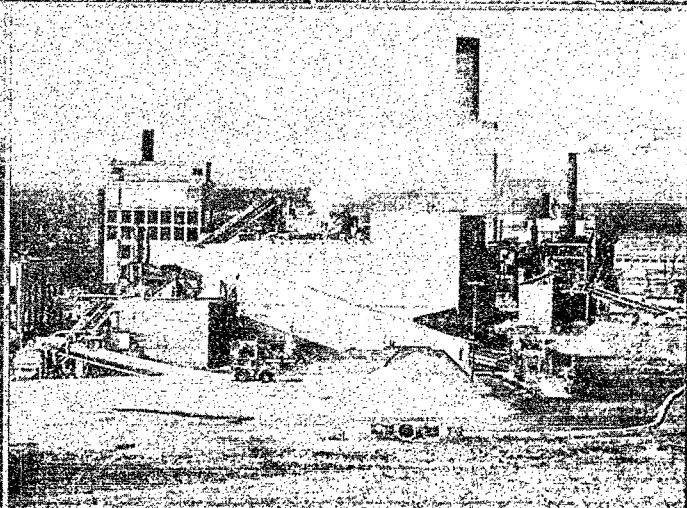




# 1996 Toxics Release Inventory

Public Data Release — Ten Years of Right-to-Know



# PUBLIC ACCESS TO THE TOXICS RELEASE INVENTORY

## TRI Reports and Data Products

Product		Supplier	Contact Information	Order Information
1996 TRI Public Data Release (annual report)		U.S. EPA EPCRA Hotline	(800) 424-9346 Fax Document Requests Only: (703) 412-3333 Hours 9:30 a.m. - 7:30 p.m. (Eastern Time)	EPA 745-R-98-005 ( <b>Free</b> )
1996 State Fact Sheets				EPA 745-F-98-001 ( <b>Free</b> )
1987-1995 TRI CD-ROM		U.S. GPO	(202) 512-1800	S/N 055-000-00582-6 (\$39)
		NTIS	(703) 487-4650 or (800) 553-6847	PB 97-502-587 (\$45)
		NCEPI	(800) 490-9198 (513) 489-8190 Fax: (513) 489-8695	EPA 749-C-97-003 ( <b>Free</b> to libraries, educators, students, non-profits, and community groups)
1996 State Data Files	dBASE Lotus	U.S. GPO	(202) 512-1530	\$15-\$25 / state
1996 Federal Facilities on Disk	dBASE	U.S. GPO	(202) 512-1530	\$15-\$25 Call for quote
TRI Information Kit		NCEPI	(800) 490-9198 (513) 489-8190 Fax: (513) 489-8695	EPA 749-K-98-001 ( <b>Free</b> )
		TRI User Support Service (TRI-US)	(202) 260-1531 Fax (202) 401-2347	EPA 749-K-98-001 ( <b>Free</b> )
Chemicals in the Environment		NCEPI	(800) 490-9198 (513) 489-8190 Fax: (513) 489-8695	Toxics Release Inventory (TRI) Pamphlet EPA 749-R-97-001b

Note: The 1987-1996 CD-ROM, containing the latest available data, will be published September 1998

## Accessing TRI Data Online

Data from Online Providers	Internet Address	Special Notes
Right to Know Network (RTKNET) – Provides public access to TRI and related environmental data bases. For more information, call (202) 797-7200.	<a href="http://www.rtk.net">http://www.rtk.net</a> <a href="ftp://ftp.rtknet.org">ftp://ftp.rtknet.org</a>	No charge for Internet access Direct access by modem at parameters to 8,N,1 and log in as "public" Phone charge may apply.
National Library of Medicine (NLM) – Offers comprehensive, user friendly searching of complete TRI data base. For more information, call (301) 496-6531.	<a href="http://www.nlm.nih.gov">http://www.nlm.nih.gov</a>	\$18-\$20 per hour charge. Password required
U.S. EPA Internet Server – Access a variety of reports, data files, and TRI information from EPA. For more information, call TRI-US at (202) 260-1531.	<a href="http://www.epa.gov">http://www.epa.gov</a> <a href="ftp://ftp.epa.gov">ftp://ftp.epa.gov</a> <a href="gopher://gopher.epa.gov">gopher://gopher.epa.gov</a>	TRI-specific information is available at: <a href="http://www.epa.gov/opptintr/tri">http://www.epa.gov/opptintr/tri</a>



## **ERRATA**

Some copies of the *1996 Toxics Release Inventory: Public Data Release* contain incomplete data in Table 2-8 on page 31. The complete data appear in Table 2-8, on the other side of this errata sheet.

# 1996 Toxics Release Inventory: Public Data Release

Table 2-8. TRI Off-site Transfers for Further Waste Management by State, 1996

State	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Transfers Excluding Transfers to Disposal Pounds
Alabama	33,675,464	10,487,499	7,163,468	516,571	750	51,843,752
Alaska	235,463	6,325	137	0	0	241,925
American Samoa	0	0	0	0	0	0
Arizona	79,468,186	784,295	9,259,081	1,951,033	0	91,462,595
Arkansas	44,916,893	6,677,636	6,119,839	122,428	250	57,837,046
California	61,488,314	8,602,952	5,054,720	13,086,610	16,705	88,249,301
Colorado	18,194,235	4,033,682	1,230,695	795,799	5	24,254,416
Connecticut	24,122,459	2,226,821	6,085,697	1,304,464	250	33,739,691
Delaware	10,054,130	1,169,726	1,299,302	4,515,982	0	17,039,140
District of Columbia	12,151	0	5	180	0	12,336
Florida	17,546,126	2,201,015	7,115,310	5,617,773	0	32,480,224
Georgia	43,272,325	9,828,150	6,065,284	2,873,071	19,456	62,058,286
Guam	0	0	0	15,000	0	15,000
Hawaii	53,075	0	4,557	0	0	57,632
Idaho	600,108	154,988	89,400	274,987	0	1,119,483
Illinois	92,791,384	29,994,071	13,946,004	10,650,115	170,140	147,551,714
Indiana	227,040,410	11,888,870	7,427,771	3,313,075	7,896	249,678,022
Iowa	26,694,400	3,079,716	3,072,917	7,613,435	0	40,460,468
Kansas	56,635,370	2,745,539	4,395,674	1,081,427	0	64,858,010
Kentucky	50,702,619	9,357,605	8,070,093	1,515,709	45,591	69,691,617
Louisiana	52,355,796	15,998,779	9,371,461	52,168	0	77,778,204
Maine	4,949,244	379,964	308,126	181,137	0	5,818,471
Maryland	3,870,056	1,340,824	3,465,720	3,837,977	0	12,514,577
Massachusetts	28,308,038	6,713,380	4,766,282	5,334,593	17,752	45,140,045
Michigan	100,909,367	69,413,222	23,506,076	14,143,038	250	207,971,953
Minnesota	21,696,873	2,196,764	1,014,387	8,095,891	8,636	33,012,551
Mississippi	21,598,058	2,654,505	2,122,333	628,934	8,632	27,012,462
Missouri	58,339,188	23,850,564	9,826,440	6,394,678	7,890	98,418,760
Montana	579,043	26,048	42,733	4,168	0	651,992
Nebraska	26,709,177	446,647	216,005	618,762	250	27,990,841
Nevada	1,635,380	9,679	18,434	21,514	0	1,685,007
New Hampshire	12,146,978	224,756	754,064	201,695	0	13,327,493
New Jersey	33,315,528	30,358,462	8,331,546	18,766,215	83,937	90,855,688
New Mexico	1,055,552	157,296	194,084	270,890	250	1,678,072
New York	64,139,124	7,747,898	6,825,645	6,792,564	1,971,363	87,476,594
North Carolina	79,313,339	14,071,452	8,705,633	3,077,616	0	105,168,040
North Dakota	802,146	19,711	15,583	198,048	0	1,035,488
Ohio	186,144,474	40,468,374	20,701,110	16,401,171	24,544	263,739,673
Oklahoma	19,065,778	967,015	1,149,182	456,827	0	21,638,802
Oregon	20,516,944	1,313,460	6,024,151	10,719,550	13	38,574,118
Pennsylvania	138,842,336	17,612,095	16,632,816	8,461,731	132,237	181,681,215
Puerto Rico	13,509,670	10,621,929	5,210,764	2,179,129	44,588	31,566,080
Rhode Island	7,619,534	838,404	369,333	386,775	0	9,214,046
South Carolina	96,310,411	6,142,486	6,654,915	4,282,130	18,150	113,408,092
South Dakota	435,739	193,405	78,484	1,294,101	0	2,001,729
Tennessee	46,687,393	6,290,202	10,324,918	5,665,208	0	68,967,721
Texas	193,240,622	74,366,119	33,729,621	36,475,413	174,466	337,986,241
Utah	5,028,082	80,661	4,351,475	422,249	538,256	10,420,723
Vermont	2,454,769	18,950	252,374	3,025	0	2,729,118
Virgin Islands	96,920	4,834	377,449	0	0	479,203
Virginia	22,724,864	6,931,822	1,762,214	16,876,073	1,000	48,295,973
Washington	12,695,274	871,255	896,850	1,693,122	0	16,156,501
West Virginia	30,508,467	8,961,334	3,422,220	2,414,351	10,500	45,316,872
Wisconsin	55,169,040	22,521,811	12,270,738	4,214,840	2,623	94,179,052
Wyoming	317,678	3,573	3,708	266	0	325,225
Total	2,150,593,994	477,056,570	290,096,828	235,813,508	3,306,380	3,156,867,280

Note: Data from Section 6 of Form R excluding off-site transfers to disposal. Other Off-site Transfers are transfers reported without a valid waste management code.

# 1996 Toxics Release Inventory: Public Data Release—Errata

**Table 5-2. Multiple SIC Codes, 1996: Pulp and Paper, SIC Code 26**

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
2611 2621	582	20	51,557,326	820,005	52,377,331	341,725,163	31,741,205	425,520,661	13,587
2611 2631 2621	122	9	16,455,781	1,265	16,457,046	86,231,831	0	102,905,648	8,387
2611 2621 2631 2653	10	1	661,950	0	661,950	7,478,870	0	8,140,390	0
2611 2621 2631 2672	9	0	677,102	0	677,102	5,577,900	0	6,259,365	0
2611 2621 2631 2679	16	0	1,622,084	0	1,622,084	18,178,293	0	19,763,234	0
2611 2621 2672	8	2	463,949	0	463,949	3,454,510	0	3,918,044	0
2611 2621 2674	17	1	1,533,418	0	1,533,418	5,811,257	0	7,336,351	2
2611 2621 2676	6	0	710,670	0	710,670	2,180,540	0	2,891,192	0
2611 2621 2679	3	0	1,229	0	1,229	0	206,942	208,201	0
2611 2622	2	0	1,321,255	0	1,321,255	194,000	0	1,514,000	0
2611 2631	100	5	18,230,555	129,127	18,359,682	75,294,424	4,213,086	97,974,419	61
2621 2631	10	0	2,209,295	0	2,209,295	5,674,760	0	7,884,051	0
2621 2631 2640	1	0	10	0	10	66,000	0	66,009	0
2621 2631 2643	9	1	1,704,914	0	1,704,914	9,766,188	0	11,110,098	0
2621 2631 2679	3	0	340,000	0	340,000	148,000	0	488,000	0
2621 2671	2	0	16,155	250	16,405	67,000	0	79,300	0
2621 2672	6	0	145,640	0	145,640	1,313,000	71,635	1,530,260	0
2621 2676	3	0	21,400	0	21,400	0	0	21,400	0
2621 2679	5	0	85,763	0	85,763	125,300	0	233,400	0
2631 2643	7	0	1,736,407	0	1,736,407	3,328,100	0	5,064,107	0
2631 2653	1	0	0	0	0	0	0	0	0
2631 2655	10	0	437,647	0	437,647	143,544	250	580,456	0
2631 2657	1	0	75,562	0	75,562	352,730	4,776	433,068	0
2631 2672 2675	3	0	161,481	0	161,481	0	0	163,120	0
2643 2674	1	0	39,282	0	39,282	0	397	39,679	0
2649 2672 2679	2	0	1,847	0	1,847	5,380	2,910	8,290	0
2671 2672	3	0	285,246	0	285,246	1,350,000	101,752	1,732,000	0
2671 2673	3	0	5,417	0	5,417	214,000	3,969	223,439	0
2671 2677	1	0	2,382	0	2,382	8,920	1,580	12,880	0
2672 2679	5	0	233,744	0	233,744	0	235,844	468,338	0
2673 2674	1	0	0	0	0	0	700	0	0
Total for SIC Code 26	952	39	100,737,511	950,647	101,688,158	568,689,710	36,585,046	706,569,400	22,037

**Note:** On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

In Chapter 5 of the first volume of the *1996 Toxics Release Inventory Public Data Release* (published May 1998), the table that presented data from TRI forms reporting more than one SIC code in SIC code 26 in 1996 (Table 5-2 on page 176) contained incorrect data. The total row in Table 5-2 was correct, but the detailed data were not. This errata sheet presents the correct data, above.

The first complete sentence on page 176 (left column) reflected the incorrect data. The revised text follows.

A total of 582 forms reported pulp (SIC code 2611) and paper (SIC code 2621) combined; they reported 60.2% (425.5 million pounds) of the total production-related waste from forms reporting multiple codes within SIC code 26.



## 1996 Toxics Release Inventory: Public Data Release—Errata

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In Chapter 6 of the first volume of the *1996 Toxics Release Inventory Public Data Release* (published May 1998), the table that presented data from TRI forms reporting more than one SIC code in SIC code 28 in 1996 (Table 6-2 on pages 214-215) contained incorrect data. The total row in Table 6-2 was correct, but the detailed data were not. This errata sheet presents the correct data, on the following pages.

The text on "Multiple Codes within SIC Code 28," on pages 215-216 reflected the incorrect data. The revised text follows on this page.

### Multiple Codes within SIC Code 28

Table 6-2 further examines reporting of multiple SIC codes within SIC code 28. The combination filing the largest number of forms was plastics materials and resins (SIC code 2821) with miscellaneous industrial organics (SIC code 2869). This combination submitted 810 forms and, within the multiple-codes category, accounted for the largest amount of on- and off-site releases (38.3 million pounds), transfers off-site for further waste management (44.4 million pounds), and production-related waste (536.0 million pounds). This combination also reported the second-largest amount of other on-site waste management (453.1 million pounds) among the multiple-codes groups in SIC code 28.

A combination of four SIC codes—miscellaneous industrial inorganic chemicals (SIC code 2819), cyclic crudes and intermediates (SIC code 2865), miscellaneous industrial organic chemicals (SIC code 2869), and miscellaneous agricultural chemicals (SIC code 2879)—reported the largest other on-site waste management (481.1 million pounds).

Miscellaneous industrial organics (SIC code 2869) appeared in 97 of the 226 multiple-codes combinations.

# 1996 Toxics Release Inventory: Public Data Release—Errata

Table 6-2. Multiple SIC Codes, 1996: Chemical Manufacturing, SIC Code 28

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production- related Waste Pounds	Non- Production- related Waste Pounds
2812 2813	13	0	9,080	29,430	38,510	50,000	10	89,089	369
2812 2813 2819	9	0	8,228	7,081	15,309	0	750	15,632	0
2812 2813 2819 2821 2869 2891	98	0	4,804,668	0	4,804,668	278,523,023	52,179	283,346,000	66,960
2812 2813 2842	3	0	49	0	49	0	0	39	0
2812 2813 2869	24	0	931,819	0	931,819	1,900,433	26,809	2,804,706	63,294
2812 2816 2869	38	0	554,674	110,781	665,455	158,779,000	1,391,845	160,828,297	7,823
2812 2819	49	10	40,027	1,096	41,123	37,884,829	99,265	38,025,989	580
2812 2819 2821 2865 2869	32	0	543,281	0	543,281	176,384,133	58,767	176,996,054	0
2812 2819 2841	11	0	2,408	0	2,408	0	8,375	10,783	0
2812 2819 2841 2851 2879 2891	4	0	20	0	20	4,300	0	4,300	0
2812 2819 2860 2899	5	0	49,728	0	49,728	2,442,719	52,764	2,545,212	0
2812 2819 2865	12	0	246,166	191	246,357	12,291,965	88,146	12,626,293	0
2812 2819 2865 2869	20	0	96,873	3,172	100,045	11,124,156	36,008	11,254,666	5,182
2812 2819 2869	23	19	409	0	409	224,237	291	224,937	2
2812 2819 2869 2899	6	3	468	0	468	153	2	625	0
2812 2819 2873	4	0	6,139,460	0	6,139,460	4,513,448	0	10,652,908	0
2812 2819 2879	3	0	1,291	2,453	3,744	8,005,992	0	8,009,725	0
2812 2821 2869	128	0	3,067,801	4,530	3,072,331	182,354,827	15,875,559	201,251,887	6,831
2812 2841 2842	3	1	260	0	260	136	0	151	0
2812 2869	54	2	938,484	176,479	1,114,963	9,148,090	971,066	11,203,363	430
2813 2819	3	0	3,823	0	3,823	23,175	0	26,764	0
2813 2819 2842 2869	8	0	334,259	24	334,283	3,356,165	913,029	4,603,477	0
2813 2819 2865 2869 2899	17	0	44,233	4,864	49,097	5,797,211	260,932	6,168,699	0
2813 2819 2869 2873 2899	13	4	7,674,410	255	7,674,665	0	21,024	7,695,665	0
2813 2821 2869 2873	22	0	2,336,185	53,021	2,389,206	56,480,918	132,267	58,975,393	0
2813 2834	3	0	0	0	0	0	255,168	255,168	0
2813 2869	4	0	1,750	0	1,750	0	750	3,760	0
2816 2819	40	1	12,139,461	228,100	12,367,561	234,975,900	574,538	247,905,269	0
2816 2821 2899	30	0	198,243	0	198,243	11,234,132	3,429,623	14,819,913	5,806
2816 2851	18	1	12,792	35,198	47,990	76,002	160,002	285,375	0
2816 2865	8	1	3,794	24,042	27,836	0	236,207	134,757	0
2816 2869	73	8	9,385,695	44,955	9,430,650	10,037,043	6,242,205	25,736,736	907
2816 2869 2899	1	1	0	0	0	0	0	0	0
2816 2879	2	0	4,850	0	4,850	0	500	5,550	0
2816 2899	9	0	4,848	158,610	163,458	0	61,294	223,680	0
2819 2821 2834 2869 2879	74	0	1,523,414	0	1,523,414	28,592,079	25,650	30,141,144	0
2819 2821 2843 2865 2899	18	3	83,345	30	83,375	168,689	61,040	313,070	0
2819 2821 2869	25	2	2,407,234	18,161	2,425,395	9,372,165	532,344	12,324,145	24,739
2819 2821 2869 2873	20	0	29,017	38	29,055	19,749,882	682,475	20,459,808	1,604
2819 2821 2869 2891	16	0	12,406	0	12,406	0	4,661,161	4,673,567	0
2819 2823	4	0	28,182,560	0	28,182,560	10,794,000	0	39,277,200	0
2819 2833 2869	23	0	308,739	47,190	355,929	3,928,000	6,253,410	10,557,233	8,403
2819 2833 2899	7	0	45,460	0	45,460	150,827	134,132	330,419	0
2819 2834	5	2	510	11,300	11,810	9,489,048	0	9,500,548	0
2819 2834 2869 2873 2879	15	0	7,742,540	5,900	7,748,440	24,605,180	345,330	32,777,071	0
2819 2841	8	1	10,836	0	10,836	0	63,068	73,000	0
2819 2841 2843	16	0	98,467	0	98,467	43,437	107,748	229,967	19,277
2819 2841 2869 2879	22	0	7,718,029	0	7,718,029	20,240,213	0	27,933,831	0
2819 2841 2869 2899	10	10	0	0	0	0	0	0	0
2819 2841 2899	2	1	50	0	50	0	0	50	0
2819 2842	4	0	270	0	270	150	260	421	0
2819 2842 2844	1	1	0	0	0	0	0	0	0
2819 2842 2869	19	13	3,220	0	3,220	241,720	241,918	485,807	20
2819 2843	2	1	1	0	1	0	815	1,035	0
2819 2843 2869	4	0	2,260	0	2,260	951,850	4,650	958,890	0
2819 2843 2869 2899	71	10	959,449	168,943	1,128,392	47,047,483	605,057	48,671,314	17,279
2819 2843 2899	5	4	34	0	34	0	660	694	0
2819 2851	4	1	1,250	0	1,250	0	1,500	0	0
2819 2851 2869	14	0	88,193	0	88,193	9,791,000	1,570,800	11,448,490	59
2819 2865	8	0	138,476	0	138,476	7,054,442	90,143	7,275,055	8,007
2819 2865 2869	176	4	24,103,630	122,780	24,226,410	173,812,294	10,195,032	213,924,863	16,081
2819 2865 2869 2873	19	0	420,200	50,453	470,653	22,453,103	640,478	23,564,228	0
2819 2865 2869 2879	29	0	1,488,589	235,938	1,724,527	481,136,989	845	482,870,734	0
2819 2869	532	63	34,200,240	628,915	34,829,155	198,123,148	27,425,671	260,235,915	3,421
2819 2869 2873	27	0	3,801,644	167,233	3,968,877	11,589,286	2,469,135	18,026,759	0

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

# 1996 Toxics Release Inventory: Public Data Release—Errata

Table 6-2. Multiple SIC Codes, 1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production- related Waste Pounds	Non- Production- related Waste Pounds
2819 2869 2879	54	9	2,770,796	25,918	2,796,714	47,692,925	1,837,130	52,282,605	36,000
2819 2869 2879 2899	27	0	61,855	5,200	67,055	1,838,865	85,278	1,991,298	0
2819 2869 2899	30	11	42,012	765	42,777	0	69,331	211,094	812
2819 2873	30	1	6,176,874	7,700	6,184,574	8,467,600	0	14,588,952	11
2819 2873 2874	28	0	36,185,857	1,155	36,187,012	4,353,952	73,839	40,613,266	18,697
2819 2873 2892	6	0	979,477	0	979,477	1,260,000	129,914	2,381,802	870
2819 2874	13	0	8,605,852	0	8,605,852	9,827,497	0	18,441,588	2,955
2819 2879	39	5	316,236	774,453	1,090,689	8,240,101	2,734,615	12,441,494	7,245
2819 2879 2899	22	18	20,645	0	20,645	135,360	30,099	186,126	0
2819 2892	1	1	0	0	0	0	0	0	0
2819 2899	44	2	140,660	4,382	145,042	11,076,731	355,312	11,593,224	2,817
2821 2819 2869	26	0	708,633	31	708,664	53,246,550	383,802	54,328,036	894
2821 2822	34	3	345,900	27,484	373,384	7,368,676	333,503	8,069,808	544
2821 2822 2869	27	8	1,490,425	408	1,490,833	7,093,576	156,272	8,740,173	7,941
2821 2822 2891	6	0	24,706	11,164	35,870	422,830	43,450	501,610	50
2821 2823 2824 2869	22	0	831,683	3,987	835,670	3,567,436	39,890	4,442,633	0
2821 2823 2865 2869 2893	72	0	5,606,314	38,000	5,644,314	40,998,221	2,632,338	49,233,777	0
2821 2823 2869	9	0	566,059	0	566,059	726,000	4,201	1,297,219	0
2821 2824	105	6	5,885,291	822,125	6,707,416	173,982,221	32,465,278	210,367,879	3,070,329
2821 2824 2865	21	0	2,806,970	42,344	2,849,314	2,902,265	5,763,959	11,515,548	0
2821 2824 2865 2869	23	0	22,368,147	4,781	22,372,928	15,291,427	110,000	37,748,197	2,580
2821 2824 2869	26	0	2,246,680	25,961	2,272,641	50,785,333	135,814	53,198,788	0
2821 2833 2843 2899	22	0	437,980	0	437,980	32,481,054	592,790	33,497,625	18,500
2821 2834 2869	25	0	2,142,512	750	2,143,262	113,830,700	85,984	116,032,039	0
2821 2841	6	3	1,388	0	1,388	1,057	946	3,391	0
2821 2841 2842 2843 2844 2865	22	7	747,427	84	747,511	15,697,346	1,863,776	18,308,301	0
2821 2841 2843 2869 2893 2899	16	9	2,206	0	2,206	2,948	27,085	31,958	0
2821 2841 2869	1	0	0	0	0	0	0	0	0
2821 2841 2891	3	0	500	500	1,000	0	10	977	0
2821 2842	9	0	4,255	40	4,295	0	6,833	7,915	0
2821 2842 2843 2869	3	0	918	0	918	0	126,511	127,429	0
2821 2842 2869	4	0	5,219	0	5,219	213,327	0	220,872	0
2821 2843	4	0	2,265	76,100	78,365	0	64,250	140,850	0
2821 2843 2851 2869	11	5	5,405	0	5,405	7,069	505	11,969	0
2821 2843 2865 2869	67	0	3,998,160	395,812	4,393,972	42,021,791	4,995,864	51,982,731	20,400
2821 2843 2869	20	0	53,526	11,628	65,154	62,626	210,597	338,003	261
2821 2843 2869 2891 2893 2899	9	0	1,584	76,620	78,204	0	188,498	266,702	24
2821 2843 2869 2899	11	0	2,380	500	2,880	14,011	5,500	19,968	0
2821 2843 2879	10	3	4,109	0	4,109	0	250	1,300	0
2821 2851	390	27	2,194,685	78,545	2,273,230	10,750,026	38,807,073	51,885,304	8
2821 2851 2865	3	0	0	69	69	0	63,539	63,608	0
2821 2851 2891	42	7	163,383	16,965	180,348	1,252,089	735,159	2,166,978	0
2821 2851 2891 2893	6	6	0	0	0	0	0	0	0
2821 2861 2869	24	5	189,595	14,237	203,832	1,192,093	21,536	1,417,006	74
2821 2861 2869 2899	8	0	772,291	0	772,291	88,228	24,000	884,519	0
2821 2861 2899	4	1	2,668	234	2,902	0	630	3,787	0
2821 2865	48	4	1,991,421	115,694	2,107,115	10,259,924	535,204	12,885,743	14,902
2821 2865 2869 2873	14	0	78,480	0	78,480	9,258,700	18,808,620	29,599,430	3,425
2821 2865 2869 2879	72	10	1,089,647	45,100	1,134,747	20,566,056	7,040,622	28,733,118	2,186
2821 2865 2893	5	0	32,768	735	33,503	0	810,341	843,843	0
2821 2869	810	43	37,620,974	653,918	38,274,892	453,103,109	44,431,173	535,972,285	736,393
2821 2869 2879	105	0	1,325,775	37,088	1,362,863	22,633,767	4,103,992	28,094,997	1,550
2821 2869 2891	12	4	33,684	260	33,944	1,498,505	24,348	1,555,691	29
2821 2869 2895	25	5	1,398,491	122,434	1,520,925	17,939,980	372,383	19,833,907	0
2821 2869 2899	35	0	591,959	1,444	593,403	1,535,760	10,706,372	12,853,044	2,595
2821 2876 2879	1	0	5,747	0	5,747	0	0	5,747	0
2821 2879	13	0	485	70,355	70,840	0	5,985	150,914	0
2821 2879 2891	27	0	33,743	0	33,743	0	349,052	382,795	0
2821 2891	81	13	227,001	3,436	230,437	1,125,237	719,567	2,074,911	200
2821 2891 2899	19	0	30,303	63,419	93,722	60,978	147,593	185,362	126,449
2821 2899	34	10	13,231	250	13,481	543,854	125,320	720,765	0
2822 2865	5	0	369,180	0	369,180	36,380	417,475	823,035	1,345
2822 2865 2869	43	0	1,598,012	23,439	1,621,451	22,367,307	5,559,501	29,538,695	0
2822 2865 2869 2873	24	0	10,880,836	28,422	10,909,258	33,859,263	598,442	45,366,488	476
2822 2869 2879	30	0	2,936,127	4,220	2,940,347	0	3,232,828	6,109,173	66,510

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).



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Table 6-2. Multiple SIC Codes, 1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
2822 2891	1	0	221	0	221	0	0	221	0
2823 2834	1	0	21,549	84	21,633	118,504	100	140,242	0
2824 2869	30	0	1,025,788	16,970	1,042,758	10,067,121	127,677	11,238,251	0
2831 2833 2834	3	0	24,700	0	24,700	21,615	29,800	75,955	10
2833 2834	102	1	1,827,418	4,873	1,832,291	38,110,524	6,696,941	46,735,021	4,407
2833 2834 2836	18	1	105,988	0	105,988	3,712,500	2,786,270	6,594,400	20
2833 2834 2836 2879	22	0	285,478	0	285,478	10,186,400	4,907,245	15,378,651	0
2833 2834 2841 2899	2	0	6,200	0	6,200	0	177,728	183,928	0
2833 2834 2865 2869 2873	9	2	104,762	0	104,762	514,887	230,865	850,713	0
2833 2834 2869	5	0	7,050	0	7,050	300,530	889,678	1,198,250	0
2833 2865	30	8	831,809	205,535	1,037,344	1,743,288	1,313,845	4,017,389	0
2833 2869	10	0	578,113	256,117	834,230	842,000	6,152,358	7,603,351	0
2833 2869 2879	16	0	329,936	13,300	343,236	3,210,760	2,269,187	5,823,180	5
2833 2879	47	0	1,323,404	365,017	1,688,421	24,185,160	8,675,478	34,563,099	18,920
2833 2899	26	0	884,745	48,050	932,795	4,131,150	4,496,933	9,504,033	400
2834 2833 2869 2879	8	0	24,621	0	24,621	1,084,284	9,219	1,118,124	0
2834 2835 2836	1	0	4	0	4	0	35,000	35,435	0
2834 2836	7	2	2,637	0	2,637	0	354,127	356,657	0
2834 2836 2879	3	1	0	1	1	622	3,397	4,020	0
2834 2841 2843 2869 2879 2899	7	0	3,395	93,484	96,879	112,690	178,721	388,290	0
2834 2842 2843	3	3	0	0	0	0	0	0	0
2834 2843	3	0	181	0	181	0	4,910	9,984	0
2834 2844	4	1	592	0	592	0	13,733	15,364	0
2834 2865 2869	16	0	212,120	0	212,120	3,276,033	1,737,561	5,248,359	0
2834 2865 2869 2899	5	0	8,110	0	8,110	0	161,320	170,330	0
2834 2869	38	0	1,292,552	250	1,292,802	6,768,200	1,224,703	9,202,756	125
2834 2879	32	2	1,206,730	25,758	1,232,488	14,638,170	535,815	16,406,101	0
2834 2892	3	0	3,988	0	3,988	22,400	4,656	30,956	0
2834 2899	2	0	1,292	0	1,292	117	200	25,431	0
2840 2842	8	4	2,039	0	2,039	10,533	30,655	43,347	0
2841 2842	135	51	33,734	1,000	34,734	264,003	284,998	581,640	125
2841 2842 2843	12	0	16,933	0	16,933	11,585	40,381	77,723	0
2841 2842 2843 2844	22	9	8,455	0	8,455	14,585	73,390	96,430	0
2841 2842 2844 2899	3	0	0	0	0	0	0	0	0
2841 2842 2899	18	13	15	6,387	6,402	25,700	4,179	34,441	0
2841 2843	20	5	2,262	0	2,262	1,742	20,020	20,294	0
2841 2843 2861	1	0	155	0	155	0	0	155	0
2841 2843 2869	9	4	18,609	0	18,609	1,858	78,551	99,015	3
2841 2843 2869 2899	11	0	359,610	15,205	374,815	273,400	324,001	998,175	575
2841 2843 2899	11	2	18,941	0	18,941	2,366,613	22,468	2,406,191	2,300
2841 2844	3	0	2,949	0	2,949	3	0	15,101	0
2841 2851	3	0	11,600	0	11,600	105,000	750	116,600	0
2841 2851 2869 2891	20	11	5,543	0	5,543	0	49,604	52,333	0
2841 2869	8	0	0	0	0	0	61,809	34,700	0
2841 2869 2899	3	0	28,600	0	28,600	0	403,500	432,221	0
2841 2891	1	0	0	250	250	0	5	15	0
2841 2899	26	7	13,804	755	14,559	54,931	6,977	75,031	0
2842 2844	4	0	33	0	33	21,994	124,646	146,673	0
2842 2851	4	2	10,285	0	10,285	1,800	4,105	14,700	4

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

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Table 6-2. Multiple SIC Codes, 1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production- related Waste Pounds	Non- Production- related Waste Pounds
2842 2851 2891	6	0	0	0	0	0	15,722	15,722	0
2842 2865	4	0	151,423	0	151,423	6,979,477	928	7,131,828	0
2842 2879	1	0	470	0	470	0	250	750	0
2842 2879 2899	9	9	0	0	0	0	0	0	0
2842 2891 2899	4	4	0	0	0	0	0	0	0
2842 2893 2899	3	0	10,360	0	10,360	0	474	10,401	0
2842 2899	12	2	4,265	0	4,265	11,519	6,850	20,782	0
2843 2844	18	7	11,542	0	11,542	4,700,398	39,180	4,751,061	0
2843 2851	2	0	1,649	0	1,649	0	1,500	1,988	0
2843 2861	5	0	358	0	358	0	0	358	0
2843 2865 2869	7	7	0	0	0	0	0	0	0
2843 2869	50	4	39,535	4,143	43,678	10,663,722	273,625	10,972,229	2,137
2843 2869 2873	1	1	0	0	0	0	0	0	0
2843 2869 2899	50	1	69,434	14,766	84,200	517,970	169,858	760,935	0
2843 2899	33	8	12,669	339	13,008	186,941	289,537	488,681	0
2844 2869	3	0	59	0	59	24,756	31,318	56,141	0
2844 2869 2874	11	0	19,560	0	19,560	64,883	690,252	774,668	0
2851 2865 2891	6	2	38,005	1,420	39,425	0	75,016	157,330	0
2851 2865 2893 2895	5	4	0	46	46	84,116	6,621	90,783	0
2851 2869	31	0	23,102	2,685	25,787	1,691,400	17,315,220	19,056,040	2,361
2851 2879	5	4	3	0	3	256	907	1,161	0
2851 2891	63	11	104,774	9,259	114,033	2,262,326	148,336	2,482,955	0
2851 2891 2893	1	0	3,982	0	3,982	0	3,882	7,964	0
2851 2899	29	3	22,267	0	22,267	38,287	111,231	181,568	0
2861 2869	9	0	543,743	0	543,743	190,390	33,960	768,093	0
2861 2869 2899	11	0	526,025	0	526,025	24,432,150	800,500	25,754,589	0
2861 2899	7	1	10,294	452	10,746	3,043	4,170	17,955	5
2865 2867	8	0	48,994	0	48,994	240,549	96,064	385,607	1,707
2865 2869	127	1	5,483,836	420,552	5,904,388	170,822,941	6,285,210	180,874,727	82,176
2865 2869 2873	34	0	8,327,597	31,106	8,358,703	12,945,000	21,430	21,362,123	234
2865 2869 2879	19	0	103,432	7,575	111,007	1,675,045	1,280,570	3,066,502	613
2865 2869 2879 2899	18	0	251,100	1,755	252,855	53,631,403	1,027,605	54,917,621	37,060
2865 2873 2879	17	2	210,728	7,970	218,698	3,489,100	2,627,785	6,331,750	0
2865 2899	6	0	367	0	367	26,450	91,131	117,625	0
2869 2873	38	3	8,125,780	5,700	8,131,480	20,680,495	142,412	28,834,431	5,902
2869 2879	121	6	959,483	258,120	1,217,603	27,909,941	5,271,809	34,615,298	9,478
2869 2879 2899	11	0	35,805	0	35,805	0	489,812	546,232	13,000
2869 2899	98	12	99,957	95,698	195,655	558,211	956,090	1,661,802	27,311
2873 2874	8	1	128,411	0	128,411	2,700,000	0	2,812,181	14,000
2873 2874 2875	2	0	6,750	0	6,750	0	0	6,000	0
2873 2874 2875 2879	2	0	18,950	0	18,950	0	0	18,950	0
2873 2879	6	0	16,322	75	16,397	0	0	16,843	0
2874 2875	5	4	1,005	0	1,005	700	0	1,350	0
2875 2879	38	2	19,643	755	20,398	14,872	21,369	60,660	719
2879 2899	56	22	52,116	1,405	53,521	4,714,034	134,710	4,910,931	0
2891 2899	8	0	2,490	0	2,490	0	38,300	36,440	0
Total for SIC Code 28	6,542	643	368,254,227	7,896,176	376,150,403	4,024,088,800	363,308,016	4,766,348,743	4,627,743

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

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Table 7-2. Multiple SIC Codes, 1996: Petroleum Refining, SIC Code 29

SIC Codes			Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On-and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production- related Waste Pounds	Non- Production- related Waste Pounds
2911	2951		14	0	66,504	0	66,504	30	1,618	68,139	0
2911	2951	2992	29	0	977,469	64,824	1,042,293	8,356,038	49,991	9,440,658	0
2911	2992		9	0	181,785	0	181,785	619,930	500	803,244	0
2911	2999		36	0	722,863	26,499	749,362	181,127	114,956	975,409	0
2951	2952		1	0	668	0	668	0	0	668	0
2952	2992		4	4	0	0	0	0	0	0	0
Total for SIC Code 29			93	4	1,949,289	91,323	2,040,612	9,157,125	167,065	11,288,118	0

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

In Chapter 7 of the first volume of the *1996 Toxics Release Inventory Public Data Release* (published May 1998), the table that presented data from TRI forms reporting more than one SIC code in SIC code 29 in 1996 (Table 7-2 on page 256) contained incorrect data. The total row in Table 7-2 was correct, but the detailed data were not. This errata sheet presents the correct data, above.

One sentence in the text reflected the incorrect data. On page 255, the right-hand column, the second paragraph, the last sentence of that paragraph, the number "72" should be "36." The corrected text follows.

Table 7-2 examines multiple-code reporting within SIC code 29. Ninety-three TRI forms reported more than one SIC code in SIC code 29 in 1996, 2.9% of all forms in the sector, a smaller percentage than in many sectors. Of these, 36 reported both petroleum refining (SIC code 2911) and miscellaneous products of petroleum and coal (SIC code 2999).



## 1996 Toxics Release Inventory: Public Data Release—Errata

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In Chapter 8 of the first volume of the *1996 Toxics Release Inventory Public Data Release* (published May 1998), the table that presented data from TRI forms reporting more than one SIC code in SIC code 33 in 1996 (Table 8-2 on page 291) contained incorrect data. The total row in Table 8-2 was correct, but the detailed data were not. This errata sheet presents the correct data in Table 8-2, on the following pages.

Text on pages 292-293 reflected the incorrect data, beginning with the first full paragraph on page 292. The corrected text follows on this page.

Reporting on forms with multiple SIC codes within the sector is further examined in Table 8-2. Secondary smelters and refiners of nonferrous metals (SIC code 3341) appear most often (in 19 of the 99 combinations). Secondary smelting generally recovers metals and alloys from scrap. This activity most often combines with further processing of the metal (rolling, drawing, extruding, in SIC code 335).

Forms with multiple SIC codes had the largest on-site waste management (842.0 million pounds) and the largest total production-related waste (1.05 billion pounds) [in SIC code 33, see Table 8-1]. Forms with multiple SIC codes also had the second or third largest amounts in the other categories (on- and off-site releases and transfers off-site for further waste management). As shown in Table 8-2, the multiple code combination with the largest total on- and off-site releases was primary production of copper (SIC code 3331) with rolling and drawing of copper (SIC code 3351). This combination had total on- and off-site releases of 31.5 million pounds. This combination also accounted for 547.6 million pounds of other on-site waste management and 591.5 million pounds of total production-related waste.

