Paint & Coatings

PROFILE The paint and coatings sector[4] manufactures a variety of products that preserve, protect, and beautify the objects to which they are applied. There are four main types of paint and coatings products:

- Architectural coatings used in homes and buildings, such as interior and exterior paints, primers, sealers, and varnishes;
- Industrial coatings that are factory-applied to manufactured goods as part of the production process;
- Special purpose coatings, such as aerosol paints, marine paints, high-performance maintenance coatings, and automotive refinish paints; and
- Allied paint products, including putties, paint and varnish removers, paint thinners, pigment dispersions, and paint brush cleaners.

Sector At-a-Glance

Number of Facilities:	1,371[1]
Value of Shipments:	$20.3 billion[2]
Number of Employees:	47,279[3]

TRENDS The paint and coatings manufacturing industry has been going through a period of consolidation, marked by a large number of mergers, acquisitions, and spin-offs during the last decade. Although hundreds of small- and medium-sized private firms continue to operate on local and regional levels, consolidation will likely continue due to shifting market dynamics.[5]

- In 2003, 53% of the gallons of paint and allied products sold were architectural coatings, 27% were industrial coatings, 10% were special purpose coatings and 10% were allied products.[6]
- Shipments of architectural coatings increased nearly 7% from 2002 to 2003, while shipments of special purpose coatings increased 4% and shipments of industrial coatings and allied products remained essentially flat.[7]
- Industry analysts forecast that the U.S. paint and coatings market will grow nearly 15% from 2004 to 2008, with the architectural segment of the sector continuing to comprise the largest share of the market.[8]

KEY ENVIRONMENTAL OPPORTUNITIES

This report focuses primarily on the environmental footprint of the paint and coatings manufacturing process. Data on the impacts of paint application and the disposal of post-consumer paint also are provided where possible.

For the paint and coatings manufacturing sector, the greatest opportunities for environmental improvements are in managing and minimizing toxics and waste, reducing air emissions, and promoting product stewardship.

Managing and Minimizing Toxics

Paint and coatings manufacturing facilities use a variety of chemicals and report on the release and management of many of those materials through EPA's Toxics Release Inventory (TRI).

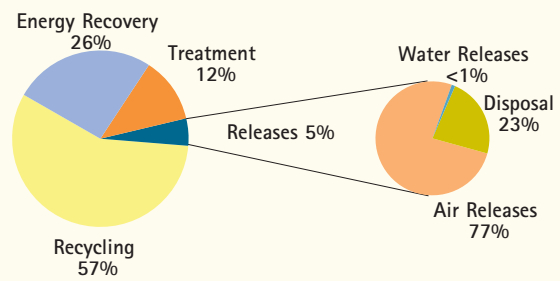
In 2003, 481 facilities in the sector reported 130 million pounds of chemicals released (including disposal) or otherwise managed through treatment, energy recovery, or recycling. Of this quantity, 95% was managed, while the remaining 5% was disposed or released to the environment, as shown in the *TRI Waste Management* pie chart. Of those chemicals disposed or released to the environment, 23% were disposed and 77% were released into air or water.

As shown in the *Total TRI Disposal or Other Releases* line graph, the annual normalized quantity of chemicals disposed or released to the environment by the paint and coatings manufacturing sector decreased by 42% between 1994 and 2003, with almost half of this decline occurring between 2000 and 2003. Over the same 10-year period, the sector's normalized releases to air and water declined by 52%, with one-third of this decline occurring between 2000 and 2003.

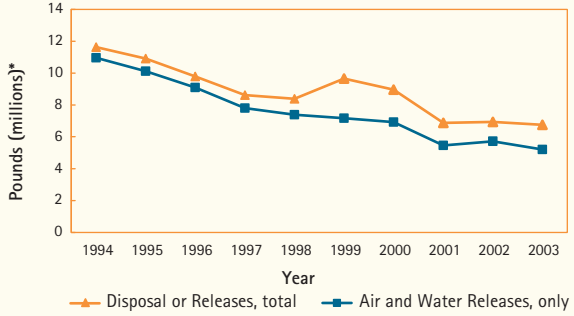
In 2003, the total pounds of chemicals disposed or released by the sector were dominated by organics. For example, xylene, toluene, methyl ethyl ketone, certain glycol ethers, and ethylene glycol accounted for 57% of the total releases and disposal for the sector.[9]

Data from TRI allow comparisons of the total quantities of a sector's reported chemical releases across years, as presented below. However, this comparison does not take into account the relative toxicity of each chemical. Chemicals vary greatly in toxicity, meaning they differ in how harmful they can be to human health. To account for differences in toxicities, each chemical can be weighted by a relative toxicity weight using EPA's Risk-Screening Environmental Indicators (RSEI) model.

