors noted; not surprisingly, a follow-up visit in early 1990 uncovered at least 18 additional violations.

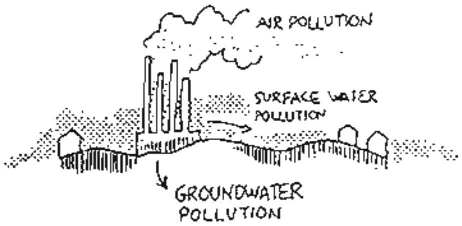


Carolina Solite has burned millions of pounds of hazardous waste in North Carolina; soon they will burn even more.

Foaming after it leaves Solite property, the Upper Long Branch no longer supports fish. Fluoride has damaged some local pine trees.

"They said it was safe and we shouldn't worry. Only a few people would answer our questions. And what we did learn, we didn't like at all.

"We just couldn't let them get away with it. When we went to the state for help, we only got a run-around," says Almond. "But we'll stop them. We'll stop them ourselves."



Our Concerns

Dirty and unreliable, industrial furnaces were not designed to safely destroy hazardous waste.

Dangerous chemicals form when hazardous waste burns. These may include the poison gas phosgene used in World War I. Dioxins may synthesize when furnace vapors condense on cooler flue surfaces.

Chlorine compounds do not all burn. But they do accumulate in animal fats like meat or fish. And they persist in human tissue.

Companies drip, dump, leak, spill, splash, and vaporize hazardous waste — then claim 99.99% destruction. Toxics reappear in air and soil, rivers and wells.

Will your well be a safe source of water in the future for your children and grandchildren?

Fish may disappear from rivers. Agricultural land may be damaged. Livestock may become sick.

Natural resources are ruined and recreation sites are lost. Property values decline.

Workers and neighbors may be exposed to heavy metals like lead and cadmium, carcinogens like benzene and dioxin, radioactive dusts and other hazardous contaminants.

Carolina Solite is near our elementary school.

Cancer clusters and neurological disorders can appear near incinerators. Corrosive gases cause lung damage in old and young. Effects may not be evident until years later.

Products manufactured with hazardous waste "fuel" could include toxic chemicals that cause pollution.

Genuine recycling becomes ever more important as known oil reserves disappear. We misuse our limited mineral wealth by burning petrochemicals that could be cleaned and reused.

America needs real solutions. We need real recycling, not sham recycling. We need industries that make less hazardous waste, not those that burn and dump in small communities. We need environmental policies based on science, not on politics.

On the inside...

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The Express-Times

SERVING PENNSYLVANIA AND NEW JERSEY SINCE 1855

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Frank Keegan Editor **James S. Flagg** Editorial Page Editor

Joseph P. Owens Managing Editor

Our **VIEW**

Just say 'NO!'

Keystone's mishap proves the DEP must not expand its hazardous-waste permit.

There was no sonic boom from the "non-incident" at Keystone Cement Co. on Monday. Instead, the sound after a 10-hour emergency-response siege was that of an entire community exhaling: One of Keystone's hazardous-waste storage tanks overheated but *didn't* go critical. The mass evacuation of a one-mile area and closure of roads in and around the East Allen Township plant amounted to a huge inconvenience and *not* a catastrophe.

First, let's credit the yeoman efforts that were turned in. The emergency response system worked because a plan was in place, because it had been rehearsed, and because it was carried out efficiently and decisively. That's a strong testament to the East Allen Township Fire Co., the Colonial Regional Police, school officials and countless others who mobilized quickly and erred on the side of caution to get people out of harm's way.

And yes: Kudos to Keystone officials, who made the right call, for which they will be second-guessed and criticized, knowing that any incident right now is going to show up as "Exhibit A" in their ongoing attempt to expand the company's hazardous-waste burning permit with the state Department of Environmental Protection.

From the company's viewpoint, the temptation is strong to say: The system worked. No one was harmed. There was no spark or source of ignition to ignite volatile fumes in the tank, thank God.

From the viewpoint of anyone living within 20 miles, the question is: How did such a high-tech, regulated system come to the point that the danger was detected by an employee feeling a pipe and noticing it was suspiciously warm?

And to a lesser degree, even if this turns out to be something that didn't approach a meltdown, how often are two schools and most of the entire Bath area going to emptied out and taken to shelter[illegible]

because the thermometer goes up at Keystone?

As of Tuesday night, Keystone officials were still investigating to determine the cause of the overheated tank, which, had it ignited, posed the potential for 1) a massive explosion that could've severely injured or killed company employees and emergency workers at the scene, and 2) sent off a cloud of vapor that might well have demonstrated the worst possible calamity from living with a hazardous-waste-burning cement kiln on the outskirts of Pennsylvania's third-largest metropolitan area.

The DEP is investigating, and state Reps. Craig Dally and Len Gruppo have called for a suspension of the review of Keystone's request for an expanded permit. That process was headed for a public hearing early next year, but now probably will be delayed. Keystone is seeking to increase greatly the rate of its hazardous waste burning.

DEP's answer to Keystone must be an emphatic "NO." Until Monday, the case for rejection was still based largely on the long-term unknowns connected with hazardous waste burning. We simply don't know the possibilities, despite the health-risk assessment that a consultant conducted for Keystone earlier this year, which concluded there is minimal risk. (Interestingly, that study *didn't* rate the odds on the type of tank explosion that had everyone worried on Monday because the potential for such an explosion was considered negligible.)