# 1996 Toxics Release Inventory: Public Data Release—Errata

Table 8-2. Multiple SIC Codes, 1996: Primary Metals, SIC Code 33

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production- related Waste Pounds	Non- Production- related Waste Pounds
3312 3313 3315	13	6	23,886	0	23,886	550,000	418,564	817,626	0
3312 3313 3316	10	3	843,460	1,232,352	2,075,812	41,000	0	2,084,200	0
3312 3313 3341	5	0	1,293	0	1,293	1,291	0	2,583	727,600
3312 3315	14	0	16,190,589	0	16,190,589	10,029,548	5,329,441	31,594,716	753
3312 3315 3398	15	0	42,749	424,170	466,919	1,744,339	2,027,792	4,235,742	0
3312 3316	41	2	3,079,908	17,690,451	20,770,359	3,211,148	3,946,119	27,873,536	0
3312 3316 3317	1	0	35,414	0	35,414	16,133	0	35,414	0
3312 3316 3398	36	0	3,514,695	2,132,736	5,647,431	25,455,355	8,879,222	39,972,923	1,849
3312 3317 3325	25	0	1,926,635	0	1,926,635	8,049,384	56	9,971,286	0
3312 3321 3366	3	0	57,405	0	57,405	0	2,150	59,303	0
3312 3354	5	0	19,264	0	19,264	785,322	3	824,257	0
3312 3356	5	0	25	1,250	1,275	0	25	70	0
3312 3356 3398	3	0	2,769	0	2,769	0	242,589	245,358	0
3312 3398	16	0	372,974	68,605	441,579	2,654,085	17,500,804	20,602,262	0
3313 3316	3	1	30,450	96,200	126,650	0	2,663	128,713	0
3313 3341	12	0	3,351	0	3,351	2,246,840	584,781	2,846,662	0
3315 3316	12	0	91	0	91	0	212,142	212,231	0
3315 3316 3357	3	0	1,930	0	1,930	0	65,013	66,930	0
3315 3351 3355	4	0	101,725	0	101,725	0	69,199	170,713	0
3315 3351 3356	5	0	54	0	54	0	0	8,724	0
3315 3355 3398	3	0	0	4,100	4,100	10	6,555	13,400	0
3315 3398	5	0	4,616	40,444	45,060	997,400	174	1,042,559	0
3316 3351 3356	7	0	151,049	7,512	158,561	13,000	4,000	175,532	20
3317 3322 3325	12	5	264,892	0	264,892	0	13,546	291,207	0
3317 3356 3399	5	0	2,975	505	3,480	111,903	113,468	228,276	0
3321 3322	4	0	1,751	230,120	231,871	0	2,786,004	2,986,673	0
3321 3322 3365	3	1	1,000	255	1,255	12,000	0	13,060	0
3321 3322 3365 3366	3	0	3,341	0	3,341	0	4,519	7,860	0
3321 3324 3369	2	0	361	0	361	104	30,603	31,069	0
3321 3325	13	3	9,333	1,515	10,848	431,996	10	442,422	0
3321 3341	3	0	19,828	0	19,828	12,512	7,430	39,770	0
3321 3365	20	2	2,428,729	3,875	2,432,604	340,000	504,391	3,258,489	0
3321 3365 3369	1	0	46	0	46	0	118,849	118,895	0
3321 3369	6	0	10,127	6	10,133	0	10,412	20,545	0
3322 3325 3369	2	1	500	0	500	18,000	0	18,500	0
3324 3325	5	0	2,015	35,700	37,715	0	178	36,775	0
3324 3325 3365	3	0	28,522	0	28,522	0	0	28,521	0
3324 3365	1	0	0	65	65	0	184	349	0
3324 3365 3366	11	0	69	35,562	35,631	9,505	351,988	419,382	0
3324 3365 3366 3369	2	1	780	0	780	590,000	334,671	920,851	0
3324 3369	10	0	22,471	17,774	40,245	2,554,800	1,360,565	3,952,796	0
3325 3365	4	0	538	0	538	0	0	538	0
3325 3365 3366	1	0	5	0	5	0	0	5	0
3325 3366 3369	6	0	2,002	0	2,002	0	0	661	0
3325 3369	5	0	2,010	4,905	6,915	227,850	34,510	266,170	0
3331 3351	23	0	31,487,709	1,799	31,489,508	547,632,371	12,379,845	591,500,408	531
3334 3341	8	0	549,250	37,499	586,749	463,825	264,998	1,013,075	302,497
3334 3353	33	0	2,974,394	162,873	3,137,267	34,639,975	1,712,577	39,275,090	0
3334 3353 3355	9	0	1,003,881	182,550	1,186,431	15,526,340	2,240,002	18,949,022	0
3334 3354 3355	10	0	756,123	706	756,829	9,046,060	0	9,800,392	16

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

# 1996 Toxics Release Inventory: Public Data Release—Errata

Table 8-2. Multiple SIC Codes, 1996: Primary Metals, SIC Code 33, Continued

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
3334 3355	16	0	813,016	18,750	831,766	2,973,250	143,204	3,947,207	2,500
3334 3399	1	0	3,150	0	3,150	3,800	0	4,300	0
3339 3341	11	0	511,566	22,986,960	23,498,526	42,000	107,067	23,646,321	12,962,592
3339 3351	6	1	667,786	45,929	713,715	886,072	2,203,202	3,749,074	0
3339 3356	12	1	1,528,200	48,864	1,577,064	17,559,435	250	19,087,835	50
3341 3351	1	1	0	0	0	0	0	0	0
3341 3351 3366	9	3	237,442	166,034	403,476	11,139	97,215	510,941	0
3341 3351 3398	14	0	138,257	771,459	909,716	103,080,400	6,038,557	109,980,964	0
3341 3353	20	0	542,014	22,836	564,850	6,388,540	31,426,836	7,822,547	0
3341 3354	14	6	1,860	56	1,916	2,324,091	30,286	2,353,348	0
3341 3354 3355 3356	6	0	2,800	2,636	5,436	0	323,212	324,851	0
3341 3354 3356 3365	3	0	62	0	62	0	132	193	0
3341 3355	6	0	3,700	2,000	5,700	200,000	128,600	334,550	0
3341 3356	11	1	1,334	755	2,089	2,848,278	449,305	3,297,216	0
3341 3356 3399	11	0	176,598	0	176,598	614,969	2,161,466	2,951,672	0
3341 3363 3365 3398	3	0	3,770	0	3,770	4,700	50,800	58,887	0
3341 3369	5	0	1,050	5	1,055	202,170	34,125	237,433	0
3341 3398	5	0	1,478	0	1,478	560,657	0	562,114	0
3341 3399	4	0	555,978	152	556,130	362,427	113	918,670	151
3351 3355	2	0	0	5	5	0	985,219	1,314,402	0
3351 3355 3356 3398 3399	3	0	52,505	0	52,505	0	59,400	103,650	0
3351 3355 3366	3	0	14,673	179	14,852	0	181	1,276,761	0
3351 3356	4	0	57,097	500	57,597	0	458,590	515,793	0
3351 3356 3357	3	0	275	760	1,035	0	8,090	180,042	0
3351 3356 3357 3398 3399	1	0	505	0	505	0	135,000	135,400	0
3351 3357	7	0	38,436	0	38,436	1,631,524	56,285	1,724,075	0
3351 3362	4	1	7,041	1,139	8,180	0	3,547,200	3,555,490	72,126
3351 3366	14	0	16,252	250	16,502	26,716,514	5,335,068	32,001,920	0
3351 3399	2	0	632	0	632	0	13	658	0
3353 3355	10	0	543,060	3,787	546,847	38,000	101,750	653,123	0
3354 3355	8	0	43,324	666	43,990	0	155	44,151	0
3354 3365	2	0	4,321	0	4,321	0	0	4,171	0
3355 3398	3	0	500	1,751	2,251	1,100	4,965	7,633	0
3356 3357 3399	2	0	29,254	0	29,254	25,000	110	54,143	0
3356 3369	4	1	4,536	0	4,536	5,300	105,410	115,334	0
3356 3398 3399	1	0	550	0	550	0	367,000	367,800	0
3356 3399	3	3	0	0	0	0	0	0	0
3357 3399	1	0	1	0	1	0	2	3	0
3362 3369	1	0	1,611	0	1,611	0	0	1,611	0
3363 3364	21	3	9,655	9,210	18,865	173,500	233,233	424,433	0
3363 3365	6	0	243	57,100	57,343	7,662,403	594,846	8,314,477	0
3363 3369	1	0	30	0	30	11,000	255	16,116	0
3364 3365	1	0	591	0	591	0	0	341	0
3364 3366 3369	1	0	33	3,497	3,530	75,205	0	78,735	0
3365 3366	42	6	49,742	5,524	55,266	17,137	1,374,265	2,116,037	0
3365 3366 3369	9	0	9,961	500	10,461	133,400	414,712	557,967	0
3365 3369	7	1	2,015	5	2,020	0	67,529	68,642	0
3365 3398	6	0	50,607	523	51,130	43,000	41,806	136,415	0
3365 3399	3	2	260	0	260	0	0	42	0
Total for SIC Code 33	784	55	72,104,755	46,565,361	118,670,116	842,007,107	118,645,496	1,050,163,029	14,070,685

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

# 1996 Toxics Release Inventory: Public Data Release—Errata

**Table 9-2. Multiple SIC Codes, 1996: Electrical Equipment, SIC Code 36**

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production- related Waste Pounds	Non- Production- related Waste Pounds
3612 3621	3	0	14,400	17	14,417	0	193,353	207,770	0
3612 3621 3699	4	0	0	0	0	0	440,013	872,527	0
3612 3625	1	0	0	0	0	0	21,967	0	0
3613 3625	6	0	3,445	1,005	4,450	104	778,031	782,739	0
3613 3629	3	1	15,840	0	15,840	0	23,363	39,103	0
3621 3624	4	0	1,516	11,705	13,221	0	1,625,010	1,628,335	0
3621 3625	2	0	8,772	0	8,772	4,633	4,795	208,019	0
3621 3634 3672	1	0	17,969	0	17,969	3,812	0	21,781	0
3621 3694	7	0	81,122	27,779	108,901	29,000	1,445,602	1,542,038	0
3625 3643	3	0	17,388	3,332	20,720	18,902	356,580	396,185	0
3625 3651 3661 3663 3669 3699	1	1	0	0	0	0	0	0	0
3625 3676	2	0	15,360	0	15,360	440	0	17,200	0
3629 3643	5	0	21,249	1,700	22,949	0	627,000	728,942	0
3631 3632	13	0	210,421	22,019	232,440	83,890	516,890	891,410	0
3631 3632 3633 3639	16	0	263,945	44,330	308,275	7,900	936,150	1,252,325	0
3632 3639	10	0	828,525	750	829,275	500,700	73,593	1,406,304	0
3641 3646 3648	1	0	255	0	255	0	60,600	60,600	0
3641 3694	1	0	10	11	21	0	62,638	62,653	0
3643 3644	9	0	1,022	21,871	22,893	3,100	930,199	953,562	0
3643 3644 3646	5	0	33	0	33	0	184,381	207,884	0
3645 3646	5	0	10,762	0	10,762	160,038	19,237	189,804	0
3646 3648	4	0	4	975	979	0	7,211	7,699	0
3648 3692	1	0	130	2,600	2,730	36,000	20,600	59,730	0
3651 3671 3672 3679 3694	9	0	14,100	71,000	85,100	613,000	466,650	1,159,900	0
3651 3672	2	0	250	0	250	3,380	250	3,395	0
3652 3695	1	0	71,670	6	71,676	19,816	44,897	136,305	154
3661 3672	7	0	9,514	0	9,514	249,000	1,936,862	2,195,734	0
3661 3679	2	0	67,705	0	67,705	0	0	73,450	0
3662 3679	2	0	260	0	260	0	538,048	269,043	0
3663 3671	15	0	5,858	18,949	24,807	297,640	57,646	374,945	0
3663 3671 3679	5	0	7,115	32,100	39,215	421,710	603,285	1,031,120	0
3663 3678 3679	6	0	150	15,656	15,806	39,109	8,388,585	8,443,591	0
3663 3679	1	0	0	0	0	28,000	0	28,000	0
3669 3672	4	0	8,505	5	8,510	84,763	105,732	199,010	0
3669 3694	1	0	0	0	0	0	9,400	9,400	0
3671 3674	1	0	4,530	0	4,530	0	40,630	45,200	0
3671 3679	1	0	0	0	0	0	22,918	22,918	0
3672 3674	4	0	2,596	0	2,596	15,549	47,541	65,046	0
3672 3678	2	0	0	0	0	32,039	2,088	34,127	0
3672 3679	11	0	34,294	0	34,294	180,298	309,812	524,223	0
3672 3699	1	0	0	0	0	0	24,385	24,385	0
3674 3679	8	0	8,301	0	8,301	247,784	87,335	343,087	150
3675 3676	8	0	243,511	42,887	286,398	8,300	178,797	472,053	0
3675 3677	3	0	223,843	0	223,843	46,761	388,114	658,363	0
3675 3679	1	0	255	104,822	105,077	0	30,777	136,109	0
3691 3692	6	0	4,817	0	4,817	82,851	355,494	441,169	0
3694 3699	4	0	760	120,250	121,010	9,000	48,257	177,520	0
Total for SIC Code 36	212	2	2,220,202	543,769	2,763,971	3,227,519	22,014,716	28,404,703	304

**Note:** On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

In Chapter 9 of the first volume of the *1996 Toxics Release Inventory Public Data Release* (published May 1998), the table that presented data from TRI forms reporting more than one SIC code in SIC code 36 in 1996 (Table 9-2 on page 335) contained incorrect data. The total row in Table 9-2 was correct, but the detailed data were not. This errata sheet presents the correct data, above.

One sentence in the first full paragraph on page 335 reflected the incorrect data. The revised text follows.

Table 9-2 examines TRI reporting from the 212 forms submitted with more than one code within SIC code 36. Printed circuit boards (SIC code 3672) appeared in nine combinations. Forms reporting multiple SIC codes are a smaller factor in electrical equipment manufacture than in many other sectors. This indicates more of a concentration in this sector on single or closely related product lines.

## **ERRATA**

As noted in **Chapter 9, Toxics Release Inventory Data for Electrical Equipment**, one facility (Thomson Consumer Electronics, Dunmore, Pennsylvania) had an apparent increase of 6.7 million pounds in on- and off-site releases from 1988 to 1996. A facility representative identified this as an error in its 1996 reporting. The reporting error was noted in the text (page 369), and information was added as a footnote to **Table 9-6, Summary of TRI Information by State, 1996**, in the main volume, and as a footnote to **Pennsylvania** in the *State Fact Sheets*.

This reporting error affects other data tables in Chapter 9, including those in which industries in the electrical equipment sector are ranked. Thomson Consumer Electronics submitted ten forms in SIC code 3672, printed circuit boards. This facility also revised its reported SIC code from 3672, to 3671, electron tubes. This errata sheet includes revised versions of **Table 9-1, Summary of TRI Information by 4-digit SIC Code**, and **Table 9-3, TRI On-site and Off-site Releases, 1996**, incorporating the corrected data.

On its 1996 Form R for lead compounds, the facility had reported 6,792,500 pounds of off-site releases (transfers off-site to disposal, in Section 6 of Form R) and a total of 6,800,695 pounds of production-related waste (largely in off-site recycling, in Section 8 of Form R) in error. The facility has revised its submission to zero off-site releases and 212,287 pounds of total production-related waste. The revision affected data for both off-site releases and off-site waste management, nearly all tables and figures in Chapter 9 and the discussion of them in the text.

Due to the incorrectly reported SIC code and the error associated with quantities of waste managed reported by this facility, the printed circuit board industry (SIC code 3672) was improperly ranked. EPA has corrected this error and prepared new tables that reflect this new ranking. Note that there will be a discrepancy between these tables and the rest of the data release (e.g., total releases and production-related waste for SIC code 36 shown in this errata will not correspond to data in Chapter 4).

# 1996 Toxics Release Inventory: Public Data Release

Table 9-1. Summary of TRI Information by 4-digit SIC Code, 1996: Electrical Equipment, SIC Code 36, Revised

Total On- and Off-site Releases Rank	Total Production- related Waste Rank	SIC Code	Industry	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds
13	13	3612	Transformers, Except Electronic	38	90	2	1,041,920	246,650	1,288,570
26	12	3613	Switchgear & Switchboard Apparatus	42	84	3	123,558	41,590	165,148
5	9	3621	Motors & Generators	79	191	8	2,487,700	99,028	2,586,728
19	10	3624	Carbon & Graphite Products	26	40	0	347,258	53,653	400,911
34	27	3625	Relays & Industrial Controls	14	26	1	81,551	4,588	86,139
28	25	3629	Electrical Industrial Apparatus, nec*	16	25	1	93,917	62,649	156,566
29	34	3631	Household Cooking Equipment	9	26	0	81,098	69,869	150,967
3	18	3632	Household Refrigerators & Freezers	13	64	1	2,751,418	47,550	2,798,968
7	20	3633	Household Laundry Equipment	10	60	0	1,745,257	161,947	1,907,204
16	28	3634	Electric Housewares & Fans	16	28	2	556,491	1,250	557,741
37	39	3635	Household Vacuum Cleaners	2	3	0	17,255	500	17,755
14	24	3639	Household Appliances, nec*	12	45	1	932,151	208,891	1,141,042
1	15	3641	Electric Lamps	26	65	0	2,373,160	728,039	3,101,199
18	16	3643	Current-carrying Wiring Devices	47	80	6	170,107	237,174	407,281
21	17	3644	Noncurrent-carrying Wiring Devices	18	42	2	299,293	7,734	307,027
27	26	3645	Residential Lighting Fixtures	10	15	5	153,711	5,900	159,611
22	32	3646	Commercial Lighting Fixtures	12	19	1	227,393	250	227,643
33	35	3647	Vehicular Lighting Equipment	6	16	0	70,206	16,754	86,960
32	19	3648	Lighting Equipment, nec*	8	18	1	33,888	59,300	93,188
17	29	3651	Household Audio & Video Equipment	13	21	0	443,864	2,604	446,468
39	37	3652	Prerecorded Records & Tapes	4	5	0	5,489	5,081	10,570
31	31	3661	Telephone & Telegraph Apparatus	12	15	3	122,377	4,006	126,383
38	36	3663	Radio & TV Communications Equipment	8	27	0	10,835	5	10,840
36	23	3669	Communications Equipment, nec*	11	13	0	40,346	7,248	47,594
15	6	3671	Electron Tubes **	15	80	0	632,671	339,378	972,049
9	2	3672	Printed Circuit Boards **	213	572	11	1,197,800	554,873	1,752,673
2	3	3674	Semiconductors & Related Devices	131	499	6	2,227,646	741,476	2,969,122
11	11	3675	Electronic Capacitors	27	63	0	917,038	641,297	1,558,335
25	30	3676	Electronic Resistors	7	12	0	100,371	78,797	179,168
30	33	3677	Electronic Coils & Transformers	16	23	0	133,084	1,750	134,834
24	14	3678	Electronic Connectors	24	60	1	166,456	26,446	192,902
8	7	3679	Electronic Components, nec*	106	194	21	1,536,616	332,553	1,869,169
10	1	3691	Storage Batteries	77	181	1	242,993	1,480,262	1,723,255
6	8	3692	Primary Batteries, Dry & Wet	22	55	0	367,994	2,210,035	2,578,029
20	22	3694	Engine Electrical Equipment	20	42	0	244,322	105,717	350,039
12	5	3695	Magnetic & Optical Recording Media	17	39	0	1,264,005	139,443	1,403,448
23	21	3699	Electrical Equipment & Supplies, nec*	23	61	10	141,107	51,952	193,059
4	4	Multiple within SIC 36		75	212	2	2,220,202	543,769	2,763,971
35	38	Invalid SIC Code within SIC 36		8	10	1	49,571	750	50,321
Total for SIC Code 36				1,233	3,121	90	25,652,119	9,320,758	34,972,877

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except: Non-production-related Waste (remedial/catastrophic incidents). Facilities/forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\* nec: not elsewhere classified.

\*\* Due to a facility reporting an incorrect SIC code and an error associated with quantities of waste managed reported by the same facility, the printed circuit board industry (SIC code 3672) and the electron tube industry (SIC code 3671) were improperly ranked. This table now reflects the correct ranking.



# 1996 Toxics Release Inventory: Public Data Release

Table 9-1. Summary of TRI Information by 4-digit SIC Code, 1996: Electrical Equipment, SIC Code 36, Revised, Continued

SIC Code	Industry	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
3612	Transformers, Except Electronic	360,608	5,832,457	8,272,263	108
3613	Switchgear & Switchboard Apparatus	587,653	8,382,165	9,279,624	17,370
3621	Motors & Generators	636,199	9,549,206	12,380,217	1,408
3624	Carbon & Graphite Products	9,560,688	233,848	10,232,251	130
3625	Relays & Industrial Controls	24,624	1,237,141	1,349,794	0
3629	Electrical Industrial Apparatus, nec*	2,482	1,363,697	1,602,541	1,156
3631	Household Cooking Equipment	4,042	252,446	411,317	0
3632	Household Refrigerators & Freezers	138,190	1,489,300	4,476,760	5,200
3633	Household Laundry Equipment	855,473	971,627	3,671,164	0
3634	Electric Housewares & Fans	71,400	491,937	1,123,011	0
3635	Household Vacuum Cleaners	206	48,355	66,044	0
3639	Household Appliances, nec*	279,422	502,213	1,942,083	0
3641	Electric Lamps	1,566,403	1,638,112	6,450,360	60
3643	Current-carrying Wiring Devices	2,817,437	2,973,124	6,254,196	0
3644	Noncurrent-carrying Wiring Devices	4,120,598	1,160,346	5,577,483	0
3645	Residential Lighting Fixtures	1,472,725	12,978	1,593,530	0
3646	Commercial Lighting Fixtures	168,917	33,472	425,192	0
3647	Vehicular Lighting Equipment	79,000	89,712	267,603	0
3648	Lighting Equipment, nec*	76,000	4,186,539	4,342,672	0
3651	Household Audio & Video Equipment	63,458	479,132	991,893	0
3652	Prerecorded Records & Tapes	527	93,103	103,423	0
3661	Telephone & Telegraph Apparatus	970	300,740	428,086	0
3663	Radio & TV Communications Equipment	116,171	17,963	140,024	0
3669	Communications Equipment, nec*	31,598	2,711,065	2,802,973	0
3671	Electron Tubes **	10,519,069	7,561,899	19,771,411	0
3672	Printed Circuit Boards **	13,147,263	34,438,035	50,250,684	103
3674	Semiconductors & Related Devices	34,547,619	12,254,762	49,332,568	17,220
3675	Electronic Capacitors	4,289,484	3,876,009	9,829,376	2
3676	Electronic Resistors	183,297	186,223	498,284	0
3677	Electronic Coils & Transformers	8,624	264,659	423,469	0
3678	Electronic Connectors	1,594,310	4,877,714	6,869,077	0
3679	Electronic Components, nec*	10,150,879	6,356,214	18,349,206	3,075
3691	Storage Batteries	104,469,548	229,399,495	358,730,306	3,536
3692	Primary Batteries, Dry & Wet	10,029,861	2,075,512	14,742,152	0
3694	Engine Electrical Equipment	466,862	1,404,347	3,004,650	0
3695	Magnetic & Optical Recording Media	21,578,346	1,730,414	24,834,037	1,601
3699	Electrical Equipment & Supplies, nec*	781,870	2,385,434	3,501,883	0
	Multiple within SIC 36	3,227,519	22,014,716	28,404,703	304
	Invalid SIC Code within SIC 36	7,735	29,131	87,521	99
	Total for SIC Code 36	238,037,077	372,905,242	672,813,831	51,372

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except: Non-production-related Waste (remedial/catastrophic incidents). Facilities/forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\* nec: not elsewhere classified.

\*\* Due to a facility reporting an incorrect SIC code and an error associated with quantities of waste managed reported by the same facility, the printed circuit board industry (SIC code 3672) and the electron tube industry (SIC code 3671) were improperly ranked. This table now reflects the correct ranking.

# 1996 Toxics Release Inventory: Public Data Release

**Table 9-3. TRI On-site and Off-site Releases, 1996: Electrical Equipment, SIC Code 36 (in Rank Order), Revised**

SIC Code	Industry	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		
3641	Electric Lamps	2,373,158	2	0	0	0	0	2,373,160	728,039	3,101,199	
3674	Semiconductors & Related Devices	1,163,923	1,035,005	12	0	0	28,706	2,227,646	741,476	2,969,122	
3632	Household Refrigerators & Freezers	2,751,418	0	0	0	0	0	2,751,418	47,550	2,798,968	
	Multiple within SIC 36	2,153,400	66,292	0	0	0	510	2,220,202	543,769	2,763,971	
3621	Motors & Generators	2,484,120	113	5	0	1,600	1,862	2,487,700	99,028	2,586,728	
3692	Primary Batteries, Dry & Wet	367,770	224	0	0	0	0	367,994	2,210,035	2,578,029	
3633	Household Laundry Equipment	1,626,148	411	0	0	0	118,698	1,745,257	161,947	1,907,204	
3679	Electronic Components, nec*	1,518,106	275	0	0	15,986	2,249	1,536,616	332,553	1,869,169	
3672	Printed Circuit Boards **	1,125,321	67,982	5	5	1,619	2,868	1,197,800	554,873	1,752,673	
3691	Storage Batteries	172,066	3,441	0	0	62,380	5,106	242,993	1,480,262	1,723,255	
3675	Electronic Capacitors	876,970	1,270	0	0	37,350	1,448	917,038	641,297	1,558,335	
3695	Magnetic & Optical Recording Media	1,236,187	1,000	0	0	26,818	0	1,264,005	139,443	1,403,448	
3612	Transformers, Except Electronic	1,032,444	19	0	0	0	9,457	1,041,920	246,650	1,288,570	
3639	Household Appliances, nec*	931,843	308	0	0	0	0	932,151	208,891	1,141,042	
3671	Electron Tubes	355,841	276,825	0	0	5	0	632,671	339,378	972,049	
3634	Electric Housewares & Fans	555,621	110	0	0	0	760	556,491	1,250	557,741	
3651	Household Audio & Video Equipment	443,614	250	0	0	0	0	443,864	2,604	446,468	
3643	Current-carrying Wiring Devices	169,241	505	0	0	0	361	170,107	237,174	407,281	
3624	Carbon & Graphite Products	342,874	274	0	0	0	4,110	347,258	53,653	400,911	
3694	Engine Electrical Equipment	175,629	0	0	0	22,849	45,844	244,322	105,717	350,039	
3644	Noncurrent-carrying Wiring Devices	298,675	18	0	0	0	600	299,293	7,734	307,027	
3646	Commercial Lighting Fixtures	227,393	0	0	0	0	0	227,393	250	227,643	
3699	Electrical Equipment & Supplies, nec*	138,515	582	0	0	1,500	510	141,107	51,952	193,059	
3678	Electronic Connectors	164,356	75	0	0	0	2,025	166,456	26,446	192,902	
3676	Electronic Resistors	60,053	0	0	0	40,318	0	100,371	78,797	179,168	
3613	Switchgear & Switchboard Apparatus	118,157	4,895	0	0	0	506	123,558	41,590	165,148	
3645	Residential Lighting Fixtures	153,711	0	0	0	0	0	153,711	5,900	159,611	
3629	Electrical Industrial Apparatus, nec*	93,486	421	0	0	0	10	93,917	62,649	156,566	
3631	Household Cooking Equipment	80,830	268	0	0	0	0	81,098	69,869	150,967	
3677	Electronic Coils & Transformers	133,079	5	0	0	0	0	133,084	1,750	134,834	
3661	Telephone & Telegraph Apparatus	122,372	5	0	0	0	0	122,377	4,006	126,383	
3648	Lighting Equipment, nec	31,858	2,030	0	0	0	0	33,888	59,300	93,188	
3647	Vehicular Lighting Equipment	70,206	0	0	0	0	0	70,206	16,754	86,960	
3625	Relays & Industrial Controls	81,541	10	0	0	0	0	81,551	4,588	86,139	
	Invalid SIC Code within SIC 36	49,571	0	0	0	0	0	49,571	750	50,321	
3669	Communications Equipment, nec*	40,346	0	0	0	0	0	40,346	7,248	47,594	
3635	Household Vacuum Cleaners	17,255	0	0	0	0	0	17,255	500	17,755	
3663	Radio & TV Communications Equipment	10,580	0	0	0	0	255	10,835	5	10,840	
3652	Prerecorded Records & Tapes	5,479	0	0	0	5	5	5,489	5,081	10,570	
Total for SIC Code 36		23,753,157	1,462,615	22	5	210,430	225,890	25,652,119	9,320,758	34,972,877	

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\* nec: not elsewhere classified.

\*\* Due to a facility reporting an incorrect SIC code and an error associated with quantities of waste managed reported by the same facility, the printed circuit board industry (SIC code 3672) was improperly ranked. This table now reflects the correct ranking.

# **1996**

## **Toxics Release Inventory**

**Public Data Release – 10 Years of Right-to-Know**

U.S. Environmental Protection Agency

Office of Pollution Prevention and Toxics (7408)

Washington, DC 20460



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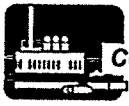
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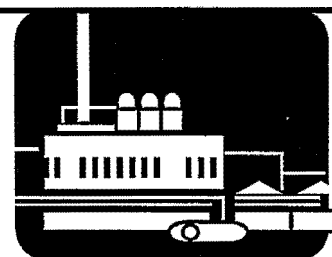
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## Chapter 1



# ***Toxics Release Inventory Reporting and the 1996 Public Data Release***

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## **Introduction**

With the release of this report, we bring to a close the first decade of TRI reporting and informed public involvement in the environmental decisions made by governments and industry. It has been a tremendously successful and challenging 10 years and the results speak loudly for themselves. Industries have reduced their on- and off-site

releases of TRI chemicals by almost 50% or 1.5 billion pounds. Governments—federal, state, and local—have used the TRI to set priorities, measure progress, and target areas of special and immediate concern. The public, perhaps our most important customer, has used the TRI data to understand their local environment, to participate in local and national debates about the choices being made that effect their health and the health of their children and, ultimately, has used the power of information

### ***A Roadmap to the 1996 TRI Public Data Release***

Chapter 1 articulates the purpose for the report and highlights new approaches to this year's data release. It also provides an overview of TRI reporting, describing who reports, what is reported, and the benefits and limitations of the data. It reviews the three-phase expansion of TRI's coverage of chemicals and industries, and looks at future modifications being considered. Chapter 1 concludes with guidance on obtaining additional TRI information. Note **Revised Presentation of TRI Data** on page 3 of this Introduction.

Chapter 2 presents an overview of the 1996 TRI data. To help put the data in context, it supplies more extensive definitions of releases and other waste management activities, and it offers information TRI users should consider in examining and analyzing TRI data. This chapter summarizes TRI data nationwide and presents more detailed analyses by state and by chemical. It also examines waste management data as a whole. Chapter 3 presents 1996 data in comparison to earlier reporting years.

Chapter 4 gives a comprehensive view of industry data in TRI and introduces the industry-specific chapters that have been added to this year's analyses. Chapters 5-10 examine five priority industrial sectors, plus reporting by federal facilities. See **Expanded Analysis of 1996 Industry Data** on page 3 of this Introduction.

In summer 1998, EPA will publish a completion of the expanded industry analyses, covering the remaining 15 sectors.



to exert their influence on the outcome of these debates.

Since 1987, the first year of TRI reporting, the TRI and the Right-to-Know Program has grown. The number of chemicals has doubled, federal facilities have been added, new sectors come on line with the 1998 reporting year and our progress in providing TRI data to the public is coming close to matching our commitment to an open and transparent environmental decision making process. The Agency applauds those who have worked with us to assure that we met the challenge that EPCRA posed, and we encourage those who continue to push us to assure and maintain the integrity and goals of the Program.

As we move into the next decade, many challenges in the Right-to-Know Program remain to be met. TRI was designed to be a program that would evolve, over time, to meet the changing needs of an informed and involved public. The program will never be static and will never be “finished.” As new chemicals of concern are identified, they will be added. Sectors that appear to contribute significantly to environmental loadings will be added. Data collection will be modified to meet new information needs and access technologies will be developed over time to assure enhanced public access.

## TRI Background

Following a fatal chemical-release accident in Bhopal, India, the Emergency Planning and Community Right-to-Know Act (EPCRA) provisions were enacted to promote emergency planning, to minimize the effects of an accident such as occurred at Bhopal, and to provide the public with information on releases of toxic chemicals in their communities.

Section 313 of EPCRA established the Toxics Release Inventory (TRI) Program, a national database that identifies facilities, chemicals manufactured and used at the identified facility, and

the annual amounts of these chemicals released (in routine operations and in accidents and other one-time events) and otherwise managed on- and off-site in waste.

In 1990, Congress passed the Pollution Prevention Act (PPA). Among its requirements was a mandate to expand TRI to include additional information on toxic chemicals in waste and on source reduction methods. Beginning in 1991, covered facilities were required to report quantities of TRI chemicals recycled, combusted for energy recovery, and treated on- and off-site. This waste management data has strengthened TRI as a tool for providing information on facilities' handling of TRI chemicals as well as for analyzing progress in reducing releases.

The *1996 Toxics Release Inventory Public Data Release (PDR)* provides an overview of the information collected through TRI. It summarizes data collected for calendar year 1996. For comparison purposes, this report also provides basic data for the two preceding years (1994 and 1995), for the period since the PPA mandated collection of waste management data (1991), and for the baseline year (1988). TRI's on-line computer database and CD-ROM contain data collected for all years, including those not found in this report.

## 1996 Public Data Release

Balancing TRI's aim to quickly provide information to the public and to offer meaningful analysis of the data collected, EPA will publish the 1996 data in two parts:

**Release 1:** *1996 State Fact Sheets* book and this *1996 Public Data Release* volume, including chapters on five priority industries (plus federal facilities): paper and allied products (SIC code 26); chemicals and allied products (SIC code 28); petroleum refining and related industries (SIC code 29); primary metal industries (SIC



code 33); and electronic and other electrical equipment and components, except computer equipment (SIC code 36).

**Release 2, summer 1998:** The additional 15 industry chapters: food and kindred products (SIC code 20); tobacco products (SIC code 21); textile mill products (SIC code 22); apparel and other finished products made from fabrics and similar materials (SIC code 23); lumber and wood products, except furniture (SIC code 24); furniture and fixtures (SIC code 25); printing, publishing, and allied industries (SIC code 27); rubber and miscellaneous plastics products (SIC code 30); leather and leather products (SIC code 31); stone, clay, glass, and concrete products (SIC code 32); fabricated metal products, except machinery and transportation equipment (SIC code 34); industrial and commercial machinery and computer equipment (SIC code 35); transportation equipment (SIC code 37); measuring, analyzing, and controlling instruments; photographic, medical, and optical goods, watches and clocks (SIC code 38); and miscellaneous manufacturing industries (SIC code 39) will be released to the public in the summer of 1998. With these 15, all SIC codes reported in 1996 will have been subject to analysis.

## Expanded Analysis of 1996 Industry Data

As evident in this two-part publication schedule, EPA is expanding the industry analysis portions of the TRI data release. Industry-specific chapters in this report examine TRI data for five priority sectors, as designated by two-digit Standard Industrial Classification (SIC) codes. These chapters set the TRI data in a context of economic, regulatory, and technological developments that influence industry-wide releases, transfers, and waste management. In addition, this data release analyzes reporting by industrial activities within each sector at the four-digit SIC code level. A similar chapter reviews reporting by federal facilities.

This industry-by-industry focus permits a more detailed view of the sources of environmental releases of TRI chemicals, a closer perspective on industrial progress in reducing them, and a better understanding of industry practices in generating and managing TRI chemicals in waste. This sector-based approach supports sector-based assessments of future prevention and technology needs, and will, ultimately, enable goal-setting within sectors and across facilities.

## Revised Presentation of TRI Data

This public release of TRI data departs from previous practice in presenting information from the TRI database. Previous data release publications have essentially followed TRI's reporting form (Form R) in organizing the data: on-site releases by environmental medium (Section 5 of Form R), off-site transfers by type (Section 6), and waste management by type (Section 8). TRI has collected release data and certain transfer data from its inception. Additional waste management data were added to the inventory in 1991 as a result of the PPA. This history is reflected in the structure of the reporting form and, therefore, in earlier presentations of data.

This year, however, the data are organized in keeping with the nature of the information rather than their origins on the reporting form. This results in two general categories: releases and waste management. Specifically, data tables in this year's report present:

### ◆ On- and off-site releases

- On-site releases (Section 5 of Form R)
- Off-site releases (transfers off-site to disposal, from Section 6)

### ◆ Other waste management

- On-site waste management, excluding on-site releases (from Section 8)





- Transfers off-site for further waste management (Section 6, except transfers to disposal)
- Total production-related waste (sum of all quantities reported in Section 8, except one-time events such as accidents or remediation activities)

## **Additions to 1996 TRI Public Data Release**

In response to requests for additional information relating to chemicals reported to TRI, the 1996 TRI Public Data Release has been augmented with a number of new sections that will enable the public to gain a better perspective on the TRI data and to begin to assess the impacts of the release of these chemicals into the environment. The new sections include data on chemical releases from some diffuse sources (sources other than those facilities that are required to report under the TRI), as well as information on a number of tools to help assess the impacts of chemical releases on the environment. These tools include information on the availability of toxicity data (the Screening Information Data Set (SIDS)) on high production volume chemicals, EPA's Screening Information System/LAN (SIS/L), and EPA's Act Locally catalogue. Each of these new sections are described in more detail below.

## **Availability of Screening Information Data Set (SIDS) Testing**

The Screening Information Data Sets (SIDS) is an Organisation for Economic Co-operation and Development (OECD) program where data on high production volume (HPV) chemicals are collected and shared. OECD member countries work cooperatively to select chemicals to be investigated; collect information from government and industry files; complete the agreed-upon Screening Information Data Set (SIDS) testing; make an initial assessment of the potential hazards and risks of each chemical; and identify the priority for additional international efforts (e.g., post-SIDS testing or exposure

information gathering). International authorities have agreed that six basic tests are necessary for a minimum understanding of a chemical's toxicity. These tests cover acute toxicity, chronic toxicity, developmental and reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate.

EPA's Office of Pollution Prevention and Toxics (OPPT) is playing an integral role representing the U.S. Government in the SIDS Program. OPPT is committed to making non-confidential chemical information available to the public and promoting information sharing with industry and the scientific community. As part of this project, EPA has conducted a data availability survey to determine what SIDS data is available for high production volume chemicals, including those on the TRI. The results of the survey for the TRI chemicals are presented in Appendix C.

As sponsoring countries complete the SIDS process for HPV chemicals, OPPT is converting the documents into electronic formats under a pilot image processing technology project to augment information sharing and provide greater accessibility to the final version of the SIDS documents. The chemical industry in the U.S. and other OECD member countries fully supports the OECD HPV work and sharing of the results. The SIDS Program will enable industry to avoid duplicative testing in fulfilling requirements of various countries.

## **Screening Information System/LAN (SIS/L)**

The SIS/L (Screening Information System/LAN) will enable the public to track chemicals across major OPPT, EPA and federal government databases, information systems, and document collections that contain information on production and use; release, exposure and monitoring; toxicity and hazard; and risk. Users will be able to search for chemicals by both CAS number and chemical name. Acting as a platform for multiple data sources, SIS/L will provide access to chemical information lists and databases



regardless of their origin. EPA is currently working to make SIS/L available on EPA's public access home page as a valuable information source for EPA, other federal agencies, state and local governments, public interest groups, research organizations, non-governmental organizations, industry, and the public.

