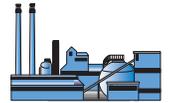


Chapter 3

Toxics Release Inventory Data for New Reporting Industries

Chapter 3



Toxics Release Inventory Data for New Reporting Industries

This chapter provides an overview of 1998 TRI data by industry sector for the seven industries that were required to report to TRI for the first time in 1998. Analyses of TRI reporting by the 20 industries in the manufacturing sector (Standard Industrial Classification codes 20–39) that have been required to report to TRI since the program began in 1987 appear in Chapter 4.

Data analyses in this chapter begin with summary tables that compare 1998 release and waste management data for the original TRI industries, the industries newly required to report, and all TRI industries. A separate analysis of reporting by federal facilities follows. The chapter then presents separate sections on each new industry and its TRI data. To help put the TRI data in context, the industry sections describe the industry's products and services, employment and production levels, processes involving toxic chemicals, general environmental issues, and management of toxic chemicals in waste. Information and TRI data for RCRA subtitle C hazardous waste treatment and disposal facilities (in SIC code 4953) and solvent recovery services (in SIC code 7389) are presented together because of their similarity.

Chapter 1 explains the types of releases and waste management activities and provides important information on factors to consider when using TRI data.

◆ New Industries ◆

As noted in Chapter 1 (see **Who Must Report?** and **Facility Expansion**), EPA conducted a detailed examination of non-manufacturing industries to determine which sectors release or otherwise manage significant quantities of TRI chemicals in waste. This effort, undertaken in 1992, focused particular attention on sectors linked to manufacturing—those providing energy, providing raw materials as inputs, further managing products, or further managing waste from the manufacturing sector. As a result, on May 1, 1997 (62 FR 23833), EPA added to TRI seven new industry sectors, beginning in reporting year 1998:

- ◆ metal mining (SIC code 10, except 1011, 1081, and 1094),
- ◆ coal mining (SIC code 12, except 1241),
- ◆ electrical utilities that combust coal and/or oil (SIC codes 4911, 4931, and 4939),
- ◆ RCRA subtitle C hazardous waste treatment and disposal facilities (in SIC code 4953),
- ◆ chemical wholesalers (SIC code 5169),
- ◆ petroleum terminals and bulk stations (SIC code 5171), and
- ◆ solvent recovery services (SIC code 7389).



Box 3–1 explains SIC codes and their use in TRI. This information is important for understanding TRI data and analyses for the new industries.

❖ TRI Data for Original and New Industries, 1998 ❖

As shown in Table 3–1, 1,970 facilities in industries reporting to TRI for the first time in 1998 submitted 15,255 forms. Although they amounted to 8.4 percent of all TRI facilities reporting, these facilities submitted 17.5 percent of the TRI forms.

On- and Off-site Releases

The new industries' on- and off-site releases totaled 4.93 billion pounds, two-thirds

(67.4 percent) of TRI's 1998 total. Table 3–1 shows that most of the new industries' releases were on-site land releases (4.00 billion pounds). While 15.0 percent of the original TRI industries' total was released on-site to land, 80.3 percent of the new industries' total was released on-site to land. TRI reports from the new industries contributed 91.7 percent of all TRI on-site land releases in 1998. As discussed later in this chapter, metal mining facilities reported the bulk of the on-site land releases.

Air emissions by the new industries totaled 796.6 million pounds, including 789.6 million pounds of point source air emissions. The large proportion of on-site land releases by the new industries substantially influences the percentages of other release types. For example, air emissions amounted

Box 3–1. An Explanation of SIC Codes and TRI

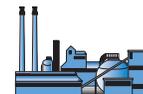
An Explanation of SIC Codes and TRI

SIC codes are the Standard Industrial Classification codes used throughout the federal government to classify economic activity by industry. Facilities in the manufacturing sectors, that is, SIC codes 20 through 39, have been required to report to TRI since the program began. Federal facilities have been required to report to TRI since 1994, regardless of their SIC code. In 1998, seven additional industries began reporting.

On TRI Form Rs and Form A certification statements, facilities report the four-digit SIC codes that define their operations. A facility might report, for example, SIC code 2873, nitrogenous fertilizers. These industries are grouped into broader categories at the three-digit and two-digit SIC code levels. For example, nitrogenous fertilizers falls into the agricultural chemicals group at the three-digit level (SIC code 287) and the chemicals and allied products major group (SIC code 28). Producers of nitrogenous fertilizers have been required to report to TRI since 1987. A facility that mines silver ore (in SIC code 1044; in the gold and silver ores group SIC code 104; in the metal mining major group SIC code 10) was newly required to report to TRI in 1998. A solvent recovery facility in SIC code 7389 was also required to report in 1998, although other types of economic activity in that SIC code (miscellaneous business services) do not report to TRI.

Tables in this chapter present data only for the SIC codes—and the economic activities within those codes—that are specifically required to report to TRI.

Industrial facilities often conduct inter-related operations that result in products or services classified in different SIC codes. TRI forms with multiple SIC codes are generally analyzed in Chapter 4 (Box 4–2 explains the methodology). However, if a facility reported for the first time in 1998 with SIC codes for both new and original industries, it is included in the analyses in this chapter under the new industry code.



to 16.2 percent of the new industries' total releases, compared to 52.8 percent of the original industries' releases. However, when all TRI releases to air are considered, 38.8 percent came from the new industries' forms. Electrical utilities reported the great majority of the new industries' air emissions, as presented later in this chapter.

Notably, the new industries also reported 99.7 percent of all underground injection to Class II–V wells (explained in Box 1–4 in Chapter 1). The new industries reported 33.25 million pounds of the TRI total of 33.35 million pounds of such underground injection.

Transfers to landfills/surface impoundments were the largest type of off-site release for both original and new industries. Facilities in the new industries reported 79.0 million pounds in this category. This amounted to just 1.6 percent of the new industries' total releases. The original industries sent 212.6 million pounds to off-site landfills and surface impoundments, 8.9 percent of their total releases.

The addition of hazardous waste treatment and disposal facilities in SIC code 4953 in 1998 means that TRI chemicals in waste may be sent by one TRI facility (reporting the amounts as transfers off-site to disposal) to another TRI facility (reporting the amounts as on-site releases). Box 3–2 explains EPA's methodology for avoiding the duplication of this data in analyses throughout this chapter.

❖ Total Releases by State ❖

The geographic distribution of total releases differed considerably between the original and new industries, and the new indus-

tries' data strongly influence state rankings for total releases by all TRI industries in 1998. State-by-state comparisons of amounts and rank for total releases by original industries, new industries, and all TRI industries appear in Table 3–2.

States with the largest releases by new industries were Nevada with 1.27 billion pounds, Arizona with 1.02 billion pounds, and Utah with 475.0 million pounds. As seen later in this chapter, metal mining facilities reported large releases in these three states. These were also the top states for total releases by all TRI industries. For total releases by the original industries, Nevada ranked 44th, Arizona 18th, and Utah seventh. As discussed in Chapter 2 (*TRI Data by State, 1995–1998*, and Table 2–5), the top states for total releases by original industries in 1998 were Texas with 262.7 million pounds, Louisiana with 175.6 million pounds, and Ohio with 153.6 million pounds.

Three states, including Utah, ranked in the top 10 for both original and new industries. Ohio ranked third for total releases by original industries and sixth for new industries. Pennsylvania ranked fourth in the original industries' reporting and seventh for the new industries. As noted, Utah was seventh for original industries and third for new industries.

Waste Management Data

Quantities of TRI Chemicals in Waste

The original industries reported production-related waste totaling 24.05 billion pounds in 1998, and 10.2 percent of that total consisted of quantities released on- and off-site (2.45 billion pounds). For the



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries

Table 3-1. TRI On-site and Off-site Releases, Original and New Industries, 1998

	Original Industries		New Industries		All TRI Industries		New Industries as Percent of All TRI Industries Percent
	Number		Number		Number		
Total Facilities	21,517		1,970		23,487		8.4
Total Forms	72,073		15,255		87,328		17.5
Form Rs	61,233		12,567		73,800		17.0
Form As	10,840		2,688		13,528		19.9
	Pounds	Percent of Total	Pounds	Percent of Total	Pounds	Percent of Total	Percent
On-site Releases							
Total Air Emissions	1,256,949,811	52.8	796,550,006	16.2	2,053,499,817	28.1	38.8
Fugitive Air Emissions	292,502,959	12.3	6,983,226	0.1	299,486,185	4.1	2.3
Point Source Air Emissions	964,446,852	40.5	789,566,780	16.0	1,754,013,632	24.0	45.0
Surface Water Discharges	223,365,761	9.4	8,074,161	0.2	231,439,922	3.2	3.5
Underground Injection	210,639,389	8.9	56,677,417	1.1	267,316,806	3.7	21.2
Class I Wells	210,544,864	8.9	23,425,024	0.5	233,969,888	3.2	10.0
Class II-V Wells	94,525	0.0	33,252,393	0.7	33,346,918	0.5	99.7
On-site Land Releases	355,674,874	15.0	3,955,141,581	80.3	4,310,816,455	59.0	91.7
RCRA Subtitle C Landfills	15,339,494	0.6	197,617,507	4.0	212,957,001	2.9	92.8
Other On-site Landfills	99,730,347	4.2	162,677,586	3.3	262,407,933	3.6	62.0
Land Treatment	5,210,603	0.2	1,313,197	0.0	6,523,800	0.1	20.1
Surface Impoundments	90,237,471	3.8	1,289,578,793	26.2	1,379,816,264	18.9	93.5
Other Disposal	145,156,959	6.1	2,303,954,498	46.7	2,449,111,457	33.5	94.1
Total On-site Releases	2,046,629,835	86.0	4,816,443,165	97.7	6,863,073,000	93.9	70.2

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Facilities/forms are included in the original industry category if they did not report a new industry SIC code.

Facilities/forms are included in the new industry category if the facility/form has a new industry SIC code and no SIC code in 20-39.

If the facility reported in any year prior to 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the original industry category.

If the facility reported for the first time in 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the new industry category.

One facility, Cyprus Miami Mining in Claypool, AZ, that reported under SIC code 33 and SIC code 10 in 1998 and previous years has been included in the new industry category SIC code 10 for the purpose of this analysis.



Table 3–1. TRI On-site and Off-site Releases, Original and New Industries, 1998 (continued)

	Original Industries		New Industries		All TRI Industries		New Industries as Percent of All TRI Industries Percent
	Pounds	Percent of Total	Pounds	Percent of Total	Pounds	Percent of Total	
Off-site Releases							
Storage Only ^a	11,749,488	0.5	2,746,021	0.1	14,495,509	0.2	18.9
Solidification/Stabilization ^b	42,775,589	1.8	5,801,379	0.1	48,576,968	0.7	11.9
Metals and Metal Compounds Only							
Wastewater Treatment (excluding POTWs) ^c	3,992,958	0.2	114,693	0.0	4,107,651	0.1	2.8
Metals and Metal Compounds Only							
Transfers to POTWs ^d	3,045,974	0.1	493,189	0.0	3,539,163	0.0	13.9
Metals and Metal Compounds Only							
Underground injection	13,382,660	0.6	334,945	0.0	13,717,605	0.2	2.4
Landfills/Surface Impoundments	212,628,687	8.9	78,974,124	1.6	291,602,811	4.0	27.1
Land Treatment	1,326,956	0.1	495,175	0.0	1,822,131	0.0	27.2
Other Land Disposal	15,597,579	0.7	11,328,044	0.2	26,925,623	0.4	42.1
Other Off-site Management	9,816,029	0.4	10,520,218	0.2	20,336,247	0.3	51.7
Transfers to Waste Broker for Disposal	14,052,361	0.6	673,476	0.0	14,725,837	0.2	4.6
Unknown ^e	3,784,392	0.2	567,726	0.0	4,352,118	0.1	13.0
Total Off-site Releases	332,152,673	14.0	112,048,990	2.3	444,201,663	6.1	25.2
(Transfers Off-site to Disposal)							
Total On-site and Off-site Releases	2,378,782,508	100.0	4,928,492,155	100.0	7,307,274,663	100.0	67.4

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

Facilities/forms are included in the original industry category if they did not report a new industry SIC code.

Facilities/forms are included in the new industry category if the facility/form has a new industry SIC code and no SIC code in 20–39.

If the facility reported in any year prior to 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the original industry category.

If the facility reported for the first time in 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the new industry category.

One facility, Cyprus Miami Mining in Claypool, AZ, that reported under SIC code 33 and SIC code 10 in 1998 and previous years has been included in the new industry category SIC code 10 for the purpose of this analysis.

^aStorage only (disposal code M10) indicates that the toxic chemical is sent off-site for storage because there is no known disposal method. Amounts reported as transferred to storage only are included as a form of disposal (off-site release). See Box 1–5.

^bBeginning in reporting year 1997, transfers to solidification/stabilization of metals and metal compounds (waste treatment code M41) are reported separately from transfers to solidification/stabilization of non-metal TRI chemicals (waste treatment code M40). Because this treatment method prepares a metal for disposal, but does not destroy it, such transfers are included as a form of disposal (off-site release). See Box 1–6. Reports under code M40 of metals and metal compounds have been included in solidification/stabilization of metals and metal compounds in this report.

^cBeginning in reporting year 1997, transfers to wastewater treatment (excluding POTWs) of metals and metal compounds (waste treatment code M61) are reported separately from transfers to wastewater treatment of non-metal TRI chemicals (waste treatment code M60). Because wastewater treatment does not destroy metals, such transfers are included as a form of disposal (off-site release). See Box 1–6. Transfers of metals and metal compounds reported under code M60 have been included in transfers of metals metal compounds to wastewater treatment.

^dReported as discharges to POTWs in Section 6.1 of Form R. EPA considers transfers of metals and metal compounds to POTWs as an off-site release because sewage treatment does not destroy the metal content of the waste material.

^eUnknown (disposal code M99) indicates that a facility is not aware of the type of waste management used for the toxic chemical that is sent off-site. Amounts reported as unknown transfers are treated as a form of disposal (off-site release).



Box 3-2. Duplication of Off-site Transfers to Disposal

Duplication of Off-site Transfers to Disposal

TRI facilities transfer off-site chemicals in waste to other facilities for disposal. These other facilities can dispose of the wastes in on-site landfills, disposal surface impoundments, in land treatment facilities, other types of land disposal, and underground injection wells or, if metals are sent to a wastewater treatment facility, they may be discharged to surface waters. These other facilities generally are treatment, storage and disposal (TSD) facilities regulated under the federal Resources Conservation and Recovery Act (RCRA). Such facilities are in one of the added industries that must, beginning with the 1998 reporting year, report their releases and other waste management to TRI. Thus, the facility that transfers these toxic chemicals in waste would report the amounts as transfers to disposal (off-site releases) and the TSD facility that receives the material would report the amounts as on-site releases to land or to surface waters.

To avoid counting the transfers to the TSD facilities that are also reported to TRI as on-site releases by the TSD facilities, off-site transfers to disposal to these TSD facilities must be omitted from tables that compare or summarize on-site and off-site releases for all industries, including the newly added industries. Only the on-site releases from the TSD facilities are included in such analyses. This applies to tables presented in this chapter of the *1998 TRI Public Data Release*.

The RCRA ID number that facilities report is used to identify such transfers and match them to on-site releases reported by TSD facilities. A TRI facility must report its own RCRA ID number as well as the RCRA ID number of the TSD facility receiving the transfer. Each amount of off-site transfer to disposal should have the RCRA ID number of the receiving facility. If this RCRA ID number matches the RCRA ID number of a TRI facility and the TRI facility receiving the waste reported on-site releases of the same chemical (or the metal and its compounds in the case of metals) that were greater than or equal to the sum of the off-site transfers received, then the off-site transfer amount is omitted from the analysis.

If the TRI facility receiving the waste reported on-site releases of the chemical less than the total reported as transferred to the facility, then the amount omitted from the analysis is reduced proportionally. For example, if Facility A reported 20,000 pounds transferred to Facility C and Facility B reported 80,000 pounds transferred to Facility C, but Facility C only reported 90,000 pounds released on-site (which is 90 percent of the total amount of 100,000 pounds reported as transferred), then the amount of transfers omitted from the analysis for Facility A is 18,000 pounds (or 90 percent of 20,000 pounds) and for Facility B is 72,000 pounds (or 90 percent of 80,000 pounds).

In tables that present off-site transfers but not on-site releases, these amounts are not omitted in order to present complete data on off-site transfers for analysis. Also, tables that present data on waste managed do not omit any reported data in order to present complete data on how waste is being managed.

The following shows which types of off-site transfers to disposal are matched with which types of on-site releases to determine if the transfers should be omitted, along with the amounts omitted for 1998:

(continued)



Box 3-2. Duplication of Off-site Transfers to Disposal (continued)

Off-site Transfer M code	Total Transfers to Disposal Pounds	Transfers to Disposal for Matching RCRA ID Pounds	Transfers to be Omitted Because Duplicated in Section 5 of Recipient TRI Facility Pounds	Section 5 Checked for Recipient TRI Facilities Based on Matching Chemical or, if Metal, Metal Plus Metal Compound
M10	14,495,624	5,189,974	115	5.5.4
M41*	144,372,954	139,073,158	94,689,199	5.5.1 A and B
M62*	4,343,782	3,611,148	236,131	5.5.1 A and B, 5.5.3 and 5.3
M71	16,880,096	16,460,668	3,162,491	5.4
M72	315,517,509	147,965,555	23,914,698	5.5.1 A and B, 5.5.3
M73	1,822,131	160,990	0	5.5.2
M79	26,925,623	17,307,748	0	
M90	20,666,431	6,511,395	330,184	All Section 5
M99	4,544,022	3,425,400	191,904	All Section 5
Total	549,568,172	339,706,036	122,524,722	
Number of Form Rs	73,800	11,432	2,709	

*Includes metals and metal compounds reported under codes M40 and M61.

new industries, production-related waste totaled 6.48 billion pounds and 78.8 percent of that total was quantities released on- and off-site (5.11 billion pounds). In contrast, the original industries recycled on-site 40.1 percent (9.65 billion pounds) of their production-related waste, while the new industries managed 2.8 percent of their total by on-site recycling (180.9 million pounds). Table 3-3 compares the quantities of TRI chemicals in waste for original and new industries.

The new industries contributed 21.2 percent of all TRI production-related waste in 1998, including 67.6 percent of the quanti-

ties released on- and off-site. The new industries also reported 46.4 percent (419.7 million pounds) of the TRI total for off-site energy recovery.

Transfers Off-site for Further Waste Management/Disposal

As shown in Table 3-4, transfers off-site for further waste management and disposal totaled 3.44 billion pounds for the original TRI industries and 669.7 million pounds for the new industries. The original industries sent the majority of the transfers to recycling (1.99 billion pounds or 57.9 percent). The new industries transferred a majority



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries

Table 3-2. TRI Total Releases, by State, Original and New Industries, 1998

State	Total On-site and Off-site Releases					
	Original Industries		New Industries		All TRI Industries	
	Pounds	Rank	Pounds	Rank	Pounds	Rank
Alabama	89,519,922	9	59,390,313	16	147,971,814	12
Alaska	1,948,559	48	305,081,385	4	307,019,139	6
American Samoa	8,750	54	5,147	54	13,897	54
Arizona	54,346,031	18	1,015,396,357	2	1,069,459,422	2
Arkansas	50,743,995	20	3,809,170	46	39,015,235	33
California	42,580,329	22	30,302,691	25	70,690,378	26
Colorado	5,473,006	43	25,485,527	27	30,257,725	38
Connecticut	7,604,324	39	2,638,515	48	9,964,122	46
Delaware	5,503,568	42	7,747,477	43	13,167,440	45
District of Columbia	11,511	53	66,250	51	77,761	53
Florida	78,499,582	11	69,004,865	13	146,950,228	13
Georgia	64,867,232	13	58,556,640	17	116,050,668	19
Guam	0	—	11,058	53	11,058	55
Hawaii	435,831	51	3,193,929	47	3,612,853	49
Idaho	22,750,923	32	76,876,735	10	99,581,448	23
Illinois	116,483,095	6	67,113,615	14	169,297,551	11
Indiana	120,941,009	5	75,188,636	12	189,475,570	9
Iowa	40,100,994	24	13,723,851	33	49,019,069	30
Kansas	29,137,835	28	11,057,823	38	40,063,944	32
Kentucky	41,033,286	23	61,618,147	15	101,459,789	22
Louisiana	175,603,883	2	13,339,377	35	188,608,079	10
Maine	9,636,269	37	111,301	50	9,746,764	47
Maryland	13,251,453	36	25,687,120	26	38,916,981	34
Massachusetts	7,278,796	41	7,757,062	42	14,947,545	44
Michigan	83,648,982	10	57,990,784	18	140,944,017	14
Minnesota	19,870,654	34	12,996,182	36	32,376,326	36
Mississippi	60,520,702	14	11,342,053	37	71,751,244	25
Missouri	57,045,614	16	79,878,997	8	136,845,034	16
Montana	51,377,382	19	76,389,299	11	123,520,951	18
Nebraska	16,186,981	35	8,195,519	41	21,281,764	42
Nevada	4,204,845	44	1,267,747,887	1	1,271,722,674	1
New Hampshire	2,970,927	46	4,098,253	45	7,061,002	48

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

Facilities/forms are included in the original industry category if they did not report a new industry SIC code.

Facilities/forms are included in the new industry category if the facility/form has a new industry SIC code and no SIC code in 20–39.

If the facility reported in any year prior to 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the original industry category.

If the facility reported for the first time in 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the new industry category.

One facility, Cyprus Miami Mining in Claypool, AZ, that reported under SIC code 33 and SIC code 10 in 1998 and previous years has been included in the new industry category SIC code 10 for the purpose of this analysis.

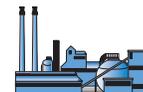


Table 3–2. TRI Total Releases, by State, Original and New Industries, 1998 (continued)

State	Total On-site and Off-site Releases					
	Original Industries		New Industries		All TRI Industries	
	Pounds	Rank	Pounds	Rank	Pounds	Rank
New Jersey	19,959,412	33	10,874,960	39	30,763,455	37
New Mexico	24,827,806	30	235,291,509	5	260,119,315	7
New York	35,489,850	25	35,469,205	23	70,444,506	27
North Carolina	76,800,683	12	57,812,311	19	133,397,919	17
North Dakota	2,449,976	47	20,932,726	29	23,382,206	39
Northern Marianas	0	—	3,086	55	3,086	56
Ohio	153,558,752	3	192,271,551	6	336,268,276	4
Oklahoma	24,397,829	31	17,652,989	32	41,831,334	31
Oregon	33,180,800	26	31,878,264	24	55,140,807	29
Pennsylvania	145,737,350	4	80,197,223	7	216,164,765	8
Puerto Rico	7,288,665	40	10,666,587	40	17,945,579	43
Rhode Island	1,751,380	49	540,804	49	2,273,531	50
South Carolina	59,695,616	15	53,408,668	21	107,300,428	20
South Dakota	3,251,231	45	19,059,501	30	22,310,732	41
Tennessee	94,907,549	8	46,205,203	22	139,312,649	15
Texas	262,681,842	1	55,631,302	20	312,239,546	5
Utah	106,252,499	7	475,024,134	3	574,225,505	3
Vermont	417,357	52	0	56	412,965	52
Virgin Islands	1,055,561	50	30,589	52	1,086,150	51
Virginia	56,848,332	17	23,502,936	28	79,924,886	24
Washington	32,108,843	27	7,005,385	44	34,491,128	35
West Virginia	26,185,485	29	77,689,489	9	103,840,324	21
Wisconsin	43,780,692	21	17,853,380	31	60,732,242	28
Wyoming	9,437,664	38	13,344,174	34	22,781,837	40
Total	2,495,651,444		4,934,147,941		7,307,274,663	

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

Facilities/forms are included in the original industry category if they did not report a new industry SIC code.

Facilities/forms are included in the new industry category if the facility/form has a new industry SIC code and no SIC code in 20–39.

If the facility reported in any year prior to 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the original industry category.

If the facility reported for the first time in 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the new industry category.

One facility, Cyprus Miami Mining in Claypool, AZ, that reported under SIC code 33 and SIC code 10 in 1998 and previous years has been included in the new industry category SIC code 10 for the purpose of this analysis.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries

Table 3-3. Quantities of TRI Chemicals in Waste by Waste Management Activity, Original and New Industries, 1998

Waste Management Activity	Original Industries	New Industries	All TRI Industries	New Industries as Percent
	Pounds	Pounds	Pounds	of All TRI Industries Percent
Recycled On-site	9,646,571,037	180,854,791	9,827,425,828	1.8
Recycled Off-site	2,059,338,694	39,905,983	2,099,244,677	1.9
Energy Recovery On-site	2,851,489,429	11,399,201	2,862,888,630	0.4
Energy Recovery Off-site	485,373,723	419,669,514	905,043,237	46.4
Treated On-site	6,012,991,050	630,290,874	6,643,281,924	9.5
Treated Off-site	547,355,031	91,837,013	639,192,044	14.4
Quantity Released On- and Off-site	2,448,429,537	5,106,263,945	7,554,693,482	67.6
Total Production-related Waste	24,051,548,501	6,480,221,321	30,531,769,822	21.2
Non-production-related Waste	26,712,347	1,730,941	28,443,288	6.1
	Percent of Total Production-related Waste			
Waste Management Activity	Percent	Percent	Percent	
Recycled On-site	40.1	2.8	32.2	
Recycled Off-site	8.6	0.6	6.9	
Energy Recovery On-site	11.9	0.2	9.4	
Energy Recovery Off-site	2.0	6.5	3.0	
Treated On-site	25.0	9.7	21.8	
Treated Off-site	2.3	1.4	2.1	
Quantity Released On- and Off-site	10.2	78.8	24.7	
Total Production-related Waste	100.0	100.0	100.0	

Note: Data are from Section 8 of Form R for 1998.

Facilities/forms are included in the original industry category if they did not report a new industry SIC code.

Facilities/forms are included in the new industry category if the facility/form has a new industry SIC code and no SIC code in 20–39.

If the facility reported in any year prior to 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the original industry category.

If the facility reported for the first time in 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the new industry category.

One facility, Cyprus Miami Mining in Claypool, AZ, that reported under SIC code 33 and SIC code 10 in 1998 and previous years has been included in the new industry category SIC code 10 for the purpose of this analysis.

to energy recovery (436.2 million pounds or 65.1 percent).

The new industries reported 47.7 percent of all TRI transfers to energy recovery in 1998, along with 22.6 percent (73.4 million pounds) to treatment and 20.8 percent (117.2 million pounds) of other transfers to disposal.

Projected Quantities of TRI Chemicals Managed in Waste, 1998–2000

As described in **Waste Management** in Chapter 1, on each Form R that it submits, a facility reports actual waste management quantities for the current and prior years and projected quantities for the next two years. By 2000, all TRI facilities (original and new industries) projected a reduction in total production-related waste to 29.22 billion pounds (down from 30.53 billion pounds in 1998, as shown in Table 3–5).

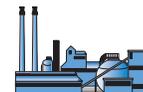


Table 3-4. TRI Off-site Transfers for Further Waste Management/Disposal, Original and New Industries, 1998

	Original Industries		New Industries		All TRI Industries		New Industries as Percent of All TRI Industries Percent
	Pounds	Percent of Total	Pounds	Percent of Total	Pounds	Percent of Total	
Transfers to Recycling	1,989,464,928	57.9	40,897,048	6.1	2,030,361,976	49.4	2.0
Transfers to Energy Recovery	478,821,401	13.9	436,183,569	65.1	915,004,970	22.3	47.7
Transfers to Treatment	251,823,538	7.3	73,407,861	11.0	325,231,399	7.9	22.6
Transfers to POTWs	269,770,149	7.8	2,001,753	0.3	271,771,902	6.6	0.7
Non-metal TRI Chemicals	266,724,175	7.8	1,508,564	0.2	268,232,739	6.5	0.6
Metals and Metal Compounds	3,045,974	0.1	493,189	0.1	3,539,163	0.1	13.9
Other Off-site Transfers*	921,574	0.0	6,740	0.0	928,314	0.0	0.7
Other Transfers Off-site to Disposal**	445,975,635	13.0	117,211,587	17.5	563,187,222	13.7	20.8
Total Transfers Off-site for Further Waste Management Disposal	3,436,777,225	100.0	669,708,558	100.0	4,106,485,783	100.0	16.3

Note: Total Transfers Off-site for Further Waste Management are from Section 6 (excluding transfers off-site to disposal) of Form R. Facilities/forms are included in the original industry category if they did not report a new industry SIC code.

Facilities/forms are included in the new industry category if the facility/form has a new industry SIC code and no SIC code in 20-39.

If the facility reported in any year prior to 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the original industry category.

If the facility reported for the first time in 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the new industry category.

One facility, Cyprus Miami Mining in Claypool, AZ, that reported under SIC code 33 and SIC code 10 in 1998 and previous years has been included in the new industry category SIC code 10 for the purpose of this analysis.

*Other Off-site Transfers are transfers reported without a valid waste management code.

**Does not include transfers to POTWs of metals and metal compounds.

Both original and new industries expected to decrease their totals, the original industries from 24.05 billion pounds to 23.26 billion pounds and the new industries from 6.48 billion pounds to 5.95 billion pounds.

The expected decreases would slightly reduce the new industries' proportion of total production-related waste, from 21.2 percent in 1998 to a projected 20.4 percent in 2000. Based on their projections, their share of all TRI quantities released on-site and off-site would be reduced from 67.6 percent to 66.8 percent and their share of all TRI off-site energy recovery from 46.4 percent to 44.0 percent.

Economic Overview, by Industry

TRI data present significant information about toxic chemicals that are released on- and off-site, managed in waste on- and off-site, and transferred off-site for further waste management. However, as discussed in Chapter 1, TRI data also have limitations. One limitation is that TRI data do not distinguish the industry-specific factors that influence the chemicals, amounts, and types of releases and waste management facilities report. For the new TRI industries, this chapter supplies information about some of these factors, such as the industry-specific processes that involve toxic chemicals. The 1996 TRI Public Data Release, in two volumes (EPA 745-R-98-005, May 1998, and EPA 745-R-98-018, December 1998), provided similar information for the original TRI industries.



Table 3–5. Current Year and Projected Quantities of TRI Chemicals in Waste, Original and New Industries, 1998–2000

Waste Management Activity	Original Industries			New Industries		
	1998 Pounds	1999 Pounds	2000 Pounds	1998 Pounds	1999 Pounds	2000 Pounds
Recycled On-site	9,646,571,037	9,024,524,241	9,232,083,438	180,854,791	167,617,877	175,960,372
Recycled Off-site	2,059,338,694	2,037,822,415	2,067,927,238	39,905,983	38,213,870	38,098,700
Energy Recovery On-site	2,851,489,429	2,807,514,489	2,820,082,686	11,399,201	11,640,308	11,848,679
Energy Recovery Off-site	485,373,723	543,757,972	478,709,496	419,669,514	376,091,119	376,785,027
Treated On-site	6,012,991,050	5,920,424,136	5,847,049,549	630,290,874	634,755,050	641,275,218
Treated Off-site	547,355,031	511,516,434	528,134,462	91,837,013	94,387,418	97,207,454
Quantity Released On- and Off-site	2,448,429,537	2,289,787,601	2,289,656,392	5,106,263,945	4,791,404,816	4,612,345,620
Total Production-related Waste	24,051,548,501	23,135,347,288	23,263,643,261	6,480,221,321	6,114,110,458	5,953,521,070

Waste Management Activity	All TRI Industries			New Industries as a Percent of Total		
	1998 Pounds	1999 Pounds	2000 Pounds	1998 Pounds	1999 Pounds	2000 Pounds
Recycled On-site	9,827,425,828	9,192,142,118	9,408,043,810	1.8	1.8	1.9
Recycled Off-site	2,099,244,677	2,076,036,285	2,106,025,938	1.9	1.8	1.8
Energy Recovery On-site	2,862,888,630	2,819,154,797	2,831,931,365	0.4	0.4	0.4
Energy Recovery Off-site	905,043,237	919,849,091	855,494,523	46.4	40.9	44.0
Treated On-site	6,643,281,924	6,555,179,186	6,488,324,767	9.5	9.7	9.9
Treated Off-site	639,192,044	605,903,852	625,341,916	14.4	15.6	15.5
Quantity Released On- and Off-site	7,554,693,482	7,081,192,417	6,902,002,012	67.6	67.7	66.8
Total Production-related Waste	30,531,769,822	29,249,457,746	29,217,164,331	21.2	20.9	20.4

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1998. Facilities/forms are included in the original industry category if they did not report a new industry SIC code. Facilities/forms are included in the new industry category if the facility/form has a new industry SIC code and no SIC code in 20–39. If the facility reported in any year prior to 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the original industry category. If the facility reported for the first time in 1998 and the facility/form has a combination of original and new industry SIC codes, then the facility/form is included in the new industry category. One facility, Cyprus Miami Mining in Claypool, AZ, that reported under SIC code 33 and SIC code 10 in 1998 and previous years has been included in the new industry category SIC code 10 for the purpose of this analysis.

Basic economic information also helps to distinguish certain industry characteristics. Table 3–6 presents two basic economic measures (employment and dollar value of sales, receipts, shipments, or revenue) that suggest the relative size of the industries newly reporting to TRI in 1998. Economic analyses make use of data on the value of production (sales, receipts, shipments, or revenue) as one way to indicate the size of industrial sectors, because no direct comparison can be drawn among products and services of the sectors. Economic data in Table 3–6 are from the 1997 Economic

Census, the latest consistent data available across all TRI industries, original and new.

Table 3–6 also includes total production-related waste managed that TRI facilities reported for 1998 to allow approximate comparisons with the economic activity of the industry sectors. The ratio of total production-related waste managed to production value (sales, receipts, shipments, or revenue), in the last column, compares the 1998 reported TRI quantities for each industry with that industry’s production level for 1997. Relating TRI quantities to the

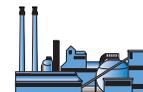


Table 3-6. Employees and Sales (1997) and Total Production-related Waste (1998), by Industry

US SIC Code	NAICS Code*		Paid Employees 1997 Number	Sales, Receipts, Shipments, or Revenue, 1997 (\$000)	TRI Total Production-related Waste Managed, 1998 Pounds	Production-related Waste Managed per Sales, Receipts, Shipments, or Revenue Pounds per \$1,000,000
10		Metal Mining**	36,884	9,166,095	3,720,598,087	405,909
1021	212234	Copper Ores				
1031	212231	Lead and Zinc Ores				
1041	212221	Gold Ores				
1044	212222	Silver Ores				
1061		Ferroalloy Ores, exc. Vanadium (included in 109920)				
1099	109920	Misc. metal ores, nec***				
12		Coal Mining†	87,793	23,377,137	13,836,849	592
1221	212111	Bituminous Coal and Lignite Surface Mining				
1222	212112	Bituminous Coal Underground Mining				
1231	212113	Anthracite Mining				
5169	4226	Chemical and Allied Products Wholesale	165,768	128,923,496	55,770,131	433
5171	42271	Petroleum Bulk Stations and Terminals‡	102,489	176,419,246	59,961,607	340
	221112	Fossil Fuel Electric Power Generation	93,765	48,324,008	1,548,764,374	32,050
4911 (part)		Electric Services (electric power generation by fossil fuels)				
4931 (part)		Electric and Other Services Combined (electric power generation by fossil fuels)				
4939 (part)		Combination utilities n.e.c. (electric power generation by fossil fuels)				
4953 (part)	562211	Hazardous Waste Treatment and Disposal	17,816	2,877,982	1,081,290,273	375,711
7389 (part)		Solvent Recovery Services				
20-39		Manufacturing Industries	17,633,977	3,964,788,992	22,950,113,332	5,788

Note: Paid Employees and Sales, Receipts, Shipments or Revenue are from U.S. Census Bureau, 1997 Economic Census. <http://www.census.gov/epcd/www/econ97.html> [accessed June 4, 2000]. These data are preliminary and are subject to change; includes only establishments with payroll. Data are in current dollars and have not been adjusted for inflation.

*1997 Economic Census data were collected and published using the 1997 North American Industry Classification System (NAICS).

