POLLUTION AND RELEASE PREVENTION

Introduction

Pollution can be generated from virtually any sector of society including agriculture, consumers, energy production, government, industry, and transportation. In order to prevent pollution, it is first necessary to identify the sources of pollution. Once the sources have been identified, steps may be taken to reduce or eliminate the pollution. Chemical pollution can result from direct use and subsequent release of the substance to the environment or can occur when two or more substances react to form a new substance (e.g., when NOx reacts with VOCs to form ozone (O_3)).

Chemical releases are often multi-media in nature and may result as a direct discharge to air and water or as an off-site transfer to a landfill. For example, ammonia can be released to air through evaporation when it is used to clean the floor. Water releases occur when the solution is poured down the drain or on the ground. Off-site transfers occur when the ammonia bottle, containing residual material, is tossed in the garbage for landfill disposal. If the consumer adds chlorine bleach to the ammonia the resulting chemical reaction releases an extremely hazardous substance known as chloramine gas.

At the industrial level, pollution (and subsequent releases) may result from direct use of a hazardous substance in a manufacturing process or as a product or byproduct of the process. When hazardous substances are used in a production process they will either end up in the product (e.g., as a bottle of ammonia), be chemically consumed in a reaction, or become production-related waste. Although the product may contain the hazardous substance, it is not considered pollution, at least not at this point, since it is the desired end result of the production process. The hazardous substances which are consumed in the production no longer exist and, therefore, are no longer a hazard. Pollution then stems from production-related waste. Some of the production related waste may be released directly, or may be recycled either on-site, as a raw material, or sent off-site for recycling/use by another facility (e.g. scrap metal re-smelted to form a new alloy). Much of the waste is treated in some fashion so the total amount released to the environment is considerably less than what is produced. Some material may be sent to an on-site treatment device, as in the case of VOCs sent to a wet scrubber, before being released to the air or water. Other material may be disposed of in a landfill, either on- or off-site.

Numerous federal and state regulations require facilities to install treatment and control devices in order to reduce the amount of waste released to the environment. In general, the strategy of waste minimization and waste prevention has received less attention in the past. Often control devices are designed to reduce direct emissions; however cross-media shifts can occur when contaminants are transferred to other environmental media. For example, when a wet scrubber is used as a control device to reduce direct VOC air emissions, the VOCs are transferred from air to water. The resulting wastewater may be discharged directly to ground or surface water or sent off site for treatment by a publicly owned treatment works (POTW). In spite of the control device, the contaminants may ultimately wind up as an air emission if they evaporate from the wastewater stream. To be most effective, pollution prevention efforts must be founded on sound information

about the use and end result of the substances that become, or lead to the generation of pollution. Multi-media materials accounting data, which quantitatively track the flow of material through a facility, provide the facility with the necessary information to identify and quantify sources of pollution, and also provides release information required by regulatory agencies.

The federal Pollution Prevention Act of 1990 sets a national policy and hierarchy for controlling pollution stating that pollution prevention (source reduction) will be at the top of the hierarchy, followed by recycling, treatment and then disposal. The Act also directed EPA to collect source reduction data. In 1987 EPA began tracking, nationally, multi-media releases of approximately 320 chemicals and 20 chemical categories through the federal Toxic Chemical Release Inventory (TRI) program. TRI originally collected information on facility level releases, however it did not account for all sources of waste, including recycling and energy recovery nor did it account for source reduction or total facility use of these substances. In 1991, EPA began to collect quantitative information on energy recovery and recycling. In 1998, EPA expanded the scope of TRI, however, it does not yet require full materials accounting for covered TRI facilities. Since facilities do not report data on total use of hazardous substances, TRI data are not an adequate measure of source reduction/pollution prevention. Pollution Prevention Planning is also not required on the national level.

The New Jersey Worker and Community Right-to-Know Act established a regulatory process for collecting materials accounting data on the flow of toxic materials though individual manufacturing facilities. Any New Jersey facility that is required to complete one or more federal “Form Rs” is also required to submit to NJDEP an annual Release and Pollution Prevention Report (RPPR) containing facility level information on throughput (i.e. chemical use), non-product output (total production-related waste), releases to the environment, and transfers to off-site waste management facilities for all TRI substances exceeding the reporting threshold. This information provides useful insight into toxic pollution produced by industrial facilities and provides a basis for measuring progress in pollution prevention by these facilities. This unique data can be used for a variety of environmental performance measures including pollution prevention trends, identification of unpermitted releases, and identification of cross-media transfers.

