This report presents the latest environmental performance information for 12 sectors. Because every sector is unique, sector chapters provide maps, economic information, and detailed explanations, analysis, and discussions of the data presented.

To provide context for the report, this Executive Summary begins by presenting the impacts of all 12 sectors using several national and global indicators.[1]

Comparing data across sectors can illuminate broader trends and opportunities. This Executive Summary includes sector-specific data gathered side-by-side for the 9 sectors with the most environmental data.

The data discussed in this report are drawn from multiple public and private sources. See the Data Guide *and the* Data Sources, Methodologies, and Considerations *chapter for important information and qualifications about how data are generated, synthesized, and presented.*

EXECUTIVE SUMMARY

Economic Overview

Number of Facilities	856,836
Employment	12.6 million – more than 10% of U.S. workers
Economic Productivity	
Value of Shipments & Construction Put in Place	$3.2 trillion – with Revenue, below, 28% of Gross Domestic Product
Revenue	
Colleges & Universities	$341 billion
Ports	$5.5 billion

Latest Environmental Statistics

Energy Use	14.5 quadrillion Btu
Emissions of Criteria Air Pollutants	5.8 million tons
Air Emissions (TRI)	519.5 million pounds
Water Discharges (TRI)	178.2 million pounds
Land Disposals (TRI)	658.1 million pounds
Recycling, Energy Recovery, or Treatment (TRI)	14.8 billion pounds
Hazardous Waste Generated	30.6 million tons

Global Standing: Examples

Cement Manufacturing	U.S. is third, behind China and India
Chemical Manufacturing	U.S. is world's largest producer, generating more than $635 billion a year
Construction	U.S. is first, with spending of $873.1 billion in 2003 – out of $3.98 trillion spent by the 55 largest nations
Food & Beverage Manufacturing	U.S. is second, behind the European Union, and followed by Japan and China
Forest Products	U.S. is world's largest producer and consumer
Iron & Steel	U.S. is third behind China, which makes nearly four times more, and Japan

General Comparisons

Mostly Small Businesses	Construction, Metal Casting, Shipbuilding & Ship Repair
Most Widespread	Construction, Colleges & Universities, Food & Beverage Manufacturing
Most Concentrated	Iron & Steel, Ports, Shipbuilding & Ship Repair
Include Government Facilities	Colleges & Universities, Ports, Shipbuilding & Ship Repair

Economic Trends 1996-2005

Facilities	Three sectors ended the period having added facilities, led by Construction. At least half of the sectors ended with fewer facilities.
Employees	The 12 sectors were split in terms of whether they added or lost employees.
Value of Shipments, Value of Construction Put in Place, or Revenue	At least 9 sectors showed increases that were, in many cases, significant.

Energy Use

The eight sectors for which we have calculations used an estimated 14.5 quadrillion British Thermal Units (Btu) in 2002, which was nearly 15% of total domestic energy consumption of 97.9 quadrillion Btu.[2] World energy consumption in 2002 was 409.7 quadrillion Btu. The U.S. consumed more energy than any other country, followed by China, Russia, and Japan, although long-term trends appear likely to change the rankings.[3] From 1996 to 2005, the U.S. industrial sector gradually consumed less energy, while residential, commercial, and especially transportation energy consumption rose.[4] See individual sector chapters for discussions of energy use, trends, and opportunities.[5]

Energy Use and Air Emissions

Energy use causes impacts such as direct air emissions, which are reflected in this report. Other impacts, such as offsite (indirect) emissions, are generally beyond the scope of this report, as are energy-related mobile source emissions, such as from freight shipping.

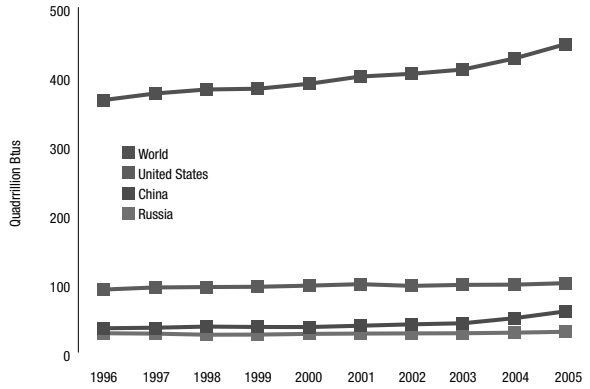
Primary among on-site energy use-related air emissions are criteria air pollutants (CAPs) from combustion. The largest components of such CAP emissions are sulfur dioxide (SO_2), nitrogen oxides (NO_X), and larger particulates from coal combustion. Most SO_2 results from combusting sulfur-containing fuels, especially coal. Combustion also generates NO_X, although emissions vary less by fuel type than for SO_2. Particulate matter (PM) can be ash and dust from combustion of coal or heavy oil, or very fine particulates ($PM_{2.5}$) largely composed of aerosols formed by NO_X and SO_2 emissions.

Excepting emissions from off-road vehicles, volatile organic compound (VOC) and carbon monoxide (CO) combustion emissions are a much smaller fraction of total energy-related emissions. CO is a product of incomplete combustion, but the largest source is vehicles. VOCs can also result from incomplete combustion, but the largest energy-related sources are fugitive emissions from fuel storage tanks and pipelines and combustion-related vehicle emissions. Fossil fuel combustion also generates carbon dioxide (CO_2), which is a greenhouse gas (GHG). Other energy-related GHG emissions, such as methane (CH_4), are far less substantial.