Data presented here with the 1987 Standard Industrial Classification (SIC) codes, used by TRI, follow the U.S. Census Bureau crosswalk between the two systems.

**Economic data for SIC code 10, metal mining, include activities not covered by TRI (processing or otherwise use of TRI chemical in mining overburden).

***nec: not elsewhere classified.

†Economic data for SIC code 12, coal mining, include extraction activities not covered by TRI.

‡1997 Economic Census data revised March 2000.

Total Production-related Waste Managed are from Section 8 (total of 8.1 through 8.7, Column B) of TRI Form for 1998.

Total Production-related Waste Managed in this table does not include forms reporting more than one 2-digit SIC code and forms reporting SIC codes outside the 20-39 range.



dollar value of each industry's products takes into account one measure of the differences among industries in their level of production.

As shown in Table 3–6, metal mines reporting to TRI managed 405,909 pounds of total production-related waste for each \$1 million of shipments. This was the largest ratio among the new TRI industries. Hazardous waste treatment and disposal facilities managed 375,711 pounds of total production-related waste per \$1 million of receipts, the second-highest ratio, and electrical utilities ranked third with 32,050 pounds per \$1 million.

◆ Federal Facilities ◆

Facilities owned and operated by federal agencies are required to report to TRI, regardless of SIC code. In 1993, President Clinton signed Executive Order 12856, which mandated that federal facilities report to TRI starting with the 1994 reporting year. The Executive Order also directs each federal agency to achieve by 1999 an agency-wide reduction of 50 percent in on-site releases and off-site transfers to treatment and disposal, based on their 1994 TRI reporting. The Executive Order encourages federal facilities to use source reduction wherever practicable to achieve their reductions.

Tables in this section list the federal agencies that have facilities reporting to TRI. Department of Defense (DOD) data are presented for DOD as a whole and for each defense agency.

1998 TRI Data for Federal Facilities

In 1998, a total of 123 federal facilities submitted 481 TRI forms, as shown in Table 3–7. Of these, 106 facilities and 309 forms were from original TRI industries, and 17 facilities and 172 forms from new industries.

Facilities owned or operated by DOD agencies submitted 210 forms in the original TRI industries. DOD submissions included 85 reports by Army facilities and 54 reports by Air Force facilities. The Department of Energy submitted 44 forms.

In the new industries, Tennessee Valley Authority (TVA) facilities submitted 160 forms (along with three in the original TRI industries). Two Energy Department facilities filed a total of 11 forms in new-industry SIC codes. One DOD form, from the Navy, was submitted in a new industry, but it reported zero amounts of releases and waste management.

On- and Off-site Releases

As also shown in Table 3–7, the federal facilities reported on- and off-site releases totaling 63.1 million pounds. The great majority of releases, 62.0 million pounds, occurred on-site. Off-site releases totaled 1.0 million pounds.

TVA facilities dominated the federal agencies' release data, reporting 57.5 million pounds of on- and off-site releases in the new industries. This amount represented 91.1 percent of all releases by all federal facilities, and it included the largest amounts in all release types by both original and new industries (except for 505 pounds of underground injection by the

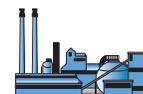


Table 3-7. TRI On-site and Off-site Releases, Federal Facilities, 1998

Federal Agency	Total Facilities Number	Total Forms Number	On-site Releases							Total On-site Releases Pounds	Off-site Releases Transfers Off-site to Disposal Pounds	Total On- and Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases					
					Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds				
Original Industries												
Department of Defense	68	210	1,958,940	878,148	0	0	0	11,762	2,848,850	322,197	3,171,047	
Air Force	13	54	916,757	103,447	0	0	0	655	1,020,859	96,917	1,117,776	
Army	28	85	516,372	688,253	0	0	0	2,307	1,206,932	101,578	1,308,510	
Army Corps of Engineers	2	4	2,700	6	0	0	0	8,800	11,506	0	11,506	
Defense Logistics	1	5	5,545	0	0	0	0	0	5,545	0	5,545	
Marines	9	18	57,203	15	0	0	0	0	57,218	30,612	87,830	
Navy	15	44	460,363	86,427	0	0	0	0	546,790	93,090	639,880	
Department of Energy	12	44	302,186	87,300	0	505	14,069	125,081	529,141	17,156	546,297	
Department of Interior	1	1	750	4,471	0	0	0	0	5,221	0	5,221	
Department of Treasury	9	15	323	0	0	0	0	115,963	116,286	4,075	120,361	
Environmental Protection Agency	1	2	0	0	0	0	0	0	0	0	0	
Health and Human Services	1	1	0	0	0	0	0	0	0	250	250	
National Aeronautics and Space Administration	8	18	168,077	0	0	0	0	0	168,077	2,451	170,528	
Tennessee Valley Authority	1	3	30	2,255	0	0	0	15	2,300	1,255	3,555	
U.S. Department of Agriculture	3	4	10	0	0	0	0	580,780	580,790	0	580,790	
U.S. Enrichment Corporation	2	11	881,979	563	0	0	0	260	882,802	0	882,802	
Subtotal for Original Industries	106	309	3,312,295	972,737	0	505	14,069	833,861	5,133,467	410,700	5,544,167	
New Industries												
Department of Defense-Navy	1	1	0	0	0	0	0	0	0	0	0	
Department of Energy	2	11	11,362	7,008	0	0	17,494	0	35,864	5,810	41,674	
Tennessee Valley Authority	14	160	42,466,280	954,480	0	0	0	13,424,230	56,844,990	624,475	57,469,465	
Subtotal for New Industries	17	172	42,477,642	961,488	0	0	17,494	13,424,230	56,880,854	630,286	57,511,140	
Total for Federal Facilities	123	481	45,789,937	1,934,225	0	505	31,563	14,258,091	62,014,321	1,040,986	63,055,307	

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.



Energy Department). Notably, TVA's new-industry reporting included 42.5 million pounds of air emissions and 13.4 million pounds of other on-site land releases.

Together, the DOD agencies reported 3.2 million pounds of total releases, including 2.0 million pounds of air emissions. Army releases of 1.3 million pounds consisted of surface water discharges of 688,253 pounds and air emissions of 516,372 pounds. The Air Force's total of 1.1 million pounds consisted principally of air emissions (916,757 pounds).

Waste Management Data

Quantities of TRI Chemicals in Waste

Federal facilities reported managing 152.2 million pounds of TRI chemicals in waste in 1998, as shown in Table 3–8. Quantities released on- and off-site totaled 63.0 million pounds, and on-site treatment totaled 52.5 million pounds. These were the largest waste management types in federal facility reporting.

Approximately two-thirds (105.6 million pounds) of the total production-related waste came from new-industry reporting by TVA facilities. These facilities reported 57.5 million pounds in quantities released on-and off-site and 47.3 million pounds treated on-site.

DOD facilities in the original industries reported the second-largest total, 24.7 million pounds, including the Army's 20.0 million pounds. The Army recycled 13.3 million pounds on-site and 3.8 million pounds off-site. The Treasury Department ranked third among federal agencies for total production-related waste with 15.0 million

pounds. Treasury facilities reported off-site recycling of 14.9 million pounds.

Transfers Off-site for Further Waste Management/Disposal

Table 3–9 summarizes federal facility reporting of transfers off-site for further waste management and disposal. Such transfers totaled 22.4 million pounds in 1998. The majority (20.4 million pounds) was transferred off-site to recycling.

Federal facilities in original TRI industries reported the bulk of the total, with 21.0 million pounds sent off-site for further waste management and disposal. The Treasury Department reported the largest total, with 14.9 million pounds, and Treasury facilities transferred nearly all of this amount off-site to recycling.

Federal facilities reporting new-industry SIC codes reported a total of 1.4 million pounds transferred, consisting of 803,720 pounds sent to recycling, 630,286 pounds to disposal, and 670 pounds to treatment.

Projected Quantities of TRI Chemicals Managed in Waste, 1998–2000

The federal facilities projected managing increasing quantities of TRI chemicals in waste through the year 2000, as shown in Table 3–10. They expected total production-related waste to increase from 152.2 million pounds in 1998 to 165.7 million pounds in 2000.

This increase was projected by federal facilities reporting in the original TRI industries. They estimated their total to increase from 46.4 million pounds in 1998 (30.5 percent of the total for all federal facilities) to



60.2 million pounds in 2000 (36.3 percent of the total).

Federal facilities in the new industries expected to reduce the production-related waste they managed from 105.7 million pounds in 1998 to 105.5 million pounds in 2000. This would decrease their proportion

of total production-related waste reported by federal facilities from 69.5 percent to 63.7 percent of the total for all federal facilities.

These changes were basically projected for 1999, with very little change expected in 2000.

Table 3-8. Quantities of TRI Chemicals in Waste, Federal Facilities by Agency, 1998

Federal Agency	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Pounds	Non-production-related Waste Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Original Industries									
Department of Defense	14,591,456	4,388,829	0	251,253	1,719,216	555,585	3,183,420	24,689,759	641
Air Force	12,093	81,430	0	63,050	186,171	195,641	1,134,993	1,673,378	183
Army	13,259,303	3,760,857	0	88,027	1,412,511	201,231	1,306,454	20,028,383	218
Army Corps of Engineers	0	0	0	0	300	5,700	11,510	17,510	0
Defense Logistics	1,300,285	0	0	0	0	0	5,545	1,305,830	0
Marines	17,575	157,882	0	24,012	1,300	18,291	89,016	308,076	34
Navy	2,200	388,660	0	76,164	118,934	134,722	635,902	1,356,582	206
Department of Energy	162,952	263,767	0	0	3,417,856	207,977	544,411	4,596,963	7,394
Department of Interior	0	0	0	0	0	0	5,130	5,130	0
Department of Treasury	0	14,908,898	0	0	31	0	125,282	15,034,211	0
Environmental Protection Agency	0	0	0	0	0	0	0	0	0
Health and Human Services	0	0	0	0	14,500	16	0	14,516	0
National Aeronautics and Space Administration	315,171	2,991	0	1,249	18,878	20,688	165,313	524,290	2,098
Tennessee Valley Authority	0	57,740	0	0	0	0	2,890	60,630	0
U.S. Department of Agriculture	0	0	0	0	0	0	580,550	580,550	20
U.S. Enrichment Corporation	0	0	0	0	56,500	0	882,796	939,296	0
Subtotal for Original Industries	15,069,579	19,622,225	0	252,502	5,226,981	784,266	5,489,792	46,445,345	10,153
New Industries									
Department of Defense — Navy	0	0	0	0	0	0	0	0	0
Department of Energy	9,555	3,535	0	0	70,301	0	10,496	93,887	31,594
Tennessee Valley Authority	0	901,586	0	0	47,251,000	670	57,473,437	105,626,693	0
Subtotal for New Industries	9,555	905,121	0	0	47,321,301	670	57,483,933	105,720,580	31,594
Total for Federal Facilities	15,079,134	20,527,346	0	252,502	52,548,282	784,936	62,973,725	152,165,925	41,747

Note: Data are from Section 8 of Form R.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries

Table 3–9. TRI Transfers Off-site for Further Waste Management/Disposal, Federal Facilities, 1998

Federal Agency	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs		Other Transfers Off-site to Disposal* Pounds	Total Transfers for Further Waste Management/Disposal Pounds
				Non-metal TRI Chemicals Pounds	Metals and Metal Compounds Pounds		
Original Industries							
Department of Defense	4,382,361	218,541	398,580	112,273	1,714	363,998	5,477,467
Air Force	81,738	51,809	118,423	98,033	828	105,436	456,267
Army	3,765,095	70,814	137,715	928	806	134,188	4,109,546
Army Corps of Engineers	0	0	0	5,700	0	0	5,700
Defense Logistics	0	0	0	0	0	0	0
Marines	157,248	24,212	18,076	209	0	31,364	231,109
Navy	378,280	71,706	124,366	7,403	80	93,010	674,845
Department of Energy	262,623	0	4,637	202,000	7	20,716	489,983
Department of Interior	0	0	0	0	0	0	0
Department of Treasury	14,896,082	0	0	0	1,025	3,050	14,900,157
Environmental Protection Agency	0	0	0	0	0	0	0
Health and Human Services	0	0	0	0	0	250	250
National Aeronautics and Space Administration	2,957	1,000	6,347	0	0	18,685	28,989
Tennessee Valley Authority	57,550	0	0	0	0	1,255	58,805
U.S. Department of Agriculture	0	0	0	0	0	0	0
U.S. Enrichment Corporation	0	0	0	0	0	0	0
Subtotal for Original Industries	19,601,573	219,541	409,564	314,273	2,746	407,954	20,955,651
New Industries							
Department of Defense — Navy	0	0	0	0	0	0	0
Department of Energy	415	0	0	0	0	5,811	6,226
Tennessee Valley Authority	803,305	0	670	0	0	624,475	1,428,450
Subtotal for New Industries	803,720	0	670	0	0	630,286	1,434,676
Total for Federal Facilities	20,405,293	219,541	410,234	314,273	2,746	1,038,240	22,390,327

Note: Data are from Section 8 of Form R.

*Does not include transfers of metals and metal compounds to POTWs.



Table 3-10. Current Year and Projected Quantities of TRI Chemicals in Waste, Federal Facilities, 1998-2000

Federal Agency	Current Year 1998		Projected 1999		Projected 2000	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
Original Industries						
Department of Defense	24,689,759	16.2	24,271,175	14.6	24,409,447	14.7
Air Force	1,673,378	1.1	1,504,492	0.9	1,445,299	0.9
Army	20,028,383	13.2	19,929,557	12.0	19,833,779	12.0
Army Corps of Engineers	17,510	0.0	9,750	0.0	10,150	0.0
Defense Logistics	1,305,830	0.9	1,315,200	0.8	1,433,665	0.9
Marines	308,076	0.2	327,268	0.2	294,672	0.2
Navy	1,356,582	0.9	1,184,908	0.7	1,391,882	0.8
Department of Energy	4,596,963	3.0	4,994,014	3.0	4,906,409	3.0
Department of Interior	5,130	0.0	5,130	0.0	5,130	0.0
Department of Treasury	15,034,211	9.9	29,127,454	17.6	29,083,353	17.6
Environmental Protection Agency	0	0.0	0	0.0	0	0.0
Health and Human Services	14,516	0.0	14,500	0.0	14,500	0.0
National Aeronautics and Space Administration	524,290	0.3	370,563	0.2	296,476	0.2
Tennessee Valley Authority	60,630	0.0	60,630	0.0	60,630	0.0
U.S. Department of Agriculture	580,550	0.4	541,113	0.3	527,800	0.3
U.S. Enrichment Corporation	939,296	0.6	904,955	0.5	876,655	0.5
Subtotal for Original Industries	46,445,345	30.5	60,289,534	36.4	60,180,400	36.3
New Industries						
Department of Defense — Navy	0	0.0	0	0.0	0	0.0
Department of Energy	93,887	0.1	15,020	0.0	14,020	0.0
Tennessee Valley Authority	105,626,693	69.4	105,521,900	63.6	105,522,019	63.7
Subtotal for New Industries	105,720,580	69.5	105,536,920	63.6	105,536,039	63.7
Total for Federal Facilities	152,165,925	100.0	165,826,454	100.0	165,716,439	100.0

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1998.



❖ Metal Mining (SIC Code 10) ❖

Introduction

Metal mining facilities in SIC code 10 explore for metallic minerals, develop mines, and conduct mining and milling operations for the production of metals, as listed in Box 3–3. These facilities also reclaim the lands mined. Ores recovered for extraction and beneficiation are valued for the metals they contain. Metals are used in consumer and industrial products such as metal alloys, chemicals, and electronics, various modes of transportation, and other products.

Products and Services

Mining operations are classified by the ores they extract. Facilities in six categories reported to TRI for the first time in the 1998 reporting year. These include copper (SIC code 1021), lead and zinc (SIC code 1031), gold (SIC code 1041), and silver (SIC code 1044). Also included are ferroalloy ores (SIC code 1061, alloys containing iron) such as chromium, manganese, molybdenum, nickel ore, and tungsten. The miscellaneous metal ores category (SIC code 1099) includes ores of aluminum, antimony,

Box 3–3. SIC Code 10, Metal Mining: Codes and Classifications Required to Report to TRI

SIC Code 10, Metal Mining: Codes and Classifications Required to Report to TRI

1021	Copper Ores	Mining, milling, or otherwise preparing copper ores. Recovery of copper concentrates by precipitation and leaching.
1031	Lead and Zinc Ores	Mining, milling or otherwise preparing lead ores, zinc ores, or lead-zinc ores.
1041	Gold Ores	Mining gold ores from lode deposits. Recovering gold from placer deposits. Includes amalgamation, cyanidation, and production of bullion at mine, mill, or dredge sites.
1044	Silver Ores	Mining, milling or otherwise preparing silver ores. Includes production of bullion at mine or mill sites.
1061	Ferroalloy Ores, Except Vanadium	Mining, milling or otherwise preparing ferroalloy ores, except vanadium. Includes chromium, cobalt, molybdenum, nickel, and others.
1099	Miscellaneous Metal Ores, Not Elsewhere Classified	Mining, milling or otherwise preparing miscellaneous metal ores, including aluminum, antimony, mercury, tin, and others.

Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: Metal Mining (SIC Code 10)

bauxite, beryllium, quicksilver (mercury), thorium, tin, and others. Three mining-related SIC codes are currently not subject to TRI reporting: iron ores (SIC code 1011), metal mining services (SIC code 1081), and uranium-radium-vanadium ores (SIC code 1094).

Metal mined by the metal mining sector are the primary raw materials used in many industrial applications and thus are essential to the U.S. and world economies. For example, copper is used in automobiles, household appliances, computers, residential plumbing and wiring, and industrial motors. Although used internationally primarily in investment, jewelry and the decorative arts, gold is also important particularly in the U.S. where the majority is used in electronics, architecture, space exploration, and communications and in medicine. The primary use of lead is in battery production. Lead is also used in radiation shielding and in fuel tanks, solder, seals and bearings. Photographic technologies represent the largest application of silver. Other silver applications occur in electronics, electroplated and sterling ware, and jewelry. The largest use of zinc is in galvanizing other metals, especially steel. Zinc is also used in alloys, such as brass and bronze. Molybdenum is used in metal alloys and lubricants.

Employment and Production

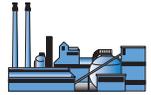
U.S. metal mining directly employed an estimated 37,900 employees in 1997. Mining employment has fluctuated around 40,000 through most of the 1990s; in 1995, the total was 41,000 production workers. Metals mined in 1997 were valued at \$9.17 billion, down from \$14.0 billion in 1995.

Some 180 metal ore mines operated in the United States in 1997 (the most recent year data are available). In 1998, U.S. mines extracted nearly 1.9 million tons of copper, 350,000 tons of gold, 460,000 tons of lead, 2.1 million tons of silver, and 655,000 tons of zinc (metric tons, preliminary data). Metals often occur together. Gold and silver, for example, may be byproducts of copper mining; molybdenum may also be recovered with copper.

Copper, gold and silver are principally mined in the Western states. Zinc mining occurs largely in Alaska and Tennessee, with additional mines operating in Missouri and New York. Mining of lead deposits occurs principally in Missouri and to a lesser extent in Alaska, Colorado, Idaho, and Montana. The 15 metals mines with the largest output of crude ore in 1996 included six copper mines in Arizona, three gold mines in Nevada, and one copper mine each in New Mexico and Utah.

General Environmental Issues

Hardrock mining is a large-scale industrial activity that takes place in the natural environment potentially disturbing large amounts of material and land area. Mining operations and the resulting pollutants can affect surface and ground water, decrease air quality, contaminate soils, and diminish ecosystem quality. Large amounts of mining waste are generated because of the high waste-to-product ratios associated with producing most ores. At mining sites, the major pollutant sources of concern include waste rock, tailings, heap leaches/dump leaches, and mine water. Environmental concerns have often focused on water pollution from acid rock drainage and mobilization of toxic metals, mine water, and leaching processes.



The formation of acid rock drainage (ARD) and the associated solubilization of toxic metals from waste rock is a major environmental problem facing the metal mining industry. Acid rock drainage primarily depends on the mineralogy of the rock material and the availability of water and oxygen. Although testing methods used to predict acid rock drainage have improved in recent years, there is often substantial uncertainty, and new mines can develop unpredicted acid rock drainage after only a few years of operation.

The potential for a mine or its associated waste rock to generate acid and solubilization of metals depends on many site-specific factors. Acid rock drainage occurs at mine sites when metal sulfide minerals are oxidized. Before mining commences, oxidation of these minerals and the formation of sulfuric acid is a slow function of the natural weathering process. Mining operations increase the rate of these same chemical reactions by moving sulfide-bearing waste rock material to the surface and thereby exposing the material to air and water. The previously buried metals in waste rock are exposed to the elements upon excavation and become susceptible to leaching by rain and snow. Unless carefully controlled and monitored, the leaching process can result in environmental transport and can lead to ground and surface water sources contaminated with heavy metals and other toxic chemical pollution that would not have occurred naturally.

Mine water from rain, from flows into surface or underground mines, or from groundwater tapped by mining may also carry dissolved pollutants (primarily metals, sulfates, and nitrates) to local ground and surface water. While acid rock drainage can enhance contaminant mobility by pro-

moting leaching from exposed wastes and mine structures, solubilization of metals and other pollutants can also occur under neutral pH conditions. Primary sources of metals and other pollutants from metal mining operations include underground and surface mine workings, direct discharges from conventional milling/beneficiation operations, leach piles and processing facilities, chemical storage areas (runoff and spills), and reclamation activities. Mines opened since 1978 are required to treat their effluent water, but the need for such treatment can continue for decades after mining operations cease. Significant releases also occur with the disposal of waste rock.

Cyanide is used to extract gold and other metals. Continued improvements in cyanidation technology have allowed the economic mining of increasingly lower-grade ores. Overall, cyanide can cause three major types of environmental impacts: (1) cyanide-containing ponds and ditches can present an acute hazard to wildlife and birds; (2) spills can result in cyanide reaching surface water or ground water (fishkills and contamination of drinking water); and (3) cyanide in active heaps, ponds, and in mining wastes may be released and present hazards to surface or groundwater.

Environmental impacts continue when mines close. Mining operations close during temporary shutdowns (in response to economic conditions) or they may be permanently decommissioned. Permanent closure includes not only regrading and revegetation, but also removing or disposing of stored fuels and chemicals, tearing down structures, removing roadways and ditches, sealing adits (mine entrances), capping tailings, detoxifying waste, and mak-



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ing final removal of sediment control structures and/or reestablishing drainage ways. Many closure situations require long-term maintenance, such as fueling and lubricating environmental control equipment as well as maintaining water diversions, dam stability, water treatment, and treatment sludge management. Substantial risk of inadequate attention to proper site closure exists when funding is not adequate for these expenses. Reclamation cost estimates—and bonds—are still sometimes based primarily on regrading and revegetation.

Processes Involving Toxic Chemicals

The extraction and beneficiation of metals necessarily leads to the generation of large quantities of waste. Because relatively large amounts of ore are handled to remove the small percentages of valuable minerals, this sector reports significantly larger amounts to TRI than the original industries.

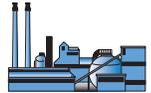
Conventional underground and surface mining techniques are employed for mineral hardrock mining in the U.S. Underground mining involves sinking a shaft to the level of the ore and cutting passages from which the ore is removed. Surface mining involves removal of overlying materials to expose the ore for excavation. Underground mining generally requires higher ore grades because it is more expensive to mine by underground methods. Surface mining has increased over time as (1) the higher ore grades have been removed; and (2) higher productivity is achieved with the advent of large earth-moving equipment and more economical means of metal extraction.

Copper, lead, zinc, gold, and silver are mined from “lodes.” Lodes are mineral

deposits in rock that are found where they were originally deposited. Copper, gold, and silver are principally mined from surface or open-pit mines, where vegetation, soil, and rock are removed to expose the ore bearing metal. Lead and zinc, along with antimony, are extracted principally by underground mining. A small portion of U.S. gold and silver is mined from placer deposits. In contrast to lodes, placer deposits are minerals that have been eroded and transported from where they were originally deposited.

TRI regulations distinguish overburden, ore, and waste rock. *Overburden* is the unconsolidated material that overlies a deposit of useful materials or ores. It does not include any portion of ore or waste rock. Overburden is exempt from TRI reporting. A TRI chemical that is a constituent of overburden is not reportable even if the metal mining facility processes or otherwise uses the chemical. However, TRI chemicals used to remove overburden are counted toward the reporting threshold and in calculating releases and other waste management (for example, explosives used to remove overburden are counted while any TRI chemical contained in the overburden is not).

Waste rock is that portion of the ore body that consists of barren or submarginal rock or ore which has been mined but is not of sufficient value to warrant treatment and is, therefore, removed ahead of the beneficiation process. Waste rock varies in size from small particles to boulders. Removal of waste rock containing TRI chemicals to gain access to the target ore does not count toward TRI thresholds, but the releases of TRI chemicals in the waste rock and other waste management of the TRI chemicals are reportable if manufacturing, processing,



or otherwise use thresholds are met elsewhere at the facility. Overburden and waste rock are typically disposed of in piles at the mine site. Overburden often contains suitable plant growth material and is used in reclamation. Overburden and waste rock are often used on-site to backfill completed excavations or sent off-site for use in construction projects.

Mining facilities generally move extracted ores to mills for beneficiation, which concentrates the ore for further processing (smelting). Beneficiation includes reducing the size of the ore by crushing and grinding (also called comminution), sorting, sizing and washing. This is often the first step in beneficiation.

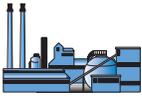
Flotation is the principal means of beneficiating copper, lead, and zinc ores. In flotation, crushed and ground ore is mixed with water and ground to the consistency of a powder. The resulting slurry is transferred to flotation cells where it is combined with reagents (frothers, collectors, such as pine oil) and aerated. The reagents coat the copper minerals causing them to adhere to the air bubbles and float to the surface of the cell for separation. The waste solids (“tailings”) sink to the bottom of the flotation cell and are removed. Tailings, having the consistency of fine sand, contain trace amounts of minerals which cannot be recovered in the process. Tailings are released in on-site impoundments. At some facilities tailings are partially dewatered (containing 30 to 60 percent solids) prior to placement in the impoundment, thereby improving stability of the tailings. Tailings impoundments are often monitored for seepage as well as structural soundness. Mining facilities also remove water for reuse and stabilize tailings for long-term storage. Stabilized tailings are often planted

with grass, trees, and other vegetation or are capped to prevent windblown emissions.

Other common beneficiation techniques include leaching, solvent extraction, electrowinning precipitation, amalgamation, carbon adsorption, and ion exchange. In dump leaching, the material is placed directly on the ground, often extending over hundreds of acres. A leaching solution is applied, which percolates through the ore, leaching out metals. The type of leaching solution used depends on the characteristics of the ore and the mineral. Sulfuric acid, for example, is used in dump leaching to recover copper ores from surface mining. Dump leaching may continue for years or decades, recovering economically viable quantities of metals. Heap leaching is used for more valuable ores, such as gold, which is typically dissolved using sodium cyanide. In heap leaching operations, one or more impermeable liners are placed under the material to contain the solution and maximize recovery. In addition to the target metal, cyanide solutions applied to heaps will also leach other metals from the ore, including arsenic and lead. Heap leaching often takes place over months rather than years. When leaching no longer produces sufficient mineral value, the spent ore is rinsed or otherwise detoxified and either reclaimed in place or nearby. In some cases, detoxified heap leach material is used for other purposes such as aggregate.

Management of Toxic Chemicals in Waste

The management of TRI chemicals can vary greatly from mine to mine, depending on target mineral(s), extraction methods, beneficiation techniques, and other factors.



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The majority of releases reported by mining facilities include chemicals in waste rock and tailings that are released to land. However, there are also releases to surface waters and air.

Air emissions can occur during the extraction of ores. Most of these air emissions tend to be uncontrolled or fugitive air emissions, such as from equipment traffic at the mine site (e.g. in open-pit mining), from rock crushers in pits and mills, and from tailings ponds. Acid aerosols may be generated during leaching operations, wastewater treatment, and other mining activities.

Mining facilities also report releases to surface water and land. Many activities and sources associated with a mine site can release toxic chemicals to surface water. Open pits, tailings ponds, ore and subore stockpiles, heap and dump leach piles as well as waste rock are all potentially significant sources of toxic releases. The mobility of the releases from these sources are magnified by exposure to rainfall and snowfall, with the eventual discharge of surface runoff, produced from rainfall and snow melt, being one mechanism by which toxic metals are transported to surface waters. Seepage from impoundment areas and ground water originating from open pits and mine openings is another example by which toxic metals can be mobilized and eventually transported to surface waters. Transport of toxic chemicals to surface waters may also occur indirectly via ground water. Water control technologies are used to divert water (including rainfall) from exposure to waste rock, to contain contaminated water, to pump mine water and contaminated groundwater, to drain subsurface seepage, and to establish subsurface barriers.

Mining facilities often release large amounts of waste rock and other materials to land. Waste rock typically contains metals, such as lead, cadmium, manganese, zinc, copper, nickel, and arsenic, which have the potential to contaminate both surface waters (e.g., rivers and lakes) and ground waters. Once TRI chemicals in waste rock are released to land and exposed to rain and snow, mining operations can greatly increase the rate of acid rock drainage and the leaching of toxic metals. Unless carefully controlled and monitored, the leaching of waste rock can lead to the contamination of surface and groundwater with heavy metals and other toxic chemical pollution that would not have occurred naturally. Other processes, such as physical beneficiation, create waste that is often disposed of in on-site landfills. In addition, air control devices, such as baghouses designed to reduce particulate emissions from ore grinding activities, may collect solid wastes that require disposal to land. Tailings and spills may also be disposed of in landfills.

1998 TRI Data for Metal Mining

On- and Off-site Releases

Metal mining facilities required to report to TRI had total on- and off-site releases of 3.51 billion pounds in 1998, as shown in Table 3–11. The great majority, 3.47 billion pounds, was released on-site to land. This amounted to 98.9 percent of the industry's reported releases, as shown in Figure 3–1. Virtually all of the on-site land releases were released to land in other than RCRA subtitle C landfills (types of on-site land releases are described in Box 1–4 in Chapter 1).

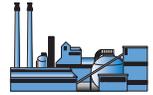
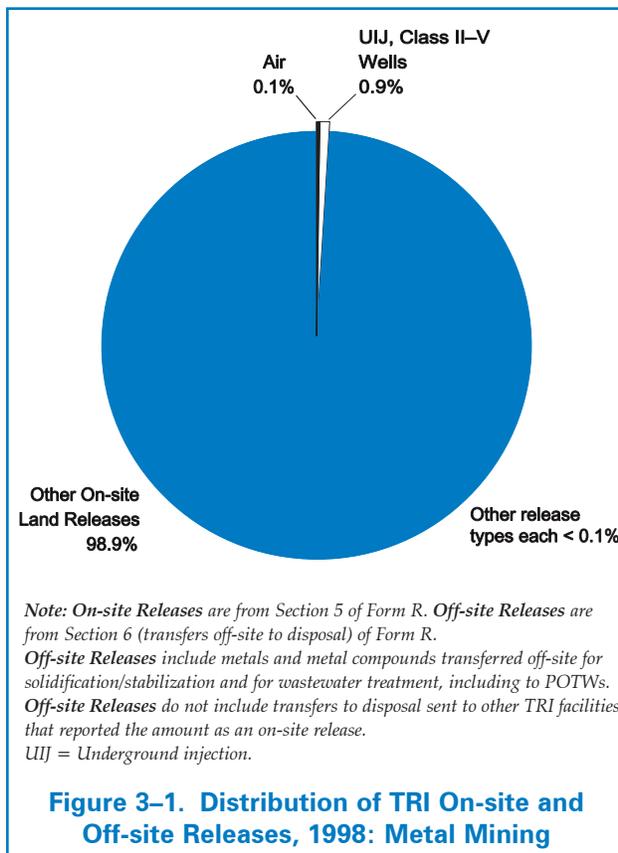


Table 3-11. TRI On-site and Off-site Releases by 4-digit SIC Code, 1998: Metal Mining

SIC Code	Industry	Total Forms Number	On-site Releases							Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Transfers Off-site to Disposal Pounds			
					Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds				
1021	Copper Ores	162	608,789	14,936	0	0	0	1,535,826,666	1,536,450,391	42,611	1,536,493,002	
1031	Lead and Zinc Ores	86	880,987	52,405	0	32,999,708	54	343,616,758	377,549,912	21	377,549,933	
1041	Gold Ores	340	1,850,981	446,739	0	1,404	0	1,072,493,27-	1,074,792,401	55	1,074,792,456	
1044	Silver Ores	43	62,762	5,877	0	0	0	158,740,157	158,808,796	181	158,808,977	
1061	Ferroalloy Ores, Except Vanadium	30	89,974	2,146	0	0	0	1,088,610	1,180,730	1,244,600	2,425,330	
1099	Miscellaneous Metal Ores, nec*	21	498,038	0	0	0	0	3,702,896	4,200,934	12,289	4,213,223	
	Multiple within SIC 10	29	61,421	744	0	0	0	38,490,443	38,552,608	0	38,552,608	
	SIC 1021 and SIC 33 (Primary Metals)	29	414,750	0	0	0	0	174,927,636	175,342,386	6,878	175,349,264	
	SIC 1021 and SIC 4931 (Electric Utilities)	19	84,634	0	0	0	0	141,637,448	141,722,082	0	141,722,082	
	Total	759	4,552,336	522,847	0	33,001,112	54	3,470,523,891	3,508,600,240	1,306,635	3,509,906,875	

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release. Forms that reported more than one 4-digit SIC code within SIC code 10 are assigned to the "multiple codes" category. *nec: not elsewhere classified.



Metal mining facilities injected 33.0 million pounds to underground wells, the second-largest release type for this industry, but this amount represented just 0.9 percent of the total. All of the underground injection was to Class II-V wells (Box 1-4 in Chapter 1 also explains the types of wells).

Copper mining facilities reported 1.54 billion pounds of total releases, the largest total within the industry. Gold mining facilities ranked second with 1.07 billion pounds. Together, copper mining and gold mining accounted for three-quarters (74.4 percent) of the metal mining total for on- and off-site releases. Nearly all of their releases were on-site land releases (also 1.54 billion pounds and 1.07 billion pounds, respectively).

Facilities in the lead and zinc mining industry ranked third for total on- and off-site



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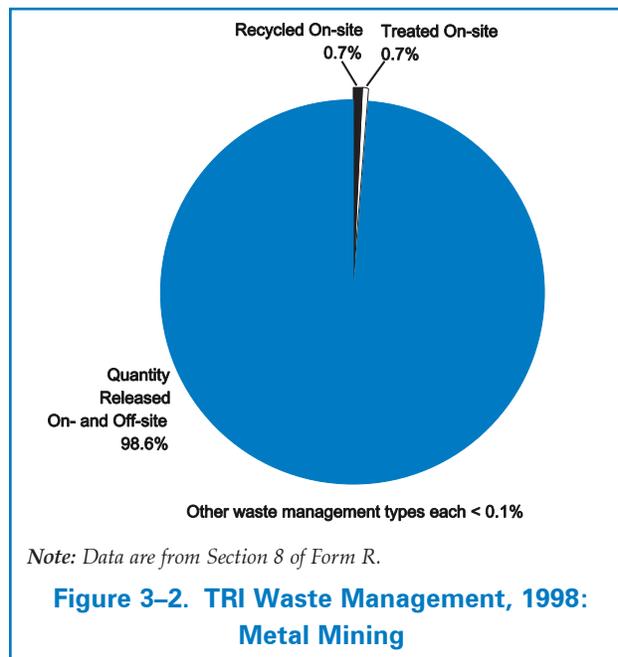
releases with a total of 377.5 million pounds. This total included 343.6 million pounds of on-site land releases and virtually all (33.0 million pounds) of the underground injection reporting by metal mines.

Facilities mining ferroalloy ores (except vanadium) reported transfers to disposal of 1.2 million pounds, nearly all of the metal mining industry's 1.3 million pounds of off-site releases. Ferroalloy mining was the only type of metal mining that released a larger amount off-site than on-site.