Pursuant to the New Jersey Pollution Prevention Act of 1991, any manufacturing facility in a regulated SIC code that is required to submit an RPPR is also required to perform Pollution Prevention Planning if the facility manufactures, processes or otherwise uses 10,000 pounds or more of a hazardous substance listed on the federal TRI list. Facilities in SIC codes 26, 28, 30, 33, and 34 (the "Big Five") were required to prepare five year Pollution Prevention Plans, based on 1993 data, and submit summaries of those plans to NJDEP by July 1, 1994. The “Big 5” account for approximately 85% of all nonproduct output (NPO) generated in New Jersey. The indicators on the following pages represent various pollution or release prevention measures that New Jersey considers important for use in its results-based management system.

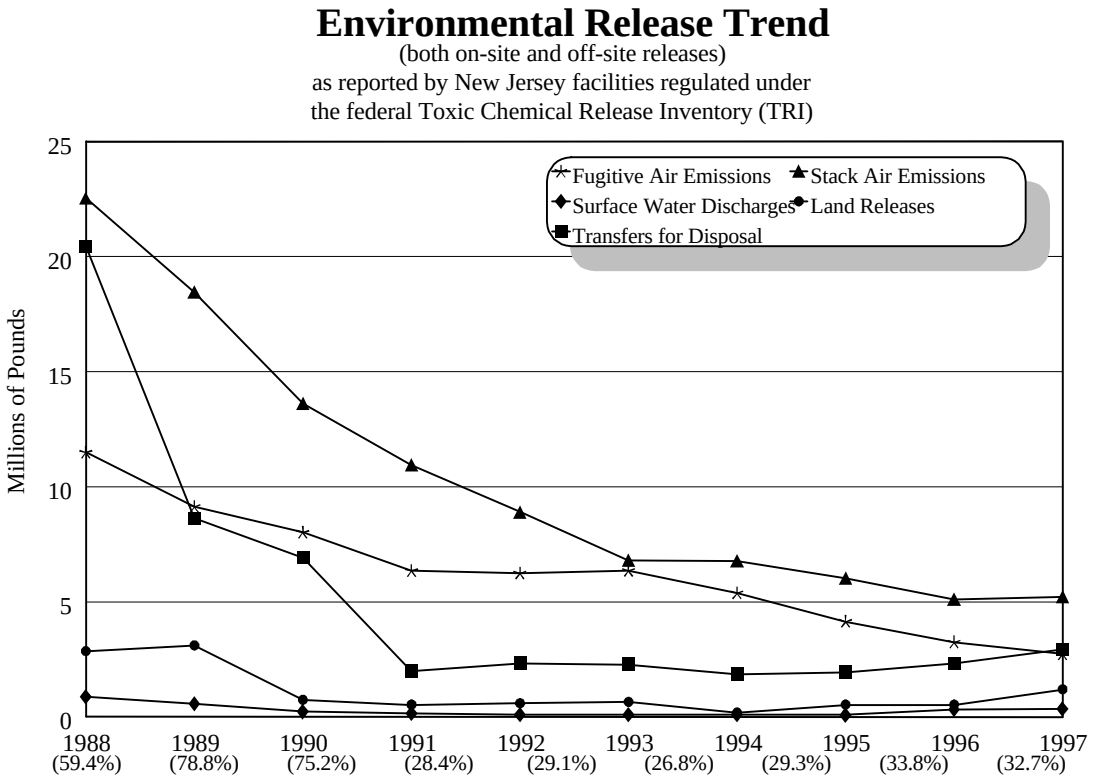
Milestone: By 2005, through pollution prevention techniques, industrial facilities will reduce the quantity of toxic chemicals generated as nonproduct output (production-related waste) by 50% from 1993 levels.

Indicator: Changes in Releases and Transfers of Hazardous Substances on A Statewide Basis. (CPM)

Type of Indicator: Cause

Nonproduct output (NPO) is a measure, in pounds, of hazardous (or toxic) substances that are generated as waste prior to any sort of treatment or control at industrial facilities. By measuring NPO quantities before treatment, it is possible to determine whether reductions are due to pollution prevention (i.e., making production processes more efficient) or to the installation of more effective or stringent treatment or control devices. Several measures are available to assess progress toward this milestone, including environmental release data and on-site and off-site waste management data provided on both the federal Form R and state Release and Pollution Prevention Report.

