Appendix A: Endnotes

Preface

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Leadership by Trade Associations

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[2] A list of sectors and partners is included in the Introduction of this report; also see http://www.epa.gov/sustainableindustry/trades.html for links to partners' Web sites, which describe the mission and membership of each trade association.

[3] Sources used to compile total contribution to Gross Domestic Product: U.S. Department of Commerce, Bureau of Economic Analysis: Industry Economic Accounts, available at: http://www.bea.gov/bea/dn2.htm; Synthetic Organic Chemical Manufacturers Association (SOCMA), revenue and number of establishments per a pre-determined list of specialty-batch chemical manufacturers, current as of August 2005; National Center for Educational Statistics financial statistics available at: http://nces.ed.gov/pubs2005/2005177.pdf; U.S. Census Bureau, Construction Spending, Value of Construction Put in Place; available at: http://www.census.gov/const/www/c30index.html; U.S. Census Bureau, 2002 Economic Census, available at: http://www.census.gov/econ/census02.

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[5] For more information on ChemStewards℠, visit: http://www.socma.org/chemstewards/.

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[7] There are four companies (BASF, DuPont, Valspar, and Akzo Nobel) with five facilities from the paint and coatings sector in Performance Track. For more information on Performance Track, visit: http://www.epa.gov/performancetrack/.

[8] For more information on AF&PA's EH&S Principles Program and Principles Verification Program, visit: http://www.afandpa.org/Content/NavigationMenu/Environment_and_Recycling/Environment,_Health_and_Safety/Environment,_Health_and_Safety.htm.

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[18] The EMS guides are available on the Sector Strategies Program web site at: http://www.epa.gov/sectors/ems.html.

[19] U.S. EPA, Findings and Recommendations on Lean Production and Environmental Management Systems in the Shipbuilding and Ship Repair Sector, October 15, 2004, available at: http://www.epa.gov/sectors/shipbuilding/leanEMS_report.pdf.

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[22] To see a sample of the letter sent to presidents or chancellors of colleges and universities, visit the web site of the Campus Consortium for Environmental Excellence at: http://www.c2e2.org/ems/EMS_Draft.pdf.

[23] Campus Consortium for Environmental Excellence, "Fact Sheet for Senior Administrators," available at: http://www.c2e2.org/ems/Fact_Sheet_10-6.pdf.

[24] To see the Web site established by the consortium's EMS work group, visit: http://www.campusems.org/.

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Beneficial Reuse of Materials

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[8] Personal correspondence, Shana Harbour, U.S. EPA, with Vince Dickinson, P.E., Bath Iron Works, June 2005.

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Energy Consumption by the Cement Sector

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Top TRI Chemicals Based on Toxicity-Weighted Results
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Total TRI Disposal or Other Releases by the Paint & Coatings Sector

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TRI Air and Water Releases by the Paint & Coatings Sector

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TRI Air and Water Releases by the Shipbuilding & Ship Repair Sector

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Total TRI Disposal or Other Releases by the Specialty-Batch Chemicals Sector
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TRI Air and Water Releases by the Specialty-Batch Chemicals Sector
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Top TRI Chemicals Based on Toxicity-Weighted Results
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Appendix B: Data Sources

Data Sources: Economic Census/Annual Survey of Manufactures (ASM)/Bureau of Economic Analysis (BEA)

Metric Used: Annual information on value of shipments/revenue.

Period Analyzed: 1994–2003.

Next Data Release: In 2006 for 2004 data.

Sector chapters presenting data:

- Construction
- Forest Products
- Metal Finishing
- Paint & Coatings
- Ports
- Shipbuilding & Ship Repair
- Specialty-Batch Chemicals

Data Source Description: The U.S. Census Bureau's Economic Census profiles American businesses every five years, in years ending in 2 and 7, from the national to the local levels. The Bureau's Annual Survey of Manufactures provides sample estimates of statistics for all manufacturing establishments with one or more paid employees in each of the four years between the Economic Census. These data were used for two purposes: (i) for normalizing environmental data and (ii) for characterizing the "Sector At-a-Glance" tables.

Data Source Considerations: Aspects of the Census influence the use of these data for EPA's Sector Strategies Program.