Waste Management Data

Quantities of TRI Chemicals in Waste

Metal mines reported total production-related waste of 3.72 billion pounds in 1998, including 3.67 billion pounds in quantities released on- and off-site (see Table 3-12). As shown in Figure 3-2, quantities released



amounted to 98.6 percent of the industry's total. The next largest waste management types were on-site recycling with 26.3 mil-

Table 3-12. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1998: Metal Mining

SIC Code	Industry	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
		On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
1021	Copper Ores	463,222	960,846	0	0	1,492,693	0	1,647,174,380	1,650,091,141	397,317
1031	Lead and Zinc Ores	8,520,404	0	0	0	0	0	378,264,477	386,784,881	8
1041	Gold Ores	11,291,817	171,279	0	0	19,972,361	16,555	1,123,130,616	1,154,582,628	69
1044	Silver Ores	12	628	0	0	2,003,800	0	158,951,198	160,955,638	22
1061	Ferroalloy Ores, Except Vanadium	0	2,000	0	0	0	0	2,477,452	2,479,452	23
1099	Miscellaneous Metal Ores, nec*	6,048,108	41,436	0	0	1,131,107	12,670	3,127,675	10,360,996	0
	Multiple within SIC 10	0	47,400	0	0	140,000	0	38,548,427	38,735,827	10
	SIC 1021 and SIC 33 (Primary Metals)	0	0	0	0	6,329	5,466	175,303,816	175,315,611	2,015
	SIC 1021 and SIC 4931 (Electric Utilities)	0	0	0	0	0	0	141,291,913	141,291,913	0
	Total	26,323,563	1,223,589	0	0	24,746,290	34,691	3,668,269,954	3,720,598,087	399,464

Note: Data are from Section 8 of Form R.

Forms that reported more than one 4-digit SIC code within SIC code 10 are assigned to the "multiple codes" category.

*nec: not elsewhere classified.



lion pounds and on-site treatment with 24.7 million pounds.

Production-related waste totaled 1.65 billion pounds for copper mining and 1.15 billion pounds for gold mining, the largest totals in the metal mining industry. Quantities released were 1.65 billion pounds for copper mining and 1.12 billion pounds for gold mining. Ranking third among metal mining types, lead and zinc mining reported 386.8 million pounds of production-related waste, including 378.3 million pounds in quantities released.

Gold mining facilities reported 20.0 million pounds treated on-site and 11.3 million pounds recycled on-site, the largest amounts in those categories. Metal mines sent little of their TRI chemicals in waste off-site for recycling (1.2 million pounds) or

treatment (34,691 pounds) and did not report energy recovery on- or off-site.

Transfers Off-site for Further Waste Management/Disposal

Transfers off-site for further waste management and disposal totaled 2.3 million pounds for the metal mining industry, as shown in Table 3–13. The 4-digit SIC code reporting the largest amount (1.2 million pounds) was mining of ferroalloy ores (except vanadium). Almost all of this amount was sent off-site to disposal. Figure 3–3 shows that other transfers to disposal accounted for 57.5 percent of the metal mining industry’s transfers for further waste management and disposal. The industry’s other transfers to disposal totaled 1.3 million pounds.

Table 3–13. TRI Transfers Off-site for Further Waste Management/Disposal by 4-digit SIC Code, 1998: Metal Mining

SIC Codes	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs		Other Off-site Transfers** Pounds	Other Transfers Off-site to Disposal*** Pounds	Total Transfers for Further Waste Management/Disposal Pounds
					Non-metal TRI Chemicals Pounds	Metals and Metal Compounds Pounds			
1021	Copper Ores	623,488	0	250	0	0	0	45,990	669,728
1031	Lead and Zinc Ores	0	0	0	0	0	0	21	21
1041	Gold Ores	209,774	0	112	500	0	0	30,829	241,215
1044	Silver Ores	628	0	0	101,482	48	0	133	102,291
1061	Ferroalloy Ores, Except Vanadium	2,000	0	0	0	750	0	1,243,850	1,246,600
1099	Miscellaneous Metal Ores, nec*	41,436	0	0	0	0	0	12,670	54,106
	Multiple within SIC 10	8,400	0	0	0	0	0	0	8,400
	SIC 1021 and SIC 33 (Primary Metals)	0	0	0	0	0	0	6,878	6,878
	SIC 1021 and SIC 4931 (Electric Utilities)	0	0	184	0	0	0	0	184
	Total	885,726	0	546	101,982	798	0	1,340,371	2,329,423

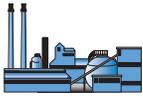
Note: Data are from Section 6 of Form R.

Forms that reported more than one 4-digit SIC code within SIC code 10 are assigned to the “multiple codes” category.

*nec: not elsewhere classified.

**Other Off-site Transfers reported without valid waste management code.

***Does not include transfers of metals and metal compounds to POTWs.



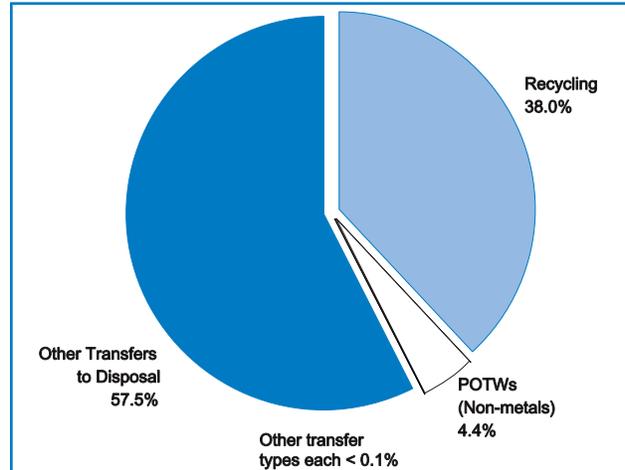
**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Metal Mining (SIC Code 10)**

TRI Data by State

Nevada metal mining facilities submitted 273 forms, the largest number of any state, followed by Arizona with 109 forms. New Mexico ranked third with 55 forms.

On- and Off-site Releases

Metal mines in Nevada and Arizona reported total on- and off-site releases of 1.26 billion pounds and 1.01 billion pounds, respectively, as shown in Table 3-14. Utah ranked third with 449.1 million pounds. As shown in Map 3-1, metal mines reported to TRI in 20 states, largely in the western United States.



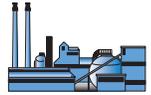
Note: Data are from Section 8 of Form R.

Figure 3-3. Distribution of TRI Transfers Off-site for Further Waste Management/Disposal, 1998: Metal Mining

Table 3-14. Summary of TRI Information by State, 1998: Metal Mining

State	Total Forms Number	On-site Releases							Total On-site Releases Pounds	Off-site Releases Transfers Off-site to Disposal Pounds	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases					
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds				
Alaska	35	511,214	1,335	0	29,024,000	0	274,958,589	304,495,138	21	304,495,159	
Arizona	109	584,912	193	0	0	0	1,005,141,555	1,005,726,660	46,908	1,005,773,568	
California	45	362,004	5	0	0	0	8,373,318	8,735,327	12,289	8,747,616	
Colorado	19	10,768	1,422	0	3,975,708	0	10,322,879	14,310,777	290,000	14,600,777	
Delaware	4	11,963	0	0	0	0	0	11,963	750	12,713	
Florida	1	0	0	0	0	0	0	0	0	0	
Idaho	29	8,693	7,924	0	0	0	45,176,356	45,192,973	33	45,193,006	
Illinois	8	16,521	0	0	0	0	0	16,521	593,396	609,917	
Missouri	21	139,670	29,661	0	0	0	47,112,532	47,281,863	0	47,281,863	
Montana	39	143,173	0	0	0	0	68,280,457	68,423,630	0	68,423,630	
Nevada	273	1,453,263	236,050	0	1,404	0	1,261,552,860	1,263,243,577	38	1,263,243,615	
New Mexico	55	332,059	8	0	0	0	221,846,712	222,178,779	0	222,178,779	
New York	9	65,560	5,973	0	0	0	10,073,005	10,144,538	0	10,144,538	
Oregon	12	10,460	0	0	0	0	18,179,396	18,189,856	0	18,189,856	
South Carolina	10	24,000	0	0	0	0	22,993,000	23,017,000	0	23,017,000	
South Dakota	15	85,608	210,595	0	0	0	16,851,505	17,147,708	15	17,147,723	
Tennessee	26	177,725	14,939	0	0	54	10,560,032	10,752,750	0	10,752,750	
Texas	4	54,030	0	0	0	0	0	54,030	360,600	414,630	
Utah	38	533,668	14,742	0	0	0	448,554,670	449,103,080	2,581	449,105,661	
Washington	7	27,045	0	0	0	0	547,025	574,070	4	574,074	
Total	759	4,552,336	522,847	0	33,001,112	54	3,470,523,891	3,508,600,240	1,306,635	3,509,906,875	

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.



Nevada, Arizona, and Utah also had the largest on-site land releases (99.9 percent of total releases in each of the three states): 1.26 billion pounds in Nevada, 1.01 billion pounds in Arizona, and 448.6 million pounds in Utah. On-site land releases amounted to more than 90 percent of total releases in 15 of the 20 states with reporting by metal mines.

Alaska's metal mining facilities reported the largest underground injection, 29.0 million pounds. Facilities in Colorado reported 4.0 million pounds of underground injection.

Metal mining facilities reported less than 5 million pounds each for the other release types.

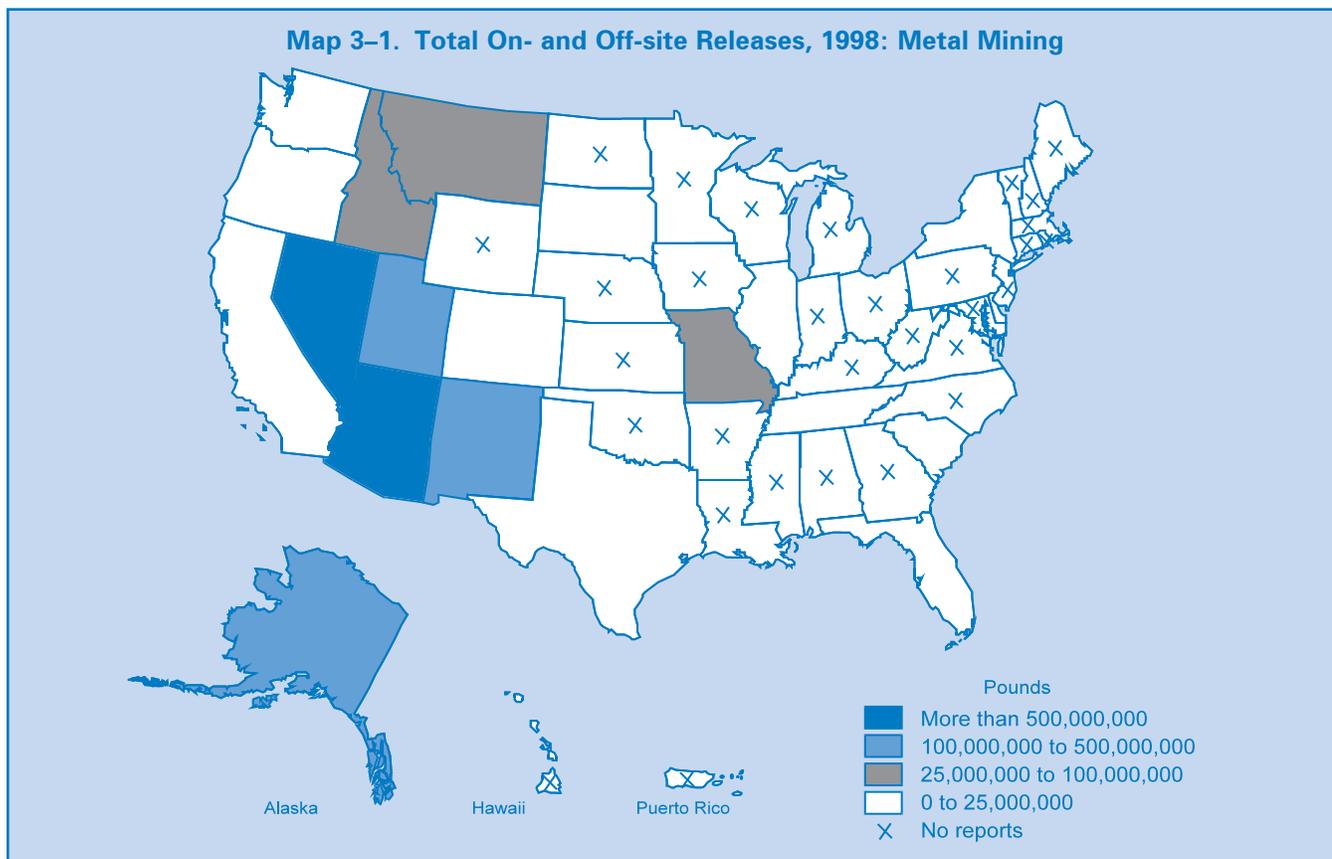
Waste Management Data

Nevada, Arizona, and Utah reported the largest total production-related waste in 1998. These were the same states that ranked highest for total releases. Nevada's production-related waste totaled 1.33 billion pounds. Arizona facilities reported 1.11 billion pounds, and Utah facilities reported 458.9 million pounds. These data also appear in Table 3-14.

Table 3-14. Summary of TRI Information by State, 1998: Metal Mining (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Alaska	520,404	0	0	0	41,631	9,330	305,216,317	305,787,682	11
Arizona	460,522	264,700	0	0	66,199	5,466	1,110,394,842	1,111,191,729	399,307
California	9,908	125,366	0	0	6,375,600	12,670	8,733,609	15,257,153	20
Colorado	0	2,000	0	0	0	0	14,600,497	14,602,497	6
Delaware	0	0	0	0	0	0	11,963	11,963	4
Florida	0	0	0	0	0	0	0	0	0
Idaho	1,730	610	0	0	0	0	45,241,768	45,244,108	7
Illinois	0	0	0	0	0	0	764,649	764,649	7
Missouri	0	0	0	0	0	0	47,280,463	47,280,463	0
Montana	0	39,000	0	0	1,045,707	0	68,809,534	69,894,241	13
Nevada	8,218,376	46,067	0	0	13,233,959	7,199	1,311,576,706	1,333,082,307	34
New Mexico	0	693,846	0	0	0	0	222,969,848	223,663,694	3
New York	0	0	0	0	0	0	10,144,432	10,144,432	0
Oregon	2,530,269	0	0	0	0	0	18,196,996	20,727,265	11
South Carolina	0	0	0	0	0	0	22,680,000	22,680,000	0
South Dakota	542,954	52,000	0	0	3,897,554	3	17,135,614	21,628,125	7
Tennessee	8,000,000	0	0	0	0	0	10,747,637	18,747,637	8
Texas	0	0	0	0	0	0	414,630	414,630	4
Utah	6,039,400	0	0	0	85,640	0	452,755,449	458,880,489	22
Washington	0	0	0	0	0	23	595,000	595,023	0
Total	26,323,563	1,223,589	0	0	24,746,290	34,691	3,668,269,954	3,720,598,087	399,464

Note: Data are from Section 8 of Form R.



Quantities released on- and off-site accounted for more than 98 percent of total production-related waste in 15 states. These included Nevada, Arizona, and Utah which also reported the largest quantities: Nevada with 1.31 billion pounds, Arizona with 1.11 billion pounds, and Utah with 452.8 million pounds.

States with the largest on-site recycling were Nevada with 8.2 million pounds and Tennessee with 8.0 million pounds, followed by Utah with 6.0 million pounds. Nevada also reported the largest on-site treatment (13.2 million pounds), followed by California (6.4 million pounds) and South Dakota (3.9 million pounds).

Top 15 Chemicals for On- and Off-site Releases

The top 15 chemicals released by the metal mining industry were metals (largely in metal compounds). On- and off-site releases of the top 15 chemicals totaled 3.47 billion pounds in 1998 (see Table 3-15). These 15 metals and metal compounds amounted to 98.9 percent of the industries' total releases.

The metal mining industry released 1.21 billion pounds of copper compounds, which ranked first. On- and off-site releases of zinc compounds totaled 615.5 million pounds, the second-largest amount. Arsenic compounds ranked third with 513.4 million pounds.

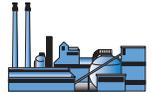


Table 3–15. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1998: Metal Mining

CAS Number	Chemical	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
				Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
—	Copper compounds	292,772	68,406	0	1,195,884	0	1,211,494,611	1,213,051,673	41,475	1,213,093,148
—	Zinc compounds	175,309	49,498	0	21,391,870	54	593,925,427	615,542,158	4,480	615,546,638
—	Arsenic compounds	46,092	5,590	0	760,075	0	512,544,503	513,356,260	281	513,356,541
—	Manganese compounds	88,328	6,805	0	720,000	0	409,678,272	410,493,405	1,221,305	411,714,710
7440-50-8	Copper	8,312	0	0	0	0	276,482,439	276,490,751	0	276,490,751
—	Lead compounds	172,859	10,591	0	7,279,134	0	202,731,841	210,194,425	16,958	210,211,383
7440-38-2	Arsenic	36,121	1,027	0	0	0	74,436,144	74,473,292	0	74,473,292
—	Chromium compounds	23,299	257	0	0	0	44,157,907	44,181,463	412	44,181,875
—	Nickel compounds	10,103	5,080	0	22,008	0	35,959,117	35,996,308	47	35,996,355
—	Antimony compounds	1,348	6,995	0	170,062	0	22,121,777	22,300,182	0	22,300,182
—	Barium compounds	5,619	5	0	1,200,000	0	12,065,102	13,270,726	9,600	13,280,326
7440-47-3	Chromium	875	20	0	12,000	0	12,865,961	12,878,856	1	12,878,857
—	Thallium compounds	1,132	250	0	0	0	9,861,750	9,863,132	0	9,863,132
—	Mercury compounds	4,610	22	0	0	0	8,804,097	8,808,729	2	8,808,731
—	Cobalt compounds	886	1	0	12,001	0	8,615,276	8,628,164	45	8,628,209
	Subtotal	867,665	154,547	0	32,763,034	54	3,435,744,224	3,469,529,524	1,294,606	3,470,824,130
	Total	4,552,336	522,847	0	33,001,112	54	3,470,523,891	3,508,600,240	1,306,635	3,509,906,875

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

On-site land releases accounted for 90 percent to 100 percent of the releases of all 15 chemicals. A total of 3.44 billion pounds of the 15 chemicals was released on-site to land. Underground injection, the second-largest release type, totaled 32.8 million pounds, including 21.4 million pounds of zinc compounds.

Projected Quantities of TRI Chemicals Managed in Waste, 1998–2000

Facilities in the metal mining industry expected to reduce their production-related waste 12.2 percent from 3.72 billion pounds in 1998 to 3.27 billion pounds in 2000. These projections are presented in Table 3–16. The projected overall reduction reflects the industry’s projected decrease in

quantities released on- and off-site, which dominated the industry’s totals. Metal mining facilities expected to reduce their quantities released on- and off-site from 3.67 billion pounds in 1998 to 3.22 billion pounds in 2000. However, quantities released—the least desirable outcome under the waste management hierarchy (described in Waste Management in Chapter 1)—were expected to decrease only from 98.6 percent to 98.5 percent of the industry’s production-related waste.

Source Reduction

The metal mining industry reported undertaking source reduction activity on 33 forms during 1998 (see Table 3–17). As noted in Waste Management in Chapter 1, source reduction—activity that prevents



**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Metal Mining (SIC Code 10)**

the generation of waste—is the preferred waste management option.

Facilities mining lead and zinc ores submitted 16 of the forms reporting source reduction activity. The 16 forms amounted to 19.0 percent of the lead and zinc mining forms. The group of forms that reported both SIC code 1021 (copper ores) and SIC code 33 (primary metals products) included

12 forms indicating source reduction activity, which was 41.4 percent of all the forms in that group.

Spill and leak prevention was identified on 25 forms, making it the most frequent source reduction activity in the industry. Good operating practices was reported on 17 forms and process modifications on 13 forms.

Table 3–16. Current Year and Projected Quantities of TRI Chemicals in Waste, 1998–2000: Metal Mining

Waste Management Activity	Current Year 1998		Projected 1999		Projected 2000	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
Recycled On-site	26,323,563	0.7	23,835,165	0.7	23,902,226	0.7
Recycled Off-site	1,223,589	0.0	1,133,171	0.0	1,116,351	0.0
Energy Recovery On-site	0	0.0	0	0.0	0	0.0
Energy Recovery Off-site	0	0.0	0	0.0	0	0.0
Treated On-site	24,746,290	0.7	24,327,248	0.7	24,298,670	0.7
Treated Off-site	34,691	0.0	33,210	0.0	43,206	0.0
Quantity Released On- and Off-site	3,668,269,954	98.6	3,387,925,634	98.6	3,215,961,971	98.5
Total Production-related Waste	3,720,598,087	100.0	3,437,254,428	100.0	3,265,322,424	100.0
Waste Management Activity	Projected Change 1998–1999 Percent		Projected Change 1999–2000 Percent		Projected Change 1998–2000 Percent	
Recycled On-site	-9.5		0.3		-9.2	
Recycled Off-site	-7.4		-1.5		-8.8	
Energy Recovery On-site	—		—		—	
Energy Recovery Off-site	—		—		—	
Treated On-site	-1.7		-0.1		-1.8	
Treated Off-site	-4.3		30.1		24.5	
Quantity Released On- and Off-site	-7.6		-5.1		-12.3	
Total Production-related Waste	-7.6		-5.0		-12.2	

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1998.

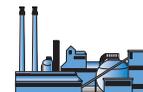


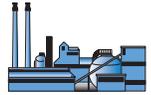
Table 3-17. Number of Forms Reporting Source Reduction Activity, 1998: Metal Mining

SIC Code	Industry	Total Form Rs Number	Forms Reporting Source Reduction Activity		Category of Source Reduction Activity							
			Number	Percent	Good Operating Practices Number	Inventory Control Number	Spill and Leak Prevention Number	Raw Material Modifications Number	Process Modifications Number	Cleaning and Degreasing Number	Surface Preparation and Finishing Number	Product Modifications Number
1021	Copper Ores	155	3	1.9	1	0	1	0	2	0	0	0
1031	Lead and Zinc Ores	84	16	19.0	3	0	22	0	11	0	0	0
1041	Gold Ores	335	2	0.6	1	1	2	0	0	0	0	0
1044	Silver Ores	43	0	0.0	0	0	0	0	0	0	0	0
1061	Ferroalloy Ores, Except Vanadium	30	0	0.0	0	0	0	0	0	0	0	0
1099	Miscellaneous Metal Ores, nec*	20	0	0.0	0	0	0	0	0	0	0	0
	Multiple within SIC 10	21	0	0.0	0	0	0	0	0	0	0	0
	SIC 1021 and SIC 33 (Primary Metals)	29	12	41.4	12	0	0	0	0	0	0	0
	SIC 1021 and SIC 4931 (Electric Utilities)	16	0	0.0	0	0	0	0	0	0	0	0
	Total	733	33	4.5	17	1	25	0	13	0	0	0

Note: All source reduction activities on a form are counted in the corresponding category. Totals do not equal the sum of the categories because forms may report more than one source reduction activity.

Forms that reported more than one 4-digit SIC code within SIC code 10 are assigned to the "multiple codes" category.

*nec: not elsewhere classified.



❖ Coal Mining (SIC Code 12) ❖

Introduction

Coal mines in SIC code 12 include anthracite and bituminous mines, as listed in Box 3–4. They may be either surface or underground. Anthracite is a hard, compact coal differing from bituminous (or soft) coal in that it contains only a small amount of volatile matter and burns with a nearly smokeless flame. Most coal mined in the United States is bituminous. Coal extraction activities are exempt from TRI reporting. Other coal mining activities, such as beneficiation, must be reported.

Products and Services

Coal is primarily used by electric utilities to generate electricity or by industrial facilities to generate heat and electricity. Some steel mills also use coal to produce coke, which is combined with iron ore and limestone in

a blast furnace to produce molten iron, the basic metal in steel. Some coal is burned in residential or commercial buildings to produce heat.

In 1998, electric utilities consumed approximately 90 percent of the coal used in the United States, with 3 percent consumed by coke plants and 6 percent consumed by other industrial facilities.

Employment and Production

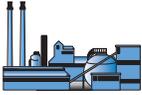
Coal mining employment totaled 87,800 (i.e., this includes production, development, and office workers) in 1997, and production was valued at \$23.38 billion. (These data approximately correlate to the SIC codes covered by TRI, but they include extraction activities that are excluded in TRI.)

Box 3–4. SIC Code 12, Coal Mining: Codes and Classifications Required to Report to TRI

SIC Code 12, Coal Mining: Codes and Classifications Required to Report to TRI

1221	Bituminous Coal and Lignite Surface Mining	Producing bituminous coal or lignite at surface mines or developing such surface mines. Includes coal preparation plants associated with a mine or operated independently of any mine.
1222	Bituminous Coal Underground Mining	Producing bituminous coal in underground mines or developing such mines. Includes coal preparation plants associated with a mine.
1231	Anthracite Mining	Producing anthracite or developing anthracite mines. Includes anthracite preparation plants.

Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries Coal Mining (SIC Code 12)

Nearly 1.12 billion tons of coal was produced in the United States in 1998. Just over half (50.1 percent) of the coal is produced in states east of the Mississippi River, with West Virginia accounting for 31 percent and Kentucky for 27 percent of the Eastern total. Production in the eastern United States is primarily from underground operations and consists largely of coal with a high sulfur content. Anthracite is mined only in eastern Pennsylvania. Wyoming accounts for 57 percent of the total produced in the western United States and contains the largest surface mines in the world producing low-sulfur coal.

The 1998 production level represented an 8.2 increase over 1995. Regions west of the Mississippi River experienced the greatest increase throughout this period. In the last year, from 1997 to 1998, eastern coal production declined 3.2 percent, while in the west, coal output rose 7.2 percent. Western coal costs less and its lower sulfur content makes it more attractive to electric utilities (and others) responding to the sulfur emissions reduction requirements of the 1990 Clean Air Act Amendments. In the eastern United States, particularly in the Appalachian region, the secondary market for coal is coke plants. As steel mills turn to greater use of recycled scrap metals, the demand for coke has fallen.

There are about 1,750 coal mines in the United States, employing an estimated 80,000 miners. About half the mines are underground and half surface mines. These numbers steadily decreased in recent years. In 1995, some 2,100 coal mines employed more than 90,000 miners. While mines closed and employment fell, however, production rose from 1.03 billion tons in 1995 to an estimated 1.12 billion tons in 1998.

Coal production was valued at \$20.0 billion in 1998, up from \$19.5 billion in 1995.

General Environmental Issues

Environmental concerns associated with coal mining have generally focused on water pollution from acid mine drainage and mine water. These concerns involve both active and closed mines. At active mine sites, release of pollutants to water, air, or both may occur during various operations of a coal preparation plant. Storage and transportation are both likely sources of air emissions.

As noted above, coal mine extraction activities are exempt from TRI reporting. However, coal mining operations also may crush or size coal or wash and/or dry the coal to improve its burning qualities before it is shipped to electric utilities. Impurities in the coal, such as metals and metal compounds and sulfur, may be released or generated as waste during a variety of coal mining activities:

- ◆ transportation of the coal (fugitive air emissions)
- ◆ coal preparation (fugitive air emissions and wastewater)
- ◆ coal cleaning (wastewater and on-site land disposal of tailings)
- ◆ coal drying (point source air emissions and on-site land disposal from coal combustion)
- ◆ storage (water run-off from rain)
- ◆ reclamation (on-site land disposal)
- ◆ recovery of fly-ash from plants burning the coal (on-site land disposal)

As with metal mining, environmental impacts continue when coal mines close.



Some coal-mining states began requiring reclamation efforts as early as the 1940s. However, the federal Surface Mining Control and Reclamation Act, passed in 1977, established stringent national standards. The Act addresses not only surface mining and reclamation, but also coal exploration and the surface effects of underground coal mining. Provisions are implemented by coal-mining states that have federally approved programs. Mining states have generally amended their mining laws or passed new legislation conforming to these provisions. When mines or portions of mines close, the federal and state laws require that the site be reclaimed. Reclamation involves regrading and revegetation as well as removing structures, removing stored fuels and chemicals, and capping tailings impoundments to maintain environmental controls and contain mine drainage. Coal mining facilities may use ash from on-site combustion (for example, during thermal drying) as well as ash returned by electric utilities that combust coal in reclamation activities.

Processes Involving Toxic Chemicals

Coal occurs in deposits, generally almost uniform, under the earth's surface. Mining operations obtain raw coal by surface mining (removing the material above the coal) or by underground mining (sinking shafts or driving adits and excavating corridors to gain access to the coal). Coal extraction activities are exempt from TRI reporting because they do not typically involve the use of listed toxic chemicals in reportable concentrations. Coal itself is generally expected to contain TRI chemicals in concentrations below the reporting requirements. Other activities, after extraction, may involve use of TRI chemicals. These activities may also result in releasing impu-

rities from the coal, such as metals and metal compounds and sulfur, that may be reportable to TRI.

Once it has been extracted, coal is usually prepared for commercial use. Coal preparation (also known as beneficiation) involves size reduction, screening/classification, and cleaning and drying. Some plants only size and classify, while others also clean and dry the coal. While coal extraction activities are exempt from TRI reporting, coal preparation activities are not.

Size reduction involves crushing the coal so that it can be handled more easily. The coal is then screened to match size specifications of cleaning equipment as well as to meet market demand. These activities may be carried out in open or closed structures and either wet or dry.

Cleaning coal improves its energy value and removes impurities, such as sulfur and ash-forming elements. For coarse coal, gravity concentration or dense-medium separation may be used. Gravity concentration methods rely on water flow and the motion of the equipment to separate the more dense impurities from the lighter coal. Dense-medium separation uses a large, open tank and pulverized magnetite in water or other medium so that inorganic material sinks to the bottom of the tank and the organic coal floats to the top.

Fine coal cleaning involves chemical conditioning of the coal to adjust the pH (using lime, sodium carbonate, sodium hydroxide, or sulfuric acid) followed by flotation to recover clean coal. Froth flotation, commonly applied, uses air, water, coal slurry and flotation agents. Air bubbles rise through the coal-water slurry, and the fine coal particles adhere to their surfaces. The



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries **Coal Mining (SIC Code 12)**

coal particles thus rise to the surface and mechanical scrapers remove the flotation agents.

Drying methods complete the coal preparation process. Fine coal is dried using vacuum filtration (using vacuum pressure to force the coal-water mixture through a porous filtering medium which captures the coal) and thermal drying (using a furnace). Coarse coal usually does not require thermal drying, but excess moisture is removed with drying screens and centrifuge drying.

Coal mines transport and store coal before and after preparation. Extracted coal is often stored in large coal piles both during coal preparation and prior to distribution into commerce. Ethylene glycol may be sprayed on the coal to prevent freezing.

As noted, most of the coal mined in the United States is shipped to electric utilities for combustion in power generation. Coal mines may receive ash from the air pollution control equipment of the facilities to which they supply coal. The mines must report any quantities of toxic chemicals in the ash that are managed as waste, if thresholds are exceeded.

When mines or portions of a mine close, the coal operators may use a variety of chemicals during reclamation of the site. These reclamation activities are reportable so long as they are not part of the extraction activities and are above threshold limits.

Management of Toxic Chemicals in Waste

Air emissions primarily result from crushing and screening the coal and from trans-

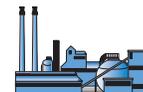
porting it. Coal may be moved by truck, rail, or conveyor belt to and from stockpiles, preparation plants, and finally, customers such as power plants and industrial facilities. These activities generate fugitive dust. Many facilities reduce the potential for fugitive air emissions by using wet processes or by enclosing the process area.

Depending on regional weather conditions, mining facilities may spray ethylene glycol on coal to prevent freezing during storage and transport. Fugitive air emissions from such applications are possible, but may be low given the low volatility of ethylene glycol.

Thermal drying, generally the final step in drying fine coal, may also result in air emissions of metals or acids. Other sources of stack or point source air emissions are tanks used to store materials containing volatile chemicals, such as flotation and conditioning agents.

Acidic leachate from coal stored in exposed sites may flow into underground streams or result in surface water discharges, when the coal piles are subject to rain or snow. Other sources of discharges to water include coal preparation and washing. Coal may be conveyed in a wet state (which reduces air emissions); subsequent dewatering can leave metal compounds in the wastewater. Metal compounds may also be present in wastewater from cleaning and rinsing the coal.

During thermal drying, some coal is combusted to provide the necessary heat. The waste ash that results from this process contains TRI chemicals. Electric plants may also return ash from combustion to the mine. Ash generated on-site or received from off-site and used for reclamation is



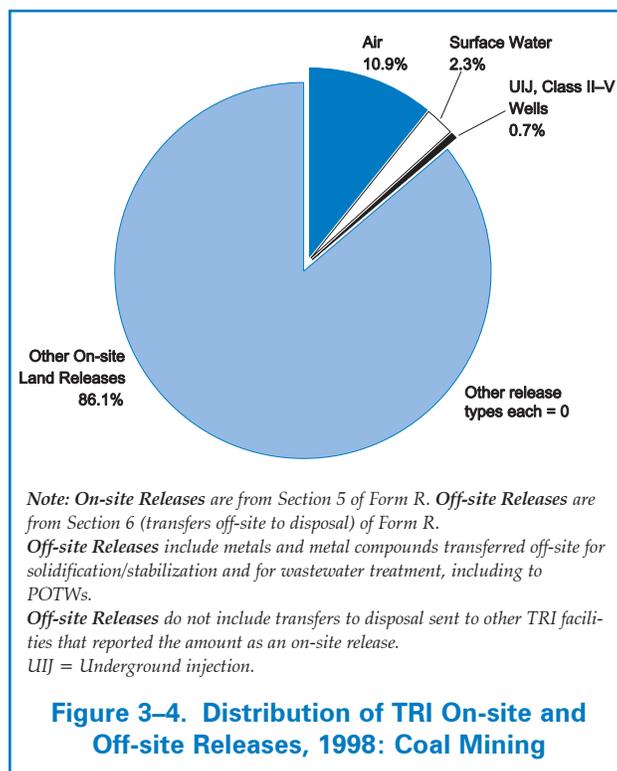
reportable as an on-site land release. Other on-site land releases include tailings from coal cleaning. After flotation during the cleaning of fine coal, wastewater slurry (called tailings) may be sent to a tailings impoundment. The tailings may include thickening agents and other chemicals used in froth flotation.

1998 TRI Data for Coal Mining

On- and Off-site Releases

Coal mining facilities required to report to TRI released 13.3 million pounds of TRI chemicals on- and off-site in 1998, as shown in Table 3–18. The majority, 11.5 million pounds, was released on-site to land in other than RCRA subtitle C landfills (types of on-site land releases are described in Box 1–4 in Chapter 1). Figure 3–4 shows that other on-site releases to land amounted to 86.1 percent of the industry’s total releases.

Air emissions by coal mines totaled 1.5 million pounds, the industry’s second-largest



release type. The coal mining industry reported less than 350,000 pounds each of surface water discharges and underground injection. The industry reported no off-site releases.

Table 3–18. TRI On-site and Off-site Releases by 4-digit SIC Code, 1998: Coal Mining

SIC Code	Industry	Total Forms Number	On-site Releases						Total On-site Releases Pounds	Off-site Releases		Total On- and Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases			Transfers Off-site to Disposal Pounds	Total Off-site Releases Pounds	
					Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds				
1221	Bituminous Coal and Lignite Surface Mining	101	385,728	173,251	0	480	0	9,162,145	9,721,604	0	9,721,604	
1222	Bituminous Coal Underground Mining	80	61,290	17,102	0	90,000	0	2,304,578	2,472,970	0	2,472,970	
	Multiple within SIC code 12	9	1,009,457	115,874	0	0	0	4,900	1,130,231	0	1,130,231	
	Invalid within SIC code 12	2	1,239	0	0	0	0	0	1,239	0	1,239	
	Total	192	1,457,714	306,227	0	90,480	0	11,471,623	13,326,044	0	13,326,044	

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release. Forms that reported more than one 4-digit SIC code within the SIC code 12 are assigned to the “multiple codes” category.