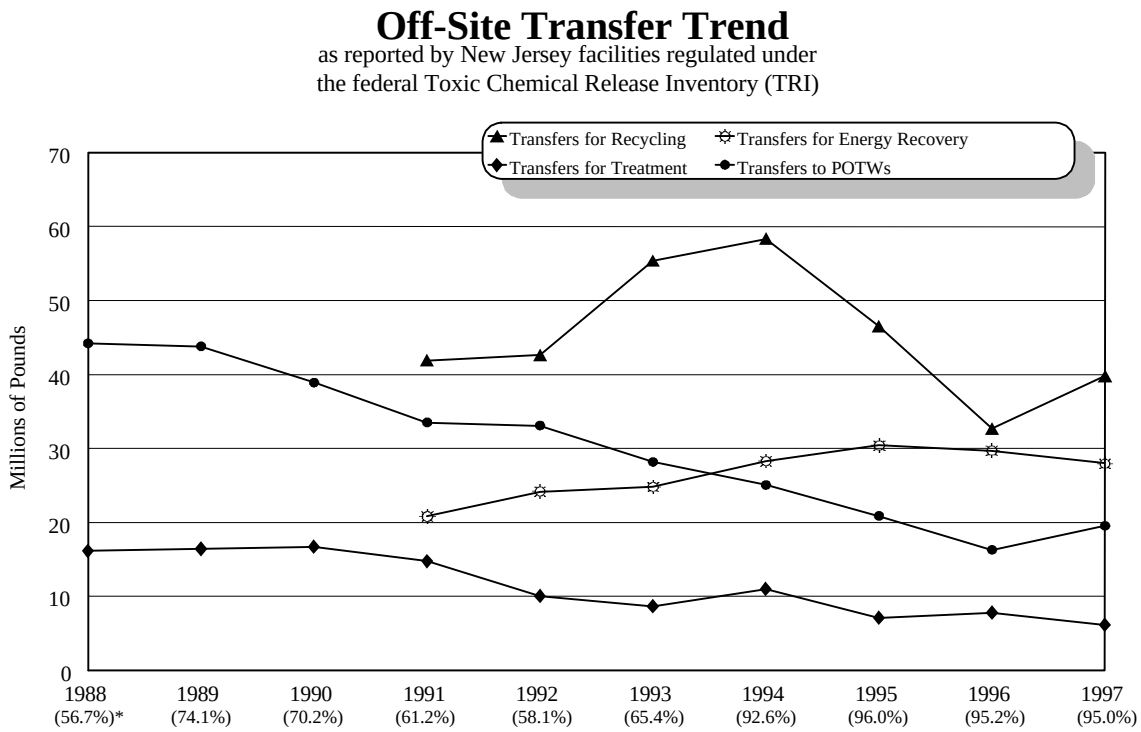
Figure 1



TRI Trend Data are for "Core" Chemicals as reported by NJ facilities on the USEPA Form R; Core Chemicals are the chemicals and categories that were reportable in all years - there are 310 substances listed as "core" chemicals (all quantities in millions of

*The percent value below each year indicates the amount that the core chemicals represent relative to the total reported quantity for the

Figure 2



TRI Trend Data are for "Core" Chemicals as reported by NJ facilities on the USEPA Form R; Core Chemicals are the chemicals and chemical categories that were reportable in all years - there are 310 substances listed as "core" chemicals (all quantities in millions of pounds).
*The percent value below each year indicates the amount that the core chemicals represent relative to the total reported quantity for the year.

Data Description

New Jersey facilities that are required to complete one or more Toxic Chemical Release Inventory (TRI) Reporting Forms (Form R) pursuant to Section 313 of the federal Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) are also subject to the New Jersey Release and Pollution Prevention Report (RPPR or DEQ-114) requirements. These facilities are required to submit additional information on the RPPR for every TRI toxic chemical reported on the Form R. Through reporting year 1997, owners and operators of facilities that met all three of the following criteria had to file the federal Form R and the NJ RPPR:

- the facility's business activity was included in the manufacturing Standard Industrial Classification codes major groups 20 through 39; and

- the facility had 10 or more full-time employees (or the equivalent; that is, the facility's payroll included 20,000 or more work-hours for the reporting year); and

- the facility manufactured (defined to include imported) or processed any listed toxic chemical in quantities equal to or greater than 25,000 pounds or otherwise used any listed chemical in quantities equal to or greater than 10,000 pounds.

Data are collected for approximately 500-550 facilities (1997 data) subject to EPCRA Section 313 in New Jersey. Facilities that are subject to submitting Form R are required to report on the New Jersey Release and Pollution Prevention Report all EPCRA Section 313 toxic chemicals that are manufactured, processed or otherwise used in excess of 10,000 pounds pursuant to the New Jersey Pollution Prevention Act. This means that a regulated employer must report all Form R chemicals reported at the federal thresholds stated previously plus any listed chemical manufactured or processed in excess of 10,000 pounds but less than the federal 25,000 pounds threshold. The data are annual, aggregated, facility-wide quantities that are to be reported by July 1 of the year following the reporting year.

Data Characteristics

Regulated employers are required to report annual chemical throughput information to the DEP. Chemical throughput includes data on chemical use, environmental releases at the reporting facility, on-site waste management activities, and off-site transfers of non-product output. The throughput data are evaluated as chemical inputs and outputs. The input component includes: the starting inventory of the toxic chemical for the year; the quantity produced on site; and the quantity brought on site. The output component includes: the quantity consumed (chemically reacted in process) on site; the quantity shipped off site as (or in) product; the quantity destroyed through on-site treatment; the quantity destroyed through on-site energy recovery; the ending inventory; and all on-site environmental releases and off-site transfers for further management. Facility owners and operators are not required to monitor or measure any data element to an extent greater than is required by federal or state regulations, permits, conditions, etc. of approved operations. The data used for analysis were restricted to those toxic substances that were reportable in all years, so that the data set represents a consistent, "core" set of chemicals.