Again, thank you to those who performed so well in a pressure-filled situation. And in a perverted way, thanks to the forces that brought us to this brink and safely delivered us, because one of the unknowns of living with Keystone, one of the unthinkables, is now known to be a possibility and a threat to the health and safety of tens of thousands of residents. That uncertainty is what many, many people feel in their gut but could never prove through scientific analysis, even if they had the money to pay a consultant to make an eloquent argument for it. Alas, Keystone has supplied a strong piece of evidence that counters its own claim of relative risk-free living near the plant.

DEP must take heed, and not let emotion sway this decision. Do the necessary homework. Conduct the hearings. Consider the events of Dec. 8, 1997, along with Keystone's previous track record.

The record says NO.

Voluntary shutdown at Keystone now mandatory

The company can't burn hazardous-waste fuels while the state conducts a probe.

By JULIA BAUER
The Express-Times

E. ALLEN TWP. — Keystone Cement Co.'s voluntary shutdown of its hazardous-waste fuel systems became mandatory Wednesday by order of state environmental officials.

The company was told hazardous-waste fuels can't be burned, trucked in or connected to the plant's two kilns until a team of experts from the state Department of Environmental Protection dissects Monday's brush with disaster, DEP spokesman Mark Carmon said.

A 30,000-gallon tank posed a disastrous explosion risk when something caused its 5,600 gallons of blended hazardous-waste fuels to heat up and pressurize Monday morning, said Thomas C. Miller, professor emeritus of chemistry at Lehigh University.

"Pressurized tanks that explode release a tremendous amount of vapor," Miller said, "and the fireball can mushroom just like a bomb."

He likened it to a gasoline tank explosion.

Firefighters worked throughout the day to hose down the massive tank to forestall an explosion while police evacuated schools, senior citizen apartments and residents of neighboring Bath. Roads to the community were barricaded during the 11-hour crisis.

Now, a series of investigations are starting that could spell trouble for Keystone's controversial use of hazardous-waste fuels — a 57-variety chemical soup that can include contaminated cleaning solvents, used motor oils and paint.

"It's a region-wide issue, not just a Bath issue," Carmon said. "This is going to be a priority investigation here."

Carmon said the DEP team will question — and perhaps

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KEYSTONE

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visit — two New Jersey suppliers which blend the used solvents. It will also examine employee procedures, equipment, and systems before answers are ready for some tough questions.

"We'll consider, 'What is the company's future in relationship to the use of this material in the future?'" Carmon said. "Can they certify to our satisfaction that they can operate safely and in compliance?

"They have not shown that obviously as of Monday."

The accident is overshadowing Keystone's quest to use 45 percent more hazardous-waste fuel to melt cement rock in its kilns. The permit would allow Keystone to use the liquid waste fuel for 75 percent of its heating needs, instead of 50 percent.

Since the early 1990s, Keystone has held permits to burn 57 types of liquid hazardous wastes and to construct six more 30,000-gallon tanks if needed, said Michael Luybli, vice president of environmental affairs. The plant relies on two 15,000-gallon tanks and two 30,000-gallon tanks now.

Until the disaster investigation ends, Keystone has to burn coal to stay in business — 400 tons a day, Luybli estimated.

He was hoping for quick answers to Monday's crisis.

"You can't hurry these experts," Luybli said after the second day with researchers. "I tried that. It doesn't work."

One expert who opposes Keystone's hazardous-waste fuel operation, St. Lawrence University chemist Paul Connett, is studying the company's $500,000 health risk study for this area's PTA Environmental Coalition.

A prerequisite for the pending permit, the massive study was supposed to measure the health risk for one person living downwind from the plant.

But its chapter on catastrophes skipped a scenario for a tank explosion such as the one feared Monday — too unlikely, the report stated.

"They said this was extremely unlikely to happen," Connett said. "They were wrong.

"Fortunately, no one was killed because they were wrong."

Connett criticized the plant's proximity to George Wolf and Sacred Heart elementary schools, less than ½-mile from the hazardous-waste fuel tanks.

"You just cannot operate burning hazardous-waste fuels so close to a school," Connett said Wednesday. "I don't think any child in the U.S. should go to school with that possibility hanging over them."

The Greene Environmental Coalition
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Citizens Cement Environmental Victory

For Immediate Release

December 12, 1994

Contact: Bruce Cornett / Michael Jones 513-767-2109 / 513-767-1004

Robert Shostak 614-593-5828

After a bitter 4 1/2 year struggle, the Greene Environmental Coalition and Southdown, Inc. today announced an agreement resolving many of the differences between them. The settlement, signed by officers of the Coalition and Southdown, and by their attorneys, resulted from discussions initiated last week by Southdown Executive VP and General Counsel Edgar Marston.