- *Nonmanufacturing sectors not included.* Although the Economic Census includes data on all sectors, the ASM for intermittent years is restricted to manufacturing sectors only. Revenue data for nonmanufacturing sectors, specifically, colleges & universities, construction, and ports are not included.
- *Changes to the ASM.* In 2003, the ASM collapsed specific 6-digit North American Industry Classification System (NAICS) codes to the 5-digit NAICS level due to budget cuts. For 2003 and preceeding years, data for these sectors will be collected and presented at the 5-digit NAICS level. Unless further budget cuts occur, the Economic Census (conducted every five years) will continue to maintain the 6-digit NAICS detail. The collapse to 5-digit codes affects two Sector Strategies Program sectors: forest products and metal finishing. For these sectors, defined at the 6-digit NAICS detail, using a 5-digit NAICS code would over-include additional sectors. For 2003 onward, this data source cannot be used for these sectors. As an alternative, data on revenue and value of shipments can be accessed from the U.S. Department of Commerce's Bureau of Economic Analysis. BEA uses and presents annual data on the value of shipments sourced from the Census Bureau. To maintain the 6-digit NAICS level, BEA extrapolates these data by applying 6-digit NAICS weights from the most current Economic Census year to the 5-digit NAICS data in annual survey years. BEA will continue to do so for preceeding years.

Data Processing Steps:

- Data and documentation from the U.S. Census Bureau are available at www.census.gov/econ/census02 and www.census.gov/mcd/asmhome.html.
- Data and documentation from the U.S. Bureau of Economic Analysis are available at www.bea.doc.gov.
- For most sectors, value of shipments/revenue was used for normalizing data. These data are extracted from the ASM, Economic Census, and BEA. For the following manufacturing sectors, production data was used from other sources: cement and iron & steel (U.S. Geological Survey) and metal casting (American Foundry Society). For colleges & universities revenue data were used from the National Center for Education Statistics.
- For value of shipments/revenue data, relevant sector assignments were based on 6-digit NAICS codes for all sectors but specialty-batch chemicals. This sector was normalized using the chemical manufacturing sector's value of shipments.

Data Source: Manufacturing Energy Consumption Survey (MECS)

Environmental Metric Used: Quadrennial energy consumption by the manufacturing industry.

Period Analyzed: 1994, 1998, and 2002.

Next Data Release: 2006 data release schedule to be determined.

Sector chapters presenting data:

- Forest Products
- Iron & Steel
- Metal Casting

Data Source Description: MECS data are maintained by the U.S. Department of Energy's statistical agency, Energy Information Administration (EIA). Data are available by manufacturing industry and region and by value of shipments and employment size category and region (e.g., Northeast Census region). MECS data are collected quadrennially for a sample size through mailed questionnaires and then extrapolated to represent the manufacturing universe. For example, in 2002, a sample size of approximately 15,500 establishments was drawn from a sample frame representing 97% to 98% of the manufacturing payroll.

Data Source Considerations: Aspects of MECS influence the use of these data for EPA's Sector Strategies Program.

- *Detail of data.* MECS energy consumption estimates for the manufacturing industry are available for all manufacturing sectors at the 3-digit NAICS code level and select manufacturing sectors at the 6-digit NAICS code level. For the Sector Strategies Program sectors, 2002 data at the 6-digit level are available for the cement, forest products, iron & steel, and metal casting sectors.
- *Small businesses are not included.* MECS does not include small establishments, including those with fewer than 5 employees or those with 5 to 20 employees with certain minimum annual payrolls and shipments

Data Processing Steps:

- Data and documentation are available at www.eia.doe.gov/emeu/mecs.
- Sectors are defined based on 3-, 4-, 5-, and/or 6-digit NAICS code combinations.
- Energy consumed for all purposes (first use) was totaled for relevant sectors. Other potential available metrics include: energy consumed as a fuel, as a nonfuel (for purposes other than for heat, power, and electricity generation), and offsite-produced fuel consumed.
- Energy consumption data presented are normalized based on the sectors' productivity (as measured by changes in value of shipments/revenue or production), with 1994 as a baseline year.
- Units of measure are maintained in trillion British thermal units (Btus).

Data Source: National Biennial RCRA Hazardous Waste Report (hereafter, National Biennial Report)

Environmental Metrics Used: Biennial information on hazardous waste generation, management, and final disposition.

Period Analyzed: 2001 and 2003.

Next Data Release: 2005 data release schedule to be determined.

Sector chapters presenting data:

- Cement
- Colleges & Universities
- Construction
- Forest Products
- Iron & Steel
- Metal Casting
- Metal Finishing
- Paint & Coatings
- Shipbuilding & Ship Repair
- Specialty-Batch Chemicals

Data Source Description: EPA's Office of Solid Waste (OSW) biennially collects information on the generation, management, and final disposition of hazardous waste from large quantity generators (LQGs) and treatment, storage, and disposal facilities (TSDFs) and compiles a National Biennial Report. OSW first collected Biennial Reporting (BR) data using a national standardized form in 1989. The Toxicity Characteristic rule in 1990 added more waste types and required more stringent analysis of waste constituents.

Data Source Considerations: Setup of the data system and changes to the last three reporting cycles influence the use of these data by EPA's Sector Strategies Program for years prior to 2001.

