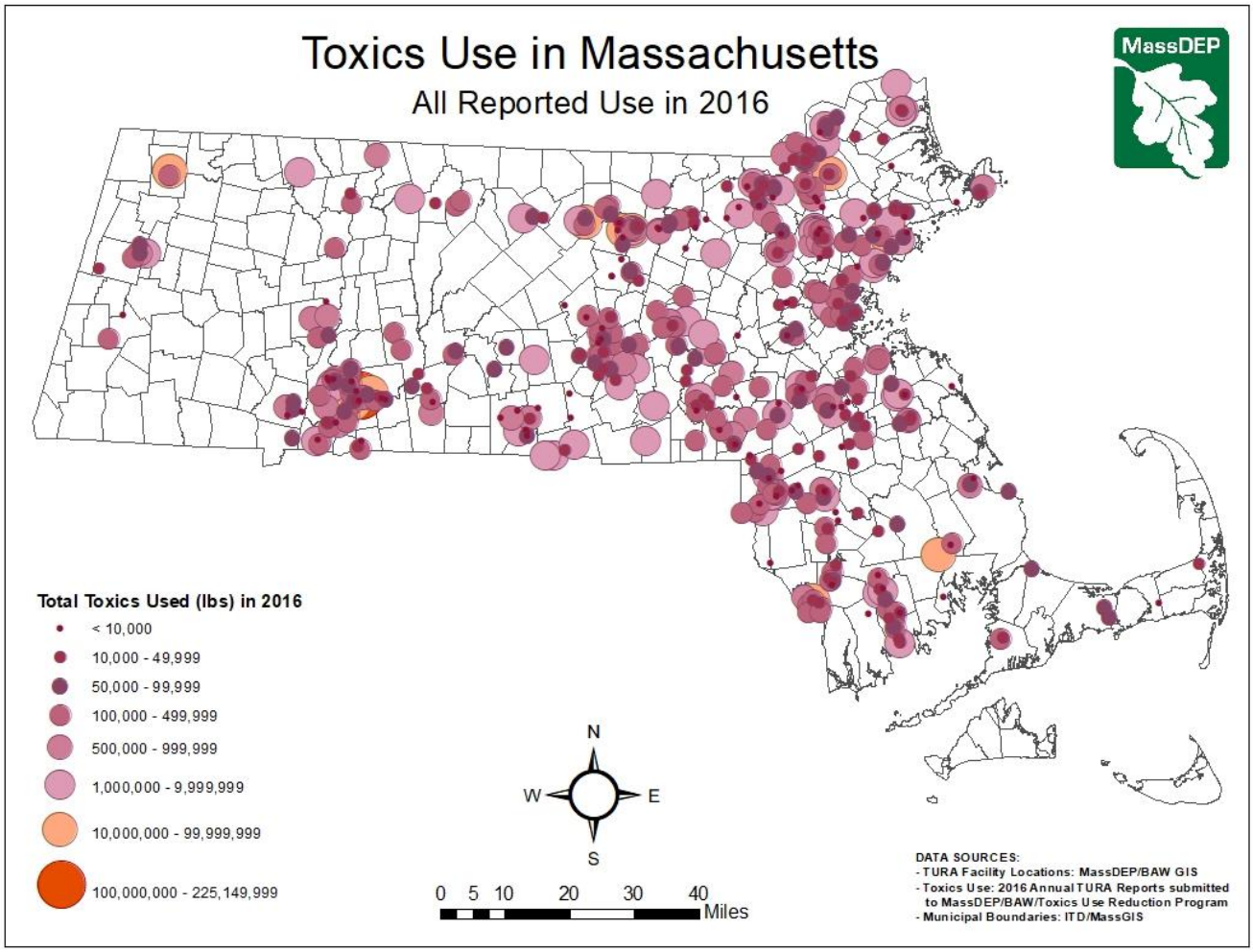
Reporting Year 2016
Toxics Use Reduction
Information Release



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

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

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Table of Contents

Executive Summary 1
I. Introduction 3
II. Key TURA Terms 4
III. 2016 Toxics Use Reduction Progress 5
IV. 2016 TURA Chemical Data 10
V. 2016 Chemicals of Particular Interest 15
VI. 2016 Significant Industrial Sectors 22
VII. 2016 Major TURA Facilities 26

Executive Summary

In 1989, the Toxics Use Reduction Act (TURA) (Chapter 21I of the Massachusetts General Laws) was enacted, to protect public health and the environment by promoting the efficient use of toxic chemicals. TURA established incentives that encourage facilities to use toxic chemicals (hereinafter referred to as chemicals, toxics, or toxic chemicals) only when necessary to make a product and to waste as little as possible in the production process. TURA has been successful. Massachusetts manufacturers and other businesses subject to TURA 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.

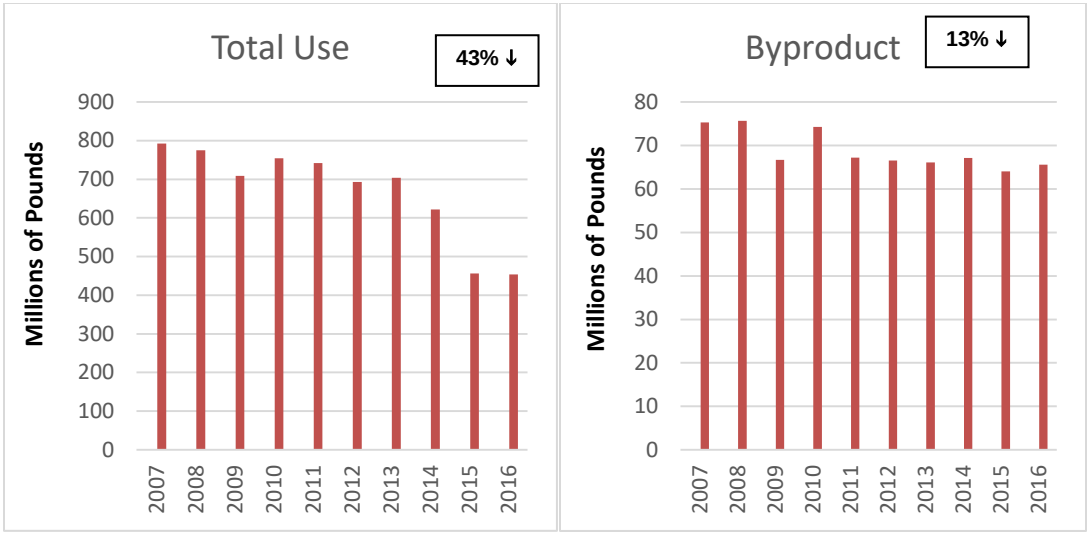
474 facilities subject to the Act reported using 125 different chemicals in 2016. In total (including data submitted as trade secret), from 1990 to 2016, the following reductions were observed:

- Chemical Use (from 1.2 to 0.7 billion pounds)
- Byproduct Generation (from 127 to 71 million pounds)
- Shipped in Product (from 434 to 326 million pounds)
- On-Site Releases (from 21 to 3 million pounds)
- Transfers Off-Site (from 46 to 35 million pounds)

From 2007 to 2016, 2007 Core Group (as defined on page 4) facilities:

- reduced toxic chemical use by 43% (from 792 to 453 million pounds)
- reduced toxic byproducts by 13% (from 75 to 66 million pounds)
- reduced toxics shipped in product by 16% (from 272 to 227 million pounds)
- reduced on-site releases of toxics to the environment by 51% (from 6 to 3 million pounds)
- increased transfers of toxics off-site for further waste management by 24% (from 25 to 31 million pounds).

2007 Core Group Toxics Use Reduction Progress 2007-2016
(Excludes Trade Secret Data)



This report includes the following six sections:

Section I: **Introduction**

Section II: **Key TURA Terms**

Section III: **2016 Toxics Use Reduction Progress** analyzes changes in reported chemical use and byproduct that can be attributed to the adoption of toxics use reduction by TURA filers, and associated reductions in pollution.

Section IV: **2016 Chemical Data** summarizes the reported information on chemical use in calendar year 2016 including detailed information on the top twenty chemicals used, generated as byproduct, shipped in product, released on-site as air or water pollution onsite, and shipped off-site for treatment and disposal.

Section V: **2016 Chemicals of Particular Concern** presents current and historical information on particularly toxic chemicals, on chemicals that promote asthma, and on carcinogens.

Section VI: **2016 Significant Industrial Sectors** describes the relative contributions of different industrial sectors to chemical use, waste and release.

Section VII: **2016 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 2016 Toxics Use Reduction Information Release contains chemical information useful to the public, government, and industry. However, because the data in this report is collected only from facilities within certain industrial sectors that have ten or more full-time employees, and use certain chemicals above established reporting thresholds, this report does not provide a complete picture of the use and release of all toxic chemicals in Massachusetts.

Downloadable data extracts, for reporting years 1990 through 2016, can be found at http://www.mass.gov/eea/agencies/massdep/toxics/reports/tura-data-and-results.html. The data extracts include all reported TURA data, with the exception of trade secret data, in an Excel format.