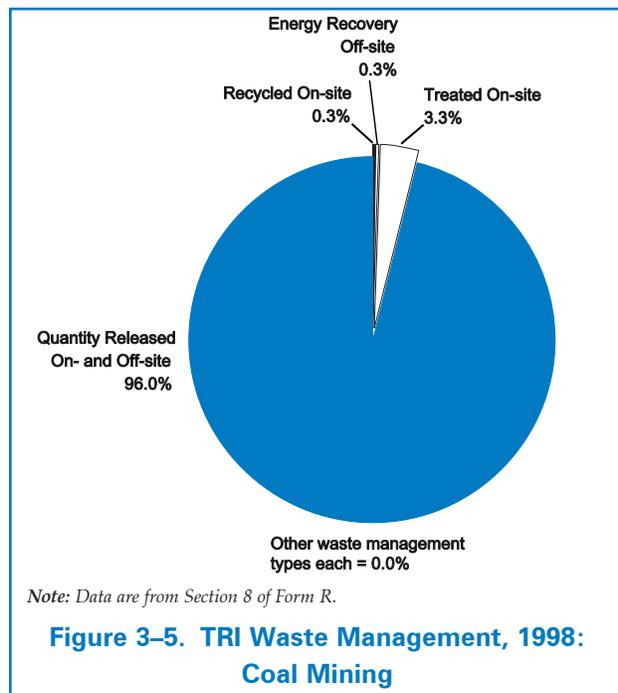


Chapter 3 — Toxics Release Inventory Data for New Reporting Industries Coal Mining (SIC Code 12)

Bituminous coal and lignite surface mines reported the largest total releases with 9.7 million pounds. Underground coal mining facilities reported 2.5 million pounds of total releases. These were largely on-site releases to land, 9.2 million pounds by surface mines and 2.3 million pounds by underground mines.

Surface and underground mining accounted for most of the forms submitted in the coal mining industry. Out of 192 forms, surface coal mines submitted 101 forms and underground coal mines submitted 80 forms. No reports were received from anthracite mines in 1998; as noted above, this type of coal is found only in eastern Pennsylvania.

Nine forms were submitted with multiple SIC codes in the SIC code 12 (coal mining). Releases reported by the multiple-codes group totaled 1.1 million pounds. They reported 1.0 million pounds of air emissions, the majority of the industry's releases to air.



Waste Management Data

Quantities of TRI Chemicals in Waste

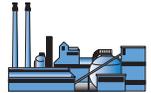
Coal mines reported managing 13.8 million pounds of total production-related waste in 1998, as shown in Table 3-19. Quantities released on- and off-site totaled 13.3 million pounds, or 96.0 percent of the industry's production-related waste (see Figure 3-5).

Table 3-19. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1998: Coal Mining

SIC Code	Industry	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
		On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
1221	Bituminous Coal and Lignite Surface Mining	7,178	0	0	43,735	37,744	0	9,734,158	9,822,815	32
1222	Bituminous Coal Underground Mining	36,000	0	0	0	420,800	0	2,439,181	2,895,981	0
	Multiple within SIC code 12	0	0	0	0	0	0	1,115,575	1,115,575	2
	Invalid within SIC code 12	1,239	0	0	0	0	0	1,239	2,478	2
	Total	44,417	0	0	43,735	458,544	0	13,290,153	13,836,849	36

Note: Data are from Section 8 of Form R.

Forms that reported more than one 4-digit SIC code within SIC code 12 are assigned to the "multiple codes" category.



The industry's on-site treatment totaled 458,544 pounds. On-site recycling and off-site energy recovery amounted to approximately 44,000 pounds each.

Surface mines managed 9.8 million pounds of total production-related waste, including 9.7 million pounds of quantities released on- and off-site. Underground mines managed a total of 2.9 million pounds, including 2.4 million pounds in quantities released. All of the 1.1 million-pound total reported by the multiple-codes group was in quantities released on- and off-site.

Transfers Off-site for Further Waste Management

One type of coal mine reported one type of transfers off-site for further waste management in 1998. As shown in Table 3-20, bituminous coal and lignite surface mines transferred 43,735 pounds off-site to recycling.

TRI Data by State

Coal mines in a dozen states reported to TRI in 1998. The states with the largest number of forms from coal mining facilities were Illinois with 55 forms, Ohio with 41 forms, and West Virginia with 28 forms.

On- and Off-site Releases

Coal mining facilities in New Mexico reported the largest total on- and off-site releases in 1998, although New Mexico ranked fourth for number of forms (24 forms) behind Illinois, Ohio, and West Virginia. As shown in Table 3-21, New Mexico's mines reported total releases of 5.6 million pounds, all as on-site releases to land.

Illinois ranked second among coal-mining states with 2.7 million pounds of total releases. Nearly all of this amount was released on-site to land. Together, New Mexico and Illinois facilities reported 72.6 percent of the coal mining industry's on-site land releases.

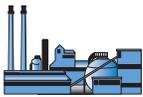
Table 3-20. TRI Transfers Off-site for Further Waste Management/Disposal by 4-digit SIC Code, 1998: Coal Mining

SIC Codes	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs		Other Transfers Off-site to Disposal*	Total Transfers for Further Waste Management/Disposal Pounds
					Non-metal TRI Chemicals Pounds	Metals and Metal Compounds Pounds		
1221	Bituminous Coal and Lignite Surface Mining	43,735	0	0	0	0	0	43,735
1222	Bituminous Coal Underground Mining	0	0	0	0	0	0	0
	Multiple within SIC code 12	0	0	0	0	0	0	0
	Invalid within SIC code 12	0	0	0	0	0	0	0
	Total	43,735	0	0	0	0	0	43,735

Note: Data are from Section 6 of Form R.

Forms that reported more than one 4-digit SIC code within the SIC code 12 are assigned to the "multiple codes" category.

*Does not include transfers of metals and metal compounds to POTWs.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries Coal Mining (SIC Code 12)

West Virginia ranked third among states for coal mining releases with 1.8 million pounds, including 1.4 million pounds of air emissions. West Virginia facilities reported 93.9 percent of the industry's air emissions.

In two other states, coal mining releases exceeded 1 million pounds. Colorado mines reported 1.6 million pounds and Alabama mines reported 1.0 million pounds. In both of these states, the largest release type was also other on-site land releases (1.6 million pounds in Colorado and 975,000 pounds in Alabama).

Map 3–2 shows the geographic distribution of coal mining releases reported to TRI in 1998.

Waste Management Data

New Mexico, Illinois, and West Virginia also ranked highest among the states for total production-related waste reported by

the coal mining industry. These data also appear in Table 3–21. New Mexico facilities managed 5.6 million pounds of production-related waste, the largest amount among the states. This consisted entirely of quantities released on- and off-site. Illinois ranked second, reporting 2.8 million pounds of production-related waste, including 2.7 million pounds in quantities released on- and off-site. West Virginia ranked third, reporting with 1.9 million pounds of total production related waste and 1.8 million pounds in quantities released on- and off-site.

Quantities released on- and off-site amounted to more than 90 percent of production-related waste in nine of the 12 states (Alabama, Colorado, Illinois, Indiana, Kentucky, New Mexico, North Dakota, Virginia, and West Virginia).

Coal mines reported much smaller quantities in other waste management activities.

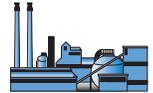
Table 3–21. Summary of TRI Information by State, 1998: Coal Mining

State	Total Forms Number	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
				Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
Alabama	1	87	10,000	0	45,000	0	975,000	1,030,087	0	1,030,087
Colorado	8	419	579	0	0	0	1,592,748	1,593,746	0	1,593,746
Illinois	55	1,780	4,843	0	0	0	2,708,418	2,715,041	0	2,715,041
Indiana	8	18,465	0	0	480	0	56,426	75,371	0	75,371
Kentucky	2	14,688	0	0	0	0	4,900	19,588	0	19,588
Maryland	3	13,313	1,450	0	45,000	0	260	60,023	0	60,023
New Mexico	24	0	0	0	0	0	5,620,000	5,620,000	0	5,620,000
North Dakota	2	0	0	0	0	0	96,707	96,707	0	96,707
Ohio	41	2,390	502	0	0	0	750	3,642	0	3,642
Pennsylvania	19	36,853	15	0	0	0	281,695	318,563	0	318,563
Virginia	1	1,630	0	0	0	0	180	1,810	0	1,810
West Virginia	28	1,368,089	288,838	0	0	0	134,539	1,791,466	0	1,791,466
Total	192	1,457,714	306,227	0	90,480	0	11,471,623	13,326,044	0	13,326,044

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.



The largest was 158,100 pounds of on-site treatment in Pennsylvania.

Top 15 Chemicals for On- and Off-site Releases

Coal mines reported releasing more barium compounds, 7.0 million pounds, than any other chemical. They also reported releases of 1.8 million pounds each of zinc compounds and manganese compounds. Table 3–22 presents data for the 15 chemicals released in the largest amounts by the TRI coal mining facilities.

For barium compounds, ranked first, and manganese compounds, ranked third, the releases consisted almost entirely of on-site land releases. However, for zinc compounds, which ranked second, coal mines released 838,881 pounds to air, as well as 996,310 pounds to on-site releases to land.

Releases of the 15 chemicals totaled 13.26 million pounds, 99.5 percent of the industry’s total of 13.33 million pounds of releases.

Projected Quantities of TRI Chemicals Managed in Waste, 1998–2000

Coal mining facilities reporting to TRI expected to reduce their production-related waste by 7.9 percent from 1998 to 2000, reducing it from a total of 13.8 million pounds to 12.7 million pounds. The projected decrease represents a reduction of 8.8 percent in 1999 followed by an increase of 1.0 percent in 2000. These projections reflect the industry’s expected changes in quantities released on- and off-site, as shown in Table 3–23.

The projections indicate very little change in waste management practices. Quantities released on- and off-site, the least desirable

Table 3–21. Summary of TRI Information by State, 1998: Coal Mining (continued)

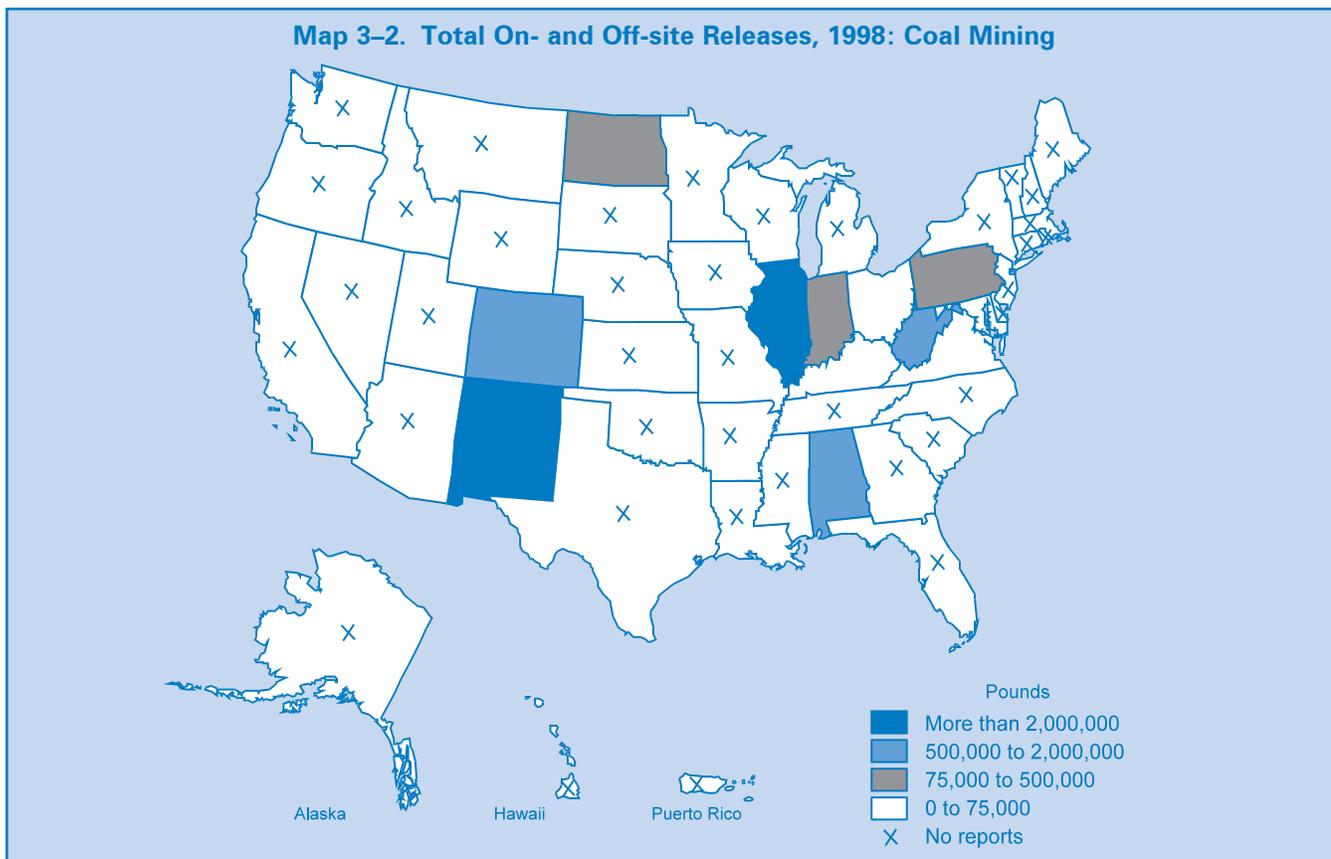
State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Alabama	36,000	0	0	0	0	0	1,000,000	1,036,000	0
Colorado	0	0	0	43,735	0	0	1,591,774	1,635,509	0
Illinois	0	0	0	0	116,300	0	2,724,186	2,840,486	3
Indiana	7,513	0	0	0	0	0	75,371	82,884	5
Kentucky	0	0	0	0	0	0	4,932	4,932	0
Maryland	0	0	0	0	49,000	0	59,812	108,812	1
New Mexico	0	0	0	0	0	0	5,620,000	5,620,000	12
North Dakota	0	0	0	0	0	0	96,707	96,707	0
Ohio	904	0	0	0	5,500	0	3,775	10,179	0
Pennsylvania	0	0	0	0	158,100	0	322,845	480,945	13
Virginia	0	0	0	0	0	0	1,810	1,810	0
West Virginia	0	0	0	0	129,644	0	1,788,941	1,918,585	2
Total	44,417	0	0	43,735	458,544	0	13,290,153	13,836,849	36

Note: Data are from Section 8 of Form R.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries Coal Mining (SIC Code 12)

Map 3-2. Total On- and Off-site Releases, 1998: Coal Mining



outcome under the waste management hierarchy (described in **Waste Management** in Chapter 1), would rise slightly, from 96.0 percent of total production-related waste in 1998 to 96.1 percent in 2000.

Source Reduction

One form was submitted by a coal mining facility in 1998 reporting source reduction

activity undertaken during the year, as shown in Table 3-24. This form, from an underground mining facility, indicated improvements in spill and leak prevention, process modifications, and cleaning and degreasing. As noted in **Waste Management** in Chapter 1, source reduction is activity that prevents the generation of waste and is the preferred waste management option.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Coal Mining (SIC Code 12)**

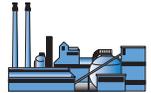


Table 3–22. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1998: Coal Mining

CAS Number	Chemical	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
—	Barium compounds	253	10,154	0	45,000	0	6,982,890	7,038,297	0	7,038,297
—	Zinc compounds	838,881	86	0	0	0	996,310	1,835,277	0	1,835,277
—	Manganese compounds	344	12,225	0	45,000	0	1,772,013	1,829,582	0	1,829,582
7664-41-7	Ammonia	448,525	282,214	0	480	0	114,617	845,836	0	845,836
—	Copper compounds	12	17	0	0	0	412,474	412,503	0	412,503
—	Lead compounds	10	87	0	0	0	407,610	407,707	0	407,707
—	Chromium compounds	33	563	0	0	0	202,214	202,810	0	202,810
—	Nickel compounds	19	15	0	0	0	191,531	191,565	0	191,565
7647-01-0	Hydrochloric acid	138,417	0	0	0	0	0	138,417	0	138,417
—	Cobalt compounds	0	0	0	0	0	101,200	101,200	0	101,200
—	Arsenic compounds	0	864	0	0	0	69,892	70,756	0	70,756
—	Selenium compounds	0	0	0	0	0	56,552	56,552	0	56,552
—	Nitrate compounds	0	0	0	0	0	56,426	56,426	0	56,426
—	Beryllium compounds	0	0	0	0	0	41,000	41,000	0	41,000
—	Thallium compounds	0	0	0	0	0	37,000	37,000	0	37,000
	Subtotal	1,426,494	306,225	0	90,480	0	11,441,729	13,264,928	0	13,264,928
	Total	1,457,714	306,227	0	90,480	0	11,471,623	13,326,044	0	13,326,044

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

Table 3–23. Current Year and Projected Quantities of TRI Chemicals in Waste, 1998–2000: Coal Mining

Waste Management Activity	Current Year 1998		Projected 1999		Projected 2000	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
Recycled On-site	44,417	0.3	40,417	0.3	41,417	0.3
Recycled Off-site	0	0.0	0	0.0	0	0.0
Energy Recovery On-site	0	0.0	0	0.0	0	0.0
Energy Recovery Off-site	43,735	0.3	0	0.0	0	0.0
Treated On-site	458,544	3.3	452,544	3.6	455,544	3.6
Treated Off-site	0	0.0	0	0.0	0	0.0
Quantity Released On- and Off-site	13,290,153	96.0	12,126,775	96.1	12,245,066	96.1
Total Production-related Waste	13,836,849	100.0	12,619,736	100.0	12,742,027	100.0
Waste Management Activity	Projected Change 1998–1999		Projected Change 1999–2000		Projected Change 1998–2000	
	Percent		Percent		Percent	
Recycled On-site	–9.0		2.5		–6.8	
Recycled Off-site	—		—		—	
Energy Recovery On-site	—		—		—	
Energy Recovery Off-site	–100.0		—		–100.0	
Treated On-site	–1.3		0.7		–0.7	
Treated Off-site	—		—		—	
Quantity Released On- and Off-site	–8.8		1.0		–7.9	
Total Production-related Waste	–8.8		1.0		–7.9	

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1998.



**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries
Coal Mining (SIC Code 12)**

Table 3–24. Number of Forms Reporting Source Reduction Activity, 1998: Coal Mining

SIC Code	Industry	Total Form Rs Number	Forms Reporting Source Reduction Activity		Category of Source Reduction Activity								
			Number	Percent of All Form Rs Percent	Good Operating Practices Number	Inventory Control Number	Spill and Leak Prevention Number	Raw Material Modifications Number	Process Modifications Number	Cleaning and Degreasing Number	Surface Preparation and Finishing Number	Product Modifications Number	
1221	Bituminous Coal and Lignite Surface Mining	82	0	0.0	0	0	0	0	0	0	0	0	0
1222	Bituminous Coal Underground Mining	26	1	3.8	0	0	1	0	1	2	0	0	0
	Multiple within SIC code 12	9	0	0.0	0	0	0	0	0	0	0	0	0
	Invalid within SIC code 12	2	0	0.0	0	0	0	0	0	0	0	0	0
	Total	119	1	3.8	0	0	1	0	1	2	0	0	0

Note: All source reduction activities on a form are counted in the corresponding category. Totals do not equal the sum of the categories because forms may report more than one source reduction activity.

Forms that reported more than one 4-digit SIC code within SIC code 12 are assigned to the "multiple codes" category.



❖ Electric Utilities that Combust ❖ Coal and/or Oil (SIC Codes 491 and 493)

Introduction

Electric utilities may use a variety of fuels to generate electricity. Facilities that must report to TRI are limited to those that combust coal and/or oil for the purpose of generating power for distribution in commerce. These facilities report under SIC codes 4911, 4931 and 4939, as identified in Box 3–5. Other electric utilities in these SIC codes—those fueled by natural gas, nuclear, hydroelectric, or other sources—are not required to report.

Products and Services

Power generation facilities include traditional regulated utilities that produce electricity for public use, manufacturers that produce electricity for their own use, and, more recently, other industrial groups that provide electricity for their own use and/or for sale to others.

Employment and Production

Net generation of electricity (total electricity generated minus the electricity used by the facility itself) was 3.62 trillion megawatt

Box 3–5. SIC Code 491, Electric Services, and 493, Combination Electric and Gas, and Other Utility Services: Codes and Classifications Required to Report to TRI

SIC Code 491, Electric Services, and 493, Combination Electric and Gas, and Other Utility Services: Codes and Classifications Required to Report to TRI

TRI reporting in these SIC codes is limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce.

4911	Electric Services	Generation, transmission, and/or distribution of electric energy for sale.
4931	Electric and Other Services Combined	Providing electric services in combination with other services, including gas (electric services are the major part but less than 95% of the total).
4939	Combination Utilities, Not Elsewhere Classified	Providing combinations of electric, gas, and other services, not elsewhere classified.

Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987.



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hours in 1998. More than half (52 percent) was generated from coal and required the use of 915 million tons of coal. Four percent of the nation's power was produced from petroleum. In 1997, fossil fuel electric power generation employed 93,765, and the industry's revenue totaled \$48.32 billion.

Electric power generation by utilities occurs across the United States. States with the highest utility net generation are those with the largest population densities and industrial centers: California, Texas, Illinois, Ohio, Pennsylvania and Florida. However, different areas of the country use different energy sources. For example, coal and petroleum-fired power plants are found in the east while gas-fired plants are in the coastal south.

Utility power generation has traditionally been regulated in the United States. Recently, however, many states have begun to encourage competition in the wholesale distribution of electricity in response to the Federal Energy Regulatory Commission's Orders 888 and 889 (April 24, 1996). These orders deal with issues of open access to transmission networks and the requirement that utilities share information on the availability of transmission capacity. In this newly competitive industry structure, mergers and cost-cutting measures are leading to changes, including the emergence of new firms that buy electric energy for resale and an increase in the share of the market for nonutilities (industrial suppliers of electricity).

While demand for electricity grew by 7 percent annually in the 1960s, by the 1990s that growth had slowed to 2 percent per year. It is projected that 186,000 megawatts of new electric generation will be required

by the United States and Canada by 2010. As demand grows, utilities must build more capacity or explore other alternatives to meet growth in demand. Of the new capacity expected, over 80 percent is projected to be fueled by natural gas or by both oil and gas. Alternatives to building capacity include demand-side management programs (encouraging conservation, rewarding the use of energy-efficient equipment and technologies, and shifting use to non-peak hours), purchases from cogenerators, and power imports from other countries.

General Environmental Issues

Fuel used by electric generating facilities is the major source of pollutants, including TRI chemicals. Air pollutants that may be released contribute to acid rain, smog, and soot. Impurities in coal or oil, used to fuel the generation of electricity, are a major health and environmental concern because they contribute to releases of metal compounds and sulfur (as well as nitrous oxides and particulates) during combustion.

The utility industry is regulated by a number of local, state and federal laws and regulations. Utility emissions are limited by state-issued operating permits that maintain compliance with state and federal air standards. The EPA also mandates certain emission limits on newer and modified plants. The utility industry has been mandated to substantially reduce emissions of SO₂ and NO_x. The typical methods used to accomplish these reductions also reduce reportable releases of TRI constituents such as hydrochloric and hydrofluoric acids.



Processes Involving Toxic Chemicals

The majority of the electricity generated in the United States is produced by steam turbine systems. Other technologies include gas turbines, internal combustion engines or some combination such as combined-cycle and cogeneration systems. Generating electricity from steam requires four components: fuel to produce the steam, a boiler, a steam turbine and a condenser (for condensation of used steam). The fuel is pumped into the boiler's furnace to produce high-pressure steam. Steam rushes from the high pressure boiler to the low pressure condenser, driving the turbine blades that power the electric generator. The steam is then cooled in the condenser and returned to the boiler system, where it is used again.

The fuel used for over half of the electricity generation in the United States is coal. A typical coal-fired power plant generating 800 megawatts of power will use two-to-four million tons of coal every year and provide enough power for approximately 200,000 homes. Because coal itself contains TRI chemicals, the burning of large quantities of coal to generate power results in large amounts of releases reported to TRI.

Coal used in power plants is transported from mines primarily by rail, but also by truck and barge. Coal may be unloaded into a storage area or directly onto conveyors leading to generation units.

Coal may be cleaned and prepared before being crushed or pulverized. Impurities in coal, such as ash, metals, silica and sulfur, can cause boiler fouling and may end up uncombusted in flue gas. Coal may be cleaned to reduce its sulfur content to meet sulfur dioxide emissions regulations. After

cleaning, coal is dried before it is fired in the burner or combustion system. Increasing the coal's particle surface area (crushing) and decreasing its moisture content (drying) greatly increases its heating capacity. Although electric utilities may clean and crush coal at the site of their power plants, a significant percentage of bituminous coal from eastern and midwestern coal mines undergoes cleaning at the mines to meet customer specifications for heat, ash and sulfur content.

Once prepared, the coal is sent to the boiler. Devices at the bottom of the boilers catch the bottom ash or slag.

Most petroleum used for power generation is refined prior to use. The principal process in separating crude oil into useful products is fractional distillation. With high boiling points, fuel oils are among the first products of this process.

Management of Toxic Chemicals in Waste

Air emissions from stack gases from coal- and oil-fired boilers contain sulfur oxides and metal compounds. The sulfur oxides react with water in the air and in flue gases to form sulfuric acid mist. Other chemicals in flue gases include hydrochloric acid (acid aerosols), hydrogen fluoride and formaldehyde.

Scrubbers, or flue gas desulfurization systems, remove sulfur from the boiler flue gas. Wet scrubbers produce a slurry of ash, unreacted lime, calcium sulfate and calcium sulfite. Dry scrubbers produce a mixture of unreacted lime, or sodium or calcium carbonates, with sulfur salts and fly ash. Flue



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gas desulfurization wastes may also contain metal compounds.

Ash is the product of combustion. Two types of ash are generated during combustion of fossil fuels: bottom ash and fly ash. Bottom ash collects at the bottom of the boiler, while fly ash is finer material that is borne by the flue gas and is collected by air pollution control equipment.

Ash characteristics depend on the content of the fuel burned. For coal, it depends on the type of coal burned, the extent to which the coal was cleaned and prepared and the operating conditions of the boiler. Typically, coal ash contains oxides of aluminum, calcium, iron and silicon plus magnesium, potassium, sodium, titanium, and small amounts of antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, zinc and other metals. For oil, small amounts of sulfur oxides and metals may be present in the ash, although oil-fired power plants generate less than 0.1 percent of the ash on a per megawatt basis than the ash produced by coal-fired plants.

Electric utilities may dispose of ash on-site in landfills or wet surface impoundments. More often, it is sent off-site to landfills. Ash can also be returned to the coal mine for disposal. When economic conditions are favorable, ash may be sold to the construction industry for use as aggregate in concrete. Sludges produced by the flue gas desulfurization systems may also be disposed of in landfills or surface impoundments.

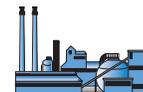
Reducing impurities in the fuel, particularly coal, before combustion can significantly reduce the generation of ash, small amounts of metals in the ash and sulfur

wastes. Coal cleaning most often occurs at the coal mine.

Fuel storage is another source of releases. Air emissions may result when tanks are used to store materials containing volatile chemicals, such as Fuel Oil No. 2. Coal stored in exposed piles may be subject to rainfall or snowfall, and it may be sprayed for dust control or to prevent freezing. These events may create acidic leachate that flows in underground streams or collects under the piles forming run-off. The run-off may contain ethylene glycol, used as antifreeze, or metal compounds leached from the coal.

Coal pile run-off can be managed by storing the coal indoors. Outdoor piles can be covered to prevent contact with precipitation and to minimize dust. Storm water retention measures (e.g., dikes and levies) can also be used. These practices apply to fly ash storage as well. Coal piles can be sprayed with anionic detergents, to reduce the bacterial oxidation of sulfur compounds in the coal and thus reduce the acidic content of the pile.

Other substances used by such utilities, such as solvents and lubricants for equipment cleaning and maintenance, may also contain TRI chemicals. Waste generated during boiler cleaning, which removes scale from inside the boiler tubes, contains spent cleaning solution as well as components of the scale, such as copper, iron, zinc, nickel, magnesium and chromium. Monitoring the thickness of the scaling allows utilities to clean boilers only when necessary, reducing cleaning waste. Utilities can control the chemistry of the boiler feed water to reduce scaling. Feed water is most often treated with hydrazine and morpholine, but other methods such as elevated



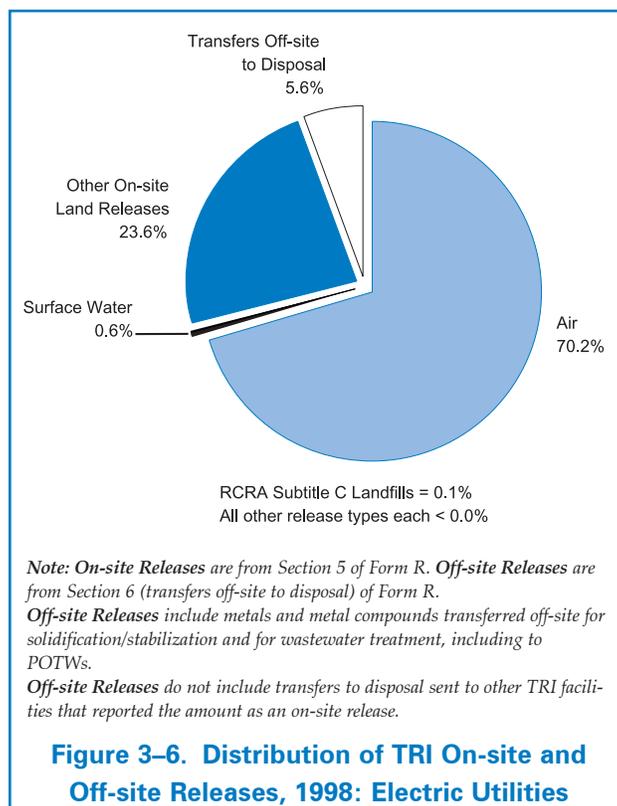
oxygen treatment can be effective.

1998 TRI Data for Electric Utilities

On- and Off-site Releases

Electric utilities required to report to TRI reported 1.12 billion pounds of TRI chemicals released on- and off-site in 1998, as shown in Table 3–25. The majority, 783.7 million pounds, was as air emissions. Figure 3–6 shows that air emissions amounted to 70.2 percent of the industry’s total releases.

The electric utilities’ second-largest release type was other on-site land releases, which totaled 263.2 million pounds, representing 23.6 percent of total releases. These are releases to land other than to RCRA subtitle C landfills (types of on-site land releases are described in Box 1–4 in Chapter 1). Electric utilities reported 62.5 million pounds released off-site as transfers to dis-



posal and 6.5 million pounds of surface water discharges. Over 1.0 million pounds

Table 3–25. TRI On-site and Off-site Releases by 4-digit SIC Code, 1998: Electric Utilities

SIC Code	Industry	Total Forms Number	On-site Releases						Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases			Transfers Off-site to Disposal Pounds	
					Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
4911	Electric Services	4,019	750,103,646	6,464,045	18	160,800	1,033,076	239,395,225	997,156,810	59,470,805	1,056,627,615
4931	Electric and Other Services Combined	144	10,180,020	12,730	0	0	0	752,754	10,945,504	1,949,221	12,894,725
4939	Combination Utilities, nec*	40	2,098,996	875	0	0	0	824,960	2,924,831	260,275	3,185,106
	Multiple within SIC code 49	10	86,596	505	0	0	0	0	87,101	0	87,101
	SIC code 4911 and SIC code 12 (Coal Mining)	142	21,076,642	36,980	0	0	0	22,237,483	43,351,105	87,550	43,438,655
	SIC code 4911 and SIC code 28 (Chemicals)	8	140,472	0	0	0	0	0	140,472	773,000	913,472
	Total	4,363	783,686,372	6,515,135	18	160,800	1,033,076	263,210,422	1,054,605,823	62,540,851	1,117,146,674

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release. Forms that reported more than one 4-digit SIC code within SIC code 49 are assigned to the multiple category. *nec: not elsewhere classified.

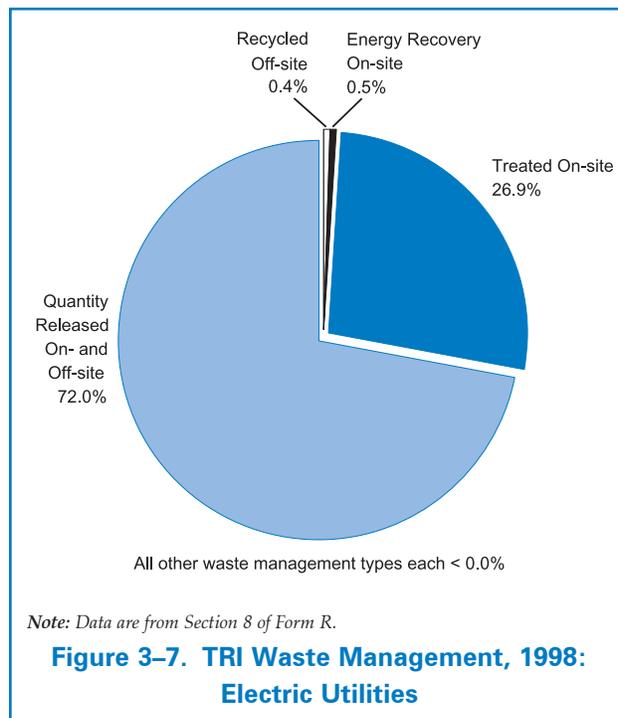


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of on-site releases to RCRA subtitle C landfills and less than 200,000 pounds of underground injection was also reported.

Facilities providing only electric services reported the largest total releases in this industry, with 1.06 billion pounds, accounting for 94.6 percent of the electric utility industry total. Electric services facilities reported 997.2 million pounds of total on-site releases. These were largely air emissions of 750.1 million pounds, with 239.4 million pounds of other on-site land releases, and 6.5 million pounds of surface water discharges. They also reported 59.5 million pounds of off-site releases (transfers to disposal).

The second ranked group within the electric utility industry was facilities that generate electricity in combination with coal mining. These facilities accounted for 3.9 percent of total releases from electric utilities, with 43.4 million pounds. Their releases



were divided between other on-site land releases of 22.2 million pounds and air emissions of 21.1 million pounds.

Table 3-26. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1998: Electric Utilities

SIC Code	Industry	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
		On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
4911	Electric Services	727,259	2,968,930	0	25,028	319,398,171	386,762	1,054,089,783	1,377,595,933	211,222
4931	Electric and Other Services Combined	0	479,791	0	0	4,977,868	0	12,819,618	18,277,277	12
4939	Combination Utilities, nec*	0	6	8,057,169	0	5,074,000	0	3,246,652	16,377,827	0
	Multiple within SIC code 49	0	3,003,000	0	0	1,429,789	0	96,145	4,528,934	3
	SIC code 4911 and SIC code 12 (Coal Mining)	0	501,800	0	0	86,014,400	40	44,554,163	131,070,403	0
	SIC code 4911 and SIC code 28 (Chemicals)	0	0	0	0	0	0	914,000	914,000	0
	Total	727,259	6,953,527	8,057,169	25,028	416,894,228	386,802	1,115,720,361	1,548,764,374	211,237

Note: Data are from Section 8 of Form R.

Forms that reported more than one 4-digit SIC code within SIC code 49 are assigned to the "multiple codes" category.

*nec: not elsewhere classified.



Waste Management Data

Quantities of TRI Chemicals in Waste

Electric utilities reported managing 1.55 billion pounds of total production-related waste in 1998, as shown in Table 3–26. Quantities released on- and off-site totaled 1.12 billion pounds, or 72.0 percent of the industry’s production-related waste (see Figure 3–7). The industry’s on-site treatment totaled 416.9 million pounds, or 26.9 percent of the total. On-site energy recovery and off-site recycling amounted to 8.1 million pounds and 7.0 million pounds, respectively.