- *Smaller generators are not included.* Only LQGs (facilities that meet minimum thresholds for reporting, such as those that generate 1,000 kilograms or more of hazardous waste per month or 1 kilogram or more of acutely hazardous waste per month) and TSDFs are required to submit a biennial Hazardous Waste Report; other generators are not.

- *Changes to the National Biennial Report.* In 1997, OSW began to exclude wastewater from its report to improve consistency, accuracy, and reliability of data collected across the program. This change was initiated in 1997 but fully implemented during the 1999 reporting cycle. Inconsistencies exist in the inclusion and exclusion of wastewater in the primary generated waste values making it inadvisable to compare 1997 and 1999 data with data collected in earlier and subsequent reporting years.

- *Improvements implemented during the 2001 reporting cycle.* States and regions were delegated the responsibility for determining inclusion or exclusion of data from the National Biennial Report. This resolved issues of translating state and regional codes to national codes needed to determine wastewater exclusion. Because states and regions have a better understanding of the waste reported under the state waste codes, they are able to improve data quality by more accurately identifying wastewater. Additionally, reporting national source codes that determine whether waste is deemed primary or secondary became mandatory. This is expected to improve the population of the primary generated waste variable analyzed. Based on these changes, it was determined that data from reporting year 2001 onward could be included in the 2006 Sector Strategies Performance Report. Although this change was initiated in 2001, it was fully implemented during the 2003 reporting cycle.

Data Processing Steps:

- Data and documentation can be found at www.epa.gov/epaoswer/hazwaste/data/biennialreport.

- For most sectors, data are compiled based on the primary 3-, 4-, 5-, and/or 6-digit NAICS codes reported in the National Biennial Report. For the cement, iron & steel, and specialty-batch chemicals sectors, the sector BR data are extracted based on a predetermined list of facilities. The count of the number of facilities reporting hazardous waste data is a total of the number of unique RCRA identification numbers (IDs) with the sectors' NAICS codes. This may overestimate facility counts, as one facility may have multiple RCRA IDs.

- Only data flagged for inclusion in the National Biennial Report are included.

- Waste associated with source code G61 and management code H141 are excluded from this analysis to avoid double counting of stored wastes. This is consistent with the National Biennial Report methodology.

- Units of measure are maintained in tons.

Data Source: National Emissions Inventory (NEI)

Environmental Metrics Used: Emission estimates of specific criteria air pollutants (CAP). Pollutants analyzed: sulfur dioxide, nitrogen oxides, particulate matter (<2.5 microns and <10 microns), and volatile organic compounds.

Period Analyzed: 1996–2002 (preliminary).

Next Data Release: February 2006 for final 2002.

Sector chapters presenting data:

- Cement
- Metal Casting
- Paint & Coatings
- Shipbuilding & Ship Repair
- Specialty-Batch Chemicals

Data Source Description: EPA's Emission Factor and Inventory Group within the Office of Air Quality Planning and Standards (OAQPS) prepares a national database of CAP emissions based on input from numerous state, tribal, and local air pollution control agencies; industry-submitted data; data from other EPA databases; as well as emission estimates. State and local emissions inventories are submitted to EPA once every three years for most point sources contained in NEI. Through the 1999 NEI, EPA estimated emissions for any jurisdiction that did not submit an emissions inventory and where data were not available through industry submissions or other EPA databases. Gaps in data for the years between submissions are filled with emission estimates modeled using sources such as sector-level economic data and supplemental emissions information. As a result of the Consolidated Emissions Reporting rule, NEI updates for 2002 and beyond are expected to include data uploads from all jurisdictions.

Data Source Considerations: Several changes to NEI influence the appropriate use of these data for EPA's Sector Strategies Program.

- *Addition of $PM_{2.5}$.* In 1997, OAQPS established National Ambient Air Quality Standards for particulate matter less than 2.5 micrometers in diameter. As a consequence, NEI began to collect $PM_{2.5}$ emissions estimates as of the 1999 inventory.

- *Improved methodology and regulatory amendments.* As a result of the Consolidated Emissions Reporting rule, NEI updates for 2002 and beyond are expected to include data uploads from all jurisdictions. If so, the need to estimate missing emissions data will be reduced.

- *Changes in "Trends" Report Methodology for PM.* In the 2002 Trends Report, OAQPS restructured certain source categories under the PM pollutant codes. Some source classification codes (SCCs) previously captured under the "Miscellaneous" category (Tier 1–14) were moved to the "Other Industrial Processes" category (Tier 1–7). The change in tier structure was made for the years 1990 and 1996 to 2002. Specifically, this increases the cement sector's PM emissions estimates as presented in the 2004 Sector Strategies Performance Report, which falls within the "Other Industrial Processes" category.