I. Introduction

This report describes toxic chemical use in Massachusetts in 2016 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, hereinafter referred to as filers) to submit annual reports to the 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 shipped 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 filers 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 codes,
- have ten or more full-time employee equivalents, and
- use listed toxic substances at or above reporting thresholds

Filers 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 companies are not required to implement identified TUR techniques, many do. The plans are not submitted to MassDEP for review and approval. Instead 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 their traditional TUR plan.

TURA also promotes toxics use reduction through two agencies that provide toxics use reduction education and assistance: The Office of Technical Assistance (OTA) and the Toxics Use Reduction Institute (TURI).

The work of MassDEP, OTA and TURI is supported by the fees paid by the filers and coordinated by the Toxics Use Reduction Administrative Council (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.

Massachusetts Department of Environmental Protection Toxics Use Reduction Program: www.mass.gov/dep/toxics/toxicsus.htm.

Office of Technical Assistance (OTA)

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 marked-based incentives to reduce toxics use for qualifying TURA filers.
https://www.mass.gov/environmental-assistance-services-for-businesses

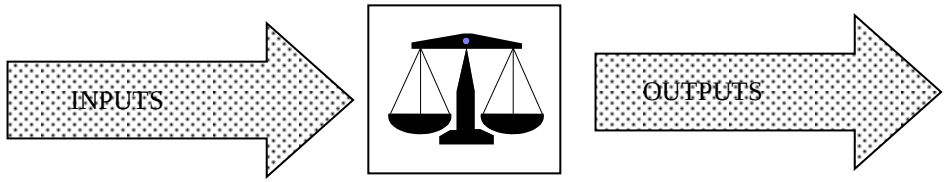
Toxics Use Reduction Institute (TURI)

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.

II. Key TURA Terms

TURA – Massachusetts Toxics Use Reduction Act of 1989 (MGL c. 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.
2007 CORE GROUP -- – includes all industry categories and chemicals that were subject to TURA reporting in 2007 and remained subject to reporting in the current reporting year at the same reporting threshold. The 2007 Core Group is used to measure progress from 2007. The 2007 Core Group does not include trade secret quantities.

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.



INPUTS

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

MANUFACTURE – TURA defines "manufacture", in part, as: "to produce, prepare, import or compound a toxic or hazardous substance".

PROCESS – TURA defines "process", in part, 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".

OTHERWISE USE – "Otherwise use" is defined in the TURA regulations (310 CMR 50.10), in part, 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".

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.
ON-SITE RELEASES – chemicals released to the air, land, surface or groundwater at the facility
TRANSFERS OFF-SITE – chemicals shipped offsite to a wastewater treatment or waste management, or recycling facility

III. 2016 Toxics Use Reduction Progress

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. TURA'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) was met by 1997, 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 TURA filers 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 1 and 2 below, the number of different TURA-listed chemicals used in the Commonwealth at reportable levels, the number of facilities using those chemicals, and the total amount of those chemicals used, generated as byproduct, released to the environment, and shipped offsite for treatment and disposal has declined in the twenty-four years since 1990.

As shown in Figure 1, out of 1,416 chemicals listed under TURA, 125 were reported in 2016, down from 133 in 1990. The number of filers rose to 728 in 1991 and 1992, gradually declined, and then rose again to 713 in 2001, largely due to the promulgation of a lower reporting threshold for persistent bioaccumulative toxic (PBT) chemicals (see Section IV, 2016 TURA Chemical Data). The number of filers has since declined to 474 in 2016. The number of individual chemical reports submitted (facilities file one Form S for each chemical reported) has followed a similar trend, decreasing from a high of 2,666 in 1994, to 1,630 in 2016, consistent with the decline in the number of TURA filers.

These reported amounts are influenced by changes in regulatory requirements. For example, the number of individual chemicals reported reached a high of 202 in 1996 due to an expansion in the chemical list, and the number of TURA filers increased to a high of 713 in 2001, due to a drop in the reporting threshold for certain chemicals. The number of chemical reports dropped by approximately 25% in 2007 when the TURA reporting threshold was raised for certain manufactured and processed chemicals to match the EPA TRI threshold. Individual chemical reports have since declined as Massachusetts businesses reported using fewer chemicals.

As shown in Figure 2, chemical use decreased from 1.2 billion pounds in 1990 to 0.7 billion pounds in 2016. Byproduct generation decreased from 127 million pounds in 1990 to 71 million pounds in 2016.

Figure 1
# of TURA Filers, Individual Chemical Reports, and Different Chemicals Reported (1990-2016)
(Including Trade Secret Data)

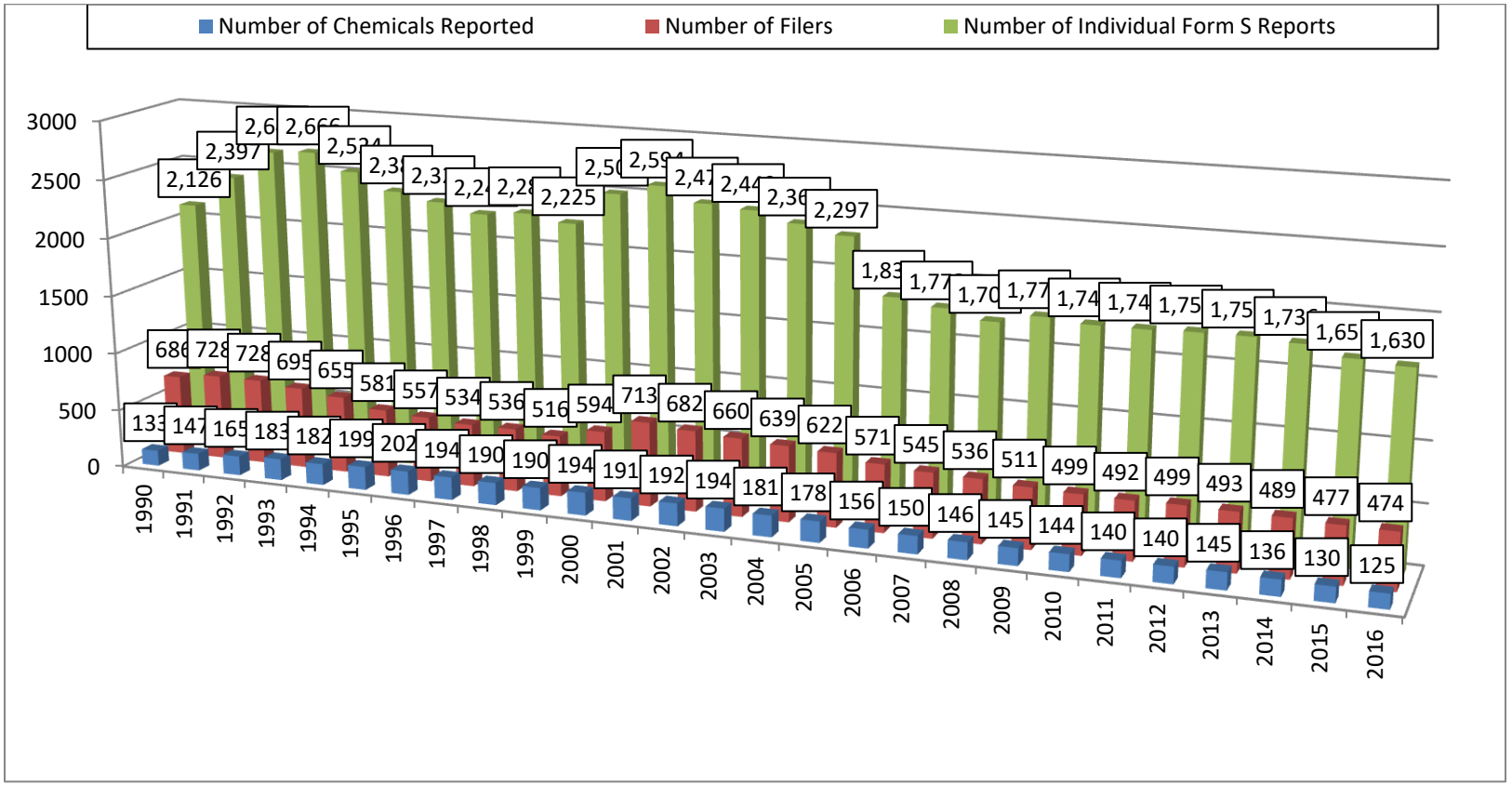
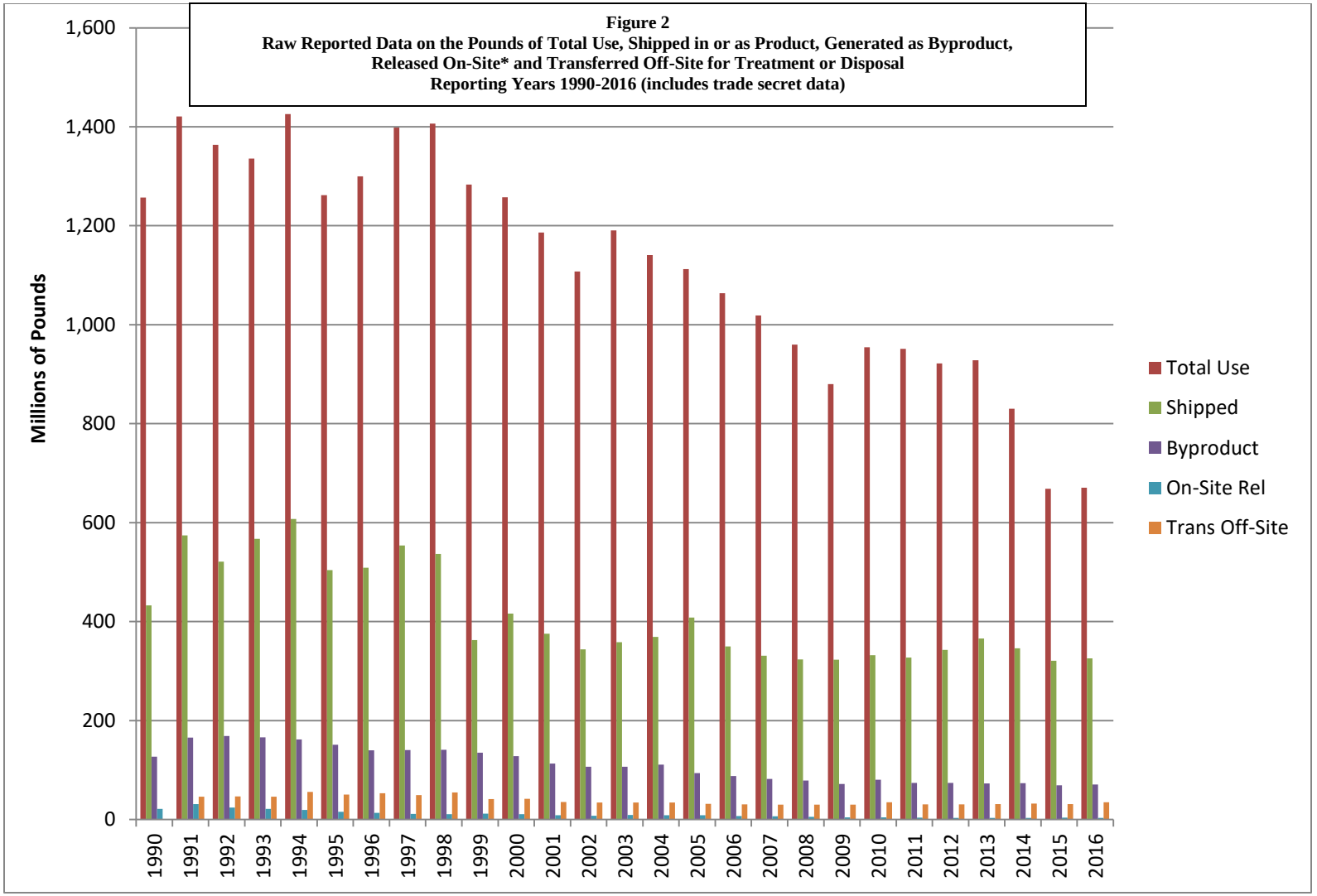