The settlement terms provide many benefits for the community. Southdown has pledged:

- Never to burn or store hazardous waste at its Ohio facility;
- To bind any future owner of the facility not to burn or store hazardous waste,
- To dispose of cement kiln dust only in properly secured, permitted landfills which will not pose a threat to the environment;
- To promptly fence a local cement kiln dust landfill site and control air dispersion of

dust from the site; and

- To make a compensatory payment of $110,000 to the Coalition, which will be used to ensure the continued operation of the Coalition's office and payment of legal fees. The Coalition intends to continue its work to protect human health and the environment. The Coalition is a non-profit organization staffed entirely by volunteers.

The Coalition, in turn, has agreed:

- Not to oppose Southdown's formal withdrawal of its waste storage and handling permit application to the Ohio Hazardous Waste Facility Board (HWFB). HWFB had previously denied the permit with harsh criticism of Southdown. Copies of the complete proceedings will remain available to the public
- To allow Southdown a 24 month period in which to work out liability with USX Corp. regarding cleanup of cement kiln dust landfills. During this period, work will continue to plan for and begin remediation, appraising the Coalition of all activities. If, after that time, no acceptable remediation of the landfill is in progress, the Coalition will renew its suit against the parties.

No agreement was reached concerning the Company's plans to renew the burning of tires at its cement kilns. The Coalition continues to oppose this practice.

C

"After the struggle we have been through, this settlement is deeply gratifying," said Bruce Cornett of the Coalition. "It vindicates all those who have worked so hard for this community."

"This battle was all about the health and safety of people. The agreement signed today will help ensure that for generations," said Diana Jackson.

"This settlement has national implications," said Michael Jones. "this is the first restrictive covenant that runs with the land prohibiting the storing or burning of hazardous waste. We have bound the deed and it can never be changed.

Ellis Jacobs of the Coalition considered the lessons learned from the conclusion to this bitterly fought struggle. "Never give up. Neither wealthy and powerful corporations, nor complacent government agencies, are any match for well-informed, engaged and vocal citizens. As Margaret Mead once said, 'Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it's the only thing that ever has.'"

C

BURNING OUR HEALTH: HAZARDOUS WASTE INCINERATION IN CEMENT KILNS IN MEXICO

In the search to be more commercially competitive, the cement industry in Mexico is burning hazardous wastes as "alternative fuel" in their cement kilns, attempting in the process to reduce the cost of more traditional fuels, like coal, fuel oils or natural gas. This strategy is promoted by a group of foreign companies that have made hazardous waste "recycling" a big business and found acceptance by Mexico's environmental authorities. The industry argues that energy recycling of wastes is ecological because it saves fossil fuels and natural resources; nonetheless, the experience internationally with this practice shows that it is a dirty technology which should not be transferred to Mexico.

Cement Production and Conventional Environmental Problems

Traditional cement production can cause environmental problems: the continual extraction and mining of limestone and other materials leaves large scars in the earth; inadequate transportation of extracted materials for grinding and storage in the plant produces a tremendous amount of dust. As in any combustion process, the calcination process in the kiln produces air pollutants, including carbon monoxide, sulfur dioxide, nitrogen oxides and particulate matter. The amount depends on the type of fuel, air pollution control equipment and parameters of the kiln's operation. The left-over cement kiln dust can be contaminated with heavy metals and other pollutants. If the cement kiln dust is deposited back in the quarries from which the limestone was extracted, or to a municipal landfill, it can contaminate soils, groundwater and flood waters.

Exposure to carbon monoxide negatively impacts the central nervous system and, along with nitrogen oxides, sulfur dioxide and suspended particulate matter, irritates the lung tissue and the respiratory system and aggravates the symptoms of people with lung diseases (asthma, chronic bronchitis). Exposure to these contaminants can also increase cardiac and other circulatory problems as well as acute respiratory sicknesses.

What environmental problems and health effects can happen when hazardous waste is used as the fuel in the cement-making process?

*The amount and types of air contaminants -- including carbon monoxide, sulfur dioxide, nitrogen oxides and particulate matter -- increase, more so than with the burning of coal, petroleum or natural gas.
*Higher levels of lead, cadmium, arsenic and mercury, and 15 other heavy metals commonly found in cement kiln air emissions, occur when hazardous wastes are burned.
*New contaminants, known as Products of Incomplete Combustion (PICs), are produced, including highly-toxic dioxins and furans, in the stack emissions.
*The cement kiln dust, the clinker, and the cement itself can contain these heavy metals (cadmium, chromium, arsenic, lead and selenium for example) as well as the PICs.

*There is a higher risk of accidents in the transport of hazardous wastes to the plants.
*Workers at the cement plants are exposed to hazardous wastes, increasing their health risks.

The exposure to heavy metals can provoke serious health effects. The exposure of a pregnant woman to lead can cause development problems in the fetus and affect the neurological development of the child, including its future intelligence; exposure to cadmium can affect the kidney, liver and lungs, cause genetic damage and has been proven to cause cancer in rats; mercury exposure at high concentrations can cause permanent damage to the brain, the kidneys and to fetuses in development; the nervous system is especially sensitive to the effects of mercury, provoking more severe disorders with increases in exposures (irritability, nervousness, trembling, vision and hearing changes, memory problems). Other suspected or known carcinogens emitted by rotating kilns incude berilium and hexavalent chromium.

