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Pollutants

Industrial Pollution and Waste

Key Findings

- Industrial pollution and waste encompass the full range of materials generated by industrial activities that are unwanted by the producer. At times, they represent an unrealized opportunity to improve production efficiency and reduce disposal costs.
- Certain components of industrial pollution and waste are hazardous to human health and the environment. Related concerns include sensitive human populations such as children, the implications of low-level exposures to multiple pollutants, and contamination of ecosystems.
- Every year, industrial activity in North America generates substantial quantities of toxic chemicals, air contaminants, hazardous and nonhazardous waste, and radioactive materials that must be managed to protect human health and the environment.
- Some trends in waste management are encouraging, such as industries' adoption of pollution prevention methods and a sustained decline in releases of carcinogens and other toxins of concern, but progress has not been uniform.

Industrial pollution and waste **encompass the full range of unwanted substances and losses generated by industrial activities, including emissions to air or surface waters and the substances sent to sewage treatment plants, deposited in landfills, released or applied to the land, treated, injected underground, controlled through storage, recycled or burned for energy recovery.**

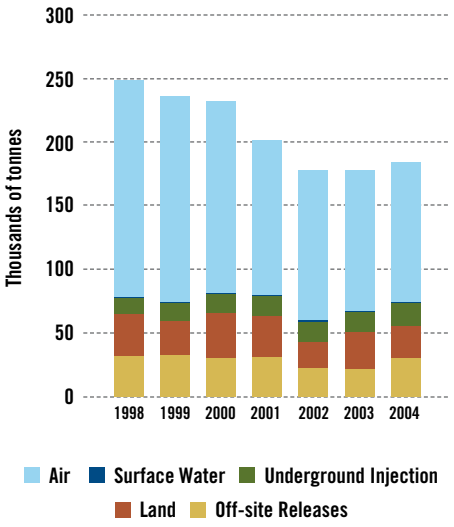
What Is the Environmental Issue?

Industrial production contributes goods, services and jobs, but it is also a major source of pollution and waste. This pollution and waste can be classified into six categories: toxic chemicals, criteria air contaminants, greenhouse gases, hazardous wastes, nonhazardous wastes and radioactive wastes.

Toxic Chemicals

These substances are hazardous to human health and the environment. In 2004 North American industrial facilities generated over 5 million tonnes of toxic chemicals as production-related pollutants and waste (see box). Despite this large amount, data for comparable industries and chemicals in Canada and the United States reveal encouraging trends. Over the period 1998–2004, total releases of carcinogens and developmental/reproductive toxicants declined by 26 percent in the United States and Canada (see graph), compared with a 15 percent reduction in all tracked chemicals. Mexican data are not available for this time period. Although releases to most media for these

Releases of carcinogens and developmental/ reproductive toxicants
(Canadian and US data)



Source: Comission for Environmental Cooperation, *Taking Stock 2004*.

chemicals have declined over time, releases to underground injection have increased. This disposal method, in which fluids are released into subsurface wells, has increased by over 40 percent since 1998 for carcinogens and developmental/reproductive toxicants. Furthermore, even though facilities with the largest reported amounts have made progress in reducing toxic releases and transfers, the more numerous facilities reporting smaller pollution amounts are tending to move in the opposite direction.

Criteria Air Contaminants

These substances, which include nitrogen oxides, sulfur oxides, carbon monoxide, particulate matter and volatile organic compounds, are associated with environmental effects such as smog, acid rain and regional haze, and health effects such as respiratory illness. These pollutants are emitted from a variety of sources, including residential fuel combustion, motor vehicles and agricultural activities. Industrial sources are also major contributors—among them, electric utilities, primary metal smelters and cement kilns. Although emissions of criteria air contaminants are trending downward, reductions from sources such as motor vehicles have been partially offset by increases from certain oil and gas industry subsectors attributed to expanded production.

Greenhouse Gases

These gases, which include carbon dioxide (CO_2), methane and nitrous oxide, are linked to global climate change. Industrial energy use is a major source of CO_2 emissions in North America, roughly on a par with the CO_2 emissions arising from energy use in the agricultural, commercial and residential sectors combined. Although CO_2 emissions from industrial energy use dropped by more than 30 percent from 1980 to 2005, emissions from transportation increased by about 50 percent and those from electricity generation and refineries by nearly 60 percent during the same time period. Total emissions of greenhouse gases in North America amounted to more than 8.5 billion tonnes of CO_2 equivalent in 2005.

Hazardous Wastes

Hazardous wastes are industrial waste streams that may contain more than a single chemical or substance. They are typically defined by characteristics such as ignitability, reactivity, corrosivity and toxicity. Comparable North American data for hazardous waste generation and management are currently lacking, making it difficult to discern trends. Although the United States issues a biennial hazardous waste report, periodic nationwide data are lacking in Canada (except for cross-border shipments) and are at an early stage of development in Mexico.