Figure 2
Raw Reported Data on the Pounds of Total Use, Shipped in or as Product, Generated as Byproduct, Released On-Site* and Transferred Off-Site for Treatment or Disposal
Reporting Years 1990-2016 (includes trade secret data)



Progress in Toxics Use Reduction: 2007 Core Group

The 2007 Core Group includes all industry categories and chemicals that were subject to TURA reporting in 2007 and remained subject to reporting in 2016 at the same reporting threshold. The 2007 Core Group is used to measure progress from 2007, the first reporting year since the 2006 TURA Amendments became effective. The 2007 Core Group does not include trade secret quantities. The 2007 Core Group includes 439 filers, which represents 93% of the 2016 TURA filers.

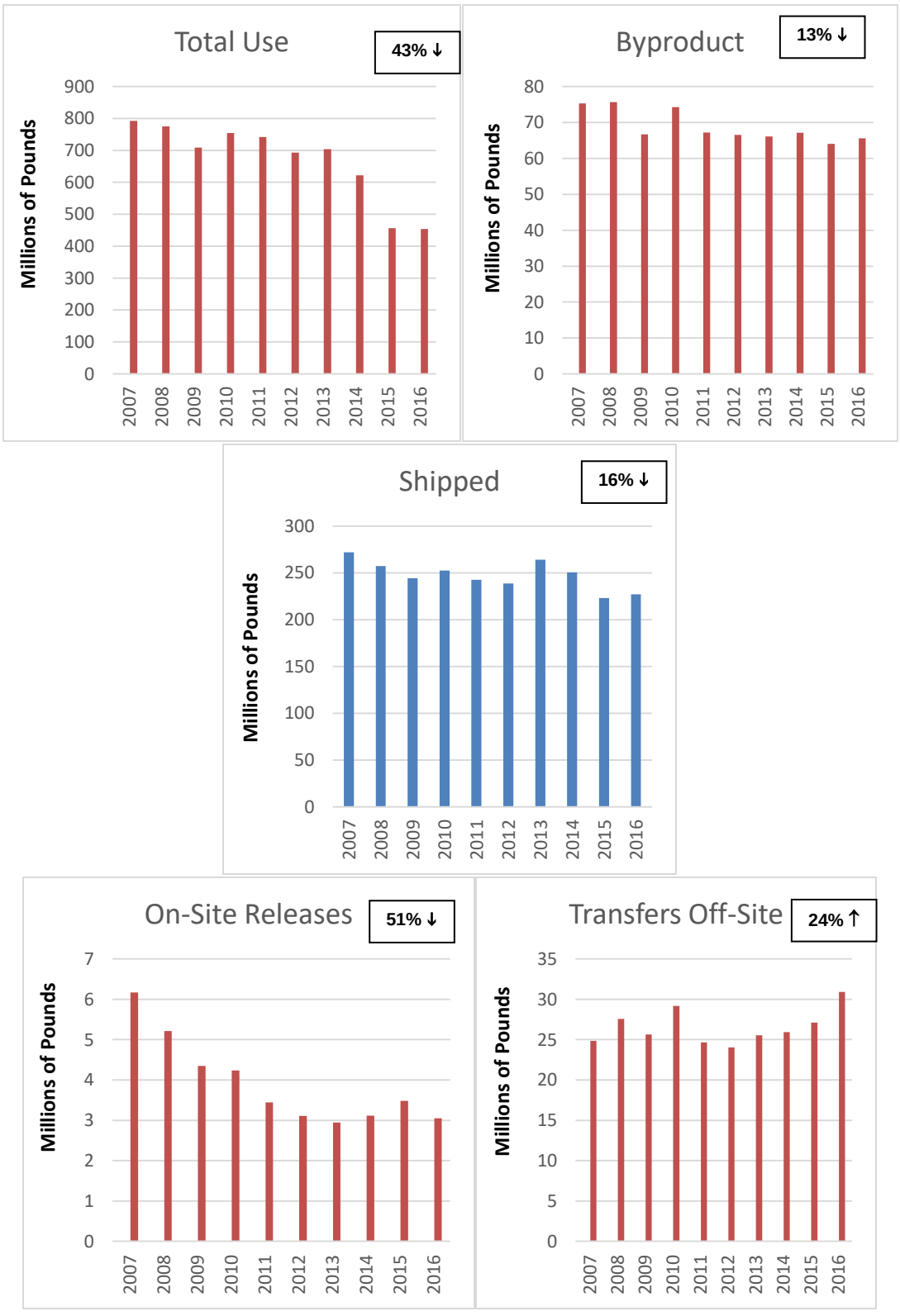
Table 1 and Figure 3 below summarize TURA data from 2007 to 2016, excluding trade secret data. The quantities reported by the 2007 Core Group over the period 2007 to 2016 are shown in Table 1. From 2007 to 2016, 2007 Core Group facilities:

- reduced toxic chemical use by 43% (from 792 to 453 million pounds)
- reduced toxic byproducts by 13% (from 75 to 66 million pounds)
- reduced toxic chemicals shipped in product by 16% (from 272 to 227 million pounds)
- reduced on-site releases of toxic chemicals to the environment by 51% (from 6 to 3 million pounds)
- increased transfers of toxic chemicals off-site for further waste management by 24% (from 25 to 31 million pounds).