Contaminants generated in the incineration of hazardous wastes in cement kilns

Atmospheric contaminants emitted	**Contaminants found in cement kiln dust, clnker and cement**
Acidic Gases: Nitrogen Oxides, Sulfuric Dioxide, and Hydrocarbons 19 heavy metals, including lead, mercury and cadmium Products of Incomplete Combustion, including dioxins and furans	19 heavy metals, including lead, mercury and cadmium Products of Incomplete Combustion, including dioxins and furans

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Dioxins and furans are organic contaminants, created in the burning of hazardous wastes, which contain chlorine (commonly present, for example, in solvents and plastics) and have three main characteristics. First of all, they are extremely toxic, producing severe chronic effects, including cancer and endocrine system disruptions, and result in the loss of fertility, affect the immune system and alter the development of fetuses in human and animals. They are also very persistent: they have a half-life of 9 to 15 years in the soil. Finally, they bioaccumulate in the environment, concentrating in the fatty tissues, increasing their concentration as they move up the food chain, which means that the largest concentrations would be found in humans and eventually in children, passed through contaminated mother's milk.

In addition to the exposure of heavy metals and dioxins and other Products of Incomplete Combustion through inhalation -- not only by the cement plant workers but others in the surrounding community -- there are a number of other exposure paths. The pollutants can be carried by air currents and deposited on water and soil, where they are taken up by plant and crop roots, and then accumulate in trgffish and animals, including in beef, milk and eggs.

Which cement plants are burning hazardous wastes and what types of hazardous wastes are they burning?

According to 1996 informaiton, 21 cement plants out of a total of 29 plants in Mexico have provisional permits and temporary authorization to burn hazardous wastes in their kilns. Leading the practice are Cementos Mexicanos (CEMEX), which has permission in 11 of its plants, and Cementos Apasco, with 6 plants authorized to burn hazardous wastes. In addition, Cooperativa Cruz Azul (2 plants) and Cementos Portland Moctezuma and Cementos de Chihuahua (one plant each) also have permission to burn hazardous wastes. Currently, CEMEX is burning hazardous wastes in 5 of its plants; Cementos Apasco in all 6; Cruz Azul in both its plants and Cementos Portland Moctezuma in its one plant. About 70,000 tons of hazardous wastes and alternative fuels were burned in cement kilns in Mexico in 1997, according to representatives from the cement industry.

The hazardous wastes permitted to be used as alternative fuels include solid wastes, such as tires, battery shells, contaminated soils and sludges. Liquid hazardous wastes, which form the majority of the waste burned, include solvents, grease and used oils, refinery waste and distillation sludges.

The hazardous waste fuel-blending facilities that produce these alternative fuels have identified 112 different liquid, semisolid and solid hazardous waste streams with combustion (energy) value. These are principally waste streams of the automobile, chemical, electronics, paint manufacturing and petroleum refining industries. The types of blended wastes include oils and grease by-products of petroleum waste and distillation tanks, paint wastes and subproducts, used solvents, used chemicals, as well as contaminated papers, rags, cardboard, filters and other products.
Heavy metals can be present in used oils, dyes, paints and solvents. The chemical organic wastes, such as hydrocarbons, which contain one of a variety of halogens (chlorine, bromine, flourine or iodine) are found in such wastes as acetone, benzene, toluene, xylene and other solvent wastes as well as in tetrachloroethylene, tri-cloroethylene and freons.

Industries designed to collect and blend hazardous wastes for their use as alternative fuels in cement kilns

Name of Business	Location of Waste Blending Facility	Names of Companies in Joint Venture
Pro Ambiente	Torreón, Coahuila	CEMEX with Mobley Environmental Services
Ecoltec	Ramos Arizpe, Saltillo, Coahuila	WMX (previously known as Chemical Waste Managment) with Cementos Apasco, owned by Holderbank, a Swiss cement company
BFI Química Omega	Tenango del Valle, Edo. de México	Brown Ferris Industries (BFI) and Ecosistemas Nacionales (Metalclad en México)

WMX (waste Management Inc.)	El Salto, Jalisco	Collection station for hazardous wastes some of which are sent to Ecoltec for blending.
Residuos Industrias Multiquim (RIMSA)	Mina, Nuevo León	Fuel blending plant at hazardous waste landfill with technical assistance from WMX Inc.

The hazardous waste recycling business increasingly includes waste from both the U.S. and Mexico and has become more binational in character. Mexico's main environmental law, the LGEEPA, permits the import of hazardous wastes for recycling (Article 153), potentially allowing waste to be imported to Mexico for incineration in cement kilns.

U.S. companies are expanding their investments in the hazardous waste disposal and recycling market, forming a powerful influence on public policy related to hazardous waste management and taking advantage of the North American Free Trade Agreement (NAFTA) and the pro-business philosophy of the Mexican government. In this way, a dirty technology which has met with fierce opposition in its country of origin is being transferred to Mexico.

On the border between the U.S. and Mexico, Ford Environmental Services (Servicios Ambientales Ford) is promoting a financing proposal to the Border Environment Cooperation Commission and North American Development Bank to establish a hazardous waste fuel-blending facility in Ciudad Juárez, Chihuahua (across from El Paso, Texas). This plant would offer these blended hazardous wastes as fuel to the cement industry on both sides of the border, thus competing for the emerging market of hazardous wastes produced by the maquiladoras.

