2011 Toxics Use Reduction Information Release

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Department of Environmental Protection

Developed in collaboration with:
Office of Technical Assistance and Technology
Toxics Use Reduction Institute

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Executive Summary

The Toxics Use Reduction Act (TURA) (Chapter 21I of the Massachusetts General Laws) was enacted in 1989 and amended in 2006 to protect public health and the environment by promoting the efficient use of toxic chemicals. The Act established incentives that encourage facilities to use toxic chemicals only when necessary to make a product and waste as little as possible in the production process. TURA has been successful. Massachusetts manufacturers and other businesses subject to the Act have dramatically reduced their reliance on toxic chemicals making Massachusetts a national leader in toxics use reduction. Through toxics use reduction, Massachusetts businesses have saved money while reducing pollution released to the environment, chemical transportation risks, workplace hazards, and toxics in products and waste.

TURA requires companies in specific industrial sectors[1] that employ the equivalent of 10 or more full-time employees to file annual reports with the Massachusetts Department of Environmental Protection (MassDEP) on the use of certain toxic chemicals in their manufacturing processes. These facilities pay an annual toxics chemical fee, and, every other year prepare "Toxic Use Reduction Plans" that evaluate whether there are cost effective ways to minimize the use or waste (and release to the environment as pollution) of those chemicals. Through this law many companies have reduced their use of those toxic chemicals, or stopped using them altogether. This report summarizes the reports filed by manufacturers and other businesses in 2011 that covered toxic use in calendar year 2011.

482 facilities reported using 138 different listed toxic substances in 2011. In total (including trade secret data), the facilities reported that in 2011:

- 952 million pounds of toxic substances were used in production, a decrease from 955 million pounds in 2010,
- 83 million pounds of the toxic substances used in production were "generated as byproduct" (wasted: neither chemically converted to nor incorporated into a product), a decrease from 84 million pounds in 2010,
- 347 million pounds of the toxic substances used in production were shipped in or as products, up from 334 million pounds in 2010,
- 4 million pounds of toxics substances generated as byproduct were released to the environment as pollution from the facility, a decrease from 5 million pounds in 2010, and
- 29 million pounds of toxic substances generated as byproduct were transferred off-site for further waste management, a 5 million pound decrease from 2010.

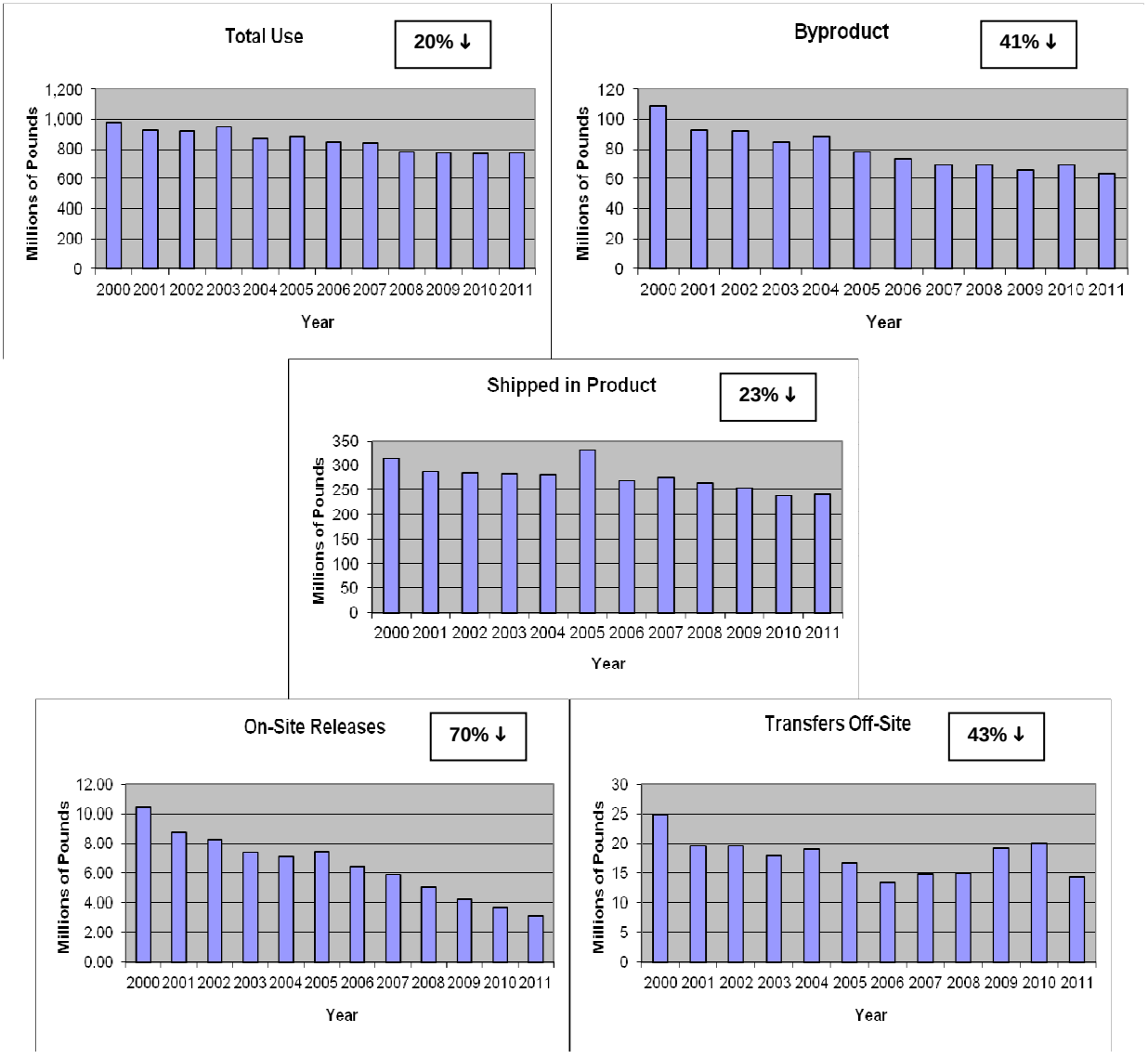
The original goal of the Act was to achieve a 50% reduction in the amount of byproduct generation by 1997. This goal was met, and progress has continued, as reflected by the data reported by the 2000 Core Group -- the industrial sectors and chemicals that have been covered by the Act since 2000 -- normalized for production levels. These two adjustments are made to the raw data to ensure that the analysis reflects actual changes in the way chemicals are used in production processes rather than changes in the amount of products produced or which types of facilities and chemicals are included in the reporting requirements.

As shown in Figure 1 below, between 2000 and 2011 when adjusted for the reported 21% decrease in production, 2000 Core Group facilities reduced:

- toxic chemical use by 20%,
- toxic byproducts by 41%,
- toxics shipped in product by 23%,
- on-site releases of toxics to the environment by 70%, and
- transfers of toxics off-site for further waste management by 43%.

[1] Manufacturing Standard Industrial Classification (SIC) codes (20-39 inclusive) and those in SIC codes 10-14, 40, 44-51, 72, 73, 75 and 76, or the corresponding NAICS code

Figure 1 – 2000 Core Group Toxics Use Reduction Progress from 2000 to 2011
(adjusted for changes in production levels and excluding trade secret data)[2]



[2] Facility-specific data for the Core Group is shared among TURA program agencies; therefore, trade secret data, which can only be viewed by authorized MassDEP staff, is excluded to protect its confidentiality.

I. Introduction

This report describes toxic chemical use in Massachusetts in 2011 and progress in toxics use reduction under the Toxics Use Reduction Act (TURA). TURA was enacted in 1989 in order to reduce the risks to the public, workers, and the environment from exposure to toxic chemicals. Rather than taking the then traditional "command and control" approach to pollution control and worker health and safety, TURA created incentives for Massachusetts companies to reduce the amount of toxics used and wasted in their production processes. TURA requires Large Quantity Toxics Users (LQTUs) to submit annual reports to Massachusetts Department of Environmental Protection (MassDEP). These reports detail the quantity of the listed chemicals they use, ship in product, "generate as byproduct" (waste -- neither ship in product nor convert to another chemical during the production process), release to the environment as pollution, and ship offsite for waste treatment and disposal. Companies are LQTUs if they meet the following criteria:

- fall within Manufacturing Standard Industrial Classification (SIC) codes (20-39 inclusive) and those in SIC codes 10-14, 40, 44-51, 72, 73, 75 and 76, or the corresponding NAICS code,
- have ten or more full-time employee equivalents, and
- use listed toxic substances at or above reporting thresholds

LQTUs are also required to pay an annual fee based on the number of chemicals they use and the number of workers they employ, and must develop biennial toxics use reduction (TUR) plans. TUR Plans identify techniques that the company could adopt that could reduce the use and waste of toxic chemicals in their production processes and evaluate which of these TUR techniques would save the facility money if implemented. Although these plans are not submitted to MassDEP for review and approval, they must be approved by a MassDEP-certified toxics use reduction planner. After several toxics use reduction planning efforts, companies have the option of developing reduction plans for energy use, water use, solid waste disposal or use of other chemicals instead of for their toxic chemical use.

TURA also promotes toxics use reduction through the establishment of two agencies that provide toxics use reduction education and assistance:

- The Office of Technical Assistance and Technology (OTA) provides non-regulatory technical assistance to facilities seeking to reduce the use of toxics, develops fact sheets and other technical guidance documents, supports the development of technology solutions by leveraging state and federal funding, and creates market-based incentives to reduce toxics use for qualifying TURA filers.
- The Toxics Use Reduction Institute (TURI) at the University of Massachusetts, Lowell provides toxics use reduction education, training, and library services; supports research on cleaner materials and processes; and operates a laboratory for testing non-toxic or less-toxic cleaning alternatives. TURI also makes TURA data available on its website - http://turadata.turi.org/ in a user-friendly way that is searchable by community, chemical or company.

The work of MassDEP, OTA and TURI is supported by the fees paid by the LQTUs and coordinated by the Toxics Use Reduction Administrative Council. The Council is a governing body consisting of the Secretaries of Energy and Environmental Affairs, Economic Development, and Public Safety, the Commissioners of MassDEP and the Department of Public Health, and the Director of Labor and Workforce Development, and chaired by the Secretary of Energy and Environmental Affairs.

For more information about the TURA program, please visit the following web sites:

- Massachusetts Department of Environmental Protection Toxics Use Reduction Program: www.mass.gov/dep/toxics/toxicsus.htm
- Office of Technical Assistance and Technology: www.mass.gov/envir/ota
- Toxics Use Reduction Institute: www.turi.org

This document is organized into six sections.