Table 1
2007 CORE GROUP DATA: 2007-2017 TREND SUMMARY
(Quantities are in millions of pounds and do not include trade secret quantities)

Year	Total Use	Byproduct	Shipped in Product	On-Site Releases	Transfers Off-Site
2007	792.35	75.30	271.92	6.17	24.85
2008	774.75	75.64	257.38	5.21	27.57
2009	708.84	66.69	244.25	4.35	25.63
2010	754.15	74.24	252.55	4.23	29.17
2011	742.17	67.20	242.66	3.44	24.66
2012	693.00	66.51	238.63	3.11	24.03
2013	703.99	66.11	264.04	2.95	25.53
2014	621.58	67.13	250.47	3.11	25.92
2015	456.21	64.03	223.18	3.49	27.12
2016	453.48	65.55	227.24	3.05	30.91
Percent Change 2007-2016	43% Reduction	13% Reduction	16% Reduction	51% Reduction	24% Increase

Figure 3 – 2007 Core Group Toxics Use Reduction Progress 2007-2016
(Excludes Trade Secret Data)



IV. 2016 TURA Chemical Data

Table 2 All Reported Chemical Data 2016 (rounded to millions of pounds) (Includes Trade Secret Data)		
TOTAL USE	671,000,000	
SHIPPED IN PRODUCT	326,000,000	49% of total chemical use
GENERATED AS BYPRODUCT (total waste prior to treatment or disposal)	71,000,000	11% of total chemical use
ON-SITE RELEASES (to air, water or land disposal)	3,000,000	0.5% of total chemical use 5% of total byproduct
TRANSFERS OFF-SITE (to a wastewater treatment plant, recycling or waste management facility for treatment or disposal)	35,000,000	5% of total chemical use 49% 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 2016, seven companies made trade secret claims on a combined total of:

- 216 million pounds of chemical use
- 5 million pounds of byproduct generation (2% of trade secret total use).
- 99 million pounds shipped in product.

Chemical Use by Use Category

TURA requires that companies report chemical use in one of three use categories, identified by the Federal Toxics Release Inventory (TRI) program.

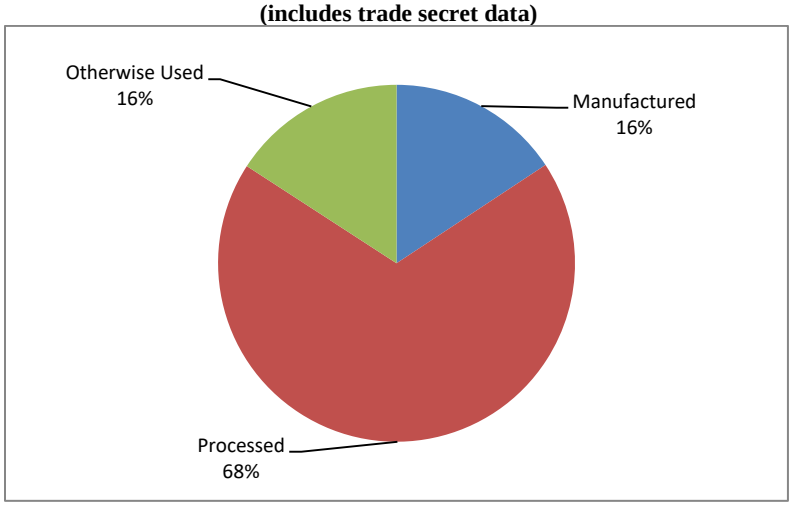
Manufacture is defined in TURA, in part, as "to produce, prepare, import or compound a toxic or hazardous substance". For example, the intentional manufacture of a chemical substance such as formaldehyde or the "coincidental" (unintentional) manufacture of chemicals such as the creation of sulfuric acid from fuel combustion for power generation and the production of nitrate compounds as a result of using nitric acid to treat wastewater. Chemicals that are imported are also counted as "manufactured". Manufacturing represented 16% of total chemical use in 2016.

Process is defined in TURA, in part, 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". Most chemical use in Massachusetts is processed. Chemicals processed accounted for 68% of 2016 total chemical use.

Otherwise Use is defined in the TURA regulations (310 CMR 50.10), in part, as "any use of a toxic substance that is not covered by the terms "manufacture" or "process" These substances are neither chemically converted nor incorporated directly into a product. Examples include chemicals used to clean parts prior to plating for finishing, chemical solvents used to carry a coating that evaporate off the product as the coating dries, catalysts, chemicals contained in fuels that are combusted, and chemicals used in waste treatment operations. Chemicals "otherwise used" accounted for 16% of 2016 total chemical use.

Figure 4 below shows the proportion of use for the three use categories:

Figure 4
2016 Total Use by Category
(671 Million Pounds)
(includes trade secret data)



Top 20 Chemicals

In 2016, filers reported using 125 out of the 1,416 TURA-listed chemicals in amounts above the reporting threshold. The company reported data was analyzed by chemical to identify the top 20 chemicals in each of the following reported amounts: used, generated as a byproduct, shipped in product, released onsite as pollution, and shipped offsite for treatment or disposal.

Chemical Use
As shown in Table 3 below, the 2016 top 20 chemicals in total use accounted for 82%, (373 million pounds) of the total reported statewide use (trade secret data was excluded to protect confidentiality claims). The top four chemicals, Sodium Hydroxide (13% of total use, 154 facilities, 60 million pounds), Methanol (12% of total use, 32 facilities, 56 million pounds), Hydrochloric Acid (11% of total use, 45 facilities, 51 million pounds), and Sodium Hypochlorite (7% of total use, 31facilities, 31 million pounds), accounted for almost half of the total reported use (excluding trade secret data) in the state.

Tables 4 and 5 show the top 20 chemicals for the other reporting categories. As with use, the top twenty chemicals represent a significant proportion of the total amount reported (Table 1): The top twenty chemicals comprised:

- 87% of the total reported byproducts (including trade secret data)
- 89% of the total reported shipped in product (excluding trade secret data)
- 94% of the total onsite releases (including trade secret data)
- 90% of the total offsite transfers (including trade secret data).

Acetone was the top "released" chemical, accounting for 17% of the statewide total of on-site releases (3 million pounds). Acetone is commonly used for cleaning and drying parts. Hydrochloric acid was the second chemical on the list. Ninety-seven percent of hydrochloric acid releases were from municipal waste combustors. 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.

Nitrate compounds was the top chemical for transfers offsite, accounting for 18% of the statewide total transfers off-site (35 million pounds). Nitrate compounds were primarily coincidentally manufactured during neutralization of nitric acid in wastewater treatment, and were discharged to Publically Owned Wastewater Treatment Plants.

Ninety-seven (97) 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.

Table 3 – 2016 Top 20 Chemicals: Total Use
These quantities do not include Trade Secret

Chemical Name (CAS #)	CAS #	Total Use (Lbs.)
Sodium Hydroxide	1310732	59,849,484
Methanol	**67561**	56,465,514
Hydrochloric Acid	7647010	50,605,130
Hypochlorous Acid, Sodium Salt	7681529	31,379,422
Sulfuric Acid	7664939	24,256,038
Nitrate Compounds	1090	14,949,186
Potassium Hydroxide	1310583	14,650,999
Toluene	**108883**	14,586,039
Ammonia	7664417	14,150,764
Acetone	**67641**	13,744,318
Ethylene Glycol	107211	10,028,169
Methyl Ethyl Ketone	**78933**	9,875,829
Ethyl Acetate	**141786**	9,351,959
Zinc Compounds	1039	8,483,552
Diisocyanates	1050	8,293,499
Phosphoric Acid	7664382	7,839,983
Nitric Acid	7697372	7,198,494
Chlorine	7782505	5,815,480
Toluene Diisocyanate	26471625	5,669,556
Methyl Methacrylate	80626	5,330,511

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

Table 4 – 2016 Top 20 Chemicals:
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.)**
Sodium Hydroxide	1310732	8,331,445	**Methanol**	**67561**	54,495,341
Ethyl Acetate	**141786**	7,414,831	Sodium Hydroxide	1310732	33,243,040
Nitrate Compounds	1090	6,843,106	Hypochlorous Acid, Sodium Salt	7681529	28,447,740
Toluene	**108883**	5,432,225	Potassium Hydroxide	1310583	12,258,817
Ethylene Glycol	107211	4,955,162	**Acetone**	**67641**	10,922,918
Sulfuric Acid	7664939	4,912,902	Sulfuric Acid	7664939	9,789,247
Methyl Ethyl Ketone	**78933**	2,815,510	**Toluene**	**108883**	8,398,275
Hydrochloric Acid	7647010	2,805,813	**Methyl Ethyl Ketone**	**78933**	6,933,966
Lead	7439921	2,686,385	Phosphoric Acid	7664382	6,396,549
Acetone	**67641**	2,645,206	Ethylene Glycol	107211	4,213,361
Methanol	**67561**	2,483,807	Zinc Compounds	1039	4,207,626
Formaldehyde	50000	2,184,038	**Ethyl Acetate**	**141786**	3,332,540
1-Methyl-2-Pyrrolidone	872504	1,749,731	Ferric Chloride	7705080	3,329,542
Acetonitrile	75058	1,623,304	Zinc (Fume Or Dust)	7440666	3,157,275
Dimethylformamide	68122	1,308,315	Glycol Ethers	1022	2,880,628
Nitric Acid	7697372	943,971	Antimony Compounds	1000	2,607,551
Aluminum Sulfate	10043013	909,751	Dimethylformamide	68122	2,450,005
Butyraldehyde	123728	680,908	Dichloromethane	75092	2,053,905
Ammonia	7664417	627,130	Diisocyanates	1050	1,753,348
Potassium Hydroxide	1310583	626,216	Xylene (Mixed Isomers)	1330207	1,734,209