Greenhouse Gases

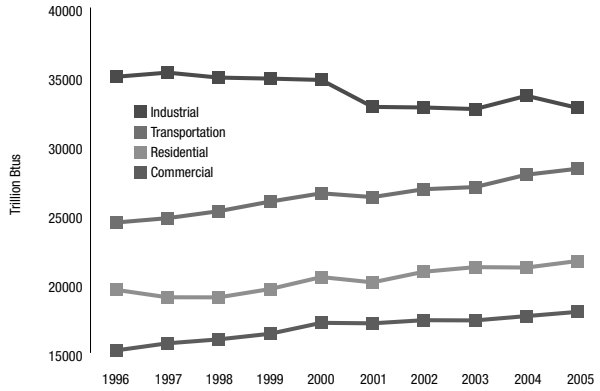
A sector's GHG footprint includes direct and indirect emission sources. Direct emission sources are those for which there is direct control, such as fossil fuel combustion and process emissions. Indirect emission sources are mainly those attributed to the generation of purchased electricity. Both EPA and the U.S. Department of Energy (DOE) estimate economy-wide GHG emissions, but neither provides sector-specific footprints that include direct and indirect emissions; data to generate such estimates are not readily available.

Top World Energy Consumption 1996–2005



Source: U.S. Department of Energy

U.S. Energy Consumption 1996–2005

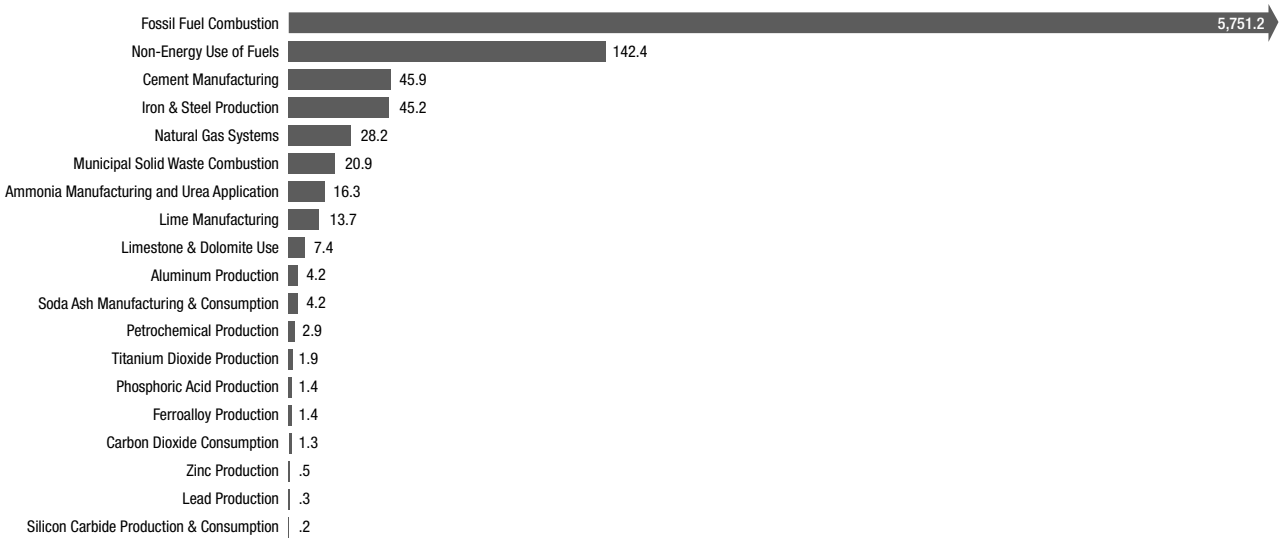


Source: U.S. Department of Energy

In 2005, total U.S. GHG emissions were 7,260 million metric tons of CO_2 equivalent, having risen 8.5% since 1996.[6] Including emissions from generation of purchased electricity, industry and transportation each accounted for 28% of total U.S. GHG emissions in 2005. In all sectors except agriculture, CO_2 accounted for more than 80% of GHG emissions, primarily from the combustion of fossil fuels.[7]

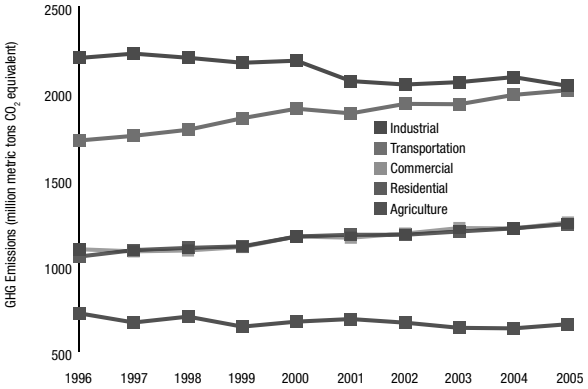
Although some gases have a higher global warming potential (GWP) per unit than CO_2, CO_2 is by far the dominant GHG emitted in terms of volume and total GWP emitted each year. EPA reports on CO_2 emissions from fossil fuel combustion for broad sectors of the U.S. economy. For CO_2 emissions other than fossil fuel use, EPA reports on particular sources, such as industrial processes in the Cement Manufacturing and Iron & Steel sectors.[8]