What have Mexico's environmental authorities done about this problem?

The federal environmental authorities from the National Ecology Institute (INE) have been authorizing temporary permits to allow cement plants to burn hazardous wastes for the last three years. These provisional permits are based on test burns, which are reported twice a year to the authorities despite the lack of any official regulations governing the practice. Proposed rules yet to be adopted would establish maximum emission limits for heavy metals, PCBs, hydroflourines, hydrocarbons and a maximum chlorine content of 2% of the total wastes burned.

The problem with basing temporary permits on the test burn procedures is that these test burns do not always reflect the daily practice of the hazardous waste burned in real operating conditions and it is very difficult to monitor the hazardous waste used as fuel, the emissions from burning them and the wastes -- principally cement kiln dust -- generated. In the case of dioxins and furans, Mexico lacks the experience and equipment to accurately monitor and measure emission levels.

In March of 1996, SEMARNAP, the federal environmental agency of Mexico, represented by INE, signed an agreement with the National Chamber of Cement (which includes representatives from all the major cement companies) and Cooperativa Cruz Azul (Blue Cross Cooperative) to establish a program of alternative fuel energy recycling in cement kilns using industrial hazardous wastes.

The Integrated Hazardous Waste Management Program for Industrial and Hazardous Wastes in Mexico (1996 - 2000) includes waste blending and incineration of hazardous wastes in cement kilns as acceptable energy recycling practices and seeks to promote this practice in CIMARIs (Integrated Centers of Management and Treatment of Hazardous Wastes), which they propose locating throughout Mexico.

What opposition has the practice of incinerating hazardous wastes in cement kilns generated in other countries?

In the United States and Europe, the communities that have lived with cement plants burning hazardous waste have recognized the myths of ecological energy recycling and have organized themselves to defend their health and environment.

National health associations -- such as the American Lung Association -- have opposed burning hazardous wastes in cement kilns and have produced video testimonials about the health problems that this practice provokes in the local population.

Citizen organizations, with help from members of the U.S. Congress, have proposed an initiative to label cement as to whether or not it was produced with hazardous wastes, giving the consumer the option of choosing cement produced with a cleaner process.

Even the commercial hazardous waste incinerator industry has opposed the cement plants that burn hazardous wastes because of their unfair competitive advantage. The cement plants are able to burn hazardous wastes in the U.S. with much less restrictive environmental standards and will continue to enjoy an unfair advantage until stricter, more comparable standards are imposed and enforced.

In Mexico, more than 40 environmental and social organizations have asked the environmental and health authorities to cancel the authorizations and temporary permits granted to the cement plants in an open letter signed June 24, 1998.

Are there any alternatives?

The alternative to burning hazardous wastes in the making of cement is simple: require the use of less contaminating fuels such as fuel oils or the least contaminating alternative, natural gas. The huge underutilization of natural gas produced by Pemex, the privatization of the delivery of natural gas in Mexico and the tendency toward price reductions offer greater opportunities for Mexican cement plants to take advantage of natural gas.

The cement industry is the key player in the construction sector, and some industries have shown themselves to be very competitive internationally, even operating outside of Mexico. Mexico's cement industry resources and innovative capacity should be focused on designing strategies to increase the efficiency and energy content of fuels, in the process rejecting the use of hazardous wastes. The industries should institute a program of reduction of hazardous wastes throughout the entire cement production-cycle.

What can you do?

*The right to know environmental information. Investigate in your municipality or state whether the cement plants are burning hazardous wastes as an alternative fuel, what types of waste and volumes they are burning, as well as the types and volume of emissions and waste they generate.

*Freedom of expression and protest. Express yourself through peaceful, public and active means. Oppose this practice and make the cement plants, municipal, state and federal environmental authorities and your political representative aware of your views. Express your comments when the official standard for thermal treatment of hazardous wastes is published in Mexico or when proposed standards in the U.S. are announced. Tell the Border Environment Cooperation Commission (BECC) and the North American Development Bank to reject any approval or financing of projects that promote the incineration of hazardous wastes in cement kilns. (BECC: PO Box 221648, El Paso, TX 79913; Tel: (011-52-16) 25-91-60; Fax: (011-52-16) 25-61-80).

*Communication and citizen solidarity. Establish relationships with national and international citizen groups which have already organized against this practice; discuss and adapt the resources, legal and political strategies to best address your particular cement kiln problem.

AIR POLLUTION:

A shuttered cement plant becomes a metaphor for political change

Amanda Peterka, E&E reporter

Greenwire: Friday, September 26, 2014

CASTLE HAYNE, N.C. -- Along the Northeast Cape Fear River, silos of an abandoned cement plant rise 20 stories over a rusty dock that was once used to load cement for the trip to nearby Wilmington. Downriver, an idle red-and-white smokestack towers over the trees.

This moonscape of abandoned industry in southeast North Carolina has been home to the state's biggest local battle over air quality. The site once hosted Ideal Cement, a major cement manufacturer that opened 50 years ago but shuttered operations in the early 1980s. Beyond the trees and out of view from the river lies a massive limestone mine. A major company is hoping to build one of the nation's largest cement plants -- with silos twice the size of those overlooking the river now -- on the site within the next decade.