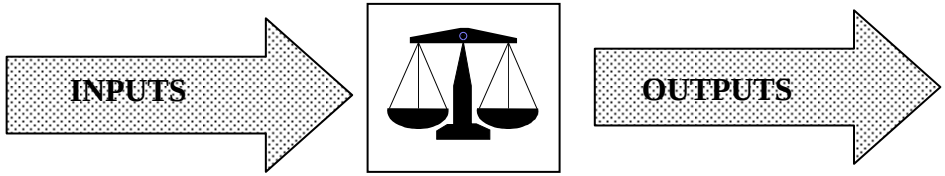
* **Key TURA Terms** explains important TURA terms and concepts
* **Toxics Use Reduction Progress 2000 - 2011** describes changes in toxic chemical use over the stated time period and documents progress toward the Act's overall toxic use reduction goal
* **2011 Chemical Data** summarizes the reported information on chemical use in calendar year 2011 including detailed information on the top twenty chemicals used, generated as byproduct, shipped in product, released onsite as air or water pollution onsite, and shipped offsite for treatment and disposal.
* **Chemicals of Particular Concern** presents current and historical information on particularly toxic chemicals, on chemicals that promote asthma, and on carcinogens
* **2011 Significant Industrial Sectors** describes the relative contributions of different industrial sectors to chemical use, waste and release
* **2011 Major TURA Facilities** presents the top 20 facilities for use, byproduct generation, shipped in product, released to the environment and shipped offsite for treatment and disposal

This 2011 Toxics Use Reduction Information Release contains chemical information useful to the public, government, and industry. However, because the data in this report are collected only from facilities within certain industrial sectors that have ten or more full-time employees and that use certain chemicals above established reporting thresholds, this report does not provide a complete picture of the use and release of all chemicals in Massachusetts.

II. Key TURA Terms

TURA – Massachusetts Toxics Use Reduction Act of 1989 (MGL 21I)
TRI – federal EPA Toxics Release Inventory
TRADE SECRET – the information identified as confidential by TURA filers. To protect confidentiality claims by Trade Secret filers, all trade secret data in this information release are presented in aggregated form. Aggregated data do not include the names and amounts of chemicals subject to claims of confidentiality.
2000 CORE GROUP – includes all industry categories and chemicals that were subject to TURA reporting in 2000 and remained subject to reporting in 2011 at the same reporting threshold. The 2000 Core Group is used to measure progress from 2000 to 2011.

The terms and definitions below have been arranged in order of inputs and outputs. Chemicals that are used by companies are brought into the facility and are manufactured, processed or otherwise used. As a result of using these chemicals, a company has outputs that can include a product that is created for sale, or a waste ("byproduct" as defined by TURA). The calculation of use and waste of chemicals is known as 'mass balance.' Generally the inputs equal the outputs, but there are some circumstances in which there is an imbalance between inputs and outputs. These most often the result of: 1) chemicals being recycled on-site, 2) the product being held in inventory, 3) chemicals being consumed or transformed into another chemical during the production process, or 4) the chemical is a metal in a compound as a result use is calculated differently than byproduct. For metal compounds, use is calculated as the total amount of the compound while byproduct is calculated as only the amount of the parent metal in the compound.



TOTAL USE – the total quantity in pounds of TURA chemicals reported as manufactured, processed and otherwise used.

MANUFACTURE – to produce, prepare, import or compound a toxic or hazardous substance. Manufacture shall also mean to produce a toxic or hazardous substance coincidentally during the manufacture, processing, use, or disposal of another substance or mixture or substances, including a toxic substance that remains in that other substance or mixture of substances as an impurity

PROCESS – the preparation of a toxic or hazardous substance, after its manufacture, for distribution in commerce: (a) in the same form or physical state, or in a different form or physical state from that in which it was received by the toxics user so preparing such substance; or (b) as a part of an article contain the toxic or hazardous substance

OTHERWISE USE – any use of a toxic substance that is not covered by the terms "manufacture" or "process" and includes use of a toxic substance contained in a mixture or trade name product.

PRODUCT – a product, a family of products, an intermediate product, family of intermediate products, or a desired result or a family of results. "Product" also means a byproduct that is used as a raw material without treatment.

SHIPPED IN PRODUCT – the quantity in pounds of the chemical that leaves the facility as product.

BYPRODUCT – all non-product outputs of reportable substances generated by a production unit prior to handling, treatment, and release.

III. Toxics Use Reduction Progress 2000-2011

In order to protect the environment, public and workers from the adverse effects of toxic chemicals, the Toxics Use Reduction Act (TURA) established incentives that encourage facilities to implement toxics use reduction techniques that result in:

1) the use of toxic chemicals only when necessary to make a product, and
2) the smallest possible amount of toxic chemicals are wasted in the production process.

TURA has been a resounding success. The Act's initial goal of a 50% reduction in the quantity of toxic chemicals "generated as byproduct" (wasted – neither shipped in product nor converted into another chemical during production) had been met by 1998, and the program has continued to make progress in toxics use reduction in the ensuing years. This section of the report describes the trends in absolute chemical use by Large Quantity Toxics Users (LQTUs) as well as their progress in implementing toxics use reduction.

Trends in the Numbers of Filers and Reported Chemical Use, Byproduct, On-site Releases, and Transfers Off-Site for Treatment or Disposal

As shown in Figures 2 and 3, the number of different TURA-listed chemicals used in the Commonwealth at reportable levels, the number of facilities using those chemicals, the number of chemicals used by those facilities, and the total amount of those chemicals used, generated as byproduct, released to the environment, and shipped offsite for treatment and disposal has continued to decline in the ten years since 2000.

Figure 2 – TURA Filer Trends 2000-2011

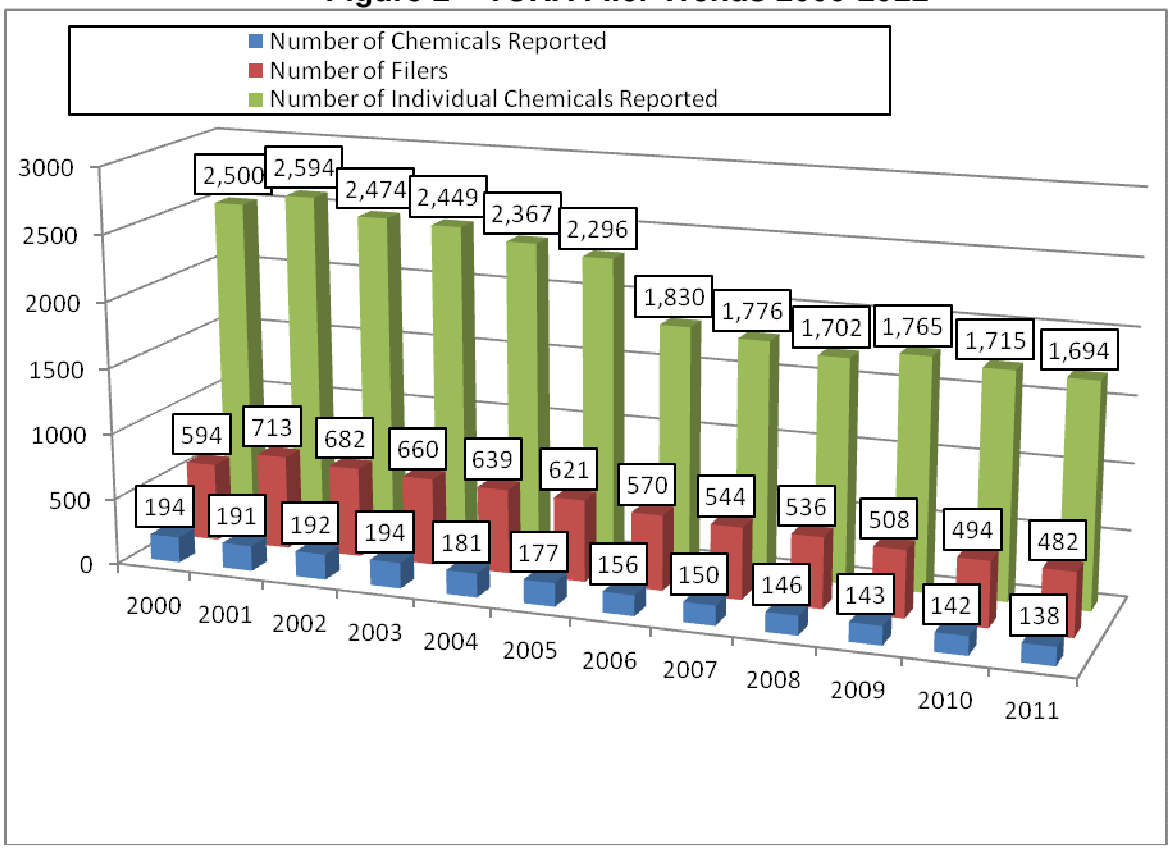
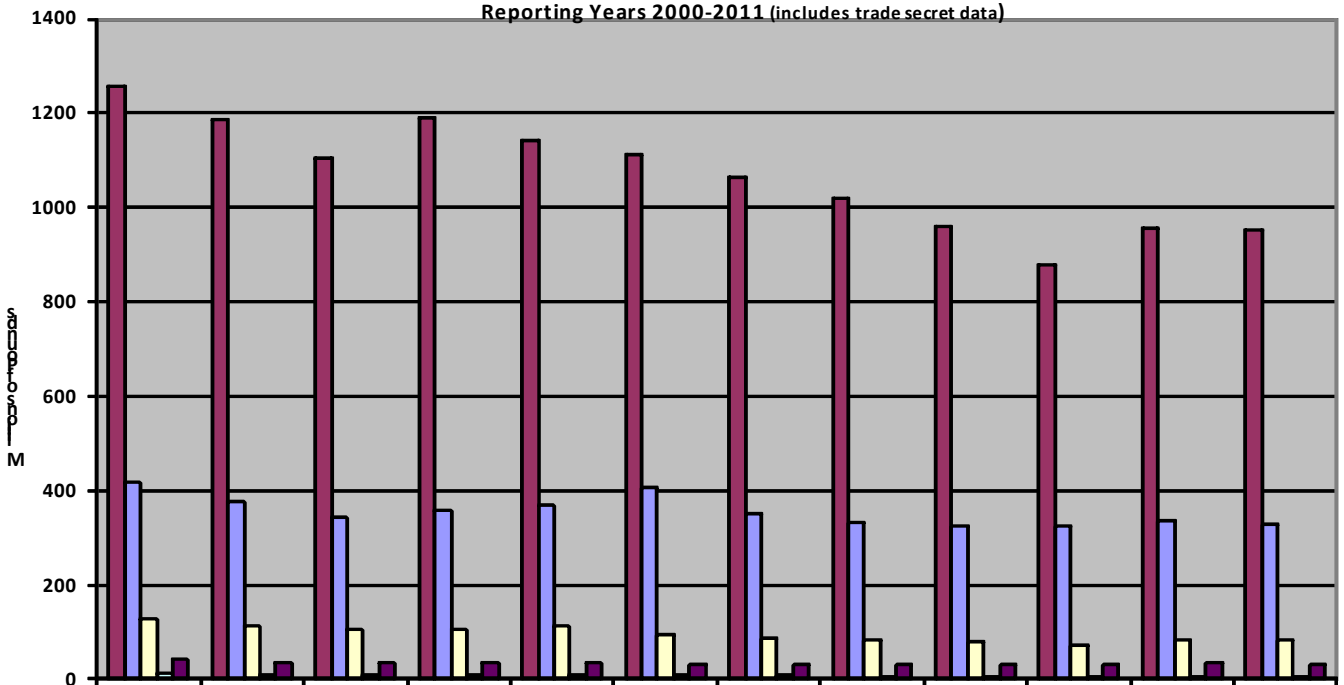