The amounts of hazardous wastes being generated are significant. In the United States, nearly 34.8 million tonnes of hazardous waste were generated in 2005, mostly in the form of liquid waste. Government estimates put Canada's annual generation at about 6 million tonnes. In Mexico, data from over 35,000 facilities put the annual total at 6.17 million tonnes in 2004. Mexico's total generation of hazardous wastes is not known, but 8 million tonnes a year is frequently cited.

Nonhazardous Wastes

Nonhazardous industrial wastes include coal ash, foundry sands, cement kiln dust, mining and mineral processing wastes, oil and gas production wastes, and other wastes that lack the characteristics of hazardous waste. Although these waste streams are not classified as hazardous, their management is not without risk and generally legal requirements are in place for their proper treatment and disposal. In Canada, disposal of wastes from nonresidential sources (industrial, commercial and institutional) increased from 14.6 to 15.5 million tonnes between 2002 and 2004. In the United States and Mexico, overall estimates of nonhazardous industrial waste are not readily available, although estimates for various individual sources may exist.

North America's Pollutant Release and Transfer Registers

In North America, all three countries track certain industrial pollutants using Pollutant Release and Transfer Registers (PRTRs). PRTRs compile facility-reported annual data on releases of specific substances to air, water and land, as well as disposal and transfers off-site for treatment or recycling. In 2004 over 5 million tonnes of releases and transfers were reported.

Canada's **National Pollutant Release Inventory** (NPRI), established in 1992 based on recommendations of stakeholders from industry and environmental organizations, tracks more than 300 chemicals as well as criteria air contaminants.

Mexico's ***Registro de Emisiones y Transferencia de Contaminantes*** (RETC), which recently became mandatory, covers some 100 chemicals and forms part of the *Cédula de Operación Anual* (annual certificate of operations), which is also used to collect data on hazardous waste generation, energy use and other indices of environmental management.

The **US Toxics Release Inventory** (TRI), begun in 1987, now tracks data from facilities on more than 600 chemicals.

Enhancing the comparability of their PRTRs is a shared priority for the three countries. In June 2002, the CEC Council signed Council Resolution 02-05: Action Plan to Enhance Comparability Among Pollutant Release and Transfer Registers in North America.

Radioactive Wastes

Radioactive wastes are by-products of certain industrial activities, in particular electricity generation. In 2005 nuclear power generation produced 1,697 tonnes of spent fuel (expressed as amounts of heavy metal) in Canada, 21 tonnes in Mexico and 2,396 tonnes in the United States.

Why Is This Issue Important to North America?

Industrial pollution and waste pose potential threats to human and ecological health if not properly managed. The concerns range from toxic effects on fetuses and children to the health implications of low-level exposures to multiple pollutants and the degradation of habitats and ecosystems. These concerns do not stop at the borders, because some pollutants can travel long distances and waste is shipped to recycling and disposal sites across political boundaries.

Health and Environment

The pollution and waste tracked through PRTRs and regulated by environmental laws in North America are those the national governments have identified as raising concerns about human health or the environment. The effects of certain toxic chemicals on the health and development of children and other vulnerable groups are a special concern. Researchers describe "windows of vulnerability" during fetal and child development in which toxic exposures can have particularly devastating effects. Although the traditional focus has been on overt health effects such as cancer, scientists are increasingly worried about the more subtle effects of low-level toxic exposures, such as impairments in endocrine and neurological functions.

Long-range Transport

Industrial pollution and waste are important in the North American context because pollutants travel through the air and water to cross national borders and because wastes are also shipped across borders for recycling, treatment and disposal. The deposition of persistent contaminants in the distant north, in locations far from industrial sources, attests to the ability of pollutants to travel far from their points of origin. The industrial pollution and waste released into rivers or water bodies that span political boundaries, such as the Great Lakes and the New River, which runs from Baja California into California, is also a shared concern, especially the effects of persistent bioaccumulative toxic substances (PBTs).

Waste Management

Decisions on how to manage wastes have environmental implications. Municipal waste incineration, medical waste incineration, burning of hazardous wastes in cement kilns and backyard waste burning were among the top sources of dioxins, according to US and Canadian inventories. Dioxins, like some other PBTs, can be dispersed long distances by air currents and other environmental pathways and tend to settle in colder regions.

The regulatory requirements governing the management of hazardous wastes can influence the waste management decisions of industrial facilities. For example, such regulations may inhibit recycling by facilities because of concerns about higher compliance costs. Jurisdictional differences in regulatory requirements, in addition to differentials in waste management pricing, can also influence decisions about where and how wastes are managed. Whatever the differences, it is true that North American companies ship hundreds of thousands of tonnes of hazardous waste each year between Canada, Mexico and the United States. When wastes are sent to other jurisdictions for recycling, treatment or disposal, the waste shipments must be transported along roads and railways and through populated areas before reaching their final destinations.