U.S. CO_2 Sources in Million Metric Tons of CO_2 Equivalent 2005



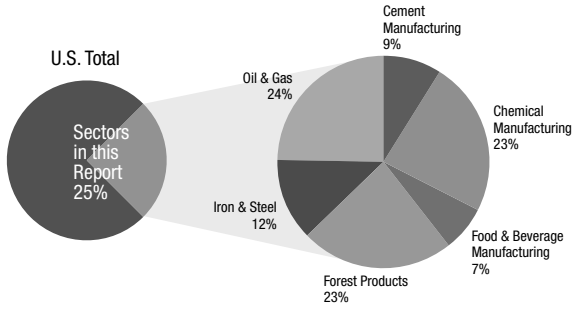
Source: U.S. Environmental Protection Agency

U.S. GHG Emissions 1996–2005
with Electricity-Related Emissions Distributed



Source: U.S. Environmental Protection Agency

Criteria Air Pollutant and VOC Emissions 2002



Note: Sectors at 1% or less are not represented.
Source: U.S. Environmental Protection Agency

Direct CO_2 and CH_4 combined process emissions from the Iron & Steel sector fell 33% from 1996 to 2005, although total steel produced was relatively unchanged.[9] Direct CO_2 process emissions from Cement Manufacturing in the same time period rose 24%, while the sector's cement production also rose 24%.[10] Trade associations for these two sectors, as well as for the Forest Products sector, estimate their members' total GHG footprint, including carbon "sinks" such as forests and products. See the respective chapters.

Criteria Air Pollutants and VOCs

Sectors in this report, which emit CAPs and VOCs from energy use and from other processes and activities, emitted 25% of total U.S. point source CAP and VOC emissions in 2002.[11] Sector-specific trend data are not available for CAP and VOC emissions.[12]

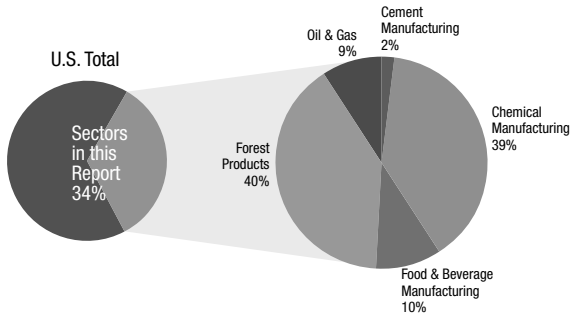
Sector Data Side by Side

The following sections present sector data for several sectors together. Because the sectors vary so substantially in size, scope, makeup, data availability, relevant drivers and barriers, and numerous other factors, a direct-one-on-one comparison of their performance would be inappropriate. To consider energy-related air emissions, for example, a sound analysis should also include sector-specific information on fuel flexibility, which is driven by percentages of fuel used for energy or for raw materials and other considerations.

TRI Air Emissions

In 2005, the 9 of our 12 sectors that report to EPA's Toxics Release Inventory (TRI) reported emitting 520 million lbs. of TRI chemicals, out of 1.5 billion lbs. emitted by all TRI reporters nationwide. Of the nine sectors, absolute total air emissions fell from 1996-2005 for all but one, while absolute emissions of hazardous air pollutants (HAPs) fell for all nine. To understand the sector-specific data, including apparent spikes, dips, and other trends, see individual sector chapters.

TRI Air Emissions 2005



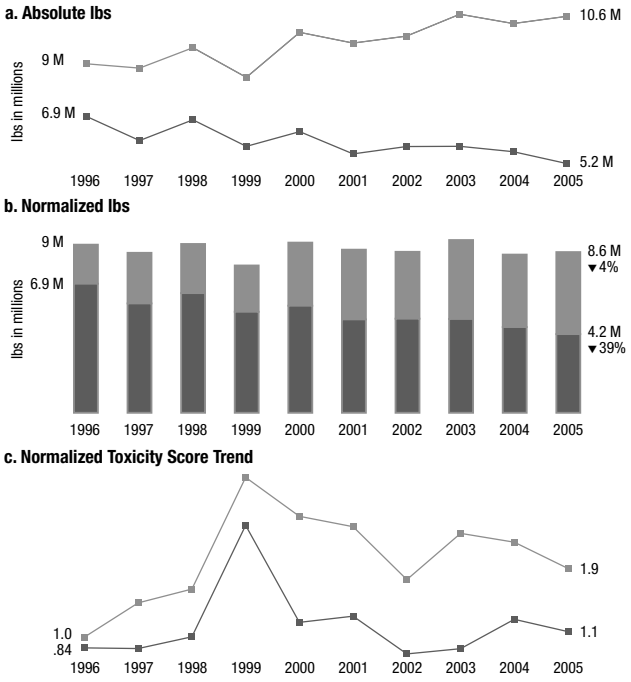
Source: U.S. Environmental Protection Agency

RSEI

To consider toxicity, EPA's Risk-Screening Environmental Indicators (RSEI) model assigns TRI chemicals a relative toxicity weight, then multiplies the pounds of media-specific releases (e.g., lbs. of mercury released to air) by it to calculate a relative Toxicity Score. RSEI methodological considerations are discussed in detail in the Data Guide, which explains the underlying assumptions and important limitations of RSEI. Data are not reported to TRI in sufficient detail to distinguish which forms of certain chemicals within a chemical category are released. For chemical categories such as chromium, RSEI conservatively assumes that chemicals are emitted in the form with the highest toxicity weight (e.g., hexavalent chromium). Thus, Toxicity Scores are overestimated for some chemical categories. Summing the Toxicity Scores for all of a sector's air emissions reveals a Normalized Toxicity Score Trend; these fell from 1996-2005 for most sectors, but rose for several. To better understand apparent spikes and trends, see individual sector chapters. The figures below show TRI air emission trends by corresponding bar and data points for each year between 1996 and 2005.