Figure 3 -- Raw Reported Data on the Pounds of Total Use, Shipped in or as Product, Generated as Byproduct, Released On-site* and Transferred Off-Site for Treatment or Disposal
Reporting Years 2000-2011 (includes trade secret data)



	RY 2000	RY 2001	RY 2002	RY 2003	RY 2004	RY 2005	RY 2006	RY 2007	RY 2008	RY 2009	RY 2010	RY 2011
TOTAL USE	1,256,935,978	1,185,864,429	1,107,027,759	1,190,332,285	1,140,660,038	1,111,805,706	1,063,355,960	1,018,076,714	959,096,601	879,404,540	955,704,746	951,966,843
SHIPPED IN PRODUCT	415,995,939	375,588,884	344,146,716	358,143,385	369,302,787	408,070,058	349,926,518	330,987,562	323,680,498	323,179,828	333,886,889	328,146,630
BYPRODUCT	128,205,288	113,034,603	106,736,933	106,664,728	111,005,739	94,013,333	87,838,862	82,301,272	78,625,813	71,589,095	84,532,695	82,745,613
ON-SITE RELEASES	10,915,556	8,929,289	7,869,483	8,985,558	8,653,909	8,599,216	7,220,038	6,447,089	5,484,492	4,590,557	4,527,453	3,719,817
TRANSFERS OFF-SITE	42,101,761	35,604,743	34,367,764	34,460,582	34,426,299	31,735,461	30,410,889	30,303,098	29,964,700	30,140,800	33,829,449	29,461,142

* On-site releases are predominantly air emissions, but can also include on-site disposal or discharge, and in rare cases, spills.

As was shown in Figure 2, out of 1,416 chemicals listed under TURA, 138 were reported in 2011, down from 194 in 2000. From 2000 to 2001, the number of facilities reporting under TURA rose to 713, largely due to the promulgation of a lower reporting threshold for lead and for lead compounds. The number of LQTUs has since declined to 482 in 2011. The number of individual chemicals reports submitted (facilities file one Form S for each chemical reported) has followed a similar trend, decreasing from a high of 2,594 in 2001, to 1,694 in 2011, consistent with the decline in the number of TURA filers.

The reduction in reported chemical use is attributable to a combination of factors. These include reduced chemical use through toxics use reduction, 2006 statutory and other regulatory changes to TURA reporting requirements which eliminated certain chemicals and industrial sectors, reduced production levels due to economic conditions, and facilities closing. In 2011 for example, 34 facilities left and 22 facilities entered the TURA reporting universe, for a net decrease of 12 facilities. The reasons for 34 facilities not reporting in 2011 were:

- 3 closed, down from 17 closures in 2010
- 11 reduced use below the reporting threshold
- 1 reduced staffing below the FTE threshold
- 19 are being investigated for potential enforcement for failure to report.

Measuring Progress in Toxics Use Reduction: Adjusting the Reported Data for Consistent Year to Year Comparisons:

While the raw reported data paints an overall picture of toxic chemical use and waste in the Commonwealth, it cannot be used to track progress in toxics use reduction. Because the types of facilities and the list of chemicals and chemical reporting thresholds change over time, progress in toxics use reduction is best measured by using a consistent set of chemicals and industries – a core group -- subject to reporting. Without the use of a core group, changes in chemical use, byproducts, releases and shipments for treatment and disposal could be due to changes in the reporting requirements, rather than changes in the efficiency with which chemicals are used.

The "2000 Core Group" is made up of chemicals and industrial categories that were subject to reporting in 2000 and that remain subject to reporting, at the same reporting thresholds in 2011.[3] The 2000 Core Group covered 100% of the reported data in 2000. It currently covers 86% of the total 755 million pounds of toxic chemicals reported in 2011 (excluding trade secret data).

Raw reported data also needs to be adjusted to account for changes in production levels. Because chemical use and byproduct generation generally increase as more products are produced, it is possible for a facility

[3] The 2000 Core Group includes all industry sectors except for 1) uses related to the combustion of fuel for heat and power at facilities whose primary business is NOT power generation (excluded as of 2006 reports by the 2006 TURA Amendments); 2) municipal waste combustor combustion-related emissions (first reportable in 2003). The Core Group includes the use of all chemicals except: 1) Respirable Crystalline Silica (first reportable in 2001); 2) N-Propyl Bromide (first reportable in 2011); 3) Lead and Lead Compounds due only to the lower 100-pound thresholds for Lead and Lead Compounds (that took effect in 2001);4) the use of higher hazard substances due only to the lower 1,000-pound threshold (Trichloroethylene, Cadmium, Cadmium Compounds, Tetrachloroethylene); 5) Adipic Acid, Ammonium Bicarbonate, Ammonium Chloride, Ammonium Sulfamate, Amyl Acetate, Fumaric Acid, and Maleic Acid (all no longer reportable, effective reporting year 2010); 6) the use of the CERCLA chemicals delisted as of 2010 reports per the 2006 TURA Amendments; 7) the use of any chemical covered by a trade secret claim because the Core Group Analysis is developed by TURI, and trade secret data cannot be shared outside of the MassDEP TURA program.

Nitrate Compounds were excluded from the 2000 Core Group because some facilities appeared to change the methods used to calculate the amount coincidentally manufactured and the amount generated as byproduct from one year to the next. The differences were large enough to skew the data. The program is working to resolve this problem going forward.

Facility-specific data for the Core Group is shared among TURA program agencies; therefore, trade secret data, which can only be viewed by authorized MassDEP staff, is excluded to protect its confidentiality

to report increases in use and byproduct while simultaneously implementing toxic use reduction. LQTUs are required to report the ratio of their production levels in the reporting year to their production levels in the prior year. The reported production ratios are used to normalize the data to eliminate the effects of changes in chemical use and waste that are due solely to changes in the amount of product produced.

The following example illustrates how data are adjusted to reflect changes in production.

ADJUSTING RAW DATA FOR YEAR TO YEAR CHANGES IN PRODUCTION

- In year 1, a facility produces 1,000 machine parts, and generates 100 lbs. of byproduct.
- In year 2, the facility produces 10% fewer machine parts (900). Therefore, the production ratio is 0.90. However, the facility only generates 80 lbs. of byproduct.
- The production adjusted byproduct for year 2 is 80 lbs/0.90 = 89 lbs.
- The production adjusted percent change from year 1 to year 2 is [100-89]/100 = 0.11, or an 11% reduction, while its actual byproduct reduction is 20%.

Progress in Toxics Use Reduction: 2000 Core Group Adjusted for Production

Table 1 below summarizes TURA data from 2000 to 2011, showing reported and production adjusted quantities. For the 2000 Core Group, the activity index shows a decrease in production of 21 percent from 2000 to 2011. As shown below in Table 1 and Figure 4, when adjusted for production, as of 2011, the 2000 Core Group facilities have reduced**:**

- toxic chemical use by 20%,
- toxic byproducts by 41%,
- toxics shipped in product by 23%,
- on-site releases of toxics to the environment by 70%, and
- transfers of toxics off-site for further waste management by 43%.

2000 Core Group Progress without Adjusting for Production

The actual quantities reported by the 2000 Core Group over the period 2000 to 2011 are shown in Figure 5. These quantities have not been adjusted for changes in production. From 2000 to 2011, Core Group facilities reduced:

- toxic chemical use by 37% (from 977 million to 618 million pounds between 2000 and 2011),
- toxic byproducts by 53% (from 109 million to 51 million pounds between 2000 and 2011),
- toxics shipped in product by 39% (from 314 million to 192 million pounds between 2000 and 2011),
- on-site releases of toxics to the environment by 76% (from 10 million to 2 million pounds between 2000 and 2011), and
- transfers of toxics off-site for further waste management by 55% (from 25 to 11 million pounds between 2000 and 2011).

Table 1
2000 CORE GROUP DATA: 2000 - 2011 TREND SUMMARY
(Quantities are in millions of pounds and do not include trade secret quantities.
Shaded columns show quantities adjusted by cumulative production ratio)

	Total Use		Byproduct		Shipped in Product		On-Site Releases		Transfers Off-Site		Production Ratio	
											Year to Year	Cumulative from 2000
2000	976.56	976.56	109.08	109.08	314.03	314.03	10.45	10.45	24.90	24.90		
2001	900.14	927.98	89.88	92.66	278.04	286.64	8.46	8.72	19.04	19.63	0.97	0.97
2002	822.46	921.63	82.40	92.34	252.63	283.09	7.41	8.30	17.42	19.52	0.92	0.89
2003	855.01	948.62	75.94	84.25	254.14	281.96	6.68	7.41	16.10	17.86	1.01	0.90
2004	780.17	874.33	78.61	88.10	250.40	280.62	6.33	7.09	16.93	18.97	0.99	0.89
2005	748.27	882.71	66.55	78.51	280.58	330.99	6.33	7.47	14.20	16.75	0.95	0.85
2006	717.70	846.65	62.37	73.58	228.59	269.66	5.47	6.45	11.36	13.40	1.00	0.85
2007	674.94	838.11	55.99	69.53	221.82	275.45	4.73	5.87	12.01	14.91	0.95	0.81
2008	620.34	786.03	54.76	69.39	209.04	264.87	3.98	5.04	11.85	15.02	0.98	0.79
2009	602.92	779.55	51.16	66.15	196.70	254.32	3.24	4.19	14.85	19.20	0.98	0.77
2010	644.57	771.67	58.06	69.51	198.39	237.51	3.09	3.70	16.72	20.02	1.08	0.84
2011	617.59	778.28	50.84	64.07	192.16	242.16	2.48	3.13	11.29	14.23	0.95	0.79
Percent Change 2000-2011	37% Reduction	20% Reduction	53% Reduction	41% Reduction	39% Reduction	23% Reduction	76% Reduction	70% Reduction	55% Reduction	43% Reduction		21% Decrease

Figure 4 – 2000 Core Group Toxics Use Reduction Progress from 2000 to 2011 (Production Adjusted)