Titan America LLC already has faced five years of resistance from local activists, who say the new plant's emissions would make New Hanover County's air some of the dirtiest in the state.

But the battle over Titan has recently taken on greater meaning.

The prospective plant has become wrapped up in bigger battles environmentalists are waging to protect regulations they credit with making the state a historical leader in air quality. Over the last few years, North Carolina's Legislature, newly under Republican control, has enacted myriad laws to make it easier for businesses to obtain environmental permits and to ensure that the state's regulations are no stricter than those from the federal government or neighboring states. Most recently, Republicans tried to eliminate a network of air pollution monitors, including one that would have tracked levels of smog-forming emissions across the street from the plant.

In short, the state Department of Environment and Natural Resources has adopted a much more "customer-service" tone toward the regulated community under Secretary John Skvarla, an appointee of Republican Gov. Pat McCrory.

North Carolina GOP leaders and the business community say they're making the state more attractive to industry. But environmental and public health advocates are concerned that their new crop of leaders are backtracking on two decades of gains in air quality in their haste to open the doors to industry.

The fight over Titan's cement plant represents a "fork in the road" of that larger showdown, said Kayne Darrell, a resident of Castle Hayne and one of the leaders of the grass-roots coalition opposed to the plant.

"If this huge polluting cement plant comes here, then there's no turning back," she said. "But if we can stop this, we have an opportunity to go down a better, cleaner path."

North Carolina has a history of getting ahead of federal regulations and leading its neighbors in air quality. In the late 1980s and early 1990s, the state was an instrumental part of the Southern Appalachian Mountains Initiative, a voluntary partnership of local and federal government agencies and stakeholders to model air quality impacts and to examine the role of incentives in reducing emissions.

In 1990, under a Republican administration, the state enacted air toxics regulations to stem hazardous emissions such as mercury and benzene that are linked to cancer and other adverse public health effects.

Then, in the early 2000s, utilities and environmentalists sat down together and came up with a plan that became the state's seminal piece of environmental legislation, the Clean Smokestacks Act. Enacted into law in 2002, it required reductions of air pollutants from coal-fired power plants and included offsets for utilities such that it would not cost anything for them to shutter old, inefficient plants. As a result, utilities in the state phased out many of their oldest coal-fired power plants. In the mid-2000s, North Carolina also sued the Tennessee Valley Authority for air pollution that had blown over from Tennessee, Alabama and Kentucky, a lawsuit that was eventually settled in 2011 when TVA agreed to resolve alleged Clean Air Act violations.

Duke Energy Corp. and Progress Energy Inc. -- which merged in 2012 -- reduced their emissions of nitrogen oxides by 83 percent and sulfur dioxides by 89 percent relative to 1998 levels thanks in large part to the Clean Smokestacks Act, according to a 2013 report by the state Environmental Management Commission. The act was also instrumental in reducing emissions of fine particles and in helping areas of the state meet the federal fine particulate matter standard. In 2014 there was only one area in the state, Charlotte, that was out of compliance with the federal ground-level ozone standard. Between 1998 and 2011, toxic air emissions decreased in the state by 62 percent, according to a December 2012 report by the Department of Environment and Natural Resources' Division of Air Quality.

"I clearly would say that within the Southeast specifically, and I even would say nationally, that North Carolina's air program was respected as a leader both for having stringent rules and requirements and having some of the best science," said Ryke Longest, director of the Environmental Law and Policy Clinic at Duke University and a former state environmental enforcement attorney. "We had a situation where our Legislature at one time, in the late 1990s and early 2000s time frame -- they were willing to say that clean air was so valuable that we're willing to spend the extra money to allow the utilities to close some of these older coal-fired plants and replace them with more efficient and less polluting newer plants."

The dramatic improvement in air quality brought on by the Clean Smokestacks Act and other regulations has correlated with fewer deaths from respiratory diseases over the past two decades, according to a recent study by researchers at Duke University. Death rates between 1990 and 2010 fell for emphysema from about 11 in 100,000 people to fewer than eight in 100,000; for asthma from about five in 100,000 to fewer than three in 100,000; and for pneumonia cases from about 90 in 100,000 to about 60 in 100,000.

A separate recent study by researchers at the University of North Carolina, Chapel Hill, found that the Clean Smokestacks Act was responsible for preventing about 1,700 premature deaths in 2012.

"These observations are really valuable because they tell us that we need to work on better air quality and try to control all emissions," said Julia Kravchenko, a co-author of the study and a research scientist at Duke University's Department of Surgery.

The state was well ahead of federal activity in the cases of both the air toxics rules and the Clean Smokestacks Act. The toxics rules came out after several highly publicized incidents in the state dealing with toxic air pollution; at the time, U.S. EPA was only just beginning to contemplate regulating major sources of hazardous air pollution. The Clean Smokestacks Act was similarly set in motion in anticipation of tighter standards for NOx and sulfur oxides from EPA.

"In 2002, I think the utilities clearly believed that tighter controls on NOx and SO2 were coming and were coming at the federal level, and I think what the bill did was get ahead of that federal process that everybody believed was coming soon," said Robin Smith, former assistant secretary at the state Department of Environment and Natural Resources who oversaw the implementation of the Clean Smokestacks Act. "It gave the utilities more time since they were starting earlier, not waiting for the federal rule."