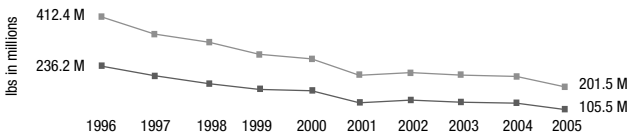
TRI Air Emissions Across Sectors 1996–2005

CEMENT MANUFACTURING

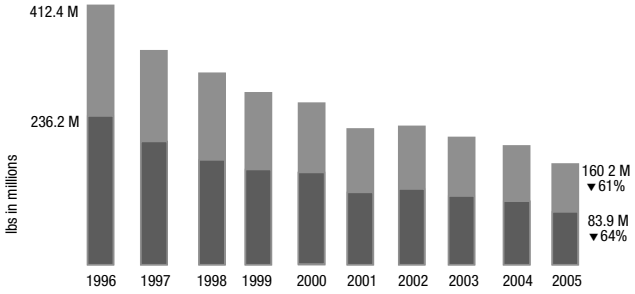


CHEMICAL MANUFACTURING

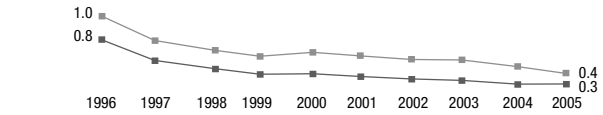
a Absolute lbs



b. Normalized lbs

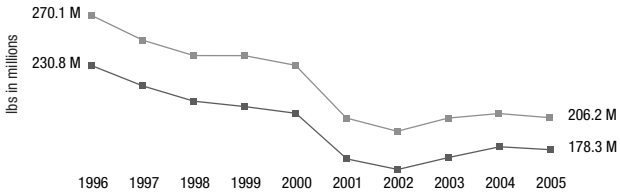


c. Normalized Toxicity Score Trend

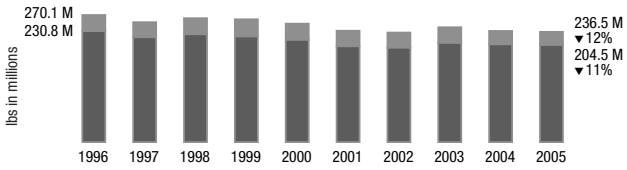


FOREST PRODUCTS

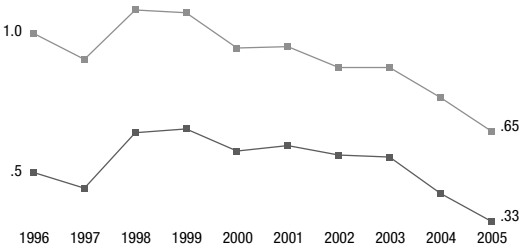
a Absolute lbs



b. Normalized lbs

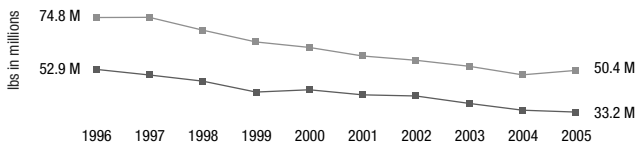


c. Normalized Toxicity Score Trend

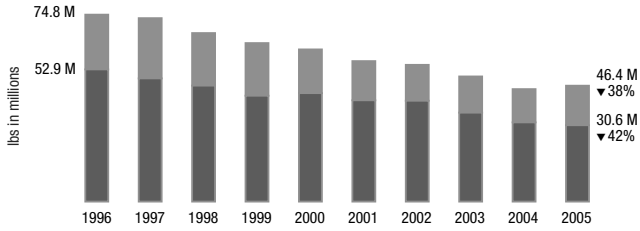


FOOD & BEVERAGE

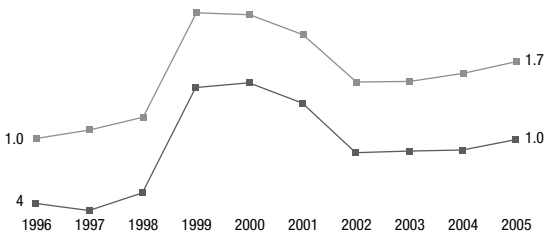
a Ab o ute lbs



b. Normalized lbs

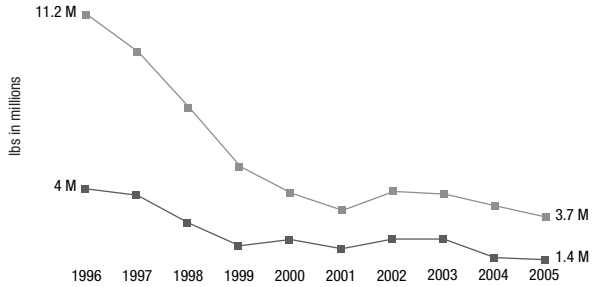


c. Normalized Toxicity Score Trend

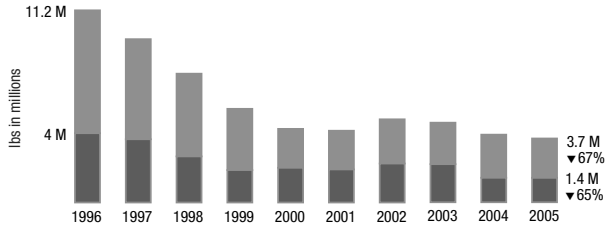


IRON & STEEL

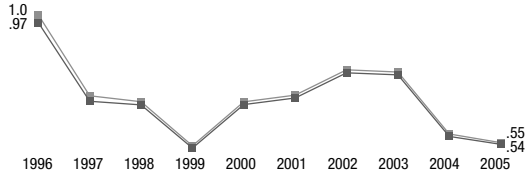
a. Absolute lbs



b. Normalized lbs