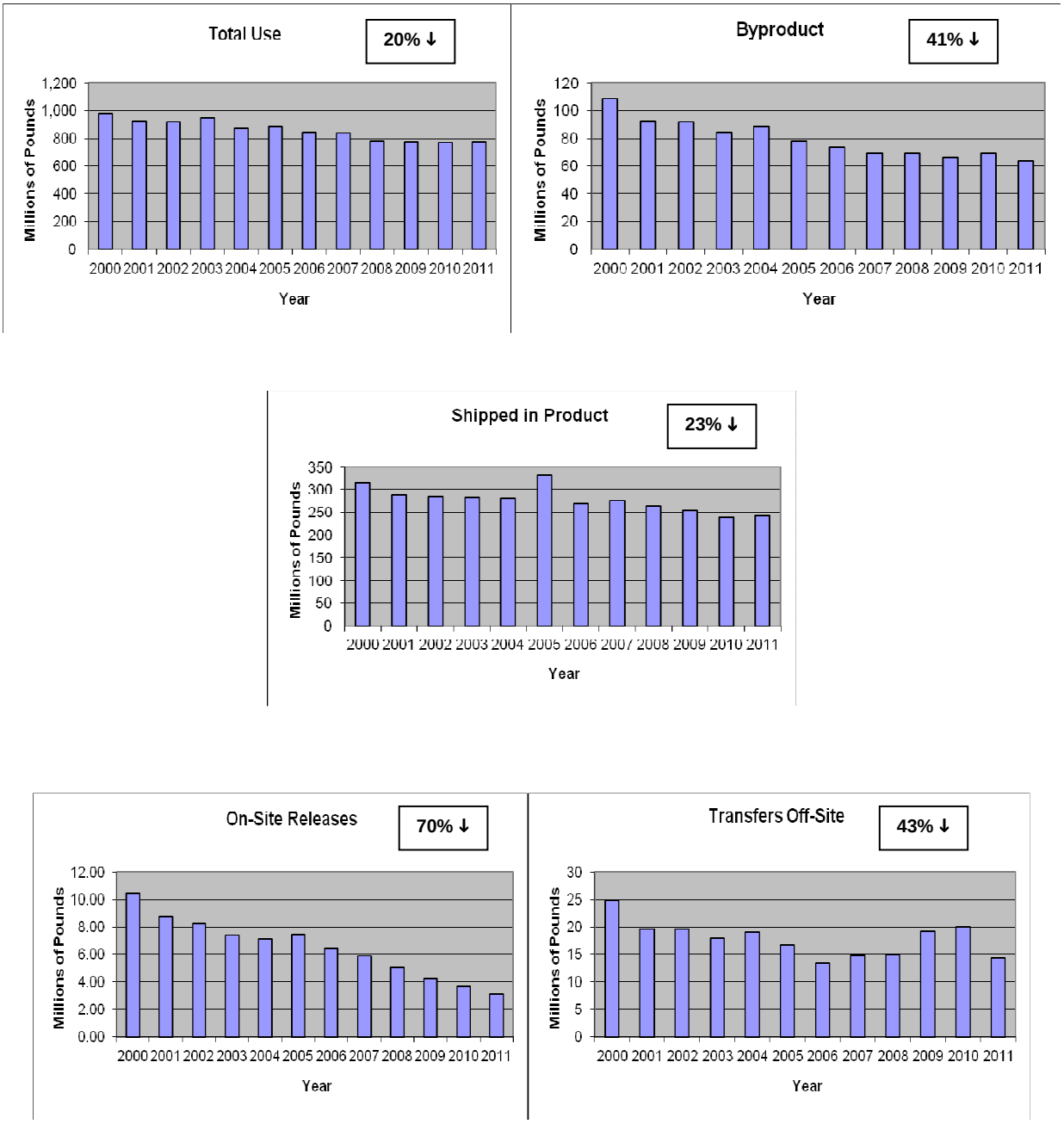
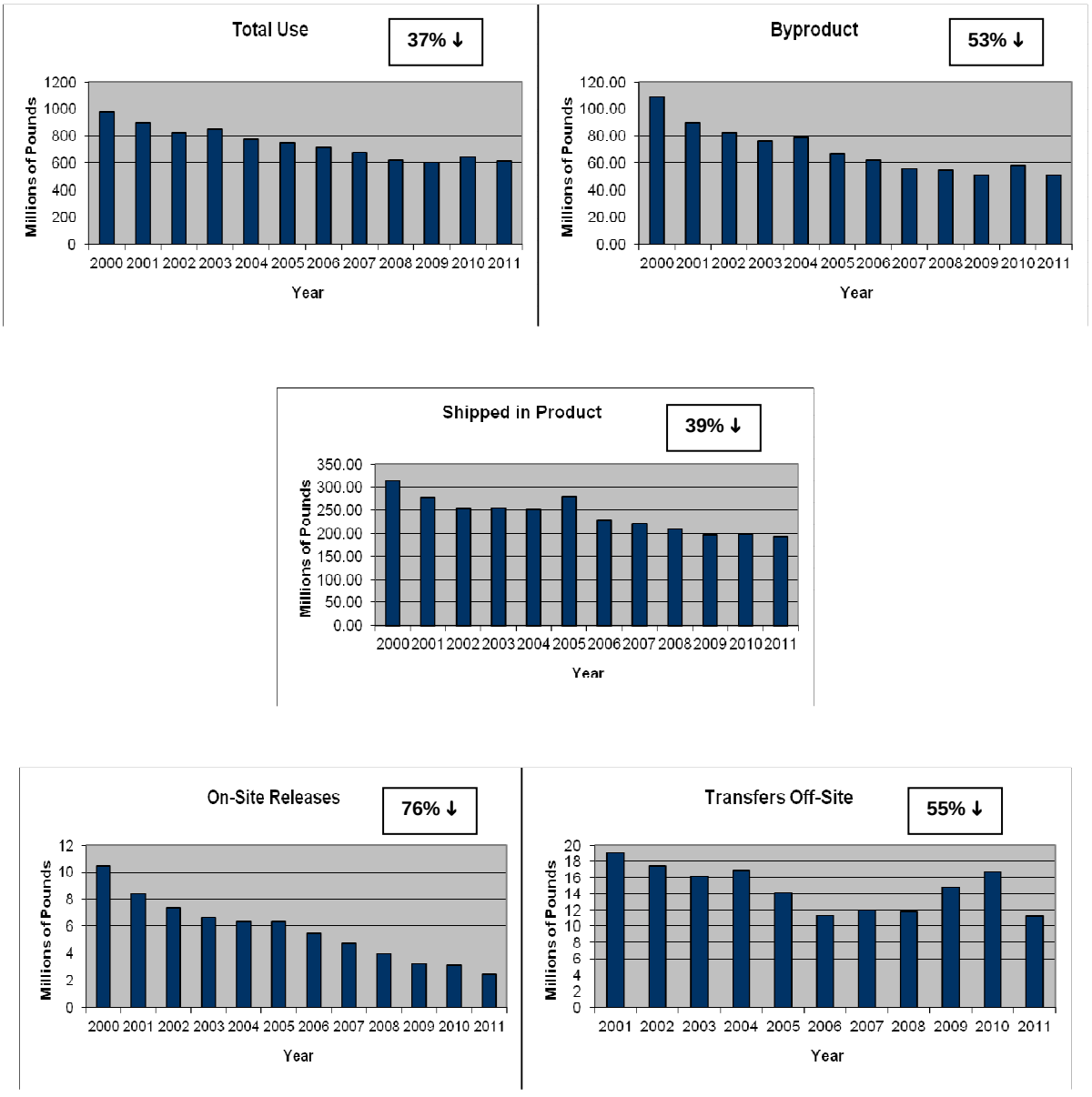


Figure 5 – 2000 Core Group Toxics Use Reduction Progress from 2000 to 2011 (Not Production Adjusted)



III. 2011 TURA Chemical Data

Table 2 summarizes the 2011 data for all TURA filers, including trade secret data, rounded to the nearest million pounds. These LQTUs reported using 952 million pounds of chemicals and generating 83 million pounds of byproduct.

Table 2 - 2011 Data for All TURA Filers (in pounds; includes trade secret data)		
Total Use	952,000,000	
Generated as Byproduct	83,000,000	• 9% of total chemical use
Shipped in Product	347,000,000	• 36% of total chemical use • the remaining 55% of total use is "consumed" or transformed into another chemical in the production process
On-Site Releases (to air or water)	4,000,000	• 0.4% of total chemical use • 5% of total byproduct • the remaining 95% of byproduct was destroyed through treatment on-site (54%) or shipped off-site for treatment or disposal (see below)
Transfers Off-Site for treatment or disposal	29,000,000	• 3% of total chemical use • 35% of total byproduct

Trade Secret

Under certain circumstances facilities have the right to claim that the amount of chemical they use and generate as byproduct is a trade secret. As long as the regulatory standards for making such a claim are met, MassDEP may not share that information, or information that could be used to back calculate trade secret reports. In 2011seven companies made trade secret claims on a combined total of:

- 230 million pounds of chemical use
- 13 million pounds of byproduct generation
- 86 million pounds shipped in product.

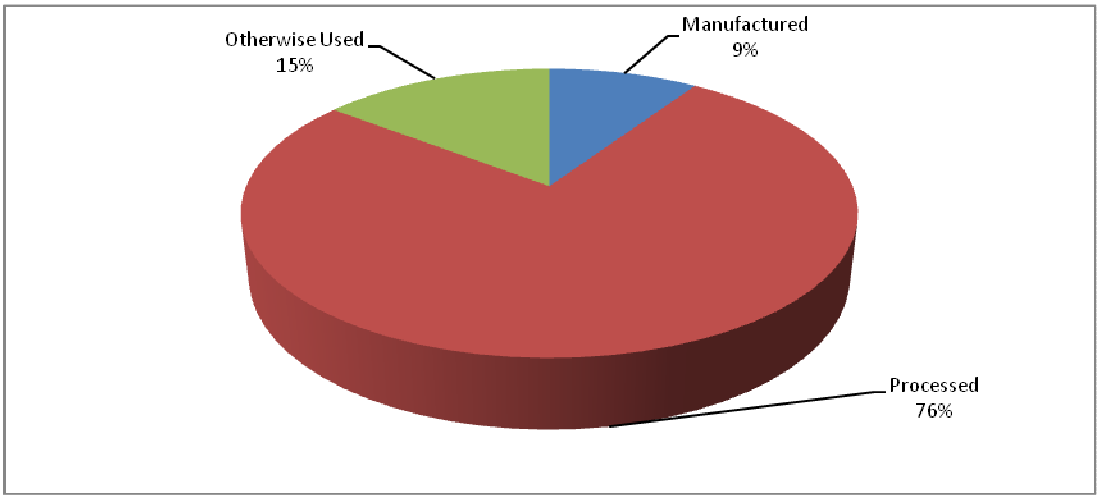
This use and byproduct resulted in a combined total of:

- 303,000 pounds of onsite releases
- 9.5 million pounds of transfers off –site.

Chemical Use by Use Category

The 952 million pounds of chemical use is reported in three categories: manufactured, processed, or otherwise used. When total use is broken down by type of use (i.e., manufactured, processed, or otherwise used), trade secret data are not included in order to product the confidentiality of trade secret claims. Thus, the total use in Figure 6 is 742 million pounds, rather than 952 million pounds (which includes trade secret data).

Figure 6 – 2011 Chemical Use (does not include trade secret data)



Total 2011 Use = 742 million pounds
(excluding trade secret data)

Manufactured Chemicals

The Toxics Use Reduction Act (TURA) defines "manufacturing" as: "to produce, prepare, import or compound a toxic or hazardous substance" e.g., intentional manufacture of a chemical substance such as formaldehyde or the "coincidental" (unintentional) manufacture of acid gases such as hydrochloric acid during combustion of fossil fuels.