- *NEI Hazardous Air Pollutant (HAP) data.* NEI also includes hazardous air pollutant (HAP), or air toxics data. Air toxics are identified as 188 chemicals that cause serious health and environmental effects, as designated by the Clean Air Act Section 112b. The 2006 Sector Strategies Performance Report presents air toxics data from the Toxics Release Inventory rather than NEI, primarily because TRI allows for annual trends analyses. Currently, the 1990 and 1996 NEI databases are not recommended for use due to unusable format or data quality concerns, and the final version of the 2002 data is not available. Consequently, NEI air toxics data are only available for 1999 within the timeframe for completing this report, limiting the ability to use these data for trends analyses. Following the release of the 1990 and 2002 databases, EPA will evaluate the suitability of NEI to perform trends analyses for the next Performance Report.

Data Processing Steps:

- NEI CAP data were obtained from OAQPS staff (August 2005) and the Clearinghouse for Inventories & Emissions Factors (CHIEF); documentation available at www.epa.gov/ttn/chief/trends.

- For most sectors, data are compiled based on the facilities' SIC codes as included in the NEI. For the specialty-batch chemicals sector, NEI data are extracted based on a predetermined list of facilities.

- Emissions estimates are totaled by criteria air pollutants for sectors.

- The cement and paint & coatings sectors present 1996 through 2002 emissions. Estimates for 2002 are preliminary, and 2000 and 2001 emissions are projected based on the 1999 inventory.

- The metal casting and shipbuilding & ship repair sectors present 1996 and 2001 emissions.

- The specialty-batch chemicals sector presents 1999 emissions.

- Data are normalized based on a sector's productivity (as measured by changes in value of shipments/revenue or production), with 1996 as the baseline year.

- Units of measure (from the trends source file) were converted from short tons to tons for presentation purposes.

Appendix B: Data Sources

Appendix B: Data Sources

Data Source: Toxics Release Inventory (TRI)

Environmental Metrics Used: Toxic chemical releases (including disposal) and waste management.

Period Analyzed: 1994–2003.

Next Data Release: In 2005 for 2004 data.

Sector chapters presenting data:

- Cement
- Forest Products
- Iron & Steel
- Metal Casting
- Metal Finishing
- Paint & Coatings
- Shipbuilding & Ship Repair
- Specialty-Batch Chemicals

Data Source Description: The Toxics Release Inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 and expanded by the Pollution Prevention Act of 1990. Following expansions of the reporting requirements in the past 10 years, TRI now includes facilities with 10 or more employees in the manufacturing sectors (SIC codes 20–39); federal facilities; metal mines; coal mines; electrical utilities that combust coal or oil; commercial hazardous waste treatment facilities; chemical wholesalers; petroleum bulk terminals and plants; and solvent recovery services who use, process, or manufacture more than a threshold amount of any of the more than 600 toxic chemicals. Facilities must report to TRI if they exceed the reporting threshold for manufacture or process (>25,000 pounds) or for other uses (>10,000 pounds) of a listed chemical. Reporting thresholds for persistent bioaccumulative toxic chemicals (PBTs) are lower. In 2003, 23,811 facilities, including federal facilities, reported to EPA's TRI Program. They reported 4.44 billion pounds of onsite and offsite disposal or other releases and 25.8 billion pounds of production-related waste managed.

Data Source Considerations: There are a number of aspects of TRI data that influence their use for sector-level performance measurement. These issues include:

- *Small businesses not included.* TRI excludes smaller facilities, that is, those with fewer than 10 employees. However, larger facilities meeting reporting thresholds are included, and these facilities are expected to have greater environmental impacts.
- *Comprises a list of reportable chemicals.* Facilities in the TRI-reporting industry sectors must file if they exceed the reporting thresholds for any of the 600+ chemicals. Use of a single list of reportable chemicals is viewed as more suitable for tracking trends over time than data sources where the reportable chemicals may vary across facilities.
- *Multimedia coverage.* TRI reporting covers releases and other disposal to all environmental media (air, water and land) for the same time period each year. Such umbrella reporting is viewed as more suitable for trends analysis than compiling release and disposal data from several data systems.
- *Annual filing.* TRI reports are submitted each year, which is preferable to data systems where information is updated less frequently.
- *Data accuracy.* Facility owners/operators are responsible for TRI reporting using their best available information. The data facilities submit on releases and waste management quantities are calculated using one of the following methods: monitoring or measurement; mass balance calculations; emission factors; or engineering estimates. In practice, some facilities may conservatively overestimate their releases, e.g., chose to use emission factors instead of actual measurements (to avoid any risk of underreporting.) Direct electronic filing of TRI reports may reduce the potential for data processing errors.
- *Changes in best available information.* Facilities are required to complete their TRI forms using their best available information. Industry representatives have pointed out that estimates of releases might change over time as more information becomes available. For example, while conducting measurements required by another regulation, such as emissions testing required by a national emission standard for hazardous air pollutants (NESHAP), a facility may find a TRI-reportable chemical in its releases that it was not aware of previously. As facilities learn of the existence of various chemicals, they are then required to report those releases to TRI. This situation would result in an increased level of reported releases that is not necessarily accompanied by an increase in actual emissions.