c. Normalized Toxicity Score Trend



FOR SECTOR-SPECIFIC AIR CHARTS

All TRI Chemicals, including HAPs All TRI HAPs

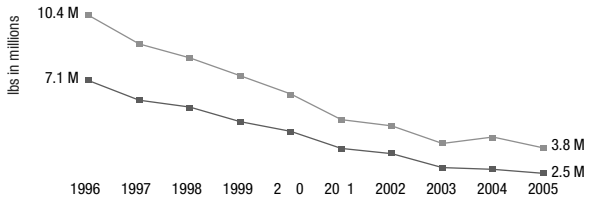
Note: Normalized by annual value of shipments or production.

Sources: U.S. Environmental Protection Agency, U.S. Geological Survey, U.S. Department of Commerce, American Foundry Society, U.S. Department of Energy

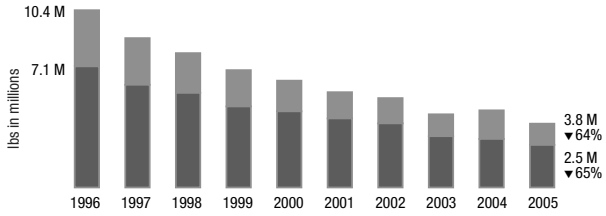
TRI Air Emissions Across Sectors 1996–2005 (continued)

METAL CASTING

a. Absolute lbs



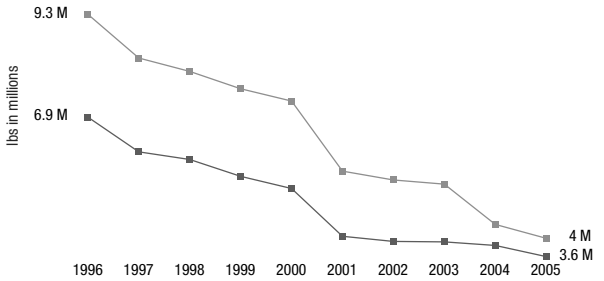
b. Normalized lbs



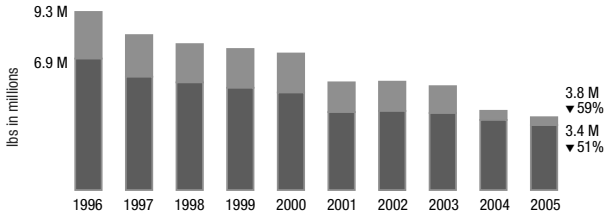
c Normalized Toxicity Score Trend

PAINT & COATINGS

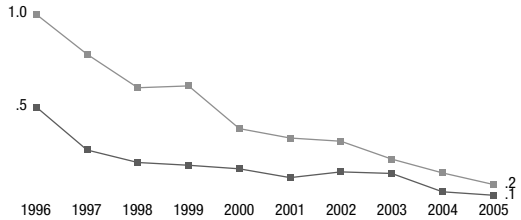
a. Absolute lbs



b. Normalized lbs

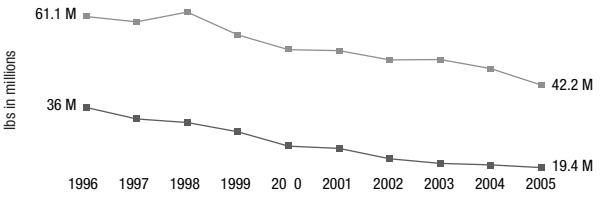


c. Normalized Toxicity Score Trend

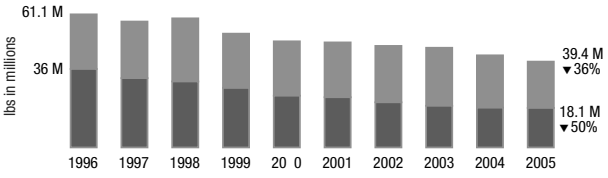


OIL & GAS (PETROLEUM REFINING)