Figure 6 shows that relatively little manufacturing of TURA chemicals occurs in Massachusetts. Chemicals reported as "manufactured" accounted for 9% (70 million pounds) of the total use statewide. A significant amount of these chemicals are coincidentally manufactured as a result of some other activity rather than manufactured intentionally. Examples include the creation of sulfuric acid from fuel combustion for power generation and the production of nitrate compounds as a result of using nitric acid to treat wastewater.

Processed Chemicals

TURA defines "processing" as: "the preparation of a toxic or hazardous substance, including without limitation, a toxic substance contained in a mixture or trade name product, after its manufacture, for distribution in commerce" e.g., toxic chemicals added to the formulation of paints or coatings or conversion of styrene monomer to polystyrene to create plastic products.

Most chemical use in Massachusetts is processed. At 565 million pounds, it accounted for 76% of total 2011 chemical use. Styrene monomer accounted for 38% (282 million pounds) of the total amount of chemicals processed.

Otherwise Used Chemicals

TURA defines "otherwise use" as: "any use of a toxic substance that is not covered by the terms "manufacture" or "process" and includes use of a toxic substance contained in a mixture or trade name product" (.g., chemicals used to clean parts prior to plating, chemicals contained in fuels that are combusted, chemicals used as catalysts in production, or chemicals used to carry a coating but that evaporate off as the coating dries.

Chemicals "otherwise used" accounted for 15% (108 million pounds) of total use.

Top 20 Chemicals

In 2011, LQTUs reported using 138 out of the 1,416 TURA-listed chemicals in amounts above the reporting threshold. The raw data was analyzed by chemical to identify the top 20 chemicals used, generated as byproduct, shipped in product, released onsite as pollution, or shipped offsite for treatment or disposal. The following four chemicals appear on all five Top 20 chemical lists and are shown in bold on the lists:

- Acetone
- Methanol
- Methyl Ethyl Ketone
- Toluene

Information reported as trade secret was excluded from the use, shipped in product and byproduct generation data in order to protect confidentiality claims.

Top 20 chemicals: Reported Total Chemical Use

As shown in Table 3, the top 20 chemicals accounted for 90%, (667 million pounds) of the total reported statewide use. Styrene monomer was the chemical with greatest reported use. Ten facilities (or 2% of the total number of LQTUs) reported using 282 million pounds of styrene monomer to make plastic. This represented 38% of total reported use and a 9 million pound decrease from the prior year.

Sodium hydroxide was the second most highly used chemical. At 62 million pounds it accounted for 8% of total reported use. Five million fewer pounds were used in 2011 than in 2010. 162 facilities (or 34% of the total number of LQTUs) reported using Sodium hydroxide to treat wastewater, neutralize acids, make sodium salts, rayon, plastics, paper and cellophane, or to manufacture laundering, bleaching, and dishwashing materials.

Hydrochloric acid ranked third on the list, with 51 facilities (or 11% of the total number of LQTUs), representing 8% of total use reported, or 60 million pounds, over five million more pounds than in 2010. Hydrochloric acid is a byproduct of combustion, and is used in chloride production, in electroplating, to clean metal products, to remove scale from boilers, and to neutralize basic waste streams.

Methanol was the fourth highest used chemical with 32 facilities (or 7% of the total number of LQTUs) reporting its use, representing 8% of total use reported (or 59 million pounds, up from 55 million pounds in 2010). Methanol is used in the production of formaldehyde, acetic acid, chloromethanes, methyl methacrylate, methylamines, and dimethyl terephthalate. Facilities use methanol as a solvent or antifreeze in the manufacturing of paint stripper, aerosol spray paints, wall paints, carburetor cleaners, and car windshield washer compounds.

Table 3 – 2011 Top 20 Chemicals: Reported Total Use

Total Use
These quantities do not include Trade Secrets

Chemical Name (CAS #)	CAS #	Total Use (Lbs.)
Styrene Monomer	100425	282,484,703
Sodium Hydroxide	1310732	62,446,698
Hydrochloric Acid	7647010	59,957,787
Methanol	**67561**	**59,496,092**
Sulfuric Acid	7664939	23,558,332
Sodium Hypochlorite	7681529	22,112,227
Nitrate Compounds	1090	17,978,468
Toluene	**108883**	**17,563,771**
Ammonia	7664417	15,644,976
Potassium Hydroxide	1310583	13,592,634
Chlorine	7782505	12,786,035
Methyl Ethyl Ketone	**78933**	**12,554,529**
Methyl Methacrylate	80626	12,364,843
Acetone	**67641**	**10,220,028**
Zinc Compounds	1039	9,924,813
Ethyl Acetate	141786	9,568,897
Diisocyanates	1050	6,522,132
Toluene Diisocyanate	26471625	6,390,503
Nitric Acid	7697372	6,105,191
Dimethylformamide	68122	5,449,812

NOTE: **Bolded** chemicals are on the Top 20 Chemicals for Total Use, Byproduct Generation, Shipped in Product, On-Site Releases, and Transfers Off-Site.

Butyraldehyde, Formaldehyde, Sodium Bisulfite, Vinyl Acetate would appear in the Top 20 Chemicals Total Use list if trade secret quantities were included.

Top 20 Chemicals: Reported Byproduct Generation and Shipped in Product

Table 4 shows the Top 20 chemicals reported generated as byproduct and shipped in product in 2011. The top 20 chemicals generated as byproduct accounted for 89% (or 73 million pounds) of the statewide total. The top twenty chemicals shipped in product statewide accounted for 89% (or 232 million pounds) of total statewide shipments in product.

Table 4 – 2011 Top 20 Chemicals:
Reported Byproduct Generation and Shipped in Product

Byproduct Generation *These quantities include Trade Secret*			**Shipped in Product** *These quantities do not include Trade Secret*		
Chemical Name	**CAS #**	**Byproduct Generation (Lbs.)**	**Chemical Name**	**CAS #**	**Shipped in Product (Lbs.)**
Nitrate Compounds	1090	15,303,427	**Methanol**	**67561**	**57,218,357**
Sodium Hydroxide	1310732	9,714,579	Sodium Hydroxide	1310732	37,001,617
Ethyl Acetate	141786	8,229,327	**Toluene**	**108883**	**30,033,761**
Toluene	**108883**	**6,284,666**	Sodium Hypochlorite	7681529	19,209,133
Sulfuric Acid	7664939	5,972,044	Chlorine	7782505	12,742,468
Hydrochloric Acid	7647010	3,617,351	Ammonia	7664417	11,260,320
Methyl Ethyl Ketone	**78933**	**3,318,136**	Potassium Hydroxide	1310583	11,167,738
Lead	7439921	2,667,243	**Methyl Ethyl Ketone**	**78933**	**9,181,544**
Methanol	**67561**	**2,640,980**	**Acetone**	**67641**	**8,463,555**
Dimethylformamide	68122	2,558,933	Zinc Compounds	1039	5,361,221
Ethylene Glycol	107211	2,480,430	Sulfuric Acid	7664939	5,231,716
Formaldehyde	50000	2,382,812	Phosphoric Acid	7664382	3,412,503
1-Methyl-2-Pyrrolidone	872504	1,500,713	1-Methyl-2-Pyrrolidone	872504	3,062,371
Acetone	**67641**	**1,429,756**	Dichloromethane	75092	2,970,833
Aluminum Sulfate	10043013	1,097,174	Antimony Compounds	1000	2,900,283
Sodium Hypochlorite	7681529	1,091,941	Dimethylformamide	68122	2,816,260
Nitric Acid	7697372	1,032,142	Methyl Methacrylate	80626	2,563,274
Ammonia	7664417	860,635	Xylene Mixed Isomer	1330207	2,342,803
Copper Compounds	1015	767,952	Di(2-ethylhexyl)phthalate	117817	2,315,025
Zinc Compounds	1039	765,803	Copper Compounds	1015	2,296,893

NOTE: Bolded chemicals are on the Top 20 Chemicals for Total Use, Byproduct Generation, Shipped in Product, On-Site Releases, and Transfers Off-Site.

Ethyl Acetate and Sodium Bisulfite would appear in the Top 20 Chemicals Shipped in Product list if trade secret quantities were included.

Top 20 Chemicals: On-Site Releases and Transfers Off-Site

As shown in Table 5, the Top 20 chemicals reported as released on-site in 2011 totaled 3.5 million pounds, 94% of the total reported on-site releases. Hydrochloric acid was the top chemical, accounting for 30% (over 1 million pounds) of the statewide total on-site releases. Almost one million pounds (27%) of total on-site releases were from power plants. Over 99% of total on-site releases of lead were attributed to lead in ash disposed by one municipal waste combustor in an on-site lined landfill.

Table 5 – 2011 Top 20 Chemicals:
Reported On-Site Releases and Transfers Off-site

On-Site Releases *These quantities include Trade Secret*			Transfers Off-Site *These quantities include Trade Secret*		
Chemical Name (CAS #)		**On-Site Releases (Lbs.)**	**Chemical Name (CAS #)**		**Transfers Off-Site (Lbs.)**
Hydrochloric Acid	7647010	1,123,816	Nitrate Compounds	1090	5,692,524
Ammonia	7664417	444,819	Ethylene Glycol	107211	2,352,814
Acetone	**67641**	**343,910**	Lead	7439921	2,326,395
Lead	7439921	338,557	Formaldehyde	50000	2,259,249
Ethyl Acetate	141786	253,433	**Toluene**	**108883**	**1,832,516**
N-Butyl Alcohol	71363	179,275	**Methanol**	**67561**	**1,793,506**
Toluene	**108883**	**152,688**	Ethyl Acetate	141786	1,437,683
Glycol Ethers	1022	147,729	1-Methyl-2-Pyrrolidone	872504	1,288,539
Methyl Ethyl Ketone	**78933**	**108,589**	Zinc Compounds	1039	1,131,512
Methanol	**67561**	**83,115**	**Acetone**	**67641**	**925,983**
Trichloroethylene	79016	42,652	**Methyl Ethyl Ketone**	**78933**	**920,183**
Hydrogen Fluoride	7664393	36,058	Sodium Hydroxide	1310732	886,985
Sulfuric Acid	7664939	33,694	Dimethylformamide	68122	738,684
Nitrogen Dioxide	10102440	32,149	Butyraldehyde	123728	619,729
Xylene Mixed Isomer	1330207	31,838	Copper Compounds	1015	609,310
1-Methyl-2-Pyrrolidone	872504	28,477	Dichloromethane	75092	338,891
Butyraldehyde	123728	26,868	Lead Compounds	1026	286,637
N-Propyl Bromide	106945	26,415	Acetonitrile	75058	283,906
Styrene Monomer	100425	26,235	Silica, Crystalline (Respirable, <10 Microns)	1095	237,576
Tetrachloroethylene	127184	24,264	Nitric Acid	7697372	234,873

NOTE: Bolded chemicals are on the Top 20 Chemicals for Total Use, Byproduct Generation, Shipped in Product, On-Site Releases, and Transfers Off-Site.

Table 5 also shows the Top 20 chemicals reported as transfers off-site in 2011, which totaled 89% (or 26 million pounds) of total transfers for waste treatment or disposal. Nitrate compounds was the top chemical, accounting for 19% of the total transfers off-site. Nitrate compounds was primarily coincidentally manufactured during neutralization of nitric acid in wastewater treatment, and were discharged to Publically Owned Wastewater Treatment Plants.