Appendix B: Data Sources

Data Processing Steps:

- Documentation can be found at www.epa.gov/tri.

- TRI data for reporting years 1994–2003 were provided by the TRI program (Office of Environmental Information) frozen as of December 28, 2004. The frozen data are used to ensure reproducibility and to support later revisions of the analysis.

- Extracted data elements for this 2006 Performance Report include the following data elements from all TRI Form Rs submitted by the sectors:

  Disposal or Other Releases includes:

  Section 5.1: Fugitive air emissions
  Section 5.2: Stack air emissions
  Section 5.3: Discharges to water
  Section 5.4: Land and other onsite disposal
  Section 6.1: Discharges to publicly owned treatment works (POTWs), for metals and metal compounds only
  Section 6.2: Transfers to other offsite locations, for disposal codes only.
  The disposal codes are as follows:

  M10 Storage Only
  M40 Solidification/Stabilization - Metals and Metal Compounds Only
  M41 Solidification/Stabilization - Metals and Metal Compounds Only
  M61 Wastewater Treatment (excluding POTW) - Metals and Metal Compounds Only
  M62 Wastewater Treatment (excluding POTW) - Metals and Metal Compounds Only
  M63 Surface Impoundment
  M64 Other Landfills
  M65 RCRA Subtitle C Landfills
  M66 Subtitle C Surface Impoundment
  M67 Other Surface Impoundment
  M71 Underground Injection
  M72 Offsite Disposal in Landfills
  M73 Land Treatment
  M79 Other Land Disposal
  M81 Underground Injection to Class I Wells
  M82 Underground Injection to Class II–V Well
  M90 Other Offsite Management
  M91 Transfers to Waste Broker - Disposal
  M94 Transfers to Waste Broker - Disposal
  M99 Unknown

  Note that quantities of chemicals sent offsite for energy recovery, recycling, or treatment were NOT included in the "disposal" quantity. These excluded quantities were any transfers coded as sent offsite for:

  M20 Solvents/Organics Recovery
  M24 Metals Recovery
  M25 Other Reuse or Recovery
  M28 Acid Regeneration
  M50 Incineration/Thermal Treatment
  M54 Incineration/Insignificant Fuel Value
  M56 Energy Recovery
  M69 Other Waste Treatment
  M90 Other Off-Site Management
  M92 Transfer to Waste Broker – Energy Recovery
  M93 Transfer to Waste Broker – Recycling
  M95 Transfer to Waste Broker – Waste Treatment

  Air Releases includes stack and fugitive emissions as reported in sections 5.1 and 5.2 of TRI Form R.

  Water Releases includes discharges to water and to POTWs for metals only as reported in sections 5.3 and 6.1 (metals only) of TRI Form R.

  Air Toxics includes stack and fugitive emissions of air toxics, also called hazardous air pollutants, as designated by the Clean Air Act Section 112b that are reportable to TRI as reported in sections 5.1 and 5.2 of TRI Form R. The act designates 188 chemicals as air toxics, 182 of which are included in TRI. TRI, rather than NEI, was used as the source for sector-level air toxics data primarily because TRI allows for a variety of annual trends analyses that were not possible with NEI.

  Recycling includes the quantity of the toxic chemicals that was either recovered at the facility and made available for further use or sent offsite for recycling and subsequently made available for use in commerce. These amounts are reported in sections 8.4 and 8.5 of TRI Form R.

  Energy Recovery includes the quantity of the toxic chemicals that was combusted in an energy recovery device, such as a boiler or industrial furnace. These amounts are reported in sections 8.2 and 8.3 of TRI Form R.

  Treatment includes the quantity of chemicals destroyed in onsite or offsite operations such as biological treatment, neutralization, incineration, and physical separation as reported in sections 8.6 and 8.7 of TRI Form R.

- For most sectors, data are compiled based on the primary SIC code reported on the TRI Form R. For the cement, iron & steel, and specialty-batch chemicals sectors, the sector TRI data are extracted based on a predetermined list of facilities. The count of the number of facilities reporting to TRI is a total of the number of unique TRI IDs in the sectors' SIC codes. This may overestimate facility counts, as one facility may have multiple TRI IDs.