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

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

Table 5 – 2016 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.)**
Acetone	**67641**	564,429	Nitrate Compounds	1090	6,481,697
Hydrochloric Acid	7647010	514,814	Ethylene Glycol	107211	5,160,111
Ammonia	7664417	356,805	Lead	7439921	2,405,621
Lead	7439921	309,550	**Toluene**	**108883**	2,387,816
Ethyl Acetate	**141786**	243,581	Formaldehyde	50000	1,983,335
Glycol Ethers	1022	230,425	**Methanol**	**67561**	1,959,335
N-Butyl Alcohol	71363	211,208	**Acetone**	**67641**	1,656,867
Toluene	**108883**	179,919	1-Methyl-2-Pyrrolidone	872504	1,654,950
Formaldehyde	50000	116,045	Acetonitrile	75058	1,621,942
Methanol	**67561**	72,887	**Methyl Ethyl Ketone**	**78933**	1,175,262
Methyl Ethyl Ketone	**78933**	71,532	Sodium Hydroxide	1310732	983,339
Trichloroethylene	79016	45,990	Nickel	7440020	628,170
N Propyl Bromide	106945	44,314	Butyraldehyde	123728	595,295
Dichloromethane	75092	41,335	Zinc Compounds	1039	574,869
Butyraldehyde	123728	37,917	Lead Compounds	1026	550,484
Sulfuric Acid	7664939	32,645	**Ethyl Acetate**	**141786**	527,751
Hexane (N-Hexane)	110543	30,520	Dichloromethane	75092	482,300
Xylene (Mixed Isomers)	1330207	26,659	N-Butyl Alcohol	71363	347,349
Tetrachloroethylene	127184	23,431	Dimethylformamide	68122	313,974
Tert-Butyl Acetate	540885	22,716	Furan, Tetrahydro-	109999	262,747

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

V. 2016 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) Chemicals

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 health and environmental threats and, therefore, the use and release of these chemicals, even in relatively small amounts, warrants public reporting as well as toxics use reduction efforts. Because of these concerns, the threshold for PBTs was lowered by USEPA 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, as of reporting year 2000, with the exception of lead and lead compounds (starting reporting year 2001).

Table 6 below shows the 2016 reported data and the number of filers for each PBT (excluding trade secret data). Nine PBTs are reported in Massachusetts. Five of these (dioxin, pacs, benzoperylene and mercury and mercury compounds) are chiefly associated with combustion at resource recovery facilities, power plants, and the manufacture of concrete and asphalt paving.

Table 7 below shows each PBT's chemical use since the year before it was designated as a PBT. The chemical use increased from zero to hundreds of pounds when the PBT designation occurred. The pounds of these combustion related chemicals increased again in 2002 when the municipal waste combustors were required to report. Despite being used primarily to produce power, companies did eliminate some of these chemicals when they switched from coal and oil to natural gas, and the majority showed that they were using less of the chemical or generating less byproduct per unit of product since the substance was designated as a PBT. However, reporting dropped substantially in 2007 when amendments to the Act exempted facilities that burned fuel for their own use from reporting on chemicals in the fuel or coincidentally manufactured during combustion.

The use of lead and lead compounds stems from a combination of combustion, waste management, paving asphalt manufacture, and traditional manufacturing. Over half of the use of lead (62%) is from the combustion of fuel by power plants and the combustion of waste by Municipal Waste Combusters.

Lowering the reporting threshold to 100 in 2001 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 129 in 2001. However, in 2016 the number of lead and lead compounds filers had decreased to 65 and 51, respectively.

Table 6 2016 Persistent Bioaccumulative Toxic (PBT) Chemicals Summary (Excludes Trade Secret Data)							
Substance	Threshold (lbs or grams for dioxin)	# Filers in 2016	Use	Byproduct	Shipped in Product	lbs On-Site Releases	Lbs Transfers Off-Site
Benzo[Ghi]Perylene	10	19	7,267	795	1,309	0	795
Dioxin And Dioxin Compounds	0.1 Gr	8	2,094	2,094	0	217	1,876
Lead	100	65	3,237,671	2,686,385	537,840	309,550	2,405,621
Lead Compounds	100	51	726,719	541,059	170,193	1,520	541,721
Mercury	10	16	8,479	3,875	6,960	517	2,892
Mercury Compounds	10	2	1,365	46	1,146	13	31
Polychlorinated Biphenyls	10	1	45,621	44,926	0	0	0
Polycyclic Aromatic Compounds	100	21	575,477	6,146	61,743	35	6,120
Tetrabromo-Bisphenol	10	2	3,418	90	3,329	0	90

Table 7
Pounds of PBTs Reported Use and Number of Facilities Reporting 2000 – 2016
(Excludes Trade Secret Data)

	Benzo[ghi]-perylene (191242)		Dioxin and Dioxin Compounds (1060)		Mercury (7439976)		Mercury Compounds (1028)		Poly-Chlorinated Biphenyls (1336363)		Polycyclic Aromatic Compounds (1040)		Tetra-bromo-bisphenol A (79947)		Lead (7439921)		Lead Compounds (1026)	
	Lbs Use	#	Grams Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#	Lbs Use	#
1999	0	0	0	0	0		0	0	0	0	37,539,261	6	0	0				
2000	146,531	120	12	8	4973	11	90,009	6	118,160	2	14,171,986	158	332	1	1,261,842	15	9,855,146	33
2001	180,326	127	12	8	9,315	13	676	5	83,890	2	13,849,697	151	115	1	1,284,199	152	7,290,727	129
2002	123,429	122	13	8	5,922	13	1,765	5	64,981	2	11,148,250	149	19,057	1	912,922	143	5,146,270	114
2003	125,099	119	11,827	17	11,476	20	1,212	6	37,325	2	11,486,388	136	152	1	3,394,134	140	5,982,308	117
2004	128,874	114	3,033	16	12,629	20	966	7	46,879	2	11,796,370	133	0	0	3,651,671	109	5,279,027	126
2005	128,809	109	6,696	17	10,444	22	1,031	6	21,741	2	11,128,163	127	0	0	3,763,242	114	3,689,910	126
2006	49,376	27	761	15	13,351	19	1,011	6	22,042	2	3,735,104	31	0	0	4,811,219	102	2,279,105	111
2007	49,412	28	1,155	13	13,733	19	1,101	5	110,303	3	5,051,904	29	0	0	4,172,982	90	1,406,092	104
2008	33,393	25	1,523	13	12,231	20	3,421	6	156,170	3	3,275,212	30	0	0	3,799,929	90	1,241,717	93
2009	12,403	24	1,951	11	10,515	17	1,610	5	42,757	3	1,168,637	28	4,596	1	4,130,556	73	971,451	84
2010	4,275	21	1,980	9	11,434	16	1,161	4	71,091	2	382,534	26	4,875	2	3,208,423	75	736,262	73
2011	3,177	23	2,811	9	15,826	17	1,307	5	72,654	2	283,498	27	7,235	3	3,080,576	75	569,666	66
2012	2,712	23	2,650	9	7,795	16	157	2	83,372	2	206,532	26	7,242	3	3,289,441	79	654,024	63
2013	4,832	22	1,847	9	6,619	17	639	4	126,857	3	523,396	26	5,881	2	3,531,726	76	754,176	61
2014	10,570	21	1,841	10	4,451	17	653	3	88,354	2	1,055,061	24	3,015	2	3,653,822	69	835,041	55
2015	10,692	21	1,762	8	6,867	17	1,000	2	59,887	1	1,397,277	23	4,466	2	3,450,622	63	956,404	51
2016	7,267	19	2,094	8	8,479	16	1,365	2	45,621	1	575,477	21	3,418	2	3,237,671	65	726,719	51

NOTE: The numbers below the dark lines indicate the first year that these chemicals were designated as a PBT and the reporting threshold was lowered.

Higher Hazard Substances (HHS)

Other higher hazard chemicals are also reported under TURA. The 2006 amendments to TURA directed the 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 higher hazard substances (HHS) to 1,000 pounds for all uses. Table 8 below shows the pounds of each HHS reported and the number of facilities reporting it from the year before it was designated as an HHS to 2016. Cyanide Compounds, Dimethylformamide, Hydrogen Fluoride, and N-Propyl Bromide were designated as HHS in 2016.

The data shows a similar trend for trichloroethylene and tetrachloroethylene, as that seen with PBTs: a gradual decline in use from 2007, 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 an HHS, followed by a drop in both measures.

Table 9 below shows the eleven HHS chemicals reported in 2016, including the number of filers, byproduct generation, shipped in product, on-site releases, and transfers off-site.

