

## **Energy Use in the Cement Industry in North America: Emissions, Waste Generation and Pollution Control, 1990–2001**

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### **Purpose**

The paper examines how energy use in the North American cement industry has changed over the past decade in trade, production and energy source trends, as well as changing regulatory structures. The environmental impacts of these various factors are assessed in relation to the production and management of pollutants, waste and emissions. These assessments are used to make recommendations regarding environmental standards and industry regulations.

### **Methodology**

The cement industry of each country is examined separately, with attention to the following areas:

- production and export trends,
- ownership/size of the industry,
- clinker processes used and electricity use,
- fuel use (type and amount) and energy consumption,
- pollution and emissions production, and
- relevant environmental regulations.

NAFTA's application to the cement industry is also discussed, particularly how tariffs have affected the Mexican industry and how environmental regulations may affect the flow of hazardous wastes being used as fuels in cement kilns.

The bulk of the data reported in the paper come from industry sources and government sources to which industry must report.

### **Main Findings**

Production in the cement industry has increased steadily between 1990 and 2001, driven primarily by US demand. In the US demand has increased 40 percent and production has increased by 27 percent. Production increased in Canada by 38 percent and in Mexico by 25 percent over the same period. This has resulted in significant increases in US imports from Mexico (353 percent) and Canada (689 percent) of cement and cement clinker (pre-cement). Pre-NAFTA tariffs on Mexican cement imported into the US were low, but have added anti-dumping tariffs since 1995. However, Mexican companies have increasingly built and bought plants in the US to gain access to the American market (perhaps helped by NAFTA's Chapter 11). The US industry has undergone significant consolidation over the last 10 years: 10 companies control 75 percent of the US market and eight are foreign owned (two of which have Mexican parent companies).

#### *Energy Consumption*

In all three countries, electricity consumption has grown steadily with production and electricity use per ton of cement produced has remained relatively stable. While electricity use by the cement industry is significant compared to other manufacturing industries, it is the fuel used during the calcination of raw materials in the kiln that accounts for the greatest energy

consumption in the cement-making process and this is a deciding factor in the cost of production. US plants have gradually been converting from wet kiln technology to the more energy-efficient, less polluting dry kilns, while almost all of Mexico's plants use dry kilns. No information was given regarding kiln technologies used in Canadian plants.

Energy consumption per ton produced has increased by approximately 10 percent in the US, although it has decreased by nearly 20 percent in Mexico and approximately 12 percent in Canada. This, combined with the increase in Mexican investment into this industry, has led some to argue that the US has become, to a certain degree, a pollution haven for the industry. Total energy consumption has increased with production in all three countries, offsetting the gains in efficiency occurring in Canada and Mexico. Coal is the predominant fuel used in Canada and the US, with both countries also using large amounts of petroleum coke and Canada using large amounts of natural gas. Fuel oil is the most-used fuel in Mexico; however, petroleum coke, coal and "alternative" fuels are being increasingly utilized—leading to a dirtier fuel mix. These last three fuel categories account for most of the industry's increases in fuel consumption in all three countries. "Alternative" fuels include hazardous and non-hazardous wastes—scrap tires, in particular, have become an important fuel source for the cement industry. Between 1993 and 2001, the US increased the use of tires (33 percent), solid wastes (255 percent) and liquid waste (12 percent), while natural gas decreased by 40 percent and the burning of coal and coal products was stable.

In Canada, interest in using scrap tires as a supplemental fuel is increasing. Canada is also collecting and processing scrap tires for export to Mexico. (Note: scrap tires are not classified as hazardous wastes, although hazardous waste-based alternative fuels are.)

#### *Emissions of Greenhouse Gases and Pollutants*

Greenhouse gas (GHG) emissions from cement production in the US increased by similar percentage amounts to fuel consumption, while Canadian energy use and GHG emissions per tonne of production fell over the study period. Detailed measurements of carbon dioxide emissions have not been made in Mexico, however, it is expected that emissions are increasing from the cement industry, considering the switch from fuel oils to petroleum coke, as well as the increasing production levels. Ratification of the Kyoto Agreement by Canada and Mexico could eventually lead to some standards regarding GHG emissions. In the US, however, action will more likely be taken through voluntary measures, led by international companies.

In all three countries, the cement industry is considered to be a leading emitter of criteria air pollutants like particulate matter, sulfur dioxide, carbon monoxide and nitrogen oxide. In the US, the cement industry is the fourth-largest emitter of dioxins and furans, and accounts for about nine percent of all air emissions reported to the US Toxics Release Inventory (TRI). Data on toxics and pollutants from the US and Canada indicate that total releases from the cement industry have been increasing, likely due to the increased burning of coal and alternative fuels. Data from the TRI show that production of toxics has risen even when adjusted for added production (pounds released to air and landfills/ton cement). No such analysis for Canada is given due to changes in reporting requirements, and there is no publicly accessible historical data for the Mexican cement industry.

#### *Emission Standards*

Emissions standards for cement kilns were recently adopted in the US and Mexico; however, they are still being implemented. Canada has no enforceable emissions standards for the cement industry. Of particular concern is the lack of standards for emissions of dioxins and furans. It is expected that the US standards will reduce dioxin emissions by approximately 40 percent.

The US applies more comprehensive standards to kilns burning hazardous wastes, while the Mexican standards only consider fuel type in determining the frequency of monitoring. Standards in the US and Mexico for kilns burning hazardous waste are significantly less stringent than similar standards for incinerators of hazardous waste. There is also concern that the limited amount of monitoring, particularly in Mexico, will not guarantee compliance with the new standards.

#### *Hazardous Waste Management*

With the increasing use of alternative fuels, US and Mexican cement industries have emerged as major managers of hazardous wastes. In Canada, however, tires and non-hazardous wastes are preferentially used as alternative fuels. Unlike the US and Mexico, cement facilities burning hazardous wastes as fuels in Canada are approved and regulated as hazardous waste disposal facilities.

#### *Cement Kiln Dust*

Cement kiln dust (CKD), the main byproduct of cement manufacturing, is also a significant environmental concern, as CKD waste can lead to serious air, groundwater and surface water pollution. The US EPA delayed a decision to classify CKD waste as hazardous and is in the process of regulating the management of CKD, but will delay final implementation until further study of current management practices has been conducted. CKD standards in Canada and Mexico are similarly ill-defined.

#### *Recommendations*

- Cement kilns burning hazardous wastes should be regulated as hazardous waste disposal facilities.
- Canada needs to adopt updated, enforceable emission standards for kilns burning both conventional fuels and hazardous wastes, as Mexico and the US have done.
- Energy efficiency standards and greenhouse gas emission standards for the cement sector should be adopted in all three countries.
- The CEC should initiate a dialogue about the burning of alternative wastes in cement kilns, with a specific focus on dioxin and furan emissions and the control of CKD.