Since those laws and regulations were put in place, though, the state has undergone a major ideological shift. Republicans in 2010 took power over both chambers of the North Carolina Legislature for the first time since the 1870s. Two years later, Democratic Gov. Bev Perdue declined to run for another term, and McCrory, a former Duke Energy executive who had lost to Perdue in 2008, won the governor's seat.

The changes at the top have been reflected in moves by the Legislature beginning around 2010 to make North Carolina more amenable to business. In the environmental space, that has broadly meant the elimination of certain regulations and a return to what are known by North Carolina politicos and environmentalists as the "Hardison amendments." The phrase refers to a series of actions in the 1970s sponsored by then-state Sen. Harold Hardison (D) that kept the state from enacting environmental regulations that were more stringent than federal standards.

"What they're talking about is this idea that EPA's regulation of something is not only the floor but it's also the ceiling," Longest said.

'Regulatory reform' an annual event

That idea has manifested itself in a new tradition taking hold in the Legislature: passage of regulatory overhaul bills.

In 2011, legislators overrode a veto from Perdue to enact a bill that prohibited state regulators from implementing new rules stricter than federal agencies. The next year, legislators targeted the state's landmark air toxics rules, exempting any sources from obtaining permits if they already had to obtain an EPA permit for toxic air pollution.

A 2013 reform bill required that regulations be reviewed and readopted every 10 years, meaning the requirement that no rules be more stringent than federal regulations would now be applied to existing regulations. The bill also relaxed certain state rules covering the open burning of leaves or other debris -- some of the earliest air regulations enacted in North Carolina -- because they weren't required by the federal government.

"We've basically moved into a landscape where there's the annual regulatory reform bill. It's kind of like reducing taxes. It's almost de rigueur now," said Molly Diggins, state director at the North Carolina chapter of the Sierra Club.

Industry and business groups welcomed the new regulatory atmosphere. According to the North Carolina Chamber of Commerce, job creators had been shackled by an "increasingly complex and costly regulatory system."

"With great strides made in recent years, the North Carolina Chamber supports further increasing regulatory efficiency that balances job creation and environmental protection by creating a more streamlined and transparent rulemaking process," the chamber said in touting its success in gaining passage of the recent regulatory reform measures.

Industry had long called for changes to the air toxics regulations, but until Republicans captured both houses, the Legislature hadn't moved any reform measures. Industry broadly argues that EPA has caught up and issued dozens of rules governing hazardous air pollutants since the state measures were put in place. In 2011, letters to state legislators, five large companies -- Duke Energy, PCS Phosphate Company Inc., Nucor Corp., Domtar Corp. and Evergreen Packaging -- said the state requirements added significant burdens and costs to the air permitting process.

"I've heard a lot from the business community complaining about the air toxic laws and rules that we have, and about how burdensome they are and how expensive they are and how North Carolina goes way beyond what other states do, and how that hurts us competitively as far as business goes, as far as even recruiting businesses to North Carolina," then-state Rep. Mitch Gillespie (R), who shepherded the air toxics reform into law and who is now No. 2 at the Department of Environment and Natural Resources, said in an interview with WRAL.com.

The first reforms came during a transition period when the Legislature was under Republican control and the governorship was still held by a Democrat. State Rep. Pricey Harrison (D), who was an environmental activist before being elected in 2004, said the general thinking was that the dynamic helped prevent a wholesale gutting or elimination of the rules.

"There was just a constant battle to fight back attempts to eliminate our air toxics program," Harrison said. "I think that, and I'm not particularly partisan, but when the Democrats were in control they put a higher premium on protecting the public health and adequately funding the Department of Environment and Natural Resources."

Some environmentalists blame the pursuit of hydraulic fracturing in the state for the onslaught of anti-regulatory measures. State leaders, they charge, are inadvertently affecting places like Castle Hayne in the southeastern part of the state -- home of the proposed cement plant -- in their rush to remove regulations to prepare the state for fracking (*E&E Daily*, July 22).

For Castle Hayne air advocates, the most worrisome proposals from the Legislature came this year. State legislators proposed to eliminate all air monitors that are not specifically required by federal environmental regulators and to limit citizens' ability to challenge air permits in court, taking away two important tools used by citizens to challenge projects they deem risky to public health. The changes were never enacted.

The air monitor provision would have eliminated an air monitor that lies across the road from the proposed cement plant and next to an experimental field for different varieties of blueberries. The monitor is 11 miles from downtown Wilmington and measures concentrations of ozone, particulate matter and other pollutants. The other provision would have hampered advocates' ability to challenge the cement plant permit's allowances of toxic air pollutants.

There has already been a protracted battle over the cement plant. The state and Titan America in 2009 announced the proposal to build the plant in Castle Hayne on the site of the empty Ideal plant, and the state offered the company $4.5 million in incentives and approved an air quality permit. "A cement plant in North Carolina complements Titan America's geographical presence and provides a resource for an area of the country that is expected to have significant growth over the next 30 years," Titan spokeswoman Kate McClain said.