More information relating to SIS/L and resources available through SIS/L is found in Appendix C of this publication. (See **Appendix C.**)

### **Act Locally Catalogue**

*Act Locally* is an online catalogue that describes tools, resources, and programs that assist communities in pollution prevention. This catalogue developed by EPA's Office of Prevention, Pesticides, and Toxic Substances (OPPTS) provides information on the characteristics and effects of pesticides and industrial chemicals, and includes: databases; computer programs for chemical screening; funding resources; access to information hotline; and descriptions of programs and initiatives that may be useful in protecting local environments.

*Act Locally* describes activities developed by OPPTS that are compatible with the Agency's community-based environmental protection (CBEP) goals and initiatives. In addition, it describes OPPTS products that are useful tools for supporting CBEP activities in large and small communities. These tools can help communities learn about potential chemical risks, and can be used to develop strategies to mitigate those risks and help improve the local environment. *Act Locally* is available online at [www.epa.gov/opptintr/cbep/actlocal/index.html](http://www.epa.gov/opptintr/cbep/actlocal/index.html) and can be reviewed, printed, or downloaded. The online site also has hyperlinks to other OPPTS and related resources. A published version of *Act Locally* is expected by late summer 1998.

More information relating to *Act Locally* and resources available through *Act Locally* is found in Appendix B of this publication. (See **Appendix B.**)

### **Diffuse Sources**

The 1996 TRI Public Data Release includes a new section on diffuse sources that provides more information on three types of chemical releases not reported to TRI -- fertilizer use, pesticide use, and volatile organic compounds (VOCs). While TRI provides key environmental data, it has certain limitations. Although additional sectors will begin reporting to TRI for the 1998 reporting year, TRI to date has covered only the manufacturing sector and, since 1994, federal facilities. Releases of chemicals from the manufacturing sector represent a significant, but limited, portion of all chemicals released into the environment, that is, they do not account for the releases associated with many of the post-manufacturing uses of chemicals. For example, manufacturers of fertilizers and pesticides must report their releases, transfers, and waste management to TRI, but the subsequent application and release of these chemicals by the agricultural sector are not captured in TRI. Similarly, the release of VOCs from nonindustrial and mobile sources is not captured in TRI. Therefore, EPA has assembled some data on releases from these sources not captured by TRI in order to put the TRI data in better perspective. This information is presented in Chapter 2.

## **TRI Reporting**

The Toxics Release Inventory is a publicly available database that contains information on specific toxic chemical releases and other waste management activities from the manufacturing sector of the U.S. economy and, since 1994, federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA). Following passage of the Pollution Prevention Act of 1990, TRI was expanded to include mandatory reporting of



additional waste management and pollution prevention activities.

The information collected under these laws can be used by the public to identify facilities and chemical release patterns that warrant further study and analysis. Combined with hazard and exposure information, TRI has proven to be a valuable tool for risk identification.

Each year, facilities that meet certain thresholds must report their releases and other waste management activities for listed toxic chemicals to EPA and to the state or tribal entity in whose jurisdiction the facility is located. The TRI list for 1996 included more than 600 chemicals and 28 chemical categories. Each facility submits a TRI reporting form, known as Form R, for each TRI chemical it has manufactured, processed, or otherwise used in amounts exceeding the thresholds for 1996. Starting with the 1995 reporting year, facilities with lower levels of reportable amounts that do not *manufacture, process, or otherwise use* more than 1 million pounds of the chemical can file a much shorter certification statement, Form A (see section on **TRI Reporting Forms** later in this chapter).

Reports for each calendar year are due by July 1 of the following year. After completion of data entry and data quality assurance activities, the Agency makes the data available to the public in printed reports, in a computer database, and through a variety of other information products such as CD-ROMs. States also make available to the public copies of the forms filed by facilities in their jurisdiction. In addition, some states independently produce a data release report.

## Who Must Report?

Manufacturing facilities that have the equivalent of 10 or more full-time employees and meet the established thresholds for manufacturing, processing, or “otherwise use” listed chemicals must report their releases, transfers, and waste management quantities. Manufacturing facilities are defined as

### Box 1-2. Who Reported Toxic Chemical Release Inventory Reports for the 1996 Reporting Year?

#### Who Reported Toxic Chemical Release Inventory Reports for the 1996 Reporting Year?

A facility must report to TRI if it.

- Conducts manufacturing operations within Standard Industrial Classification (SIC) codes 20 through 39 (or is a federal facility in any SIC code),
- Has 10 or more full-time equivalent employees, and
- Manufactures or processes more than 25,000 pounds or otherwise uses more than 10,000 pounds of any listed chemical during the calendar year.

facilities in Standard Industrial Classification (SIC) primary codes 20-39, which include, among others: chemicals, petroleum refining, primary metals, fabricated metals, paper, plastics, and transportation equipment. Federal facilities have been required to report since 1994, regardless of their SIC classification.

In May 1997, EPA added seven new industry sectors that will report to the TRI for the first time in July 1999 for reporting year 1998. Thresholds for manufacturing and processing are currently 25,000 pounds for each listed chemical, while the threshold for “otherwise using” is 10,000 pounds per chemical. Beginning with the 1995 reporting year, certain facilities are able to take advantage of a burden-reducing reporting threshold. (See “Form A” in **TRI Reporting Forms**, later in this chapter.)

## What Must Be Reported?

Each year, facilities report to TRI the amounts of toxic chemicals released on-site to the air, water, and land and injected underground (Section 5 of TRI Form R), and the amounts of chemicals transferred off-site for recycling, energy recovery, treatment, and disposal (Section 6 of Form R). They also report production-related waste



### Box 1-3. Who Will Report to TRI Starting in the 1998 Reporting Year?

#### Who Will Report to TRI Starting in the 1998 Reporting Year?

- Metal mining (SIC code 10 except for SIC codes 1011, 1081, and 1094)
- Coal mining (SIC code 12 except for extraction activities)
- Electrical utilities that combust coal and/or oil (SIC codes 4931 and 4939)
- Resource Conservation and Recovery Act (RCRA) Subtitle C hazardous waste treatment and disposal facilities (SIC code 4953)
- Chemicals and allied products wholesale distributors (SIC code 5169)
- Petroleum bulk plants and terminals (SIC code 5171)
- Solvent recovery services (SIC code 7389)

### Box 1-4. What Must Be Reported to TRI?

#### What Must Be Reported?

Information reported by facilities includes:

- Basic information identifying the facility;
- Name and telephone number of a contact person;
- Environmental permits held;
- Amounts of each listed chemical released to the environment at the facility;
- Amounts of each chemical shipped from the facility to other locations for recycling, energy recovery, treatment, or disposal;
- Amounts of each chemical recycled, burned for energy recovery, or treated at the facility;
- Maximum amount of chemical present on-site at the facility during the year;
- Types of activities conducted at the facility involving the toxic chemical; and
- Source reduction activities.

management information on quantities recycled, combusted for energy recovery, treated, or released or otherwise disposed of, both on- and off-site, and catastrophic or other one-time releases (Section 8 of Form R). To some extent, data in Sections 5, 6, and 7 of Form R and those in Section 8 represent a different view of essentially the same information.

Facilities provide specific identifying information, such as:

- Name
- Location
- Type of business
- Contact names
- Name of parent company
- Environmental permit numbers

They also provide information about the manufacture, process, and otherwise use of the listed chemical at the facility and the maximum amount of the chemical on-site during the year. Facilities

provide information about methods used to treat waste streams containing the toxic chemicals at the site and the efficiencies of those treatment methods. In addition to information about the amount of toxic chemicals sent off-site for waste management, facilities also must specify the destination of these transfers. Beginning with the 1991 reports, facilities were required to provide information about source reduction activities, along with the quantities managed in waste by activities such as recycling. Companies must provide a production index that can help relate changes in reported quantities of toxic chemicals in waste to changes in production.

These additional data elements facilitate tracking of industry progress in reducing waste generation and moving towards safer management alternatives. While current TRI data cannot provide an absolute measure of pollution prevention, the data can provide new insight into the complete toxics cycle.



## What Are the Benefits and Limitations of the Data?

*We believe that people know what's best for their own communities and, given the facts, they themselves will determine what is best to protect public health and the environment.*

—Carol Browner, U.S. EPA Administrator

### Benefits

The TRI Program has given the public unprecedented direct access to toxic chemical release and other waste management data at the local, state, regional, and national level. Responsible use of this information can enable the public to identify potential concerns, gain a better understanding of potential risks, and work with industry and government to reduce toxic chemical releases and the risks associated with them. When combined with hazard and exposure data, this information can allow informed environmental priority-setting at the local level. More than 1,500 citizen groups have used TRI data to achieve the goal of a cleaner and healthier neighborhood.

Federal, state, and local governments can use the data to compare facilities or geographic areas, to identify hot spots, to evaluate existing environmental programs, to more effectively set regulatory priorities, and to track pollution control and waste reduction progress. TRI data, in conjunction with demographic data, can help government agencies and the public identify potential environmental justice concerns.

Industry can use the data to obtain an overview of the release and management of toxic chemicals, to identify and reduce costs associated with toxic chemicals in waste, to identify promising areas of pollution prevention, to establish reduction targets, and to measure and document progress toward reduction goals. Public availability of the data has

prompted many facilities to work with communities to develop effective strategies for reducing environmental and human health risks posed by toxic chemical releases. Since 1988, facilities have reduced toxic releases, on- and off-site, by 45.6%, for chemicals reportable in all years.

Completion of Phase 1 of TRI expansion in the 1995 reporting year has significantly increased the usefulness of the data. The scope of the program was broadened to include 286 new chemicals and chemical categories<sup>1</sup> on the toxic chemical list for a total of 643 reportable chemicals and chemical categories. Many of these new chemicals are high production volume (HPV) chemicals and highly toxic substances. (See **TRI Expansion** later in this chapter for more information.)

Recognizing that the manufacturing sector is not the only industrial sector releasing toxic chemicals to the environment or otherwise managing them as waste, EPA undertook a thorough review of all U.S. industrial sectors. This effort, Phase 2 of TRI expansion, focused particular attention on sectors linked to manufacturing—those providing energy, further managing products, or further managing waste from the manufacturing sector. On May 1, 1997, EPA published a final rule expanding TRI's industry coverage. As a result of this effort, EPA added seven industry sectors: metal mining, coal mining, electrical utilities that combust coal and/or oil, hazardous waste treatment and disposal facilities, chemical wholesale distributors, petroleum bulk stations and terminals, and solvent recovery services. Facilities in these industries will begin reporting in July 1999 for the year 1998.

EPA believes this action will greatly enhance communities' Right-to-Know by requiring TRI reports from an estimated 6,600 additional facilities. EPA is conducting an aggressive outreach

<sup>1</sup> Of the 286 chemicals, 20 were diisocyanates and 19 were polyaromatic compounds. These are reported not as individual chemicals, but as two chemical compound categories. Not individually counting the members of these two categories converts 286 to 249. Furthermore, three other chemicals have been remanded, and one chemical was not reportable because of an administrative stay. Thus, the number of chemicals added to TRI in 1995, that were reportable in 1996, was 245.



campaign, including guidance, training, and technical assistance, to assist these new industries in understanding their reporting obligations. In addition, as a result of a Presidential Executive Order, federal facilities have been required to report since 1994.

### Limitations

While TRI provides the public, industry, and state and local governments an invaluable source of key environmental data, it has some limitations that must be considered when using the data. Through the 1997 reporting year, the program applies to industries in the manufacturing sector and those owned by the federal government. It, therefore, does not cover all sources of releases and other waste management activities of TRI chemicals. With finalization of the facility expansion rule, industries providing energy, further managing products, or further managing waste from the manufacturing sector will also report. Although TRI is successful in capturing information on a significant portion of toxic chemicals currently being used by covered industry sectors, it does not cover all toxic chemicals or all industry sectors, nor will it do so after the facility expansion takes effect. In addition, facilities that do not meet the TRI threshold levels (those with fewer than 10 full-time employees or those not meeting TRI quantity thresholds) are not required to report. Thus, while the TRI includes 71,381 reports from 21,626 facilities for 1996, the 2.43 billion pounds of on- and off-site releases reported represent only a portion of all toxic chemical releases nationwide.

Another limitation of the existing TRI Program is that the data currently collected provide limited information on the life cycle of chemicals used by facilities. Beyond reporting on releases and other waste management, only limited and very general information on chemical storage is provided and none on the toxicity of the chemicals. In addition, although this report attempts to put certain releases in a broader context (such as pesticides, volatile organic compounds, and fertilizers), TRI does not

#### Box 1-5. Factors to Consider in Using TRI Data

##### **Factors to Consider in Using TRI Data**

**Toxicity of the Chemical:** TRI chemicals vary widely in their ability to produce toxic effects. Some high-volume releases of less toxic chemicals may appear to be a more serious problem than lower-volume releases of highly toxic chemicals, when just the opposite may be true.

**Exposure Considerations:** The potential for exposure is greater the longer the chemical remains unchanged in the environment. Sunlight, heat, or microorganisms may or may not decompose the chemical. For example, microorganisms readily degrade some chemicals, such as methanol, into less toxic chemicals, whereas metals are persistent and will not degrade when released to the environment.

**Type of Release (Environmental Medium):** Chemical exposure of a population depends on the environmental medium (air, water, land, etc.) to which a chemical is released. The medium also affects the types of exposures possible, such as inhalation, dermal exposure, or ingestion

account for toxic emissions from cars and trucks and from many other non-industrial sources.

Furthermore, facilities report estimated data to TRI, and the program does not mandate that they monitor their releases. Various estimation techniques are used when monitoring data are not available, and EPA has published estimation guidance for the regulated community. Variations between facilities can result from the use of different estimation methodologies. These factors should be taken into account when considering data accuracy and comparability.

As discussed above, the TRI data summarized in this report reflect chemical releases and other waste management activities that occurred in the 1996 calendar year. Patterns of releases and other waste management activities can change dramatically from one year to the next. Thus, it is important to recognize that current facility activities may be different from those reported for 1996.



TRI reports reflect releases and other waste management activities of chemicals, not exposures of the public to those chemicals.

Release estimates alone are not sufficient to determine exposure or to calculate potential adverse effects on human health and the environment. Although additional information is necessary to assess exposure and risk, TRI data can be used to identify areas of potential concern. Furthermore, TRI data, in conjunction with other information, can be used as a starting point in evaluating exposures that may result from releases and other waste management activities of toxic chemicals. The determination of potential risk depends upon many factors, including the toxicity of the chemical, the fate of the chemical after it is released, the locality of the release, and the human or other populations that are exposed to the chemical after its release.

## TRI In Perspective

TRI has achieved tremendous results. The public now has a much better picture of toxic chemical risks in their communities, while industry and government have better data for identifying opportunities and measuring successes in preventing pollution. The sections below provide an overview of recent and proposed expansions to TRI. These expansions allow TRI to provide even more valuable information to the general public and industry.

### TRI Expansion

There are few who would disagree that the 1987 Emergency Planning and Community Right-to-Know Act (EPCRA) provisions have proven to be among the most successful stimuli for reducing the amount of toxic chemicals that enter the environment. TRI, specifically, has focused public and industry attention on the billions of pounds of toxic materials that are released directly into our air, our land and our water, or injected underground, or are

recycled, burned for energy recovery or otherwise treated. While all releases are not equal, and some may not lend themselves to reduction or elimination, the TRI has forced a hard look at our approach to the use of toxic chemicals. This hard look has been beneficial. Between 1988, TRI's baseline year, and 1996, industrial on- and off-site releases have decreased 45.6%, from 3.35 billion pounds to 1.82 billion pounds, for chemicals reportable in all years (see Chapter 3 for additional information). This reduction reflects the hard work of manufacturing facilities that have refined their processes, looked for source reduction opportunities, assured outstanding housekeeping practices and worked to minimize the footprint they leave on their surrounding environment. Designed to be non-intrusive, TRI has provided the guide for all to use when seeking areas for environmental improvement.

One valid criticism of the program has been the limited breadth and depth of its chemical, facility and data coverage. In 1987, when the Congress passed EPCRA, 300-plus chemicals and chemical categories were presented as the "TRI Chemical List." This list combined two existing chemical lists: the New Jersey Environmental Hazardous Substance List and the Maryland Chemical Inventory Report List. Over time, through the EPA's petition process, the original list has been modified as the Agency responded to petitions to add and delete chemicals, given the law's toxicity listing criteria. These criteria focus on both acute and chronic health effects as well as environmental effects. TRI's coverage of facilities has been limited to the manufacturing sector (SIC codes 20-39), required to report under EPCRA section 313. Finally, data coverage was initially confined to information on releases and certain transfers off-site for further waste management.

Over time, EPA has worked to expand TRI to cover other industrial sectors, other chemicals that have similar adverse impacts on our environment, and further information about facilities' use of toxic chemicals. Towards that end, the Agency has pursued an expansion strategy that would enlarge





the boundaries of TRI in several directions. EPA has pursued a three-phase approach to broaden the scope of TRI: chemical expansion, facility expansion, and chemical use reporting. EPA's recent actions include a significant expansion of the number of chemicals in the program to give the public a more complete picture of toxic chemicals in their communities. At the same time, EPA provided a burden reducing option (Form A) for facilities with lower levels of reportable amounts. In Phase 2, EPA has expanded the facilities reporting to TRI. The third phase addresses a broader range of information about facilities' use of TRI chemicals.

### Phase 1: Chemical Expansion

The Phase 1 Expansion included two major actions. The first occurred in 1993 with the addition of certain Resource Conservation and Recovery Act (RCRA) chemicals and certain hydrochlorofluorocarbons (HCFCs) to EPCRA section 313.

The second action of this phase was the addition of 286 chemicals and chemical categories on November 30, 1994 (59FR 61432). These 286 additional chemicals can be characterized as high or moderately high in toxicity, and they are currently manufactured, processed, or otherwise used in the U.S. This expansion of the chemical list raised the number of chemicals and chemical categories reported to TRI to over 600. Specifically, the rule added more than 150 pesticides, certain Clean Air Act chemicals, certain Clean Water Act Priority Pollutants, and certain Safe Drinking Water Act chemicals. Many of the chemicals are carcinogens, reproductive toxicants, or developmental toxicants. Of particular note is the addition of industrial chemicals such as diisocyanates, n-hexane, n-methylpyrrolidone, and chemicals such as polycyclic aromatic compounds that result from the combustion of fuels. This 1996 data release is the second year facilities have reported on these added chemicals.

While this constituted a major component of the chemical expansion, the TRI chemical list is always

fluid and dynamic. EPA continues to review other chemicals for addition, including chemicals that were proposed for addition but not listed in 1994 because of the lack of available data. Other chemicals under consideration include, for example, persistent bioaccumulators. EPA may also add or delete a number of chemicals each year through the petition process. Chemicals may be added or deleted according to the toxicity criteria outlined in sections 313(c) and (d) of EPCRA.

### Phase 2: Facility Expansion

Since the enactment of EPCRA, the TRI Program has focused on the releases and other waste management activities of the manufacturing sector—facilities classified as being primarily in SIC codes 20-39. To provide the public with a more complete picture of the toxics in their community, EPA undertook a detailed examination of other, non-manufacturing industries to determine which may be significant generators of toxic chemical releases and wastes. Factors used to evaluate which industries would be considered for this expansion included other available data on toxic chemical releases and other waste management activities, the interrelationship of non-manufacturing operations to manufacturing operations, the degree to which reporting would be expected to occur and the potential burden that TRI reporting might impose on these facilities.

As a result of its assessments, EPA added seven industry sectors to TRI in May 1997. The sectors are:

- Metal mining (SIC code 10 except for SIC codes 1011, mining of iron ores; 1081 metal mining services on a contract or fee basis, such as drilling or exploration and development; and 1094, mining of uranium-radium-vanadium ores);
- Coal mining (SIC code 12 except for 1241 and extraction activities);
- Electrical utilities that combust coal and/or oil (SIC codes 4911, 4931 and 4939);





- RCRA subtitle C hazardous waste treatment and disposal facilities (SIC code 4953);
- Chemicals and allied products wholesale distributors (SIC code 5169);
- Petroleum bulk plants and terminals (SIC code 5171); and
- Solvent recovery services (SIC code 7389).

The first reports from these facilities are due July 1, 1999, for the 1998 reporting year. As part of this rule, EPA revised its interpretation of otherwise use to clarify that the treatment for destruction, stabilization, and disposal of toxic chemicals in wastes received from other facilities is reportable. EPA estimates that about 6,600 additional facilities will submit more than 37,000 additional Form R reports because of the addition of these industry groups. EPA will continue to review other industries for possible inclusion in the TRI Program.

Since the final rule was published, EPA has developed guidance documents to help facilities in each of the newly added industries understand and comply with EPCRA Section 313 requirements. These documents were circulated to industry for review before being made final. The final guidance documents are available from EPA's Web site at <http://www.epa.gov/opptintr/tri>. In addition, the Agency is conducting training sessions around the country. The training sessions give an overview of EPCRA Section 313 reporting requirements, with training modules that provide exercises in interpretation and form completion.

### Phase 3: Chemical Use Reporting

TRI serves as the public's primary source of easily accessible environmental information on a local, regional, and national level. EPA believes that chemical use information could expand the public's ability to evaluate a range of important environmental issues at all of these levels.

EPA has been exploring the nature, scope, and issues involved in requiring the collection of

chemical use information. Following several public meetings, extensive public dialogue, and publication of several issue papers, EPA issued an Advance Notice of Proposed Rulemaking (ANPR) in October 1997. The purpose of the ANPR was: 1) to describe the Agency's plan to further evaluate these issues; 2) to provide preliminary notice of additional public meetings; 3) to request comments and information on issues where additional assessment is needed; 4) to solicit actual assessments that have been performed using materials use data; and 5) to initiate public input concerning the development of regulation on this issue. EPA's Phase 3 expansion to assess the utility of materials accounting data is commonly referred to as "chemical use expansion."

The materials accounting information that EPA is considering focuses on the complete life cycle of chemicals used by TRI-covered facilities. This includes amounts of listed chemicals entering a facility, amounts consumed in processing activities, amounts released on-site to all environmental media, and amounts transferred off-site in products or as wastes. EPA believes that chemical use data could provide communities and government with information to better evaluate facilities' source reduction and pollution prevention performance, to focus emergency planning efforts related to the transportation of chemicals through their communities and the storage of chemicals within their communities, to identify amounts of toxic chemicals in products distributed in commerce, and to address worker safety and health concerns.

In the course of EPA's public dialogue on chemical use expansion, the Agency has identified several significant issues that will require extensive review. EPA has reviewed the comments submitted in response to the ANPR and the issues they identify, and is continuing to evaluate other issues as well. The Agency anticipates a decision in mid-1998 on the next steps for chemical use reporting.



## TRI Reporting Forms

### Form A

While expanding chemical and industry coverage, EPA has also provided a burden reducing option for facilities with relatively low quantities of listed toxic chemicals in waste. Beginning in 1995, as the expanded chemical list went into effect, facilities whose total annual reportable amount of a listed toxic chemical does not exceed 500 pounds can apply a higher activity threshold in determining their reporting obligations. The total annual reportable amount is defined as the sum of the waste management categories that would be reported to TRI: quantities released (including disposal), recovered as a result of on-site recycling operations, combusted on-site for energy recovery, and treated at the facility, plus amounts transferred off-site for recycling, energy recovery, treatment, and disposal. These amounts correspond to total production-related waste in this report.

If the facility does not exceed the total-production-related amount, and does not manufacture, process, or otherwise use more than 1 million pounds of the listed chemical, the facility does not have to file a Form R. Instead of filing a Form R detailing all its releases and waste management activities, the facility can submit a certification statement (Form A). Form A certifies that the facility met the conditions outlined above for the listed chemical, but does not require reporting of any amounts of the toxic chemical released or otherwise managed as waste.

### Revisions to Form R

In 1997, EPA made several changes to Form R for the 1996 reporting year. Section 5.5, formerly titled "Release to Land On-site," was renamed "Disposal to Land On-site." This change was made to address concerns about public misperception and to help the public better understand the nature of various

methods of disposal. Section 5.5 now contains five subsections: RCRA subtitle C landfills; other landfills; land treatment/application farming; surface impoundment; and other disposal.

EPA also revised Form R for the 1996 reporting year to recognize the difference in the management and regulatory oversight provided by the Underground Injection Control program of Class I wells from other forms of injection into the land. Section 5.4 was previously titled "Underground Injections On-site," and the 1995 guidance document specifically stated that this data element included the "Total annual amount of the toxic chemical that [is] injected to all wells, including Class I wells, at the facility." On the 1996 Form R, two sections deal with underground injection: Section 5.4.1, "Underground Injection On-Site to Class I Wells," and section 5.4.2, "Underground Injection On-Site to Class II-V Wells." These changes provide an opportunity to better distinguish between the various types of underground wells.

Beginning with the 1995 reporting year, Section 5 of Form R, previously titled "Releases of the Toxic Chemical to the Environment On-Site" was renamed "Quantity of the Toxic Chemical Entering Each Environmental Medium."

## Future TRI Modifications

### Pollution Prevention Act Reporting

Under the Pollution Prevention Act of 1990 (PPA), EPA is required to collect information on source reduction and recycling activities on TRI's Form R. In September 1991, all facilities subject to TRI reporting were required to provide the following data:

- Quantity of the chemical (prior to recycling, treatment, or disposal) entering any waste stream or released to the environment;
- Quantities of the chemical recycled at the facility and elsewhere;



- Quantities of the chemical treated at the facility and elsewhere;
- Information on source reduction activities and the methods used to identify those activities;
- Quantities of the chemical released in one-time events not associated with production processes;
- Quantities of the chemical expected to enter any waste stream or be recycled in future years; and
- Production ratio or activity index for the reported chemical.

This change in the program generated many comments (regarding, for example, definitions of waste stream, reportable recycling, and in-process recycling) from industry, environmental groups, and the public. Therefore, EPA sought to develop a consensus approach through a special subcommittee of the National Advisory Committee on Environmental Protection and Technology (NACEPT), which was composed of industry, environmental groups and governmental agencies. As a result of those discussions, the Agency is currently developing a supplemental notice of proposed rulemaking (SNPR) and final rule.

### Redesign of TRI Reporting Forms and TRI Stakeholder Dialogue

Since 1987, EPA has used Form R to collect the facility-specific information required by TRI. The form has undergone a number of changes over the years, especially in 1990 when it was redesigned to capture the data required by the Pollution Prevention Act (PPA). There have been some more recent changes in the form, including those noted above for reporting year 1996. Currently, several efforts are underway to identify possible additional revisions to Form R and Form A.

In May 1997, when EPA finalized the industry expansion rule, the Vice President announced that

the Agency would initiate an intensive stakeholder process to comprehensively evaluate the current reporting forms (Form R and Form A) and reporting practices relating to the TRI Program. The goals of this process are to improve the type of right-to-know information available to communities and to help streamline right-to-know reporting to ease the paperwork burden for businesses affected by the requirements. EPA is using the Toxics Data Reporting Committee (TDR) of the National Advisory Council for Environmental Policy and Technology (NACEPT) and additional public stakeholder meetings to obtain input from interested parties on these issues.

NACEPT is a federal advisory committee under the Federal Advisory Committee Act, PL 92-463. It provides advice and recommendations to the Administrator of EPA on a broad range of environmental policy issues. The TDR is a committee created under NACEPT's auspices. The TDR committee currently consists of 24 members from industry, academia, government agencies, environmental groups, environmental justice groups, labor, and public interest groups. The committee is working to identify improvements and burden-reduction measures in the TRI Program. The committee may also make recommendations about how EPA presents the data to the public. EPA will review the recommendations received from NACEPT and use them to make decisions about changes to the TRI reporting forms, Form R and Form A. Changes to the forms will be made as expeditiously as possible, depending on whether they can be made administratively or require notice-and-comment rulemaking. As of April 1998, four TDR Committee meetings have been held. Three more are planned in 1998.

In addition to the NACEPT process, EPA is obtaining additional views and information from stakeholders by holding a number of smaller meetings for interested parties. As of April 1998, EPA has held five public meetings to solicit comments from stakeholders regarding the issues outlined above. These meetings were held in Washington, DC; San



Francisco, CA; Chicago, IL; Dallas, TX; and New York, NY. EPA may convene several more public meetings in 1998. Both of these efforts are aimed not only at reducing the burden to industry, but at improving the quality and practical utility of the information in the TRI Program.

### Persistent Bioaccumulators

TRI currently includes information on several persistent bioaccumulators (PBTs), and EPA is considering adding others. EPA is also considering lowering the reporting thresholds for these chemicals because of their persistence and bioaccumulative nature and the relatively small amounts being manufactured (often below current TRI threshold levels).

Persistent bioaccumulators are chemicals that are stable for long periods of time (sometimes many years), and build up in the environment, particularly in food chains. Those PBTs on the TRI list are toxic to humans and/or animals and plants. Small release amounts of such chemicals, not reported to TRI because they do not meet current reporting thresholds, may accumulate in the environment. Persistent bioaccumulators include high-volume industrial chemicals, such as hexachlorobenzene, that are used to manufacture other chemicals; currently produced pesticides, such as lindane; metals, such as lead and mercury compounds; and by-products of industrial processes or products of combustion during waste destruction or energy generation, such as benzo(a)anthracene.

Although certain PBTs are not currently produced in the U.S., chemical manufacturers, federal facilities, and other industrial sources that made or used the now-discontinued chemicals release these PBTs during treatment and disposal activities. Chlordane and polychlorinated biphenyls (PCBs) are examples of chemicals not currently being produced in the U.S., but which are being released and reported to TRI. TRI reporting of these PBTs may increase in the 1998 reporting year, as treatment, storage, and disposal (TSD) facilities

#### **Box 1-6. Some Toxic Persistent Bioaccumulators Listed on the Toxics Release Inventory**

##### **Some Toxic Persistent Bioaccumulators Listed on the Toxics Release Inventory**

Chemical	Source/Use
Chlordane	Pesticide; no longer in use in the United States
Benzo(a)anthracene	Burning of coal, oil
Mercury compounds	Many industrial uses
Lindane	Pesticide; currently in use in the United States
PCBs	No longer in production, but still found in electrical equipment

(hazardous waste management facilities) begin reporting under the Phase 2 facility expansion rule. Reporting of mercury releases is also expected to increase, as electric utilities similarly begin reporting to TRI.

### Airports Petition

On April 16, 1997, EPA received a petition from the Natural Resources Defense Council, the Defenders of Wildlife, the National Audubon Society, and the Humane Society of the U.S. requesting EPA to initiate rulemaking to add SIC code 45, transportation by air, to the list of facilities required to report to TRI. The petitioners stated that airports should report because they meet EPA's three criteria for adding facilities under section 313 of EPCRA. In addition, the petitioners asserted that requiring such reporting would further the purposes of EPCRA by making TRI information publicly available to communities located near airports.

In response, EPA issued a Notice of Receipt and request for comments in the *Federal Register* on February 10, 1998. In the notice, the Agency published the full text of the petition and requested comments on 1) whether the use of TRI chemicals would or should be exempt under the Motor Vehicle Maintenance Exemption, 40 CFR 372.38(c), and 2) the practical impacts of requiring



airports to report under section 313 of EPCRA. The Agency recognizes that if airports were required to report under section 313 of EPCRA and 6607 of the PPA, there could be unique reporting issues associated with their ownership, operation, and control. Therefore, information gathered from those who commented on the February 10, 1998, *Federal Register* notice will be instrumental in helping the Agency determine whether to add airports as facilities that should report to TRI.

### Oil and Gas Expansion

During the facility expansion analysis, several industry sectors were identified as sources that routinely manage materials containing TRI-listed toxic chemicals, but were not added in the May 1, 1997 rule. These included the oil and gas exploration and production industry, which appears to be a source that manages significant amounts of TRI chemicals. A number of questions existed regarding the application of EPCRA section 313 requirements to this industry, which prevented EPA from including it in the expansion rulemaking, but which the Agency is now reconsidering.

## **International Aspects of TRI**

Toxic chemical releases know no boundaries. While TRI data provide a wealth of information about releases, on-site waste management, and off-site transfers of toxic chemicals within the U.S., information from other countries is limited. This, however, is changing. There are an increasing number of countries developing TRI-like systems. The international term for these systems is Pollutant Release and Transfer Registers (PRTRs).

The real stimulus for PRTRs was the 1992 United Nations conference on the environment, popularly known as the Earth Summit. One conclusion from this conference was the benefit and value of PRTRs. Countries were encouraged to develop these systems. In an important step, the Earth Summit also linked these PRTR systems with public Right-to-Know, an integral aspect of TRI.

Since 1992, there has been a growing interest in PRTRs. The Organisation for Economic Cooperation and Development (OECD), an organization of 29 industrialized democracies, created a guidance document for governments on PRTRs. Development of this guidance manual included the participation of representatives from government, industry, and other non-governmental organizations. Following the publication of this manual in 1996, and recognizing the value and importance of PRTR systems to environmental protection, the OECD environment ministers issued a Council Recommendation that encourages all OECD nations to establish PRTR systems.

For developing nations, the United Nations Institute for Training and Research (UNITAR) developed a step-by-step process, with accompanying guidance manuals, on how to implement a PRTR system. In an initial phase, UNITAR selected three countries to serve in a pilot program (Mexico, Czech Republic, Egypt). The goal was to take the lessons learned from this pilot stage to help other industrializing nations develop PRTR systems.

Currently, PRTR work now has entered its second stage. While the initial work, including the OECD's guidance manual and UNITAR's pilot program, focused on creating the framework for PRTR development, the second stage is shifting to greater coordination between countries and international organizations. The OECD is hosting a PRTR conference in Japan that will be a venue for discussions between countries with PRTR systems. The OECD also is integrating its PRTR work with other chemicals management projects. UNITAR is using its materials developed in the pilot stage to help the Slovak Republic and South Africa create PRTR systems.

Recognizing this new focus, the international community has formed a PRTR Coordination Group to coordinate and prevent duplication of efforts. The U.S. is the chair of the group, while the OECD is the Secretariat. With the number of



countries with operational PRTR systems growing from the present eight (Australia, Canada, France, Mexico, Netherlands, Norway, United Kingdom, U.S.) to over 30 in the next few years, the need for this PRTR Coordination Group is obvious.

On a more regional scale, North America offers the first opportunity to collect PRTR data across a continent. The U.S. has collected PRTR data since 1987. The first year of Canadian data is 1993. Mexico is phasing in its PRTR system starting with the 1997 reporting year. Facilities must file air emissions data for 1997, while voluntarily reporting for other releases and transfers. Mexico intends to make these other media mandatory.

Supporting this work is the Commission on Environmental Cooperation (CEC), an organization created by the environmental side-agreements to the North American Free Trade Agreement (NAFTA). The CEC has developed two important reports. The first compares PRTR systems in the three North American nations. The second report, developed annually, compiles and analyzes the data from the North American PRTR systems. The 1994, 1995, and planned 1996 reports include only U.S. and Canadian data. When the Mexican data are available, starting with the 1997 reporting year, the report will cover all three nations.

The U.S. will continue to work closely with other countries and international organizations on PRTR issues. The expanding work on PRTRs will require the commitment and guidance of the U.S. and rely on the growing experience of the TRI.

## How Can I Obtain Additional TRI Information?

The TRI data are available in an on-line computer database and in a variety of common computer and hard copy formats to ensure that everyone can easily use the information. Information about accessing the TRI database is provided on the inside front cover of this report as well as in Appendix B. The TRI User Support Service (202-260-1531) can provide assistance in accessing and using the TRI data. On-line services include the EPA's Envirofacts, the National Library of Medicine's TOXNET system, and the Right-to-Know Computer Network (RTK NET). Appendix B provides additional information on these and other means of access to TRI data.

To request copies of TRI and EPCRA documents or to obtain further information about the program, contact the toll-free Emergency Planning and Community Right-to-Know Information Hotline at 1-800-424-9346. TRI information is also available on the TRI Web site at [www.epa.gov/opptintr/tri](http://www.epa.gov/opptintr/tri).

Other potential sources of TRI information include the state EPCRA section 313 contact, the EPA Regional Office, or the facility itself. Information about EPA regional and state EPCRA section 313 contacts appears in Appendix A.



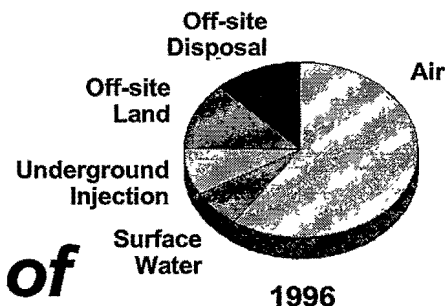
## ***Chapter 1—TRI Reporting and the 1996 Public Data Release***

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# Chapter 2

## National Overview of 1996 Toxics Release Inventory

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### Introduction

This chapter provides a summary of the information reported by facilities for calendar year 1996. This summary includes data for on- and off-site releases of TRI chemicals from the facility, on-site waste management of the chemicals, and transfers of the chemicals in waste to off-site locations for further management.

The chapter begins with a description of which release and other waste management categories are reportable to TRI; then describes information on toxicity and exposure considerations pertinent to use of TRI data. National, state, and chemical analyses of the 1996 data follow. Industry-specific analyses of 1996 TRI data appear in Chapters 4 through 10.

### TRI Releases and Waste Management

Figure 2-1 illustrates on-site and off-site releases, on-site waste management activities, and transfers off-site for further waste management, as reportable to TRI. Box 2-1 describes reportable releases that may occur on-site at the facility or as a result of transferring chemicals off-site for disposal, and identifies types of activities that may contribute releases to various media. Box 2-2 lists

on-site waste management activities that are reportable to TRI. Box 2-3 describes transfers off-site for further waste management.

### What to Consider When Using TRI Data

Users of TRI information should be aware that TRI data reflect releases and other waste management of chemicals, not exposures of the public to those chemicals. TRI data, in conjunction with other information, can be used as a starting point in evaluating exposures that may result from releases and other waste management activities which involve toxic chemicals. The determination of potential risk depends upon many factors, including the toxicity of the chemical, the fate of the chemical and the length of their exposure after it is released, and the human or other populations that are exposed to the chemical and the length of their exposure after its release. Listed below are some of the factors that should be considered when reviewing TRI data.

#### Toxicity of the Chemical

The TRI list consists of chemicals that vary widely in their ability to produce toxic effects.