Much of the NPO generated at industrial facilities is managed or processed in some way to remove these toxic substances, so the actual quantity of toxic substances released into the environment is considerably smaller (see Figures 1 and 2). The overall quantity of total releases and transfers of the core chemicals has shown a downward decline. A closer look at the categories of releases and transfers shows that some types of releases, including fugitive air, stack air and transfers to Publicly Owned Treatment Works (POTWs) have declined (see Figures 1 and 2). Other categories of releases, including transfers for disposal, land releases, transfers for energy recovery, and transfers for recycling, have shown upward trends in recent years. There are a variety of possible reasons for changes in particular categories including, but not limited to:

- reductions in the use of toxic substances and the subsequent generation of toxic NPO; when a facility does not exceed a threshold for a chemical in a reporting year, it does not have to report any activities relevant to that chemical;

- ♦ the elimination of a process or the closure of a facility that used a reportable chemical;
- ♦ reporting by newly regulated facilities or of newly reportable chemicals at facilities that have been reporting in previous years;
- ♦ more stringent regulations in a particular media program, cross-media shifts (where pollutants are moved from one media to another by treatment or control activities);
- ♦ a change or clarification in the federal reporting requirements relevant to the reporting of releases or transfers to any media or waste management activity; and,
- ♦ changes in economic and /or production activities. It is likely that pollution prevention has played a significant role in this decline, especially considering that total statewide use (or throughput) has continued to increase in recent years. It is also likely that increases in economic production in New Jersey since 1995 have resulted in increases in the amount of NPO generated and in similar increases in quantities of environmental releases and off-site transfers.

Data Strengths and Limitations

These data are limited to covered chemicals as reported by covered industrial facilities, and thus do not include many parameters and sources important to the overall environmental quality in New Jersey. Additionally, the data are limited to the core chemicals only, i.e. those that were reportable in every year since 1998. Also, TRI and RPPR data are self-reported by the regulated facilities. New Jersey RPPR data are based on materials accounting, a method of comparing the inputs and outputs of a toxic substance to determine how much of the substance ended up in the product, was chemically consumed or became nonproduct output ("waste"). NJDEP staff annually review the data submitted for consistency, and, in the case of RPPR throughput data, perform mass balance calculations to assess the extent to which reported outputs correspond to reported inputs. However, unlike some regulatory programs, NJDEP does not routinely check actual facility measurements to verify their accuracy. Because inputs and outputs should balance (given some margin of error), materials accounting data provide a more comprehensive view of the chemical life cycle at a facility than the federal "release" data that are collected at the national level as part of TRI.

Discussion

The direct releases to the environment and the quantities of NPO reported as transferred off site under the TRI and RPPR reporting requirements have shown marked declines since 1988. Year-to-year comparisons of the on-site releases and off-site transfers are based on a consistent set of chemicals that have been reported for all years. The “core” chemicals are those that were reportable in every year of the federal TRI program. This normalization process produces quantities that will differ from those generated by analyses of any one year’s full data set. As a point of reference, Figures 1 and 2 present the percent value that the core chemicals represent of the total quantity reported in each year (see the value in parentheses below each year on the X axis). Remember that the reporting requirements have changed over the years including increasing stringent manufacture and

process thresholds from 1987 to 1989, additions and deletions of chemicals to the list of reportable substances, and clarifications to the reporting requirements. Yet, the observations indicate that the trends are in the right direction.

In addition to measuring trends in chemical use, releases, off-site transfers and total NPO, it is necessary to determine whether these trends are impacted by changes in economic activity. Several indicators presented in the remainder of this section will describe the potential impacts of such factors.

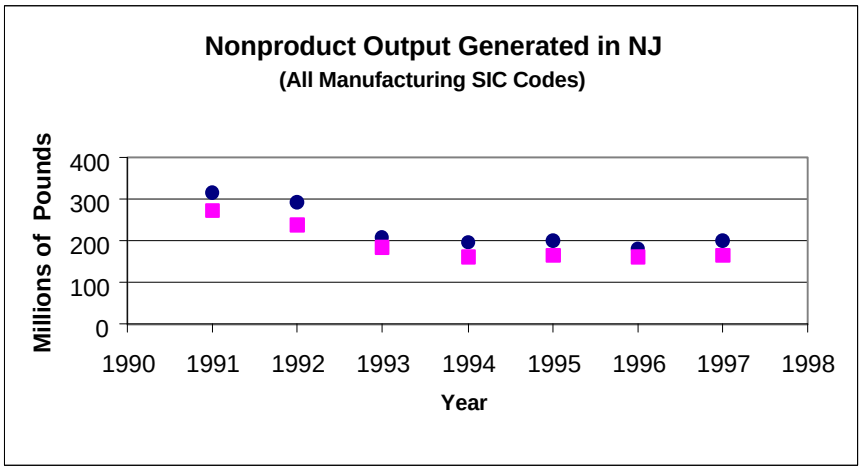
Milestone: By 2005, through pollution prevention techniques, industrial facilities will reduce the quantity of toxic chemicals generated as nonproduct output (production-related) waste by 50% from 1993 levels.