Table 8
Pounds of High Hazard Chemicals Reported and Number of Facilities
(Excludes Trade Secret Data)

Year	Cadmium # Facilities (HHS as of 2008)		Cadmium Compounds # Facilities (HHS as of 2008)		Trichloroethylene # Facilities (HHS as of 2008)		Tetrachloro-ethylene # Facilities (HHS as of 2009)		Formaldehyde # Facilities (HHS as of 2012)		Hexavalent Chromium Compounds # Facilities (HHS as of 2012)		Methylene Chloride/ Dichloromethane # Facilities (HHS as of 2014)		Cyanide Compounds # Facilities (HHS as of 2016)		Dimethyl-formamide # Facilities (HHS as of 2016)		Hydrogen Fluoride # Facilities (HHS as of 2016)		N-Propyl Bromide # Facilities (HHS as of 2016)	
	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#
2007	0	0	184,400	1	604,671	9																
2008	29,429	5	167,355	6	536,073	27	230,345	4														
2009	28,969	4	145,324	7	556,457	23	176,186	23														
2010	23,970	4	242,702	7	294,836	16	151,918	18														
2011	26,878	4	180,654	5	303,076	17	163,773	19	4,027,226	9	0	0										
2012	29,805	6	181,666	5	354,351	14	89,216	16	4,119,146	25	121,504	16										
2013	20,447	6	210,550	6	176,891	15	110,550	18	4,011,427	27	113,466	16	3,496,421	11								
2014	16,655	4	217,235	6	262,811	14	164,606	16	3,276,305	25	103,595	15	3,031,438	24								
2015	20,312	3	128,953	6	243,143	13	320,950	11	3,017,674	23	92,490	14	2,628,764	24	71,695	3	3,505,082	8	386,390	7	12,687	1
2016	17,707	3	154,714	5	236,683	14	909,566	12	3,154,185	21	77,657	14	2,625,937	19	118,955	14	3,845,720	13	499,148	24	92,300	21

NOTE: The numbers below the dark lines indicate the first year that these chemicals were designated as an HHS and the reporting threshold was lowered.

Table 9 2016 Higher Hazard Substances (HHS) Summary (Excludes Trade Secret Data)						
Substance and Year Designated as HHS	# Filers in 2016	Use	Byproduct	Shipped in Product	On-Site Releases	Transfers Off-Site
Cadmium/2008	3	17,707	1,218	16,489	14	891
Cadmium Compounds/2008	5	154,714	11,633	17,896	18	11,614
Trichloroethylene/2008	12	909,566	42,238	837,251	23,431	17,916
Tetrachloroethylene/2009	14	236,683	115,797	139,247	45,990	21,290
Formaldehyde/2012	21	3,154,185	480,820	172,307	110,438	285,724
Hexavalent Chromium Compounds/2012	14	77,657	12,705	63,492	122	12,692
Methylene Chloride/ Dichloromethane/2014	19	2,625,937	530,622	2,053,905	41,335	482,300
Cyanide Compounds/2016	14	118,955	39,264	7,848	6	27,138
Dimethylformamide/2016	13	3,845,720	1,308,315	2,450,005	9,294	313,974
Hydrogen Fluoride/2016	24	499,148	284,532	34,393	876	155,504
N-Propyl Bromide/2016	21	92,300	82,898	10,574	44,314	30,928

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 2016 data on some of the chemicals identified in the LCSP report that were reported under TURA. In 2016, 15 chemicals identified as asthmagens by the Association of Occupational and Environmental Clinics (AOEC) were reported under TURA. In 2016, formaldehyde and sulfuric acid were reported with the largest amount of releases. Sulfuric acid was reported with the largest amount of use.

Table 10 Asthma-Related Toxics (in pounds) (Excludes Trade Secret Data)		
Chemical Name (Number of facilities)	**Use**	**On-Site Releases**
Acetic Acid (17)	1,465,297	838
Aluminum (1)	76,277	381
Chlorine (4)	5,815,480	643
Chromium (2)	203,494	32
Ethylene Oxide (1)	161,056	208
Formaldehyde (21)	3,154,185	110,438
Hydrazine (3)	237,455	11
Maleic Anhydride (1)	394,540	337
Methyl Methacrylate (6)	5,330,511	11,924
Nickel (5)	382,310	338
Nickel Compounds (4)	694,038	2,936
Phthalic Anhydride (1)	90,934	18
Styrene Monomer (7)	4,255,674	19,073
Sulfuric Acid (87)	24,256,038	32,645
Toluene Diisocyanate (5)*	6,240,560	168

* Toluene Diisocyanate includes CAS numbers 91087, 584849, and 26471625.

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 2016, six IARC Group 1 carcinogens were reported under TURA (see Table 11). Formaldehyde and nickel compounds were reported with the largest amounts of use. Formaldehyde was reported with the largest amount of releases and the most facilities. Of these chemicals, formaldehyde was reported by the most facilities. Releases were primarily air releases; however, there were also releases to water and land.

Table 11 IARC Group 1 Carcinogens (in pounds unless otherwise noted) (Excludes Trade Secret Data)		
Chemical Name (Number of Facilities)	**Use**	**On-Site Releases**
Cadmium (3)	17,707	14
Dioxin (8)*	2,094 grams	217 grams
Ethylene Oxide (1)	161,056	208
Formaldehyde (21)	3,154,185	110,438
Hexavalent Chromium Compounds (14)	77,657	122
Nickel Compounds (4)	694,038	2,936

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

VI. 2016 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.

Figures 1 through 4 present, by sector, the 2016 numbers of companies reporting, reported amount of use, byproduct, and releases on-site by industrial sector.

The charts demonstrate that the chemical manufacturing sector dominates chemical use in the Commonwealth. This sector had the greatest percentage of filers (Figure 5)17%, by far the greatest percentage of use (Figure 6) 57%, the largest percentage of byproduct (Figure 7) 39%, and the third largest percentage of on-site releases (Figure 8) 12%. This sector is a diverse group of industries, and includes companies that "manufacture" chemicals according to the TURA definition as well as companies that "process" chemicals to formulate adhesives, paints, pharmaceuticals, and plastic materials and resins. The chemical manufacturing sector is broken into further sectors in Figure 6.

Chemical distributors at (Figure 6) 16%, were the second largest contributor to use, but had virtually no impact on byproduct and releases. Paper manufacturing, waste management and remediation services, and fabricated metal processors, were other sectors with substantial contributions to byproduct and releases. The paper manufacturing sector, which accounted for (Figure 6) 2% of total statewide use, accounted for (Figure 7) 14% of total byproduct generated. Likewise, waste management and remediation services, which accounted for (Figure 6) 6% of total statewide use, had the highest contribution of on-site releases (Figure 8) 24%.

Figure 5 –2016 Number of Facilities by Industrial Sector
Total Number of Facilities = 474
(Includes Trade Secret Data)

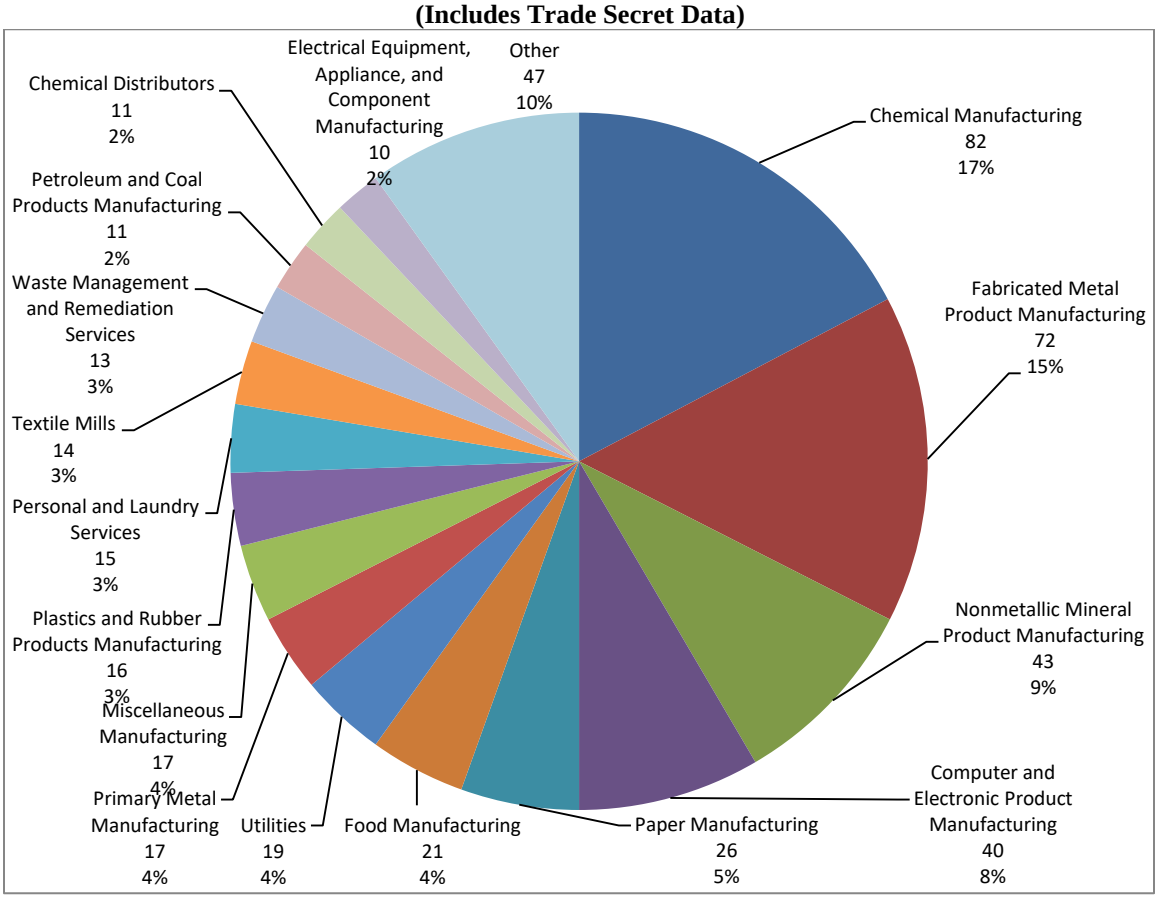


Figure 6 – All Reported Data: 2016 Chemical Use by Industrial Sector
Total Use = 671,000,000 Pounds
(Includes Trade Secret Data)