- TRI releases and disposals were totaled for all chemicals reported by a sector. Absolute pounds are presented for 1994–2003. Absolute pounds of releases to air and water also are presented only for the same 10-year period.
- Data are normalized based on the sectors' productivity (as measured by changes in value of shipments/revenue or production), with 1994 as the baseline year.
- TRI waste managed by management method and ultimate disposition also are presented. Absolute pounds are presented for the most current year of data available.
- Units of measure are maintained in pounds.

Data Source: Risk Screening Environmental Indicators (RSEI)

Environmental Metrics Used: Relative toxicity of air and water releases reported to TRI.

Period Analyzed: 1994–2003 TRI data.

Next Data Release: In early 2006 for 2004 data

Sector chapters presenting data:

- Cement
- Forest Products
- Iron & Steel
- Metal Casting
- Metal Finishing
- Paint & Coatings
- Shipbuilding & Ship Repair
- Specialty-Batch Chemicals

Data Source Description: Data from TRI allows comparisons of the quantities of chemicals reported year-to-year. Comparisons of the sum of TRI release data of two or more chemicals for a given year to the sum of release data for the same chemicals for different years is a simple and useful way to assess overall environmental loading of pollutants across years. However, the relative toxicity of each chemical is not taken into account. For example, mercury and methanol are both toxic chemicals. However, a pound of mercury released to air is likely to be more harmful to human health than a pound of methanol released to air because the toxic effects of mercury are much more severe and debilitating to humans and can occur at lower levels of exposure. These chemicals are treated equally when all pounds are simply summed. A sector's progress in reducing higher toxicity substances, therefore, is not fully evident when trends are presented by total pounds alone. To consider toxicity, each chemical can be weighted by a relative toxicity weight using EPA's Risk-Screening Environmental Indicators model. The model multiplies the pounds of media-specific releases (e.g., pounds of mercury released to air) by a chemical-specific toxicity weight to calculate a toxicity-weighted result.

Data Source Considerations: Aspects of RSEI influence the use of these modeled data for EPA's Sector Strategies Program.

- *Comparing RSEI results.* The numeric RSEI output depicts the relative toxicity of TRI releases for comparative purposes and is meaningful only when compared to other values produced by RSEI.
- *Excludes certain chemicals.* RSEI does not provide toxicity weights for all TRI chemicals, although chemicals without toxicity weights account for a very small percentage (<1%) of total reported pounds released and transferred. If there is no toxicity weight available for the chemical, then the toxicity-weighted result is zero.
- *Acute human or environmental toxicity not addressed.* RSEI addresses chronic human toxicity (cancer and noncancer effects, e.g., developmental toxicity, reproductive toxicity, neurotoxicity, etc.) associated with long-term exposure but does not address concerns for either acute human toxicity or environmental toxicity.
- *Currently excludes toxicity weights for chemicals disposed.* An inhalation toxicity weight is used for fugitive and stack air releases. An oral toxicity weight is used for direct water releases and for releases of metals to POTWs. Releases to land and other disposal are not modeled because necessary data on site-specific conditions are lacking; therefore, for screening purposes, the higher of the inhalation or oral toxicity weight is used. As this could overestimate the toxicity-weighted results for disposals, these data have been excluded from the toxicity-weighted results presented in this 2006 Performance Report.

- *Assumes highest toxicity weight for chemical form.* Metals and metal compounds are assumed to be released in the chemical form associated with the highest toxicity weight because information on the form is not subject to TRI reporting. The form of a chemical compound can affect its bioavailability and, therefore, its toxicity. For example, hexavalent chromium has an oral toxicity weight of 170 and an inhalation toxicity weight of 86,000; whereas trivalent chromium has an oral and inhalation toxicity weight of 0.33. TRI reports on "chromium" do not specify the valence, so all reported pounds of chromium are more conservatively assigned the toxicity weight of hexavalent chromium. In cases where a facility is releasing the chemical in the lower toxicity form, RSEI would overestimate toxicity-weighted results.

- *Results presented do not include a risk perspective.* Although the RSEI model can provide a full risk-related perspective for air and water releases, only the toxicity portion of the model was used in the analysis for the 2006 Performance Report. It is important to note that risk-related factors were not considered in the analysis for this report. These factors that impact the risk potentially posed by a chemical release are a function of chemical toxicity, the fate and transport of the chemical in the environment after it is released, the pathway of human exposure, and the number of people exposed. Readers interested in the risk perspective for a facility or sector can use the publicly available RSEI model to conduct this screening-level risk analysis.

Data Processing Steps:

- RSEI model documentation is available at www.epa.gov/opptintr/rsei.

- For most sectors, data are compiled based on the primary SIC codes reported on the TRI Form R. For the cement, iron & steel, and specialty-batch chemicals sectors, the sector TRI data are extracted based on a predetermined list of facilities.

- TRI air and water releases, weighted for toxicity, were totaled for all chemicals reported by a sector. Both absolute pounds and toxicity-weighted results are presented for a 10-year period.