Local advocates and environmental groups immediately challenged the permit based on public health impacts, worried over the large amounts of mercury, particulate matter, sulfur dioxide and NOx that the plant would be allowed to emit. They argued that a large industrial facility does not belong in the second smallest and second most densely populated area in North Carolina. But in the middle of the challenge process, EPA released a proposal for tighter cement kilns, and in response, Titan revised the permit to have lower emissions. But when EPA finalized a rule that was weaker than the proposal, Titan revised its permit to emit more pollutants.

According to its permit, Titan would be allowed to emit 182 tons per year of fine particulate matter, making it the largest source of fine particles in New Hanover County and moving New Hanover County from 11th to fifth place in the rankings of top fine particle emitters in the state. The plant's emissions would also rank it among the largest sources of SO_2, NOx, carbon monoxide, volatile organic compounds, mercury, ammonia, benzene and other hazardous pollutants in the county. The company says it would have the same emissions with or without the state air toxics rule.

http://www.eenews.net/stories/1060006494 https://www.heraldmailmedia.com/news/tri_state/west_virginia/martinsburg-cement-plant-to-pay-m-fine-for-air-pollution/article_b0062af3-c1bd-517f-a889-1e7bbe13a2a3.html

Martinsburg cement plant to pay $1.5M fine for air pollution

By Matthew Umstead mumstead@herald-mail.com Apr 19, 2019

The Argos USA LLC cement manufacturing plant south of Martinsburg, W.Va., is seen in this undated Herald-Mail Media file photo.

File photo

MARTINSBURG, W.Va. — Operators of the cement manufacturing plant on the south end of Martinsburg have agreed to pay a $1.5 million fine for violations of the federal Clean Air Act from 2013 through 2016, the Environmental Protection Agency announced on Thursday.

The EPA said in a news release that the alleged violations at the industrial site at 1826 S. Queen St. included:

• Exceeding annual emission limits for total suspended particulates and fine particulate matter less than 10 micrometers in diameter.

• Non-compliance with opacity testing, monitoring, reporting and recordkeeping requirements and exceeding opacity limits.

• Failing to comply with requirements for operating a kiln that is subject to dioxin/furan emission limits.

• Failing to perform required stack testing on the kiln's exhaust in a timely manner to determine compliance with emission limits for total suspended particulates, fine particulate matter and volatile organic compounds.

• Having prohibited visible emissions from manufacturing-related storage structures.

• Failing to install, operate and maintain continuous emission monitoring for hydrochloric acid in a timely manner.

The fine of $1,505,309 is part of administrative consent agreement reached between the EPA, Argos USA LLC, the plant's owner since Dec. 1, and Lehigh Cement Co. LLC, the successor to Essroc Cement Corp., the prior plant owner, the government agency said.

Argos did not immediately respond to a request for comment on Thursday.

The alleged violations relate to the plant's Clean Air Act operating permit and federal restrictions on hazardous air pollutants from portland cement plants, the EPA said.

"This settlement demonstrates that EPA will hold accountable companies that fail to comply with operating permits that set forth requirements for protecting public health and the environment," EPA Regional Administrator Cosmo Servidio said in a news release. "Communities have a right to be protected from hazardous air pollutants, and EPA continues to ensure those protections."

The EPA noted that the violations occurred, at least in part, during a change in the facility's corporate ownership.

From 2009 until June 30, 2016, the facility was owned and operated by Essroc, the EPA said.

On July 1, 2016, Lehigh's parent corporation, HeidelbergCement AG, acquired Essroc's parent corporation, Italcementi S.p.A., and Argos, the current plant owner, acquired the facility on December 1, 2016.

The EPA said that it cited the companies for various Clean Air Act violations based on responses to EPA information requests and data collected and reported under the plant's permit.

While Lehigh and Argos were cooperative in negotiating the administrative consent agreement, neither party, as part of the settlement, admitted liability for the alleged violations, the EPA said.

Argos did not immediately respond to a request for comment on Thursday.

The EPA's announcement comes three years after the director of the West Virginia Department of Environmental Protection's (DEP) Division of Air Quality issued an order on April 12, 2016, in which Essroc agreed to pay a $38,400 penalty for air-pollution violations stemming from several complaints by Martinsburg residents in 2015.

DEP officials conducted an inspection of visible emissions at the cement plant between the fall of 2015 in response to the citizen complaints and found dust coming from near the top of a silo that houses clinker. Nodules of clinker typically are ground to a fine powder and used as a binding agent in cement products.

Nearby residents had said dust from the plant had repeatedly coated their vehicles, and that it was difficult to remove without using vinegar or other special treatment.

Considered a "major stationary source," the portland cement plant is required to have an operating permit under the Clean Air Act because it has the potential to emit more than 100 tons per year of various pollutants, including carbon monoxide, nitrogen oxide, particulate matter, sulfur dioxide and volatile organic compounds.

Formerly known as Capitol Cement, the plant can produce more than 2 million metric tons of cement per year, a spokesman for the plant has said.

The plant employed 150 people at the time of the 2016 sale.

In February, Argos reported to investors that cement and ready-mix dispatches in its U.S. region in the fourth quarter of 2018 were off by 9% and 10.7%, respectively, reflecting historic condition and a 43-day closing of the Martinsburg plant.

EPA Consent Decree
Apr 19, 2019

Matthew Umstead

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