- ◆ Some high-volume releases of less toxic chemicals may appear to be a more serious problem



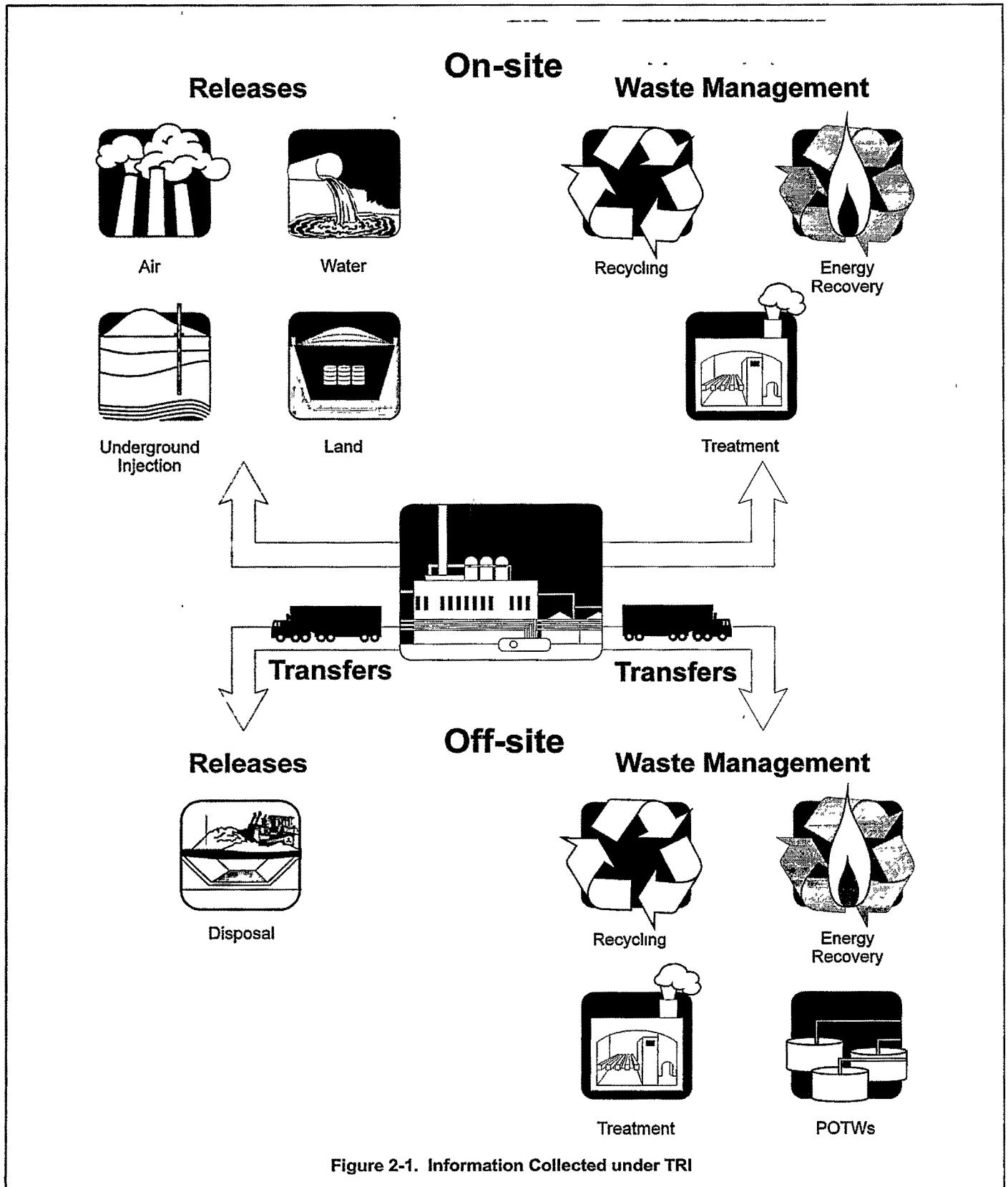


Figure 2-1. Information Collected under TRI

**Box 2-1. An Explanation of On- and Off-site Releases****An Explanation of On- and Off-site Releases**

A release is a discharge of a toxic chemical to the environment. On-site releases include emissions to the air, discharges to bodies of water, releases at the facility to land, as well as into underground injection wells. Releases are reported to TRI by media type. Chemicals in waste transferred off-site for disposal are also released to the environment. On- and off-site releases thus include releases to the environment at the facility (reported in Section 5 for Form R) plus off-site transfers to disposal (reported in Section 6 of Form R).

**Air Emissions.** Releases to air are reported either as point source or fugitive emissions. Point source emissions, also referred to as stack emissions, occur through confined air streams, such as stacks, vents, ducts, or pipes. Fugitive emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems.

**Surface Water Discharges.** Releases to water include discharges to streams, rivers, lakes, oceans, and other bodies of water. This includes releases from contained sources, such as industrial process outflow pipes or open trenches. Releases due to runoff, including stormwater runoff, are also reportable to TRI.

**Underground Injection.** Underground injection is the subsurface emplacement of fluids through wells. TRI chemicals associated with manufacturing, the petroleum industry, mining, commercial and service industries, and Federal and municipal government related activities may be injected into Class I, II, III, V or V wells, if they do not endanger underground sources of drinking water (USDW), public health or the environment. The different types of authorized injection activities are described below:

- Class I industrial, municipal and manufacturing wells inject fluids into deep, confined and isolated formations below potable water supplies.
- Class II oil and gas related wells which re-inject produced fluids for disposal, enhanced recovery of oil, or hydrocarbon storage.
- Class III wells are associated with the solution mining of minerals.
- Class IV wells may inject hazardous or radioactive fluids directly or indirectly into USDW, only if the injection is part of an authorized CERCLA/RCRA clean up operation.
- Class V wells, which include all types of injection wells which do not fall under I-V, may inject only if they do not endanger USDW, public health or the environment. Class V wells are, generally, shallow drainage wells, such as floor drains connected to dry wells or drain fields.

Beginning with the 1996 reporting year, facilities separately report amounts injected into Class I wells and into all other wells.

**On-site Land Releases.** On-site releases to land occur within the boundaries of the reporting facility. Releases to land include disposal of toxic chemicals in landfills (in which wastes are buried), land treatment/application farming (in which a waste containing a listed chemical is applied to or incorporated into soil), surface impoundments (which are uncovered holding areas used to volatilize and/or settle waste materials), and other land disposal methods (such as waste piles) or releases to land (such as spills or leaks). Beginning with the 1996 reporting year, facilities separately report amounts released to RCRA Subtitle C landfills from amounts released to other on-site landfills.

**Transfers Off-site to Disposal.** Toxic chemicals in waste that are transferred to a facility for disposal generally are either released to land at an off-site facility or are injected underground.



**Box 2-2. An Explanation of On-site Waste Management**

**An Explanation of On-site Waste Management**

On-site waste management activities are reported in Section 8 of Form R. These amounts do not include one-time events such as accidental releases or remediation (clean-up).

**Recycled On-site.** This is the quantity of the toxic chemical recovered at the facility and made available for further use. It is not the quantity that entered an on-site recycling or recovery operation.

**Used for Energy Recovery On-site.** This is the quantity of the toxic chemical that was combusted in some form of energy recovery device, such as a furnace (including kilns) or boiler. The toxic chemical should have a heating value high enough to sustain combustion. To avoid double-counting, the amount reported represents the amount destroyed in the combustion process, not the amount that entered the energy recovery unit. For example, 100,000 pounds of toluene entered a boiler that, on average, combusted 98% of the toluene. Any remaining toluene was discharged to air. A total of 98,000 pounds is reported as combusted for energy recovery (the remaining 2,000 pounds is reported as released).

**Treatment On-site.** This is the quantity of the toxic chemical destroyed in on-site waste treatment operations, not the amount that entered any treatment operation. For example, if 100,000 pounds of benzene were combusted in an incinerator that destroyed 99% of the benzene, the facility would report 99,000 pounds as treated on-site (the remaining 1,000 pounds would be reported as released).

**Box 2-3. An Explanation of Transfers Off-site for Further Waste Management**

**An Explanation of Transfers Off-site for Further Waste Management**

An off-site transfer, reported in Section 6 of Form R, is the transfer of toxic chemicals in waste to a facility that is geographically or physically separate from the facility reporting under TRI. Chemicals reported to TRI as transferred are sent to off-site facilities for the purposes of recycling, energy recovery, treatment, or disposal. The quantities reported represent a movement of the chemical away from the reporting facility. Except for off-site transfers to disposal, these quantities do not necessarily represent entry of the chemical into the environment. Transfers to disposal represent an off-site release (see Box 2-1).

**Transfers Off-site to Recycling.** Toxic chemicals in waste that are sent off-site for the purposes of recycling are generally recovered by a variety of recycling methods, including solvent recovery and metals recovery. The choice of the recycling method depends on the toxic chemical being sent for recycling. Once they have been recycled, these chemicals may be returned to the originating facility for further processing or made available for use in commerce.

**Transfers Off-site to Energy Recovery.** Toxic chemicals in waste sent off-site for purposes of energy recovery are combusted off-site in industrial furnaces (including kilns) or boilers that generate heat or energy for use at that location. Treatment of a chemical by incineration is not considered to be energy recovery.

**Transfers Off-site to Treatment.** Toxic chemicals in waste that are transferred off-site may be treated through a variety of methods, including biological treatment, neutralization, incineration, and physical separation. These methods typically result in varying degrees of destruction of the toxic chemical. In some cases (such as stabilization or solidification), the chemical is not destroyed but is prepared for further waste management, such as contained disposal.

**Transfers to Publicly Owned Treatment Works (POTWs).** A POTW is a wastewater treatment facility that is owned by a state or municipality. Wastewaters from facilities reporting under TRI are transferred through pipes or sewers to a POTW. Treatment or removal of a chemical from the wastewater depends upon the nature of the chemical, as well as the treatment methods present at the POTW. In general, chemicals that are easily utilized as nutrients by microorganisms, or have a low solubility in water, are likely to be removed to some extent. Chemicals that are volatile and have a low solubility in water may evaporate into the atmosphere. Not all TRI chemicals can be treated or removed by a POTW. Some chemicals, such as metals, may be removed, but are not destroyed and may be disposed of in landfills or discharged to receiving waters.

**Other Off-site Transfers.** In this report, toxic chemicals in waste that were reported as transferred off-site but for which the off-site activity (i.e., treatment, disposal, energy recovery, or recycling) was not specified or was not an accepted code have been classified as "other off-site transfers."



than lower-volume releases of more toxic chemicals, when just the opposite may be true. For example, phosgene is toxic in smaller quantities than methanol. A comparison between these two chemicals for setting hazard priorities or estimating potential health concerns, solely on the basis of volumes released, may be misleading.

### Exposure Considerations

- ◆ **Potential degradation or persistence of the chemical in the environment.** Exposure to a chemical is dependent upon the chemical being available. The longer the chemical remains unchanged in the environment, the greater the potential for exposure. Sunlight, heat, or microorganisms may or may not decompose the chemical.
  - For example, microorganisms readily degrade some chemicals, such as methanol, into less toxic chemicals; volatile organic compounds, such as ethylene and propylene, react in the atmosphere and contribute to the formation of smog; metals are persistent and will not degrade upon release to the environment.
  - As a result, smaller releases of a persistent, highly toxic chemical may create a more serious problem than larger releases of a chemical that is rapidly converted to a less toxic form.
- ◆ **Bioconcentration of the chemical in the food chain.** As a chemical becomes incorporated in the food chain, it may concentrate or disperse as it moves up the food chain.
  - Some chemicals, such as mercury, accumulate as they move up the food chain.
  - Small releases of a chemical that bioaccumulates may result in significant exposures to consumers.
- ◆ **The environmental medium (air, water, land, or underground injection) to which the toxic chemical has been released.** Chemical exposure of a population depends on the environmental medium to which a chemical is released. The medium also affects the types of exposures possible, such as inhalation, dermal exposure, or ingestion.
  - Releases of a chemical to the air can result in exposures to organisms living near and downwind from facilities releasing toxic chemicals to the atmosphere. Persistent chemicals may fall or precipitate from air onto land or into water bodies, resulting in exposures via these environmental media.
  - Exposures that may result from releases to water bodies (streams, lakes, etc.) depend in part on the downstream uses of the water, including drinking, cooking, and bathing.
  - Injection of toxic chemicals into properly designed and constructed Class I wells will result in substantially lower exposure potential than more direct forms of environmental release. These wells are designed to entomb liquid wastes for at least 10,000 years.
- ◆ **The type of off-site facility receiving the chemical and the efficiency of its waste management practices.** The amount of a toxic chemical that ultimately enters the environment depends on how the chemical was handled during disposal, treatment, energy recovery, or recycling activities. Several factors to keep in mind when considering amounts sent off-site are presented below.
  - The efficiency of recycling operations varies depending on the method of recycling and the chemical being recycled.



- Use of a combustible toxic chemical for energy recovery typically results in the destruction of 95% to 99% or more of the toxic chemical. The remaining quantity may be either released to air or disposed of in ash to land.
  - The efficiency of the treatment of toxic chemicals in waste sent to sewage treatment plants varies depending on the chemical and the sewage plant. Some high-volume pollutants such as methanol are readily degraded by most sewage treatment plants. Other high-volume chemicals such as ammonia are not readily treated by most sewage treatment plants and will pass through the plant into the aquatic environment. The efficiency of other treatment methods, such as incineration, also depends upon the specifications of the treatment facility and the nature of the chemical. Metals sent to sewage treatment plants, for example, may be removed with solid wastes and sent to landfills, or they may pass through the plant and be discharged into surface waters; they are not, however, destroyed.
  - Toxic chemicals in waste sent off-site for disposal are typically released to land or injected underground.
- ◆ **On-site waste management of the toxic chemical.** As with off-site waste management, the amount of the toxic chemical released to the environment depends on how the chemical was handled during disposal, treatment, energy recovery, or recycling activities. However, since the waste management is on-site, any amount of the chemical that enters the environment after waste management is reported to TRI as part of that facility's releases.

## 1996 National Overview

This chapter discusses and analyzes data for 1996 for all chemicals reported under TRI. Chapter 3 examines chemical reporting over time, using only those "core chemicals" that have been reportable in all years in the period under discussion.

For 1996, 21,626 facilities filed 71,381 TRI reporting forms, an average of 3.3 forms per facility (see Table 2-1). One out of every 10 submissions was a Form A certification statement rather than the Form R detailed reporting form. EPA established the Form A certification option, beginning with the 1995 reporting year, for facilities that meet TRI reporting thresholds for a listed chemical (manufacturing or processing 25,000 pounds or otherwise using 10,000 pounds), but whose total annual reportable amount\* for that chemical does not exceed 500 pounds and who do not manufacture,

Table 2-1. 1996 TRI Facilities and Forms

	Number
Total Facilities	21,626
Total Forms	71,381
Form Rs	64,147
Form As	7,234

process, or otherwise use more than 1 million pounds of the chemical. Form A certification statements do not report amounts of chemical releases, transfers, or other waste management activities. (Form A certification statements are further explained in Chapter 1.)

\* The total annual reportable amount is defined as the sum of the waste management categories that would be reported to TRI: quantities released (including disposal), recovered as a result of recycling operations, combusted for energy recovery, or treated at the facility, plus amounts transferred off-site for recycling, energy recovery, treatment, or disposal. These amounts correspond to total production-related waste in this report.



Table 2-2. 1996 TRI On-site and Off-site Releases

	Pounds
<b>Total On- and Off-site Releases</b>	<b>2,433,506,582</b>
<b><u>On-Site Releases</u></b>	
Total Air Emissions	1,452,089,962
Fugitive Air	355,271,752
Point Source Air	1,096,818,210
Surface Water Discharges	173,288,209
Underground Injection	204,329,109
Class I Wells	203,572,710
Class II-V Wells	756,399
On-site Land Releases	309,063,206
RCRA Subtitle C Landfills	26,454,969
Other On-site Land Releases	85,252,669
Land Treatment	6,266,119
Surface Impoundments	84,862,374
Other Disposal	106,227,075
<b>Total On-site Releases</b>	<b>2,138,770,486</b>
<b><u>Off-Site Releases</u></b>	
Transfers Off-site to Disposal	294,736,096
<b>Total Off-site Releases</b>	<b>294,736,096</b>

Note. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. UIJ = underground injection

## On- and Off-site Releases

These facilities reported on- and off-site releases of 2.43 billion pounds of toxic chemicals, as shown in Table 2-2. This includes amounts released directly to the air, water, or land, as well as disposal of toxic chemicals on-site or off-site in landfills, impoundments, waste piles, and underground injection wells.

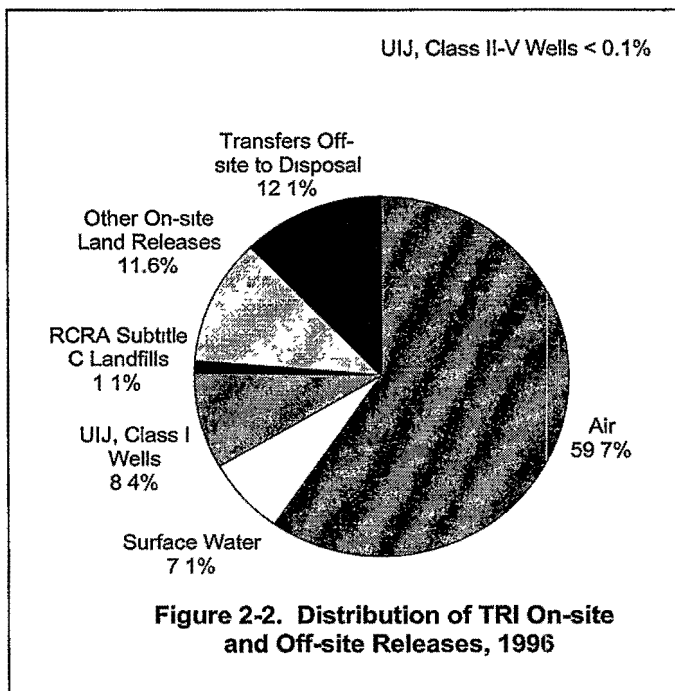
Air emissions totaled 1.45 billion pounds, or 59.7% of all releases in 1996 (see Figure 2-2). Facilities report their air releases as either point source (stack) emissions or fugitive (non-point source) emissions. Three-quarters (75.5%) of air releases reported to TRI in 1996 were point source emissions.

Facilities discharged 173.3 million pounds of toxic chemicals into the nation's rivers, lakes, bays, and other bodies of water in 1996. This represents 7.1% of all releases in 1996. A total of 204.3 million pounds (8.4%) of toxic chemicals were injected into underground wells, and 99.6% of this amount went to Class I wells (see description in Box 2-1). Another 309.1 million pounds (12.7% of all releases) were released on-site to land. Of these on-site land releases, 8.6% went to RCRA Subtitle C landfills; the largest portion, 34.4%, was reported as other disposal.

These on-site releases totaled 2.14 billion pounds. Off-site releases—that is, transfers to disposal—totaled 294.7 million pounds. Releases at the facility represented 87.9% of all on- and off-site releases, and transfers to disposal represented 12.1% of the total.

## Other On-site Waste Management

Facilities reported on-site waste management—recycling, energy recovery, and treatment—totaling 17.74 billion pounds in 1996 (see Table 2-3). Recycling and treatment represented roughly equal portions of the total: 7.84 billion pounds recycled (44.2%) and 7.14 billion pounds treated (40.2%).



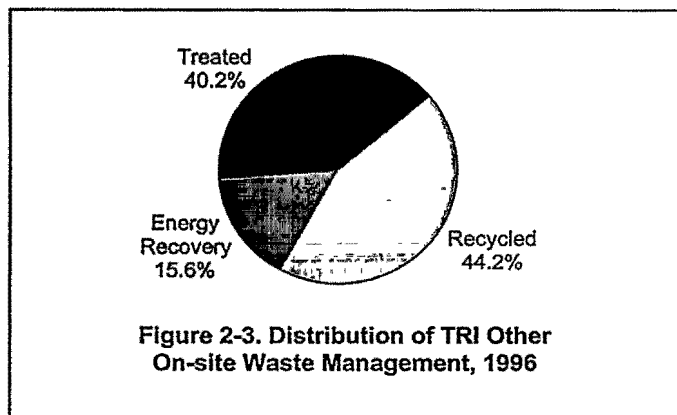
Note: On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. UIJ = underground injection



**Table 2-3. 1996 Other On-site Waste Management**

	Pounds
<b>Total Other On-site Waste Management</b>	<b>17,744,196,508</b>
Recycled On-site	7,842,595,142
Energy Recovery On-site	2,761,739,445
Treated On-site	7,139,861,921

Note: Data from Section 8 of Form R.



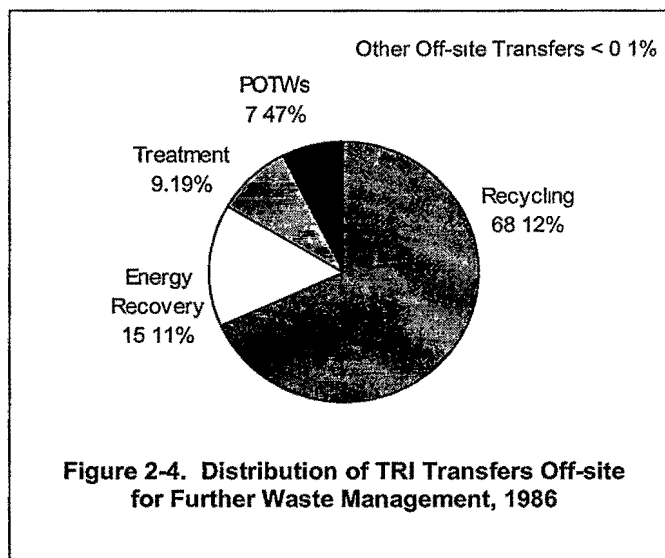
**Figure 2-3. Distribution of TRI Other On-site Waste Management, 1996**

Note: Data from Section 8 of Form R.

**Table 2-4. 1996 TRI Transfers Off-site for Further Waste Management**

	Pounds
<b>Total Transfers Off-site for Further Waste Management</b>	<b>3,156,867,280</b>
Transfers to Recycling	2,150,593,994
Transfers to Energy Recovery	477,056,570
Transfers to Treatment	290,096,828
Transfers to POTWs	235,813,508
Other Off-site Transfers	3,306,380

Note: Data from Section 6 of Form R excluding off-site transfers to disposal. Other Off-site Transfers are transfers reported without a valid waste management code.



**Figure 2-4. Distribution of TRI Transfers Off-site for Further Waste Management, 1996**

Note: Data from Section 6 of Form R excluding off-site transfers to disposal. Other Off-site Transfers are transfers reported without a valid waste management code.

On-site energy recovery of 2.76 billion pounds (15.6%) accounted for the rest (see Figure 2-3).

## Transfers Off-site for Further Waste Management

In 1996, facilities sent 3.16 billion pounds of toxic chemicals to off-site locations for further waste management: recycling, energy recovery, or treatment (see Table 2-4). The great majority of these off-site transfers (2.15 billion pounds, or 68.1%) were sent off-site to be recycled (see Figure 2-4). Another 477.1 million pounds (15.1%) of toxic chemicals were sent off-site to be burned for energy recovery. Transfers to other locations for treatment totaled 290.1 million pounds, or 9.2%, while transfers to Publicly Owned Treatment Works (POTWs, or sewage treatment plants) totaled 235.8 million pounds, or 7.5%.

Another 3.3 million pounds of toxic chemicals reported as transferred off-site were reported with no waste management codes or with invalid codes and are listed as "Other Off-site Transfers."



## 1996 TRI Data by State

Tables 2-5 through 2-8 present the distribution of TRI releases (including transfers off-site to disposal), other on-site waste management, and transfers off-site for further waste management by state. No reports were received in 1996 for the Northern Mariana Islands.

### On- and Off-site Releases

The top states for total releases for 1996 were Texas with 267.4 million pounds, Louisiana with 184.5 million pounds, and Ohio with 145.1 million pounds (see Table 2-5). These were also the top-ranking states for on-site releases. Ranking fourth and fifth for total releases, on- and off-site, were Pennsylvania with 122.4 million pounds and Indiana with 109.0 million pounds. Altogether, eight states reported more than 100 million pounds in releases; the others were Illinois with 107.7 million pounds, Tennessee with 103.9 million pounds, and Alabama with 102.9 million pounds.

Texas facilities reported primarily air emissions and underground injection to class I wells. Air releases of 127.2 million pounds (51.1 million as fugitive emissions and 76.1 million pounds as stack emissions) represented 47.6% of Texas releases. Underground injection of 92.0 million pounds accounted for another 34.4%. Texas reported more of both types of release than any other state. For air emissions, Tennessee (84.4 million pounds) and Louisiana (83.9 million pounds) ranked second and third. For underground injection, Louisiana (54.4 million pounds) and Florida (23.1 million pounds) followed Texas. All underground injection in the top three states was reported as injected to Class I wells.

Facilities in California reported the largest amount of injection to Class II-V wells, 702,000 pounds. Facilities in 33 states and territories reported no underground injection. (Some states are not geologically suitable for the practice of

underground injection. Others have banned this disposal method or have never implemented an underground injection control program.)

Louisiana led all states for surface water discharges, with 38.2 million pounds, followed by Pennsylvania with 22.8 million pounds and Texas with 18.9 million pounds.

Facilities reported larger total on-site land releases in Montana than in any other state, 44.4 million pounds, which comprised the great majority of that state's releases. Arizona followed with 37.5 million pounds and Ohio with 28.5 million pounds. Most of these were releases to non-RCRA subtitle C landfills. In five states, RCRA subtitle C landfills received half or more of on-site land releases (New York, 88.2% of on-site land releases, Indiana 75.6%, New Jersey 73.6%, Massachusetts 53.0%, and Illinois 52.2%), but only one of these had total on-site land releases of more than 10 million pounds (Illinois with 23.9 million pounds, ranked fourth for on-site land releases).

Top states for off-site transfers to disposal were Pennsylvania with 55.7 million pounds, Indiana with 34.3 million pounds, and Michigan with 31.7 million pounds. Nearly half (45.5%) of Pennsylvania's releases were transferred off-site for disposal, as were nearly one-third (31.5%) of Indiana's and more than one-third (35.1%) of Michigan's. These off-site releases account for Pennsylvania's and Indiana's ranking fourth and fifth among states for all releases, on- and off-site.

TRI facilities report the specific off-site locations to which they are transferring TRI chemicals. For each state, Table 2-6 summarizes transfers to disposal that were sent out of state, transferred within the state, or received into the state from TRI facilities elsewhere. The state shipping the largest amounts of TRI chemicals outside its borders for disposal was Pennsylvania, with 15.9 million pounds, which was 28.6% of all transfers to disposal from Pennsylvania facilities. States ranking second and third were Alabama (6.0





Table 2-5. TRI On-site and Off-site Releases by State, 1996

State	On-site Releases								Off-site Releases	Total On- and Off-site Releases Pounds
	Air		Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds		
	Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions 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	14,679,468	64,451,577	3,530,565	0	10	737,142	6,625,949	90,024,711	12,897,823	102,922,534
Alaska	444,665	5,433,523	1,024,160	20	400	0	6,015	6,908,783	0	6,908,783
American Samoa	10,500	0	0	0	0	0	0	10,500	0	10,500
Arizona	7,014,110	2,961,244	4,828	5	0	4,500	37,450,068	47,434,755	529,455	47,964,210
Arkansas	7,489,372	20,697,670	1,399,842	1,750,002	0	129,326	1,031,917	32,498,129	1,533,946	34,032,075
California	12,192,141	21,650,006	5,560,015	0	701,929	163,496	1,494,795	41,762,382	8,320,256	50,082,638
Colorado	1,119,954	2,457,061	909,035	0	0	0	103,774	4,589,824	1,121,667	5,711,491
Connecticut	2,410,477	4,059,776	658,631	0	0	10	59,251	7,188,145	997,034	8,185,179
Delaware	650,470	2,633,596	226,013	0	0	0	26,495	3,536,574	123,446	3,660,020
District of Columbia	3,900	10	300	0	0	0	5,000	9,210	250	9,460
Florida	6,334,872	24,296,086	733,455	23,122,868	0	4,178	20,897,563	75,389,022	5,568,660	80,957,682
Georgia	7,417,838	39,624,898	6,880,098	0	0	457,651	1,978,295	56,358,780	2,472,951	58,831,731
Guam	0	0	3,000	0	0	0	0	3,000	0	3,000
Hawaii	318,432	178,076	3,265	0	33,209	785	2,505	536,272	3,995	540,267
Idaho	1,604,857	3,152,513	1,038,998	0	0	0	9,309,921	15,106,289	46,398	15,152,687
Illinois	16,461,617	51,490,781	5,095,236	521	250	12,454,790	11,414,339	96,917,534	10,746,122	107,663,656
Indiana	20,791,054	42,110,757	2,389,013	1,174,432	0	6,204,155	2,002,979	74,672,390	34,315,644	108,988,034
Iowa	5,281,557	21,997,747	2,753,444	0	0	98,544	1,499,061	31,630,353	1,678,056	33,308,409
Kansas	5,762,051	14,046,481	411,678	1,048,848	250	105,295	835,951	22,210,554	4,365,830	26,576,384
Kentucky	8,113,822	29,867,564	1,468,738	0	0	184,646	1,750,422	41,385,192	5,981,671	47,366,863
Louisiana	15,624,901	68,249,573	38,211,313	54,412,356	0	73,116	5,534,484	182,105,743	2,432,044	184,537,787
Maine	1,057,853	6,396,001	603,236	0	0	4,148	188,765	8,250,003	1,101,262	9,351,265
Maryland	1,696,511	6,861,660	1,837,147	0	0	1,065	1,916,394	12,312,777	785,974	13,098,751
Massachusetts	2,297,145	4,265,577	81,830	0	0	8,453	7,491	6,660,496	3,316,675	9,977,171
Michigan	9,614,347	36,587,819	1,989,436	6,617,820	14,683	64,693	3,590,258	58,479,056	31,679,546	90,158,602
Minnesota	3,265,430	16,453,023	322,363	0	0	3,550	79,372	20,123,738	846,841	20,970,579
Mississippi	9,785,463	29,717,453	7,566,742	83,315	0	1,924	5,665,772	52,820,669	2,025,693	54,846,362
Missouri	8,399,325	27,099,218	3,008,012	750	0	314,575	16,719,376	55,541,256	4,253,324	59,794,580
Montana	881,451	3,108,205	91,808	0	0	760	44,361,763	48,443,987	33,655	48,477,642
Nebraska	2,538,818	5,771,457	319,530	0	0	6,000	568,617	9,204,422	3,818,356	13,022,778
Nevada	318,825	1,037,572	0	0	0	2,800	2,331,464	3,690,661	75,975	3,766,636
New Hampshire	442,696	1,766,521	30,398	0	0	0	10,845	2,250,460	217,777	2,468,237
New Jersey	3,945,243	6,094,664	5,357,477	4	0	684,726	245,354	16,327,468	1,749,437	18,076,905
New Mexico	692,433	1,226,068	12	0	0	0	17,972,637	19,891,150	72,559	19,963,709
New York	6,074,255	20,790,492	3,879,544	262	2,308	954,758	127,225	31,828,844	3,825,159	35,654,003
North Carolina	10,559,626	49,385,541	2,544,384	0	0	133,872	18,552,160	81,175,583	3,998,991	85,174,574
North Dakota	398,228	1,605,737	317,631	0	0	0	758	2,322,354	2,766	2,325,120
Ohio	20,232,510	50,007,417	5,740,395	13,680,825	0	1,134,058	27,364,552	118,159,757	26,980,078	145,139,835
Oklahoma	5,056,004	16,223,849	567,182	1,007,056	2,600	24,913	101,573	22,983,177	3,438,632	26,421,809
Oregon	10,725,114	13,293,388	2,529,329	0	0	250	2,460,571	29,008,652	727,041	29,735,693
Pennsylvania	14,266,043	27,104,113	22,786,860	0	0	579,317	1,995,160	66,731,493	55,691,692	122,423,185
Puerto Rico	3,339,480	4,425,402	220,557	0	0	250	6,845	7,992,534	556,244	8,548,778
Rhode Island	928,458	1,401,883	8,734	0	0	0	10,538	2,349,613	252,371	2,601,984
South Carolina	8,244,215	38,349,890	2,188,612	0	0	51,437	714,777	49,548,931	7,119,229	56,668,160
South Dakota	516,550	1,140,757	3,401,460	0	0	0	1,002	5,059,769	136,305	5,196,074
Tennessee	15,955,870	68,465,805	1,624,484	2,256,427	0	78,708	6,495,409	94,876,703	8,997,696	103,874,399
Texas	51,110,064	76,109,816	18,881,567	91,979,394	0	1,631,980	13,693,639	253,406,460	14,034,326	267,440,786
Utah	2,117,279	66,701,765	37,580	0	0	15,414	13,114,111	81,986,149	903,685	82,889,834
Vermont	100,849	202,396	122,915	0	0	0	1,351	427,511	35,338	462,849
Virgin Islands	961,406	506,479	31,720	0	0	0	6,526	1,506,131	8	1,506,139
Virginia	11,367,098	40,624,192	1,190,080	5	5	762	1,016,173	54,198,315	1,893,878	56,092,193
Washington	4,849,423	18,325,626	2,597,302	0	0	5,980	133,819	25,912,150	2,527,221	28,439,371
West Virginia	4,202,081	12,360,503	8,337,073	0	0	122,693	519,919	25,542,269	3,295,461	28,837,730
Wisconsin	4,656,892	21,988,474	2,761,776	0	0	10,249	427,823	29,845,214	17,177,877	47,023,091
Wyoming	948,709	2,060,508	9,406	6,437,800	755	0	177,414	9,634,592	29,776	9,664,368
Total	355,271,752	1,096,818,210	173,288,209	203,572,710	756,399	26,454,969	282,608,237	2,138,770,486	294,736,096	2,433,506,582

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



Table 2-6. Off-site Transfers for Disposal Sent Out of State, Within States and Received into State, 1996

State	Off-site Transfers to Disposal		
	Sent Out of State Pounds	Transferred Within State Pounds	Received Into State Pounds
Alabama	6,026,440	6,871,383	1,486,832
Alaska	0	0	0
Arizona	81,072	448,383	341,320
Arkansas	1,018,149	515,797	256,870
California	4,941,772	3,378,484	88,976
Colorado	781,300	340,367	1,574,962
Connecticut	643,592	353,442	233,620
Delaware	78,550	44,896	4,103
District of Columbia	250	0	0
Florida	4,306,141	1,262,519	66,248
Georgia	947,485	1,525,466	213,592
Hawaii	9	3,986	0
Idaho	22,769	23,629	1,452,466
Illinois	2,576,099	8,170,023	5,642,106
Indiana	4,089,152	30,226,492	2,716,060
Iowa	1,089,765	588,291	22,098
Kansas	1,053,498	3,312,332	182,591
Kentucky	4,064,375	1,917,296	1,479,261
Louisiana	955,387	1,476,657	2,141,215
Maine	49,932	1,051,330	5,277
Maryland	568,730	217,244	514,720
Massachusetts	2,803,710	512,965	298,699
Michigan	622,313	31,057,233	4,430,373
Minnesota	371,071	475,770	23,153
Mississippi	1,446,743	578,950	80,498
Missouri	2,365,525	1,887,799	429,547
Montana	33,641	14	785,525
Nebraska	2,984,052	834,304	20,307
Nevada	0	75,975	3,527,608
New Hampshire	151,415	66,362	211,235
New Jersey	1,305,202	444,235	248,402
New Mexico	16,634	55,925	750
New York	1,198,106	2,627,053	7,783,226
North Carolina	741,558	3,257,433	269,743
North Dakota	658	2,108	973,089
Ohio	4,436,753	22,543,325	18,230,605
Oklahoma	1,717,325	1,721,307	3,716,489
Oregon	55,757	671,284	1,196,970
Pennsylvania	15,913,070	39,778,622	5,742,150
Puerto Rico	211,462	344,782	4
Rhode Island	174,315	78,056	172,586
South Carolina	3,776,836	3,342,393	5,456,615
South Dakota	21,486	114,819	2,000
Tennessee	1,071,334	7,926,362	1,028,141
Texas	3,232,288	10,802,038	1,782,513
Utah	67,026	836,659	2,849,655
Vermont	32,083	3,255	242
Virgin Islands	8	0	0
Virginia	391,888	1,501,990	11,996
Washington	1,241,922	1,285,299	63,957
West Virginia	1,511,751	1,783,710	47,099
Wisconsin	240,291	16,937,586	455,761
Wyoming	23,282	6,494	0
Other*	—	—	3,192,717
Total	81,453,972	213,282,124	81,453,972

\* "Other" includes waste sent to other countries and to sites not identified by state by the reporting facility



Table 2-7. TRI Other On-site Waste Management by State, 1996

State	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
Alabama	247,765,725	35,866,493	316,900,305	600,532,523
Alaska	25,842	457,400	2,761,278	3,244,520
American Samoa	0	0	0	0
Arizona	629,813,584	695,864	7,501,763	638,011,211
Arkansas	202,786,365	33,421,106	113,334,864	349,542,335
California	48,933,381	18,173,050	1,102,173,175	1,169,279,606
Colorado	18,998,219	8,287,872	8,234,284	35,520,375
Connecticut	91,847,249	4,467,216	36,458,784	132,773,249
Delaware	29,782,121	219,184	50,920,120	80,921,425
District of Columbia	0	0	1,695	1,695
Florida	133,882,239	19,362,992	131,946,077	285,191,308
Georgia	246,187,301	48,222,623	196,531,036	490,940,960
Guam	0	0	0	0
Hawaii	6,611	0	3,590,519	3,597,130
Idaho	176,378	26,900	17,160,464	17,363,742
Illinois	316,452,083	35,570,868	120,405,877	472,428,828
Indiana	192,429,951	86,416,362	171,880,470	450,726,783
Iowa	142,535,240	1,827,848	28,677,544	173,040,632
Kansas	210,117,169	100,585,103	35,937,066	346,639,338
Kentucky	270,427,752	70,165,040	119,641,055	460,233,847
Louisiana	725,090,414	350,796,650	816,209,604	1,892,096,668
Maine	10,123,918	11,099,536	63,525,017	84,748,471
Maryland	17,008,373	13,397,901	34,005,595	64,411,869
Massachusetts	23,084,234	5,223,661	27,615,676	55,923,571
Michigan	304,344,692	87,992,757	94,427,464	486,764,913
Minnesota	147,195,055	10,743,037	32,157,870	190,095,962
Mississippi	215,890,406	18,567,578	104,186,585	338,644,569
Missouri	177,893,875	79,482,408	72,793,495	330,169,778
Montana	50,305,985	2,513,550	8,610,407	61,429,942
Nebraska	18,289,870	1,499,579	6,867,436	26,656,885
Nevada	2,125,936	0	8,595,388	10,721,324
New Hampshire	16,867,518	1,858,325	10,301,186	29,027,029
New Jersey	56,031,604	347,873,373	125,963,690	529,868,667
New Mexico	1,509,122	33,800,000	1,868,997	37,178,119
New York	176,304,149	25,633,557	112,267,207	314,204,913
North Carolina	362,510,160	25,898,390	147,228,500	535,637,050
North Dakota	44,438	3,300	4,853,566	4,901,304
Ohio	329,167,620	96,800,899	155,733,167	581,701,686
Oklahoma	53,640,688	52,550,449	16,068,996	122,260,133
Oregon	33,343,531	17,268,217	61,437,014	112,048,762
Pennsylvania	392,219,178	50,287,872	149,258,161	591,765,211
Puerto Rico	24,267,097	142,187	17,004,946	41,414,230
Rhode Island	13,987,327	226,963	7,123,050	21,337,340
South Carolina	303,352,841	78,185,193	112,054,076	493,592,110
South Dakota	30,204,647	1,050,000	1,894,335	33,148,982
Tennessee	164,053,491	49,580,975	106,752,628	320,387,094
Texas	965,065,180	836,485,137	1,375,842,159	3,177,392,476
Utah	9,803,457	25,620,841	317,147,921	352,572,219
Vermont	457,075	6,200	1,026,694	1,489,969
Virgin Islands	711,124	0	10,248,528	10,959,652
Virginia	178,353,110	29,707,489	317,770,559	525,831,158
Washington	80,436,589	18,590,204	90,430,822	189,457,615
West Virginia	121,297,058	10,237,138	146,675,430	278,209,626
Wisconsin	53,677,399	14,787,808	112,924,941	181,390,148
Wyoming	1,770,771	62,350	4,934,435	6,767,556
<b>Total</b>	<b>7,842,595,142</b>	<b>2,761,739,445</b>	<b>7,139,861,921</b>	<b>17,744,196,508</b>

Note: Data from Section 8 of Form R.