Facilities providing only electric services managed 1.38 billion pounds of total production-related waste, including 1.05 billion pounds of quantities released on- and off-site. The facilities combining electric services and coal mining operations managed a total of 131.1 million pounds, including 86.0 million pounds treated on-site and 44.6 mil-

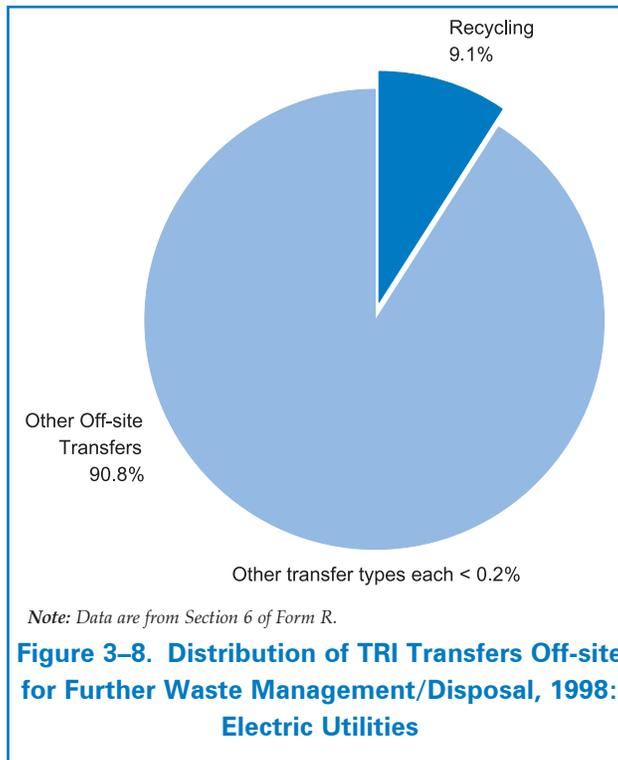


Figure 3–8. Distribution of TRI Transfers Off-site for Further Waste Management/Disposal, 1998: Electric Utilities

lion pounds of quantities released on- and off-site.

Table 3–27. TRI Transfers Off-site for Further Waste Management/Disposal by 4-digit SIC Code, 1998: Electric Utilities

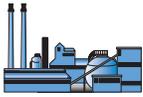
SIC Codes	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs		Other Transfers Off-site to Disposal* Pounds	Total Transfers for Further Waste Management/Disposal Pounds
					Non-metal TRI Chemicals Pounds	Metals and Metal Compounds Pounds		
4911	Electric Services	2,264,800	25,037	40,983	24,809	5,076	59,915,780	62,276,485
4931	Electric and Other Services Combined	479,791	0	0	9,414	9	1,949,212	2,438,426
4939	Combination Utilities, nec**	60,820	0	0	500	0	260,275	321,595
	Multiple within SIC code 49	3,003,000	0	0	0	0	0	3,003,000
	SIC code 4911 and SIC code 12 (Coal Mining)	499,200	0	15	0	0	87,560	586,775
	SIC code 4911 and SIC code 28 (Chemicals)	0	0	0	0	0	773,000	773,000
	Total	6,307,611	25,037	40,998	34,723	5,085	62,985,827	69,399,281

Note: Data are from Section 6 of Form R.

Forms that reported more than one 4-digit SIC code within SIC code 49 are assigned to the “multiple codes” category.

*Does not include transfers of metals and metal compounds to POTWs.

**nec: not elsewhere classified.



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Electric Utilities that Combust Coal and/or Oil (SIC Codes 491 and 493)**

Table 3–28. Summary of TRI Information by State, 1998: Electric Utilities

State	Total Forms Number	On-site Releases							Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Transfers Off-site to Disposal Pounds			
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds				
Alabama	122	28,660,982	211,735	0	0	0	16,841,649	45,714,366	366,780	46,081,146	
Alaska	4	567,100	0	0	0	0	0	567,100	0	567,100	
Arizona	56	3,531,238	955	0	0	0	5,994,157	9,526,350	6,708	9,533,058	
Arkansas	27	1,248,681	20,329	0	0	0	2,028,613	3,297,623	912	3,298,535	
California	44	385,620	17	0	0	0	147,300	532,937	45,823	578,760	
Colorado	63	1,912,616	2,980	0	0	0	3,153,460	5,069,056	3,780,883	8,849,939	
Connecticut	21	1,259,018	39	0	0	0	0	1,259,057	217,571	1,476,628	
Delaware	27	6,818,633	59,740	0	0	0	590,579	7,468,952	263,696	7,732,648	
District of Columbia	1	66,250	0	0	0	0	0	66,250	0	66,250	
Florida	218	57,697,392	67,446	0	0	934,073	7,493,671	66,192,582	2,546,115	68,738,697	
Georgia	114	47,191,872	137,364	0	0	0	11,136,522	58,465,758	10	58,465,768	
Guam	1	0	0	0	0	0	0	0	0	0	
Hawaii	17	3,133,022	0	0	0	0	0	3,133,022	4,500	3,137,522	
Illinois	209	32,126,653	40,697	0	0	0	4,752,045	36,919,395	1,671,753	38,591,148	
Indiana	253	44,326,731	312,566	0	0	5,000	16,405,667	61,049,964	838,007	61,887,971	
Iowa	98	8,696,569	14,967	0	0	0	3,945,293	12,656,829	1,036,473	13,693,302	
Kansas	72	5,113,220	6,515	0	0	0	5,772,385	10,892,120	100,464	10,992,584	
Kentucky	196	44,786,767	788,373	0	0	3	12,744,988	58,320,131	493,973	58,814,104	
Louisiana	37	4,197,816	79,231	0	0	0	4,520,798	8,797,845	2,149	8,799,994	
Maine	3	43,001	0	0	0	0	0	43,001	0	43,001	
Maryland	59	24,749,607	129,725	0	0	0	147,282	25,026,614	509,100	25,535,714	
Massachusetts	60	5,639,923	531	0	0	0	39,335	5,679,789	442,449	6,122,238	
Michigan	173	33,812,186	201,662	0	0	0	9,540,682	43,554,530	2,039,725	45,594,255	
Minnesota	83	1,751,834	18,636	0	0	0	10,097,510	11,867,980	1,105,212	12,973,192	
Mississippi	31	9,271,476	4,712	0	0	0	2,028,530	11,304,718	0	11,304,718	
Missouri	118	12,983,638	130,117	0	0	0	19,316,590	32,430,345	290	32,430,635	
Montana	32	950,655	10	0	0	0	6,830,111	7,780,776	159,400	7,940,176	
Nebraska	42	4,086,255	120,760	0	0	0	3,611,307	7,818,322	165,200	7,983,522	
Nevada	24	1,209,417	0	0	0	0	1,661,938	2,871,355	10,087	2,881,442	
New Hampshire	19	4,026,179	0	0	0	0	21,700	4,047,879	49,870	4,097,749	
New Jersey	67	7,529,062	36,569	0	0	0	311,900	7,877,531	177,887	8,055,418	
New Mexico	26	711,363	8,468	0	0	0	1,177,689	1,897,520	5,546,000	7,443,520	
New York	108	16,100,838	166,365	0	0	0	1,925,080	18,192,283	504,170	18,696,453	

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Electric Utilities that Combust Coal and/or Oil (SIC Codes 491 and 493)**



Table 3–28. Summary of TRI Information by State, 1998: Electric Utilities (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Alabama	0	8,700	8,057,169	0	6,458,000	670	46,084,997	60,609,536	0
Alaska	0	0	0	0	0	0	567,100	567,100	4
Arizona	0	848	0	0	2,220,160	0	9,675,610	11,896,618	21,009
Arkansas	0	0	0	0	72,900	0	3,307,911	3,380,811	120
California	0	0	0	0	0	395	308,069	308,464	365
Colorado	0	0	0	0	2,154,100	1,700	9,135,042	11,290,842	4,900
Connecticut	0	0	0	0	0	0	1,477,400	1,477,400	7
Delaware	0	0	0	0	926,667	300	7,732,664	8,659,631	2
District of Columbia	0	0	0	0	0	0	66,000	66,000	295
Florida	0	59	0	0	25,272,870	26,000	66,979,737	92,278,666	7,539
Georgia	0	0	0	0	0	0	58,466,081	58,466,081	0
Guam	0	0	0	0	0	0	0	0	0
Hawaii	0	0	0	0	0	0	3,137,487	3,137,487	0
Illinois	0	77,000	0	0	26,304,728	0	38,360,789	64,742,517	142,254
Indiana	0	331,532	0	28	39,829,342	38	61,877,943	102,038,883	12,067
Iowa	0	0	0	0	210,103	0	12,877,232	13,087,335	1,526
Kansas	0	475,991	0	0	1,179,500	414	11,081,439	12,737,344	2
Kentucky	0	32,800	0	0	21,517,400	3	58,990,240	80,540,443	39
Louisiana	0	0	0	0	1,058,750	0	8,921,510	9,980,260	10
Maine	0	0	0	0	0	0	43,002	43,002	0
Maryland	0	0	0	0	50,269,228	445	25,400,466	75,670,139	2
Massachusetts	0	560	0	0	62,497	30	6,210,056	6,273,143	91
Michigan	0	189,206	0	0	9,924,390	0	45,430,946	55,544,542	12
Minnesota	0	0	0	0	1,134,100	0	12,923,411	14,057,511	0
Mississippi	0	0	0	0	0	0	11,304,718	11,304,718	4
Missouri	656,527	656,527	0	0	7,078,716	0	31,898,437	40,290,207	0
Montana	0	0	0	0	3,473,960	0	7,948,592	11,422,552	0
Nebraska	70,732	0	0	0	0	0	7,918,735	7,989,467	20,000
Nevada	0	9,400	0	0	577,476	0	2,304,024	2,890,900	2
New Hampshire	0	30	0	0	110	0	4,114,210	4,114,350	0
New Jersey	0	14,506	0	0	3,683,265	481	8,049,512	11,747,764	242
New Mexico	0	0	0	0	3,350,000	0	7,392,310	10,742,310	0
New York	0	210,000	0	25,000	6,720,000	300	18,626,623	25,581,923	11

Note: Data are from Section 8 of Form R.



**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Electric Utilities that Combust Coal and/or Oil (SIC Codes 491 and 493)**

Table 3–28. Summary of TRI Information by State, 1998: Electric Utilities (continued)

State	Total Forms Number	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
North Carolina	157	48,387,026	99,731	0	0	0	8,304,875	56,791,632	157,242	56,948,874
North Dakota	83	1,404,407	59,011	0	0	0	8,069,360	9,532,778	11,302,469	20,835,247
Ohio	237	95,220,630	386,974	0	0	0	14,008,971	109,616,575	4,307,068	113,923,643
Oklahoma	52	6,178,303	61,874	0	0	0	1,839,091	8,079,268	1,628,650	9,707,918
Oregon	7	127,585	0	0	0	0	620,005	747,590	0	747,590
Pennsylvania	332	58,894,300	84,857	0	160,800	94,000	5,533,579	64,767,536	8,416,171	73,183,707
Puerto Rico	33	9,857,078	62,123	0	0	0	154,741	10,073,942	203,305	10,277,247
Rhode Island	3	455,002	5	0	0	0	0	455,007	0	455,007
South Carolina	116	13,713,725	7,925	0	0	0	2,387,888	16,109,538	20,623	16,130,161
South Dakota	14	189,732	56	0	0	0	1,625,000	1,814,788	96,990	1,911,778
Tennessee	101	26,657,215	332,655	0	0	0	7,794,265	34,784,135	515,065	35,299,200
Texas	185	8,138,409	33,911	0	0	0	25,280,363	33,452,683	7,800,256	41,252,939
Utah	59	2,981,457	198	0	0	0	6,031,746	9,013,401	211,971	9,225,372
Virgin Islands	8	81	26,832	0	0	0	0	26,913	0	26,913
Virginia	172	17,440,563	2,677,567	0	0	0	2,807,865	22,925,995	298,461	23,224,456
Washington	20	1,139,941	738	0	0	0	3,364,936	4,505,615	88,078	4,593,693
West Virginia	158	62,340,588	81,669	18	0	0	11,500,597	73,922,872	1,958,941	75,881,813
Wisconsin	124	13,704,098	25,853	0	0	0	1,758,842	15,488,793	2,280,962	17,769,755
Wyoming	77	2,270,618	12,647	0	0	0	9,891,517	12,174,782	1,169,392	13,344,174
Total	4,363	783,686,372	6,515,135	18	160,800	1,033,076	263,210,422	1,054,605,823	62,540,851	1,117,146,674

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

Transfers Off-site for Further Waste Management/Disposal

Electric utilities reported 69.4 million pounds of transfers off-site for further waste management and disposal in 1998. As shown in Table 3–27, facilities providing only electric services reported 59.9 million pounds transferred off-site to disposal. Figure 3–8 shows that other transfers to disposal accounted for 90.8 percent of all transfers for further waste management and disposal for this industry. The industry’s other transfers to disposal totaled 63.0 million pounds and total transfers to recycling were 6.3 million pounds or 9.1 percent of the total.

TRI Data by State

The states with the largest number of forms from electric utilities were Pennsylvania with 332 forms, Indiana with 253 forms, and Ohio with 237 forms. No reports were received from Idaho and Vermont in 1998.

On- and Off-site Releases

Electric utilities in Ohio reported the largest total on- and off-site releases in 1998. As shown in Table 3–28, Ohio’s electric utilities reported total releases of 113.9 million pounds, primarily as air emissions. As shown in Map 3–3, the three contiguous states of Ohio, West Virginia and

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
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Table 3–28. Summary of TRI Information by State, 1998: Electric Utilities (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
North Carolina	0	0	0	0	3,209,200	0	56,989,360	60,198,560	531
North Dakota	0	2,500	0	0	832,000	0	21,299,360	22,133,860	15
Ohio	0	309,000	0	0	62,611,060	0	114,379,417	177,299,477	101
Oklahoma	0	0	0	0	1,647,600	0	9,671,754	11,319,354	15
Oregon	0	0	0	0	0	0	747,560	747,560	1
Pennsylvania	0	185	0	0	24,393,772	0	73,701,915	98,095,872	30
Puerto Rico	0	0	0	0	0	0	10,277,208	10,277,208	2
Rhode Island	0	0	0	0	0	12	454,997	455,009	0
South Carolina	0	0	0	0	6,360,600	0	16,160,065	22,520,665	4
South Dakota	0	0	0	0	282,192	0	1,896,082	2,178,274	0
Tennessee	0	892,886	0	0	27,593,000	0	35,277,247	63,763,133	0
Texas	0	13,591	0	0	16,237,218	230	41,188,118	57,439,157	9
Utah	0	0	0	0	44,138,500	0	10,014,733	54,153,233	7
Virgin Islands	0	0	0	0	0	0	26,863	26,863	0
Virginia	0	3,096,700	0	0	5,750,091	1	23,035,825	31,882,617	13
Washington	0	0	0	0	83,365	0	4,647,336	4,730,701	0
West Virginia	0	324,506	0	0	6,510,000	0	75,860,713	82,695,219	0
Wisconsin	0	0	0	0	2,207,268	355,783	17,720,952	20,284,003	6
Wyoming	0	307,000	0	0	1,560,100	0	13,758,563	15,625,663	0
Total	727,259	6,953,527	8,057,169	25,028	416,894,228	386,802	1,115,720,361	1,548,764,374	211,237

Note: Data are from Section 8 of Form R.

Pennsylvania reported the largest amounts of total releases in 1998.

West Virginia ranked second with 75.9 million pounds of total releases, of which 62.3 million pounds were released to air.

Pennsylvania ranked third among states for electric utility releases with 73.2 million pounds, including 58.9 million pounds of air emissions.

In five other states, electric utility releases exceeded 50 million pounds. Florida electric utilities reported 68.7 million pounds, Indiana reported 61.9 million pounds, Kentucky reported 58.8 million pounds, Georgia reported 58.5 million pounds, and

North Carolina reported 56.9 million pounds. Electric utilities in all of the states with the largest on- and off-site releases reported more than 70 percent of total releases as air emissions.

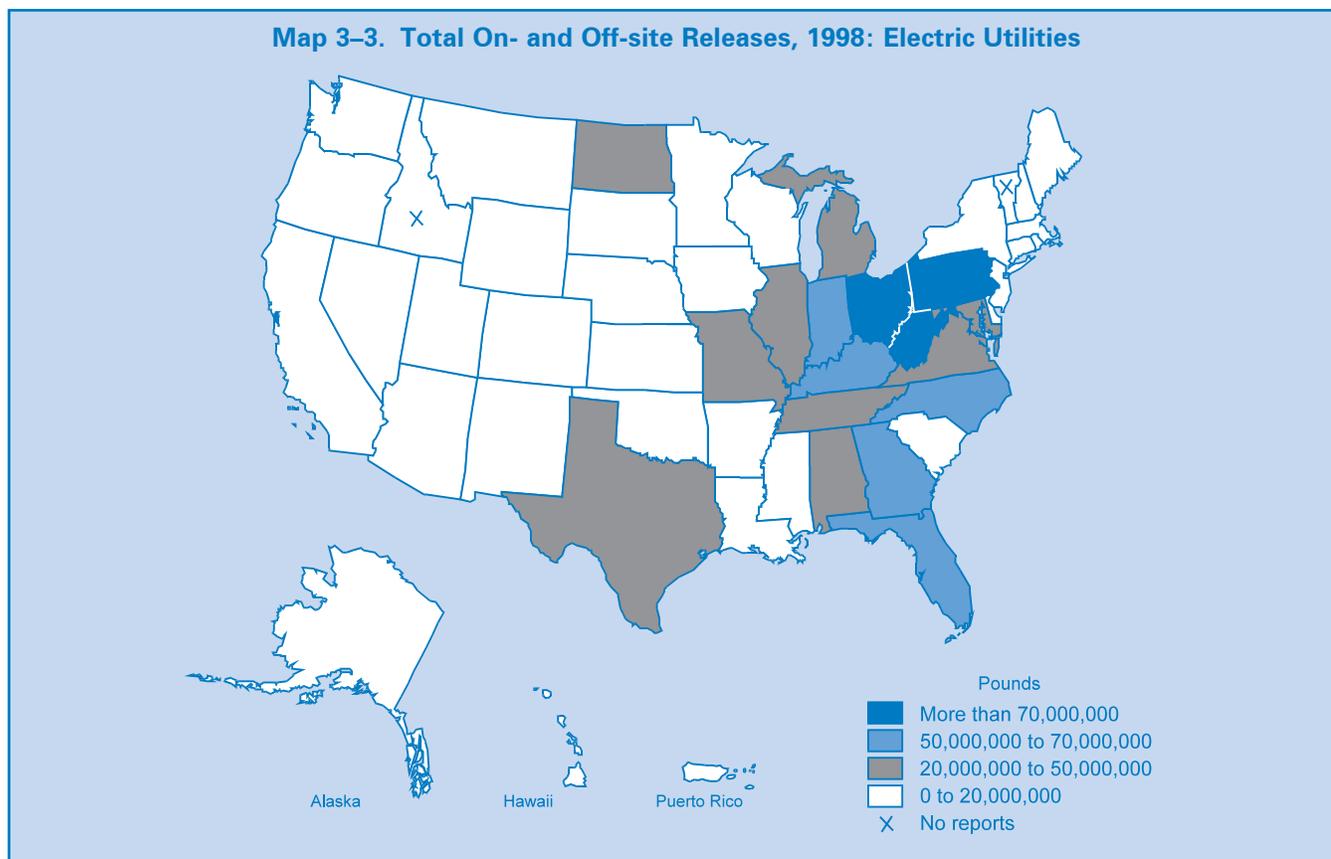
Waste Management Data

Ohio also ranked highest among the states for total production-related waste reported by the electric utility industry. These data also appear in Table 3–28. Ohio facilities managed 177.3 million pounds of production-related waste. This consisted largely of 114.4 million pounds of quantities released on- and off-site, but also included 62.6 million pounds of waste treated on-site, the



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: Electric Utilities that Combust Coal and/or Oil (SIC Codes 491 and 493)

Map 3-3. Total On- and Off-site Releases, 1998: Electric Utilities



largest of any state in both of these categories.

Indiana ranked second with total production-related waste of 102.0 million pounds. This consisted of 61.9 million pounds in quantities released on- and off-site (the fifth-largest amount of any state) and 39.8 million pounds treated on-site (the fourth-largest amount of any state). Pennsylvania ranked third for total production-related waste with 98.1 million pounds, consisting of 73.7 million pounds of quantities released on- and off-site (ranking third for this category) and 24.4 million pounds treated on-site (ranking eighth).

Electric utilities reported much smaller quantities in other waste management

activities. The largest amount was 8.1 million pounds of on-site energy recovery in Alabama and 3.1 million pounds of off-site recycling reported by Virginia facilities.

Top 15 Chemicals for On- and Off-site Releases

Electric utilities reported releasing more hydrochloric acid, 535.9 million pounds, than any other chemical. Only aerosol forms of hydrochloric acid are reportable to TRI so air emissions of hydrochloric acid accounted for 99.9 percent of the total releases of this chemical. Table 3-29 presents data for the 15 chemicals released in the largest amounts by the TRI electric utilities.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Electric Utilities that Combust Coal and/or Oil (SIC Codes 491 and 493)**



Table 3–29. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1998: Electric Utilities

CAS Number	Chemical	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
				Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
7647-01-0	Hydrochloric acid	535,502,971	11	0	0	0	364,017	535,866,999	0	535,866,999
—	Barium compounds	2,188,624	978,745	0	82,000	438,000	140,501,453	144,188,822	35,907,811	180,096,633
7664-93-9	Sulfuric acid	166,354,057	2,400,001	0	0	0	20,000	168,774,058	20,000	168,794,058
7664-39-3	Hydrogen fluoride	64,849,987	636	0	0	0	543,642	65,394,265	13,101	65,407,366
—	Manganese compounds	440,232	988,125	0	17,400	87,161	31,735,695	33,268,613	6,108,684	39,377,297
—	Zinc compounds	883,781	503,210	11	19,200	152,589	27,179,647	28,738,438	4,094,960	32,833,398
—	Copper compounds	287,759	298,747	7	17,000	270,481	13,630,919	14,504,913	2,761,045	17,265,958
—	Nickel compounds	646,646	285,150	0	10,400	34,316	10,789,697	11,766,209	1,967,789	13,733,998
—	Chromium compounds	275,744	112,644	0	14,800	45,526	10,400,307	10,849,021	1,971,268	12,820,289
7440-39-3	Barium	220,764	141,458	0	0	0	7,278,423	7,640,645	1,840,275	9,480,920
—	Lead compounds	166,143	65,838	0	0	3	5,781,992	6,013,976	2,181,127	8,195,103
—	Arsenic compounds	152,021	153,124	0	0	0	5,230,393	5,535,538	989,388	6,524,926
7664-41-7	Ammonia	5,389,610	57,533	0	0	0	92,660	5,539,803	13,019	5,552,822
—	Cobalt compounds	53,195	24,031	0	0	0	3,635,345	3,712,571	432,716	4,145,287
7440-66-6	Zinc (fume or dust)	2,636,026	31,268	0	0	0	261,701	2,928,995	208,293	3,137,288
	Subtotal	780,047,560	6,040,521	18	160,800	1,028,076	257,445,891	1,044,722,866	58,509,476	1,103,232,342
	Total	783,686,372	6,515,135	18	160,800	1,033,076	1,033,076	1,054,605,823	62,540,851	1,117,146,674

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

For barium compounds, ranked second with 180.1 million pounds, most of the releases were other on-site land releases, 140.5 million pounds or 78.0 percent of total releases for barium compounds. Sulfuric acid was the chemical with the third-largest total releases. Like hydrochloric acid, only aerosol forms are reportable to TRI and air emissions of sulfuric acid, 166.4 million pounds, were 98.6 percent of total releases for that chemical.

Releases of the 15 chemicals totaled 1.10 billion pounds, or 98.8 percent of the industry's total of 1.12 billion pounds of releases.

Projected Quantities of TRI Chemicals Managed in Waste, 1998–2000

Electric utility facilities reporting to TRI expected to reduce their production-related waste by 3.2 percent from 1998 to 2000, reducing it from a total of 1.55 billion pounds to 1.50 billion pounds. The projected decrease represents a reduction of 2.5 percent in 1999 followed by a decrease of 0.7 percent in 2000. These projections reflect the industry's expected reductions in quantities released on- and off-site of 3.4 percent and in treated on-site of 2.9 percent, since these two types of waste management accounted for over 98 percent of total production-related waste, as shown in Table 3–30.



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Table 3–30. Current Year and Projected Quantities of TRI Chemicals in Waste, 1998–2000: Electric Utilities

Waste Management Activity	Current Year 1998		Projected 1999		Projected 2000	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
Recycled On-site	727,259	0.0	725,822	0.0	739,377	0.0
Recycled Off-site	6,953,527	0.4	6,684,737	0.4	6,883,008	0.5
Energy Recovery On-site	8,057,169	0.5	8,218,462	0.5	8,382,829	0.6
Energy Recovery Off-site	25,028	0.0	33,328	0.0	33,328	0.0
Treated On-site	416,894,228	26.9	408,975,357	27.1	404,827,828	27.0
Treated Off-site	386,802	0.0	4,787	0.0	3,725	0.0
Quantity Released On- and Off-site	1,115,720,361	72.0	1,084,911,988	71.9	1,078,176,656	71.9
Total Production-related Waste	1,548,764,374	100.0	1,509,554,481	100.0	1,499,046,751	100.0
Waste Management Activity	Projected Change 1998–1999		Projected Change 1999–2000		Projected Change 1998–2000	
	Percent		Percent		Percent	
Recycled On-site	–0.2		1.9		1.7	
Recycled Off-site	–3.9		3.0		–1.0	
Energy Recovery On-site	2.0		2.0		4.0	
Energy Recovery Off-site	33.2		0.0		33.2	
Treated On-site	–1.9		–1.0		–2.9	
Treated Off-site	–98.8		–22.2		–99.0	
Quantity Released On- and Off-site	–2.8		–0.6		–3.4	
Total Production-related Waste	–2.5		–0.7		–3.2	

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1998.

The projections indicate little change in waste management practices. Quantities released on- and off-site—the least desirable outcome under the waste management hierarchy (described in Waste Management in Chapter 1)—would remain about the same at 72.0 percent of total production-related waste in 1998 to 71.9 percent in 2000.

Source Reduction

Eleven percent of the Form Rs submitted by electric utility facilities in 1998 reported source reduction activity undertaken during the year (see Table 3–31). As noted in Waste Management in Chapter 1, source reduction is activity that prevents the gen-

eration of waste and is the preferred waste management option.

Facilities with the combination of electric services and coal mining operations reported source reduction activities on 21.9 percent of the Form Rs submitted (on 30 forms), and facilities providing only electric services reported source reduction activity on 416 forms, representing 10.8 percent of the Form Rs from these facilities.

Good operating practices were identified on 376 forms, making it the most frequent source reduction activity in the industry. Process modifications were reported on 59 forms and inventory control on 58 forms.

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Electric Utilities that Combust Coal and/or Oil (SIC Codes 491 and 493)**

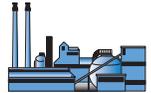


Table 3–31. Number of Forms Reporting Source Reduction Activity, 1998: Electric Utilities

SIC Code	Industry	Total Form Rs Number	Forms Reporting Source Reduction Activity		Category of Source Reduction Activity							
			Number	Percent of All Form Rs Percent	Good Operating Practices Number	Inventory Control Number	Spill and Leak Prevention Number	Raw Material Modifications Number	Process Modifications Number	Cleaning and Degreasing Number	Surface Preparation and Finishing Number	Product Modifications Number
4911	Electric Services	3,850	416	10.8	340	54	32	38	59	0	0	6
4931	Electric and Other Services Combined	137	11	8.0	6	0	1	9	0	0	0	0
4939	Combination Utilities, nec*	38	1	2.6	0	4	0	0	0	0	0	0
	Multiple within SIC code 49	9	0	0.0	0	0	0	0	0	0	0	0
	SIC code 4911 and SIC code 12 (Coal Mining)	137	30	21.9	30	0	0	0	0	0	0	0
	SIC code 4911 and SIC code 28 (Chemicals)	8	0	0.0	0	0	0	0	0	0	0	0
Total		4,179	458	11.0	376	58	33	47	59	0	0	6

Note: All source reduction activities on a form are counted in the corresponding category. Totals do not equal the sum of the categories because forms may report more than one source reduction activity.

Forms that reported more than one 4-digit SIC code within SIC code 49 are assigned to the “multiple codes” category.

*nec: not elsewhere classified.



❖ Chemical Wholesale Distributors ❖ (SIC Code 5169)

Introduction

Chemical wholesale distributors (SIC code 5169) package, blend or formulate chemicals for distribution into commerce, as shown in Box 3–6. Facilities that only store, relabel or redistribute chemicals are not included in this industry sector.

Products and Services

Chemical distribution facilities buy chemicals in bulk and blend and/or repackage them to customer specifications. For example, a facility may repackage xylene into various size containers for resale to customers, or it may blend chemicals to formulate lacquer thinner for autobody shops. Products include acids, industrial and

heavy chemicals, dyes and substances used to make dyes, industrial salts, rosin, and turpentine. Also included are industrial gases (compressed and liquefied), such as oxygen and acetylene.

Employment and Production

There were 15,920 chemical wholesale distribution establishments with 165,768 employees and \$128.92 billion in production value in 1997.

General Environmental Issues

Environmental concerns in chemical wholesale distribution arise from potential releases during repackaging and reformulating. These are similar to the environmen-

Box 3–6. SIC Code 516, Wholesale Trade—Chemicals and Allied Products: Codes and Classifications Required to Report to TRI

SIC Code 516, Wholesale Trade—Chemicals and Allied Products: Codes and Classifications Required to Report to TRI

5169	Chemicals and Allied Products, Not Elsewhere Classified	Wholesale distribution of chemicals and allied products, not elsewhere classified, such as acids, industrial and heavy chemicals, dyestuffs, industrial salts, rosin, turpentine, and others.
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Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: Chemical Wholesale Distributors (SIC Code 5169)

tal concerns from activities undertaken by chemical manufacturing facilities in SIC code 28, covered by TRI since its inception. In particular, releases may result as chemicals are transferred from one container to another—from receipt of the product to storage to processing equipment (as appropriate) to shipping containers.

Processes Involving Toxic Chemicals

Chemicals handled by wholesale distributors may be dry or liquid, and they may be brought on-site by rail, truck or pipeline. Chemicals may be stored on-site before and after packaging. Some chemicals must be refrigerated (for example, flammable materials) while they are stored. Wholesale distributors may also blend and mix chemicals before repackaging them.

Repackaging chemicals consists of transferring them to specified containers for distribution. Chemicals delivered to the facility by rail or truck are first stored in permanent containers or tanks on-site. In repackaging, these chemicals are transferred to other containers through pipes. Chemicals that enter the facility through pipelines do not require storage and can be repackaged directly into shipping containers. A third type of repackaging activity does not involve products for distribution. Because the wastes that chemical distributors send off-site for recycling or direct re-use first undergo a recovery step, they are also considered to be “repackaged.”

Blending and mixing (i.e., formulation) of products involves mixing chemicals with additives and catalysts. They may also be diluted. Cleaning the equipment used in blending and mixing requires draining the tanks and blowing out the pipes. The resulting residue consists of wastewater

with small amounts of product, which is either drained and discharged or directed to a tank for subsequent recovery. Cleaners, lubricants or degreasers are used in the maintenance of mixers, stationary cranes and other processing equipment.

Other sources of chemicals in waste include packaging residues and unsold products. Empty drums may contain residue, and empty bags may contain residues of dust and powder. Facilities must also dispose of chemicals that did not sell or that expired while in storage waiting for shipment, as well as damaged or contaminated product.

Management of Toxic Chemicals in Waste

Fugitive air emissions can occur during the loading, unloading, formulation and transfer of products. Emissions occur from leaks in valves, seals or connectors in fuel handling equipment. They may also result from losses during cylinder changeovers, tank cleanings, pipe flushing, and other cleaning operations. The types and amounts of the emissions depend on the concentrations of the chemicals in the products. Vapor recovery equipment used while loading and unloading products captures organic vapors that are displaced during loading operations and either pipes the recovered product to a storage unit or a thermal oxidation unit where the vapor is combusted.

Most chemical distribution facilities conduct formulation operations in enclosed systems that are vented to control devices to minimize fugitive air emissions.



Primary sources of point source air emissions include storage tanks containing volatile chemicals such as toluene, xylene and ethylbenzene.

Wastewater discharges include process wastewater and storm water. Process wastewater results mainly from storage tank clean-out and pipe blowout water. Chemical distribution facilities can reduce the wastewater they generate by monitoring the need for cleaning, so that cleaning occurs only when necessary, or by applying a protective coating to the surfaces of internal heater coils to prevent the accumulation of scale on coil surfaces. Storm water run-off at a chemical distribution facility may contain chemicals washed from raw materials or products or other wastes.

Empty drums, container residues, solids from product filtration, and expired chemicals may be disposed of in landfills on site or they may be transferred off-site for disposal.

1998 TRI Data for Chemical Wholesale Distributors

On- and Off-site Releases

Chemical wholesale distributors required to report to TRI reported 1.6 million pounds of TRI chemicals released on- and off-site in 1998, as shown in Table 3–32. The largest type of release was 1.3 million pounds of air emissions. Figure 3–9 shows that air emissions amounted to 79.8 percent of the industry’s total releases.

Off-site releases (transfers off-site to disposal) totaled 215,380 pounds, the industry’s second-largest release type. Less than 100,000 pounds were released on-site to land and less than 12,000 pounds were discharged to surface waters. No underground injection was reported by chemical wholesale distributors.

Some forms indicated a combination of operations along with chemical wholesale

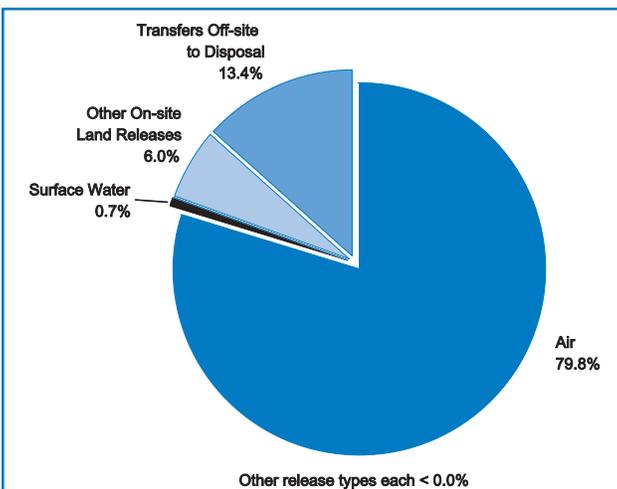
Table 3–32. TRI On-site and Off-site Releases by 4-digit SIC Code, 1998: Chemical Wholesalers

SIC Code	Industry	Total Forms Number	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
					Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
5169	Chemical Wholesale Distributors	3,561	1,207,793	11,013	0	1	0	96,294	1,315,101	110,564	1,425,665
	SIC code 5169 and 5171 (Petroleum Bulk Terminals)	18	13,505	55	0	0	0	0	13,560	2,275	15,835
	SIC code 5169 and 7389 (Solvent Recovery Services)	62	42,793	0	0	0	0	700	43,493	102,489	145,982
	SIC code 5169 and SIC code 28 (Chemical Products)	54	19,941	535	0	0	0	260	20,736	52	20,788
	Total	3,695	1,284,032	11,603	0	1	0	97,254	1,392,890	215,380	1,608,270

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.



**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Chemical Wholesale Distributors (SIC Code 5169)**



Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

Figure 3-9. Distribution of TRI On-site and Off-site Releases, 1998: Chemical Wholesalers

distribution, for example, solvent recovery services. However, those reporting only chemical wholesale distribution reported 1.4 million pounds of total releases, representing 88.6 percent of the total for this

industry. These were largely air emissions, totaling 1.2 million pounds.