Indicator: Changes in Throughput/Chemical Use and Nonproduct Output on A Statewide Basis (CPM)

Type of Indicator: Cause

The quantity of nonproduct output (NPO) generated by New Jersey manufacturing facilities has shown a downward trend from 1991 to 1993, although the rate of decline has flattened since 1994 (see Figure 3). This trend is consistent with data reported for the overall quantity of total releases and transfers, reported in the previous indicator, which shows a similar decline over the same time period. It is likely that pollution prevention has played a significant role in this decline, especially considering that total statewide use (or throughput) has shown a slight increase in recent years (see Figures 4 and 5).

Figure 3



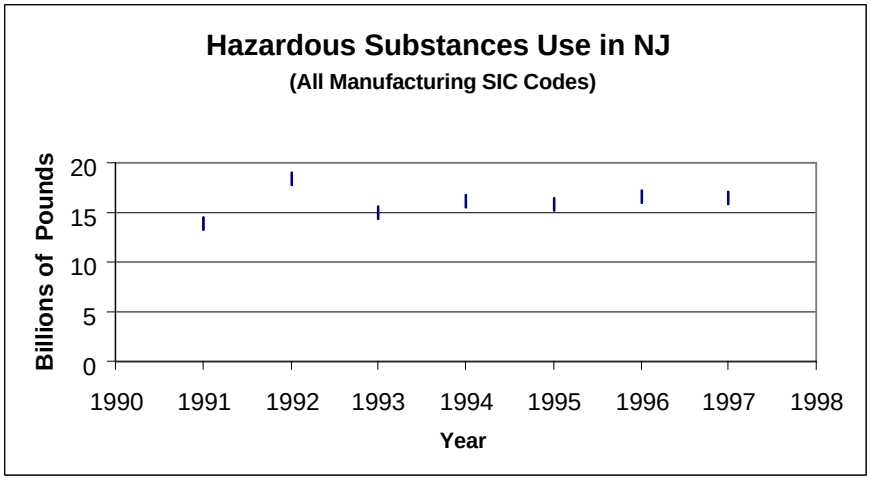
○ **All SIC codes / manufacturers in NJ**

□ **Big 5 SIC codes**

Data are for manufacturing facilities subject to Release and Pollution Prevention Reporting in NJ and represent the "core chemicals" (those hazardous substances that were reported every year over the time period analyzed).

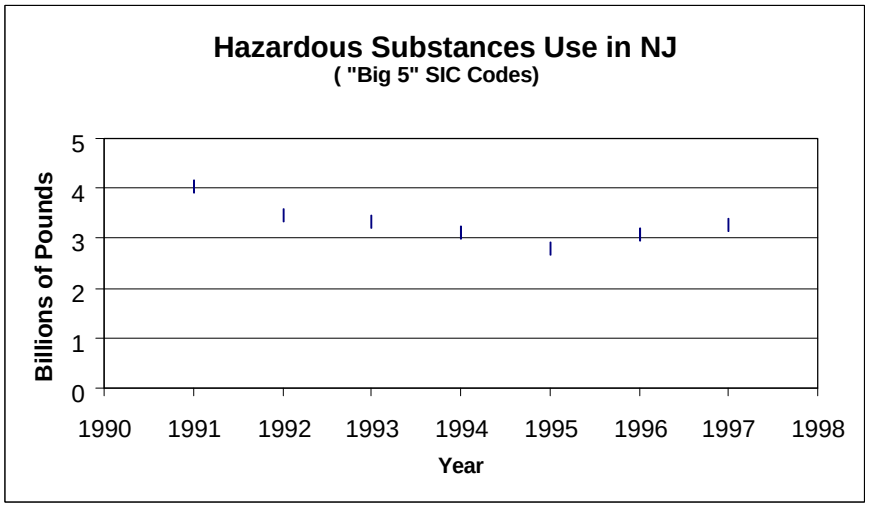
The "Big 5" refers to SIC codes 26, 28, 30, 33 & 34. This portion of the manufacturing sector generates 85% of statewide NPO in NJ.