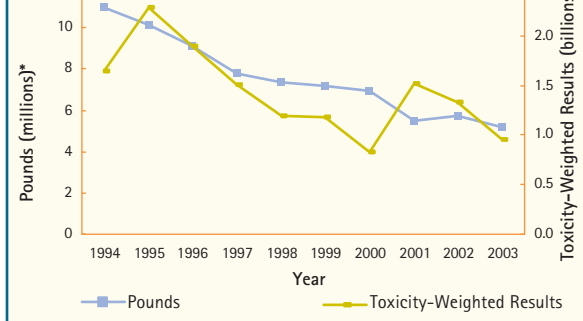
The *TRI Air and Water Releases* line graph presents trends for the sector's air and water releases in both reported pounds and toxicity-weighted results. When weighted for toxicity, the sector's normalized air and water releases show a 42% decline from 1994 to 2003, despite a marked increase in 2001 that is explained on the next page.



Source: U.S. EPA, 2003.



* Normalized by annual value of shipments.
Sources: U.S. EPA, U.S. Census Bureau.



* Normalized by annual value of shipments.
Sources: U.S. EPA, U.S. Census Bureau.

The table below presents a list of the chemicals released that accounted for 90% of the sector's total toxicity-weighted releases to air and water in 2003. More than 99% of the sector's toxicity-weighted results were attributable to air releases, while discharges to water accounted for less than 1%. Therefore, reducing air emissions of these chemicals represents the greatest opportunity for the sector to make progress in reducing the toxicity of its releases.

Top TRI Chemicals Based on Toxicity-Weighted Results

AIR RELEASES (99%)	WATER RELEASES (<1%)
Diisocyanates	Antimony
Chromium	Copper
1,2,4-Trimethylbenzene	Lead
Cobalt	Chromium
Certain Glycol Ethers	
Xylene	
Toluene Diisocyanate	
Nickel	

Source: U.S. EPA, 2003

In 2003, toxicity-weighted air releases were dominated by diisocyanates and chromium, accounting for 74% of the sector's total toxicity-weighted releases to air. From 2000 to 2003, normalized diisocyanate releases to air fluctuated considerably, including a marked increase in 2001, followed by declines in 2002 and 2003. The increase in 2001 resulted from the first-time reporting of diisocyanates by three individual facilities. Due to the high toxicity weight assigned to diisocyanates by the RSEI model, the increase reported by the three facilities in 2001 was sufficient to create a spike in the sector's overall toxicity-weighted results, as reflected in the *TRI Air and Water Releases* line graph. Normalized chromium releases to air remained fairly steady from 2000 to 2003.

EPA's RSEI model conservatively assumes that chemicals are released in the form associated with the highest toxicity weight. With respect to chromium releases to air and water, therefore, the model assumes that 100% of these emissions are hexavalent chromium (the most toxic form, with significantly higher toxicity weights than trivalent chromium).[10] Research indicates that the hexavalent form of chromium does not constitute a majority of total chromium releases from paint and coatings manufacturing operations.[11] Thus, RSEI analyses overestimate the relative harmfulness of chromium releases from the sector.

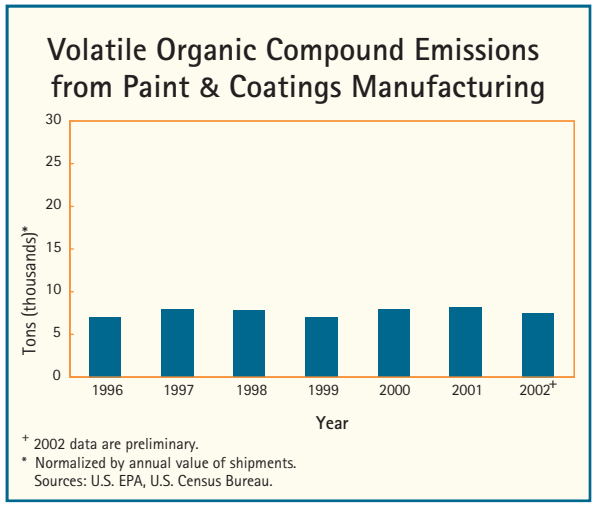
Reducing Air Emissions Organic solvents are used in the production of oil-based paint and coatings due to their ability to dissolve and disperse other coating constituents. They also are used in smaller quantities in the production of water-based paint and coatings, as well as in other aspects of the manufacturing process. As organic solvents evaporate, they release emissions of volatile organic compounds (VOCs) and air toxics. These releases occur inside production facilities as well as when paint and coatings products are ultimately applied to building structures, consumer products, and other surfaces. Although emissions of VOCs and air toxics during the manufacturing process are largely captured in the TRI air releases discussed above, this section takes a closer look at these chemical categories.