Facilities reporting both chemical wholesale distribution operations and solvent recovery operations reported the second largest amount, 145,982 pounds of total releases (9.1 percent of the total for the industry). Their releases consisted of 102,489 pounds of off-site releases and 42,793 pounds of air emissions.

Waste Management Data

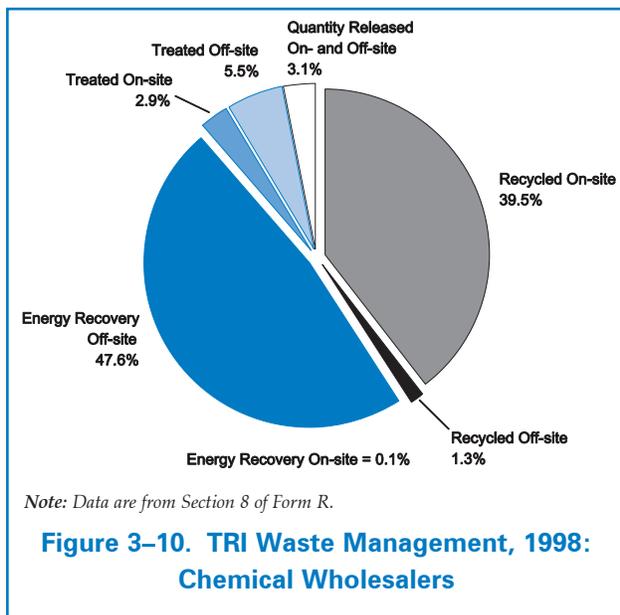
Quantities of TRI Chemicals in Waste

The chemical wholesale distribution industry reported managing 55.8 million pounds of total production-related waste in 1998, as shown in Table 3-33. Off-site energy recovery totaled 26.6 million pounds, or 47.6 percent of the industry's production-related waste (see Figure 3-10). The industry's on-site recycling totaled 22.0 million pounds, or 39.5 percent of the total. Off-site treatment amounted to 3.1 million pounds and on-site treatment amounted to 1.6 million pounds.

Table 3-33. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1998: Chemical Wholesalers

SIC Code	Industry	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
		On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
5169	Chemical Wholesale Distributors	452,740	719,958	54,418	3,674,943	1,571,933	1,778,699	1,528,382	9,781,073	51,161
	SIC code 5169 and 5171 (Petroleum Bulk Terminals)	0	0	0	64,655	0	25,198	14,674	104,527	0
	SIC code 5169 and 7389 (Solvent Recovery Services)	21,336,738	0	0	22,809,790	4,900	1,221,432	149,027	45,521,887	220
	SIC code 5169 and SIC code 28 (Chemical Products)	233,712	10,356	0	2,980	14,000	60,843	40,753	362,644	1,156
	Total	22,023,190	730,314	54,418	26,552,368	1,590,833	3,086,172	1,732,836	55,770,131	52,537

Note: Data are from Section 8 of Form R.



Facilities with a combination of chemical wholesale distribution and solvent recovery services managed the largest quantities of TRI chemicals in waste, with 45.5 million pounds of total production-related waste, or 81.6 percent of the total for the industry. These facilities reported 22.8 million

pounds of off-site energy recovery and 21.3 million pounds of on-site recycling.

Facilities reporting only chemical wholesale distribution operations reported 9.8 million pounds of total production-related waste managed, or 17.5 percent of the industry total. These facilities reported 3.7 million pounds of off-site energy recovery, 1.8 million pounds treated off-site and 1.6 million pounds of TRI chemicals released on- and off-site.

Transfers Off-site for Further Waste Management/Disposal

The chemical wholesale distribution industry reported 31.1 million pounds of transfers off-site for further waste management and disposal in 1998. As shown in Table 3-34, facilities with a combination of chemical wholesale distribution operations and solvent recovery services reported 24.5 million pounds, with 20.5 million pounds of

Table 3-34. TRI Transfers Off-site for Further Waste Management/Disposal by 4-digit SIC Code, 1998: Chemical Wholesalers

SIC Code	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs		Other Off-site Transfers* Pounds	Other Transfers Off-site to Disposal** Pounds	Total Transfers for Further Waste Management/Disposal Pounds
					Non-metal TRI Chemicals Pounds	Metals and Metal Compounds Pounds			
5169	Chemical Wholesale Distributors	513,848	3,936,779	1,815,352	88,113	66	740	121,950	6,476,848
	SIC code 5169 and 5171 (Petroleum Bulk Terminals)	0	64,655	25,198	0	275	0	2,000	92,128
	SIC code 5169 and 7389 (Solvent Recovery Services)	2,616,878	20,473,854	1,264,663	2,134	10	0	107,821	24,465,360
	SIC code 5169 and SIC code 28 (Chemical Products)	8,661	1,280	1,891	60,075	0	0	52	71,959
	Total	3,139,387	24,476,568	3,107,104	150,322	351	740	231,823	31,106,295

Note: Data are from Section 6 of Form R.

*Other Off-site Transfers reported without valid waste management code.

**Does not include transfers of metals and metal compounds to POTWs.



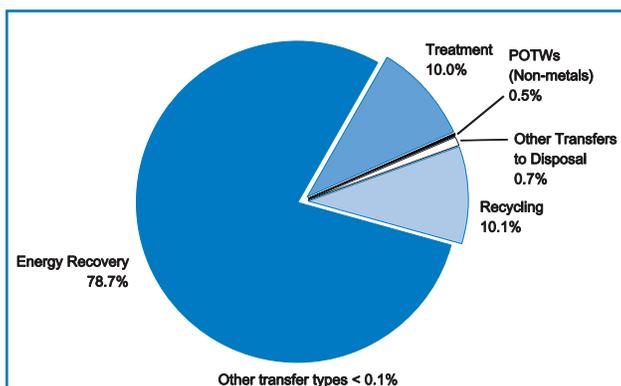
Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: Chemical Wholesale Distributors (SIC Code 5169)

that transferred off-site to energy recovery. Facilities with only chemical distribution operations reported 6.5 million pounds of transfers off-site for further waste management and disposal. These facilities reported 3.9 million pounds of transfers to energy recovery and 1.8 million pounds of transfers to treatment.

Figure 3–11 shows that transfers off-site to energy recovery represented 78.7 percent of all transfers for further waste management and disposal. The industry also reported 3.1 million pounds sent off-site both to recycling and to treatment, accounting for approximately 10 percent for each of these types of transfers.

TRI Data by State

Facilities in the chemical wholesale distribution industry in Texas submitted the largest number of forms, 513 forms. Ohio and California were ranked second and third with 263 and 254 forms, respectively.



Note: Data are from Section 6 of Form R.

*Other Off-site Transfers reported without valid waste management code.

**Does not include transfers of metals and metal compounds to POTWs.

Figure 3–11. Distribution of TRI Transfers Off-site for Further Waste Management/Disposal, 1998: Chemical Wholesalers

On- and Off-site Releases

Chemical wholesale distributors in Texas also reported the largest total on- and off-site releases in 1998. As shown in Table 3–35, Texas facilities in this industry reported total releases of 240,952 pounds, primarily as air emissions. As shown in Map 3–4, the three states of Texas, Ohio, and New Jersey reported the largest amounts of total releases in 1998, over 150,000 pounds each.

Ohio ranked second behind Texas with 186,800 pounds of total releases, of which 103,697 pounds were transferred off-site to disposal and 83,073 pounds were released to air. Ohio’s transfers to disposal were 48.1 percent of the total of such transfers for the entire industry. New Jersey ranked third among states for releases in this industry with 151,584 pounds, including 144,514 pounds of air emissions.

In two other states, California and North Carolina, releases exceeded 100,000 pounds. California reported 120,126 pounds with 108,745 pounds of air emissions. North Carolina reported 115,685 pounds, with 77,829 pounds of on-site land releases or 80.0 percent of total on-site land releases for this industry. Facilities in Puerto Rico reported the largest amounts of surface water discharges, 10,789 pounds.

Waste Management Data

Ohio was the only state with total production-related waste of more than 6.0 million pounds reported by the chemical wholesale distribution industry. These data also appear in Table 3–35. Ohio facilities in this industry managed 37.9 million pounds of production-related waste. Ohio’s 19.2 million pounds of off-site energy recovery represents 72.2 percent of all of the industry’s off-site energy recovery. Ohio’s 17.2 million



pounds of on-site recycling represents 78.2 percent of the total on-site recycling reported by the chemical distribution industry.

Wisconsin ranked second with total production-related waste of 5.8 million pounds. This consisted of 3.2 million pounds of on-site recycling and 2.6 million pounds of off-site energy recovery. Texas ranked third with 2.7 million pounds of total production-related waste and reported the largest amount treated on-site, 1.3 million pounds.

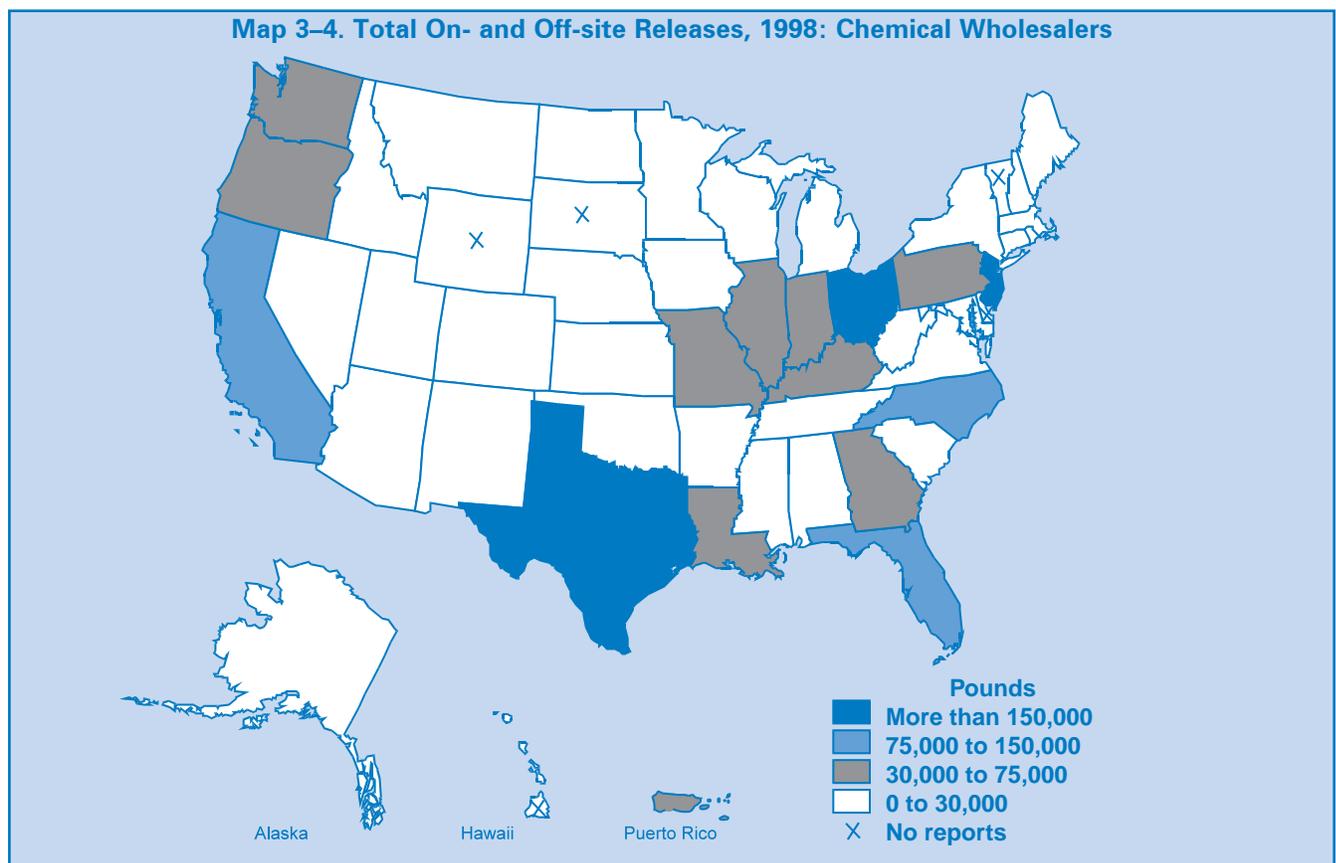
Chemical wholesale distributors reported smaller quantities in other waste management activities. The largest amount of quantities released on- and off-site was 272,948 pounds in Texas. Iowa reported the

largest amount of off-site recycling, 211,132 pounds.

Top 15 Chemicals for On- and Off-site Releases

Methanol was the chemical with the largest amount of on- and off-site releases in the chemical wholesale distribution industry. Chemical wholesale distributors reported releasing 225,651 pounds of methanol, largely as air emissions. Table 3-36 presents data for the 15 chemicals released in the largest amounts by TRI chemical wholesale distributors.

Toluene ranked second with 171,441 pounds, most of which was air releases. Three other chemicals had total on- and





**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Chemical Wholesale Distributors (SIC Code 5169)**

Table 3-35. Summary of TRI Information by State, 1998: Chemical Wholesalers

State	Total Forms Number	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
Alabama	74	25,916	0	0	0	0	0	25,916	0	25,916
Alaska	4	1,255	0	0	0	0	0	1,255	0	1,255
Arizona	43	12,249	0	0	0	0	0	12,249	0	12,249
Arkansas	6	985	0	0	0	0	0	985	0	985
California	254	108,745	536	0	0	0	0	109,281	10,845	120,126
Colorado	34	4,092	0	0	0	0	0	4,092	0	4,092
Connecticut	17	7,408	0	0	0	0	0	7,408	0	7,408
Florida	100	84,042	50	0	0	0	10	84,102	0	84,102
Georgia	120	35,448	0	0	0	0	0	35,448	2,250	37,698
Idaho	3	0	0	0	0	0	0	0	0	0
Illinois	123	36,143	36	0	0	0	0	36,179	17,200	53,379
Indiana	167	37,540	0	0	0	0	0	37,540	1,505	39,045
Iowa	72	13,902	0	0	0	0	2,219	16,121	4,440	20,561
Kansas	43	5,350	0	0	0	0	0	5,350	5,226	10,576
Kentucky	82	29,946	0	0	0	0	0	29,946	242	30,188
Louisiana	104	42,310	0	0	0	0	0	42,310	3,879	46,189
Maine	2	347	0	0	0	0	0	347	0	347
Maryland	17	260	0	0	0	0	0	260	0	260
Massachusetts	99	24,402	0	0	0	0	0	24,402	1,294	25,696
Michigan	104	28,177	0	0	0	0	0	28,177	0	28,177
Minnesota	89	17,798	5	0	0	0	5	17,808	20	17,828
Mississippi	25	7,961	0	0	0	0	0	7,961	0	7,961
Missouri	171	63,269	5	0	0	0	18	63,292	2,433	65,725
Montana	7	1,907	0	0	0	0	0	1,907	0	1,907
Nebraska	10	34	0	0	0	0	0	34	2,150	2,184
Nevada	1	475	0	0	0	0	0	475	0	475
New Hampshire	2	504	0	0	0	0	0	504	0	504
New Jersey	162	144,514	5	0	0	0	0	144,519	7,065	151,584
New Mexico	6	25	0	0	0	0	0	25	1,140	1,165
New York	100	16,473	0	0	0	0	0	16,473	0	16,473
North Carolina	129	26,311	0	0	0	0	77,829	104,140	11,545	115,685
North Dakota	5	772	0	0	0	0	0	772	0	772
Ohio	263	83,073	30	0	0	0	0	83,103	103,697	186,800

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Chemical Wholesale Distributors (SIC Code 5169)**

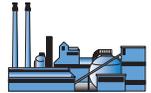


Table 3-35. Summary of TRI Information by State, 1998: Chemical Wholesalers (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Alabama	5,219	0	0	45,030	3	65	25,150	75,467	265
Alaska	0	0	0	0	0	0	580	580	0
Arizona	10,000	0	0	9,262	161,980	187	11,547	192,976	0
Arkansas	0	0	0	0	0	0	985	985	0
California	712	25,516	0	677,873	22,786	79,806	203,618	1,010,311	1,550
Colorado	0	0	0	878	0	56	3,828	4,762	0
Connecticut	0	0	0	0	0	0	7,402	7,402	1
Florida	500	0	0	58,753	1,171	910	80,369	141,703	3,961
Georgia	0	1,300	0	95,515	0	4,120	35,611	136,546	260
Idaho	0	0	0	0	0	0	0	0	0
Illinois	0	510	0	214,483	1,002	33,854	51,414	301,263	10
Indiana	58,500	19,133	0	305,458	39,875	128,801	33,290	585,057	3,080
Iowa	54,744	211,132	0	71,671	0	4,581	15,959	358,087	0
Kansas	19,185	0	0	44,326	0	6,466	5,333	75,310	0
Kentucky	0	0	0	8,310	2,143	279	27,718	38,450	167
Louisiana	0	4	54,418	110,272	2,277	5,297	127,282	299,550	199
Maine	0	0	0	0	4,940	0	347	5,287	2
Maryland	0	0	0	0	0	0	260	260	0
Massachusetts	233,000	18,506	0	33,396	2,806	9,658	27,980	325,346	1,323
Michigan	0	0	0	238,402	2,652	15,351	27,534	283,939	56
Minnesota	0	10,187	0	105,123	4,280	1,625	17,599	138,814	0
Mississippi	0	0	0	111,993	0	188,090	7,399	307,482	0
Missouri	0	0	0	254,293	2,545	71,136	64,048	392,022	64
Montana	0	0	0	0	0	0	1,907	1,907	0
Nebraska	0	0	0	0	2,500	2,160	34	4,694	0
Nevada	75	0	0	0	0	0	540	615	0
New Hampshire	0	0	0	0	0	18	504	522	0
New Jersey	0	4,120	0	59,736	6,354	32,083	196,448	298,741	3,042
New Mexico	0	0	0	0	0	0	1,160	1,160	0
New York	0	0	0	35,227	0	5,625	14,765	55,617	11
North Carolina	0	201,200	0	104,070	16,940	834,883	26,265	1,183,358	140
North Dakota	0	0	0	0	0	0	772	772	0
Ohio	17,218,400	23,887	0	19,168,062	6,241	1,235,900	204,667	37,857,157	6,182

Note: Data are from Section 8 of Form R.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: Chemical Wholesale Distributors (SIC Code 5169)

Table 3–35. Summary of TRI Information by State, 1998: Chemical Wholesalers (continued)

State	Total Forms Number	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
Oklahoma	68	11,281	0	0	0	0	0	11,281	0	11,281
Oregon	55	25,327	0	0	0	0	70	25,397	10,450	35,847
Pennsylvania	202	41,652	9	0	1	0	0	41,662	1,361	43,023
Puerto Rico	18	23,617	10,789	0	0	0	0	34,406	0	34,406
Rhode Island	5	250	0	0	0	0	0	250	0	250
South Carolina	33	12,990	0	0	0	0	1,493	14,483	500	14,983
Tennessee	116	28,104	0	0	0	0	310	28,414	0	28,414
Texas	513	214,272	13	0	0	0	0	214,285	26,667	240,952
Utah	47	4,718	0	0	0	0	0	4,718	0	4,718
Virginia	65	25,787	0	0	0	0	0	25,787	1,371	27,158
Washington	41	16,565	125	0	0	0	14,600	31,290	0	31,290
West Virginia	18	2,200	0	0	0	0	0	2,200	100	2,300
Wisconsin	76	15,636	0	0	0	0	700	16,336	0	16,336
Total	3,695	1,284,032	11,603	0	1	0	97,254	1,392,890	215,380	1,608,270

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

off-site releases greater than 100,000 pounds each. They were methyl ethyl ketone with 159,181 pounds, dichloromethane with 158,185 pounds, and ammonia with 131,254 pounds. For all of these chemicals, air emissions accounted for more than 80 percent of total on- and off-site releases. Only two of the top 15 chemicals reported off-site transfers to disposal as the majority of their total releases. Both zinc compounds and chromium compounds had more than 98 percent of total releases reported as off-site releases (transfers to disposal).

Releases of the 15 chemicals totaled 1.3 million pounds, 82.7 percent of the industry's total releases of 1.6 million pounds.

Projected Quantities of TRI Chemicals Managed in Waste, 1998–2000

Chemical wholesale distribution facilities reporting to TRI expected to reduce their production-related waste by 11.5 percent from 1998–2000, reducing it from a total of 55.8 million pounds to 49.4 million pounds, as shown in Table 3–37. The projected decrease represents a reduction of 16.4 percent in 1999 followed by an increase of 5.9 percent in 2000. The projected decrease from 1998 to 1999 is expected to come from decreases in on-site recycling and off-site energy recovery. The subsequent increase projected from 1999–2000 is expected to occur in on-site recycling.

The projections indicate a small change in waste management practices. On-site recycling would go from 39.5 percent of total production-related waste in 1998 to 41.2

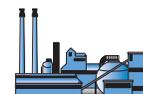


Table 3-35. Summary of TRI Information by State, 1998: Chemical Wholesalers (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Oklahoma	0	0	0	6,670	34	250	11,288	18,242	34
Oregon	0	0	0	26,045	9,704	1,151	36,974	73,874	1,095
Pennsylvania	100	1,218	0	67,644	0	67,045	39,589	175,596	4,845
Puerto Rico	0	0	0	0	2,979	0	24,635	27,614	4
Rhode Island	0	0	0	0	0	0	400	400	0
South Carolina	0	0	0	6,459	0	1,493	12,977	20,929	0
Tennessee	3,361	4,358	0	9,569	10,972	1,076	36,183	65,519	557
Texas	0	205,130	0	665,408	1,273,217	332,610	272,948	2,749,313	25,534
Utah	0	0	0	15,603	12,425	19,764	4,270	52,062	4
Virginia	1,219,208	243	0	1,378,381	180	0	24,045	2,622,057	18
Washington	0	0	0	35	0	580	29,075	29,690	0
West Virginia	0	3,200	0	0	0	100	1,725	5,025	0
Wisconsin	3,200,186	670	0	2,624,421	827	1,152	16,412	5,843,668	133
Total	22,023,190	730,314	54,418	26,552,368	1,590,833	3,086,172	1,732,836	55,770,131	52,537

Note: Data are from Section 8 of Form R.

percent in 2000 and off-site energy recovery would go from 47.6 percent to 46.0 percent. Quantities released on- and off-site—the least desirable outcome under the waste management hierarchy (described in **Waste Management** in Chapter 1)—would remain about the same at about 3 percent of total production-related waste.

Source Reduction

Twelve percent of the Form Rs submitted by the chemical wholesale distribution facilities in 1998 reported source reduction activity undertaken during the year (see Table 3-38). As noted in Waste Management in Chapter 1, source reduction is activity that prevents the generation of waste and is the preferred waste management option.

Facilities with only chemical wholesale distribution operations reported both the largest number of forms and the largest number with source reduction activities. These facilities identified spill and leak prevention on 119 forms and good operating practices on 111 forms, making them the most frequent source reduction activity in the industry. The facilities with combinations of chemical wholesale distribution and other operations reported smaller numbers of forms but reported source reduction activity on a greater percentage of forms. Facilities with the combination of chemical wholesale distribution with petroleum bulk terminals and with manufacture of chemical products reported source reduction activity on more than 50 percent of their Form Rs. They also identified spill and leak prevention and good operating practices most frequently.



**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Chemical Wholesale Distributors (SIC Code 5169)**

Table 3–36. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1998: Chemical Wholesalers

CAS Number	Chemical	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
				Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
67-56-1	Methanol	200,444	0	0	0	0	11,679	212,123	13,528	225,651
108-88-3	Toluene	135,048	17	0	0	0	22,874	157,939	13,502	171,441
78-93-3	Methyl ethyl ketone	140,791	7	0	0	0	12,460	153,258	5,923	159,181
75-09-2	Dichloromethane	152,935	1	0	1	0	450	153,387	4,798	158,185
7664-41-7	Ammonia	107,763	710	0	0	0	22,752	131,225	29	131,254
110-54-3	n-Hexane	78,761	0	0	0	0	840	79,601	1,504	81,105
1330-20-7	Xylene (mixed isomers)	70,926	11	0	0	0	50	70,987	2,112	73,099
75-45-6	Chlorodifluoromethane (HCFC-22)	64,602	0	0	0	0	0	64,602	0	64,602
—	Zinc compounds	562	0	0	0	0	0	562	50,518	51,080
—	Chromium compounds	350	0	0	0	0	0	350	50,610	50,960
—	Glycol ethers	20,393	0	0	0	0	12,275	32,668	10,545	43,213
108-05-4	Vinyl acetate	34,370	0	0	0	0	0	34,370	6,440	40,810
96-33-3	Methyl acrylate	24,232	0	0	0	0	0	24,232	3,675	27,907
115-07-1	Propylene	26,294	0	0	0	0	0	26,294	0	26,294
7664-38-2	Phosphoric acid	6,552	10,807	0	0	0	4,828	22,187	3,150	25,337
	Subtotal	1,064,023	11,553	0	1	0	88,208	1,163,785	166,334	1,330,119
	Total	1,284,032	11,603	0	1	0	97,254	1,392,890	215,380	1,608,270

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Chemical Wholesale Distributors (SIC Code 5169)**



**Table 3–37. Current Year and Projected Quantities of TRI Chemicals in Waste,
1998–2000: Chemical Wholesale Distributors**

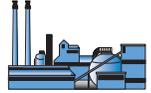
Waste Management Activity	Current Year 1998		Projected 1999		Projected 2000	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
Recycled On-site	22,023,190	39.5	17,425,942	37.4	20,358,880	41.2
Recycled Off-site	730,314	1.3	428,285	0.9	416,916	0.8
Energy Recovery On-site	54,418	0.1	80,000	0.2	80,000	0.2
Energy Recovery Off-site	26,552,368	47.6	22,791,390	48.9	22,692,883	46.0
Treated On-site	1,590,833	2.9	1,558,110	3.3	571,197	1.2
Treated Off-site	3,086,172	5.5	2,955,300	6.3	3,880,822	7.9
Quantity Released On- and Off-site	1,732,836	3.1	1,381,467	3.0	1,378,893	2.8
Total Production-related Waste	55,770,131	100.0	46,620,494	100.0	49,379,591	100.0
Waste Management Activity	Projected Change 1998–1999 Percent		Projected Change 1999–2000 Percent		Projected Change 1998–2000 Percent	
Recycled On-site	–20.9		16.8		–7.6	
Recycled Off-site	–41.4		–2.7		–42.9	
Energy Recovery On-site	47.0		0.0		47.0	
Energy Recovery Off-site	–14.2		–0.4		–14.5	
Treated On-site	–2.1		–63.3		–64.1	
Treated Off-site	–4.2		31.3		25.7	
Quantity Released On- and Off-site	–20.3		–0.2		–20.4	
Total Production-related Waste	–16.4		5.9		–11.5	

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1998.

Table 3–38. Number of Forms Reporting Source Reduction Activity, 1998: Chemical Wholesalers

SIC Code	Industry	Total Form Rs Number	Forms Reporting Source Reduction Activity		Category of Source Reduction Activity							
			Number	Percent of All Form Rs Percent	Good Operating Practices Number	Inventory Control Number	Spill and Leak Prevention Number	Raw Material Modifications Number	Process Modifications Number	Cleaning and Degreasing Number	Surface Preparation and Finishing Number	Product Modifications Number
5169	Chemical Wholesale Distributors	1,845	196	10.6	111	36	119	6	18	3	0	1
	SIC code 5169 and 5171 (Petroleum Bulk Terminals)	16	8	50.0	8	0	16	0	0	0	0	0
	SIC code 5169 and 7389 (Solvent Recovery Services)	58	9	15.5	0	5	0	6	8	0	0	0
	SIC code 5169 and SIC code 28 (Chemical Products)	31	18	58.1	17	0	4	0	2	1	0	0
	Total	1,950	231	11.8	136	41	139	12	28	4	0	1

Note: All source reduction activities on a form are counted in the corresponding category. Totals do not equal the sum of the categories because forms may report more than one source reduction activity.



❖ Petroleum Terminals and Bulk Storage Facilities ❖ (SIC Code 5171)

Introduction

Petroleum terminals and bulk storage facilities (SIC code 5171) repackage or blend petroleum products for sale to gasoline stations and other retailers. Others may sell directly to end users such as farmers and construction companies. Box 3–7 describes the products of the wholesale petroleum industry

Products and Services

Petroleum bulk storage facilities buy petroleum products in bulk and blend and/or repackage them to customer specifications. The industry includes liquefied petroleum gases. These facilities sell to industrial, com-

mercial, institutional, farm, construction or business users and to other wholesalers. They have a bulk liquid storage capacity of 10,000 gallons or more, and the quantities sold are large; retail gasoline stations are not included in this industry sector.

Employment and Production

There were 7,690 petroleum terminals and bulk storage facilities with 102,489 employees in 1997. Petroleum bulk terminals had sales valued at \$176.72 billion that year.

General Environmental Issues

Petroleum terminals and bulk storage facilities transfer petroleum products from

Box 3–7. SIC Code 517, Wholesale Trade—Petroleum and Petroleum Products: Codes and Classifications Required to Report to TRI

SIC Code 517, Wholesale Trade—Petroleum and Petroleum Products: Codes and Classifications Required to Report to TRI

5171	Petroleum Terminals and Bulk Stations	Wholesale distribution of crude petroleum and petroleum products, including liquefied petroleum gas, from bulk liquid storage facilities.
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Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: Petroleum Terminals and Bulk Storage Facilities (SIC Code 5171)

pipelines to bulk storage to processing equipment (as appropriate) to tanker trucks for distribution. Releases may result as the petroleum products are transferred through these steps. Packaging and blending are similar to some activities performed by petroleum refineries (SIC code 27) and petrochemical facilities (SIC code 28), covered by TRI since its inception.

Processes Involving Toxic Chemicals

Fuel is stored in bulk storage tanks and transferred to tanker trucks for distribution. Blending and mixing of products by the facilities involves mixing additives or other agents into gasoline and aviation fuel. Other blending operations involve mixing refined motor fuel with oxygenated compounds such as methanol, ethanol or methyl tertiary butyl ether (MTBE). However, this type of blending is usually done at petroleum refineries rather than the petroleum bulk storage facility.

During cleaning operations, tanks are drained to remove and recover product. The wastewater may have small amounts of hydrocarbons including benzene, cyclohexane, ethylbenzene, toluene, 1,2,4-trimethylbenzene and xylene. The wastewater is either drained and discharged or directed to a tank for subsequent fuel recovery. Cleaners, lubricants and degreasers are used in the maintenance of pumps, valves and other processing equipment.

Precipitation often accumulates in the secondary containment area of the storage tanks and loading/unloading zones. This wastewater may be drained to water ditches or oil/water separators.

Management of Toxic Chemicals in Waste

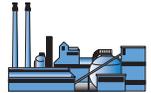
Fugitive air emissions can occur during the loading and unloading of petroleum products. Losses occur during loading as organic vapors in the empty storage tanks are displaced by the liquid being loaded into the tanks. The types and amounts of the emissions will depend on the physical and chemical characteristics of the previous fuel and new fuel being loaded. Vapor recovery equipment used while loading and unloading petroleum products captures organic vapors that are displaced during loading operations. This recovered product is then either piped to a storage unit or to a thermal oxidation unit for combustion.

Other fugitive air emissions can come from leaks in valves, seals or connectors in fuel handling equipment. They may also occur from losses during cylinder changeovers, tank cleanings, blowing out pipes and other cleaning operations.

Blending and mixing operations in most petroleum terminals and bulk storage facilities are conducted in enclosed systems that are vented to control devices to minimize fugitive air emissions.

Point source air emissions may come from storage tanks that store materials containing volatile chemicals, such as Fuel Oil No. 2.

Wastewater discharges include process wastewater and storm water. Process wastewater results mainly from storage tank clean-out. Eliminating unnecessary tank cleaning reduces the amount of wastewater generated. Petroleum bulk storage facilities can clean tanks less often if they



closely monitor the process chemistry and the need for cleaning. Applying a protective coating to internal heater coils, which reduces the accumulation of scale, also reduces the need for frequent cleanings.

Storm water run-off at a petroleum bulk storage facility may contain chemicals washed from raw materials or products or from other wastes. Secondary containment of the storage tanks and loading areas may be used to collect rainwater run-off contaminated with petroleum and other chemicals from equipment cleaning operations, leaks and spills.

Wastewater may be treated by neutralization, settling, filtration, chemical precipitation, dewatering, or evaporation. Sludge and other solid wastes may be treated on-site by filtration, sludge dewatering, settling and thermal drying.

Storage tank residue may be disposed of in on-site landfills or surface impoundments. These wastes may also be sent off-site for disposal or recycling.

1998 TRI Data for Petroleum Terminals and Bulk Storage Facilities

On- and Off-site Releases

Petroleum terminals and bulk storage facilities required to report to TRI reported 4.7 million pounds of TRI chemicals released on- and off-site in 1998, as shown in Table 3-39. The majority, 4.3 million pounds, was air emissions. Figure 3-12 shows that air emissions amounted to 90.9 percent of the industry's total releases.

Off-site releases (transfers off-site to disposal) totaled 233,487 pounds, the industry's second-largest release type, representing 5.0 percent of total releases. Petroleum terminals and bulk stations also reported 137,947 pounds discharged to surface waters and 53,692 pounds of on-site land releases. No underground injection was reported.

Fifteen of the 3,748 forms indicated a combination of operations covering terminals and bulk storage stations along with petroleum refining. However, those reporting only petroleum terminals and bulk storage stations represented 99.8 percent of the total forms submitted by this industry. Facilities reporting this combination of operations reported 8,010 pounds of total releases for 1998.

Waste Management Data

Quantities of TRI Chemicals in Waste

The petroleum terminals and bulk storage industry reported managing 60.0 million pounds of total production-related waste in 1998, as shown in Table 3-40. On-site recycling totaled 22.8 million pounds, or 38.0 percent of the industry's production-related waste (see Figure 3-13). The industry's quantities released on- and off-site totaled 14.7 million pounds, or 24.5 percent of the total. Off-site recycling amounted to 11.1 million pounds and on-site treatment amounted to 9.8 million pounds, each less than 20 percent of the total. Energy recovery both on- and off-site was less than 500,000 pounds.

Facilities reporting only petroleum terminals and bulk storage operations reported 59.9 million pounds of total production-related waste managed, representing more



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: Petroleum Terminals and Bulk Storage Facilities (SIC Code 5171)

Table 3–39. TRI On-site and Off-site Releases by 4-digit SIC Code, 1998: Petroleum Bulk Terminals

SIC Code	Industry	Total Forms Number	On-site Releases						Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases				
					Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
5171	Petroleum Terminals and Bulk Stations	3,733	4,258,610	137,909	0	0	0	53,692	4,450,211	230,652	4,680,863
	SIC code 5171 and SIC code 29 (Petroleum Refining)	15	5,137	38	0	0	0	0	5,175	2,835	8,010
	Total	3,748	4,263,747	137,947	0	0	0	53,692	4,455,386	233,487	4,688,873

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

than 99.9 percent of the industry’s total. Facilities with a combination of petroleum terminals and bulk storage and petroleum refining reported 14,432 pounds of production-related waste managed, largely as quantities released on- and off-site.

Transfers Off-site for Further Waste Management/Disposal

The petroleum terminals and bulk storage industry reported 13.0 million pounds of transfers off-site for further waste management and disposal in 1998, as shown in Table 3–41. Figure 3–14 shows that transfers off-site to recycling, 11.4 million pounds, represented 87.4 percent of all transfers for further waste management and disposal. The industry also reported 1.0 million pounds sent off-site to treatment, accounting for 8.0 percent of the total.

These figures also represent reporting by facilities with only petroleum terminals and bulk storage operations. Facilities reporting a combination of petroleum terminals and bulk storage operations and petroleum refining reported just 6,166 pounds of transfers off-site for further waste management and disposal.

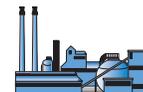
TRI Data by State

Facilities in the petroleum terminals and bulk storage industry in California submitted the largest number of forms, with 362 forms. New York and Pennsylvania were ranked second and third with 359 and 292 forms, respectively.