Figure 4



Data are for all manufacturing facilities subject to Release and Pollution Prevention Reporting in NJ and represent the "core chemicals" (those hazardous substances that were reported every year over the time period analyzed).

Figure 5



Data are for the "Big 5" manufacturing facilities subject to Release and Pollution Prevention Reporting in NJ and represent the "core chemicals" (those hazardous substances that were reported every year over the time period analyzed).

The "Big 5" refers to SIC codes 26, 28, 30, 33 & 34. This portion of the manufacturing sector generates 85% of statewide NPO in NJ.

Data Description

These data are collected for approximately 600 facilities subject to Pollution Prevention Planning in New Jersey, which includes manufacturing facilities in Standard Industrial Classification codes 20-39 who use 10,000 pounds or more of any hazardous substance on the federal Toxic Chemical Release Inventory. The "Big 5" category of facilities refers to those covered facilities in SIC codes 26 (paper products), 28 (chemical and allied products), 30 (rubber and miscellaneous plastics), 33 (primary metals) and 34 (fabricated metals) who began Pollution Prevention Planning in 1993 and who account for approximately 85% of all NPO generated in New Jersey.

Data Characteristics

The data used for analysis were modified to remove hazardous substances that were added or deleted from TRI, during the period analyzed, so that the data set represents a consistent set of “core” chemicals. One data element (called "Energy Recovery") was also deleted from the NPO and use analyses because large errors in reporting are known to have occurred over the time period analyzed.

Data Strengths and Limitations

Facility level materials accounting data are collected in New Jersey through the submission of the Release and Pollution Prevention Report. Materials accounting data is a method of comparing the inputs and outputs of a hazardous substance to determine how much of the substance ended up in the product, was chemically consumed or became nonproduct output ("waste"). Because inputs and outputs need to balance, materials accounting data are more complete than "release" data that are collected at the national level, as part of TRI.

Discussion

From 1991 to 1993 there has been a downward trend in the quantities of NPO generated by the manufacturing sector (SIC codes 20-39) in New Jersey. The rate of decline has flattened since 1994. This trend has been mirrored by the “Big 5” facilities which account for approximately 85% of all NPO generated in New Jersey (see Figure 3). As expected, this trend is consistent with the decline in total releases and transfers discussed in the previous indicator. It is likely that pollution prevention has played a significant role in the decline of NPO, especially considering that total statewide use (or throughput) of hazardous substances for all New Jersey manufacturing facilities, as well as the “Big 5,” has shown a slight increase in recent years (see Figures 4 and 5).

As mentioned in the Throughput/Chemical Use & Economic Activity indicator, New Jersey is working to achieve a new milestone since the previous milestone was achieved around 1994. The new milestone sets an aggressive goal of 50% reduction in nonproduct output from New Jersey’s manufacturing sector compared to 1993 levels. Although minimal progress has been made toward this milestone, additional environmental

strategies may be required to achieve this goal. Many of the 600 manufacturing facilities covered under pollution prevention planning began a second five-year Pollution Prevention Planning cycle in 1998 and it is hoped that there will be statewide reductions associated with those efforts.

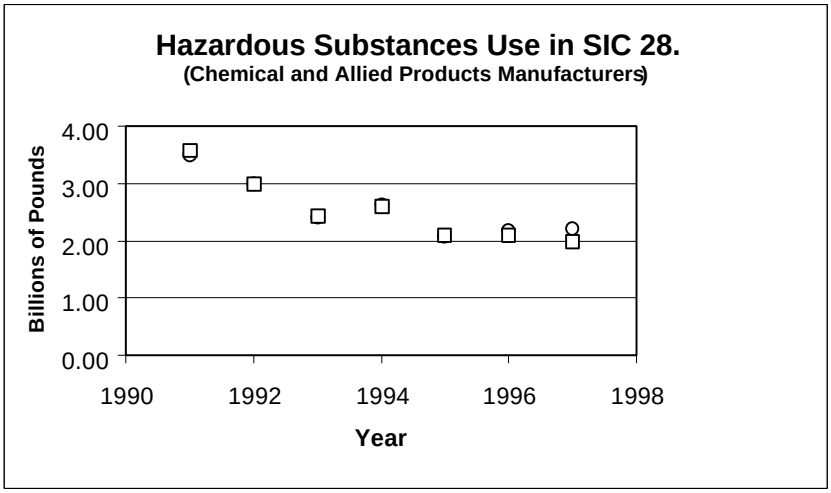
Milestone: By 2005, through pollution prevention techniques, industrial facilities will reduce the quantity of toxic chemicals generated as nonproduct output (production-related waste) by 50% from 1993 levels.