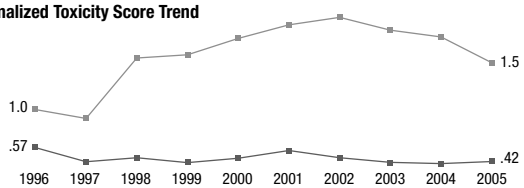
a. Absolute lbs



b. Normalized lbs

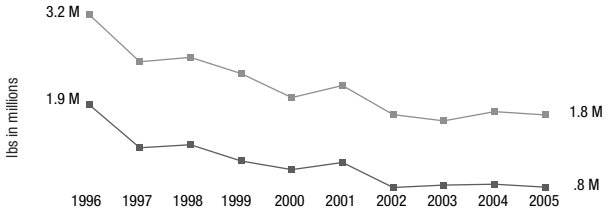


c. Normalized Toxicity Score Trend

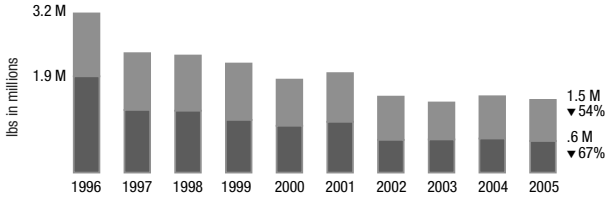


SHIPBUILDING & SHIP REPAIR

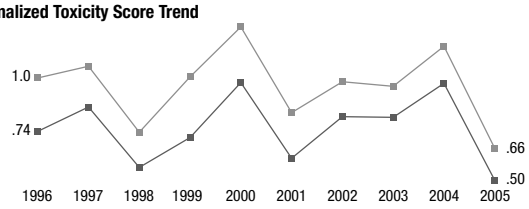
a. Absolute lbs



b. Normalized lbs



c. Normalized Toxicity Score Trend



Waste Management

This section includes information on hazardous wastes and on TRI chemicals managed as waste.[13] EPA emphasizes reducing waste generation whenever possible and, if waste is generated, minimizing the quantity that is released or disposed by instead increasing recycling, energy recovery, or treatment. TRI includes the volume of the toxic chemicals within a waste stream, while Resource Conservation and Recovery Act (RCRA) reporting on hazardous wastes encompasses the volume of the entire waste or waste stream that meets the definition of RCRA hazardous waste. See individual sector chapters for explanations of apparent spikes and trends.

Hazardous Waste Generated and Managed 2005

	Hazardous Waste Generated (Tons)	Hazardous Waste Managed (Tons)
Sectors in this Report	30,557,598	32,993,131
U.S. Total	38,350,145	42,825,913
Sectors in this Report as a Percentage of the U.S. Total	**80%**	**77%**
Sector		
Cement Manufacturing	17,195	30,641
Chemical Manufacturing	23,861,975	26,138,338
Colleges & Universities	26,158	23,544
Construction	17,058	16,437
Food & Beverage Manufacturing	3,071	2,367
Forest Products	135,541	396,336
Iron & Steel	1,395,650	1,269,594
Metal Casting	30,274	28,210
Oil & Gas (Petroleum Refining)	5,063,461	5,081,593
Paint & Coatings	145,832	147,595
Shipbuilding & Ship Repair	7,214	6,071

Source: U.S. Environmental Protection Agency

Filling in the Picture

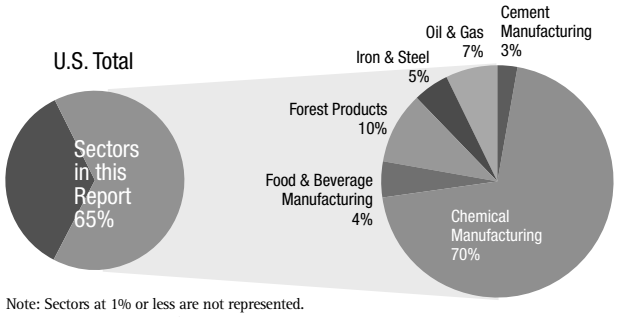
For waste and other indicators, we use available data to understand and improve sectors' environmental performance. Where data are incomplete, inadequate, or unavailable, we try to fill the gaps to provide a more complete picture. We determine what needs to be measured, what is already measured, and how to find—or create appropriate surrogates for—remaining needed information. See, for example, the discussion of GHG emissions in the Construction chapter, which draws upon DOE fuel sales data.

States also may provide useful information. See information from several states about recycling construction and demolition debris, in the Construction chapter.

When government data are unavailable, information from private organizations may be useful, such as the American Association of Port Authorities' survey cited in the Ports chapter.

When no data are available, we sometimes assist in preparing tools for generating future data. As discussed in the Shipbuilding & Ship Repair chapter, we are working with the American Shipbuilding Association and the Shipbuilders Council of America to develop a tool for individual facilities to measure their GHG emissions, which could enable those groups to provide better data on the sector's overall GHG emissions in the future.

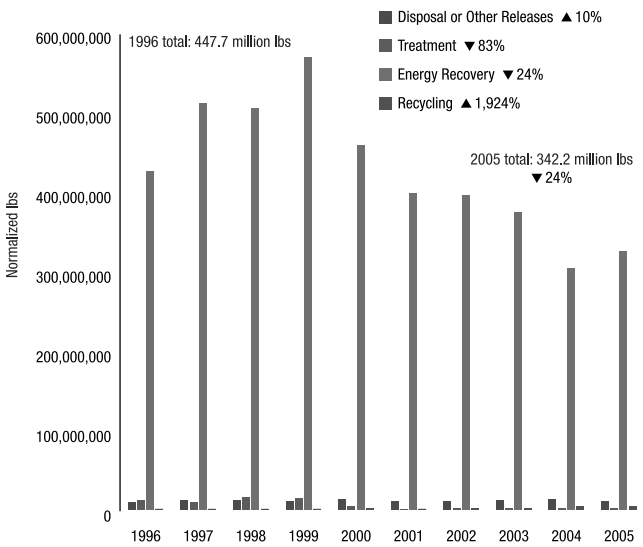
TRI Waste Management 2005



Note: Sectors at 1% or less are not represented.
Source: U.S. Environmental Protection Agency