Table 2-8. TRI Transfers Off-site for Further Waste Management by State, 1996

State	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Transfers Excluding Transfers to Disposal Pounds
Alabama	33,675,464	10,487,499	7,163,468	516,571	750	51,843,752
Alaska	235,463	6,325	137	0	0	241,925
American Samoa	0	0	0	0	0	0
Arizona	79,468,186	784,295	9,259,081	1,951,033	0	91,462,595
Arkansas	44,916,893	6,677,636	6,119,839	122,428	250	57,837,046
California	61,488,314	8,602,952	5,054,720	13,086,610	16,705	88,249,301
Colorado	18,194,235	4,033,682	1,230,695	795,799	5	24,254,416
Connecticut	24,122,459	2,226,821	6,085,697	1,304,464	250	33,739,691
Delaware	10,054,130	1,169,726	1,299,302	4,515,982	0	17,039,140
District of Columbia	12,151	0	5	180	0	12,336
Florida	17,546,126	2,201,015	7,115,310	5,617,773	0	32,480,224
Georgia	43,272,325	9,828,150	6,065,284	2,873,071	19,456	62,058,286
Guam	0	0	0	15,000	0	15,000
Hawaii	53,075	0	4,557	0	0	57,632
Idaho	600,108	154,988	89,400	274,987	0	1,119,483
Illinois	92,791,384	29,994,071	13,946,004	10,650,115	170,140	147,551,714
Indiana	227,040,410	11,888,870	7,427,771	3,313,075	7,896	249,678,022
Iowa	26,694,400	3,079,716	3,072,917	7,613,435	0	40,460,468
Kansas	56,635,370	2,745,539	4,395,674	1,081,427	0	64,858,010
Kentucky	50,702,619	9,357,605	8,070,093	1,515,709	45,591	69,691,617
Louisiana	52,355,796	15,998,779	9,371,461	52,168	0	77,778,204
Maine	4,949,244	379,964	308,126	181,137	0	5,818,471
Maryland	3,870,056	1,340,824	3,465,720	3,837,977	0	12,514,577
Massachusetts	28,308,038	6,713,380	4,766,282	5,334,593	17,752	45,140,045
Michigan	100,909,367	69,413,222	23,506,076	14,143,038	250	207,971,953
Minnesota	21,696,873	2,196,764	1,014,387	8,095,891	8,636	33,012,551
Mississippi	21,598,058	2,654,505	2,122,333	628,934	8,632	27,012,462
Missouri	58,339,188	23,850,564	9,826,440	6,394,678	7,890	98,418,760
Montana	579,043	26,048	42,733	4,168	0	651,992
Nebraska	26,709,177	446,647	216,005	618,762	250	27,990,841
Nevada	1,635,380	9,679	18,434	21,514	0	1,685,007
New Hampshire	12,146,978	224,756	754,064	201,695	0	13,327,493
New Jersey	33,315,528	30,358,462	8,331,546	18,766,215	83,937	90,855,688
New Mexico	1,055,552	157,296	194,084	270,890	250	1,678,072
New York	64,139,124	7,747,898	6,825,645	6,792,564	1,971,363	87,476,594
North Carolina	79,313,339	14,071,452	8,705,633	3,077,616	0	105,168,040
North Dakota	802,146	19,711	15,583	198,048	0	1,035,488
Ohio	186,144,474	40,468,374	20,701,110	16,401,171	24,544	263,739,673
Oklahoma	19,065,778	967,015	1,149,182	456,827	0	21,638,802
Oregon	20,516,944	1,313,460	6,024,151	10,719,550	13	38,574,118
Pennsylvania	138,842,336	17,612,095	16,632,816	8,461,731	132,237	181,681,215
Puerto Rico	13,509,670	10,621,929	5,210,764	2,179,129	44,588	31,566,080
Rhode Island	7,619,534	838,404	369,333	386,775	0	9,214,046
South Carolina	96,310,411	6,142,486	6,654,915	4,282,130	18,150	113,408,092
South Dakota	435,739	193,405	78,484	1,294,101	0	2,001,729
Tennessee	46,687,393	6,290,202	10,324,918	5,665,208	0	68,967,721
Texas	193,240,622	74,366,119	33,729,621	36,475,413	174,466	337,986,241
Utah	5,02p-1X2,521,811		12,270,738	4,214,840	2,623	94,179,052
Wyoming	317,678	3,573	3,708	266	0	325,225
Total	2,150,593,994	477,056,570	290,096,828	235,813,508	3,306,380	3,156,867,280

Note: Data from Section 6 of Form R excluding off-site transfers to disposal. Other Off-site Transfers are transfers reported without a valid waste management code.



million pounds, or 46.7% of its transfers to disposal) and California (4.9 million pounds, or 59.4%). Pennsylvania was also one of the largest recipient states, ranking third with 5.7 million pounds. The top two states receiving the largest amount of transfers to disposal from TRI facilities outside their borders were Ohio (18.2 million pounds) and New York (7.8 million pounds).

### Other On-site Waste Management

Texas and Louisiana also led all states for on-site waste management, with 3.18 billion pounds and 1.89 billion pounds respectively (see Table 2-7). Ranking third was California, with 1.17 billion pounds. These were the only states whose facilities reported more than 1 billion pounds in total on-site waste management. In two other states, totals exceeded 600 million pounds: Arizona with 638.0 million pounds and Alabama with 600.5 million pounds.

Treatment represented the largest on-site waste management option for four of the top five states. For Texas and Louisiana, treatment amounted to 43.3% and 43.1%, respectively, of on-site waste management. For third-ranked California, treatment accounted for 94.3% of the total, and for fifth-ranked Alabama 52.8%. In contrast, 98.7% of on-site waste management reported in Arizona, ranked fourth overall, was recycling.

Texas facilities also reported the largest amounts in each on-site waste management activity: 965.1 million pounds recycled, 836.5 million pounds burned for energy recovery, and 1.38 billion pounds treated. Louisiana ranked second for both recycling (725.1 million pounds) and energy recovery (350.8 million pounds) and third for treatment (816.2 million pounds). California ranked second for treatment, with 1.10 billion pounds.

### Transfers Off-site for Further Waste Management

Texas also ranked first for transfers off-site (excluding transfers to disposal), with 338.0 million pounds, as shown in Table 2-8. Ohio followed with 263.7 million pounds and Indiana with 249.7 million pounds. Another five states totaled more than 100 million pounds each in off-site transfers: Michigan (208.0 million pounds), Pennsylvania (181.7 million pounds), Illinois (147.6 million pounds), South Carolina (113.4 million pounds), and North Carolina (105.2 million pounds).

In all eight of these states, most off-site transfers were sent for recycling. Off-site recycling ranged from 90.9% of transfers in Indiana to 48.5% in Michigan. With 227.0 million pounds, Indiana led all states for recycling. Texas ranked second with 193.2 million pounds and Ohio third with 186.1 million pounds. For energy recovery, the top states were Texas (74.4 million pounds), Michigan (69.4 million pounds), and Ohio (40.5 million pounds).

Texas facilities also sent larger amounts off-site for treatment (33.7 million pounds) and to POTWs (36.5 million pounds) than facilities in any other state. Michigan ranked second for transfers to treatment with 23.5 million pounds and Ohio third with 20.7 million pounds. For transfers to POTWs, New Jersey was second (18.8 million pounds) and Virginia third (16.9 million pounds).

## 1996 TRI Data by Chemical

This section presents chemical-specific TRI data for 1996, including the chemicals with the largest releases. It also reviews data for several groups of TRI chemicals of particular concern: metals, chemicals identified as known or suspected OSHA



carcinogens, chemicals that may adversely affect children's health, and pesticides. Also included is information about the uses, toxicity, and environmental fate of the TRI chemicals with the largest reported releases. At the end of this chapter, Table 2-21 presents releases, on-site waste management, and off-site transfer data for all TRI chemicals for which 1996 reports were received.

## Top 20 Chemicals for On- and Off-site Releases

Table 2-9 lists the top 20 chemicals—among all TRI chemicals—with the largest total releases. With 1.79 billion pounds in releases, these chemicals represented three-quarters (73.8%) of all on- and off-site releases reported to TRI in 1996. Methanol, the leading chemical, accounted for one-tenth (9.9%) of all TRI releases for the year, with 241.4 million pounds. Other chemicals reported in amounts greater than 100 million pounds were zinc compounds (207.0 million pounds), ammonia (193.0 million pounds), nitrate compounds (163.8 million pounds), and toluene (127.4 million pounds). These were also the top chemicals for on-site releases, although zinc compounds ranked fifth in that category, because more than half of its total releases were transfers off-site to disposal. Information on the uses, toxicity, and environmental fate of these top five chemicals appears below.

Methanol also led all chemicals for air releases with 206.4 million pounds total (28.0 million pounds fugitive emissions and 178.4 million pounds stack emissions). Ammonia and toluene followed with 154.8 million pounds and 125.4 million pounds total air emissions, respectively.

More nitrate compounds, a chemical category added to TRI reporting in 1995, were discharged to surface waters than any other chemical, with 117.7 million pounds. This amount was more than four times the releases to water of phosphoric acid (28.4 million pounds), the chemical ranked second for this environmental medium. Nitrate compounds

were also injected underground in larger amounts than any other chemical: 39.4 million pounds, virtually all to Class I wells. Ammonia and methanol were second and third with 24.4 million pounds and 24.3 million pounds, respectively, also predominantly to Class I wells.

Zinc compounds led all chemicals for on-site land releases with 94.8 million pounds. Of that amount, 15.0 million pounds were released to RCRA subtitle C landfills. Copper compounds and manganese compounds were second and third for on-site land releases, with 48.1 million pounds and 40.1 million pounds, respectively. Nearly 1 million pounds of the copper compounds were placed in RCRA landfills, as were 4.6 million pounds of the manganese compounds.

Zinc compounds also dominated off-site transfers to disposal among these top 20 chemicals, with 105.1 million pounds, more than four times the transfers to disposal of manganese compounds (26.7 million pounds) or of lead compounds (21.5 million pounds), ranked second and third.

### Use, Toxicity, and Environmental Fate Information

TRI chemicals may cause a variety of adverse health and environmental effects. Information on use, toxicity, and environmental fate is provided here for the top five chemicals with the largest releases in 1996 (see Table 2-9).

#### **Methanol**

**Uses.** Methanol is used as a solvent, as a raw material in the synthesis of organic chemicals, as a fuel, as a de-icing agent, and to denature ethanol.

**Toxicity.** Methanol is readily absorbed from the gastrointestinal tract and the respiratory tract, and is toxic to humans in moderate to high doses. In the body, methanol is converted into formaldehyde and formic acid. Observed toxic effects at high dose levels include central nervous system damage



Table 2-9. Top 20 Chemicals with Largest Total On-site and Off-site Releases, 1996

CAS Number	Chemical	Air		Surface Water Discharges Pounds	Underground Injection	
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds		Class I Wells Pounds	Class II-V Wells Pounds
67-56-1	Methanol	27,987,712	178,370,259	7,353,977	23,801,105	499,383
—	Zinc compounds	2,327,688	3,506,502	1,065,164	129,498	0
7664-41-7	Ammonia	35,870,521	118,910,062	8,267,591	24,180,232	225,985
—	Nitrate compounds	12,981	334,102	117,714,518	39,398,312	250
108-88-3	Toluene	41,711,487	83,670,741	68,697	325,920	3,355
1330-20-7	Xylene (mixed isomers)	20,296,828	62,388,723	39,902	130,351	2,620
75-15-0	Carbon disulfide	3,212,583	69,569,637	66,555	3,788	0
110-54-3	n-Hexane	22,361,785	49,482,089	218,217	101,579	0
—	Manganese compounds	806,259	1,020,847	1,901,227	14,880	2,808
7782-50-5	Chlorine	1,119,170	65,308,331	465,787	74,196	0
7647-01-0	Hydrochloric acid	1,934,070	63,180,765	4,985	260,005	0
7664-38-2	Phosphoric acid	196,086	851,959	28,367,233	9,716	0
78-93-3	Methyl ethyl ketone	20,641,669	38,426,835	74,989	432,767	5
—	Copper compounds	1,198,319	666,754	62,013	298,693	14,683
75-09-2	Dichloromethane	21,519,922	31,900,543	10,060	749,507	0
100-42-5	Styrene	10,917,192	31,011,969	12,864	228,317	0
—	Glycol ethers	8,347,921	31,823,871	143,511	99,208	0
—	Chromium compounds	168,943	237,261	137,319	37,422	0
74-85-1	Ethylene	16,159,552	19,627,812	25,228	0	0
—	Lead compounds	434,594	752,764	50,186	794	0
	Subtotal	237,225,282	851,041,826	166,050,023	90,276,290	749,089
	Total	355,271,752	1,096,818,210	173,288,209	203,572,710	756,399

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

and blindness. Inhalation of methanol at relatively high doses affects the liver and blood in animals.

Methanol is expected to have low toxicity to aquatic organisms and is not likely to persist in water or to bioaccumulate in aquatic life.

**Environmental Fate.** Methanol reacts in air to produce formaldehyde, which contributes to formation of air pollutants. In the atmosphere, it can react with other chemicals or be washed out by rain. Methanol is readily degraded by micro-organisms in soils and surface waters.

### Zinc Compounds

**Uses.** Zinc is used as a coating on iron and steel and in making brass metal alloys. Zinc compounds are widely used in industry to make paint, rubber, dye, wood preservatives, and ointments.

**Toxicity.** Zinc compounds are listed on TRI primarily because of concerns for the toxicity of the parent metal, zinc. EPA has categorized zinc as a Group D carcinogen, meaning that sufficient evidence is not available to classify zinc as to its cancer-causing potential. EPA has established an oral reference dose (RfD) of 0.3 mg/kg/day for soluble zinc salts. Zinc has been shown to damage



Table 2-9. Top 20 Chemicals with Largest Total On-site and Off-site Releases, 1996, Continued

CAS Number	Chemical	On-site Land Releases		Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
		RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	
67-56-1	Methanol	10,041	1,921,624	239,944,101	1,411,828	241,355,929
—	Zinc compounds	14,985,107	79,857,092	101,871,051	105,122,823	206,993,874
664-41-7	Ammonia	444,378	3,159,106	191,057,875	1,917,792	192,975,667
—	Nitrate compounds	3,415	3,710,521	161,174,099	2,590,615	163,764,714
108-88-3	Toluene	143,008	414,152	126,337,360	1,022,535	127,359,895
330-20-7	Xylene (mixed isomers)	10,465	48,486	82,917,375	499,478	83,416,853
75-15-0	Carbon disulfide	0	270	72,852,833	19,097	72,871,930
110-54-3	n-Hexane	547	23,365	72,187,582	291,798	72,479,380
—	Manganese compounds	4,583,105	35,566,390	43,895,516	26,664,625	70,560,141
782-50-5	Chlorine	0	312,638	67,280,122	21,045	67,301,167
647-01-0	Hydrochloric acid	0	23,148	65,402,973	236,994	65,639,967
664-38-2	Phosphoric acid	43,325	31,417,396	60,885,715	2,331,930	63,217,645
78-93-3	Methyl ethyl ketone	36,301	103,297	59,715,863	247,023	59,962,886
—	Copper compounds	968,892	47,098,824	50,308,178	6,935,031	57,243,209
75-09-2	Dichloromethane	15	4,942	54,184,989	116,409	54,301,398
100-42-5	Styrene	90,680	176,010	42,437,032	3,251,349	45,688,381
—	Glycol ethers	1,000	57,625	40,473,136	653,180	41,126,316
—	Chromium compounds	864,202	25,270,469	26,715,616	11,759,262	38,474,878
74-85-1	Ethylene	7,800	280	35,820,672	10,845	35,831,517
—	Lead compounds	1,657,584	9,910,784	12,806,706	21,476,996	34,283,702
	Subtotal	23,849,865	239,076,419	1,608,268,794	186,580,655	1,794,849,449
	Total	26,454,969	282,608,237	2,138,770,486	294,736,096	2,433,506,582

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

the developing fetus at doses as low as 100 mg/kg/day in animal studies.

**Environmental Fate.** Many zinc salts are highly soluble in water. Zinc and its salts are highly toxic to aquatic organisms. Zinc is likely to persist in water. Its concentration in aquatic tissue is expected to be significantly higher than its concentration in surrounding water.

### Ammonia

**Uses.** Ammonia is used in the manufacture of nitrogen compounds, including chemicals used as fertilizers or in making nylon and plastics. It is also

used in refrigeration, paper and pulp production, explosives, cleaners, and metal-treating operations.

**Toxicity.** Anhydrous ammonia is a corrosive and severely irritating gas with a pungent odor; it is irritating to the skin, eyes, nose, throat, and upper respiratory system.

Aqueous ammonia is moderately toxic to aquatic organisms. Because it is a source of nitrogen, an essential element for aquatic plant growth, ammonia may contribute to eutrophication of standing or slow-moving surface water, particularly in nitrogen-limited waters, such as the Chesapeake Bay.





**Environmental Fate.** Ammonia combines with sulfate ions in the atmosphere and is washed out by rainfall, resulting in rapid return of ammonia to the soil and surface waters. Ammonia is a central compound in the environmental cycling of nitrogen. Ammonia in lakes, rivers, and streams is converted to nitrate.

### Nitrate Compounds

**Uses.** There are many compounds covered by the nitrate compounds category, and they have many uses. The most significant use is as fertilizers, either straight or blended to make complex fertilizers. Some compounds are also used as oxidizing agents and as constituents in some explosives and pyrotechnics. Nitrate compounds are also used as refining agents for removing air bubbles from melts in the glass and enamel industry and in metallurgy as heat-transfer baths for quench hardening and tempering of steel, light alloys, and copper alloys.

**Toxicity.** Nitrate compounds that are soluble in water release nitrate ion which can cause both human health and environmental effects. Human infants exposed to aqueous solutions of nitrate ion can develop a condition in which the blood's ability to carry oxygen is reduced. This reduced supply of oxygen can lead to damaged organs and death. Because it is a source of nitrogen, an essential element for aquatic plant growth, nitrate ion may contribute to eutrophication of standing or slow-moving surface water, particularly in nitrogen-limited waters, such as the Chesapeake Bay.

**Environmental Fate.** Nitrate-nitrogen is the form of nitrogen most available to plants. In the environment, nitrate ion is taken up by plants and becomes part of the natural nitrogen cycle. Excess nitrate can stimulate primary production of plants and can produce changes in the dominant species of plants, leading to cultural eutrophication and ultimately to deterioration of water quality.

### Toluene

**Uses.** Toluene is a flammable liquid used in the manufacture of organic chemicals, as a solvent for paint, gums, and resins. It is also a constituent of gasoline.

**Toxicity.** Inhalation or ingestion of toluene can cause headaches, confusion, weakness, and memory loss. Toluene may also affect the way the kidneys and liver function. Some studies have shown that unborn animals were harmed when high levels of toluene were inhaled by their mothers, although the same effects were not seen when the mothers were fed large quantities of toluene.

Reactions of toluene in the atmosphere contribute to the formation of ozone in the lower atmosphere. Ozone can affect the respiratory system, especially in sensitive individuals such as asthma or allergy sufferers.

**Environmental Fate.** As a volatile organic chemical, toluene will react with other atmospheric components in the lower atmosphere, contributing to the formation of ozone and other air pollutants. The majority of releases to land and water will evaporate. Toluene may also be degraded by microorganisms.

### Metals and Metal Compounds

Both metals and their metal compounds are listed on TRI. Releases, on-site waste management, and off-site transfers reported in 1996 for these chemicals appear in Tables 2-10 and 2-11. Under EPCRA section 313, facilities that manufacture, process, or otherwise use metal compounds report only the metal portion of the metal compound. For example, a facility that releases a copper compound, such as copper sulfate, would report as a release only the weight of the copper, not the weight of the entire copper compound. This is done to capture information on the targeted portion of each member of the category, so that



Table 2-10. TRI On-site and Off-site Releases of Metals and Metal Compounds, 1996

Chemical	Air		Surface Water Discharges Pounds	Underground Injection	
	Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds		Class I Wells Pounds	Class II-V Wells Pounds
Antimony and antimony compounds	35,250	78,347	40,274	13,908	0
Arsenic and arsenic compounds	108,842	46,076	4,468	61,280	0
Barium and barium compounds	93,581	248,867	91,867	750	0
Beryllium and beryllium compounds	39	1,215	32	0	0
Cadmium and cadmium compounds	7,890	36,774	4,624	82	0
Chromium and chromium compounds	522,191	372,505	711,411	37,431	0
Cobalt and cobalt compounds	23,366	40,060	32,290	15,917	0
Copper and copper compounds	5,515,158	1,374,259	108,791	339,720	14,688
Lead and lead compounds	626,869	1,178,551	62,419	794	0
Manganese and manganese compounds*	7,558,035	1,405,101	2,018,602	14,881	2,815
Mercury and mercury compounds	12,155	4,942	541	9	0
Nickel and nickel compounds	335,509	371,280	88,809	90,253	250
Selenium and selenium compounds	1,991	45,318	2,501	3,100	0
Silver and silver compounds	9,277	15,322	8,296	370	0
Thallium and thallium compounds	0	0	0	0	0
Zinc and zinc compounds**	2,961,395	4,507,867	1,077,226	129,498	0
Total	17,811,548	9,726,484	4,252,151	707,993	17,753

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

\*One facility reported 6,211,171 pounds of fugitive air emissions of manganese in error for 1996, the correct amount is 750 pounds. Fugitive air emissions for manganese and manganese compounds should be 1,347,614 pounds.

\*\*Only fume and dust forms of zinc metal are reportable.

information on the listed portion of the compound is collected in TRI.

Metals (including the metal portion of metal compounds) differ from other TRI chemicals because they do not degrade and are not destroyed. Other TRI-listed chemicals can be destroyed by sunlight, heat, microorganisms, or other chemicals. Although metals cannot be destroyed, they may be converted to a less toxic form. For example, many facilities convert hexavalent chromium (a known carcinogen) to the less toxic trivalent form before releasing or transferring it to off-site locations.

Other metal waste may be treated before disposal so that the metal will be less likely to be transported through soils. Although such treatment may limit the availability of the metal to the environment, it does not destroy the metal.

Releases of TRI metals and metal compounds in 1996 totaled 217.9 million pounds, as shown in Table 2-10. Note that a few other metals [for example, aluminum (fume or dust) and certain metal-containing pesticides] are also reportable to TRI, but are not included in this table because they do not have associated compound categories. The



Table 2-10. TRI On-site and Off-site Releases of Metals and Metal Compounds, 1996, Continued

Chemical	On-site Land Releases			Off-site Releases	Total On- and Off-site Releases Pounds
	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
Antimony and antimony compounds	107,945	1,876,063	2,151,787	4,419,320	6,571,107
Arsenic and arsenic compounds	16,091	1,833,695	2,070,452	1,243,489	3,313,941
Barium and barium compounds	66,678	1,773,639	2,275,382	4,701,773	6,977,155
Beryllium and beryllium compounds	28,000	19,428	48,714	3,030	51,744
Cadmium and cadmium compounds	58,179	495,268	602,817	938,552	1,541,369
Chromium and chromium compounds	1,196,377	25,703,645	28,543,560	16,744,943	45,288,503
Cobalt and cobalt compounds	39,040	248,330	399,003	699,089	1,098,092
Copper and copper compounds	1,375,076	50,045,648	58,773,340	21,428,628	80,201,968
Lead and lead compounds	1,782,543	13,196,913	16,848,089	23,220,634	40,068,723
Manganese and manganese compounds*	4,627,631	45,562,235	61,189,300	40,570,018	101,759,318
Mercury and mercury compounds	6	531	18,184	25,884	44,068
Nickel and nickel compounds	156,007	3,803,581	4,845,689	8,238,804	13,084,493
Selenium and selenium compounds	0	211,266	264,176	62,275	326,451
Silver and silver compounds	0	51,999	85,264	31,868	117,132
Thallium and thallium compounds	0	0	0	0	0
Zinc and zinc compounds**	15,006,828	86,635,257	110,318,071	107,600,650	217,918,721
Total	24,460,401	231,457,498	288,433,828	229,928,957	518,362,785

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

\*One facility reported 6,211,171 pounds of fugitive air emissions of manganese in error for 1996, the correct amount is 750 pounds. Fugitive air emissions for manganese and manganese compounds should be 1,347,614 pounds.

\*\*Only fume and dust forms of zinc metal are reportable.

large majority (88.7%) of on-site releases of metals and metal compounds were land releases. Off-site transfers to disposal are also often land releases. For metals and metal compounds, on-site land releases and off-site disposal together accounted for 93.7% of total releases. Zinc and its compounds and manganese and its compounds together accounted for 61.7% of on- and off-site releases presented in Table 2-10;<sup>1</sup> compounds of

both metals were among the top 20 TRI chemicals for releases (see Table 2-9).

On-site waste management of metals and metal compounds totaled 2.06 billion pounds in 1996, as shown in Table 2-11. By far the largest portion of this was recycled, 1.98 billion pounds or 96.0% of the total. Similarly, of the 1.81 billion pounds of metals and metal compounds sent off-site for further waste management, recycling accounted for 1.73 billion pounds or 95.4%. Copper and its compounds ranked first for recycling both at the facility and at other locations, with 926.9 million

<sup>1</sup> The error reported on Table 2-10 makes no significant difference (0.5%) in this analysis.



**Table 2-11. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management of Metals and Metal Compounds, 1996**

Chemical	Recycled On-site Pounds	Energy Recovery On-site* Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds
Antimony and antimony compounds	9,687,071	109,302	1,314,869	11,111,242	5,814,806
Arsenic and arsenic compounds	6,123,353	0	162,032	6,285,385	1,119,459
Barium and barium compounds	37,231,106	220,521	6,952,920	44,404,547	2,864,642
Beryllium and beryllium compounds	38,389	0	921	39,310	111,128
Cadmium and cadmium compounds	8,335,956	0	136,455	8,472,411	1,105,529
Chromium and chromium compounds	55,956,018	61,449	5,735,179	61,752,646	113,926,660
Cobalt and cobalt compounds	3,993,972	0	1,254,768	5,248,740	8,639,502
Copper and copper compounds	926,877,740	123,156	47,438,898	974,439,794	733,814,441
Lead and lead compounds	605,496,338	89,267	3,753,868	609,339,473	319,323,729
Manganese and manganese compounds	167,198,587	21,216	1,271,142	168,490,945	142,331,048
Mercury and mercury compounds	850,230	0	4,115	854,345	25,748
Nickel and nickel compounds	42,663,278	54,474	3,716,271	46,434,023	98,921,322
Selenium and selenium compounds	601,563	0	29	601,592	133,241
Silver and silver compounds	1,180,088	0	3,994,082	5,174,170	3,055,284
Thallium and thallium compounds	0	0	0	0	0
Zinc and zinc compounds**	110,195,972	102,429	5,650,980	115,949,381	298,971,948
Total	1,976,429,661	781,814	81,386,529	2,058,598,004	1,730,158,487

**Note:** On-site Waste Management data from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code.

\*Metals do not burn and do not contribute to combustion. Therefore, metals should not be reported as combusted for energy recovery. Any value other than zero represents misreporting.

\*\*Only fume and dust forms of zinc metal are reportable.

pounds recycled on-site and 733.8 million pounds off-site.

Some facilities reported transfers of metals in waste off-site for treatment by POTWs. Treatment processes employed at POTWs may remove the metal from a waste stream or convert the metal into a less toxic form, but they do not destroy the metal. For example, public sewage treatment plants will remove some fraction of the metals during treatment of the waste stream when removing solid materials. The amounts removed

are then generally sent to a landfill for disposal. The metal waste that is not removed remains in the wastewater and will pass through the treatment plant and into the aquatic environment.

## OSHA Carcinogens

Some chemicals are listed in TRI because they are either known human carcinogens or suspect carcinogens (see Box 2-4). Known human carcinogens are those that have been shown to cause cancer in humans. Suspect carcinogens are those



Table 2-11. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management of Metals and Metal Compounds, 1996, Continued

Chemical	Transfers to Energy Recovery* Pounds	Other Transfers to Treatment Pounds	Transfers to POTWs Pounds	Off-site Transfers Pounds	Total Transfers for Further Waste Management Pounds
Antimony and antimony compounds	97,012	902,319	116,956	2	6,931,095
Arsenic and arsenic compounds	326	1,814,504	532	0	2,934,821
Barium and barium compounds	228,123	1,759,760	393,780	2,941	5,249,246
Beryllium and beryllium compounds	0	4,566	1	0	115,695
Cadmium and cadmium compounds	1,613	227,611	3,147	1	1,337,901
Chromium and chromium compounds	56,368	3,971,183	297,040	5,441	118,256,692
Cobalt and cobalt compounds	2,020	126,429	13,966	47,000	8,828,917
Copper and copper compounds	83,758	3,109,147	526,578	18,163	737,552,087
Lead and lead compounds	74,305	14,078,006	47,511	728,614	334,252,165
Manganese and manganese compounds	259,552	7,664,467	395,643	60,863	150,711,573
Mercury and mercury compounds	500	14,441	15	0	40,704
Nickel and nickel compounds	71,961	2,924,939	180,123	12,301	102,110,646
Selenium and selenium compounds	5,455	45,098	426	8,464	192,684
Silver and silver compounds	0	35,562	2,648	257	3,093,751
Thallium and thallium compounds	0	5	0	0	5
Zinc and zinc compounds**	372,253	43,049,381	429,381	71,441	342,894,404
Total	1,253,246	79,727,418	2,407,747	955,488	1,814,502,386

Note: On-site Waste Management data from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code

\*Metals do not burn and do not contribute to combustion. Therefore, metals should not be reported as combusted for energy recovery. Any value other than zero represents misreporting.

\*\* Only fume and dust forms of zinc metal are reportable.

chemicals that have been shown to cause cancer in animals. TRI thresholds for reporting known and suspect carcinogens in mixtures are lower than for other substances. Table 2-12 shows releases for these chemicals.

#### Clarification of the Basis for Carcinogen Listings on the EPCRA Section 313 List of Toxic Chemicals

Under section 313, a chemical does not have to be counted towards threshold and release calculations

if it is present in a mixture below a certain concentration. This is known as the section 313 “*de minimis*” concentration in mixture. When the section 313 rule was developed, EPA adopted the *de minimis* percentages from the Occupational Safety and Health Administration’s (OSHA) Hazard Communication Standards (29 CFR 1910.1200), because much of the information that industry would have relating to chemicals in mixtures would most likely be from the material safety data sheet (MSDS) on that mixture. The OSHA *de minimis* limitation is 0.1% if the chemical is a



Box 2-4. Basis of OSHA Carcinogen Listing for Individual Chemicals

Chemical	IARC	NTP	OSHA	Chemical	IARC	NTP	OSHA
Acetaldehyde	2B	P	—	2,4-D chlorocrotyl ester†	2B	—	—
Acetamide	2B	—	—	2,4-D 2-ethylhexyl ester†	2B	—	—
2-Acetylaminofluorene	—	P	Z	2,4-D 2-ethyl-4-methylpentyl ester†	2B	—	—
Acrylamide	2A	P	—	2,4-Diaminoanisole	2B	—	—
Acrylonitrile	2A	P	Z	2,4-Diaminoanisole sulfate	—	P	—
2-Aminoanthraquinone	—	P	—	4,4'-Diaminodiphenyl ether	2B	—	—
4-Aminoazobenzene	2B	—	—	2,4-Diaminotoluene	2B	P	—
4-Aminobiphenyl	1	K	Z	Diaminotoluene (mixed isomers)	2B	P	—
1-Amino-2-methylantraquinone	—	P	—	1,2-Dibromo-3-chloropropane	2B	P	Z
Amitrole	2B	P	—	1,2-Dibromoethane	2A	P	—
o-Anisidine	2B	—	—	1,4-Dichlorobenzene	2B	P	—
o-Anisidine hydrochloride	—	P	—	Dichlorobenzene (mixed isomers)	2B	P	—
Arsenic and inorganic arsenic compounds	1	K†	Z	3,3'-Dichlorobenzidine	2B	P	Z
Asbestos (friable)	1	K	Z	3,3'-Dichlorobenzidine dihydrochloride	2B	P	—
Atrazine	2B	—	—	3,3'-Dichlorobenzidine sulfate	2B	P	—
Benzene	1	K	Z	1,2-Dichloroethane	2B	P	—
Benzidine	1	K	Z	Dichloromethane	2B	P	—
Benzoic trichloride	2B	P	—	trans-1,3-Dichloropropene	2B	—	—
Beryllium and beryllium compounds	1	P†	—	1,3-Dichloropropylene	2B	P	—
Bis(chloromethyl)ether	1	K	Z	Dichlorvos	2B	—	—
1,3-Butadiene	2A	P	—	Diepoxybutane	2B	P	—
C.I. Acid Red 114	2B	—	—	Di-(2-ethylhexyl)phthalate	2B	P	—
C.I. Direct Black 38	2A	P	—	Diethyl sulfate	2A	P	—
C.I. Direct Blue 6	2A	P	—	Diglycidyl resorcinol ether	2B	P	—
C.I. Direct Brown 95	2A	—	—	Dihydrosafrole	2B	—	—
C.I. Food Red 5	2B	—	—	3,3'-Dimethoxybenzidine	2B	P	—
C.I. Solvent Yellow 34 (Auramine)	2B	—	—	3,3'-Dimethoxybenzidine dihydrochloride	2B	P	—
Cadmium and cadmium compounds	1	P†	—	3,3'-Dimethoxybenzidine hydrochloride	2B	P	—
Carbon tetrachloride	2B	P	—	4-Dimethylaminoazobenzene	2B	P	Z
Chlordane	2B	—	—	3,3'-Dimethylbenzidine	2B	P	—
Chlorendic acid	2B	P	—	3,3'-Dimethylbenzidine dihydrochloride	2B	P	—
p-Chloroaniline	2B	—	—	3,3'-Dimethylbenzidine dihydrofluoride	2B	P	—
Chloroform	2B	P	—	Dimethylcarbaryl chloride	2A	P	—
Chloromethyl methyl ether	1	K	Z	N,N-Dimethylformamide	2B	—	—
3-Chloro-2-methyl-1-propene	—	P	—	1,1-Dimethylhydrazine	2B	P	—
Chlorophenols	2B	—	—	Dimethyl sulfate	2A	P	—
p-Chloro-o-toluidine	2B	—	—	1,4-Dioxane	2B	P	—
Chromium (VI) compounds	1	K	—	1,2-Diphenylhydrazine	—	P	—
Cobalt and cobalt compounds	2B	—	—	2,4-D isopropyl ester†	2B	—	—
Creosote	2A	—	—	2,4-DP†	2B	—	—
p-Cresidine	2B	P	—	2,4-D propylene glycol butyl ether ester†	2B	—	—
Cupferron	—	P	—	2,4-D sodium salt†	2B	—	—
2,4-D†	2B	—	—	Epichlorohydrin	2A	P	—
2,4-D butoxyethyl ester†	2B	—	—	Ethyl acrylate	2B	P	—
2,4-D butyl ester†	2B	—	—	Ethyleneimine	—	—	Z

**Note** The list of TRI chemicals meeting the OSHA carcinogen standard and, therefore, reported when in a mixture at a concentration level below the *de minimus* level of 0.1%, has been updated, and this list reflects the update.

**IARC** 1—The chemical is carcinogenic to humans, 2A—The chemical is probably carcinogenic to humans, 2B—The chemical is possibly carcinogenic to humans

**NTP** K—The chemical is known to be carcinogenic; P—The chemical may reasonably be anticipated to be carcinogenic

**OSHA** Z—The chemical appears at 29 CFR Part 1910 Subpart Z

† Certain compounds

‡ Chlorophenoxy herbicides (IARC 2B)



Box 2-4. Basis of OSHA Carcinogen Listing for Individual Chemicals, Continued

Chemical	IARC	NTP	OSHA	Chemical	IARC	NTP	OSHA
Ethylene oxide	1	P	Z	Benzo(j)fluoranthene	2B	P	—
Ethylene thiourea	2B	P	—	Benzo(k)fluoranthene	2B	—	—
Formaldehyde	2A	P	Z	Benzo(rst)pentaphene	2B	—	—
Heptachlor	2B	—	—	Benzo(a)pyrene	2A	P	—
Hexachlorobenzene	2B	P	—	Dibenz(a,h)acridine	2A	P	—
Hexamethylphosphoramide	2B	P	—	Dibenz(a,j)acridine	2B	P	—
Hydrazine	2B	P	—	Dibenzo(a,h)anthracene	2B	P	—
Hydrazine sulfate	—	P	—	7H-Dibenzo(c,g)carbazole	2B	P	—
Lead and inorganic lead compounds	2B	—	Z	Dibenzo(a,e)pyrene	2B	P	—
Lindane	2B	P	—	Dibenzo(a,h)pyrene	2B	P	—
Mecoprop†	2B	—	—	Dibenzo(a,l)pyrene	2B	P	—
Methoxone‡	2B	—	—	7,12-Dimethylbenz(a)anthracene	2B	—	—
Methoxone sodium salt‡	2B	—	—	Indeno[1,2,3-cd]pyrene	2B	P	—
4,4'-Methylenebis (2-chloroaniline)	2A	P	—	5-Methylchrysene	2B	P	—
4,4'-Methylenebis (N,N-dimethyl) benzeneamine	2B	P	—	1-Nitropyrene	2B	—	—
4,4'-Methylenedianiline	2B	P	Z	Potassium bromate	2B	—	—
Michler's ketone	—	P	—	Propane sultone	2B	P	—
Mustard gas	1	K	—	beta-Propiolactone	2B	P	Z
alpha-Naphthylamine	—	—	Z	Propyleneimine	2B	P	—
beta-Naphthylamine	1	K	Z	Propylene oxide	2B	P	—
Nickel	2B	P	—	Saccharin (manufacturing)	2B	P	—
Nickel compounds	1	P†	—	Safrole	2B	P	—
Nitrilotriacetic acid	—	P	—	Sodium o-phenylphenoxide	2B	—	—
4-Nitrobiphenyl	—	—	Z	Styrene	2B	—	—
Nitrofen	2B	P	—	Styrene oxide	2A	—	—
Nitrogen mustard	2A	—	—	Tetrachloroethylene	2B	P	—
2-Nitropropane	2B	P	—	Thioacetamide	2B	P	—
N-Nitrosodi-n-butylamine	2B	P	—	4,4'-Thiodianiline	2B	P	—
N-Nitrosodiethylamine	2A	P	—	Thiourea	2B	P	—
N-Nitrosodimethylamine	2A	P	Z	Toluene-2,4-diisocyanate	2B	P	—
N-Nitrosodi-n-propylamine	2B	P	—	Toluene-2,6-diisocyanate	2B	P	—
N-Nitroso-N-ethylurea	2A	P	—	Toluene diisocyanate (mixed isomers)	2B	P	—
N-Nitroso-N-methylurea	2A	P	—	o-Toluidine	2B	P	—
N-Nitrosomethylvinylamine	2B	P	—	o-Toluidine hydrochloride	—	P	—
N-Nitrosomorpholine	2B	P	—	Toxaphene	2B	P	—
N-Nitrosornicotine	2B	P	—	Trichloroethylene	2A	—	—
N-Nitrosopiperidine	2B	P	—	2,4,6-Trichlorophenol	2B	P	—
Pentachlorophenol	2B	—	—	1,2,3-Trichloropropane	2A	—	—
Phenytoin	2B	P	—	Tris(2,3-dibromopropyl)phosphate	2A	P	—
Polybrominated biphenyls (PBBs)	2B	P	—	Trypan blue	2B	—	—
Polychlorinated biphenyls (PCBs)	2A	P	—	Urethane	2B	P	—
Polycyclic aromatic compounds (PACs):				Vinyl acetate	2B	—	—
Benz(a)anthracene	2A	P	—	Vinyl bromide	2A	—	—
Benzo(b)fluoranthene	2B	P	—	Vinyl chloride	1	K	Z
				2,6-Xylydine	2B	—	—

Note: The list of TRI chemicals meeting the OSHA carcinogen standard and, therefore, reported when in a mixture at a concentration level below the *de minimus* level of 0.1%, has been updated, and this list reflects the update.