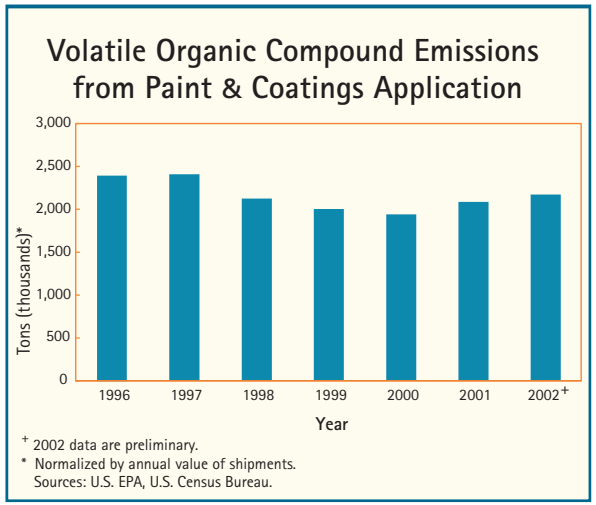
EPA's National Emissions Inventory estimates that, in 2002, paint and coatings manufacturers released 7,000 tons of VOCs. During the same year, VOC emissions resulting from the use of paint and coatings products were estimated at 2 million tons. As shown in the *Volatile Organic Compound Emissions* bar charts, between 1996 and 2002, the normalized quantity of VOC emissions resulting from the manufacture of paint and coatings products remained relatively stable, while the normalized quantity of VOC emissions resulting from the use of paint and coatings products declined by 9%.[12] Air toxics, also called hazardous air pollutants (HAPs), are a subset of the TRI chemicals presented in the previous section. The Clean Air Act designates 188 chemicals (182 of which are included in TRI) that can cause serious health and environmental effects as air toxics.

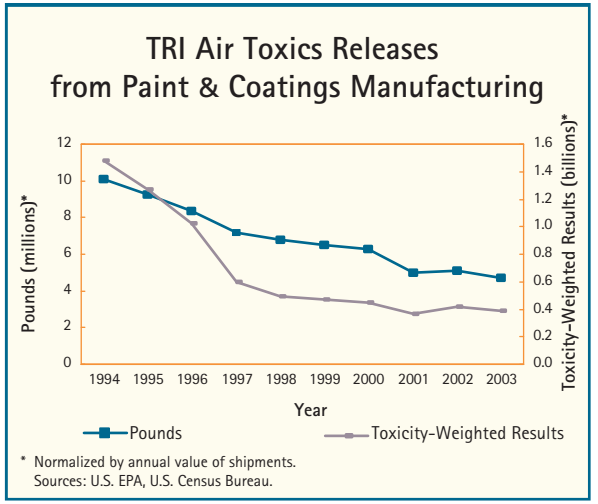
In 2003, 420 facilities in the paint and coatings manufacturing sector reported air toxics releases of 4.7 million pounds. As shown in the *TRI Air Toxics Releases* line graph, normalized air toxics releases resulting from the manufacture of paint and coatings decreased by more than half (53%) between 1994 and 2003, with more than one-quarter of this reduction occurring between 2000 and 2003.[13] Toxicity-weighted results for air toxics releases declined by 73% over the 10-year period.[14]

A downward trend in VOC and air toxics emissions is likely to continue because of new regulatory requirements, improved industrial housekeeping, and technological advances related to solventless and low-VOC/HAP coatings products, as well as improvements in the manufacturing process and changing consumer preferences. These factors already have contributed to the following developments:

- From 1994 to 2003, environmentally preferable water-based paint increased from 76% to 82% of architectural coatings sales, further eroding the market share of oil-based paint.[15]
- Markets for industrial and special purpose coatings also have undergone transformation as customers have demanded, and manufacturers have introduced, more environmentally benign coatings products, including a wide variety of water-based, high-solids, powder, and radiation-cured coatings.







Managing and Minimizing Hazardous Waste

EPA hazardous waste data on large quantity generators, as reported in the *National Biennial RCRA Hazardous Waste Report*, indicate that the paint and coatings manufacturing sector accounted for less than 1% of the hazardous waste generated nationally in 2003.

In 2003, 351 paint and coatings manufacturing facilities reported 120,900 tons of hazardous waste generated. Approximately 60% of this waste was generated from cleaning out process equipment and from product and byproduct processing. The waste management methods most utilized by this sector were fuel blending, solvents recovery, and onsite energy recovery.