- Data are normalized based on the sectors' productivity (as measured by changes in value of shipments/revenue or production), with 1994 as the baseline year.

- The chemicals that account for 90% of the sectors' total toxicity-weighted results for air and water releases in 2003 are presented for each sector.

Industry-Supplied Environmental Data

The following data were supplied by industry partners for two sectors.

Sector: Cement

Data Source: Cement kiln dust surveys, March 7, 2005, provided by Garth Hawkins, Portland Cement Association and Portland Cement Association Report on Sustainable Manufactures, February 2005, Chapter 3 – Solid Waste Production.

Environmental Metric Used: Cement kiln dust sent to landfills, in metric tons.

Sector: Forest Products

Data Source: American Forest & Paper Association Environmental, Health, and Safety Verification Program, Year 2002 Report: Issued 2004.

Environmental Metrics Used:

- Sulfur dioxide and nitrogen oxide air emissions from pulp and paper mills, in pounds per ton of production.

- Wastewater discharges (volume, biochemical oxygen demand, and total suspended solids) from pulp and paper mills, in pounds per ton of production.

- Adsorbable organic halides from pulp and paper mills, in kilograms per tonne of production.

Appendix C: Glossary

Acid rain: Air *pollution* produced when acid chemicals are incorporated into rain, snow, fog, or mist. The "acid" in acid rain comes from *sulfur oxides* and *nitrogen oxides*, products of burning coal and other fuels and from certain industrial processes. The sulfur oxides and nitrogen oxides are related to two strong acids: sulfuric acid and nitric acid. When *sulfur dioxide* and nitrogen oxides are released from power plants and other sources, winds blow them far from their source. If the acid chemicals in the air are blown into areas where the weather is wet, the acids can fall to Earth in the rain, snow, fog, or mist. In areas where the weather is dry, the acid chemicals may become incorporated into dusts or smokes. Acid rain can damage the environment, human health, and property.

Air toxics: Air *pollutants* that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. Examples of toxic air pollutants include benzene, found in gasoline; perchloroethylene, emitted from some dry cleaning facilities; and methylene chloride, used as a solvent by a number of industries.

Beneficial reuse: Use or reuse of a material that would otherwise become a waste.

Biomass: All of the living material in a given area; often refers to vegetation.

Byproduct: Material other than the intended product that is generated as a consequence of an industrial process.

Combustion: Burning. Many *pollutants*, such as *sulfur dioxide*, *nitrogen oxides*, and *particulates* (PM_{10}) are combustion products, often products of the burning of fuels such as coal, oil, gas, and wood.

Co-product: A substance produced for a commercial purpose during the manufacture, processing, use, or disposal of another substance or mixture.

Criteria air pollutant: A group of six widespread and common air *pollutants* regulated by EPA on the basis of standards set to protect public health or the environment. These six criteria pollutants are carbon monoxide, lead, *nitrogen dioxide, ozone, particulate matter,* and *sulfur dioxide*.

Energy efficiency: Actions to save fuels by better building design, modification of production processes, better selection of road vehicles and transport policies, etc.

Energy recovery: Obtaining energy from waste through a variety of processes, including *combustion*.

Environmental management system: (EMS) A systematic approach to managing all environmental aspects of an operation. International Organization for Standardization (ISO) 14001 is a widely recognized international standard for EMS.

Greenhouse gas: (GHG) A collective term for those gases, including carbon dioxide, methane, nitrous oxide, *ozone*, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, which contribute to potential climate change.

Hazardous air pollutant: (HAP) A category of air *pollutants* that may present a threat of adverse human health effects or adverse environmental effects. Includes asbestos, beryllium, mercury, benzene, coke oven emissions, radionuclides, and vinyl chloride.

Hazardous waste: A *byproduct* of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or is specifically listed as hazardous by EPA.

Industrial waste: Process waste associated with manufacturing. This waste usually is not classified as either *municipal solid waste* or *hazardous waste* by federal or state laws.

Large quantity generator: (LQG) Generator of 1,000 kilograms per month or more of *hazardous waste*, or more than 1 kilogram per month of acutely hazardous waste. LQGs must submit a biennial hazardous waste report and are subject to other specific regulatory requirements, including requirements regarding waste accumulation, emergency coordination, etc.

Municipal solid waste: Waste discarded by households, hotels/motels, and commercial, institutional, and industrial sources. It typically consists of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. It does not include wastewater.

National Ambient Air Quality Standards: (NAAQS) Standards established by EPA under the Clean Air Act that apply to outdoor air throughout the country. See *criteria air pollutant*.

Net electricity: Net electricity is obtained by summing purchases, transfers in, and generation from noncombustible renewable resources, minus quantities sold and transferred out. It does not include electricity inputs from onsite cogeneration or generation from combustible fuels because that energy has already been included as generating fuel (for example, coal).