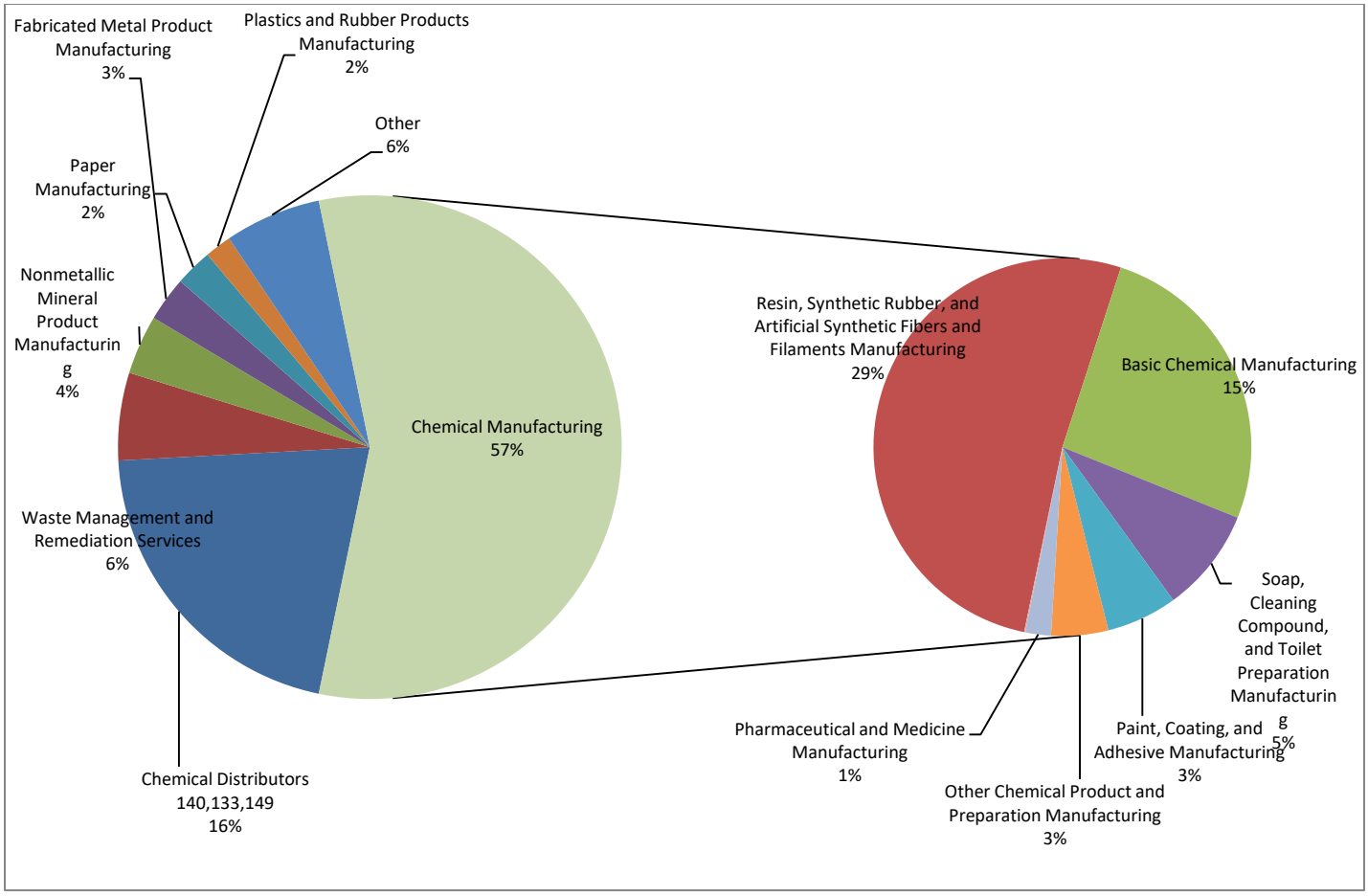


Figure 7 – All Reported Data: 2016 Byproduct Generation by Industrial Sector Total Byproduct = 71,000,000 Pounds
(Includes Trade Secret Data)

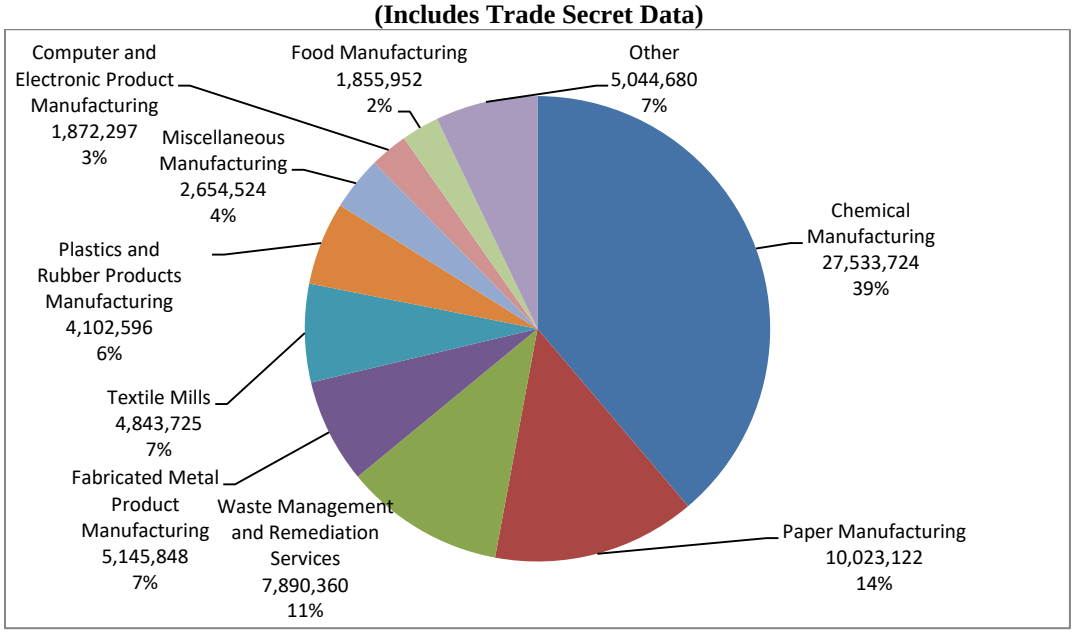
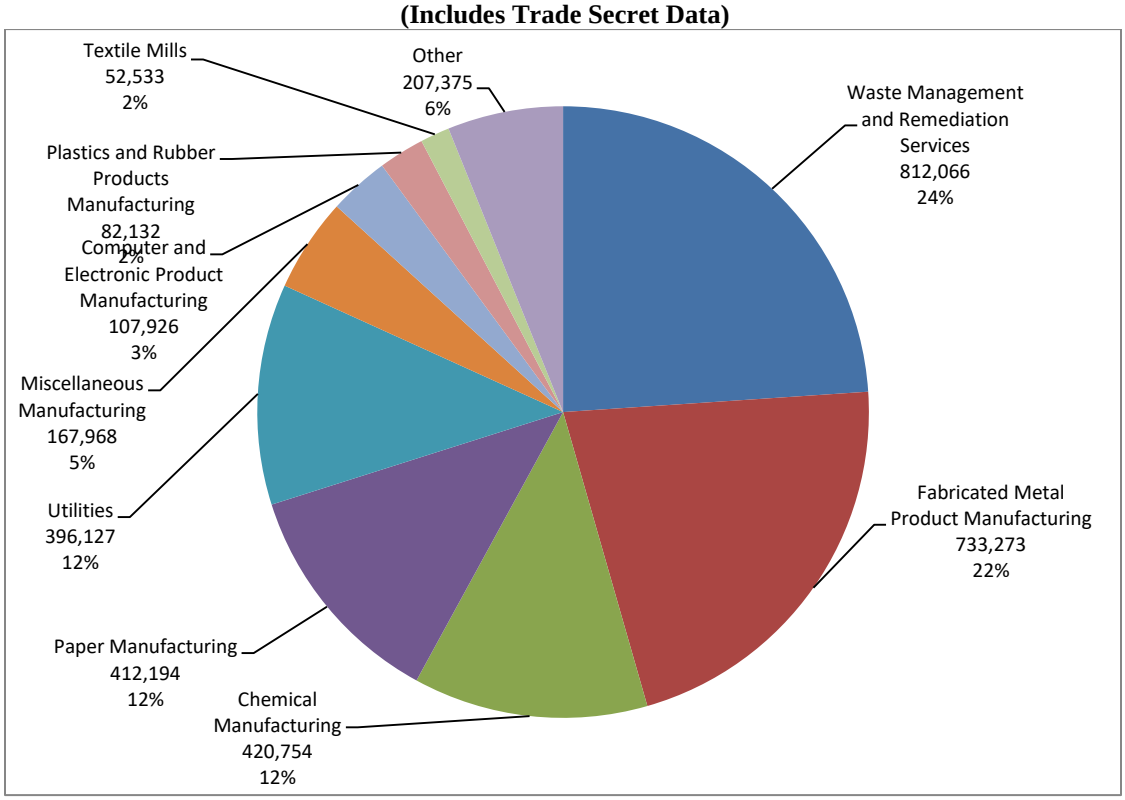