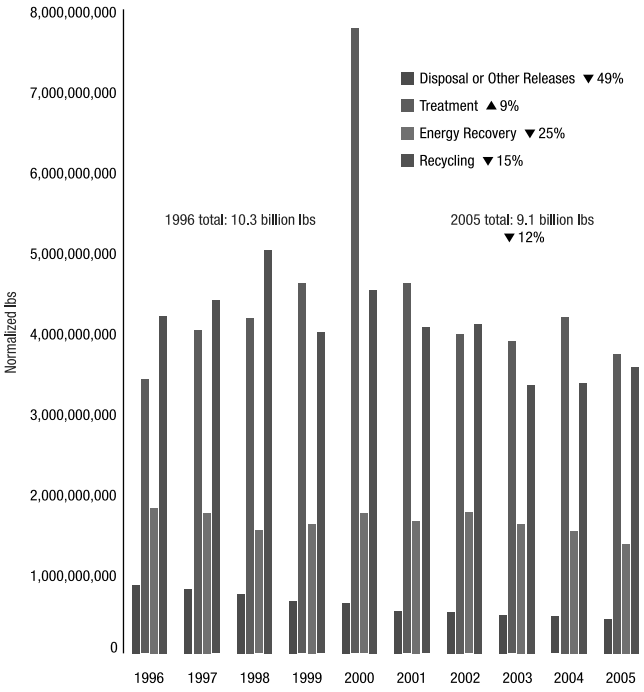
TRI Waste Management Across Sectors 1996-2005

CEMENT MANUFACTURING

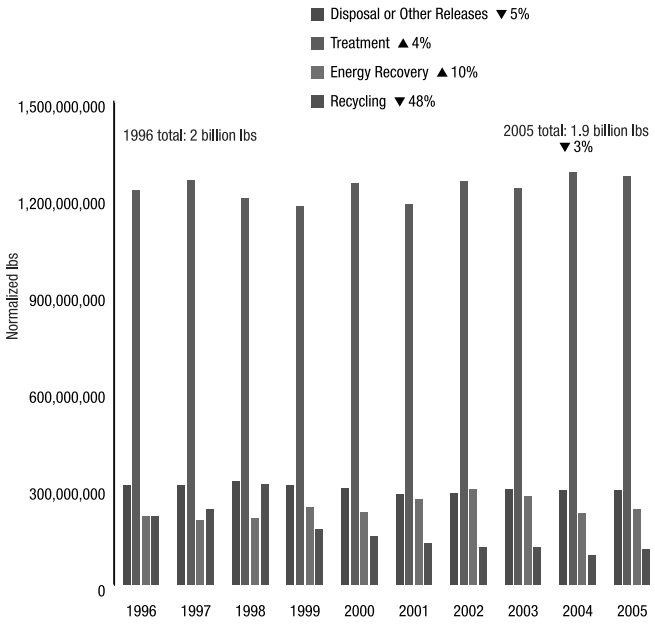


TRI Waste Management Across Sectors 1996-2005 (continued)