Ninety-five percent of total transfers off-site of lead, the third chemical on the list, was attributed to six municipal waste combustors that transferred lead in ash to off-site lined landfills.

IV. Chemicals of Particular Interest

Certain toxic chemicals are of particular concern because of their higher potential for harm to the environment or public health. These include:

- Chemicals classified as persistent bioaccumulative toxic (PBT) chemicals by the U.S. Environmental Protection Agency (EPA) under the Toxics Release Inventory (TRI) Program
- Chemicals designated as Higher Hazard by the TURA Administrative Council
- Chemicals known to promote asthma (Asthmagens)
- Carcinogens

Trends in reported data for each of these groups of substances are discussed below.

Persistent Bioaccumulative Toxic (PBT) Chemical Trends

PBTs are highly toxic, remain in the environment for long periods of time, are not readily destroyed, and build up or accumulate in body tissue. As a result, relatively small releases of PBT chemicals can pose human and environmental health threats and, therefore, the use and release of these chemicals, even in relatively small amounts, warrant public reporting as well as toxics use reduction efforts Because of these concerns, the threshold for PBTs was lowered from 25,000 pounds if the substance is manufactured or processed, and 10,000 pounds if the substance is otherwise used, to between 0.1 grams and 100 pounds, depending on the chemical, for all uses. The threshold was lowered for all PBTs, except lead and lead compounds, as of reporting year 2000. The lower threshold for lead and lead compounds took effect in 2001.

Table 6 below shows the 2011 reporting data on PBT chemicals. For 2011, Massachusetts facilities reported the use of nine PBT chemicals/chemical categories.

Table 6
2011 Persistent Bioaccumulative Toxic (PBT) Chemicals Summary
(in pounds unless otherwise noted)

Substance	Reporting Threshold	Number of Facilities	Total Use	Generated as Byproduct	Shipped in Product	On-Site Releases	Transfers Off-Site
Polycyclic Aromatic Compounds (PACs)	100 lbs.	27	283,498	3,108	51,946	572	1,993
Benzo[g,h,i]-perylene	10 lbs.	23	3,177	194	1,127	0	191
Mercury	10 lbs.	17	15,826	8,610	6,404	653	7,977
Mercury Compounds	10 lbs.	5	1,307	266	773	33	233
Poly-chlorinated biphenyls (PCBs)	10 lbs.	2	72,654	62,826	0	0	61,910
Dioxin & Dioxin-like Compounds	0.1 grams	9	2,810.85 grams	2,809.85 grams	0.00 grams	27.80 grams	2,782.56 grams
Lead	100 lbs.	72	3,039,674	2,667,243	376,953	338,557	2,326,395
Lead Compounds	100 lbs.	65	584,264	276,541	267,175	2,457	286,637
Tetrabromo-bisphenol A	10 lbs.	2	1,226	174	1,052	0	175

Table 7 below shows the 2011 reporting data on PBT chemicals reported and the numbers of facilities reporting PBTs, 1999 or 2000 to the present. The data shows a fairly common trend. Llowering the reporting threshold for these chemicals typically leads to an initial increase in the number of facilities reporting the chemical,(indicative of the fact that there were facilities that had reduced use below the basic using less than 25,000 /10,000 pound threshold. Over time, however, the number of filers trends back downward, apparently as facilities adopt TUR options in response to the reporting and planning requirements.

This trend is shown most clearly with lead and lead compounds. Lowering the reporting threshold in 2001 for these substances resulted in an increase in the number of facilities reporting lead from 15 in reporting year 2000, to 152 in 2001, and an increase in the number of facilities reporting lead compounds from 33 in 2000, to 130 in 2001. By reporting year 2011, the number of facilities reporting lead had decreased to 72, and the number of facilities reporting lead compounds had decreased to 65.

The number of facilities reporting mercury and mercury compounds rose from 0 for both chemicals in 1999, to 11 and 6, respectively in 2000. When municipal waste combustors emissions were first reported in 2003, the number of facilities reporting mercury jumped to 20, and use increased from 4,973 to 11,476 pounds. As of 2011, reported mercury use has declined to 17 facilities and 15,826 pounds. Likewise, the number of facilities reporting mercury compounds decreased from six in 2000, to five in 2011. Total use was at its peak in 2000 at 90,009 pounds, then dropped to 676 pounds in 2001, and has since remained around 1200 pounds, with occasional spikes. Ninety-nine percent of the 90,000 pounds reported in 2000 was due to a one-time shipment of waste from a hazardous waste transfer facility.

Dioxin use followed a similar pattern to mercury. The number of filers and amounts reported increased substantially when municipal waste combustion emissions were brought into the TURA program in 2003, and then the number of filers dropped down to primarily the municipal waste combustors.

For benzo[ghi]perylene and polycyclic aromatic compounds (PACs), there was a dramatic drop in the number of facilities reporting. For benzo[ghi]perylene, the number of facilities reporting dropped from 120 in 2000 to 23 in 2011. For PACs, the number of facilities reporting went from 158 in 2000 to 27 in 2011. The main reason for the drop was a statutory change in 2006, that limited reporting of benzo[ghi]perylene and PACs to facilities whose primary business is power production (e.g. electric utilities) and asphalt batch plants.

There has been a substantial decline in the use of many of these substances since 2008. Since these quantities are not adjusted for production levels, the decline in reported use of these chemicals could possibly be attributed to the economic recession that began in 2008.

Table 7
Pounds of PBTs Reported and Number of Facilities Reporting 2000 - 2011

	Benzo[ghi]-perylene (191242)		Dioxin and Dioxin Compounds (1060)		Lead (7439921)		Lead Compounds (1026)		Mercury (7439976)		Mercury Compounds (1028)		Poly-Chlorinated Biphenyls (1336363)		Polycyclic Aromatic Compounds (1040)		Tetra-bromo-bisphenol A (79947)	
	Lbs Use	#	Grams Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#
1999	0	0	0	0	723,675	15	9,287,998	31	0		0	0	0	0	37,539,261	6	0	0
2000	**146,531**	**120**	**12.05**	**8**	1,261,842	15	9,855,146	33	**4973**	**11**	**90,009**	**6**	**118,160**	**2**	**14,171,986**	**158**	**332**	**1**
2001	180,326	127	12.11	8	**1,284,199**	**152**	**7,296,183**	**130**	9,315	13	676	5	83,890	2	13,849,697	151	115	1
2002	123,429	122	12.78	8	912,922	143	5,152,078	115	5,922	13	1,765	5	64,981	2	11,148,250	149	19,057	1
2003	*125,099*	*119*	*11,827*	*17*	*3,394,134*	*140*	*5,989,183*	*118*	*11,476*	*20*	*1,212*	*6*	*37,325*	*2*	*11,486,388*	*136*	*152*	*1*
2004	128,874	114	3,033	16	3,651,671	109	5,284,597	127	12,629	20	966	7	46,879	2	11,796,370	133	0	0
2005	128,809	109	6,696	17	3,763,242	114	3,694,150	127	10,444	22	1,031	6	21,741	2	11,128,163	127	0	0
2006	49,376	27	761	15	4,811,219	102	2,282,694	112	13,351	19	1,011	6	22,042	2	3,735,104	31	0	0
2007	49,412	28	1,155	13	4,172,982	90	1,418,897	105	13,744	20	1,101	5	110,303	3	5,051,904	29	0	0
2008	33,393	25	1,523	13	3,801,242	90	1,251,744	94	12,243	21	3,421	6	156,170	3	3,275,212	30	0	0
2009	12,403	24	1,951	11	4,107,792	72	988,051	84	10,515	17	1,610	5	42,757	3	1,168,637	28	0	0
2010	4,275	21	1,980	9	3,183,035	74	750,928	72	11,434	16	1,161	4	71,091	2	382,534	26	743	1
2011	3,177	23	2,811	9	3,039,674	72	584,264	65	15,826	17	1,307	5	72,654	2	283,498	27	1,226	2

NOTE: Bolded numbers indicate the first year that a chemical was designated as a PBT and the reporting threshold lowered.
2003 was the first year that municipal waste combustors were required to report

Higher Hazard Substances (HHS) Trends

The 2006 amendments to TURA directed the Administrative Council to categorize the TURA list of chemicals into higher or lower hazard substances, or to leave them uncategorized and lowered the reporting threshold for HHS to 1,000 pounds for all uses. Effective reporting year 2008, the Council designated cadmium, cadmium compounds, and trichloroethylene as HHS. Effective reporting year 2009, the Council designated tetrachloroethylene as a HHS.

Table 8 shows the summary HHS data for 2011. Massachusetts facilities reported the use of all four higher hazard chemicals/chemical categories in 2011.

Table 8
2011 Higher Hazard Substances (HHS) Summary

Substance	Reporting Threshold	Number of Facilities	Total Use (lbs)	Generated as Byproduct (lbs)	Shipped in Product (lbs)	On-Site Releases (lbs)	Transfers Off-Site (lbs)
Cadmium	1,000 lbs.	4	26,878	542	23,273	0	545
Cadmium Compounds	1,000 lbs.	6	192,047	12,988	20,876	35	12,115
Trichloroethylene	1,000 lbs.	17	303,076	154,578	203,158	42,652	42,356
Tetrachloroethylene	1,000 lbs.	17	145,811	54,926	74,966	24,264	30,877

Table 9 below shows the pounds of HHS chemicals reported and the numbers of facilities reporting HHSs from 2000 to the present. The data shows a similar trend as that seen with PBTs: a gradual decline in use between 2000, the year before the substance was designated as an HHS, an initial increase in the number of facilities reporting and the pounds of chemical reported after designation as HHS, followed by a drop in both measures.

Table 9
Pounds of High Hazard Chemicals Reported and Number of Facilities Reporting 2000-2011

Reporting Year	Cadmium / # Facilities (HHS as of 2008)		Cadmium Compounds / # Facilities (HHS as of 2008)		Trichloroethylene / # Facilities (HHS as of 2008)		Tetrachloroethylene / # Facilities (HHS as of 2009)	
	Lbs	*#*	*Lbs*	*#*	*Lbs*	*#*	*Lbs*	*#*
2000	43,658	2	16,605	2	1,870,884	26	860,336	11
2001	35,614	2	30,472	2	1,471,956	18	628,790	10
2002	48,125	2	38,127	2	1,293,294	18	330,024	10
2003	37,121	2	11,025	1	1,115,010	16	338,984	7
2004	25,058	1	172,435	2	1,102,745	15	263,769	6
2005	21,960	1	208,035	3	834,462	9	290,319	5
2006	0	0	248,470	1	770,538	11	210,473	4
2007	0	0	184,400	1	604,671	9	252,229	5
2008	**29,429**	**5**	**173,834**	**7**	**536,073**	**27**	257,542	5
2009	28,969	4	152,916	8	556,457	23	**191,293**	**24**
2010	23,970	4	250,700	8	294,836	16	151,918	18
2011	26,878	4	192,047	6	303,076	17	145,811	17

NOTE: **Bolded** numbers indicate the first year that these chemicals were designated as an HHS and the reporting threshold lowered

This pattern held true for all substances, except cadmium compounds. Cadmium compounds use declined between 2007 and 2008, when it was classified as an HHS, although the number of filers jumped from 1 to 7 in 2008, the year it was designated as an HHS. Use declined in 2009 and then increased in 2010, to levels just above those seen in 2006. Some of these changes could have been due to changes in economic activity, since the HHS data presented has not been normalized for production.