IARC: 1—The chemical is carcinogenic to humans; 2A—The chemical is probably carcinogenic to humans, 2B—The chemical is possibly carcinogenic to humans

NTP: K—The chemical is known to be carcinogenic, P—The chemical may reasonably be anticipated to be carcinogenic.

OSHA: Z—The chemical appears at 29 CFR Part 1910 Subpart Z.

† Certain compounds.

‡ Chlorophenoxy herbicides (IARC 2B).



Table 2-12. TRI On-site and Off-site Releases of OSHA Carcinogens, 1996

CAS Number	Chemical	Air		Surface Water Discharges Pounds	Underground Injection	
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds		Class I Wells Pounds	Class II-V Wells Pounds
75-07-0	Acetaldehyde	1,637,438	10,938,582	198,485	468,662	0
60-35-5	Acetamide	5	14	2	1,169,000	0
79-06-1	Acrylamide	2,751	8,949	3,653	5,748,154	0
107-13-1	Acrylonitrile	291,729	1,003,720	590	3,595,236	0
60-09-3	4-Aminazobenzene	0	0	0	203	0
92-67-1	4-Aminobiphenyl	0	0	0	2	0
90-04-0	o-Anisidine	1,443	74	28	0	0
7440-38-2	Arsenic	32,882	6,590	421	0	0
1332-21-4	Asbestos (friable)	1,398	1,362	2	0	0
1912-24-9	Atrazine	5,067	21,944	1,326	1	0
71-43-2	Benzene	3,365,712	4,753,759	27,376	312,016	750
98-07-7	Benzoic trichloride	7,925	66	16	0	0
7440-41-7	Beryllium	9	850	31	0	0
—	Beryllium compounds	30	365	1	0	0
542-88-1	Bis(chloromethyl) ether	0	0	0	0	0
106-99-0	1,3-Butadiene	1,429,487	1,296,809	11,001	1,000	0
7440-43-9	Cadmium	1,926	2,849	1,010	0	0
—	Cadmium compounds	5,964	33,925	3,614	82	0
56-23-5	Carbon tetrachloride	140,533	210,317	215	44,515	0
57-74-9	Chlordane	660	0	95	0	0
115-28-6	Chlorendic acid	0	43	0	0	0
106-47-8	p-Chloroaniline	97	47	407	0	0
67-66-3	Chloroform	3,086,308	6,235,110	340,396	45,387	0
107-30-2	Chloromethyl methyl ether	199	2,642	7	0	0
563-47-3	3-Chloro-2-methyl-1-propene	331	22,676	0	0	0
—	Chlorophenols	1,851	2,924	13	113,554	0
7440-48-4	Cobalt	19,372	13,129	4,330	0	0
—	Cobalt compounds	3,994	26,931	27,960	15,917	0
8001-58-9	Creosote	382,479	555,535	9,114	0	0
120-71-8	p-Cresidine	1,665	1,800	0	0	0
135-20-6	Cupferron	0	0	0	0	0
94-75-7	2,4-D (acetic acid)	2,218	3,771	832	0	0
1929-73-3	2,4-D butoxyethyl ester	262	401	0	0	0
1928-43-4	2,4-D 2-Ethylhexyl ester	2,160	1,065	5	0	0
101-80-4	4,4'-Diaminodiphenyl ether	9	7	182	0	0
95-80-7	2,4-Diaminotoluene	211	1,364	0	0	0
25376-45-8	Diaminotoluene (mixed isomers)	10,404	6,845	590	7,600	0
106-93-4	1,2-Dibromoethane	6,503	2,207	7	24	0
106-46-7	1,4-Dichlorobenzene	93,651	142,851	1,881	2,000	0
25321-22-6	Dichlorobenzene (mixed isomers)	239	13,808	0	0	0
91-94-1	3,3'-Dichlorobenzidine	1	1	0	0	0
612-83-9	3,3'-Dichlorobenzidine dihydrochloride	0	5	0	0	0
64969-34-2	3,3'-Dichlorobenzidine sulfate	0	0	0	0	0
107-06-2	1,2-Dichloroethane	434,047	610,525	1,848	5,126	0
75-09-2	Dichloromethane	21,519,922	31,900,543	10,060	749,507	0
10061-02-6	trans-1,3-Dichloropropene	810	30	0	0	0
542-75-6	1,3-Dichloropropylene	8,686	761	1,270	0	0
62-73-7	Dichlorvos	5	250	5	0	0
117-81-7	Di-(2-ethylhexyl) phthalate	80,785	383,644	274	0	0
64-67-5	Diethyl sulfate	3,024	184	0	0	0
101-90-6	Diglycidyl resorcinol ether	255	255	0	0	0
94-58-6	Dihydrosafrole	533	300	0	0	0
119-90-4	3,3'-Dimethoxybenzidine	0	0	0	0	0
20325-40-0	3,3'-Dimethoxybenzidine dihydrochloride	2	8	0	0	0
119-93-7	3,3'-Dimethylbenzidine	3	3	25	0	0
612-82-8	3,3'-Dimethylbenzidine dihydrochloride	0	0	0	0	0
68-12-2	N,N-Dimethylformamide	368,967	1,282,686	43,956	1,220,000	0
57-14-7	1,1-Dimethyl hydrazine	259	43	0	0	0

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





Table 2-12. TRI On-site and Off-site Releases of OSHA Carcinogens, 1996, Continued

CAS Number	Chemical	On-site Releases to Land			Off-site Releases	Total On- and Off-site Releases Pounds
		RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
75-07-0	Acetaldehyde	121	16,679	13,259,967	2,463	13,262,430
60-35-5	Acetamide	0	0	1,169,021	0	1,169,021
79-06-1	Acrylamide	149,156	0	5,912,663	301,575	6,214,238
107-13-1	Acrylonitrile	5	297	4,891,577	6,639	4,898,216
60-09-3	4-Aminoazobenzene	0	0	203	0	203
92-67-1	4-Aminobiphenyl	0	0	2	0	2
90-04-0	o-Anisidine	0	0	1,545	1	1,546
7440-38-2	Arsenic	2,181	96,577	138,651	47,420	186,071
1332-21-4	Asbestos (friable)	26,010	453,549	482,321	3,316,112	3,798,433
1912-24-9	Atrazine	0	614,353	642,691	188,963	831,654
71-43-2	Benzene	28,841	47,316	8,535,770	65,750	8,601,520
98-07-7	Benzoic trichloride	0	0	8,007	0	8,007
7440-41-7	Beryllium	28,000	3,240	32,130	1,590	33,720
—	Beryllium compounds	0	16,188	16,584	1,440	18,024
542-88-1	Bis(chloromethyl) ether	0	0	0	0	0
106-99-0	1,3-Butadiene	110	153	2,738,560	4,790	2,743,350
7440-43-9	Cadmium	4,561	46,859	57,205	39,864	97,069
—	Cadmium compounds	53,618	448,409	545,612	898,688	1,444,300
56-23-5	Carbon tetrachloride	0	0	395,580	9,245	404,825
57-74-9	Chlordane	0	0	755	0	755
115-28-6	Chlorendic acid	0	0	43	0	43
106-47-8	p-Chloroaniline	0	5	556	0	556
67-66-3	Chloroform	25,156	7,553	9,739,910	38,868	9,778,778
107-30-2	Chloromethyl methyl ether	0	0	2,848	70	2,918
563-47-3	3-Chloro-2-methyl-1-propene	0	0	23,007	0	23,007
—	Chlorophenols	0	0	118,342	2,290	120,632
7440-48-4	Cobalt	9,683	57,053	103,567	139,708	243,275
—	Cobalt compounds	29,357	191,277	295,436	559,381	854,817
8001-58-9	Creosote	460	250	947,838	7,333,126	8,280,964
120-71-8	p-Cresidine	0	0	3,465	0	3,465
135-20-6	Cupferron	0	0	0	0	0
94-75-7	2,4-D (acetic acid)	250	5	7,076	6,017	13,093
1929-73-3	2,4-D butoxyethyl ester	0	0	663	0	663
1928-43-4	2,4-D 2-Ethylhexyl ester	0	0	3,230	2,077	5,307
101-80-4	4,4'-Diaminodiphenyl ether	0	0	198	53	251
95-80-7	2,4-Diaminotoluene	0	0	1,575	0	1,575
25376-45-8	Diaminotoluene (mixed isomers)	0	10	25,449	23,286	48,735
106-93-4	1,2-Dibromoethane	0	1	8,742	0	8,742
106-46-7	1,4-Dichlorobenzene	0	480	240,863	0	240,863
25321-22-6	Dichlorobenzene (mixed isomers)	0	0	14,047	10	14,057
91-94-1	3,3'-Dichlorobenzidine	0	0	2	5,550	5,552
612-83-9	3,3'-Dichlorobenzidine dihydrochloride	0	0	5	0	5
64969-34-2	3,3'-Dichlorobenzidine sulfate	0	0	0	0	0
107-06-2	1,2-Dichloroethane	25,000	250	1,076,796	91,249	1,168,045
75-09-2	Dichloromethane	15	4,942	54,184,989	116,409	54,301,398
10061-02-6	trans-1,3-Dichloropropene	0	0	840	0	840
542-75-6	1,3-Dichloropropylene	0	0	10,717	0	10,717
62-73-7	Dichlorvos	0	0	260	1,228	1,488
117-81-7	Di-(2-ethylhexyl) phthalate	264	70,047	535,014	1,762,843	2,297,857
64-67-5	Diethyl sulfate	0	0	3,208	47	3,255
101-90-6	Diglycidyl resorcinol ether	0	0	510	0	510
94-58-6	Dihydrosafrole	0	0	833	0	833
119-90-4	3,3'-Dimethoxybenzidine	0	0	0	0	0
20325-40-0	3,3'-Dimethoxybenzidine dihydrochloride	0	0	10	0	10
119-93-7	3,3'-Dimethylbenzidine	0	0	31	229	260
612-82-8	3,3'-Dimethylbenzidine dihydrochloride	0	0	0	0	0
68-12-2	N,N-Dimethylformamide	1,350	278	2,917,237	184,053	3,101,290
57-14-7	1,1-Dimethyl hydrazine	0	1	303	425	728

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



Table 2-12. TRI On-site and Off-site Releases of OSHA Carcinogens, 1996, Continued

CAS Number	Chemical	Air		Surface Water Discharges Pounds	Underground Injection	
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds		Class I Wells Pounds	Class II-V Wells Pounds
77-78-1	Dimethyl sulfate	4,977	819	0	0	0
123-91-1	1,4-Dioxane	41,019	78,937	226,998	0	0
120-36-5	2,4-DP	257	255	0	0	0
2702-72-9	2,4-D sodium salt	0	0	0	0	0
106-89-8	Epichlorohydrin	246,061	84,963	20,735	0	0
140-88-5	Ethyl acrylate	88,053	98,738	199	0	0
151-56-4	Ethyleneimine	0	2	0	0	0
75-21-8	Ethylene oxide	436,537	352,902	4,474	22,200	0
96-45-7	Ethylene thiourea	5	263	0	0	0
50-00-0	Formaldehyde	1,779,994	9,639,206	320,003	9,403,275	0
76-44-8	Heptachlor	198	0	5	0	0
118-74-1	Hexachlorobenzene	115	105	274	717	0
302-01-2	Hydrazine	7,797	2,646	23	0	0
10034-93-2	Hydrazine sulfate	0	0	0	350,000	0
7439-92-1	Lead	192,275	425,787	12,233	0	0
58-89-9	Lindane	255	255	5	0	0
93-65-2	Mecoprop	520	1,170	0	0	0
94-74-6	Methoxone	271	761	250	0	0
101-14-4	4,4'-Methylenebis(2-chloroaniline)	251	255	0	0	0
101-61-1	4,4'-Methylenebis(N,N-dimethyl) benzene	0	1	0	0	0
101-77-9	4,4'-Methylenedianiline	8,227	1,535	23	41,120	0
505-60-2	Mustard gas	0	0	0	0	0
134-32-7	alpha-Naphthylamine	0	0	0	0	0
7440-02-0	Nickel	256,602	125,211	28,163	4,225	0
—	Nickel compounds	78,907	246,069	60,646	86,028	250
139-13-9	Nitrilotriacetic acid	10	0	78	1,500	0
79-46-9	2-Nitropropane	19,226	15,062	2,790	0	0
59-89-2	N-Nitrosomorpholine	0	0	0	0	0
87-86-5	Pentachlorophenol	8,164	4,977	8,236	0	0
57-41-0	Phenytoin	0	0	0	0	0
—	Polybrominated biphenyls	0	250	0	0	0
1336-36-3	Polychlorinated biphenyls (PCBs)	5	250	0	0	0
—	Polycyclic aromatic compounds	121,107	521,753	8,079	0	0
7758-01-2	Potassium bromate	5	0	0	0	0
1120-71-4	Propane sulfone	0	0	0	0	0
75-55-8	Propyleneimine	366	36	0	0	0
75-56-9	Propylene oxide	226,160	354,701	45,393	12,141	0
81-07-2	Saccharin (manufacturing)	210	33	0	0	0
94-59-7	Safrole	500	5	0	0	0
100-42-5	Styrene	10,917,192	31,011,969	12,864	228,317	0
96-09-3	Styrene oxide	7	24	0	0	0
127-18-4	Tetrachloroethylene	3,095,666	4,765,504	1,311	13,436	0
62-56-6	Thiourea	1,093	119	339	5,000	0
584-84-9	Toluene-2,4-diisocyanate	3,247	4,086	0	0	0
91-08-7	Toluene-2,6-diisocyanate	6,262	7,404	0	0	0
26471-62-5	Toluenediisocyanate (mixed isomers)	22,122	23,191	0	0	0
95-53-4	o-Toluidine	8,997	8,584	260	17,450	0
79-01-6	Trichloroethylene	10,665,331	10,606,835	541	1,291	0
88-06-2	2,4,6-Trichlorophenol	136	155	28	0	0
96-18-4	1,2,3-Trichloropropane	8,068	695	0	0	0
51-79-6	Urethane	496	12,042	0	0	0
108-05-4	Vinyl acetate	829,617	3,010,281	2,393	300,768	0
593-60-2	Vinyl bromide	240	5,600	0	0	0
75-01-4	Vinyl chloride	272,926	746,882	356	333	0
87-62-7	2,6-Xyldine	0	53	0	0	0
	Subtotal	62,303,685	121,652,940	1,447,727	23,985,787	1,000
	Total for All TRI Chemicals	355,271,752	1,096,818,210	173,288,209	203,572,710	756,399

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



Table 2-12. TRI On-site and Off-site Releases of OSHA Carcinogens, 1996, Continued

CAS Number Pounds	Chemical	On-site Releases to Land			Off-site Releases	Total On- and Off-site Releases Pounds
		RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
77-78-1	Dimethyl sulfate	0	0	5,796	0	5,796
123-91-1	1,4-Dioxane	0	5,409	352,363	479,388	831,751
120-36-5	2,4-DP	5	0	517	39	556
2702-72-9	2,4-D sodium salt	0	0	0	0	0
106-89-8	Epichlorohydrin	1	2,204	353,964	4,137	358,101
140-88-5	Ethyl acrylate	0	516	187,506	32,734	220,240
151-56-4	Ethyleneimine	0	0	2	0	2
75-21-8	Ethylene oxide	0	551	816,664	1,048	817,712
96-45-7	Ethylene thiourea	0	0	268	4,071	4,339
50-00-0	Formaldehyde	755	113,651	21,256,884	329,509	21,586,393
76-44-8	Heptachlor	0	0	203	0	203
118-74-1	Hexachlorobenzene	0	0	1,211	23,449	24,660
302-01-2	Hydrazine	0	250	10,716	18,549	29,265
10034-93-2	Hydrazine sulfate	0	0	350,000	0	350,000
7439-92-1	Lead	124,959	3,286,129	4,041,383	1,743,638	5,785,021
58-89-9	Lindane	0	250	765	276	1,041
93-65-2	Mecoprop	250	5	1,945	3,896	5,841
94-74-6	Methoxone	250	0	1,532	4,778	6,310
101-14-4	4,4'-Methylenebis(2-chloroaniline)	0	750	1,256	5	1,261
101-61-1	4,4'-Methylenebis(N,N-dimethyl) benzeneamine	0	0	1	0	1
101-77-9	4,4'-Methylenedianiline	0	0	50,905	19,591	70,496
505-60-2	Mustard gas	0	0	0	0	0
134-32-7	alpha-Naphthylamine	0	0	0	0	0
7440-02-0	Nickel	54,458	206,208	674,867	3,480,910	4,155,777
—	Nickel compounds	101,549	3,597,373	4,170,822	4,757,894	8,928,716
139-13-9	Nitrilotriacetic acid	0	0	1,588	0	1,588
79-46-9	2-Nitropropane	0	0	37,078	0	37,078
59-89-2	N-Nitrosomorpholine	0	0	0	0	0
87-86-5	Pentachlorophenol	2,750	250	24,377	196,075	220,452
57-41-0	Phenytol	0	0	0	12,800	12,800
—	Polybrominated biphenyls	0	0	250	375	625
1336-36-3	Polychlorinated biphenyls (PCBs)	9,205	0	9,460	51,086	60,546
—	Polycyclic aromatic compounds	0	14,439	665,378	1,248,088	1,913,466
7758-01-2	Potassium bromate	0	0	5	0	5
1120-71-4	Propane sultone	0	0	0	0	0
75-55-8	Propyleneimine	0	0	402	0	402
75-56-9	Propylene oxide	0	335	638,730	39,230	677,960
81-07-2	Saccharin (manufacturing)	0	0	243	1,200	1,443
94-59-7	Safrole	0	0	505	0	505
100-42-5	Styrene	90,680	176,010	42,437,032	3,251,349	45,688,381
96-09-3	Styrene oxide	0	0	31	0	31
127-18-4	Tetrachloroethylene	26,000	4,442	7,906,359	22,071	7,928,430
62-56-6	Thiourea	0	250	6,801	2,590	9,391
584-84-9	Toluene-2,4-diisocyanate	0	192	7,525	3,586	11,111
91-08-7	Toluene-2,6-diisocyanate	0	48	13,714	897	14,611
26471-62-5	Toluenediisocyanate (mixed isomers)	0	353	45,666	33,029	78,695
95-53-4	o-Toluidine	0	10	35,301	1,401	36,702
79-01-6	Trichloroethylene	5,550	17,590	21,297,138	76,327	21,373,465
88-06-2	2,4,6-Trichlorophenol	0	0	319	0	319
96-18-4	1,2,3-Trichloropropane	0	0	8,763	0	8,763
51-79-6	Urethane	0	0	12,538	3,675	16,213
108-05-4	Vinyl acetate	0	2,834	4,145,893	27,065	4,172,958
593-60-2	Vinyl bromide	0	0	5,840	0	5,840
75-01-4	Vinyl chloride	0	1	1,020,498	19,614	1,040,112
87-62-7	2,6-Xyldine	0	0	53	0	53
	Subtotal	800,550	9,505,822	219,697,511	31,045,829	250,743,340
	Total for All TRI Chemicals	26,454,969	282,608,237	2,138,770,486	294,736,096	2,433,506,582

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



known or suspect carcinogen by virtue of appearing in one of three sources:

1. National Toxicology Program (NTP), "Annual Report on Carcinogens" (Latest Edition);
2. International Agency for Research on Cancer (IARC) "Monographs" (Latest Editions); or
3. 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration.

The *de minimis* limitation is 1.0% for chemicals that do not meet the above OSHA carcinogen criteria. The carcinogen designation in the list of chemicals relates to any chemical that the Agency determined met the above OSHA criteria for the 0.1% *de minimis* limitation. Box 2-4 shows the specific bases for which the individual chemical was designated as a known or suspect carcinogen. This list was updated for last year's TRI data release, based on a review of the NTP, IARC, and OSHA sources.

Certain metal compound categories have two *de minimis* limitations. For example, hexavalent chromium compounds and inorganic arsenic compounds meet the OSHA carcinogen criteria, while trivalent chromium compounds and organic arsenic do not meet the OSHA criteria. These groups are included in Table 2-12, even though not all compounds may meet the criteria.

As shown in Table 2-12, TRI facilities reported releases of 250.7 million pounds of OSHA carcinogens in 1996. This represents 10.3% of all releases reported to TRI for the year. Releases were reported for 113 OSHA carcinogens, out of 164 such chemicals on the TRI list. Air emissions amounted to almost two-thirds of the total (73.4%, or 184.0 million pounds). Dichloromethane was released in the largest amount, 54.3 million pounds or about one-fifth (21.7%) of the total.

## Chemicals Affecting Children's Health

Children are especially vulnerable to toxic chemicals for a number of reasons, including their body weight relative to food and air intake, their behavior (play) patterns that result in the potential for higher outdoor exposures, their developing systems and their relative inability to identify and protect themselves from exposure that are not obvious threats. For those reasons, parents may wish to use TRI information to identify chemicals that may be of potential concern their child's development.

In 1994, EPA added 286 toxic chemicals to the TRI list. A full one-third of these chemicals were added because of the developmental effects that they can cause. These chemicals may cause effects such as structural abnormalities, reduced birth weight, non-viable births (as shown in animal studies) as well as effects upon a growing child. In 1996, on-and off-site releases of these chemicals totaled 14.6 million pounds. Table 2-13 lists the top 10 of these chemicals for total releases.

### Nitrate Compounds and Children's Health

Of all of the chemicals added in the 1995 reporting year, Nitrate compounds were released in the greatest quantities in the 1996 reporting year. Since modern water treatment plants are required to monitor and control nitrate levels in drinking water, exposure to these compounds is limited. In addition to causing adverse environmental impacts, nitrates have been linked to infantile methemoglobinemia, or 'blue-baby' syndrome. This condition, which occurs in human infants exposed to aqueous solutions of nitrate ion and which can cause damage to developing organs and death, is caused by the reduced capacity of the blood to carry oxygen. Infants 0-3 months of age are the most sensitive population to nitrate-induced methemoglobinemia. This is primarily due to their higher stomach pH which favors the growth of nitrate-reducing bacteria, the immaturity of their metabolic enzyme systems, and reduced capacity of



Table 2-13. TRI On-site and Off-site Releases for Developmental Toxins Added to TRI for 1995 Reporting Year, Top 10 Chemicals for Total Releases, 1996

CAS Number	Chemical	Air		Surface Water Discharges Pounds	Underground Injection	
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds		Class I Wells Pounds	Class II-V Wells Pounds
872-50-4	N-Methyl-2-pyrrolidone	1,579,639	1,510,899	52,339	2,905,944	1,760
108-93-0	Cyclohexanol	66,799	133,202	122	3,630,080	0
7632-00-0	Sodium nitrite	75,141	210,769	1,302,379	727,000	0
—	Nicotine and salts	25,720	418,225	881	0	0
128-04-1	Sodium dimethyldithiocarbamate	1,453	1,381	10	0	0
1918-00-9	Dicamba	365	694	132	59,200	0
122-34-9	Simazine	1,007	3,584	93	0	0
137-42-8	Metham sodium	2,107	1,342	4	0	0
1689-99-2	Bromoxynil octanoate	270	251	0	0	0
333-41-5	Diazinon	286	15,301	21	0	0
	Subtotal	1,752,787	2,295,648	1,355,981	7,322,224	1,760
	Total for Developmental Toxins Added to TRI for 1995 Reporting Year	1,765,534	2,310,253	1,360,321	7,323,000	1,760

Table 2-13. TRI On-site and Off-site Releases for Developmental Toxins Added to TRI for 1995 Reporting Year, Top 10 Chemicals for Total Releases, 1996, Continued

CAS Number	Chemical	On-site Releases to Land			Off-site Releases	Total On- and Off-site Releases Pounds
		RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
872-50-4	N-Methyl-2-pyrrolidone	40,336	26,613	6,117,530	550,926	6,668,456
108-93-0	Cyclohexanol	0	74	3,830,277	3,221	3,833,498
7632-00-0	Sodium nitrite	0	63,654	2,378,943	504,474	2,883,417
—	Nicotine and salts	0	0	444,826	426,142	870,968
128-04-1	Sodium dimethyldithiocarbamate	0	0	2,844	121,595	124,439
1918-00-9	Dicamba	0	0	60,391	0	60,391
122-34-9	Simazine	0	0	4,684	54,457	59,141
137-42-8	Metham sodium	0	2	3,455	15,937	19,392
1689-99-2	Bromoxynil octanoate	0	0	521	16,605	17,126
333-41-5	Diazinon	0	0	15,608	1,000	16,608
	Subtotal	40,336	90,343	12,859,079	1,694,357	14,553,436
	Total for Developmental Toxins Added to TRI for 1995 Reporting Year	40,596	90,343	12,891,807	1,723,751	14,615,558



their erythrocytes to reduce methemoglobin to hemoglobin. Information concerning this chemical is important to a family's right-to-know.

On- and off-site releases of nitrate compounds reported to TRI in 1996 totaled 163.8 million pounds, and as noted above, nitrate compounds ranked fourth among all TRI chemicals for total releases. Another 131.2 million pounds of nitrate compounds received other on-site waste management, and 70.8 million pounds were transferred off-site for further waste management. (TRI data for 1996 for all chemicals appear in Table 2-21, at the end of this chapter.)

### Mercury and Children's Health

Exposure to high levels of mercury has been associated with serious neurological and developmental effects in humans. The fetal nervous system has been found to be more sensitive to mercury toxicity than that of adults. Women of child-bearing age are therefore at greatest risk. Fish consumption dominates the pathway for human and wildlife exposure to mercury. While most United States consumers need not be concerned about their exposure to mercury, some exposures may be of concern. Those who regularly and frequently consume large amounts of fish—either marine species that typically have much higher levels of mercury than other seafood, or freshwater fish that have been affected by mercury pollution—are more highly exposed. In the recent Mercury Study Report to Congress, EPA concluded that between 1% and 3% of women of child-bearing age eat sufficient amounts of fish to be at risk from mercury exposure.

In 1996, reporting of mercury and its compounds totaled 44,000 pounds of on- and off-site releases, 854,000 pounds of other on-site waste management, and 41,000 pounds transferred off-site for further waste management. Such reporting is expected to increase in the 1998 reporting year, as electric utilities and other industry sectors are added to TRI. (TRI data for 1996 for all chemicals appear in Table 2-21, at the end of this chapter.)

### Ozone and Children's Health

EPA has also noted that there are special concerns relating to children's exposure to ozone. Children are most at risk from exposure to ozone because: children breathe more air per pound of body weight than adults; children are more susceptible than adults to environmental threats because of their developing respiratory systems; and children are outside most during the summer, when ozone levels are the highest. Also, because asthma is a growing concern in children, additional factors must be taken into account in understanding ozone exposure of asthmatic children. Concern has grown recently because children are 25% of the population and comprise 40% of the asthma cases; the asthma death rate is three times as great as 20 years ago; African-Americans die from asthma at a rate six times that of Caucasians; and ozone aggravates asthma, increasing use of medication, medical treatment, and visits to emergency clinics.

For ozone, 702,000 pounds were emitted to air in 1996, and another 2.2 million pounds were treated on-site. (TRI data for 1996 for all chemicals appear in Table 2-21, at the end of this chapter.) TRI also captures releases of many VOCs that contribute to ozone formation in the lower atmosphere. (See VOCs later in this chapter for more information.)

### Diffuse Sources

In an effort to put the TRI data into perspective, the *1996 TRI Public Data Release* includes this section on diffuse sources. Depending upon the emission inventory, the definition of "diffuse sources" may differ. For the purposes of this data release, diffuse sources are those sources of chemicals that are not captured by TRI. While TRI provides some key environmental data, it also has some limitations, as noted in Chapter 1. Although additional sectors will begin reporting to TRI for the 1998 reporting year, TRI to date has covered only the manufacturing sector and, since 1994, federal facilities. Manufacturing represents a significant, but limited, portion of the industrial world handling toxic chemicals. For example, manufacturers of



fertilizers and pesticides must report their releases, transfers, and waste management to TRI, but the subsequent application and release of these chemicals by the agricultural sector is not captured in TRI. Similarly, the release of VOCs from non-industrial and mobile sources is not captured in TRI. In addition, manufacturing facilities are not required to report if they do not meet TRI's reporting thresholds.

By supplying more information on other sources of releases of certain chemicals and categories, the *1996 TRI Public Data Release* endeavors to help the public understand the relative role of industrial releases (those releases reported to TRI) versus those releases not reported to TRI. This section on diffuse sources includes three subsections: fertilizer use, pesticide use, and VOCs. The application of fertilizers and pesticides are major sources of releases that are not reported to TRI. Similarly, TRI reports include only a portion of total VOC emissions. Therefore, this year's data release has included a brief discussion on each to provide the public a context for those chemicals that are reported to TRI.

### Fertilizer Use

In 1996, a total of 44 billion pounds of fertilizers were used in the United States (year ending June 30; *Chemical and Engineering News*, June 23, 1997). That total included 24.5 billion pounds of nitrogen, 9.0 billion pounds of phosphates, and 10.4 billion pounds of potash. Chemicals that are often used in the production of fertilizer and are currently reported to TRI include nitrate compounds ( $\text{NO}_3$ ), ammonia ( $\text{NH}_3$ ), and phosphoric acid ( $\text{P}_2\text{O}_5$ ). Neither potash ( $\text{K}_2\text{O}$ ), nor its primary ingredient potassium (K), are currently on the TRI list.

In 1996, TRI facilities reported 163.8 million pounds of nitrate compounds released both on- and off-site to the environment. Ammonia is the source of nearly all nitrogen fertilizers. TRI facilities reported on- and off-site releases of 193.0 million pounds of ammonia. Comparing the sum of the TRI reported releases of nitrate compounds and ammonia with the total amount of nitrogen applied as fertilizer, TRI reported releases make up approximately 1.8% the total amount of nitrogen applied as fertilizer in the United States during 1996.<sup>2</sup> It is important to note that not all of the nitrate compounds and ammonia reported to TRI were generated during the production of fertilizer. Although the most significant use is in the manufacture of fertilizers, nitrate compounds are also used as an oxidizing agent and as a constituent in explosives and pyrotechnics, as a refining agent in the glass and enamel industry, and in metallurgy as heat transfer baths for quench hardening and tempering of steel, light alloys, and copper alloys. In addition to fertilizers, ammonia is used in manufacturing nylon and plastics, refrigeration, paper and pulp production, explosives, cleaners, and metal-treating operations. This limited comparison is useful, however, in an attempt to gain perspective on the overall amounts of nitrogen that facilities reported to TRI compared with total releases of nitrogen through fertilizer use.

Similarly, TRI facilities reported 60.9 million pounds of phosphoric acid released on- and off-site in 1996. Phosphoric acid is the only form of phosphate reported to TRI. Comparing the sum of the TRI reported releases of phosphoric acid with the total amount of phosphate applied as fertilizer, TRI reported releases make up approximately 0.5% of the total amount of phosphate applied as fertilizer in the United States during 1996.<sup>3</sup> It is

<sup>2</sup> Note that in making this comparison, a number of assumptions are necessary, including: (1) TRI requires reporting of only 10% of total aqueous ammonia to surface water, underground injection, and transfers. For the purposes of this comparison, total ammonia was determined by multiplying reported amounts by 10; and (2) in determining the amount of nitrogen reported to TRI, the ratio of the molecular weight of nitrogen to nitrate compounds and nitrogen to ammonia was calculated to determine the amount of nitrogen attributed to each reported chemical

<sup>3</sup> In comparing phosphoric acid reported to TRI with total phosphate used in fertilizers, the quantity of phosphoric acid reported to TRI was converted to the equivalent  $\text{P}_2\text{O}_5$ , which is the standard unit of measure in the industry



**Table 2-14. Pesticide Use in Agricultural Crop Production, 1995, and TRI Releases and Transfers of Selected Pesticides, 1996**

CAS Number	Chemical	1995 Pesticide Use in Agricultural Crop Production Millions of Pounds of Active Ingredient	1996 Total On- and Off-site Releases Pounds	1996 Total Transfers Off-site for Further Waste Management Pounds	1996 Total TRI Releases and Transfers Pounds	TRI Total Releases and Transfers as Percent of Pesticide Use in Agricultural Crop Production Percent
1912-24-9	Atrazine	70.50	831,654	252,417	1,084,071	1.5
21725-46-2	Cyanazine	26.50	5,031	22,422	27,453	0.1
—	Dichloropropene	40.50	21,790	360,285	382,075	0.9
94-75-7	2,4-D (acetic acid)	33.50	13,093	31,898	44,991	0.1
137-42-8	Metham sodium	51.50	19,392	6,496	25,888	0.1
74-95-3	Methylene bromide	42.50	99,292	0	99,292	0.2
40487-42-1	Pendimethalin	25.50	3,142	5,108	8,250	0.0
1582-09-8	Trifluralin	25.50	67,681	111,795	179,476	0.7
	Total	316.00	1,061,075	790,421	1,851,496	0.6

Note: Dichloropropene represented by two TRI chemicals, 2,3-dichloropropene and trans-1,3-dichloropropene. Pesticide use amounts from "Pesticides Industry Sales and Usage," EPA 733-R-97-002, August 1997, US Environmental Protection Agency, Washington, DC. On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R.

important to note that most of the phosphoric acid produced in the United States is neutralized and not required to be reported to TRI. In addition, not all of the phosphoric acid reported to TRI is generated during the production of fertilizer. Phosphoric acid is used in the manufacture of ethylene gas, incandescent-light filaments, rubber, and textiles. It also has numerous uses in food production, including soft drinks and jellies. This limited comparison is useful, however, in an attempt to gain perspective on the overall amounts of phosphate uses that are reported to TRI compared with the application of phosphates through fertilizer use in the agricultural sector.

### Pesticide Use

The majority of the active ingredients registered as pesticides (EPA registers approximately 875 pesticides) are "conventional pesticides" (i.e., chemicals developed and produced primarily for use as pesticides). A number of chemicals produced for other purposes are also often used as

pesticides. Of the 4.5 billion pounds of pesticides used in 1995 in the United States, approximately 1 billion pounds, or 22%, are considered conventional pesticides. To meet this demand, the United States produces approximately 1.3 billion pounds, imports approximately 0.2 billion pounds, and exports approximately 0.5 billion pounds. (U.S. EPA, *Pesticides Industry Sales and Usage: 1994 and 1995 Market Estimates*, EPA-733-R-97-002, August 1997)

Under TRI, EPA requires reporting of approximately 180 currently active pesticides registered with EPA's Office of Pesticide Programs. The top eight conventional pesticides (in millions of pounds) used in United States agricultural crop production that are reported to TRI appear in Table 2-14.

These eight chemicals made up about 30% of the total 1 billion pounds of conventional pesticides used in the United States in 1995. A comparison of





the amounts of pesticides used on crops with releases reported by facilities covered by TRI shows that on- and off-site releases are quite small (i.e., less than 0.4%, for these eight chemicals, of the total amount used annually as pesticides by the United States agricultural sector). It is important to note that the estimate for pesticide use in U.S. crop production is for 1995, while the TRI amount is for 1996. In addition, the agricultural sector accounts for approximately 77% of the total U.S. annual pesticide usage (the remainder used in industry/government operations and by homeowners). However, this limited comparison is useful in an attempt to gain perspective on the overall amounts of pesticides reported to TRI from the manufacturing sector compared with the total usage of conventional pesticides in the United States agricultural sector.

Pesticides reportable to TRI for which reports were received in 1996 are denoted with an asterisk in Table 2-21, which appears at the end of this chapter and provides data for all TRI chemicals reported in 1996.

### Volatile Organic Compounds

Under the Clean Air Act (40 CFR Parts 51 and 52), EPA defines volatile organic compounds (VOCs) as any compound of carbon that participates in atmospheric photochemical reactions. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and they do not include those chemicals that have been determined to have negligible photochemical reactivity.

EPA's National Air Pollutant Emissions Trends report estimates total U.S. emissions of VOCs in 1996 at approximately 19.1 million tons or 38.2 billion pounds (U.S. EPA, *National Air Pollutant Emissions Trends, 1900-1996*, EPA-454/R-97-011, December 1997). This amount includes a number of sources, such as: industrial point sources (i.e., boilers and processes), utility sources (including fossil-fueled steam electric generating boilers and

gas turbines), non-road engines and vehicles (including all transportation sources that are not counted as highway vehicles), motor vehicles, area sources (solvent use and small stationary sources), and biogenic/natural sources. A number of these sources are required to report under TRI. All TRI chemicals are considered to be VOCs except for metals, metal-containing compounds, and inorganic chemicals on the list, as well as CFCs, HCFCs, methylene chloride, 1,1,1-trichloroethane, and tetrachloroethylene. By definition, 505 TRI chemicals are considered VOCs. Total VOC air emissions reported to TRI were 995 million pounds, approximately 2.6% of the total 38.2 billion pounds of all VOCs emitted in 1996. The 20 VOCs in TRI with the largest air emissions appear in Table 2-15.

### **1996 Data for All TRI Chemicals**

Releases, on-site waste management, and off-site transfers for further waste management, for all TRI chemicals reported in 1996, are presented in Table 2-21, at the end of this chapter.

## **Prevention and Management of TRI Chemicals in Waste**

The Pollution Prevention Act of 1990 (PPA) requires facilities to report information about the quantities of TRI chemicals managed in waste, both on- and off-site. The PPA also requires facilities to provide information about the efforts they have made to reduce or eliminate those quantities. Facilities began reporting this information for the 1991 reporting year. This section summarizes the PPA data provided by facilities in their 1996 TRI reports.

The Pollution Prevention Act established as national policy that source reduction is the



Table 2-15. TRI Air Emissions for Top 20 Volatile Organic Chemicals with Largest Total Air Emissions, 1996

CAS Number	Chemical	Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds	Total Air Emissions Pounds
67-56-1	Methanol	27,987,712	178,370,259	206,357,971
108-88-3	Toluene	41,711,487	83,670,741	125,382,228
1330-20-7	Xylene (mixed isomers)	20,296,828	62,388,723	82,685,551
75-15-0	Carbon disulfide	3,212,583	69,569,637	72,782,220
110-54-3	n-Hexane	22,361,785	49,482,089	71,843,874
78-93-3	Methyl ethyl ketone	20,641,669	38,426,835	59,068,504
100-42-5	Styrene	10,917,192	31,011,969	41,929,161
—	Glycol ethers	8,347,921	31,823,871	40,171,792
74-85-1	Ethylene	16,159,552	19,627,812	35,787,364
115-07-1	Propylene	10,546,131	15,859,826	26,405,957
71-36-3	n-Butyl alcohol	4,906,789	17,938,341	22,845,130
79-01-6	Trichloroethylene	10,665,331	10,606,835	21,272,166
463-58-1	Carbonyl sulfide	610,328	19,241,733	19,852,061
108-10-1	Methyl isobutyl ketone	4,570,658	14,312,039	18,882,697
75-07-0	Acetaldehyde	1,637,438	10,938,582	12,576,020
50-00-0	Formaldehyde	1,779,994	9,639,206	11,419,200
108-95-2	Phenol	2,456,348	7,096,154	9,552,502
100-41-4	Ethylbenzene	2,487,776	6,902,212	9,389,988
67-66-3	Chloroform	3,086,308	6,235,110	9,321,418
71-43-2	Benzene	3,365,712	4,753,759	8,119,471
Subtotal for Top 20 TRI VOCs		217,749,542	687,895,733	905,645,275
Subtotal for All TRI VOCs		249,297,328	746,154,897	995,452,225

preferred approach to managing waste. Source reduction means preventing waste from being generated. The PPA also established as national policy a hierarchy of waste management options, illustrated in Figure 2-5, for situations where source reduction cannot be implemented feasibly.