Nitrogen dioxide: (NO_2) A *criteria air pollutant* and *smog*-forming chemical formed by the burning of gasoline, natural gas, coal, oil, etc.

Appendix C: Glossary

Nitrogen oxides: (NO_x) A reddish-brown gas compound that is a product of combustion and a major contributor to the formation of *smog* and *acid rain*.

Non-attainment area: A geographic area in which the level of a *criteria air pollutant* is higher than the level allowed by the federal standards. A single geographic area may have acceptable levels of one criteria air pollutant but unacceptable levels of one or more other criteria air pollutants; thus, an area can be both attainment and non-attainment at the same time.

Non-hazardous waste: Any solid, semi-solid, liquid, or contained gaseous materials discarded from industrial, commercial, mining, or agricultural operations, and from community activities, that is not defined as "hazardous."

Normalization: A process applied to a data set to compare the data against some common measure of annual economic output, such as value of shipments, number of employees, or units of production.

Ozone: A gas which is a variety of oxygen. The oxygen gas found in the air consists of two oxygen atoms stuck together; this is molecular oxygen. Ozone consists of three oxygen atoms stuck together into an ozone molecule. High concentrations of ozone gas are found in a layer of the atmosphere – the stratosphere – high above the Earth. Stratospheric ozone shields the Earth against harmful rays from the sun. *Smog*'s main component is ozone; this ground-level ozone is a product of reactions among chemicals produced by burning coal, gasoline and other fuels, and chemicals found in products including solvents, paints, hairsprays, etc.

Particulate matter: (PM) Solid particles or liquid droplets suspended or carried in the air (e.g., soot, dust, fumes, or mist). $PM_{2.5}$: Particles less than or equal to 2.5 micrometers in diameter. PM_{10}: Particles less than or equal to 10 micrometers in diameter.

Pollutants: (pollution) Unwanted chemicals or other materials found in specific environments – air, water, soil – that are the subject of regulatory concern and activities. Pollutants can harm health, the environment, and property.

Sludge: Solid, semisolid, or liquid waste generated from a municipal, commercial, or industrial wastewater facility.

Solid waste: Nonliquid, nonsoluble materials ranging from municipal garbage to *industrial wastes* that contain complex and sometimes hazardous substances. Solid wastes also include sewage sludge, agricultural refuse, demolition wastes, mining residues, and liquids and gases in containers.

Smog: A mixture of *pollutants*, principally ground-level *ozone*, produced by chemical reactions in the air involving smog-forming chemicals. A major portion of smog-formers come from burning of petroleum-based fuels such as gasoline. Other smog-formers, *volatile organic compounds*, are found in products such as paints and solvents. Smog can harm health, damage the environment, and cause poor visibility. Major smog occurrences are often linked to heavy motor vehicle traffic, sunshine, high temperatures and calm winds, or temperature inversion (weather condition in which warm air is trapped close to the ground instead of rising). Smog is often worse away from the source of the smog-forming chemicals, since the chemical reactions that result in smog occur in the sky while the reacting chemicals are being blown away from their sources by winds.

Stormwater runoff: The portion of precipitation, snowmelt, or irrigation water that does not infiltrate the ground or evaporate but instead flows onto adjacent land or watercourses or is routed into drain/sewer systems.

Sulfur dioxide: (SO_2) A *criteria air pollutant*. Sulfur dioxide is a gas produced by burning coal, most notably in power plants. Some industrial processes, such as production of paper and smelting of metals, produce SO_2. Sulfur dioxide is closely related to sulfuric acid, a strong acid. Sulfur dioxide plays an important role in the production of *acid rain*.

Sulfur oxides: (SO_x) A gas compound that is primarily the product of combustion of fossil fuels and a major contributor to climate change and *acid rain*.

Twenty-foot equivalent unit: (TEU) A measure of containerized cargo equal to one standard 20 ft (length) X 8 ft (width) X 8.5 ft (height) container.

Toxicity weighting: Computation that determines weight given to *pollutants* to aid in the comparison of the relative risks of toxic pollutants. The higher the number – or toxicity weight – the greater the risk that air and water releases pose to people's long-term health.

Value of shipments: The net selling values, exclusive of freight and taxes, of all products shipped by manufacturers.

Volatile organic compound: (VOC) Any organic compound that evaporates readily to the atmosphere, contributing significantly to *smog* production and certain health problems. Volatile organic chemicals include gasoline, industrial chemicals such as benzene, solvents such as toluene and xylene, and tetrachloroethylene (perchloroethylene, the principal dry cleaning solvent). Many volatile organic chemicals are also *hazardous air pollutants*; for example, benzene causes cancer.