Figure 8 – All Reported Data: 2016 On-Site Releases by Industrial Sector Total On-Site Releases = 3,000,000 Pounds
(Includes Trade Secret Data)



VII. 2016 Major TURA Facilities

Tables 12 through 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.

- Table 12 lists the 20 facilities that reported the largest total quantity of TURA chemicals used. These 20 facilities used 499 million pounds, or 74% of total statewide use.

- Table 13 lists the 20 facilities that generated the largest reported quantity of byproduct generated and shipped in product. These facilities generated 42 million pounds of byproduct or 59% of the statewide total. The 20 facilities with the largest quantity shipped in product, shipped 292 million pounds in product, or 90% of the statewide total.

- 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 million pounds, or 63% of total releases statewide. Five of the top 20 facilities of reported on-site releases were municipal waste combustors (MWCs) that also reported combustion-related emissions. Of the 785,000 pounds of on-site releases reported by these MWCs, 61% was due to the coincidental manufacture of hydrochloric acid during combustion, and 39% 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 26 million pounds, or 73% of the total statewide transfers off-site.

Table 12 2016 Top 20 Facilities: Reported Total Use (Includes trade secret data)		
Facility Name	Town	Total Use (Lbs.)
Solutia Inc	Springfield	127,976,196
Boremco Specialty Chemicals	Fall River	76,352,717
Holland Company Inc	Adams	61,756,800
Ineos Melamines Llc	Springfield	37,496,241
Astro Chemicals	Springfield	31,406,133
Rousselot Peabody Inc	Peabody	28,477,755
Southwin Ltd	Leominster	21,805,769
James Austin Co	Ludlow	17,944,406
Camco Manufacturing Inc	Leominster	14,123,111
Omnova Solutions Inc	Fitchburg	11,691,741
Semass Resource Recovery Facility	Rochester	10,598,713
Roberts Chemical Co	Attleboro	8,409,254
Nexeo Solutions Llc	Tewksbury	7,927,244
Houghton Chemical Corporation	Allston	6,876,001
Webco Chemical Corp	Dudley	6,773,379
Metalor Technologies Inc	Attleboro	6,568,378
Wheelabrator North Andover Inc	North Andover	6,042,612
Wheelabrator Millbury Inc	Millbury	5,979,204
Univar USA Inc	Salem	5,531,094
Innocor Foam Technologies Newburyport	Newburyport	5,519,000

Table 13 2016 Top 20 Facilities: Reported Byproduct and Shipped in Product (Includes trade secret data)					
Byproduct			**Shipped in Product**		
Facility Name	Town	Byproduct Generation (Lbs.)	Facility Name	Town	Shipped in Product (Lbs.)
Solutia Inc	Springfield	6,906,711	Holland Company Inc	Adams	61,756,800
Rousselot Peabody Inc	Peabody	4,352,078	Boremco Specialty Chemicals	Fall River	55,384,360
3M	Rockland	4,198,135	Solutia Inc	Springfield	34,092,532
Flexcon Company Inc	Spencer	3,643,340	Astro Chemicals	Springfield	28,749,040
Ineos Melamines Llc	Springfield	3,080,275	Southwin Ltd	Leominster	21,799,988
Safety Kleen Systems Inc	Marlborough	2,713,600	James Austin Co	Ludlow	17,873,505
Nitto Denko Avecia Inc	Milford	2,500,814	Camco Manufacturing Inc	Leominster	14,121,695
Foilmark Inc	Newburyport	1,655,682	Roberts Chemical Co	Attleboro	8,409,254
Genzyme A Sanofi Company	Boston	1,354,455	Houghton Chemical Corporation	Allston	8,260,017
Crane And Company Inc Pioneer Mill	Dalton	1,346,655	Nexeo Solutions LLC	Tewksbury	7,896,706
Thermo Fisher Scientific	Bedford	1,275,771	Webco Chemical Corp	Dudley	6,770,578
Semass Resource Recovery Facility	Rochester	1,164,244	Univar USA Inc	Salem	5,521,000
Haartz Corporation	Acton	1,109,596	ITW Polymers Sealants North America	Rockland	4,980,889
Koch Membrane System Inc	Wilmington	1,006,865	Savogran Company	Norwood	2,936,051
Munters Corp	Amesbury	989,114	Bostik Inc	Middleton	2,500,115
Genzyme Corporation	Framingham	984,062	Shield Packaging Co Ink	Dudley	2,467,757
Barnhardt Manufacturing Co	Colrain	895,773	Callahan Chemical Co	Walpole	2,442,004
Metalor Technologies Inc	Attleboro	891,747	Alpha Chemical Services	Stoughton	2,426,671
Covanta Springfield LLC	Agawam	849,721	Mexichem Specialty Chemicals Inc	Leominster	2,179,440
Ideal Tape Company	Lowell	844,831	Riverdale Mills Corporation	Northbridge	1,892,425

Table 14
2016 Top 20 Facilities: Reported On-Site Releases and Transfers Off-Site
(Includes trade secret data)

On-Site Releases			**Transfers Off-Site**		
Facility Name		On-Site Releases (Lbs.)	Facility Name	Town	Transfers Off-Site (Lbs.)
Crown Beverage Packaging USA	Lawrence	403,007	Solutia Inc	Springfield	5,809,337
Covanta Haverhill Inc	Haverhill	343,990	Safety Kleen Systems Inc	Marlborough	2,713,558
Semass Resource Recovery Facility	Rochester	181,100	Ineos Melamines LLC	Springfield	2,686,142
Wheelabrator Millbury Inc	Millbury	139,933	Nitto Denko Avecia Inc	Milford	2,499,105
Solutia Inc	Springfield	137,208	Genzyme A Sanofi Company	Boston	1,217,082
Ideal Tape Company	Lowell	127,152	Thermo Fisher Scientific	Bedford	1,191,804
Mystic Station	Everett	119,839	Semass Resource Recovery Facility	Rochester	983,145
AR Metallizing Ltd	Franklin	86,536	Koch Membrane System Inc	Wilmington	960,482
Callaway Golf Ball Operations Inc	Chicopee	79,970	Genzyme Corporation	Framingham	960,398
Wheelabrator Saugus Inc	Saugus	79,693	Bostik Inc	Middleton	813,351
Millennium Power Project	Charlton	58,161	Waters Chromatography Division	Taunton	778,225
Jen Manufacturing Inc.	Millbury	52,051	Wyman Gordon Company	Grafton	726,428
Metalor Technologies Inc	Attleboro	49,042	Ideal Tape Company	Lowell	717,679
Hollingsworth And Vose Company	West Groton	47,218	Skyworks Solutions Inc	Woburn	652,640
Waters Chromatography Division	Taunton	42,554	Johnson Matthey Pharma Services	Devens	625,242
Smith & Wesson Corp	Springfield	41,479	PCI Synthesis Inc	Newburyport	530,545
Wheelabrator North Andover Inc	North Andover	40,366	Brittany Dyeing & Printing Corporation	New Bedford	528,003
3M	Rockland	39,671	Electronic Recyclers International Mass	Holliston	471,519
Flexcon Company Inc	Spencer	38,631	Pharm Eco DBA	North Andover	421,253
The Duncan Group	Everett	37,315	Flexcon Company Inc	Spencer	417,801

Massachusetts Department of
Environmental Protection
One Winter Street
Boston, MA 02108-4746

Commonwealth of Massachusetts
Charles D. Baker, Governor

Executive Office of Energy and Environmental Affairs
Kathleen A. Theoharides, Secretary

Department of Environmental Protection
Martin Suuberg, Commissioner