The more typical trend is shown with trichloroethylene. The number of facilities reporting this chemical dropped from 26 in reporting year 2000 to 9 in reporting year 2007. It jumped to 27 when the reporting threshold was lowered in 2008, and has since declined to 17 in 2011. Use dropped dramatically between 2000 and 2011, from 1,870,884 pounds in 2000, to 536,073 pounds in 2008, to 303,076 pounds in 2011.

Asthmagens

In 2009 the Lowell Center for Sustainable Production (LCSP) published *Asthma-Related Chemicals in Massachusetts: an Analysis of Toxics Use Reduction Data* (available on TURI's website www.turi.org). The purpose of this project was to understand the extent to which chemicals that can cause the initial onset of asthma or trigger subsequent asthma attacks are being used by Massachusetts industries who report under the Toxics Use Reduction Act (TURA) program (using 1990 to 2005 data). The report identified 335 chemicals that can cause or exacerbate asthma, of which 68 are reportable under TURA and of which 41 have been reported at some point during the program's history.

The TURA Program has begun working to better understand the uses of these chemicals in relation to potential exposures and toxics use reduction opportunities. Table 10 summarizes 2011 data on some of the chemicals identified in the LCSP report that were reported under TURA. In 2010, 17 chemicals identified as asthmagens by the Association of Occupational and Environmental Clinics (AOEC) were reported under TURA. Styrene monomer and sulfuric acid had the greatest amount of use and release.

Table 10
Asthma-Related Toxics
(in pounds)

Chemical Name (Number of facilities)	Use	On-Site Releases
Acetic Acid (16)	1,287,577	2,487
Aluminum (3)	130,684	324
Chlorine (3)	12,786,035	552
Chromium (1)	35,217	0
Chromium Compounds (6)*	243,974	213
Ethylenediamine (1)	85,651	24
Ethylene Oxide (1)	275,200	410
Formaldehyde (8)	1,845,610	20,025
Hydrazine (1)	151,659	0
Maleic Anhydride (1)	365,693	260
Methylmethacrylate (6)	12,364,843	3,185
Nickel (3)	90,975	5
Nickel Compounds (8)	464,536	919
Phthalic Anhydride (1)	304,262	109
Styrene Monomer (10)	282,484,716	26,235
Sulfuric Acid (96)	23,558,332	33,694
Toluene Diisocyanate (45**	6,922,295	181

* Chromium is considered an asthmagen by AOEC but chromium compounds are not.
** Toluene Diisocyanate includes CAS numbers 91087, 584849, and 26471625.

Styrene monomer was used by 10 facilities, although the bulk of its use was by one facility. All reported releases of styrene were air releases. Sulfuric acid was used by 96 facilities. Power plants had the largest amount of releases, which were all to air.

Carcinogens

Several TURA chemicals are identified as Group 1 carcinogens (i.e., carcinogenic to humans) by the International Agency for Research on Cancer (IARC). In 2011, seven IARC Group 1 carcinogens were reported under TURA (see Table 11). Formaldehyde, nickel compounds and ethylene oxide had the largest amounts of reported uses. Formaldehyde, nickel compounds, and ethylene oxide had the largest amounts of reported releases. Of these chemicals, dioxin was reported by the most facilities. Releases were primarily air releases; however, there also were releases to water and land.

Table 11
IARC Group 1 Carcinogens
(in pounds unless otherwise noted)

Chemical Name (Number of Facilities)	Use	On-Site Releases
Cadmium (4)	26,878	0
Chromium Compounds (7)*	243,974	213
Crystalline Silica (1)	237,600	24
Dioxin (9)*	2810.85 grams	27.8 grams
Ethylene Oxide (1)	275,200	410
Formaldehyde (8)	1,845,610	20,025
Nickel Compounds (8)	464,536	919

* Hexavalent Chromium and 2,3,7,8-Tetrachlorodibenzo-*para*-dioxin are the agents specifically listed as Group 1 by IARC.

V. 2011 Significant Industrial Sectors

Under TURA, facilities in the Manufacturing Standard Industrial Classification (SIC) codes (20-39 inclusive) and those in SIC codes 10-14, 40, 44-51, 72, 73, 75 and 76, or the corresponding NAICS code must report their chemical use if they meet or exceed certain thresholds.

Figure 7 shows the number of TURA reporting facilities in each industry sector. The Chemical Manufacturing sector represents approximately 17% (84 facilities) of the number of TURA reporting facilities, and, as shown in Figure 8 uses 64% of the reportable TURA chemicals. This sector is a diverse group of industries, and includes companies that "manufacture" chemicals according to the TURA definition and companies that "process" chemicals to formulate adhesives, paints, pharmaceuticals, and plastic materials and resins. Approximately 46% of the total chemical use for this sector was attributable to the use of styrene monomer, which is used in the manufacture of polystyrene and other plastics.

Figure 7 - 2011 Number of Facilities by Industrial Sector
Total Number of Facilities = 482

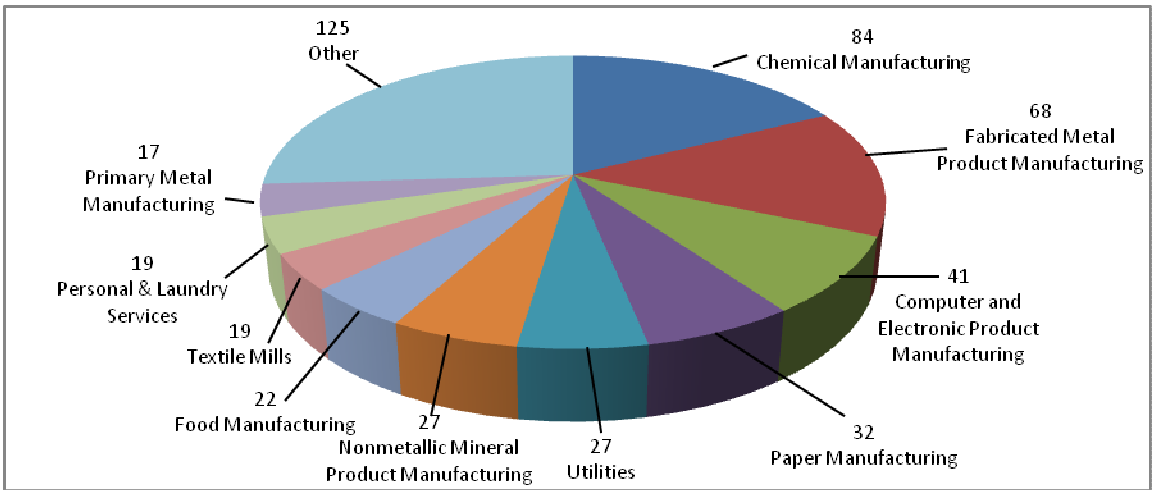
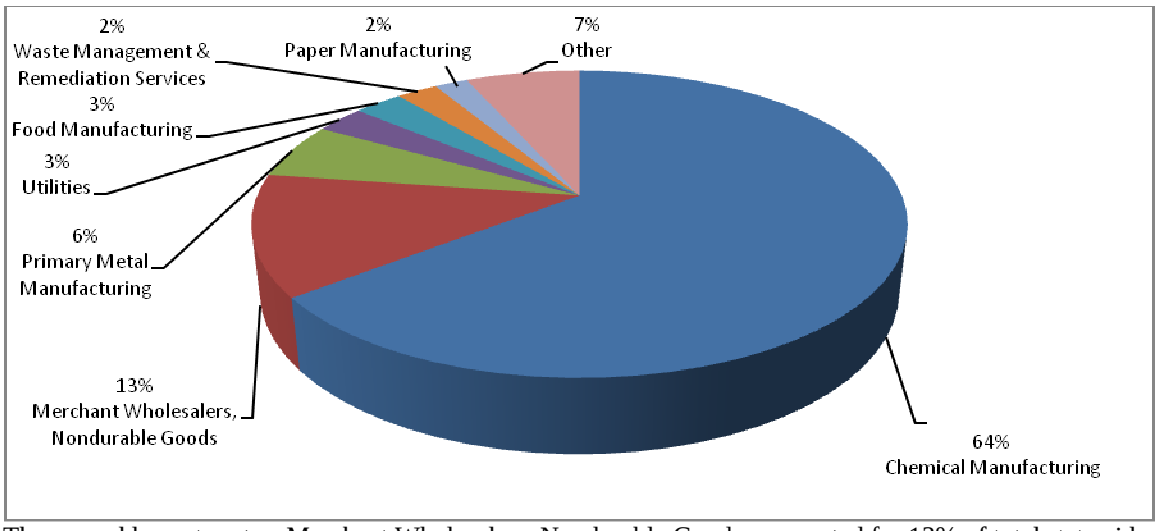


Figure 8 - 2011 Chemical Use by Industrial Sector
Total Use = 952,000,000 Pounds



The second largest sector, Merchant Wholesalers, Nondurable Goods, accounted for 13% of total statewide use. The third largest sector, Primary Metal Manufacturing, accounted for 6% of chemical use. Utilities accounted for 3% of chemical use, and the Waste Management and Remediation Services and Paper Manufacturing sectors each accounted for 2% of chemical use. The remaining 7% of statewide chemical use was attributed to a variety of sectors.

Figure 9 shows byproduct generation by industrial sector. While the Chemical Manufacturing sector accounted for 64% of total statewide use, this sector produced 39% of the total byproduct generated in 2011. In contrast, the Paper Manufacturing sector, which accounted for 2% of total statewide chemical use, accounted for 16% of the total byproduct generated.