Indicator: Measures of Changes in Throughput/Chemical Use, Nonproduct Output & Releases of Hazardous Substances Resulting From Economic Activity Changes (CPM)

Type of Indicator: Cause

Between 1991 and 1997, the annual use of hazardous substances by the Chemical and Allied Products (SIC code 28) sector in New Jersey decreased by approximately 1.2 billion pounds (see Figure 6). Nonproduct output (NPO) for SIC code 28 decreased approximately 120 million pounds over the same time period (see Figure 7). After adjusting the figures for economic growth, using the Mid-Atlantic Manufacturing Index (MMI), the trend in the use of hazardous substances for SIC code 28 continues to show a slight decline, even in recent years when economic activity increased.

Figure 6



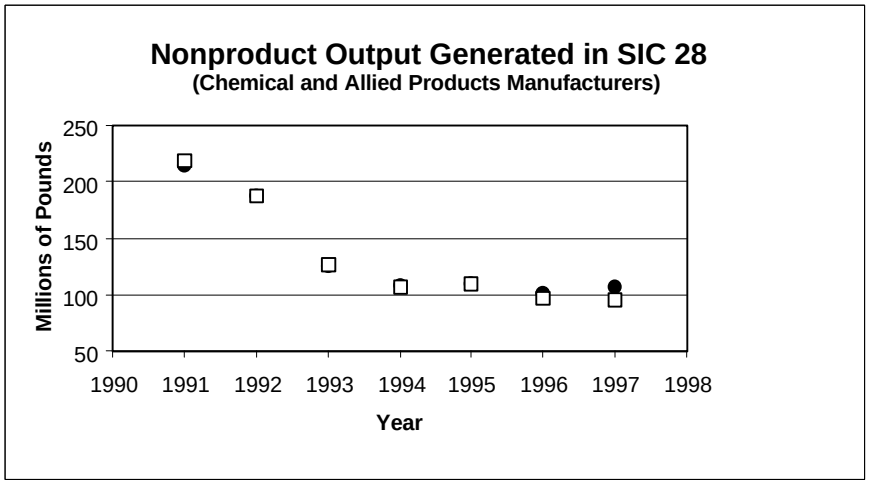
○ **Total Use**

□ **Total Use Corrected Using MMI**

Data are for SIC 28 facilities subject to Release and Pollution Prevention Reporting in NJ and represent the "core chemicals" (those hazardous substances that were reported every year over the time period analyzed).

The Mid-Atlantic Manufacturing Index (MMI) was used to correct for economic activity. The figures reported are the quantities of hazardous substance use that would be expected without any change in economic activity.

Figure 7



○ **Total NPO**

□ **Total NPO Corrected Using MMI**

Data are for SIC 28 facilities subject to Release and Pollution Prevention Reporting in NJ and represent the "core chemicals" (those hazardous substances that were reported every year over the time period analyzed).

The Mid-Atlantic Manufacturing Index (MMI) was used to correct for economic activity. The figures reported are the quantities of Nonproduct Output (NPO) that would be expected without any change in economic activity.

Data Description

The reasons for measuring NPO, use and releases are described above in the discussion sections of the previous two indicators. The "Big 5" SIC codes account for approximately 85% of all statewide NPO. Standard Industrial Classification code 28 was chosen for this indicator because a very large percent of the Big 5's NPO (approximately 90%) is generated in the chemical manufacturing sector and because the economic growth in this sector is similar to overall growth for all manufacturing sectors in New Jersey over this time period.

Nonproduct output quantities come from data submitted annually to NJDEP as part of Release and Pollution Prevention Reporting. Production factors, developed by the Federal Reserve Bank of Philadelphia as part of the Mid-Atlantic Manufacturing Index (MMI), were used to adjust these NPO quantities in order to account for economic activity.

Data Characteristics

The data used for this indicator are the same as the data used in the previous two indicators. The Mid-Atlantic Manufacturing Index measures economic productivity in the manufacturing sector in the Mid-Atlantic Region (defined here as Delaware, New

Jersey, New York and Pennsylvania). Production Indices are available for each manufacturing SIC Code 20-39.

Data Strengths and Limitations

It is important to use an economic indicator that measures economic effects in the manufacturing sector, since manufacturing is more sensitive to economic change than other parts of the economy. Other measurements, such as Gross State Product or Gross National Product, would not be as accurate in measuring production changes in the manufacturing sector. Although one does not exist at this time, a Manufacturing Index specific for New Jersey would provide for a more accurate picture of economic activity in the state.

Discussion

Increases in economic growth are expected to result in increases in the amount of hazardous substances used on a statewide basis, with concurrent increases in the amount of NPO generated and released to the environment, unless industrial facilities implement pollution prevention. To determine whether economic activity has had any measurable effect on pollution prevention progress in New Jersey, the quantities of hazardous substances used and generated as NPO in a single industrial sector, Chemicals and Allied Products (SIC Code 28), were examined with and without adjustment for production increases. Figures 6 & 7 indicate the quantities of hazardous substances used and generated as NPO (respectively) as well as the quantities that would be expected without any change in economic activity.