When reporting hazardous wastes to EPA, quantities can be reported as a single waste code (e.g., lead) or as a commingled waste composed of multiple types of wastes. Quantities of a specific waste within the commingled waste are not reported. The paint and coatings manufacturing sector reported 32% of its wastes as individual waste codes. Of the individually reported wastes, the predominant hazardous waste types reported by the sector in 2003 were ignitable and corrosive wastes and specific spent non-halogenated solvents.[16]

The following two case studies illustrate some of the pollution prevention initiatives underway across the sector to minimize waste generation, promote recycling, and reduce VOC emissions.

Case Study: Collaborative Waste Minimization and Recycling Initiative *The National Paint and Coatings Association (NPCA) and EPA recently completed the first phase in a joint initiative to analyze the sector's hazardous waste flows and waste management practices. The goal of this initiative is to identify opportunities for increased waste minimization and recycling.*

Through a review of data from EPA's National Biennial RCRA Hazardous Waste Report and discussions with NPCA and industry experts, two types of hazardous waste were found to warrant special attention based on the quantity of the wastes generated and their ability to be recycled or reworked into new product: (1) spent wash solvents used to clean out process equipment and (2) rejected, out-of-date, or off-specification products. For the second phase of the initiative, NPCA and EPA will determine the factors that preclude or limit the recycling or reclamation of these wastes, including technical constraints, financial considerations, operational concerns, and regulatory restrictions.[17]

Case Study: New Eco-Efficient Products from BASF *The market for automotive refinish coatings in North America exceeds $2 billion annually for both collision repairs and commercial vehicle applications. More than 50,000 body shops in North America use these products. For more than a decade, automotive refinishers and coatings manufacturers have faced increasing regulation of emissions of VOCs. As regulatory thresholds for VOC emissions have been lowered, manufacturers have reformulated their reactive coatings to meet lower emissions standards and the demand for faster film setting without compromising quality.*

Through research and development, BASF invented a new primer system that performs better than the current conventional urethane technologies. The new system cures 10 times faster, requires fewer preparation steps, has a lower application rate, is more durable, controls corrosion better, and has an unlimited shelf life. BASF's primer contains only 1.7 pounds of VOCs per gallon, in contrast to 3.5 to 4.8 pounds of VOCs per gallon of conventional primers – a reduction of more than 50%, even before accounting for the fact that less coating is required. Moreover, the one-component nature of the product reduces hazardous waste and cleaning of equipment, which typically requires solvents. Applications in repair facilities over the past year have shown that only one-third as much primer is needed, with waste reduced from 20% to nearly zero.[18]

Promoting Product Stewardship

Product stewardship in the paint and coatings sector comprises a range of practices, including developing cleaner products, recycling leftover paint, and taking adequate measures to inform consumers about the past use of lead-based paint.

Leftover paint is a top concern for product stewardship efforts because of its high volume in the household hazardous waste stream, high waste management costs, and the potential for increased reduction, recovery, reuse, and recycling. Of all household hazardous wastes, paint represents the largest cost for local governments to collect and manage.[19] In a draft report, EPA estimates that 9% to 22% of paint sold could become leftover paint.[20]

NPCA and its members are actively participating in the National Post-Consumer Paint Management Dialogue, a collaborative multi-stakeholder effort to reduce the environmental impacts and cost of managing leftover latex and oil-based paint.[21] The primary goal of this Paint Product Stewardship Initiative is to develop an agreement that will result in reduced paint waste; the efficient collection, reuse, and recycling of leftover paint; increased markets for products made from leftover paint; and a sustainable financing system to cover any resulting end-of-life management costs for past and future products.[22] NPCA is contributing to the initiative's joint research agenda by funding projects targeting (1) consumer education, (2) paint reuse, (3) a lifecycle cost-benefit assessment of leftover paint management options, and (4) the evaluation of environmental, health, and safety regulations for recycled paint products.

The following case study illustrates another product stewardship effort underway that addresses the hazards of lead-based paint.

Case Study: Product Stewardship Effort by NPCA and Attorneys General *In 2004, NPCA and the State Attorneys General reached an agreement with Attorneys General from 46 states, plus the District of Columbia and three territories, which establishes a national program of consumer paint warnings, point-of-sale information, and education and training to avoid the potential exposure to lead-dust hazards. The agreement calls for a universal product sticker program and permanent product labeling on paint to alert consumers that lead dust exposure may occur during the renovation and remodeling of buildings that may contain old, lead-based paint. The agreement also requires manufacturers to distribute new point-of-sale consumer information containing the elements of a designated EPA brochure. In addition, NPCA devised and deployed a new national training program, which is offered without cost to contractors, state and local officials, and others. This four-year educational and training program seeks to offer 150 sessions in roughly 50 locations across the U.S. annually.*[23]