Although source reduction is the preferred method of reducing risk, environmentally sound recycling shares many of its advantages. Like source reduction, recycling reduces the need for treatment or disposal of waste and helps conserve energy and natural resources. Where source reduction and recycling are not feasible, waste can be treated. Release (including disposal) of a chemical is

viewed as a last resort, to be employed only if the preferred methods of waste management cannot be implemented. The PPA did not specifically address the combustion of waste for energy recovery as a waste management option. However, because energy recovery shares aspects of recycling and treatment, EPA chose to list this activity separately in the waste management hierarchy.

Throughout this book, data tables present waste management information in the order of the hierarchy: recycling, energy recovery, treatment, and release (including disposal).

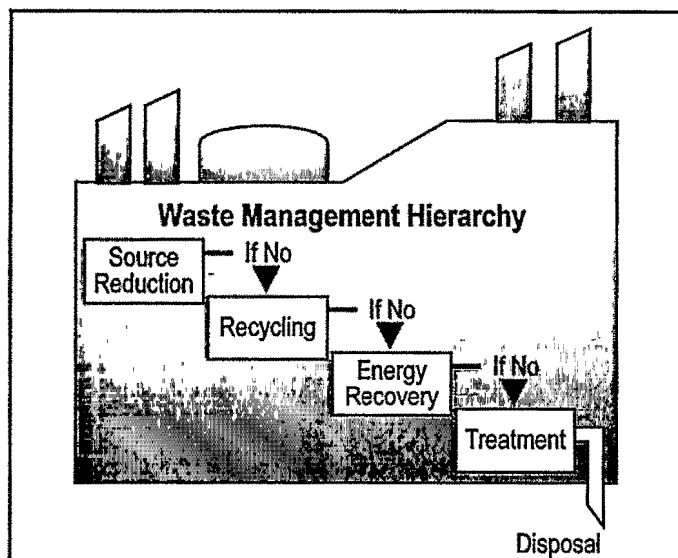


Figure 2-5. Waste Management Hierarchy

## Waste Management Information Collected

The waste management information required by the PPA is collected in Section 8 of TRI's Form R. It includes: quantity released to the environment at the facility and sent off-site for disposal; quantities used for energy recovery at the facility or sent off-site for energy recovery; quantities recycled at the facility or sent off-site for recycling; and quantities treated at the facility or sent off-site for treatment. The amount of TRI chemicals in waste reported includes both waste generated by the facility and waste received by the facility for the purpose of waste management. Box 2-5 further describes waste management information reported to TRI.

Facilities report this waste management data as estimates for the reporting year (1996) and the previous year (1995) and as projections for the two following years (1997 and 1998). The PPA requires the projected data to encourage facilities to consider their future waste generation, opportunities for source reduction, and potential improvement in waste management options as presented in the hierarchy. Future-year estimates

are not commitments that facilities reporting to TRI must meet.

The individual quantities are mutually exclusive to avoid double-counting. For example, an incinerator may destroy 99% of the chemical in the waste; in this case, the amount reported as treated on-site is the amount destroyed by the incinerator, not the amount that entered the incinerator. The amount not destroyed in incineration (1%) is reported as released. The sum of the individual quantities in a given year equals the total quantity of TRI chemicals in waste resulting from routine production operations at a facility during that year.

For the reporting year only, facilities also must report the quantity of waste released (including disposal) as a result of activities other than routine production operations. This quantity appears in the data tables in this book as "non-production-related waste." It includes waste released to the environment at the facility or transferred off-site because of catastrophic events or remedial (clean-up) actions at the facility. Non-production-related waste is considered less amenable to source reduction because facilities cannot reasonably anticipate these quantities.

It is important to note that facilities may vary in how they interpret some of the reporting requirements under the PPA. EPA has not yet specifically defined in rulemaking the reporting requirements for these data elements, so some facilities may include in their reports amounts that other facilities do not believe they must include. Because of this, higher quantities of TRI chemicals in waste for a particular state or industry may reflect not only differences in actual quantities, but also different interpretations of the reporting requirements.

## Source Reduction Activities

Facilities reporting to TRI also provide information about any source reduction activities they implemented during the reporting year. Source reduction activities are undertaken to reduce the amount of a

**Box 2-5. An Explanation of Waste Management Information****An Explanation of Waste Management Information**

Information about facilities management of TRI chemicals in waste is reported in Section 8 of Form R.

**Recycled On-site.** This is the quantity of the toxic chemical recovered at the facility and made available for further use. It is not the quantity that entered an on-site recycling or recovery operation.

**Recycled Off-site.** This is the quantity of the toxic chemical that left the facility boundary for recycling, not the amount recovered at the off-site location. This quantity includes the amount(s) reported in Section 6 of Form R as transferred off-site for recycling, less any amount(s) associated with non-routine events.

**Used for Energy Recovery On-site.** This is the quantity of the toxic chemical that was combusted in some form of energy recovery device, such as a furnace (including kilns) or boiler. The toxic chemical should have a heating value high enough to sustain combustion. To avoid double-counting, the amount reported represents the amount destroyed in the combustion process, not the amount that entered the energy recovery unit. For example, 100,000 pounds of toluene entered a boiler that, on average, combusted 98% of the toluene. Any remaining toluene was discharged to air. A total of 98,000 pounds is reported as combusted for energy recovery (the remaining 2,000 pounds is reported as released).

**Used for Energy Recovery Off-site.** This is the quantity of the toxic chemical that left the facility boundary for energy recovery, not the amount combusted at the off-site location. The toxic chemical must have a significant heating value, and the off-site location must have some form of energy recovery unit in place. This quantity includes the amount(s) reported in Section 6 of Form R as transferred off-site for energy recovery, less any amount(s) associated with non-routine events.

**Treated On-site.** This is the quantity of the toxic chemical destroyed in on-site waste treatment operations, not the amount that entered any treatment operation. For example, if 100,000 pounds of benzene were combusted in an incinerator that destroyed 99% of the benzene, the facility would report 99,000 pounds as treated on-site (the remaining 1,000 pounds would be reported as released).

**Treated Off-site.** This is the quantity of the toxic chemical that left the facility boundary and was sent to POTWs or other off-site locations for treatment, not the amount that was destroyed at the off-site location(s). This quantity includes the amount(s) reported in Section 6 of Form R as transferred to POTWs or other off-site locations for treatment, less any amount(s) associated with non-routine events.

**Released On- and Off-site.** This is the total quantity of the toxic chemical that was released to the environment or disposed of at the facility (directly discharged to air, land, and water, and injected underground) or sent off-site for disposal. This quantity is the sum of the amounts reported in Sections 5 and 6 of Form R (releases plus transfers to disposal only) less any amount(s) associated with non-routine events.

**Released to the Environment Due to One-time Events.** This amount is referred to as non-production-related waste and is the quantity released to the environment or sent off-site for recycling, energy recovery, treatment, or disposal due to one-time events not associated with routine production practices. Such events include catastrophic events, such as accidental releases, as well as remedial actions (clean up). This quantity is separated from the quantities recycled, used for energy recovery, treated, and released, to distinguish between quantities that are routinely associated with production operations and are more amenable to source reduction and those that are not routinely associated with production processes and are not so amenable to source reduction because they are not readily anticipated. This separation is important in assessing progress in source reduction at facilities.



toxic chemical which enters a waste stream or is otherwise released to the environment. By reducing the generation of toxic chemicals in waste, source reduction activities reduce the need to recycle, treat, or dispose of toxic chemicals. Box 2-6 explains source reduction as defined by the PPA.

A reported source reduction activity could have been implemented at any time during the reporting year. This is important to consider when analyzing the impact that source reduction activities may have had on the total quantity of waste that a facility managed during the year. Undertaking a source reduction activity late in the reporting year would have a smaller impact on the amount of waste that was managed during the year than implementing the same activity earlier in the year.

Table 2-16 summarizes national source reduction activity reporting by category for 1996. The most frequently reported categories of source reduction activities were good operating practices (8.6% of all forms), process modifications (6.0%), and spill and leak prevention (4.1%). These categories were also the most frequently reported in previous years. Nearly 5,900 facilities reported at least one source reduction activity, a little more than one-quarter of all reporting facilities. They submitted 13,988 forms that indicated at least one source reduction activity, 19.6% of all forms submitted in 1996.

Thus, for every form indicating source reduction activity in 1996, four did not.

## Quantities of TRI Chemicals in Waste

### National Overview

In 1996, facilities reported managing 23.42 billion pounds of TRI chemicals in production-related waste. They projected that their production-related waste will increase to 24.17 billion pounds by 1998, an increase of 3.2% (see Table 2-17). On-site waste management activities were projected to increase 5.8%, from 17.74 billion pounds to 18.78 billion pounds. This accounts for the projected overall increase, offsetting decreases of 3.4% in off-site waste management and 6.9% in releases on- and off-site over the two years. All on-site waste management types were projected to increase, and all off-site types to decrease. Thus, the projections indicate a small shift in where facilities expect to manage their waste, but little change in how they expect to do so and little foreseeable progress in moving up the waste management hierarchy.

Totals for 1996 reported in Section 8 of Form R and presented in Table 2-17 show little overall difference from comparable amounts reported in Sections 5 and 6 of Form R and discussed earlier

#### Box 2-6. What Is Source Reduction?

### What is Source Reduction?

Through source reduction, risks to people and the environment can be reduced, financial and natural resources can be saved that would otherwise have to be expended on environmental clean-up or pollution control, and industrial processes can become more efficient. Source reduction is defined in the Pollution Prevention Act of 1990 as any practice that:

- reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions); and
- reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

Source reduction practices can include modifications in equipment, process, procedure, or technology, reformulation or redesign of products, substitution of raw materials, and improvements in maintenance and inventory controls. Under this definition, waste management activities, including recycling, treatment, and disposal, are not considered forms of source reduction.



Table 2-16. Facilities and Forms Reporting Source Reduction Activity, by Category, 1996

Source Reduction Activity Categories	Facilities Reporting Source Reduction Activity		Forms Reporting Source Reduction Activity	
	Number	As Percent of All TRI Facilities	Number	As Percent of All TRI Forms
		Percent		Percent
Good Operating Practices	2,652	12.3	6,145	8.6
Inventory Control	582	2.7	1,303	1.8
Spill and Leak Prevention	1,152	5.3	2,944	4.1
Raw Material Modifications	1,453	6.7	2,459	3.4
Process Modifications	2,001	9.3	4,254	6.0
Cleaning and Degreasing	638	3.0	958	1.3
Surface Preparation/Finishing	646	3.0	1,233	1.7
Product Modification	551	2.5	1,025	1.4
Any Source Reduction Activity	5,899	27.3	13,988	19.6

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

Table 2-17. Current Year, and Projected Quantities of TRI Chemicals in Waste, 1996-1998

Waste Management Activity	Current Year 1996 Pounds	Projected 1997 Pounds	Projected 1998 Pounds
<u>On-site Waste Management</u>	17,744,196,508	19,069,339,345	18,777,856,416
Recycled On-site	7,842,595,142	9,058,050,236	8,519,036,977
Energy Recovery On-site	2,761,739,445	2,834,933,863	2,827,656,852
Treated On-site	7,139,861,921	7,176,355,246	7,431,162,587
<u>Off-site Waste Management</u>	3,257,227,459	3,123,106,723	3,146,215,747
Recycled Off-site	2,230,297,511	2,139,384,425	2,171,369,720
Energy Recovery Off-site	510,267,931	469,607,626	466,659,144
Treated Off-site	516,662,017	514,114,672	508,186,883
Quantity Released On- and Off-site	2,414,916,746	2,352,037,799	2,249,143,815
Total Production-related Waste	23,416,340,713	24,544,483,867	24,173,215,978

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996.



in this chapter (see Tables 2-2 and 2-4). Altogether, releases and transfers reported in Sections 5 and 6 totaled 85.0 million pounds (or 1.5%) less than corresponding data reported in Section 8. The largest absolute difference appeared in off-site recycling, which was 79.7 million pounds (or 3.5%) less when reported as off-site transfers in Section 6 than when reported as off-site waste management in Section 8. The largest difference in percentage terms was off-site energy recovery, where off-site transfers in Section 6 were 6.5% (or 33.2 million pounds) smaller than waste management quantities reported in Section 8. The only category with a smaller amount reported in Section 8 was treatment off-site, where 9.3 million pounds (or 1.8%) more were reported as transfers off-site to treatment and to POTWs in Section 6 than as treated off-site in Section 8. Metals reported in Section 6 should be reported in Section 8.1, not 8.7.

These differences can arise because Section 5 and 6 amounts include releases and transfers resulting from remedial actions or other one-time events; these are reported separately in Section 8. Furthermore, facilities can round off the quantities they report in Section 8 to two significant digits. In addition, some facilities may not understand that the total of the amounts that a facility reports in Section 5 and 6 should equal the total reported in the current year column of Section 8.

### Waste Management Data by State

Table 2-18 provides the waste management data for each state and territory. Facilities in four states reported more than 1 billion pounds of total production-related waste in 1996: Texas (3.78 billion pounds), Louisiana (2.15 billion pounds), California (1.33 billion pounds), and Ohio (1.01 billion pounds).

As noted earlier in this chapter, Texas led all states in all types of on-site waste management, with 965.1 million pounds recycled, 836.5 million pounds burned for energy recovery, and 1.38 billion pounds treated. Louisiana was second in recycling

(725.1 million pounds) and energy recovery (350.8 million pounds). California was second for treatment (1.10 billion pounds).

Off-site recycling is the only waste management category in which Texas did not rank first. Facilities in Indiana reported 245.4 million pounds of TRI chemicals in waste sent off-site for recycling, followed by Ohio with 190.0 million pounds. Texas ranked third with 178.2 million pounds. For off-site energy recovery, Texas (with 72.8 million pounds) was followed by Michigan (70.9 million pounds) and Ohio (40.5 million pounds). These states also reported the largest quantities of off-site treatment, with Texas first (with 79.5 million pounds), but in this case Ohio was second (42.3 million pounds) and Michigan third (36.3 million pounds).

The states with the largest quantities released on- and off-site were Texas (273.3 million pounds), Louisiana (183.5 million pounds), and Ohio (152.7 million pounds). These positions correspond to their rankings for total releases reported in Sections 5 (on-site releases) and 6 (off-site transfers to disposal) of Form R, discussed earlier in this chapter.

States projecting the largest net increases in total production-related waste through 1998 were Michigan, with 360.6 million pounds (45.1% increase); Texas, with 153.3 million pounds (4.1%); and Virginia, with 115.4 million pounds (18.3%). No other state or territory had projections totalling an increase of more than 100 million pounds. States whose facilities projected the largest net decreases were Kansas, with 86.1 million pounds (19.6% decrease) and Arkansas, with 71.2 million pounds (16.4% decrease). No other state or territory projected a net decrease of more than 50 million pounds by 1998. Waste management quantities reported in 1996 for the current year, prior year, and (projected) future years, for all states and territories, appear in Table 2-19.



Table 2-18. Quantities of TRI Chemicals in Waste, by State, 1996

State	On-site Waste Management			Off-site Waste Management			Releases	Total Production-related Waste
	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Recycled Off-site Pounds	Energy Recovery Off-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site Pounds	
Alabama	247,765,725	35,866,493	316,900,305	35,529,473	25,359,373	7,922,475	95,182,733	764,526,577
Alaska	25,842	457,400	2,761,278	235,363	5,869	943	6,908,058	10,394,753
American Samoa	0	0	0	0	0	0	10,500	10,500
Arizona	629,813,584	695,864	7,501,763	79,178,016	781,997	11,197,887	47,930,882	777,099,993
Arkansas	202,786,365	33,421,106	113,334,864	41,400,704	7,246,845	3,522,772	33,544,838	435,257,494
California	48,933,381	18,173,050	1,102,173,175	69,551,505	22,064,027	15,705,219	49,809,089	1,326,409,446
Colorado	18,998,219	8,287,872	8,234,284	18,399,440	4,139,362	1,752,199	5,164,556	64,975,932
Connecticut	91,847,249	4,467,216	36,458,784	24,608,796	2,207,815	7,282,528	8,426,865	175,299,253
Delaware	29,782,121	219,184	50,920,120	10,044,253	1,170,244	5,768,778	3,638,053	101,542,753
District of Columbia	0	0	1,695	12,000	0	181	9,295	23,171
Florida	133,882,239	19,362,992	131,946,077	18,166,359	2,320,957	12,762,520	77,916,828	396,357,972
Georgia	246,187,301	48,222,623	196,531,036	48,876,516	10,144,806	4,746,163	62,230,297	616,938,742
Guam	0	0	0	0	0	0	0	0
Hawaii	6,611	0	3,590,519	53,077	0	2,233	533,144	4,185,584
Idaho	176,378	26,900	17,160,464	600,490	165,822	281,151	15,155,543	33,566,748
Illinois	316,452,083	35,570,868	120,405,877	95,627,540	28,285,621	24,496,364	107,248,201	728,086,554
Indiana	192,429,951	86,416,362	171,880,470	245,351,295	10,914,590	11,026,374	110,151,053	828,170,095
Iowa	142,535,240	1,827,848	28,677,544	27,317,298	3,011,874	10,150,245	33,036,740	246,556,789
Kansas	210,117,169	100,585,103	35,937,066	56,985,523	2,733,483	5,423,288	26,360,461	438,142,093
Kentucky	270,427,752	70,165,040	119,641,055	52,361,408	9,429,533	11,147,552	43,766,296	576,938,636
Louisiana	725,090,414	350,796,650	816,209,604	52,384,305	15,957,047	10,003,097	183,477,795	2,153,918,912
Maine	10,123,918	11,099,536	63,525,017	3,353,816	406,981	366,806	9,462,695	98,338,769
Maryland	17,008,373	13,397,901	34,005,595	3,781,350	1,415,359	7,255,933	12,878,468	89,742,979
Massachusetts	23,084,234	5,223,661	27,615,676	29,387,616	6,680,311	10,461,917	9,741,126	112,194,541
Michigan	304,344,692	87,992,757	94,427,464	109,522,352	70,907,331	36,320,511	96,612,300	800,127,407
Minnesota	147,195,055	10,743,037	32,157,870	22,262,688	2,349,468	8,841,148	21,136,326	244,685,592
Mississippi	215,890,406	18,567,578	104,186,585	25,108,852	2,674,253	2,178,444	53,292,116	421,898,234
Missouri	177,893,875	79,482,408	72,793,495	59,989,152	27,006,551	11,964,685	59,126,923	488,257,089
Montana	50,305,985	2,513,550	8,610,407	586,363	1,559	62,202	48,511,195	110,591,261
Nebraska	18,289,870	1,499,579	6,867,436	19,004,619	434,688	1,132,693	12,743,662	59,972,547
Nevada	2,125,936	0	8,595,388	1,855,164	11,125	39,104	3,780,672	16,407,389
New Hampshire	16,867,518	1,858,325	10,301,186	12,351,423	312,436	944,007	2,476,520	45,111,415
New Jersey	56,031,604	347,873,373	125,963,690	41,733,440	30,957,035	23,687,382	19,408,308	645,654,832
New Mexico	1,509,122	33,800,000	1,868,997	1,054,684	157,340	469,286	19,990,405	58,849,834
New York	176,304,149	25,633,557	112,267,207	68,467,184	7,814,260	12,984,222	36,237,438	439,708,017
North Carolina	362,510,160	25,898,390	147,228,500	88,351,160	14,154,483	11,689,900	83,478,894	733,311,487
North Dakota	44,438	3,300	4,853,566	834,318	20,061	215,671	2,312,172	8,283,526
Ohio	329,167,620	96,800,899	155,733,167	190,012,535	40,513,765	42,263,264	152,721,169	1,007,212,419
Oklahoma	53,640,688	52,550,449	16,068,996	19,639,683	979,666	1,557,350	25,995,800	170,432,632
Oregon	33,343,531	17,268,217	61,437,014	20,382,063	1,404,094	16,476,844	23,842,013	174,153,776
Pennsylvania	392,219,178	50,287,872	149,258,161	149,691,289	17,815,663	21,877,011	115,008,743	896,157,917
Puerto Rico	24,267,097	142,187	17,004,946	13,804,916	10,661,013	8,446,328	8,200,030	82,526,517
Rhode Island	13,987,327	226,963	7,123,050	14,710,524	858,003	891,635	2,203,317	40,000,819
South Carolina	303,352,841	78,185,193	112,054,076	97,338,156	7,886,714	10,814,955	56,205,773	665,837,708
South Dakota	30,204,647	1,050,000	1,894,335	508,822	185,424	1,411,791	5,101,582	40,356,601
Tennessee	164,053,491	49,580,975	106,752,628	49,461,184	6,244,944	12,365,334	106,047,967	494,506,523
Texas	965,065,180	836,485,137	1,375,842,159	178,196,574	72,829,686	79,465,740	273,328,764	3,781,213,240
Utah	9,803,457	25,620,841	317,147,921	7,763,733	106,125	4,686,207	80,758,371	445,886,655
Vermont	457,075	6,200	1,026,694	2,453,609	13,332	264,620	451,988	4,673,518
Virgin Islands	711,124	0	10,248,528	96,920	4,834	377,449	1,506,138	12,944,993
Virginia	178,353,110	29,707,489	317,770,559	23,042,524	7,097,789	19,350,747	56,322,865	631,645,083
Washington	80,436,589	18,590,204	90,430,822	11,732,574	884,619	2,504,576	27,405,507	231,984,891
West Virginia	121,297,058	10,237,138	146,675,430	30,312,857	9,237,060	5,804,792	28,809,290	352,373,625
Wisconsin	53,677,399	14,787,808	112,924,941	56,504,531	22,299,121	16,294,697	39,640,292	316,128,789
Wyoming	1,770,771	62,350	4,934,435	317,475	3,573	2,797	9,676,690	16,768,091
Total	7,842,595,142	2,761,739,445	7,139,861,921	2,230,297,511	510,267,931	516,662,017	2,414,916,746	23,416,340,713

Note: Data from current year (Column B), Section 8 of Form R for 1996





Table 2-19. Actual and Projected Quantities of TRI Chemicals in Waste, by State, 1995-1998

State	Year	On-site Waste Management			Off-site Waste Management			Releases Quantity Released On- and Off-site	Total Production- related Waste
		Recycled On-site	Energy Recovery On-site	Treated On-site	Recycled Off-site	Energy Recovery Off-site	Treated Off-site		
Alabama	95	219,467,972	29,584,924	351,827,816	35,519,367	30,484,802	5,610,686	104,116,292	776,611,859
	96	247,765,725	35,866,493	316,900,305	35,529,473	25,359,373	7,922,475	95,182,733	764,526,577
	97	265,839,978	38,913,149	336,579,788	36,855,806	27,433,244	8,012,760	88,209,844	801,844,569
	98	280,513,089	42,296,780	330,281,488	37,148,385	28,519,583	9,121,436	86,963,696	814,844,457
Alaska	95	29,470	1,211,000	2,395,209	2,034	3	12	6,833,331	10,471,059
	96	25,842	457,400	2,761,278	235,363	5,869	943	6,908,058	10,394,753
	97	27,500	457,400	3,652,132	189,500	3	901	4,781,550	9,108,986
	98	27,500	457,400	6,192,132	29,500	3	942	1,652,765	8,360,242
American Samoa	95	0	0	0	0	0	0	5,500	5,500
	96	0	0	0	0	0	0	10,500	10,500
	97	0	0	0	0	0	0	8,800	8,800
	98	0	0	0	0	0	0	5,500	5,500
Arizona	95	484,880,620	450,436	7,926,180	51,066,569	876,773	10,509,493	35,410,045	591,120,116
	96	629,813,584	695,864	7,501,763	79,178,016	781,997	11,197,887	47,930,882	777,099,993
	97	665,023,628	727,854	7,563,850	54,952,082	835,715	6,022,147	45,930,204	781,055,480
	98	664,537,289	778,605	8,002,943	53,147,186	904,696	6,282,829	44,396,829	778,050,377
Arkansas	95	200,836,918	35,286,643	131,623,494	50,668,477	6,569,340	6,298,787	35,443,104	466,726,763
	96	202,786,365	33,421,106	113,334,864	41,400,704	7,246,845	3,522,772	33,544,838	435,257,494
	97	211,072,328	27,158,942	113,391,126	39,347,670	6,938,893	2,122,669	32,080,324	432,111,952
	98	143,688,683	28,716,478	114,560,701	37,521,322	7,044,809	973,191	31,553,572	364,058,756
California	95	43,406,401	16,731,524	165,981,733	67,824,469	23,834,775	16,162,797	44,146,211	378,087,910
	96	48,933,381	18,173,050	1,102,173,175	69,551,505	22,064,027	15,705,219	49,809,089	1,326,409,446
	97	45,648,039	15,905,475	1,099,888,806	69,551,988	22,280,848	19,265,330	44,377,837	1,316,918,323
	98	44,137,360	12,320,213	1,099,316,151	71,741,859	23,572,492	16,123,456	40,864,117	1,308,075,648
Colorado	95	14,154,013	9,200,000	7,463,134	21,483,549	3,534,014	1,570,209	4,225,300	61,630,219
	96	18,998,219	8,287,872	8,234,284	18,399,440	4,139,362	1,752,199	5,164,556	64,975,932
	97	22,156,172	8,727,500	7,535,477	15,898,758	5,882,450	1,981,226	5,110,928	67,292,511
	98	29,364,283	8,733,500	8,888,156	16,178,257	5,598,648	2,025,868	5,068,277	75,856,989
Connecticut	95	101,132,184	4,684,785	36,684,424	25,794,257	2,382,702	7,924,633	10,268,190	188,871,175
	96	91,847,249	4,467,216	36,458,784	24,608,796	2,207,815	7,282,528	8,426,865	175,299,253
	97	92,249,043	3,605,295	36,154,545	25,072,622	2,434,043	6,862,368	7,421,396	173,799,312
	98	94,260,961	3,741,001	35,225,624	26,218,588	2,464,214	6,832,799	6,518,819	175,262,006
Delaware	95	28,988,464	332,836	55,612,821	17,201,009	2,251,577	4,015,714	4,486,670	112,889,091
	96	29,782,121	219,184	50,920,120	10,044,253	1,170,244	5,768,778	3,638,053	101,542,753
	97	32,227,122	170,000	50,693,906	10,851,548	1,232,515	4,725,462	3,341,249	103,241,802
	98	34,616,402	190,000	54,911,008	10,734,632	1,309,352	3,577,840	3,359,720	108,698,954
District of Columbia	95	0	0	580	13,000	0	301	22,000	35,881
	96	0	0	1,695	12,000	0	181	9,295	23,171
	97	0	0	1,520	12,000	0	201	19,495	33,216
	98	0	0	1,495	9,700	0	201	19,476	30,872
Florida	95	136,096,589	18,443,697	113,882,754	13,290,886	1,438,594	8,866,851	74,653,934	366,673,305
	96	133,882,239	19,362,992	131,946,077	18,166,359	2,320,957	12,762,520	77,916,828	396,357,972
	97	143,109,672	18,625,150	135,374,285	16,617,122	2,398,726	12,758,671	77,142,881	406,026,507
	98	143,473,003	17,204,108	136,340,610	16,739,484	2,870,588	12,631,760	77,631,977	406,891,530
Georgia	95	255,463,864	55,200,432	246,467,698	44,738,315	7,969,702	5,092,309	59,554,126	674,486,446
	96	246,187,301	48,222,623	196,531,036	48,876,516	10,144,806	4,746,163	62,230,297	616,938,742
	97	269,514,510	50,459,174	209,916,458	42,543,250	9,300,970	4,156,106	61,831,074	647,721,542
	98	269,584,391	51,068,639	217,170,277	43,011,731	9,303,497	4,060,073	60,792,761	654,991,369



Table 2-19. Actual and Projected Quantities of TRI Chemicals in Waste, by State, 1995-1998, Continued

State	Year	On-site Waste Management			Off-site Waste Management			Releases	Total Production-related Waste
		Recycled On-site	Energy Recovery On-site	Treated On-site	Recycled Off-site	Energy Recovery Off-site	Treated Off-site	Quantity Released On- and Off-site	
Guam	95	0	0	0	0	0	0	200	200
	96	0	0	0	0	0	0	0	0
	97	0	0	0	0	0	0	0	0
	98	0	0	0	0	0	0	0	0
Hawaii	95	5,002	0	4,020,323	31,298	0	8,311	526,687	4,591,621
	96	6,611	0	3,590,519	53,077	0	2,233	533,144	4,185,584
	97	13,095	0	3,606,960	45,007	0	1,178	535,935	4,202,175
	98	13,179	0	3,606,985	45,008	0	4,708	532,035	4,201,915
Idaho	95	79,381	26,600	14,629,446	618,240	99,082	245,680	14,798,404	30,496,833
	96	176,378	26,900	17,160,464	600,490	165,822	281,151	15,155,543	33,566,748
	97	161,435	29,000	16,910,920	646,129	167,680	274,423	14,508,212	32,697,799
	98	170,150	31,800	17,079,193	684,253	168,866	284,371	14,716,367	33,135,000
Illinois	95	212,160,290	17,217,921	119,001,986	97,063,564	31,010,926	27,943,182	107,722,726	612,120,595
	96	316,452,083	35,570,868	120,405,877	95,627,540	28,285,621	24,496,364	107,248,201	728,086,554
	97	365,174,196	34,827,012	118,359,358	83,400,865	26,898,516	28,733,922	100,591,924	757,985,793
	98	368,688,995	34,827,591	126,067,801	83,529,541	27,036,157	27,956,922	98,915,603	767,022,610
Indiana	95	200,488,445	54,698,263	117,571,011	207,532,211	11,051,214	10,412,799	105,415,248	707,169,191
	96	192,429,951	86,416,362	171,880,470	245,351,295	10,914,590	11,026,374	110,151,053	828,170,095
	97	183,320,682	75,565,928	177,124,609	227,296,934	9,909,867	10,670,196	111,944,696	795,832,912
	98	165,364,498	76,696,673	180,974,406	226,613,953	9,766,935	14,302,686	109,032,068	782,751,219
Iowa	95	210,191,023	1,621,517	30,919,395	38,742,753	4,165,128	9,055,841	35,712,940	330,408,597
	96	142,535,240	1,827,848	28,677,544	27,317,298	3,011,874	10,150,245	33,036,740	246,556,789
	97	151,040,397	1,778,000	28,347,408	27,502,327	2,455,100	10,975,548	32,110,920	254,209,700
	98	152,166,830	1,778,000	28,403,356	27,328,529	2,262,442	11,539,317	30,810,925	254,289,399
Kansas	95	344,076,586	163,803,089	42,974,398	41,443,936	1,522,106	3,124,467	28,106,985	625,051,567
	96	210,117,169	100,585,103	35,937,066	56,985,523	2,733,483	5,423,288	26,360,461	438,142,093
	97	172,350,660	76,742,580	30,221,018	59,536,773	2,443,634	7,771,993	23,377,047	372,443,705
	98	130,834,841	79,783,680	42,269,210	63,914,555	2,404,577	8,465,313	24,403,887	352,076,063
Kentucky	95	249,733,864	53,171,189	94,901,838	50,599,860	7,685,528	12,492,084	45,939,840	514,524,203
	96	270,427,752	70,165,040	119,641,055	52,361,408	9,429,533	11,147,552	43,766,296	576,938,636
	97	280,179,863	70,259,565	108,193,839	60,132,880	8,217,190	12,405,717	39,919,136	579,308,190
	98	286,183,857	70,358,282	113,795,016	64,331,077	8,310,170	12,563,385	39,140,643	594,682,430
Louisiana	95	687,755,914	319,488,010	804,299,854	54,288,026	14,500,229	9,022,999	176,659,049	2,066,014,081
	96	725,090,414	350,796,650	816,209,604	52,384,305	15,957,047	10,003,097	183,477,795	2,153,918,912
	97	737,080,787	361,838,512	827,982,234	53,850,411	14,853,540	8,817,621	186,135,189	2,190,558,294
	98	736,202,605	398,550,769	830,290,259	53,940,241	14,568,140	7,142,907	167,978,196	2,208,673,117
Maine	95	9,926,951	11,337,913	72,254,423	2,489,316	486,675	685,277	11,003,221	108,183,776
	96	10,123,918	11,099,536	63,525,017	3,353,816	406,981	366,806	9,462,695	98,338,769
	97	10,310,687	11,664,226	65,236,039	3,400,112	403,221	640,308	9,551,394	101,205,987
	98	10,329,245	12,348,916	65,264,854	3,063,439	399,141	624,412	9,174,264	101,204,271
Maryland	95	14,108,909	13,968,772	30,015,914	6,561,633	1,661,599	5,130,867	13,976,556	85,424,250
	96	17,008,373	13,397,901	34,005,595	3,781,350	1,415,359	7,255,933	12,878,468	89,742,979
	97	19,599,216	14,019,001	34,636,540	3,989,785	1,372,780	5,528,871	13,063,884	92,210,077
	98	19,645,929	15,054,300	34,143,833	4,250,046	1,357,848	5,706,355	13,025,830	93,184,141
Massachusetts	95	24,143,263	8,340,614	25,053,928	27,017,638	8,181,825	11,503,493	8,817,706	113,058,467
	96	23,084,234	5,223,661	27,615,676	29,387,616	6,680,311	10,461,917	9,741,126	112,194,541
	97	21,307,702	5,545,174	27,805,276	26,791,088	6,180,813	10,055,167	8,782,190	106,467,410
	98	22,937,559	5,771,934	28,149,120	30,860,708	6,273,419	10,048,620	8,494,412	112,535,772



Table 2-19. Actual and Projected Quantities of TRI Chemicals in Waste, by State, 1995-1998, Continued

State	Year	On-site Waste Management			Off-site Waste Management			Releases	Total Production-related Waste
		Recycled On-site	Energy Recovery On-site	Treated On-site	Recycled Off-site	Energy Recovery Off-site	Treated Off-site	Quantity Released On- and Off-site	
Michigan	95	171,481,860	108,318,595	130,519,722	102,772,789	62,603,906	29,318,219	119,802,545	724,817,636
	96	304,344,692	87,992,757	94,427,464	109,522,352	70,907,331	36,320,511	96,612,300	800,127,407
	97	565,436,601	114,442,661	94,085,470	109,601,210	69,064,689	31,401,602	97,065,310	1,081,097,543
	98	651,921,845	117,989,684	91,173,912	108,741,152	68,262,599	31,555,340	91,054,210	1,160,698,742
Minnesota	95	150,902,425	24,194,538	28,875,750	21,118,170	2,751,381	8,322,922	22,365,059	258,530,245
	96	147,195,055	10,743,037	32,157,870	22,262,688	2,349,468	8,841,148	21,136,326	244,685,592
	97	156,855,777	10,885,174	31,522,009	20,412,696	2,253,113	9,090,046	20,645,985	251,664,800
	98	161,883,046	10,880,474	31,293,355	20,818,524	2,226,141	9,441,414	19,807,222	256,350,176
Mississippi	95	239,115,840	7,757,942	106,747,614	37,127,185	2,777,089	2,432,071	54,206,478	450,164,219
	96	215,890,406	18,567,578	104,186,585	25,108,852	2,674,253	2,178,444	53,292,116	421,898,234
	97	226,639,557	20,691,427	108,327,208	23,209,638	2,836,492	1,568,971	49,076,321	432,349,614
	98	216,853,163	20,985,879	108,919,572	22,929,577	2,670,025	1,325,728	41,414,278	415,098,222
Missouri	95	184,142,307	88,370,962	74,705,094	55,862,604	27,875,621	13,319,301	56,781,935	501,057,824
	96	177,893,875	79,482,408	72,793,495	59,989,152	27,006,551	11,964,685	59,126,923	488,257,089
	97	201,206,404	71,722,272	70,229,707	58,267,849	11,061,520	12,147,169	56,719,180	481,354,101
	98	211,701,625	71,635,972	71,706,835	61,833,606	11,513,724	12,678,478	54,676,333	495,746,573
Montana	95	48,846,536	17,305,350	9,178,710	114,088	14,948	36,092	43,840,102	119,335,826
	96	50,305,985	2,513,550	8,610,407	586,363	1,559	62,202	48,511,195	110,591,261
	97	38,430,146	2,489,150	8,952,428	297,221	1,558	71,488	46,967,394	97,209,385
	98	38,437,346	2,489,150	8,952,428	293,221	1,558	60,488	46,930,768	97,164,959
Nebraska	95	10,330,640	1,879,530	6,249,946	32,929,648	558,633	1,059,237	13,935,727	66,943,361
	96	18,289,870	1,499,579	6,867,436	19,004,619	434,688	1,132,693	12,743,662	59,972,547
	97	5,042,941	578,696	6,983,096	17,011,375	472,245	1,179,778	12,043,822	43,311,953
	98	1,904,024	578,865	7,188,406	17,691,735	556,553	1,178,319	9,296,086	38,393,988
Nevada	95	2,452,241	0	6,840,500	2,306,858	6,236	18,688	3,784,296	15,408,819
	96	2,125,936	0	8,595,388	1,855,164	11,125	39,104	3,780,672	16,407,389
	97	2,353,184	0	15,916,020	1,892,704	9,960	16,746	3,947,732	24,136,346
	98	2,352,897	0	15,917,420	1,867,911	9,980	17,040	3,898,565	24,063,813
New Hampshire	95	17,604,327	1,684,385	10,847,794	11,284,316	238,437	786,989	2,465,137	44,911,385
	96	16,867,518	1,858,325	10,301,186	12,351,423	312,436	944,007	2,476,520	45,111,415
	97	18,342,433	1,956,218	10,305,178	12,605,887	296,039	989,791	2,321,997	46,817,543
	98	18,354,043	1,956,218	10,203,683	12,860,395	311,414	1,015,885	2,188,666	46,890,304
New Jersey	95	44,699,570	188,618,111	146,846,720	42,592,246	30,986,427	23,310,572	17,322,281	494,375,927
	96	56,031,604	347,873,373	125,963,690	41,733,440	30,957,035	23,687,382	19,408,308	645,654,832
	97	57,982,745	344,050,005	117,760,336	38,359,097	27,793,209	21,600,707	16,991,634	624,537,733
	98	55,510,470	344,220,825	116,072,654	38,808,550	25,616,113	22,870,995	16,462,234	619,561,841
New Mexico	95	2,049,130	48,000,000	2,299,637	872,727	304,703	343,712	18,337,965	72,207,874
	96	1,509,122	33,800,000	1,868,997	1,054,684	157,340	469,286	19,990,405	58,849,834
	97	1,508,912	33,800,000	3,730,657	1,471,458	182,115	628,687	20,621,028	61,942,857
	98	1,508,537	33,800,000	3,997,653	1,793,467	205,079	764,682	19,864,437	61,933,855
New York	95	180,309,512	23,320,957	108,416,905	77,097,766	9,384,258	13,169,349	39,728,489	451,427,236
	96	176,304,149	25,633,557	112,267,207	68,467,184	7,814,260	12,984,222	36,237,438	439,708,017
	97	176,510,089	26,229,328	116,633,402	73,332,942	7,323,634	13,133,349	32,395,595	445,558,339
	98	176,721,572	26,728,870	118,001,093	77,786,623	6,738,126	12,772,370	30,624,974	449,373,628
North Carolina	95	462,392,427	35,657,780	146,439,231	102,388,950	10,640,119	14,041,845	87,004,373	858,564,725
	96	362,510,160	25,898,390	147,228,500	88,351,160	14,154,483	11,689,900	83,478,894	733,311,487
	97	413,059,086	26,391,309	151,062,521	84,274,099	14,546,636	11,395,311	82,450,349	783,179,311
	98	443,635,515	28,712,851	151,308,433	89,256,876	15,108,257	8,342,756	80,770,323	817,135,011