Economic Costs

Apart from their potential effects on humans and the environment, wastes represent inefficiency in industrial production. Wastes impose costs on facilities; they must pay for waste management, regulatory compliance and underutilized material inputs. From a societal perspective, the economic costs include paying for cleaning up contaminated sites, regulating waste-generating industries and ensuring medical treatment for the adverse effects of environmental exposures. The nonmonetary costs include the depletion of nonrenewable resources, consumptive land use and degradation of ecosystems.

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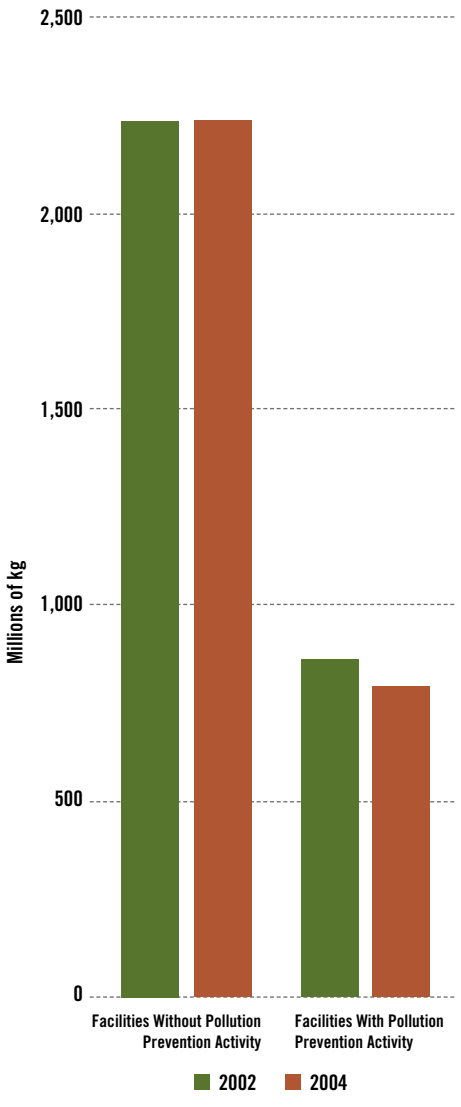
Companies and jurisdictions are increasingly striving to decouple waste generation from economic productivity. PRTR data demonstrate that facilities undertaking pollution prevention activities are able to reduce their wastes faster than those who do not (see graph). The graph also reveals that over three-quarters of waste is generated at facilities that have yet to pursue pollution prevention. Reducing waste does not require reducing economic activity. California has the largest subnational economy in North America, but ranks thirtieth among states and provinces in total releases of toxic chemicals.

Total releases and transfers of PRTR substances for facilities with and without pollution prevention activities (Canadian and US data)



Source: Comission for Environmental Cooperation, *Taking Stock 2004*.

What Are the Linkages to Other North American Environmental Issues?

Land use planning and climate change are just two of the other important environmental issues linked to industrial pollution and waste.

Land Use

Waste poses challenges for local land use planning, ranging from the siting of new treatment, storage and disposal facilities to the question of how to manage "brownfield" sites. In the United States, as of 2008, 1,581 sites (final and deleted) were on the Superfund program's National Priorities List and 3,746 facilities are expected to need cleanup under the Federal Resource Conservation and Recovery Act. Numerous other sites are under local or state jurisdiction, and so the full extent of contaminated land is unknown. In Canada, about one-quarter of the 17,866 contaminated sites under federal responsibility are on native reserves, placing an additional burden on populations already vulnerable to environmental threats because of socioeconomic factors or geography. In Mexico, the federal government has identified 300 contaminated sites covering 200,000 hectares. The location of polluting industries, landfills and other waste management sites also raises questions of environmental justice.

Natural Resource Depletion

Inefficient use of materials and energy affects the use of natural resources. Depletion of natural resources is mediated by the renewability of the inputs used and the degree of recycling undertaken within or among industrial sectors. Recycling and energy recovery of industrial wastes enable the wastes from one process to become the material inputs or energy source for another. More than a million tonnes of materials, mostly metals, were sent for recycling by PRTR-reporting facilities in 2004, and nearly 300,000 tonnes were sent for energy recovery. However, recycling and energy recovery can have their drawbacks. Recycling activities themselves can be sources of environmental contamination, and the air releases and residuals from energy recovery are a concern.

Climate Change

Industrial pollution and waste contribute to climate change as well. The anaerobic decomposition of wastes in landfills produces methane, a potent greenhouse gas, and waste incineration releases carbon dioxide. The transportation of wastes to recycling, treatment and disposal sites produces transportation-related carbon emissions. Finally, the materials disposed of as waste must be replaced by more raw materials, which implies further consumption of fossil fuels and additional carbon releases.