On- and Off-site Releases

Petroleum terminals and bulk storage facilities in Texas, however, reported the largest total on- and off-site releases in 1998. As shown in Table 3–42, Texas facilities in this industry reported total releases of 530,011 pounds, consisting primarily of 522,883 pounds of air emissions. As shown in Map 3–5, the four states of Texas, California, New York and New Jersey reported the largest amounts of total releases in 1998, over 300,000 pounds each.

California ranked second with 496,843 pounds of total releases, of which 470,307 pounds were released to air. New York, ranked third, reported 325,122 pounds of total releases, with 302,030 pounds of air emissions. New Jersey ranked fourth among states for releases in this industry



with 310,138 pounds, including 296,064 pounds of air emissions.

Facilities in Virginia reported the largest amount of discharges to surface waters with 113,127 pounds, representing 82.0 percent of the total surface water discharges for this industry. Facilities in Massachusetts reported the largest off-site releases (off-site transfers to disposal) with 40,008 pounds.

Waste Management Data

Pennsylvania was the state with the largest total production-related waste in the petroleum terminals and bulk storage industry, with 20.0 million pounds. These data also appear in Table 3–42. Pennsylvania facilities in this industry reported 10.0 million pounds as quantities released on- and off-site, which represents 68.2 percent of all quantities released on- and off-site in this industry. Pennsylvania facilities also reported 9.8 million pounds of off-site recycling, representing 88.3 percent of total off-site recycling in this industry.

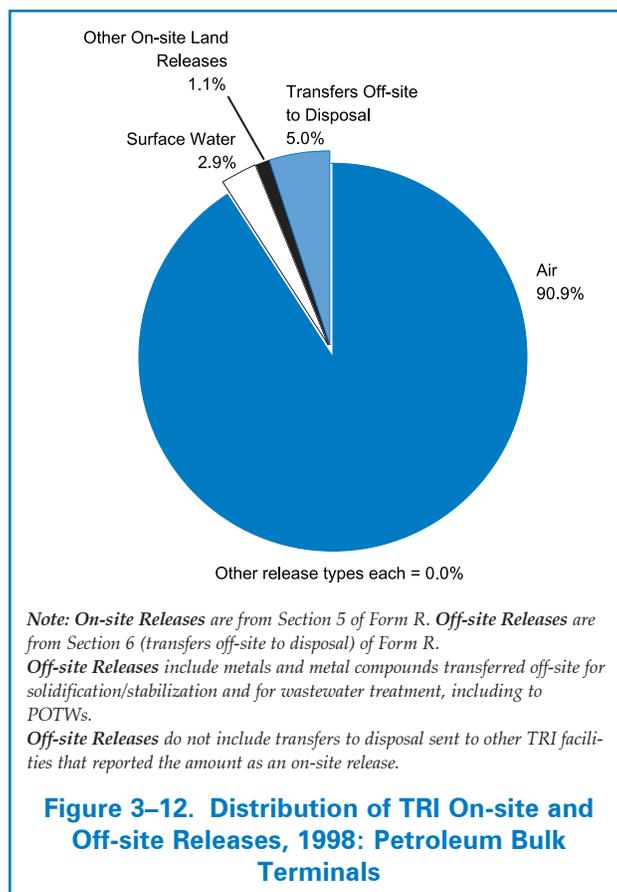


Figure 3–12. Distribution of TRI On-site and Off-site Releases, 1998: Petroleum Bulk Terminals

Texas ranked second with total production-related waste of 11.9 million pounds. This

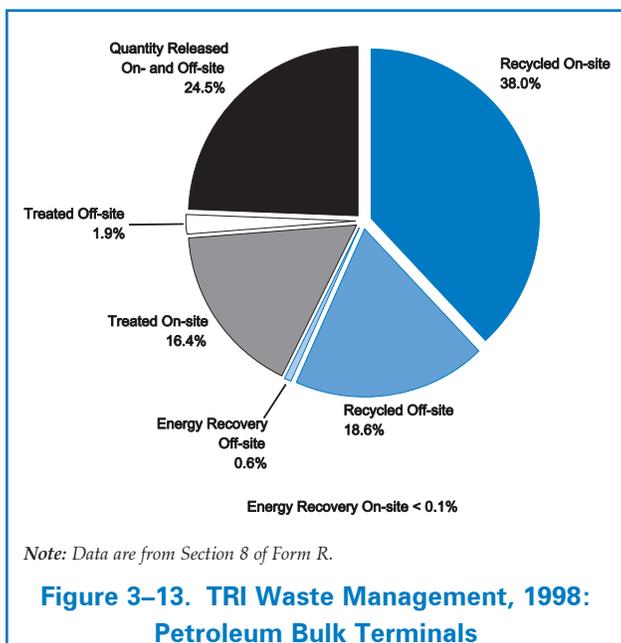
Table 3–40. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1998: Petroleum Bulk Terminals

SIC Code	Industry	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
		On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
5171	Petroleum Terminals and Bulk Stations	22,796,695	11,134,868	6	337,216	9,808,300	1,165,737	14,704,353	59,947,175	942,486
	SIC code 5171 and SIC code 29 (Petroleum Refining)	2,613	2,118	0	0	0	744	8,957	14,432	0
	Total	22,799,308	11,136,986	6	337,216	9,808,300	1,166,481	14,713,310	59,961,607	942,486

Note: Data are from Section 8 of Form R.



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consisted of 8.6 million pounds of on-site recycling, which was the largest amount of on-site recycling of any state in this industry and represented 37.7 percent of all on-site recycling in the industry.

Michigan ranked third with 4.4 million pounds of total production-related waste. Michigan facilities reported 3.0 million pounds recycled on-site and 1.3 million pounds treated on-site. California facilities reported 2.6 million pounds treated on-site, the largest amount treated on-site reported by any state in this industry.

Top 15 Chemicals for On- and Off-site Releases

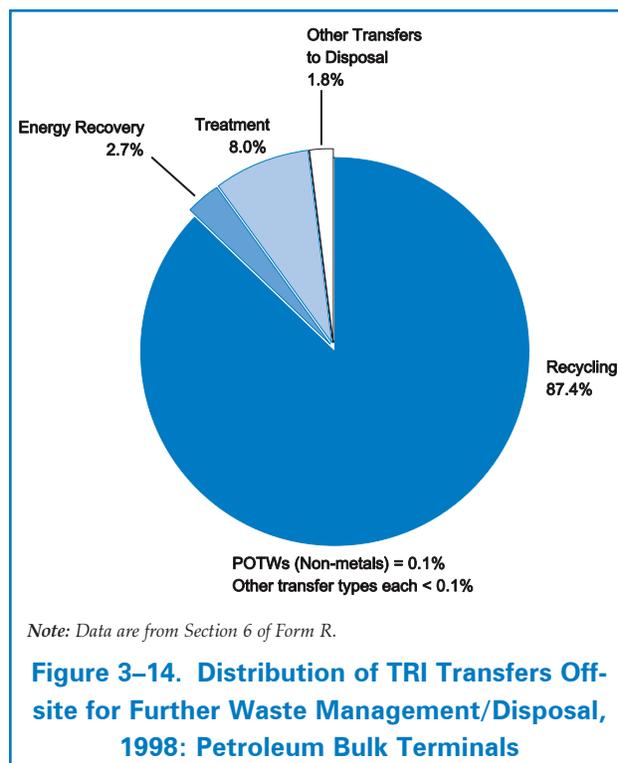
Methyl tert-butyl ether was the chemical with the largest amount of on- and off-site releases in the petroleum terminals and bulk storage industry. Petroleum terminals and bulk storage industry reported releasing 1.6 million pounds of methyl tert-butyl ether, primarily as air emissions. Table 3-43 presents data for the 15 chemicals released

in the largest amounts by petroleum terminals and bulk storage facilities.

Toluene ranked second with 755,529 pounds, most of which was air releases. One other chemical, n-hexane, had total on- and off-site releases of greater than 500,000 pounds. Total releases of n-hexane were 715,851 pounds.

For all of the top 15 chemicals except one, air emissions accounted for more than 85 percent of total on- and off-site releases. Ethylene glycol discharges to surface water accounted for the majority of releases, 111,765 pounds, or 98.6 percent of the total releases for this chemical.

Releases of the 15 chemicals totaled 4.6 million pounds, 98.7 percent of the industry's total releases of 4.7 million pounds.



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**Table 3-41. TRI Transfers Off-site for Further Waste Management/Disposal by 4-digit SIC Code, 1998:
Petroleum Bulk Terminals**

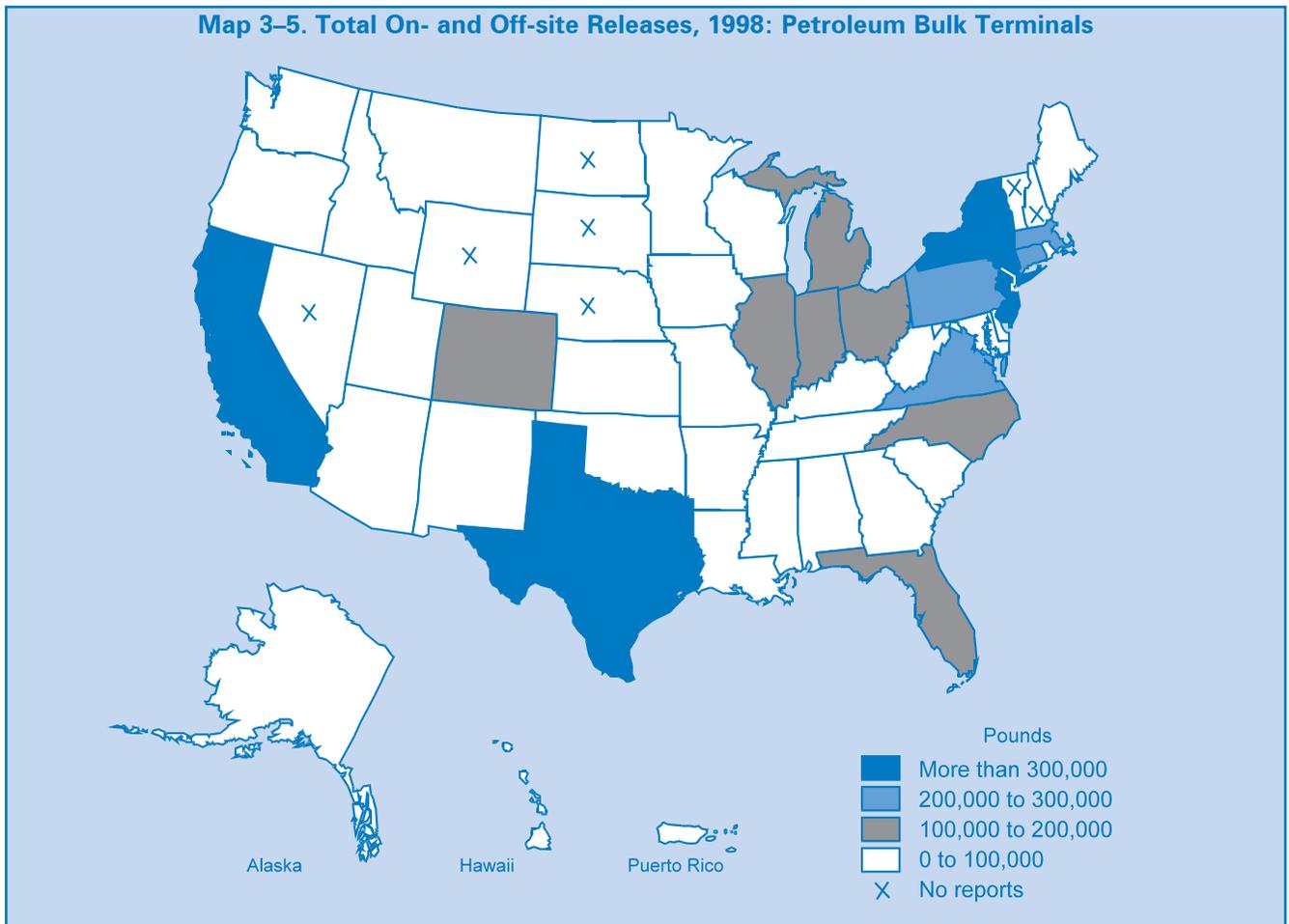
SIC Code	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs		Other Off-site Transfers* Pounds	Other Transfers Off-site to Disposal** Pounds	Total Transfers for Further Waste Management/Disposal Pounds
					Non-metal TRI Chemicals Pounds	Metals and Compounds Pounds			
5171	Petroleum Terminals and Bulk Stations	11,388,894	353,636	1,040,527	7,815	370	6,000	237,081	13,034,323
	SIC code 5171 and SIC code 29 (Petroleum Refining)	2,118	0	1,213	0	0	0	2,835	6,166
Total		11,391,012	353,636	1,041,740	7,815	370	6,000	239,916	13,040,489

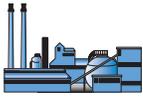
Note: Data are from Section 6 of Form R.

*Other Off-site Transfers reported without valid waste management code.

**Does not include transfers of metals and metal compounds to POTWs.

Map 3-5. Total On- and Off-site Releases, 1998: Petroleum Bulk Terminals





**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Petroleum Terminals and Bulk Storage Facilities (SIC Code 5171)**

Table 3-42. Summary of TRI Information by State, 1998: Petroleum Bulk Terminals

State	Total Forms Number	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
Alabama	19	9,381	78	0	0	0	20	9,479	51	9,530
Alaska	40	17,503	0	0	0	0	38	17,541	325	17,866
American Samoa	6	5,146	1	0	0	0	0	5,147	0	5,147
Arizona	68	57,387	0	0	0	0	0	57,387	10	57,397
Arkansas	11	24,216	0	0	0	0	0	24,216	0	24,216
California	362	470,307	72	0	0	0	2,043	472,422	24,421	496,843
Colorado	39	79,668	515	0	0	0	34,390	114,573	0	114,573
Connecticut	52	177,468	45	0	0	0	0	177,513	25,880	203,393
Delaware	41	2,100	0	0	0	0	0	2,100	0	2,100
Florida	130	151,682	389	0	0	0	1,810	153,881	236	154,117
Georgia	72	34,607	545	0	0	0	0	35,152	516	35,668
Guam	5	9,783	1,275	0	0	0	0	11,058	0	11,058
Hawaii	34	56,407	0	0	0	0	0	56,407	0	56,407
Idaho	15	30,224	0	0	0	0	0	30,224	0	30,224
Illinois	81	108,246	120	0	0	0	1,609	109,975	4,514	114,489
Indiana	98	175,042	1,227	0	0	0	15	176,284	5,574	181,858
Iowa	12	9,935	0	0	0	0	0	9,935	43	9,978
Kansas	24	28,055	1,020	0	0	0	0	29,075	0	29,075
Kentucky	70	33,309	0	0	0	0	0	33,309	114	33,423
Louisiana	26	9,394	3	0	0	0	250	9,647	0	9,647
Maine	26	50,787	2	0	0	0	0	50,789	17,164	67,953
Maryland	51	89,175	1,600	0	0	0	116	90,891	226	91,117
Massachusetts	75	237,434	9,468	0	0	0	0	246,902	40,008	286,910
Michigan	126	130,038	31	0	0	0	0	130,069	0	130,069
Minnesota	12	3,110	0	0	0	0	0	3,110	707	3,817
Mississippi	76	28,585	36	0	0	0	0	28,621	751	29,372
Missouri	61	67,900	30	0	0	0	0	67,930	3,160	71,090
Montana	16	23,586	0	0	0	0	0	23,586	0	23,586
New Jersey	153	296,064	537	0	0	0	0	296,601	13,537	310,138
New Mexico	16	42,055	0	0	0	0	0	42,055	0	42,055
New York	359	302,030	658	0	0	0	169	302,857	22,265	325,122
North Carolina	146	153,474	1,048	0	0	0	0	154,522	1,287	155,809

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
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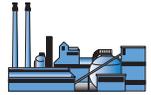


Table 3-42. Summary of TRI Information by State, 1998: Petroleum Bulk Terminals (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Alabama	0	634	0	0	1	0	7,074	7,709	0
Alaska	16,075	0	0	269	8,659	2,565	16,285	43,853	18
American Samoa	0	0	0	4,796	0	0	5,148	9,944	0
Arizona	0	202	0	0	0	2,135	55,673	58,010	23
Arkansas	17,780	0	0	0	0	0	24,216	41,996	0
California	0	45,457	6	0	2,645,538	392,328	482,305	3,565,634	100,969
Colorado	3,830	55	0	0	143,990	0	75,426	223,301	41,289
Connecticut	0	0	0	0	4,198	24,341	159,892	188,431	0
Delaware	0	210	0	0	0	0	2,100	2,310	1
Florida	1,144,000	33,043	0	12,178	84,901	154	148,194	1,422,470	175
Georgia	538,000	3,453	0	0	5	522	25,545	567,525	2,383
Guam	0	0	0	0	0	0	11,624	11,624	0
Hawaii	0	0	0	10	0	64	53,304	53,378	6
Idaho	0	0	0	0	157,400	699	30,240	188,339	99
Illinois	581,822	9,557	0	21	600,700	14,115	114,567	1,320,782	206,300
Indiana	1,319,937	12,013	0	727	223,046	1,290	175,881	1,732,894	1,211
Iowa	4,520	0	0	0	1	43	9,935	14,499	135,000
Kansas	16,503	5	0	0	43,937	5	27,519	87,969	0
Kentucky	1,093,674	0	0	2,974	0	2,228	33,276	1,132,152	0
Louisiana	2,770,000	610,000	0	0	0	0	9,401	3,389,401	0
Maine	0	0	0	0	0	23,972	59,961	83,933	0
Maryland	2,043	22,863	0	635	81,100	1,040	76,911	184,592	125
Massachusetts	427,375	0	0	0	1,000	97,041	361,177	886,593	5,715
Michigan	2,953,703	10,491	0	5,642	1,264,058	1,964	127,205	4,363,063	284
Minnesota	932	102	0	0	322,835	0	3,046	326,915	251
Mississippi	0	2	0	0	0	4	28,717	28,723	0
Missouri	930	24,400	0	51,698	705,355	4,325	103,225	889,933	10,927
Montana	0	0	0	0	0	45,566	20,752	66,318	0
New Jersey	1,307	6,028	0	35,068	46,395	12,937	346,800	448,535	4,284
New Mexico	0	0	0	0	0	0	39,605	39,605	0
New York	236,300	7,055	0	5,089	266,514	9,567	343,584	868,109	51,649
North Carolina	0	2,928	0	15,293	0	12,024	275,428	305,673	3,307

Note: Data are from Section 8 of Form R.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: Petroleum Terminals and Bulk Storage Facilities (SIC Code 5171)

Table 3–42. Summary of TRI Information by State, 1998: Petroleum Bulk Terminals (continued)

State	Total Forms Number	On-site Releases						Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases				
				Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
Northern Marianas	10	3,066	20	0	0	0	0	3,086	0	3,086
Ohio	213	107,514	709	0	0	0	3,164	111,387	10,454	121,841
Oklahoma	23	49,020	0	0	0	0	0	49,020	0	49,020
Oregon	46	60,199	38	0	0	0	0	60,237	1,370	61,607
Pennsylvania	292	216,632	2,149	0	0	0	0	218,781	3,242	222,023
Puerto Rico	32	21,796	0	0	0	0	0	21,796	555	22,351
Rhode Island	22	48,113	356	0	0	0	0	48,469	35,646	84,115
South Carolina	46	27,662	561	0	0	0	0	28,223	11	28,234
Tennessee	105	45,312	394	0	0	0	0	45,706	510	46,216
Texas	273	522,883	1,558	0	0	0	1,500	525,941	4,070	530,011
Utah	8	5,988	0	0	0	0	0	5,988	0	5,988
Virgin Islands	19	3,641	0	0	0	0	0	3,641	35	3,676
Virginia	184	127,367	113,127	0	0	0	0	240,494	4,062	244,556
Washington	57	73,452	0	0	0	0	7,063	80,515	11,653	92,168
West Virginia	24	12,119	280	0	0	0	1,505	13,904	0	13,904
Wisconsin	72	24,885	55	0	0	0	0	24,940	1,090	26,030
Total	3,748	4,263,747	137,947	0	0	0	53,692	4,455,386	233,487	4,688,873

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

Projected Quantities of TRI Chemicals Managed in Waste, 1998–2000

Petroleum terminals and bulk storage facilities reporting to TRI expected their production-related waste to increase by 17.3 percent from 1998–2000, from a total of 60.0 million pounds to 70.4 million pounds, as shown in Table 3–44. The projected increase represents an increase of 13.8 percent expected in 1999 followed by a smaller increase of 3.1 percent expected in 2000. The projected increase from 1998–2000 is expected to come from an increase of 49.5 percent in on-site recycling, as well as increases in on-site energy recovery and treatment.

Other types of waste management are expected to decrease. Quantities released on- and off-site—the least desirable outcome under the waste management hierarchy (described in **Waste Management** in Chapter 1)—are projected to decrease from 1998–2000 by 3.7 percent. Other types of off-site waste management are expected to decrease as well, off-site energy recovery by 75.0 percent, off-site treatment by 46.2 percent, and off-site recycling by 1.3 percent.

The projections indicate a change in waste management practices from these off-site waste management activities and quantities released on- and off-site towards on-site recycling. The percentage of waste managed through on-site recycling would rise

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
Petroleum Terminals and Bulk Storage Facilities (SIC Code 5171)**

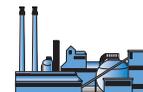


Table 3–42. Summary of TRI Information by State, 1998: Petroleum Bulk Terminals (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Northern Marianas	0	0	0	0	0	0	3,091	3,091	1
Ohio	2,905,029	39,930	0	326	516,483	3,416	104,671	3,569,855	3,898
Oklahoma	0	0	0	0	29,820	21	46,497	76,338	0
Oregon	0	29	0	8,239	1,455	401,774	59,447	470,944	1
Pennsylvania	153,713	9,829,142	0	1,612	18,955	1,327	10,038,394	20,043,143	1,346
Puerto Rico	0	0	0	15,577	0	2,061	20,448	38,086	0
Rhode Island	0	0	0	307	124,573	985	84,202	210,067	0
South Carolina	1,396	169	0	0	0	11	24,072	25,648	80
Tennessee	2,049	5,146	0	0	0	10,401	34,580	52,176	75
Texas	8,604,506	424,810	0	172,530	1,872,022	15,537	780,920	11,870,325	259,743
Utah	0	0	0	0	0	6,297	4,776	11,073	0
Virgin Islands	0	0	0	0	0	0	2,055	2,055	0
Virginia	2,952	45,321	0	1	197	4,563	133,488	186,522	111,913
Washington	0	425	0	397	645,162	70,164	90,699	806,847	0
West Virginia	0	0	0	3,417	0	129	6,861	10,407	40
Wisconsin	932	3,516	0	410	0	866	25,093	30,817	1,373
Total	22,799,308	11,136,986	6	337,216	9,808,300	1,166,481	14,713,310	59,961,607	942,486

Note: Data are from Section 8 of Form R.

from 38.0 percent of total production-related waste in 1998 to 48.4 percent in 2000. At the same time, the percentage of quantities released on- and off-site were expected to fall from 24.5 percent in 1998 to 20.1 percent in 2000, with similar reductions in percentage of off-site recycling, energy recovery and treatment.

Source Reduction

Sixteen percent of the Form Rs submitted by the petroleum terminals and bulk storage facilities in 1998 reported source reduction activity undertaken during the year (see Table 3–45). As noted in **Waste Management** in Chapter 1, source reduction is activity that prevents the generation of waste and is the preferred waste management option.

Facilities with only petroleum terminals and bulk storage operations reported the largest number of forms and reported source reduction activities on 16.2 percent of them. These facilities identified spill and leak prevention on 380 forms and good operating practices on 110 forms, making them the most frequent source reduction activities in the industry. The facilities with a combination of petroleum terminals and bulk storage and petroleum refining reported smaller numbers of forms but source reduction activity on a greater percentage of the forms. These facilities reported source reduction activity on 21.4 percent of the Form Rs. They also identified good operating practices as the source reduction activity undertaken.



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Petroleum Terminals and Bulk Storage Facilities (SIC Code 5171)**

Table 3-43. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1998: Petroleum Bulk Terminals

CAS Number	Chemical	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
1634-04-4	Methyl tert-butyl ether	1,553,211	7,161	0	0	0	3,123	1,563,495	46,104	1,609,599
108-88-3	Toluene	682,054	5,292	0	0	0	17,959	705,305	50,224	755,529
110-54-3	n-Hexane	687,799	1,661	0	0	0	2,488	691,948	23,903	715,851
1330-20-7	Xylene (mixed isomers)	394,067	5,039	0	0	0	18,919	418,025	43,823	461,848
71-43-2	Benzene	348,185	3,683	0	0	0	2,727	354,595	15,679	370,274
95-63-6	1,2,4-Trimethylbenzene	130,767	686	0	0	0	3,045	134,498	12,859	147,357
100-41-4	Ethylbenzene	114,191	2,491	0	0	0	3,453	120,135	16,735	136,870
107-21-1	Ethylene glycol	1,072	111,765	0	0	0	500	113,337	0	113,337
91-20-3	Naphthalene	79,582	36	0	0	0	24	79,642	11,035	90,677
110-82-7	Cyclohexane	80,368	28	0	0	0	266	80,662	4,175	84,837
74-85-1	Ethylene	36,530	0	0	0	0	0	36,530	0	36,530
115-07-1	Propylene	30,490	0	0	0	0	0	30,490	0	30,490
78-93-3	Methyl ethyl ketone	27,163	0	0	0	0	0	27,163	0	27,163
75-65-0	tert-Butyl alcohol	22,995	21	0	0	0	10	23,026	3,225	26,251
7664-41-7	Ammonia	21,534	0	0	0	0	0	21,534	0	21,534
	Subtotal	4,210,008	137,863	0	0	0	52,514	4,400,385	227,762	4,628,147
	Total	4,263,747	137,947	0	0	0	53,692	4,455,386	233,487	4,688,873

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

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Table 3–44. Current Year and Projected Quantities of TRI Chemicals in Waste, 1998–2000: Petroleum Bulk Terminals

Waste Management Activity	Current Year 1998		Projected 1999		Projected 2000	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
Recycled On-site	22,799,308	38.0	32,352,179	47.4	34,075,627	48.4
Recycled Off-site	11,136,986	18.6	10,985,661	16.1	10,991,581	15.6
Energy Recovery On-site	6	0.0	21	0.0	25	0.0
Energy Recovery Off-site	337,216	0.6	82,666	0.1	84,284	0.1
Treated On-site	9,808,300	16.4	9,863,599	14.5	10,408,458	14.8
Treated Off-site	1,166,481	1.9	831,224	1.2	627,492	0.9
Quantity Released On- and Off-site	14,713,310	24.5	14,105,045	20.7	14,171,876	20.1
Total Production-related Waste	59,961,607	100.0	68,220,395	100.0	70,359,343	100.0
Waste Management Activity	Projected Change 1998–1999		Projected Change 1999–2000		Projected Change 1998–2000	
	Percent	Percent	Percent	Percent	Percent	Percent
Recycled On-site	41.9		5.3		49.5	
Recycled Off-site	–1.4		0.1		–1.3	
Energy Recovery On-site	250.0		19.0		316.7	
Energy Recovery Off-site	–75.5		2.0		–75.0	
Treated On-site	0.6		5.5		6.1	
Treated Off-site	–28.7		–24.5		–46.2	
Quantity Released On- and Off-site	–4.1		0.5		–3.7	
Total Production-related Waste	13.8		3.1		17.3	

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1998.

Table 3–45. Number of Forms Reporting Source Reduction Activity, 1998: Petroleum Bulk Terminals

SIC Code	Industry	Total Form Rs Number	Forms Reporting Source Reduction Activity		Category of Source Reduction Activity							
			Number	Percent of All Form Rs	Good Operating Practices Number	Inventory Control Number	Spill and Leak Prevention Number	Raw Material Modifications Number	Process Modifications Number	Cleaning and Degreasing Number	Surface Preparation and Finishing Number	Product Modifications Number
5171	Petroleum Terminals and Bulk Stations	3,244	527	16.2	110	0	380	1	21	3	0	11
	SIC code 5171 and SIC code 29 (Petroleum Refining)	14	3	21.4	3	0	0	0	0	0	0	0
	Total	3,258	530	16.3	113	0	380	1	21	3	0	11

Note: All source reduction activities on a form are counted in the corresponding category. Totals do not equal the sum of the categories because forms may report more than one source reduction activity.



❖ RCRA Subtitle C Treatment, ❖ Storage, and Disposal Facilities (in SIC Code 4953) and Solvent Recovery Facilities (in SIC Code 7389)

Introduction

Facilities regulated under the Resource Conservation and Recovery Act (RCRA), subtitle C, receive hazardous wastes from other facilities or from other operations at their own facilities and treat, store and dispose of the wastes. These treatment, storage and disposal (TSD) facilities are categorized among refuse systems in SIC code 4953, as shown in Box 3–8. This SIC code also includes many refuse facilities that col-

lect and dispose of non-hazardous waste; they are not covered by RCRA subtitle C and are not required to report to TRI.

TSD facilities obtain RCRA subtitle C hazardous waste permits from EPA that regulate how they may treat, store, and dispose of the wastes. RCRA subtitle C establishes a federal program to manage hazardous wastes from cradle to grave to ensure that hazardous waste is handled in a manner that protects human health and the envi-

Box 3–8. SIC Codes 495, Sanitary Services, and 738, Miscellaneous Business Services: Codes and Classifications Required to Report to TRI

SIC Codes 495, Sanitary Services, and 738, Miscellaneous Business Services: Codes and Classifications Required to Report to TRI

4953	Refuse Systems	Collection and disposal of refuse by processing or destruction. Operation of incinerators, waste treatment plants, landfills, or other disposal sites.
<i>TRI reporting in SIC code 4953 is limited to facilities regulated under the Resource Conservation and Recovery Act, subtitle C, 42 U.S.C. section 6921 et seq.</i>		
7389	Business Services, Not Elsewhere Classified	Furnishing business services, not elsewhere classified.
<i>TRI reporting in SIC code 7389 is limited to facilities primarily engaged in solvent recovery services on a contract or fee basis.</i>		

Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: RCRA Subtitle C Treatment, Storage and Disposal Facilities (SIC Code 4953) and Solvent Recovery Facilities (SIC Code 7389)

ronment. It regulates hazardous waste generators, transporters, and TSD facilities.

Solvent recovery facilities receive spent solvents and recover them for further use. Only facilities that recover solvents on a contract or fee basis are required to report to TRI. This business activity is one of many categorized in miscellaneous business services (SIC code 7389), also listed in Box 3–8.

Products and Services

TSD facilities treat hazardous wastes containing TRI chemicals by incineration and by various wastewater treatment methods. TSDs dispose of the wastes they receive in landfills and underground injection wells. Their activities also include recovery of solvents, metals and other TRI substances. TSDs receive hazardous waste for processing from a wide variety of industrial facilities and business, including manufacturers, hospitals, and universities. Small businesses and laboratories may also use TSD services to manage and dispose of their hazardous waste.

Solvent recovery facilities typically use a heat-based recovery system, such as distillation, to recover chemicals from waste that can then be sold for use as solvents again. Solvent recovery services receive spent solvents from industrial users such as chemical manufacturers, printers, electronic and photographic industries, textile plants and food processors. Other industrial processes that use organic solvents include painting and coating, metal degreasing and dry cleaning; spent solvents from these activities may also be sent to recovery services. Some TSDs send solvents to these recovery-services facilities as well.

In addition, some TSD and solvent recovery facilities may engage in fuel-blending to adjust the heat value of the waste for optimal energy recovery.

Employment and Production

In 1997, 2,025 TSDs subject to RCRA permitting managed 37.7 million tons of hazardous wastes. This represented an increase of 42 facilities and an apparent decrease of 170.5 million tons since 1995. The reduction in the amount of waste managed resulted largely from a change in reporting requirements for wastewater. When 1995 data are adjusted to the same reporting basis, the changes from 1995 to 1997 show increases of 43 facilities and 2.6 million tons. These amounts of hazardous waste include the total volume of the waste stream, both the hazardous constituents and the medium (water or soil). As explained in “General Environmental Issues” later in this chapter, these amounts also include corrosive and ignitable wastes, which may not contain toxic compounds.

Employment in the hazardous waste treatment and disposal industry totaled 17,816 in 1997, with receipts of \$2.88 billion.

General Environmental Issues

While many industries and business activities generate hazardous waste as a result of their ongoing operations, TSD facilities and solvent recovery services are unique among TRI-covered entities in having hazardous waste as their principal input. They also use TRI chemicals in treating and processing the wastes and spent solvents. For example, they may use reactants or stabilizers in recovery processes. Similarly, TSDs



may use solvents to extract organic compounds from waste mixtures.

RCRA hazardous wastes include not only toxic compounds but also corrosive or ignitable wastes that may not include TRI chemicals and other toxic substances. Hazardous wastes generators, transporters, and TSD facilities report under RCRA's Biennial Reporting System (BRS). Reporting requirements in BRS do not allow for determination of amounts of particular chemicals in the wastes. One study of 1991 BRS data estimated that approximately 27 percent of the volume of hazardous waste generated consisted of TRI chemicals.

Many TSDs and solvent recovery services also package hazardous waste at the customer's site and transport the material to the TSD or recovery plant. Packaging and transportation activities are also regulated under RCRA.

Processes Involving Toxic Chemicals

TSDs and solvent recovery facilities receive both liquid and solid hazardous waste. Both types of facilities treat or recover spent solvents, which are also in liquid form. Some solvent waste streams are sent directly to treatment rather than to recovery operations.

TSDs and solvent recovery facilities receive liquid wastes in drums and other containers. They may store the containers as received, transfer the contents into holding tanks, or place the waste directly into pretreatment units. Storage tanks and pretreatment units consist of primary tanks, secondary containment, and associated equipment (such as piping, flanges and valves).

Drums and other containers that are no longer in use may be washed and triple-rinsed. They are then returned to the generators for reuse or sent to a drum conditioner.

Pretreatment of liquid hazardous waste may include filtering to remove solids such as inert materials as well as removal of metals, acid/base neutralization, and other steps. Larger industrial customers of TSDs typically pre-treat wastewater before transferring waste to TSDs. Some TSD facilities operate hazardous waste incinerators that thermally decompose organic constituents of liquid waste. The four most common types of incineration are liquid injection, rotary kiln, fluidized bed and fixed hearth.

In solvent recovery, pretreatment processes include blending to stabilize the solvent, neutralization to adjust pH values, filtration and separation to remove debris and other organic compounds, decanting to separate and draw off the desirable solvent form and/or thermal drying to remove water and volatile organics. Most of these processes are tank-based.

The principal method of solvent recovery is distillation, in which heat is applied to liquid solvent waste to generate vapors. Differences in volatility of the components of the waste lead to separation. The heat may also convert compounds in the waste into other TRI chemicals, such as methyl ethyl ketone, trichloroethylene, 1,1,1-trichloroethane or toluene. These materials are recovered and sold or otherwise distributed into commerce. As with liquid hazardous waste, solvent recovery and treatment generates wastewater.

Treatment of liquid hazardous waste and treatment or recovery of solvents generates



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wastewater from cleaning and other processes.

Treatment processes result in hazardous waste in solid form. Facilities stabilize the solid hazardous waste, including waste they receive directly from customers, by mixing it with binders or other materials and curing the resulting mixture. This stabilization is also referred to as waste fixation or solidification. The waste is then disposed of to land or in underground injection wells. On-site land disposal includes placing the waste in landfills regulated under RCRA subtitle C, other landfills, land treatment/application farming units, or surface impoundments.

Management of Toxic Chemicals in Waste

Releases may occur during storage and transport of wastes received, during pretreatment and treatment/recovery processes, during packaging of recovered products for distribution, and during (and after) disposal.

Storage and transport releases occur as air emissions, resulting from evaporative losses from storage tanks or during filling or emptying of tanks. A primary source of evaporative losses is displacement of vapors in partially filled tanks as more liquid enters. The use of vapor equalization or vapor recovery equipment can reduce evaporative losses from tanks. Vapor equalization equipment uses the gas being displaced from the tank being filled to provide the gas needed in the tank being emptied. Vapor recovery equipment captures organic vapors and pipes them to storage or to a thermal oxidation unit where the vapor is combusted.