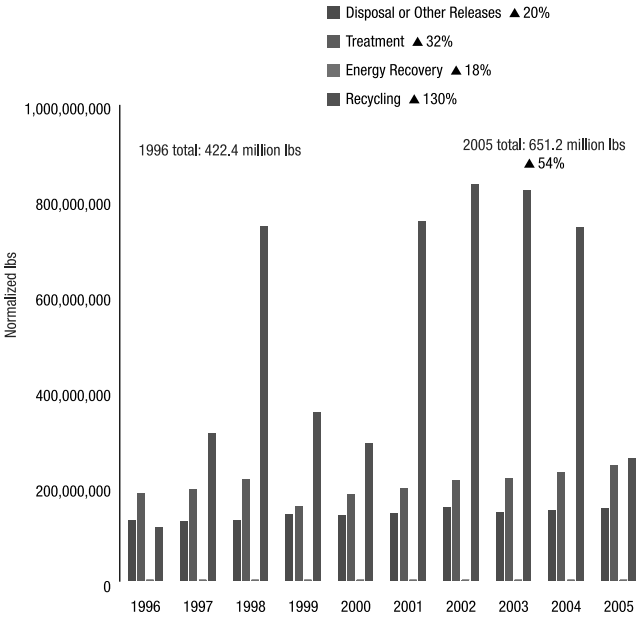
CHEMICAL MANUFACTURING



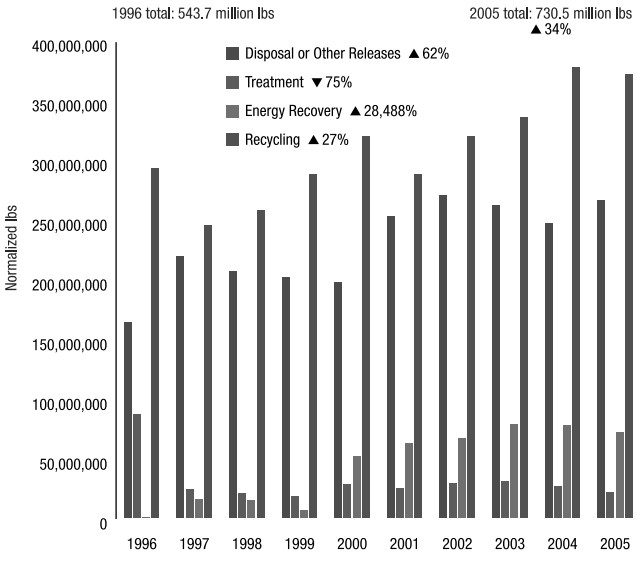
FOREST PRODUCTS



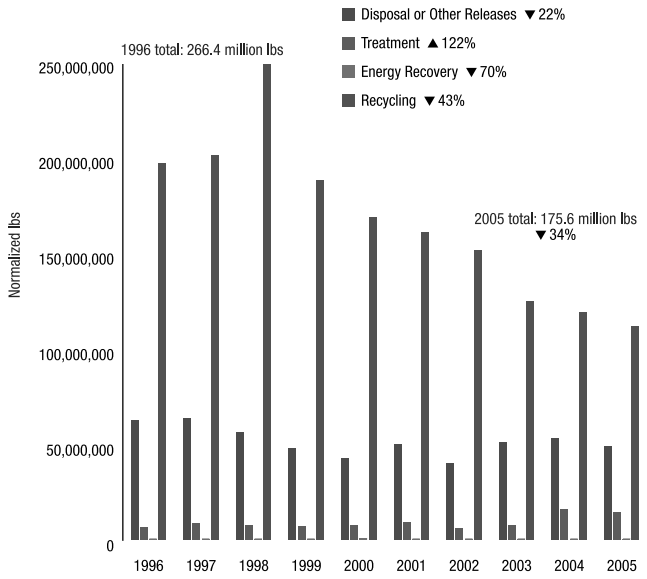
FOOD & BEVERAGE



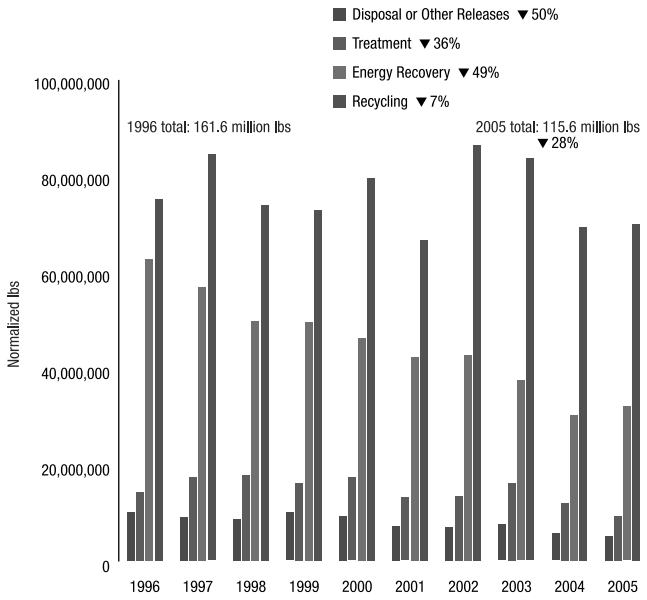
IRON & STEEL



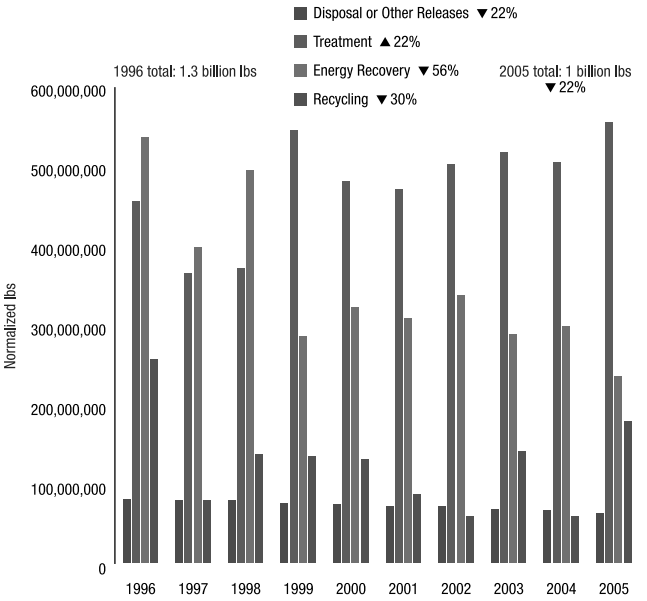
METAL CASTING



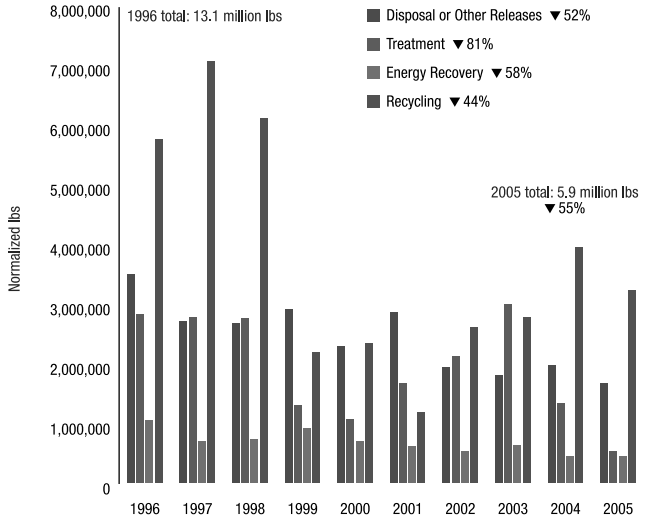
PAINT & COATINGS



OIL & GAS (PETROLEUM REFINING)



SHIPBUILDING & REPAIR



FOR SECTOR-SPECIFIC WASTE MANAGEMENT CHARTS

Notes:

1. Normalized by annual value of shipments or production. Oil & gas lbs. normalized by annual crude oil input into refineries.
2. Disposal and Other Releases includes air emissions, water discharges, and land disposals.
3. The apparent spike in treatment for Chemical Manufacturing in 2000 was due to the report filed by a single facility.

Sources: U.S. Environmental Protection Agency, U.S. Department of Commerce, U.S. Geological Survey, American Foundry Society, and U.S. Department of Energy