Figure 9 - 2011 Byproduct Generation by Industrial Sector
Total Byproduct = 84,000,000 Pounds

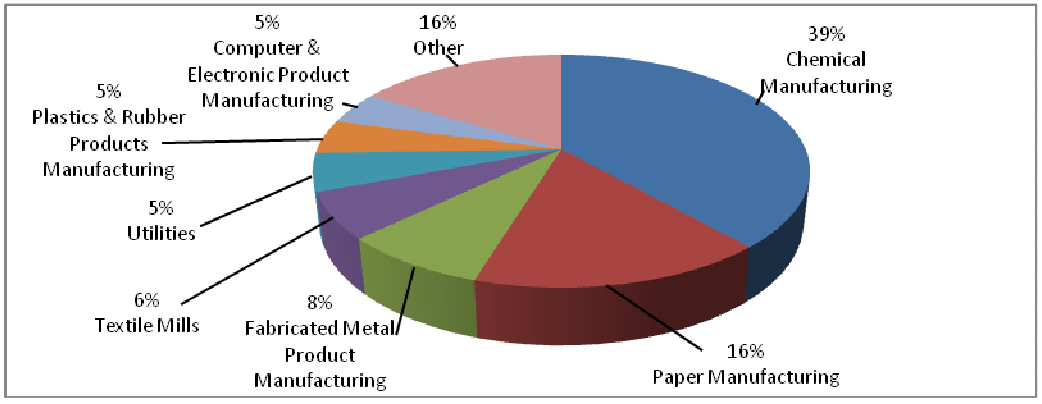
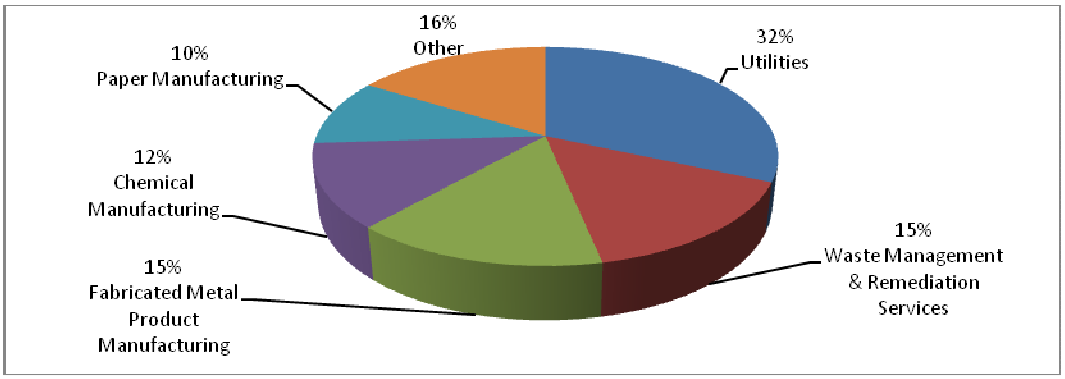


Figure 10 shows on-site releases to the environment by industrial sector. The Utilities sector, which represented 3% of total statewide use, was the largest source of on-site releases, accounting for 32% of all on-site releases. This sector provides power for Massachusetts businesses and citizens. Sixty-three percent of on-site releases in this sector are attributed to the coincidental manufacture of hydrochloric acid during combustion. The Waste Management and Remediation Services and Fabricated Metal Product Manufacturing sectors each accounted for 15% of total on-site releases. The Chemical Manufacturing sector (which accounted for 64% of total chemicals use) accounted for 12% of total on-site releases. The Paper Manufacturing sector accounted for 10% of total on-site releases. The remaining 16% of total on-site releases was attributed to a variety of sectors.

Figure 10 - 2011 On-Site Releases by Industrial Sector
Total On-Site Releases = 4,000,000 Pounds



VI. 2011 Major TURA Facilities

Tables 12-14 show the top 20 facilities for the quantities of reported chemical use, generated as byproduct, shipped in or as product, on-site releases, and transfer off-site.

Top 20 Facilities: Reported Total Chemical Use

Table 12 lists the 20 facilities that reported used the largest total quantity of TURA chemicals. These 20 facilities used 762 million pounds, or 80% of total statewide use.

Table 12
2011 Top 20 Facilities: Reported Total Use
These quantities include Trade Secret

Facility Name	Town	Total Use (Lbs.)
Styrolution America LLC - Indian Orchard	Springfield	282,388,309
Solutia Inc. - Indian Orchard Plant	Springfield	115,184,219
Borden & Remington	Fall River	84,491,220
Holland Company Inc.	Adams	44,953,700
Ineos Melamines LLC	Springfield	38,892,165
Rousselot Peabody Inc.	Peabody	37,640,000
Southwin Ltd.	Leominster	23,292,121
Camco Manufacturing Inc.	Leominster	19,664,829
Semass Partnership	Rochester	14,933,275
Omnova Solutions Inc.	Fitchburg	13,520,256
Nexeo Solutions LLC	Tewksbury	12,860,162
James Austin Co.	Ludlow	12,230,536
Henkel Corp.	Springfield	10,884,537
Astro Chemicals Inc.	Springfield	9,767,162
Metalor Technologies USA	North Attleborough	8,483,081
Wheelabrator Millbury Inc.	Millbury	7,021,951
Univar Usa Inc.	Salem	6,913,176
Covanta Haverhill Inc.	Haverhill	6,674,458
Nyacol Products Inc.	Ashland	6,405,346
Advanced Urethane Technologies Inc.	Newburyport	6,238,426

Top 20 Facilities: Reported Byproduct Generation and Shipped in Product

Table 13 lists the 20 facilities that generated the largest reported quantity of byproduct. These facilities generated 49 million pounds or 60% of total statewide byproduct. Table 15 also lists the 20 facilities with

the largest quantity shipped in product. These facilities shipped 309 million pounds in product, or 89% of the statewide total shipped in product.

Table 13
2011 Top 20 Facilities: Reported Byproduct Generation and Shipped in Product

Byproduct Generation *These quantities include Trade Secret*			Shipped in Product *These quantities include Trade Secret*		
Facility Name	**Town**	**Byproduct Generation (Lbs.)**	**Facility Name**	**Town**	**Shipped in Product (Lbs.)**
Rousselot Peabody Inc.	Peabody	13,074,137	Borden & Remington	Fall River	84,047,847
Solutia Inc. - Indian Orchard Plant	Springfield	7,011,577	Holland Company Inc.	Adams	44,927,226
3M	Rockland	4,458,481	Solutia Inc. - Indian Orchard Plant	Springfield	32,060,037
Flexcon Company Inc.	Spencer	3,655,819	Southwin Ltd.	Leominster	23,285,931
Ineos Melamines LLC	Springfield	3,177,204	Allcoat Technology Inc.	Wilmington	22,536,093
Crane & Co Inc. Pioneer Mill	Dalton	2,384,556	Camco Manufacturing Inc.	Leominster	19,662,359
ITW Foilmark Inc.	Newburyport	1,596,052	Nexeo Solutions LLC	Tewksbury	12,818,433
Madico Inc.	Woburn	1,536,981	James Austin Co.	Ludlow	12,152,192
Koch Membrane Systems Inc.	Wilmington	1,494,398	Astro Chemicals Inc.	Springfield	9,144,439
Bradford Industries	Lowell	1,252,078	Univar USA Inc.	Salem	6,900,967
Ideal Tape Company	Lowell	1,228,094	Webco Chemical Corp.	Dudley	6,119,189
Barnhardt Manufacturing Co.	Colrain	1,223,905	ITW Tacc	Rockland	5,389,088
Genzyme Corp.	Boston	1,019,612	Henkel Corp.	Springfield	4,849,519
Waters Corp.	Taunton	1,007,761	Houghton Chemical Corporation	Boston	4,598,825
Intel Massachusetts Inc.	Hudson	980,606	Roberts Chemical Co. Inc.	Attleboro	4,247,762
Semass Partnership	Rochester	946,708	Rohm & Haas Electronics Materials LLC	Marlborough	4,032,259
Covanta Springfield LLC	Agawam	910,890	Alphagary Corporation	Leominster	3,706,014
Hollingsworth & Vose Company	West Groton	872,300	Savogran Company	Norwood	3,153,456
Majilite Manufacturing Inc.	Dracut	824,150	Callahan Company	Walpole	2,768,027
Archer Rubber LLC	Milford	816,504	ITW Devcon Plexus	Danvers	2,643,033

Top 20 Facilities: On-Site Releases and Transfers Off-Site

Table 14 lists the 20 facilities that reported the largest quantity of on-site releases and the 20 facilities that had the largest quantity of transfers off-site. These facilities released 2.5 million pounds, or 68% of total releases statewide. Six of these facilities were power plants, accounting for 0.9 million pounds of releases, all due to the coincidental manufacture of the following products of combustion:

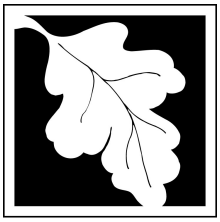
- hydrochloric acid (63% of 0.9 million pounds)
- ammonia (32% of 0.9 million pounds)
- hydrogen fluoride (4% of 0.9 million pounds)
- metal compounds (1% of 0.9 million pounds)

Four of the Top 20 facilities of reported on-site releases were municipal waste combustors (MWCs) that also reported combustion-related emissions. Of the 0.7 million pounds of on-site releases reported by these MWCs, 53% was due to the coincidental manufacture of hydrochloric acid during combustion, and 47% was due to lead in ash disposed in an on-site lined landfill at one facility.

The 20 facilities with the largest reported quantity of transfers off-site transferred almost 19 million pounds, or 64% of the total statewide transfers off-site.

Table 14
2011 Top 20 Facilities: Reported On-Site Releases and Transfers Off-Site

On-Site Releases *These quantities include Trade Secret*			**Transfers Off-Site** *These quantities include Trade Secret*		
Facility Name	**Town**	**On-Site Releases (Lbs.)**	**Facility Name**	**Town**	**Transfers Off-Site (Lbs.)**
Dominion Energy Brayton Point LLC	Somerset	584,230	Solutia Inc. - Indian Orchard Plant	Springfield	4,592,726
Covanta Haverhill Inc.	Haverhill	371,128	Ineos Melamines LLC	Springfield	2,799,426
Crown Beverage Packaging USA	Lawrence	289,935	Koch Membrane Systems Inc.	Wilmington	1,029,533
Solutia Inc. - Indian Orchard Plant	Springfield	238,544	Waters Corp.	Taunton	995,270
Semass Partnership	Rochester	193,963	Genzyme Corp.	Boston	945,842
AR Metallizing Ltd.	Franklin	107,755	Safety Kleen Systems Inc.	Marlborough	761,069
Ideal Tape Company	Lowell	88,563	Semass Partnership	Rochester	752,745
Wheelabrator Millbury Inc.	Millbury	77,097	Ideal Tape Company	Lowell	720,472
Wheelabrator Saugus Inc.	Saugus	75,278	Metalor Technologies USA	Attleboro	713,279
Salem Harbor Station	Salem	71,112	Henkel Corp.	Springfield	691,723
Mystic Station	Everett	61,320	Intel Massachusetts Inc.	Hudson	649,384
Millennium Power	Charlton	56,503	The Duncan Group	Everett	543,978
Berkshire Power Company LLC	Agawam	50,112	Metalor Technologies USA	North Attleborough	497,286
Jen Mfg. Inc.	Millbury	49,022	Flexcon Company Inc.	Spencer	482,587
Hazen Paper Co.	Holyoke	42,848	Borden & Remington	Fall River	470,327
Flexcon Company Inc.	Spencer	35,762	Wheelabrator Millbury Inc.	Millbury	468,585
Masspower	Indian Orchard	35,664	Johnson Matthey Pharmaceutical Services Inc.	North Andover	455,093
Wyman Gordon Company	North Grafton	34,819	PCI Synthesis Inc.	Newburyport	430,569
3M	Rockland	34,492	Wheelabrator Saugus Inc.	Saugus	427,736
Metalor Technologies USA	Attleboro	34,049	Wheelabrator North Andover Inc.	North Andover	423,306



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