Air emissions also come from distillation columns through vents or equipment leaks. Leaks from pipes, flanges and valves may occur as air emissions or in liquid form as wastewater. Storm water runoff may also contain TRI chemicals from spills during transfers to storage or treatment equipment.

Pretreatment and treatment processes generate wastewater. Other sources include washing and rinsing of drums and containers, tank washing, draining of secondary containment areas, oil-and-water separators, and spills or tank failures. In tanks, wastewater may also form as a separate layer that can be periodically drained and treated. Wastewaters at TSD and solvent recovery facilities are treated through such methods as chromium reduction, equalization, metals precipitation, flocculation (forming an aggregation material of fine suspended particles), filtration or settling, neutralization, wastewater air stripping, and biological treatment.

Sludge and semi-solid residuals may result as heavy compounds settle during storage or as a result of periodic cleaning of pretreatment equipment and distillation columns. Along with ash from incineration and sludge from dewatering, these materials are generally disposed of in landfills or underground injection wells.

Incineration typically produces bottom ash and fly ash. Bottom ash may require stabilization before disposal. Fly ash passes through air pollution control equipment (baghouses, scrubbers, and/or precipitators). Depending on the waste constituents entering the incinerators, ash and wastewater from scrubbers may contain metals (which do not combust), organic chemicals not completely combusted, and acids pro-



duced from chlorine, fluorine or sulfur during combustion.

1998 TRI Data for RCRA Subtitle C and Solvent Recovery Facilities

On- and Off-site Releases

RCRA subtitle C and solvent recovery facilities reported 281.8 million pounds of TRI chemicals released on- and off-site in 1998, as shown in Table 3–46. The majority of the releases, 196.6 million pounds, was to on-site RCRA subtitle C landfills. Figure 3–15 shows that releases to on-site RCRA subtitle C landfills amounted to 69.8 percent of the industry’s total releases.

The industry’s second-largest release type, off-site releases (transfers off-site to disposal), totaled 47.8 million pounds, representing 16.9 percent of total releases. The RCRA subtitle C and solvent recovery industry

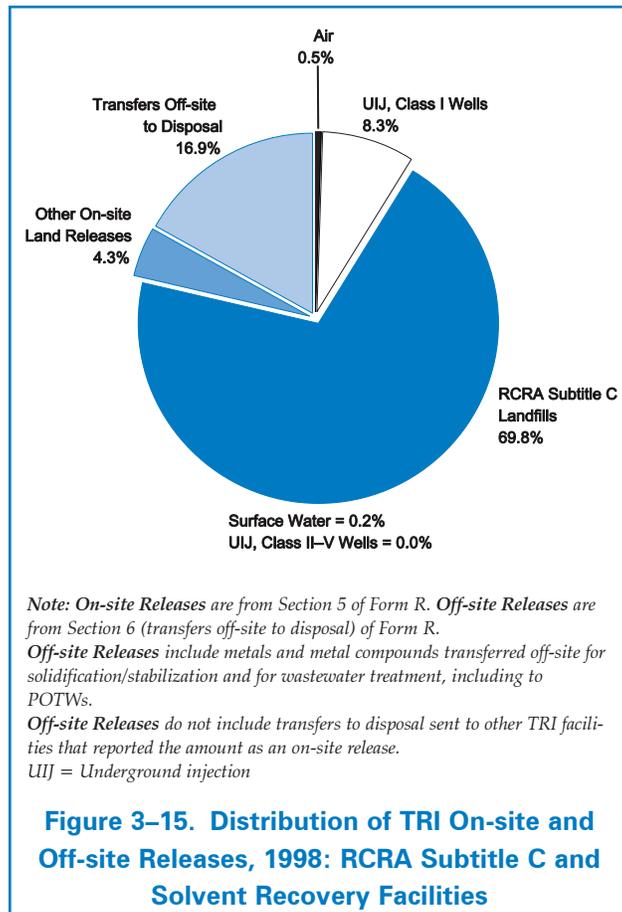


Figure 3–15. Distribution of TRI On-site and Off-site Releases, 1998: RCRA Subtitle C and Solvent Recovery Facilities

**Table 3–46. TRI On-site and Off-site Releases by 4-digit SIC Code, 1998:
RCRA Subtitle C and Solvent Recovery Facilities**

SIC Code	Industry	Total Forms Number	On-site Releases						Total On-site Releases Pounds	Off-site Releases	
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases			Transfers Off-site to Disposal Pounds	Total On- and Off-site Releases Pounds
					Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
4953	RCRA Subtitle C Facilities	2,076	472,389	580,402	23,425,006	0	164,943,377	11,067,108	200,488,282	37,619,455	238,107,737
7389	Solvent Recovery Services	322	741,314	0	0	0	0	0	741,314	9,106,430	9,847,744
	SIC code 4953 and SIC code 7389	84	89,607	0	0	0	31,641,000	0	31,730,607	1,009,796	32,740,403
	SIC code 4953 and SIC code 5169 (Chemical Wholesalers)	5	2,480	0	0	0	0	0	2,480	0	2,480
	SIC code 4953 and SIC code 34 (Fabricated Metals)	11	15	0	0	0	0	1,100,084	1,100,099	16,956	1,117,055
	Total	2,498	1,305,805	580,402	23,425,006	0	196,584,377	12,167,192	234,062,782	47,752,637	281,815,419

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: RCRA Subtitle C Treatment, Storage and Disposal Facilities (SIC Code 4953) and Solvent Recovery Facilities (SIC Code 7389)

also reported 23.4 million pounds injected underground into Class I wells, representing 8.3 percent of total releases for this industry, and 12.2 million pounds of other on-site land releases, for 4.3 percent of total releases (types of underground injection wells and on-site land releases are described in Box 1–4 in Chapter 1).

Facilities with RCRA subtitle C operations only reported the largest total releases with 238.1 million pounds, representing 84.5 percent of total releases for this industry. These facilities reported 164.9 million pounds of TRI chemicals released on-site to RCRA subtitle C landfills. Another 37.6 million pounds was transferred off-site for disposal and 23.4 million pounds was injected underground in Class I wells.

Facilities that had both RCRA subtitle C and solvent recovery operations reported the second-largest total releases for this industry. These facilities reported 32.7 mil-

lion pounds of total releases with 31.6 million pounds going to RCRA subtitle C landfills on-site. Facilities with only solvent recovery operations had the third-largest total releases with 9.8 million pounds. Over 9.1 million pounds of this amount was transferred off-site for disposal.

Waste Management Data

Quantities of TRI Chemicals in Waste

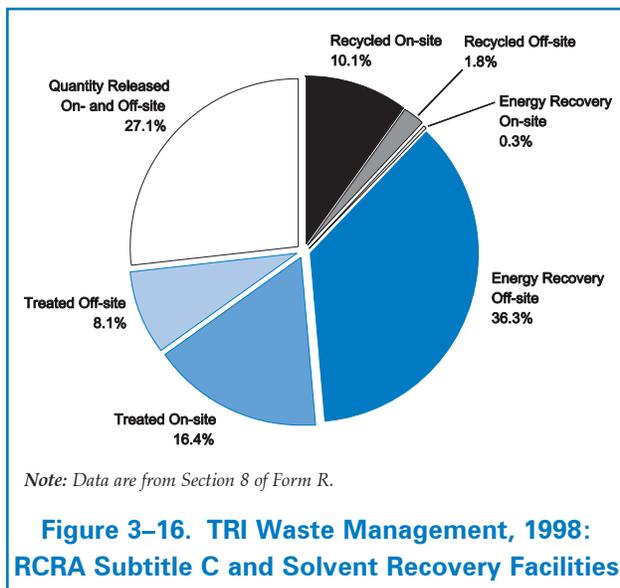
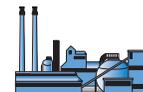
The RCRA subtitle C and solvent recovery industry reported managing 1.08 billion pounds of total production-related waste in 1998, as shown in Table 3–47. Off-site energy recovery totaled 392.7 million pounds, or 36.3 percent of the industry’s production-related waste (see Figure 3–16). The industry’s quantities released on- and off-site totaled 292.5 million pounds, or 27.1 percent of the total. On-site treatment amounted to 176.8 million pounds, representing 16.4 percent of the total, and on-site

Table 3–47. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1998: RCRA Subtitle C and Solvent Recovery Facilities

SIC Code	Industry	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
		On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
4953	RCRA Subtitle C Facilities	39,634,508	5,855,777	3,287,608	203,190,698	173,594,286	38,805,738	248,516,533	712,885,148	125,028
7389	Solvent Recovery Services	35,169,201	13,155,647	0	63,697,071	3,179,486	5,930,050	10,364,184	131,495,639	153
	SIC code 4953 and SIC code 7389	34,133,345	845,526	0	125,821,088	18,907	42,413,971	32,554,043	235,786,880	0
	SIC code 4953 and SIC code 5169 (Chemical Wholesalers)	0	0	0	2,310	0	6,990	2,480	11,780	0
	SIC code 4953 and SIC code 34 (Fabricated Metals)	0	4,617	0	0	0	6,118	1,100,091	1,110,826	0
	Total	108,937,054	19,861,567	3,287,608	392,711,167	176,792,679	87,162,867	292,537,331	1,081,290,273	125,181

Note: Data are from Section 8 of Form R.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
RCRA Subtitle C Treatment, Storage and Disposal Facilities (SIC Code 4953) and
Solvent Recovery Facilities (SIC Code 7389)**



recycling amounted to 108.9 million pounds, 10.1 percent of the total.

Facilities with RCRA subtitle C operations only reported 712.9 million pounds of total production-related waste managed, or 65.9 percent of the total for this industry. These facilities reported 248.5 million pounds of

quantities released on- and off-site, 203.2 million pounds sent for energy recovery off-site, and 173.6 million pounds treated on-site.

Facilities reporting both RCRA subtitle C and solvent recovery operations reported 235.8 million pounds of total production-related waste managed, representing 21.8 percent of the total for this industry. These facilities reported 125.8 million pounds as off-site energy recovery. Facilities with only solvent recovery operations reported 131.5 million pounds of total production-related waste managed, or 12.2 percent of the total for this industry. These facilities reported 63.7 million pounds as off-site energy recovery.

Transfers Off-site for Further Waste Management/Disposal

The RCRA subtitle C and solvent recovery industry reported 553.8 million pounds of transfers off-site for further waste manage-

Table 3-48. TRI Transfers Off-site for Further Waste Management/Disposal by 4-digit SIC Code, 1998: RCRA Subtitle C and Solvent Recovery Facilities

SIC Codes	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs		Other Transfers Off-site to Disposal* Pounds	Total Transfers for Further Waste Management/Disposal Pounds
					Non-metal TRI Chemicals Pounds	Metals and Metal Compounds Pounds		
4953	RCRA Subtitle C Facilities	6,874,556	217,250,305	19,084,165	1,057,666	486,585	42,100,135	286,853,412
7389	Solvent Recovery Services	11,404,651	63,686,599	7,483,142	154,765	0	9,127,825	91,856,982
	SIC code 4953 and SIC code 7389	845,531	130,389,114	42,640,968	1,291	0	1,168,594	175,045,498
	SIC code 4953 and SIC code 5169 (Chemical Wholesalers)	0	2,310	6,990	0	0	0	9,300
	SIC code 4953 and SIC code 34 (Fabricated Metals)	4,839	0	2,208	0	0	17,096	24,143
Total		19,129,577	411,328,328	69,217,473	1,213,722	486,585	52,413,650	553,789,335

Note: Data are from Section 6 of Form R.

*Does not include transfers of metals and metal compounds to POTWs.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: RCRA Subtitle C Treatment, Storage and Disposal Facilities (SIC Code 4953) and Solvent Recovery Facilities (SIC Code 7389)

ment and disposal in 1998, as shown in Table 3–48. Figure 3–17 shows that transfers off-site to energy recovery represented 74.3 percent of all transfers for further waste management and disposal. The industry also reported 69.2 million pounds sent off-site to treatment, accounting for 12.5 percent of the total.

Facilities with RCRA subtitle C operations only reported 51.8 percent of total transfers off-site for further waste management and disposal in this industry, a total of 286.9 million pounds, primarily as transfers sent off-site for energy recovery. These facilities sent 217.3 million pounds off-site for energy recovery and 42.1 million pounds of other transfers off-site for disposal.

Facilities with both RCRA subtitle C and solvent recovery operations reported 175.0 million pounds, or 31.6 percent of the total such transfers for this industry. These facilities reported 130.4 million pounds sent off-site for energy recovery and 42.6 million pounds sent off-site for treatment.

TRI Data by State

Facilities in the RCRA subtitle C and solvent recovery industry in Texas submitted the largest number of forms, with 388 forms. One other state, Ohio with 373 forms, also submitted more than 300 forms.

On- and Off-site Releases

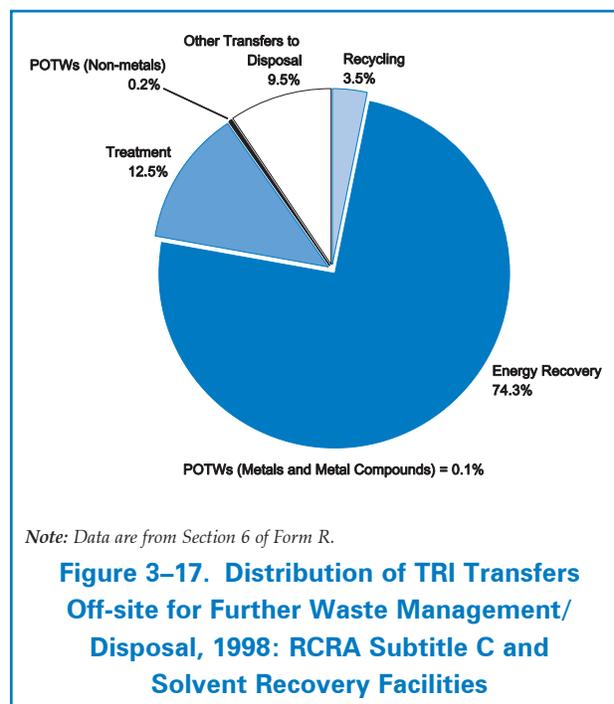
The RCRA subtitle C and solvent recovery industry in Ohio reported the largest total on- and off-site releases in 1998, as shown in Table 3–49. As shown in Map 3–6, the four states of Ohio, Idaho, Illinois, and California reported the largest amounts of total releases in 1998, over 20 million pounds each.

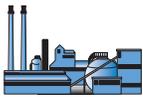
Ohio facilities in this industry reported total releases of 77.7 million pounds. These facilities reported 50.5 million pounds released on-site to RCRA subtitle C landfills, the largest such amount of any state. They also reported the largest amount injected underground in Class I wells, 17.8 million pounds.

Idaho ranked second with 31.7 million pounds of total releases, primarily as 31.6 million pounds released in on-site RCRA subtitle C landfills. Illinois ranked third with 24.8 million pounds of total releases, and California ranked fourth with 20.3 million pounds. Each of these states reported most of their total releases in on-site RCRA subtitle C landfills. Facilities in Indiana, ranked eighth overall, reported the largest amount of off-site releases, with 11.1 million pounds transferred off-site to disposal.

Waste Management Data

Michigan was the state with the largest total production-related waste managed in the RCRA subtitle C and solvent recovery





**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
RCRA Subtitle C Treatment, Storage and Disposal Facilities (SIC Code 4953) and
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Table 3–49. Summary of TRI Information by State, 1998: RCRA Subtitle C and Solvent Recovery Facilities

State	Total Forms Number	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
				Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
Alabama	43	13,838	0	0	0	12,060,964	0	12,074,802	165,104	12,239,906
Arizona	6	997	0	0	0	0	0	997	5	1,002
Arkansas	140	22,492	49	0	0	22,800	0	45,341	212,836	258,177
California	158	53,196	0	0	0	19,813,437	308,756	20,175,389	155,642	20,331,031
Connecticut	16	0	0	0	0	0	0	0	739,191	739,191
Florida	6	18,109	0	0	0	0	9,840	27,949	0	27,949
Georgia	6	17,488	0	0	0	0	0	17,488	0	17,488
Idaho	17	12,465	0	0	0	31,641,000	0	31,653,465	40	31,653,505
Illinois	147	82,283	10	0	0	21,607,926	173,297	21,863,516	2,908,792	24,772,308
Indiana	127	38,667	1,345	0	0	1,257,263	0	1,297,275	11,103,121	12,400,396
Iowa	2	10	0	0	0	0	0	10	0	10
Kansas	13	17,113	0	0	0	0	0	17,113	7,564	24,677
Kentucky	88	41,604	15	0	0	0	1,100,084	1,141,703	1,573,146	2,714,849
Louisiana	51	1,583	2	530,351	0	3,803,510	0	4,335,446	122,371	4,457,817
Maryland	1	6	0	0	0	0	0	6	0	6
Massachusetts	12	4,986	5	0	0	0	0	4,991	1,231,461	1,236,452
Michigan	155	126,173	0	0	0	8,258,900	0	8,385,073	3,693,902	12,078,975
Minnesota	8	345	0	0	0	0	0	345	1,000	1,345
Mississippi	1	2	0	0	0	0	0	2	0	2
Missouri	11	11,552	75	0	0	17,494	0	29,121	0	29,121
Nebraska	56	16,003	0	0	0	0	168,694	184,697	25,034	209,731
Nevada	18	1,865	0	0	0	1,321,200	0	1,323,065	69,232	1,392,297
New Jersey	152	25,429	741	0	0	0	0	26,170	2,326,678	2,352,848
New Mexico	2	5,990	0	0	0	0	0	5,990	0	5,990
New York	22	922	816	0	0	6,231,080	0	6,232,818	50,822	6,283,640
North Carolina	15	66,755	43	0	0	0	0	66,798	480,157	546,955
Ohio	373	304,834	1,028	17,841,000	0	50,522,000	0	68,668,862	9,029,130	77,697,992
Oklahoma	21	1,737	0	1,109,751	0	6,642,012	0	7,753,500	130,236	7,883,736
Oregon	35	4,265	0	0	0	6,105,389	6,723,810	12,833,464	9,851	12,843,315
Pennsylvania	57	5,452	556,760	0	0	1,116,200	2,824,100	4,502,512	1,893,158	6,395,670
Puerto Rico	6	264,929	0	0	0	0	0	264,929	59,843	324,772
Rhode Island	4	422	0	0	0	0	0	422	863	1,285

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R.

Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs.

Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
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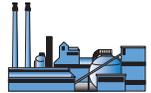


Table 3–49. Summary of TRI Information by State, 1998: RCRA Subtitle C and Solvent Recovery Facilities (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
Alabama	4,153,054	252,789	0	29,555,869	3,873	214,508	12,359,925	46,540,018	282
Arizona	2,667,961	0	0	9,756	14,656	2	881	2,693,256	1
Arkansas	400,082	434,534	3,164,825	4,402,565	25,563,977	68,112	486,945	34,521,040	2
California	2,369,984	1,051,356	0	7,532,021	1,788,348	929,085	20,981,539	34,652,333	173
Connecticut	0	0	0	0	234,487	32,407	1,063,530	1,330,424	9
Florida	443,479	195,333	0	702,177	692,337	0	768,411	2,801,737	0
Georgia	0	180,764	0	0	354,728	0	16,928	552,420	0
Idaho	0	0	0	0	0	0	31,641,000	31,641,000	0
Illinois	7,687,441	874,085	0	13,345,080	15,714,874	3,310,657	25,051,641	65,983,778	0
Indiana	8,904,600	496,723	0	80,645,915	2,815,172	131,905	14,107,071	107,101,386	76
Iowa	0	309,122	0	0	0	0	10	309,132	0
Kansas	135,823	312,550	0	0	795,198	29,630	25,561	1,298,762	27
Kentucky	0	191,900	0	10,433,058	5,652,855	2,211,127	1,139,787	19,628,727	5
Louisiana	0	70,816	0	910	173,123	412,223	4,337,150	4,994,222	0
Maryland	0	192,574	0	0	0	0	6	192,580	0
Massachusetts	56,630	261,113	0	260,070	0	116,244	2,102,808	2,796,865	6
Michigan	32,450,995	587,155	0	130,002,805	1,300,655	43,963,197	11,415,455	219,720,262	17
Minnesota	4,030,989	1,152,410	0	0	78,543	11,698	969	5,274,609	0
Mississippi	0	78,962	0	0	0	0	2	78,964	0
Missouri	9,555	572,702	0	0	96,384	0	30,818	709,459	28,903
Nebraska	0	65,559	0	84,564	10,095,636	53,224	291,764	10,590,747	0
Nevada	0	1,290,407	0	0	1,571,156	420,409	1,323,054	4,605,026	0
New Jersey	8,210,631	389,444	0	22,213,059	19,852,587	628,929	2,480,949	53,775,599	42
New Mexico	0	0	0	0	440,000	0	6,000	446,000	0
New York	0	265,146	0	0	286,000	56,831	6,283,396	6,891,373	1
North Carolina	0	836,851	0	0	256,000	12,500	611,133	1,716,484	4
Ohio	5,776,849	1,719,734	0	23,890,411	17,253,160	26,325,028	77,250,474	152,215,656	83,025
Oklahoma	0	0	0	0	154,000	1,995	7,880,837	8,036,832	21
Oregon	0	56,569	0	0	364,676	559,298	23,928,531	24,909,074	47
Pennsylvania	0	1,182,151	0	0	4,288,778	358,704	6,392,516	12,222,149	0
Puerto Rico	3,860,419	1,875,384	0	8,545,872	114,191	2,068,828	332,578	16,797,272	1
Rhode Island	120,974	108,500	0	0	0	768,783	846	999,103	0

Note: Data are from Section 8 of Form R.



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Table 3–49. Summary of TRI Information by State, 1998: RCRA Subtitle C and Solvent Recovery Facilities (continued)

State	Total Forms Number	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Off-site Releases Transfers Off-site to Disposal Pounds	
South Carolina	154	42,891	0	0	0	5,145,517	2	5,188,410	9,019,382	14,207,792
Tennessee	47	7,364	7,039	0	0	0	0	14,403	64,219	78,622
Texas	388	59,572	12,474	3,943,904	0	5,482,518	107	9,498,575	1,144,534	10,643,109
Utah	71	3,237	0	0	0	15,535,167	858,502	16,396,906	50,623	16,447,529
Virginia	6	4,937	0	0	0	0	0	4,937	0	4,937
Washington	37	0	0	0	0	0	0	0	1,469,733	1,469,733
West Virginia	1	6	0	0	0	0	0	6	0	6
Wisconsin	25	26,286	0	0	0	0	0	26,286	14,967	41,253
Total	2,498	1,305,805	580,402	23,425,006	0	196,584,377	12,167,192	234,062,782	47,752,637	281,815,419

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

Most of the releases of zinc and zinc compounds consisted of releases on-site to RCRA subtitle C landfills, with 66.6 million pounds for zinc and 31.5 million pounds for zinc compounds. Also reported for zinc compounds were 8.1 million pounds of off-site transfers to disposal and 1.3 million pounds of other on-site land releases.

Eight of the 15 chemicals reported more than 75 percent of their total releases as releases on-site to RCRA subtitle C landfills. Two chemicals, ethylene glycol and nickel, had the majority of their releases as transfers off-site to disposal. Two, nitrate compounds and nitric acid, had the majority of their releases injected underground into Class I wells.

Projected Quantities of TRI Chemicals Managed in Waste, 1998–2000

RCRA subtitle C and solvent recovery facilities reporting to TRI expected their production-related waste managed to decrease

by 2.3 percent from 1998 to 2000, from a total of 1.08 billion pounds to 1.06 million pounds, as shown in Table 3–51. The projected decrease represents an expected decrease of 3.8 percent in 1999 followed by a small increase of 1.6 percent in 2000.

The projected decrease from 1998 to 2000 is expected to come from a decrease of 11.1 percent in on-site recycling and 9.9 percent in off-site energy recovery. Quantities released on- and off-site—the least desirable outcome under the waste management hierarchy (described in **Waste Management** in Chapter 1)—are projected to decrease slightly from 1998 to 2000 by 0.7 percent. The decreases are expected to offset an increase in on-site treatment of 13.5 percent and off-site treatment of 6.3 percent.

The projections indicate little change in waste management practices. Off-site energy recovery would fall to 33.5 percent of total production-related waste managed in

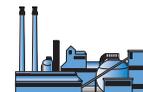


Table 3-49. Summary of TRI Information by State, 1998: RCRA Subtitle C and Solvent Recovery Facilities (continued)

State	Recycled		Energy Recovery		Treated		Quantity Released On- and Off-site Pounds	Total Production-related Waste Managed Pounds	Non-production-related Waste Managed Pounds
	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds	On-site Pounds	Off-site Pounds			
South Carolina	3,948,087	2,014,279	0	25,180,268	12,355,884	1,387,001	14,747,731	59,633,250	0
Tennessee	0	143,759	122,783	3,726,163	217,574	10	73,842	4,284,131	2,691
Texas	14,548,311	1,262,388	0	30,371,704	37,725,162	1,232,927	8,737,439	93,877,931	9,818
Utah	0	0	0	0	16,322,054	46,445	16,618,938	32,987,437	30
Virginia	0	768,195	0	0	216,611	0	4,937	989,743	0
Washington	0	0	0	0	0	0	338	338	0
West Virginia	0	200,269	0	0	0	0	6	200,275	0
Wisconsin	9,161,190	468,044	0	1,808,900	0	1,811,160	41,585	13,290,879	0
Total	108,937,054	19,861,567	3,287,608	392,711,167	176,792,679	87,162,867	292,537,331	1,081,290,273	125,181

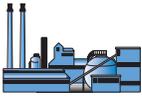
Note: Data are from Section 8 of Form R.

2000 from 36.3 percent in 1998. On-site treatment would rise from 16.4 percent in 1998 to 19.0 percent in 2000. Quantities released on- and off-site would remain at about 27 percent of total production-related waste managed for this industry.

Source Reduction

About eleven percent of the Form Rs submitted by the RCRA subtitle C and solvent recovery industry in 1998 reported source reduction activity undertaken during the year (see Table 3-52). As noted in **Waste Management** in Chapter 1, source reduction is activity that prevents the generation of waste and is the preferred waste management option.

Facilities with a combination of RCRA subtitle C and solvent recovery operations had the largest percentage of forms reporting source reduction activities, with two-thirds of them reporting source reduction activities. These facilities identified two source reduction activities, spill and leak prevention on 82 forms and process modifications on 15 forms. Facilities with solvent recovery services only reported undertaking source reduction activities on 19.4 percent of their Form Rs. These facilities also identified spill and leak prevention and process modifications as the source reduction activities undertaken most often. Facilities with RCRA subtitle C operations only reported source reduction activity on 7.9 percent of their Form Rs, with good operating practices identified most often.



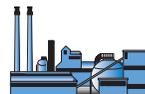
**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
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**Table 3–50. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1998:
RCRA Subtitle C and Solvent Recovery Facilities**

CAS Number	Chemical	On-site Releases							Off-site Releases	Total On- and Off-site Releases Pounds
		Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
				Class I Wells Pounds	Class II–V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
7440-66-6	Zinc (fume or dust)	9,061	0	294,942	0	66,622,097	9,988	66,936,088	92,397	67,028,485
—	Zinc compounds	6,970	957	350,005	0	31,480,984	1,269,336	33,108,252	8,076,066	41,184,318
—	Lead compounds	9,264	563	1,005	0	14,889,426	462,175	15,362,433	3,042,822	18,405,255
1332-21-4	Asbestos (friable)	138	0	0	0	6,364,715	7,162,786	13,527,639	2,142,048	15,669,687
7439-92-1	Lead	3,305	86	23,068	0	11,949,854	230,734	12,207,047	1,060,449	13,267,496
107-21-1	Ethylene glycol	9,892	755	215,158	0	379,252	0	605,057	9,260,638	9,865,695
—	Copper compounds	6,976	838	170,255	0	7,020,760	678,315	7,877,144	1,189,391	9,066,535
—	Nitrate compounds	26	562,592	5,935,087	0	42,590	680,000	7,220,295	731,244	7,951,539
—	Nickel compounds	4,781	963	310,005	0	3,038,709	399,735	3,754,193	3,840,317	7,594,510
—	Chromium compounds	2,623	844	660,355	0	3,078,774	171,101	3,913,697	3,438,948	7,352,645
—	Barium compounds	2,792	369	250	0	5,010,059	88,593	5,102,063	774,918	5,876,981
7697-37-2	Nitric acid	1,623	5	5,300,750	0	63,501	43	5,365,922	194,034	5,559,956
—	Manganese compounds	656	854	85,000	0	4,571,328	83,283	4,741,121	81,073	4,822,194
1344-28-1	Aluminum oxide (fibrous forms)	25	0	0	0	4,451,550	407	4,451,982	141,030	4,593,012
7440-02-0	Nickel	671	916	110,158	0	615,825	35,929	763,499	3,802,723	4,566,222
	Subtotal	58,803	569,742	13,456,038	0	159,579,424	11,272,425	184,936,432	37,868,098	222,804,530
	Total	1,305,805	580,402	23,425,006	0	196,584,377	12,167,192	234,062,782	47,752,637	281,815,419

Note: On-site Releases are from Section 5 of Form R. Off-site Releases are from Section 6 (transfers off-site to disposal) of Form R. Off-site Releases include metals and metal compounds transferred off-site for solidification/stabilization and for wastewater treatment, including to POTWs. Off-site Releases do not include transfers to disposal sent to other TRI facilities that reported the amount as an on-site release.

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
RCRA Subtitle C Treatment, Storage and Disposal Facilities (SIC Code 4953) and
Solvent Recovery Facilities (SIC Code 7389)**



**Table 3–51. Current Year and Projected Quantities of TRI Chemicals in Waste, 1998–2000:
RCRA Subtitle C and Solvent Recovery Facilities**

Waste Management Activity	Current Year 1998		Projected 1999		Projected 2000	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
Recycled On-site	108,937,054	10.1	93,238,352	9.0	96,842,845	9.2
Recycled Off-site	19,861,567	1.8	18,982,016	1.8	18,690,844	1.8
Energy Recovery On-site	3,287,608	0.3	3,341,825	0.3	3,385,825	0.3
Energy Recovery Off-site	392,711,167	36.3	353,183,735	34.0	353,974,532	33.5
Treated On-site	176,792,679	16.4	189,578,192	18.2	200,713,521	19.0
Treated Off-site	87,162,867	8.1	90,562,897	8.7	92,652,209	8.8
Quantity Released On- and Off-site	292,537,331	27.1	290,953,907	28.0	290,411,158	27.5
Total Production-related Waste	1,081,290,273	100.0	1,039,840,924	100.0	1,056,670,934	100.0
Waste Management Activity	Projected Change 1998–1999		Projected Change 1999–2000		Projected Change 1998–2000	
	Percent		Percent		Percent	
Recycled On-site	-14.4		3.9		-11.1	
Recycled Off-site	-4.4		-1.5		-5.9	
Energy Recovery On-site	1.6		1.3		3.0	
Energy Recovery Off-site	-10.1		0.2		-9.9	
Treated On-site	7.2		5.9		13.5	
Treated Off-site	3.9		2.3		6.3	
Quantity Released On- and Off-site	-0.5		-0.2		-0.7	
Total Production-related Waste	-3.8		1.6		-2.3	

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1998.

**Table 3–52. Number of Forms Reporting Source Reduction Activity, 1998:
RCRA Subtitle C and Solvent Recovery Facilities**

SIC Code	Industry	Total Form Rs Number	Forms Reporting Source Reduction Activity		Category of Source Reduction Activity							
			Number	Percent of All Form Rs Percent	Good Operating Practices Number	Inventory Control Number	Spill and Leak Prevention Number	Raw Material Modifications Number	Process Modifications Number	Cleaning and Degreasing Number	Surface Preparation and Finishing Number	Product Modifications Number
4953	RCRA Subtitle C Facilities	1,919	152	7.9	135	0	74	0	27	0	0	0
7389	Solvent Recovery Services	309	60	19.4	29	0	47	0	34	0	0	3
	SIC code 4953 and SIC code 7389	84	56	66.7	0	0	82	0	15	0	0	0
	SIC code 4953 and SIC code 5169 (Chemical Wholesalers)	5	0	0.0	0	0	0	0	0	0	0	0
	SIC code 4953 and SIC code 34 (Fabricated Metals)	11	0	0.0	0	0	0	0	0	0	0	0
	Total	2,328	268	11.5	164	0	203	0	76	0	0	3

Note: All source reduction activities on a form are counted in the corresponding category. Totals do not equal the sum of the categories because forms may report more than one source reduction activity.



Chapter 3 — Toxics Release Inventory Data for New Reporting Industries: RCRA Subtitle C Treatment, Storage and Disposal Facilities (SIC Code 4953) and Solvent Recovery Facilities (SIC Code 7389)

❖ Sources ❖

Information sources for the industry descriptions in this chapter include:

1997 Economic Census, U.S. Census Bureau
<www.census.gov/epcd/www/econ97.html>

Metal Mining

EPCRA Section 313 Industry Guidance: Metal Mining Facilities
<www.epa.gov/tri/industry.htm>

Mining and the Toxics Release Inventory, National Mining Association
<www.nma.org>

Profile of the Metal Mining Industry, EPA Office of Compliance Sector Notebook Project
<www.es.epa.gov/oeca/sector/>

The “**Processes Involving Toxic Chemicals**” section was reviewed by the Western Regional Council, National Mining Association and other groups for comments and suggestions.

Coal Mining

EPCRA Section 313 Industry Guidance: Coal Mining Facilities
<www.epa.gov/tri/industry.htm>

Mining and the Toxics Release Inventory, National Mining Association
<www.nma.org>

Salient Statistics of the Coal Mining Industry, National Mining Association
<www.nma.org>

U.S. Coal Supply and Demand: 1998 Review, Energy Information Administration,
<www.eia.doe.gov/cneaf/coal/cia/new_yr_revu/coalfeat.html>; see also
<www.eia.doe.gov/fuelcoal.html>

The “**Processes Involving Toxic Chemicals**” section was reviewed by the Western Regional Council, National Mining Association, Edison Electric Institute and other groups for comments and suggestions.

Electric Utilities

Electric Power Annual, 1998, US Department of Energy, Energy Information Administration,
<www.eia.doe.gov/cneaf/electricity/page/annual.html>; see also
<www.eia.doe.gov/fuelectric.html>

EPCRA Section 313 Industry Guidance: Electricity Generating Facilities
<www.epa.gov/tri/industry.htm>

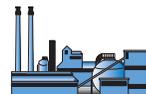
Profile of the Fossil Fuel Electric Power Generation Industry, EPA Office of Compliance Sector Notebook Project
<www.es.epa.gov/oeca/sector/>

The “**Processes Involving Toxic Chemicals**” section was reviewed by the Edison Electric Institute, Western Regional Council, National Mining Association and other groups for comments and suggestions.

Chemical Wholesalers

EPCRA Section 313 Industry Guidance: Chemical Distribution Facilities
<www.epa.gov/tri/industry.htm>

**Chapter 3 — Toxics Release Inventory Data for New Reporting Industries:
RCRA Subtitle C Treatment, Storage and Disposal Facilities (SIC Code 4953) and
Solvent Recovery Facilities (SIC Code 7389)**



EPCRA Section 313: Look-up Tables for Estimating Toxic Release Inventory Air Emissions from Chemical Distribution Facilities

www.epa.gov/tri/industry.htm

Petroleum Terminals and Bulk Stations

EPCRA Section 313 Industry Guidance: Petroleum terminals and bulk storage facilities

www.epa.gov/tri/industry.htm

RCRA Subtitle C/Solvent Recovery

EPCRA Section 313 Industry Guidance: RCRA Subtitle C TSD Facilities and Solvent Recovery Facilities

www.epa.gov/tri/industry.htm

National Biennial RCRA Hazardous Waste Report (Based on 1997 Data)

www.epa.gov/epaoswer/hazwaste/data/br97/index.htm

RCRA Orientation Manual, EPA Office of Solid Waste

www.epa.gov/epaoswer/general/orientat/

Toxics Watch 1995, INFORM, New York, NY