With the exception of the last few years, production changes do not appear to have had much of an effect on hazardous substance use and NPO generation. During 1996 and 1997, however, production has increased and this increase has had an impact on the quantity of hazardous substances used and NPO generated in New Jersey. It appears that the rate of economic growth for 1996 and 1997 has exceeded the rate of pollution prevention improvement, and may explain the increases in NPO, use and releases on a statewide basis (see Figures 1- 5). Without new environmental strategies, it is likely that these indicators will continue to increase as economic growth continues.

After reaching the previous milestone in approximately 1994, New Jersey has set a new milestone of 50% reduction in nonproduct output compared to 1993 levels. Many of the 600 manufacturing facilities covered under pollution prevention planning began a second five-year Pollution Prevention Planning cycle in 1998 and it is hoped that there will be statewide reductions associated with those efforts. Although progress has been made toward this milestone, additional environmental strategies may be required to achieve this goal.

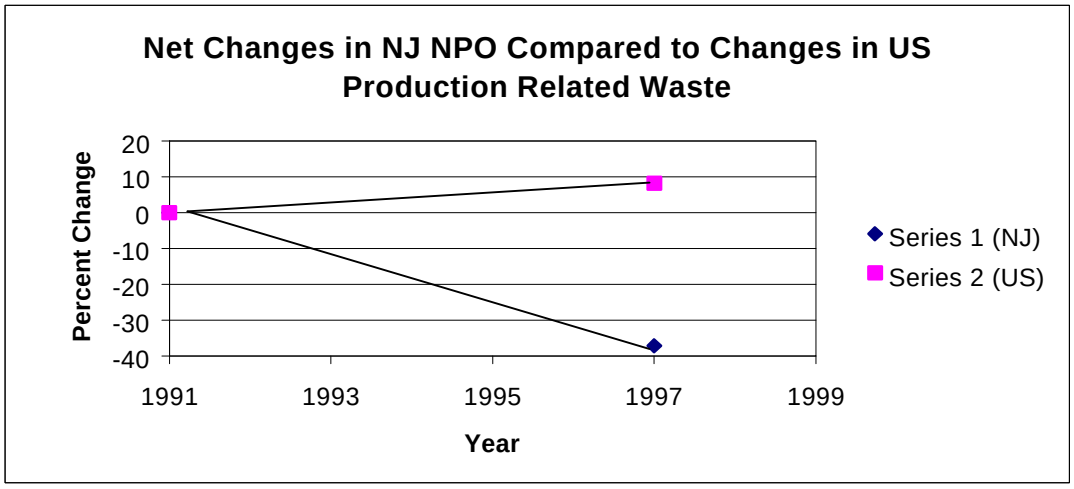
Milestone: By 2005, through pollution prevention techniques, industrial facilities will reduce the quantity of toxic chemicals generated as production-related waste by 50% from 1993 levels.

Indicator: Comparison of New Jersey Pollution Prevention Trends Compared to U.S. Pollution Prevention Trends.

Type of Indicator: Condition

In 1997, the amount of nonproduct output (NPO) generated in New Jersey decreased by 37.1% compared to 1991 figures. In contrast, "Production Related Waste", measured on the national level as part of the Toxic Chemical Release Inventory (TRI), increased by 8.3% over the same time period.

Figure 8



Data Description

As described in the discussion section of the previous three indicators, New Jersey uses NPO as a measure of pollution prevention progress. At the national level, EPA measures "production related waste" as part of the Toxic Chemical Release Inventory. These two measurements are very similar, so this indicator compares the changes in rates of NPO/production related waste over time. Series 1 represents the percent change in NPO in New Jersey from 1991 to 1997. Series 2 represents the percent change in Production Related Waste for the entire United States from 1991 to 1997.

Data Characteristics

For most facilities, the quantities of production related waste and NPO will be the same and these quantities are directly comparable. Because EPA uses slightly different definitions of what constitutes recycling, there could be slight differences in these quantities.

Data Strengths and Limitations

Data collected at both the state and federal level will include errors in reporting, especially since all of the data are self-reported by facilities. EPA has been improving its ability to identify major errors in reporting, and the data used in this indicator reflects some of these corrections.

Discussion

While the rates of change differ from year to year, this indicator clearly shows that the trend in United States NPO is increasing at the same time that NPO has shown a significant decrease in New Jersey. The decline in NPO in New Jersey represents major progress in pollution prevention compared to the United States and may be the result of materials accounting and pollution prevention rules that have been in place in New Jersey for the past ten years. Although the decline in New Jersey includes some decreases in NPO due to facility or process shutdowns as well as true pollution prevention activities, facilities in New Jersey have made significant accomplishments in pollution prevention, particularly in the chemical and allied products sector.