Table 2-19. Actual and Projected Quantities of TRI Chemicals in Waste, by State, 1995-1998, Continued

State	Year	On-site Waste Management			Off-site Waste Management			Releases	Total Production-related Waste
		Recycled On-site	Energy Recovery On-site	Treated On-site	Recycled Off-site	Energy Recovery Off-site	Treated Off-site	Quantity Released On- and Off-site	
North Dakota	95	53,707	4,200	3,854,548	967,698	9,714	653,466	2,831,733	8,375,066
	96	44,438	3,300	4,853,566	834,318	20,061	215,671	2,312,172	8,283,526
	97	44,517	3,300	11,227,119	848,350	23,802	218,779	3,065,688	15,431,555
	98	44,637	3,000	11,204,954	848,350	20,852	193,931	2,615,643	14,931,367
Ohio	95	357,113,023	89,144,781	175,401,791	180,011,637	28,347,722	33,116,606	149,163,113	1,012,298,673
	96	329,167,620	96,800,899	155,733,167	190,012,535	40,513,765	42,263,264	152,721,169	1,007,212,419
	97	336,531,518	101,028,491	150,406,553	194,198,149	30,141,071	45,567,711	148,202,400	1,006,075,893
	98	339,102,230	106,879,906	160,611,187	187,131,700	26,956,354	42,493,050	143,384,871	1,006,559,298
Oklahoma	95	51,815,273	95,421,680	12,566,124	19,984,131	2,843,786	1,204,530	27,387,172	211,222,696
	96	53,640,688	52,550,449	16,068,996	19,639,683	979,666	1,557,350	25,995,800	170,432,632
	97	54,335,262	58,000,431	16,024,278	20,041,948	1,355,395	1,435,419	23,692,194	174,884,927
	98	50,883,583	58,000,431	16,197,036	20,473,869	1,038,192	1,418,806	21,471,873	169,483,790
Oregon	95	35,903,722	17,090,728	56,027,077	21,528,149	1,162,022	13,818,469	23,669,447	169,199,614
	96	33,343,531	17,268,217	61,437,014	20,382,063	1,404,094	16,476,844	23,842,013	174,153,776
	97	35,152,544	17,519,770	63,164,157	17,999,932	1,154,249	16,677,938	25,041,678	176,710,268
	98	35,228,389	17,625,970	65,581,916	18,937,523	1,246,212	16,708,936	25,379,313	180,708,259
Pennsylvania	95	417,121,400	51,207,089	166,187,096	135,594,906	15,900,996	21,770,185	100,693,535	908,475,207
	96	392,219,178	50,287,872	149,258,161	149,691,289	17,815,663	21,877,011	115,008,743	896,157,917
	97	338,423,564	51,046,927	151,042,133	145,782,479	17,935,600	22,868,314	112,997,798	840,096,815
	98	333,688,503	54,610,513	155,176,996	149,545,374	18,041,048	22,198,894	113,026,197	846,287,525
Puerto Rico	95	30,330,473	531,226	13,861,336	11,706,122	9,927,345	8,169,262	9,632,280	84,158,044
	96	24,267,097	142,187	17,004,946	13,804,916	10,661,013	8,446,328	8,200,030	82,526,517
	97	24,157,885	9,000	21,752,120	11,420,426	10,238,274	7,522,959	8,132,473	83,233,137
	98	15,213,992	0	26,945,030	12,247,295	11,230,304	8,111,173	7,278,531	81,026,325
Rhode Island	95	17,344,535	237,930	7,434,547	13,829,904	868,305	1,100,845	2,946,818	43,762,884
	96	13,987,327	226,963	7,123,050	14,710,524	858,003	891,635	2,203,317	40,000,819
	97	11,592,386	225,225	7,231,809	16,028,822	550,062	731,423	1,789,702	38,149,429
	98	11,750,519	269,500	7,770,670	17,033,082	559,092	407,035	1,821,933	39,611,831
South Carolina	95	279,881,113	49,028,680	113,792,493	108,538,907	11,807,750	11,916,160	55,955,740	630,920,843
	96	303,352,841	78,185,193	112,054,076	97,338,156	7,886,714	10,814,955	56,205,773	665,837,708
	97	321,445,881	78,193,006	113,689,226	99,867,231	6,539,274	11,085,513	56,094,653	686,914,784
	98	372,257,633	78,038,558	113,302,629	104,633,162	6,908,421	10,916,292	52,389,985	738,446,680
South Dakota	95	36,980,289	1,065,000	1,147,835	370,122	167,753	555,298	7,542,847	47,829,144
	96	30,204,647	1,050,000	1,894,335	508,822	185,424	1,411,791	5,101,582	40,356,601
	97	34,318,935	1,118,000	2,435,346	500,822	187,274	1,061,350	6,209,886	45,831,613
	98	34,344,535	1,216,000	2,451,939	525,438	195,726	1,072,875	6,341,423	46,147,936
Tennessee	95	139,305,627	58,224,173	131,821,169	56,246,392	6,045,762	11,184,985	108,943,716	511,771,824
	96	164,053,491	49,580,975	106,752,628	49,461,184	6,244,944	12,365,334	106,047,967	494,506,523
	97	183,315,566	50,202,122	109,044,718	51,130,494	5,179,581	11,193,284	105,854,007	515,919,772
	98	189,358,652	56,101,194	109,897,408	49,062,074	4,932,286	10,389,382	100,115,163	519,856,159
Texas	95	851,351,242	802,343,769	1,756,510,238	147,314,196	131,170,022	96,486,725	285,373,579	4,070,549,771
	96	965,065,180	836,485,137	1,375,842,159	178,196,574	72,829,686	79,465,740	273,328,764	3,781,213,240
	97	1,722,593,864	911,615,423	1,356,528,683	163,538,778	68,835,844	75,152,754	268,416,810	4,566,682,156
	98	1,023,433,433	838,470,021	1,505,544,277	166,800,583	66,294,108	74,566,747	259,410,360	3,934,519,529
Utah	95	13,692,011	4,418,581	309,942,774	3,224,718	85,923	763,467	76,593,979	408,721,453
	96	9,803,457	25,620,841	317,147,921	7,763,733	106,125	4,686,207	80,758,371	445,886,655
	97	8,766,613	21,620,300	316,408,567	5,473,299	123,301	8,770,604	83,040,797	444,203,481
	98	8,731,227	21,637,457	316,429,929	5,344,669	134,435	8,848,085	70,136,456	431,262,258



Table 2-19. Actual and Projected Quantities of TRI Chemicals in Waste, by State, 1995-1998, Continued

State	Year	On-site Waste Management			Off-site Waste Management			Releases Quantity Released On- and Off-site	Total Production- related Waste
		Recycled On-site	Energy Recovery On-site	Treated On-site	Recycled Off-site	Energy Recovery Off-site	Treated Off-site		
Vermont	95	1,073,467	12,000	741,603	1,760,132	45,611	329,343	571,414	4,533,570
	96	457,075	6,200	1,026,694	2,453,609	13,332	264,620	451,988	4,673,518
	97	459,765	3,000	1,054,094	1,869,600	400	166,307	439,805	3,992,971
	98	470,080	0	1,074,149	716,100	0	98,689	459,896	2,818,914
Virgin Islands	95	766,194	0	10,014,402	117,182	51,700	192,110	1,460,160	12,601,748
	96	711,124	0	10,248,528	96,920	4,834	377,449	1,506,138	12,944,993
	97	711,124	0	10,248,528	96,920	4,834	377,449	1,641,691	13,080,546
	98	711,124	0	10,248,528	96,920	4,834	377,449	1,641,691	13,080,546
Virginia	95	152,431,389	40,127,426	342,447,586	26,936,757	7,609,951	18,440,473	54,244,301	642,237,883
	96	178,353,110	29,707,489	317,770,559	23,042,524	7,097,789	19,350,747	56,322,865	631,645,083
	97	181,014,830	30,492,814	317,760,882	19,824,123	7,908,276	18,535,397	55,614,506	631,150,828
	98	263,122,649	30,995,661	353,116,201	18,236,779	8,744,718	18,528,448	54,287,103	747,031,559
Washington	95	79,400,362	12,310,080	83,876,405	13,450,710	652,856	2,205,532	27,652,784	219,548,729
	96	80,436,589	18,590,204	90,430,822	11,732,574	884,619	2,504,576	27,405,507	231,984,891
	97	73,706,411	19,064,399	89,455,332	7,962,906	893,166	6,534,488	25,967,859	223,584,561
	98	76,901,535	19,451,420	90,750,947	6,621,422	870,927	8,179,156	25,504,038	228,279,445
West Virginia	95	121,278,361	11,819,776	156,343,554	34,736,094	30,508,269	6,742,802	33,584,598	395,013,454
	96	121,297,058	10,237,138	146,675,430	30,312,857	9,237,060	5,804,792	28,809,290	352,373,625
	97	125,430,748	9,369,471	148,879,489	26,042,129	8,492,090	5,288,322	26,497,725	349,999,974
	98	133,413,272	8,578,814	157,596,505	26,306,802	9,096,259	5,394,764	25,080,642	365,467,058
Wisconsin	95	60,306,238	11,313,067	113,768,447	55,286,633	18,806,052	13,139,030	39,346,821	311,966,288
	96	53,677,399	14,787,808	112,924,941	56,504,531	22,299,121	16,294,697	39,640,292	316,128,789
	97	53,426,685	15,102,560	109,203,571	57,098,530	22,560,602	15,832,900	37,775,440	311,000,288
	98	50,982,071	15,026,503	106,343,709	60,565,947	23,026,657	15,987,984	37,178,309	309,111,180
Wyoming	95	1,855,743	118,190	4,068,157	68,369	1,830	1,793	11,030,850	17,144,932
	96	1,770,771	62,350	4,934,435	317,475	3,573	2,797	9,676,690	16,768,091
	97	1,847,551	64,447	6,114,515	438,654	3,573	87,331	9,540,231	18,096,302
	98	1,874,181	64,447	5,248,515	519,000	3,573	2,301	9,580,553	17,292,570
Total	95	7,599,457,107	2,604,326,691	6,713,283,164	2,172,130,513	573,861,721	503,626,870	2,426,043,539	22,592,729,605
	96	7,842,595,142	2,761,739,445	7,139,861,921	2,230,297,511	510,267,931	516,662,017	2,414,916,746	23,416,340,713
	97	9,058,050,236	2,834,933,863	7,176,355,246	2,139,384,425	469,607,626	514,114,672	2,352,037,799	24,544,483,867
	98	8,519,036,977	2,827,656,852	7,431,162,587	2,171,369,720	466,659,144	508,186,883	2,249,143,815	24,173,215,978

Note: Data from Section 8 of Form R for 1996. 95 is prior year, 96 is current year, 97 and 98 are projected years

### Chemical-Specific Waste Management Data

Table 2-20 presents the top 20 TRI chemicals for total production-related waste, led by methanol (2.29 billion pounds). Four other chemicals were reported in quantities of more than 1 billion pounds: toluene (1.82 billion pounds), copper (1.35 billion pounds), sulfuric acid (1.22 billion pounds), and ethylene (1.22 billion pounds).

Waste management of the top five chemicals varied. For methanol, this consisted primarily of on-site treatment (41.5% of its total production-related waste), and more methanol was treated

on-site than any other TRI chemical in 1996 (950.7 million pounds). On-site recycling accounted for more than half the management of the next three chemicals: toluene (968.3 million pounds, or 53.3%), copper (737.2 million pounds, or 54.5%), and sulfuric acid (798.6 million pounds, or 65.4%). These were the leading chemicals for on-site recycling. About equal shares of ethylene, ranked fifth overall, were burned on-site for energy recovery and treated on-site (40.3% and 39.8%, respectively). Propylene, however, ranking sixth overall, was the chemical with the largest on-site energy recovery (567.6 million pounds, compared to 490.6 million pounds for ethylene).



Table 2-20. Top 20 Chemicals with the Largest Total Production-related Waste, 1996

CAS Number	Chemical	On-site Waste Management			Off-site Waste Management			Releases Quantity Released On- and Off-site	Total Production-related Waste
		Recycled On-site	Energy Recovery On-site	Treated On-site	Recycled Off-site	Energy Recovery Off-site	Treated Off-site		
67-56-1	Methanol	537,583,324	331,508,259	950,729,426	17,596,160	91,920,468	115,676,226	245,467,067	2,290,480,930
108-88-3	Toluene	968,269,305	187,671,839	395,302,542	26,647,879	93,076,963	19,431,352	125,826,351	1,816,226,231
7440-50-8	Copper	737,221,219	123,097	41,621,864	547,960,360	45,526	6,663,640	20,249,615	1,353,885,321
7664-93-9	Sulfuric acid	798,641,136	3,600	389,473,985	6,021,651	6,722	4,306,466	22,069,485	1,220,523,045
74-85-1	Ethylene	194,529,481	490,573,955	483,574,781	13,317	13,028,334	2,112,396	32,662,262	1,216,494,526
115-07-1	Propylene	60,407,279	567,598,551	302,585,973	13	215,250	278,482	26,440,895	957,526,443
7664-41-7	Ammonia	337,049,680	38,613,184	342,109,457	8,898,654	66,067	16,369,151	193,035,326	936,141,519
7647-01-0	Hydrochloric acid	73,213,533	120,000	684,523,200	3,701,000	11,200	6,024,057	66,271,877	833,864,867
—	Lead compounds	396,430,669	0	1,350,570	317,306,000	66,447	7,827,663	29,787,645	752,768,994
107-21-1	Ethylene glycol	378,289,176	6,653,981	57,466,450	115,505,157	16,998,309	22,366,793	18,306,032	615,585,898
—	Zinc compounds	84,991,928	102,429	3,458,463	235,539,067	319,843	29,509,406	209,342,225	563,263,361
1330-20-7	Xylene (mixed isomer)	110,754,065	146,026,399	81,266,575	45,207,020	81,139,488	9,077,257	87,947,647	561,418,451
110-54-3	n-Hexane	226,946,357	27,541,392	183,924,283	10,713,933	10,361,400	8,225,491	71,903,265	539,616,121
7664-38-2	Phosphoric acid	310,993,398	8,300	117,388,358	8,585,442	71,813	4,285,837	62,229,276	503,562,424
—	Copper compounds	189,656,521	59	5,817,034	202,204,906	19,489	1,643,531	57,165,332	456,506,872
7782-50-5	Chlorine	82,275,726	4,000	259,753,478	751,497	14,348	1,279,178	67,322,428	411,400,655
—	Nitrate compounds	103,734,553	0	27,468,515	4,700,612	98,981	61,901,864	169,285,536	367,190,061
78-93-3	Methyl ethyl ketone	61,050,421	92,654,090	68,944,661	20,448,105	41,818,751	5,660,666	60,360,784	350,937,478
—	Glycol ethers	195,662,187	43,392,075	27,509,395	3,304,996	17,139,212	11,860,515	42,287,893	341,156,273
7697-37-2	Nitric acid	24,081,964	165,558	269,641,370	2,378,483	330	15,672,065	21,715,136	333,654,906
	Subtotal	5,871,781,922	1,932,760,768	4,693,910,380	1,577,484,252	366,418,941	350,172,036	1,629,676,077	16,422,204,376
	Total	7,842,595,142	2,761,739,445	7,139,861,921	2,230,297,511	510,267,931	516,662,017	2,414,916,746	23,416,340,713

Note: Data from current year (Column B), Section 8 of Form R for 1996

More than half of total production-related waste for all but three of the top 20 chemicals was managed on-site. The exceptions were zinc compounds (11th overall), copper compounds (15th), and nitrate compounds (17th). These substances were primarily recycled off-site (235.5 million pounds of zinc compounds and 202.2 million pounds of copper compounds) and/or released on- and off-site to the environment (209.3 million pounds of zinc compounds and 169.3 million pounds of nitrate compounds).

The leading chemical for off-site recycling was copper, with 548.0 million pounds. Toluene led for off-site energy recovery, with 93.1 million pounds. As with on-site treatment, methanol was the top chemical sent for off-site treatment, with 115.7 million pounds. Methanol also led all TRI chemicals in on- and off-site releases, with 245.5 million pounds. Zinc compounds were second (209.3 million pounds), and ammonia was third (193.0 million pounds).

## Chemical-Specific Data Table

Table 2-21 presents on- and off-site releases, on-site waste management, and transfers off-site for further waste management for all reported TRI chemicals for 1996. Pesticides are denoted with an asterisk (\*) next to the chemical name.



Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996

CAS Number	Chemical	On-site Releases								Off-site Releases	Total On- and Off-site Releases
		Air			Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds	Class I Wells Pounds		Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
71751-41-2*	Abamectin	0	0	10	0	0	0	0	10	0	10
30560-19-1*	Acetate	255	1,250	0	0	0	0	0	1,505	1,400	2,905
75-07-0	Acetaldehyde	1,637,438	10,938,582	198,485	468,662	0	121	16,679	13,259,967	2,463	13,262,430
60-35-5	Acetamide	5	14	2	1,169,000	0	0	0	1,169,021	0	1,169,021
75-05-8	Acetonitrile	601,735	421,386	11,900	22,826,712	0	11	37	23,861,781	548,193	24,409,974
98-86-2	Acetophenone	149,441	29,865	734	474,202	0	0	2,738	656,980	15,950	672,930
62476-59-9*	Acifluorfen, sodium salt	219	7	7	0	0	0	5	238	0	238
107-02-8*	Acrolein	928	81,348	550	100,360	0	0	0	183,186	0	183,186
79-06-1	Acrylamide	2,751	8,949	3,653	5,748,154	0	149,156	0	5,912,663	301,575	6,214,238
79-10-7	Acrylic acid	193,012	231,271	3,171	5,168,000	0	0	67	5,595,521	51,375	5,646,896
107-13-1	Acrylonitrile	291,729	1,003,720	590	3,595,236	0	5	297	4,891,577	6,639	4,898,216
15972-60-8*	Alachlor	2,100	240	330	0	0	0	0	2,670	4,100	6,770
116-06-3*	Aldicarb	151	1,205	0	0	0	0	5	1,361	0	1,361
28057-48-9	d-trans-Allethrin	0	0	0	0	0	0	0	0	0	0
107-18-6	Allyl alcohol	43,237	15,383	4,962	374,263	0	0	0	437,845	134,595	572,440
107-11-9	Allylamine	0	0	0	0	0	0	0	0	0	0
107-05-1	Allyl chloride	56,007	24,141	9	0	0	0	0	80,157	0	80,157
7429-90-5	Aluminum (fume or dust)	285,959	1,397,308	48,989	0	0	54,398	3,818,509	5,605,163	7,747,964	13,353,127
1344-28-1	Aluminum oxide (fibrous forms)	74,648	32,743	505	0	0	20	357,630	465,546	9,452,079	9,917,625
20859-73-8*	Aluminum phosphide	0	0	0	0	0	0	0	0	0	0
834-12-8*	Ametryn	2,835	486	59	0	0	0	0	3,380	0	3,380
60-09-3	4-Aminoazobenzene	0	0	0	203	0	0	0	203	0	203
92-67-1	4-Aminobiphenyl	0	0	0	2	0	0	0	2	0	2
33089-61-1*	Amitraz	0	0	0	0	0	0	0	0	0	0
7664-41-7*	Ammonia	35,870,521	118,910,062	8,267,591	24,180,232	225,985	444,378	3,159,106	191,057,875	1,917,792	192,975,667
62-53-3	Aniline	111,741	133,351	16,217	835,298	0	210	571	1,097,388	21,071	1,118,459
90-04-0	o-Anisidine	1,443	74	28	0	0	0	0	1,545	1	1,546
104-94-9	p-Anisidine	0	0	0	0	0	0	0	0	0	0
120-12-7	Anthracene	23,583	40,617	122	0	0	272	389	64,983	51,041	116,024
7440-36-0	Antimony	2,905	7,962	5,388	0	0	6,086	3,394	25,735	217,968	243,703
—	Antimony compounds	32,345	70,385	34,886	13,908	0	101,859	1,872,669	2,126,052	4,201,352	6,327,404
7440-38-2	Arsenic	32,882	6,590	421	0	0	2,181	96,577	138,651	47,420	186,071
—	Arsenic compounds	75,960	39,486	4,047	61,280	0	13,910	1,737,118	1,931,801	1,196,069	3,127,870
1332-21-4	Asbestos (friable)	1,398	1,362	2	0	0	26,010	453,549	482,321	3,316,112	3,798,433
1912-24-9*	Atrazine	5,067	21,944	1,326	1	0	0	614,353	642,691	188,963	831,654
7440-39-3	Barium	9,579	33,400	2,482	0	0	0	306,932	352,393	574,589	926,982
—	Barium compounds	84,002	215,467	89,385	750	0	66,678	1,466,707	1,922,989	4,127,184	6,050,173
22781-23-3*	Bendiocarb	0	0	0	0	0	0	0	0	0	0
1861-40-1*	Benfluralin	1,200	2,208	0	0	0	0	0	3,408	0	3,408
17804-35-2*	Benomyl	0	0	0	0	0	0	0	0	0	0
98-87-3	Benzal chloride	1,158	8	0	0	0	0	0	1,166	0	1,166
71-43-2	Benzene	3,365,712	4,753,759	27,376	312,016	750	28,841	47,316	8,535,770	65,750	8,601,520
98-07-7	Benzene trichloride	7,925	66	16	0	0	0	0	8,007	0	8,007
98-88-4	Benzoyl chloride	16,874	1,829	0	0	0	0	0	18,703	2,370	21,073
94-36-0	Benzoyl peroxide	325	1,694	10	0	0	0	1,655	3,684	6,352	10,036
100-44-7	Benzyl chloride	13,695	5,697	324	660	0	0	173	20,549	4,824	25,373
7440-41-7	Beryllium	9	850	31	0	0	28,000	3,240	32,130	1,590	33,720
—	Beryllium compounds	30	365	1	0	0	0	16,188	16,584	1,440	18,024
82657-04-3*	Bifenthrin	6	1	0	0	0	0	0	7	0	7
92-52-4	Biphenyl	409,862	237,574	9,779	31,558	0	15	29,257	718,045	34,962	753,007
111-91-1	Bis(2-chloroethoxy)methane	1,320	11	0	6,688	0	542	0	8,561	0	8,561
111-44-4	Bis(2-chloroethyl) ether	799	2,119	6	0	0	0	0	2,924	16	2,940
542-88-1	Bis(chloromethyl) ether	0	0	0	0	0	0	0	0	0	0
108-60-1	Bis(2-chloro-1-methylethyl) ether	520	4,100	44	0	0	0	3	4,667	0	4,667
56-35-9*	Bis(tributyltin) oxide	5	5	21	0	0	0	55	86	4,537	4,623

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

\*Pesticide



Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996

Chemical	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production- related Waste Pounds
Abamectin	0	0	31	31	0	0	78	0	0	78	114
Acephate	30	0	176,000	176,030	0	0	15,820	250	0	16,070	185,345
Acetaldehyde	178,600	12,168,237	21,603,608	33,950,445	43	144,723	311,747	346,698	0	803,211	47,988,233
Acetamide	0	98,900	1	98,901	0	0	411	0	0	411	1,269,087
Acetonitrile	22,263,727	24,163,715	12,010,669	58,438,111	1,736,000	6,436,847	3,730,563	911,800	0	12,815,210	96,460,892
Acetophenone	900	36,395,314	1,013,493	37,409,707	7,255	243,525	9,811	51,510	0	312,101	38,393,585
Acifluorfen, sodium salt	0	0	90	90	0	0	0	674	0	674	1,002
Acrolein	0	3,641,691	6,126,756	9,768,447	0	27,729	39	0	0	27,768	9,971,496
Acrylamide	307	90,400	137,990	228,697	4	22,780	27,346	65,280	0	115,410	6,525,693
Acrylic acid	4,427,743	27,444,611	27,724,878	59,597,232	96,828	3,738,960	1,107,155	19,688	0	4,962,631	70,187,482
Acrylonitrile	12,680,622	3,485,381	10,463,883	26,629,886	517	317,693	1,013,860	88,141	0	1,420,211	32,917,197
Alachlor	0	0	28,000	28,000	0	0	148,600	0	0	148,600	183,400
Aldicarb	0	0	505	505	0	0	32,588	0	0	32,588	34,215
d-trans-Allethrin	0	0	0	0	0	0	0	0	0	0	0
Allyl alcohol	120,525	822,495	1,313,506	2,256,526	0	653,065	107,040	211,324	0	971,429	3,678,780
Allylamine	0	0	2	2	0	2	0	0	0	2	4
Allyl chloride	260,000	2,300,000	504,432	3,064,432	0	360	487,384	11	0	487,755	3,640,974
Aluminum (fume or dust)	15,382,373	0	18,105,328	33,487,701	22,941,895	88,524	152,126	12,754	0	23,195,299	68,452,437
Aluminum oxide (fibrous forms)	175,000	0	3,900	178,900	16,417	22,333	36,314	1,328	0	76,392	1,883,324
Aluminum phosphide	0	0	0	0	0	0	0	0	0	0	0
Ametryn	0	0	33,000	33,000	0	0	19,620	0	0	19,620	54,961
4-Aminoazobenzene	0	0	0	0	0	0	99	0	0	99	302
4-Aminobiphenyl	0	0	91,000	91,000	0	0	103	0	0	103	91,105
Amtraz	0	0	0	0	0	0	0	0	0	0	0
Ammonia	337,049,680	38,613,184	342,109,457	717,772,321	8,590,971	83,430	2,373,153	14,637,033	61,588	25,746,175	936,141,519
Aniline	8,838,234	6,189,043	3,641,917	18,669,194	0	314,762	381,821	1,113,702	0	1,810,285	21,595,574
o-Anisidine	0	1,465	3,992	5,457	0	0	0	6,251	0	6,251	13,254
p-Anisidine	0	0	0	0	0	0	0	0	0	0	0
Anthracene	214,266	112,111	1,257,051	1,583,428	9,722	210,273	4,782	345	0	225,122	1,916,943
Antimony	3,549,028	109,302	1,220,051	4,878,381	2,939,941	33,085	155,173	22,558	2	3,150,759	8,273,867
Antimony compounds	6,138,043	0	94,818	6,232,861	2,874,865	63,927	747,146	94,398	0	3,780,336	15,280,785
Arsenic	1,191,541	0	70,004	1,261,545	751,303	0	95,712	303	0	847,318	2,276,319
Arsenic compounds	4,931,812	0	92,028	5,023,840	368,156	326	1,718,792	229	0	2,087,503	9,549,085
Asbestos (friable)	142,589	0	519,822	662,411	0	0	75	752	0	827	4,348,203
Atrazine	59	0	365,171	365,230	0	0	252,344	73	0	252,417	1,340,928
Barium	58,305	220,321	75,212	353,838	92,646	3,253	167,142	1,629	0	264,670	1,496,638
Barium compounds	37,172,801	200	6,877,708	44,050,709	2,771,996	224,870	1,592,618	392,151	2,941	4,984,576	54,816,803
Bendiocarb	0	0	0	0	0	0	0	0	0	0	0
Benfluralin	74,000	0	2,500	76,500	0	0	39,250	0	0	39,250	118,253
Benomyl	0	0	340,000	340,000	0	0	6,000	0	0	6,000	346,000
Benzal chloride	0	0	110,000	110,000	0	780,000	180	5	0	780,185	891,348
Benzene	61,704,353	15,645,404	64,991,646	142,341,403	531,327	2,196,809	1,491,143	214,698	6	4,433,983	156,110,718
Benzoic trichloride	0	0	150,000	150,000	0	12,000	44	5	0	12,049	170,025
Benzoyl chloride	0	0	1,998,467	1,998,467	0	138	630,473	6	0	630,617	2,650,142
Benzoyl peroxide	11,580	0	36,266	47,846	6,000	3,760	6,842	38,772	0	55,374	113,431
Benzyl chloride	19,000	20,600	258,415	298,015	0	559,486	1,608	1,581	0	562,675	882,915
Beryllium	38,389	0	921	39,310	93,078	0	3,257	0	0	96,335	166,725
Beryllium compounds	0	0	0	0	18,050	0	1,309	1	0	19,360	36,966
Bifenthrin	0	0	0	0	0	0	48	0	0	48	55
Biphenyl	161,010	1,094,809	3,058,232	4,314,051	527,079	243,039	513,754	404,785	0	1,688,657	6,793,939
Bis(2-chloroethoxy)methane	0	0	0	0	0	0	0	0	0	0	8,561
Bis(2-chloroethyl) ether	0	573,000	960,300	1,533,300	180,000	407,512	34,692	2,382	0	624,586	2,160,836
Bis(chloromethyl) ether	0	0	6,500	6,500	0	0	0	0	0	0	6,500
Bis(2-chloro-1-methylethyl) ether	13,000,000	0	8,934,000	21,934,000	0	0	0	0	0	0	21,938,700
Bis(tributyltin) oxide	0	0	339	339	55,471	0	0	0	0	55,471	60,426

Note: Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).





Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number    Chemical		On-site Releases								Off-site	Total On- and Off-site Releases Pounds	
		Air			On-site Land Releases					Releases		
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		RCRA		Other On-site Land Releases Pounds	Total On-site Releases Pounds		Transfers Off-site to Disposal Pounds
					Class I Wells Pounds	Class II-V Wells Pounds	Subtitle C Landfills Pounds					
10294-34-5	Boron trichloride	1	36	0	0	0	0	0	37	0	37	
7637-07-2	Boron trifluoride	10,975	12,456	0	0	0	0	0	23,431	0	23,431	
314-40-9*	Bromacil	6	0	30,740	0	0	0	0	30,746	0	30,746	
7726-95-6*	Bromine	39,175	38,525	10	7	0	245,117	6	322,840	245,117	567,957	
35691-65-7*	1-Bromo-1-(bromomethyl)-1,3-propanedicarbonitrile	0	0	0	0	0	0	0	0	0	0	
353-59-3	Bromochlorodifluoromethane (Halon 1211)	4,688	0	0	0	0	0	0	4,688	0	4,688	
74-83-9*	Bromomethane	414,088	1,885,755	7	303	0	0	6	2,300,159	0	2,300,159	
52-51-7*	2-Bromo-2-nitropropane-1,3-diol	0	0	0	0	0	0	0	0	0	0	
75-63-8	Bromotrifluoromethane (Halon 1301)	12,153	14,000	0	0	0	0	0	26,153	0	26,153	
1689-84-5*	Bromoxynil	5	10	0	0	0	0	0	15	1,388	1,403	
1689-99-2*	Bromoxynil octanoate	270	251	0	0	0	0	0	521	16,605	17,126	
357-57-3	Brucine	0	0	0	0	0	0	0	0	0	0	
106-99-0	1,3-Butadiene	1,429,487	1,296,809	11,001	1,000	0	110	153	2,738,560	4,790	2,743,350	
141-32-2	Butyl acrylate	105,689	108,649	712	0	0	0	2,165	217,215	50,540	267,755	
71-36-3	n-Butyl alcohol	4,906,789	17,938,341	61,936	2,452,006	0	617	5,517	25,365,206	304,582	25,669,788	
78-92-2	sec-Butyl alcohol	320,953	929,317	6,920	120,169	0	0	490	1,377,849	18,769	1,396,618	
75-65-0	tert-Butyl alcohol	494,612	272,590	30,430	1,007,213	0	0	758	1,805,603	42,468	1,848,071	
106-88-7	1,2-Butylene oxide	5,499	7,198	45	0	0	0	0	12,742	12	12,754	
123-72-8	Butyraldehyde	128,227	155,403	441	43,344	0	0	46	327,461	37	327,498	
7440-43-9	Cadmium	1,926	2,849	1,010	0	0	4,561	46,859	57,205	39,864	97,069	
—	Cadmium compounds	5,964	33,925	3,614	82	0	53,618	448,409	545,612	898,688	1,444,300	
156-62-7	Calcium cyanamide	1	1	0	0	0	0	0	2	0	2	
133-06-2*	Captan	519	12,106	5	5	0	0	0	12,635	2,191	14,826	
63-25-2*	Carbaryl	1,270	11,662	54	0	0	2,685	0	15,671	2,848	18,519	
1563-66-2*	Carbofuran	2,315	274	1	0	0	0	0	2,590	0	2,590	
75-15-0	Carbon disulfide	3,212,583	69,569,637	66,555	3,788	0	0	270	72,852,833	19,097	72,871,930	
56-23-5	Carbon tetrachloride	140,533	210,317	215	44,515	0	0	0	395,580	9,245	404,825	
463-58-1	Carbonyl sulfide	610,328	19,241,733	0	0	0	0	0	19,852,061	0	19,852,061	
5234-68-4*	Carboxin	8	0	0	0	0	0	0	8	384	392	
120-80-9	Catechol	2,480	2,826	24,475	0	0	38	2,184	32,003	239	32,242	
57-74-9	Chlordane	660	0	95	0	0	0	0	755	0	755	
115-28-6	Chlorendic acid	0	43	0	0	0	0	0	43	0	43	
90982-32-4*	Chlorimuron ethyl	0	1	0	0	0	0	0	1	0	1	
7782-50-5*	Chlorine	1,119,170	65,308,331	465,787	74,196	0	0	312,638	67,280,122	21,045	67,301,167	
10049-04-4*	Chlorine dioxide	20,395	1,189,230	0	0	0	0	0	1,209,625	0	1,209,625	
79-11-8	Chloroacetic acid	5,620	812	2	0	0	0	250	6,684	255	6,939	
4080-31-3*	1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride	6	54	15	0	0	0	607	682	4,582	5,264	
106-47-8	p-Chloroaniline	97	47	407	0	0	0	5	556	0	556	
108-90-7	Chlorobenzene	775,735	402,361	2,086	68,701	0	0	5	1,248,888	106,844	1,355,732	
75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	677,293	5,566,588	2,858	0	0	0	0	6,246,739	2,450	6,249,189	
75-45-6	Chlorodifluoromethane (HCFC-22)	4,388,043	5,388,543	2,538	0	0	0	1	9,779,125	54,200	9,833,325	
75-00-3	Chloroethane	1,130,568	1,422,692	285	92	0	0	0	2,553,637	0	2,553,637	
67-66-3	Chloroform	3,086,308	6,235,110	340,396	45,387	0	25,156	7,553	9,739,910	38,868	9,778,778	
74-87-3	Chloromethane	772,463	3,685,312	803	99,705	0	0	80	4,558,363	392	4,558,755	
107-30-2	Chloromethyl methyl ether	199	2,642	7	0	0	0	0	2,848	70	2,918	
563-47-3	3-Chloro-2-methyl-1-propene	331	22,676	0	0	0	0	0	23,007	0	23,007	
—	Chlorophenols	1,851	2,924	13	113,554	0	0	0	118,342	2,290	120,632	
76-06-2*	Chloropicrin	5,269	6,504	0	0	0	0	0	11,773	216	11,989	
126-99-8	Chloroprene	112,905	913,190	5	120,000	0	8,640	0	1,154,740	8,640	1,163,380	

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

\*Pesticide



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Boron trichloride	6,000	0	6,500	12,500	0	0	0	0	0	0	12,537
Boron trifluoride	11	0	382,165	382,176	0	0	1,169	5	0	1,174	406,841
Bromacil	0	0	18,062	18,062	0	0	29,048	0	0	29,048	77,856
Bromine	4,662,000	0	14,057,885	18,719,885	0	0	158,170	2,674,844	0	2,833,014	21,877,588
1-Bromo-1-(bromomethyl)-1,3-propanediacarbonitrile	0	0	29,000	29,000	0	0	7,104	0	0	7,104	36,104
Bromochlorodifluoromethane (Halon 1211)	674,672	0	0	674,672	0	0	0	0	0	0	679,371
Bromomethane	39,200	207,750	454,397	701,347	0	190	0	0	0	190	3,001,785
2-Bromo-2-nitropropane-1,3-diol	0	0	0	0	0	0	0	0	0	0	0
Bromotrifluoromethane (Halon 1301)	343,951	0	0	343,951	0	0	0	0	0	0	367,704
Bromoxynil	0	0	0	0	0	0	8	0	0	8	1,546
Bromoxynil octanoate	0	0	0	0	0	0	1,448	0	0	1,448	18,174
Brucine	0	0	0	0	0	0	0	0	0	0	0
1,3-Butadiene	5,953,022	37,128,076	61,528,326	104,609,424	7,241,635	3,409	92,020	670	0	7,337,734	120,423,280
Butyl acrylate	93,695	1,902,440	3,155,076	5,151,211	90,081	308,058	59,934	112,122	0	570,195	5,979,902
n-Butyl alcohol	7,330,808	22,248,666	39,477,166	69,056,640	2,929,058	7,807,862	1,222,863	1,862,777	11,000	13,833,560	109,092,615
sec-Butyl alcohol	472,175	20,272,772	2,060,170	22,805,117	143,765	3,500,087	86,670	56,350	0	3,786,872	27,617,067
tert-Butyl alcohol	437,181	53,474,091	2,117,278	56,028,550	12,084	8,386,360	184,233	1,151,656	0	9,734,333	68,708,742
1,2-Butylene oxide	0	46,792	350,376	397,168	0	263,538	20,558	0	0	284,096	690,769
Butyraldehyde	0	2,757,675	1,905,739	4,663,414	3,405	26,894	22,351	258,800	0	311,450	5,333,341
Cadmium	504,123	0	67,708	571,831	395,287	0	34,693	570	1	430,551	1,078,869
Cadmium compounds	7,831,833	0	68,747	7,900,580	710,242	1,613	192,918	2,577	0	907,350	10,221,593
Calcium cyanamide	0	0	0	0	0	0	0	0	0	0	1
Captan	4,079	0	9,500	13,579	0	0	2,081	0	0	2,081	28,694
Carbaryl	46,121	458,932	437,614	942,667	0	0	67,982	5	0	67,987	984,715
Carbofuran	0	0	3	3	0	0	60,346	0	0	60,346	62,223
Carbon disulfide	19,122,418	6,776,413	23,478,038	49,376,869	395	297,411	24,954	292,225	0	614,985	123,183,876
Carbon tetrachloride	2,073,632	1,050,017	41,816,616	44,940,265	128,727	26,337	1,600,815	480	0	1,756,359	45,991,160
Carbonyl sulfide	0	1,805,617	14,041,155	15,846,772	0	0	5,900	0	0	5,900	35,818,382
Carboxin	2,604	0	0	2,604	0	0	390	2	0	392	3,388
Catechol	0	10,927,849	3,729,029	14,656,878	0	32,112	19,160	34,644	0	85,916	14,752,655
Chlordane	0	0	4,150	4,150	0	0	1	83	0	84	4,989
Chlorendic acid	0	0	0	0	0	0	553	0	0	553	596
Chlorimuron ethyl	0	0	0	0	0	0	36,604	0	0	36,604	36,605
Chlorine	82,275,726	4,000	259,753,478	342,033,204	751,987	10,348	1,011,185	567,079	0	2,340,599	411,400,655
Chlorine dioxide	2,242,600	0	50,907,468	53,150,068	0	0	0	16,000	0	16,000	54,522,783
Chloroacetic acid	42,416	0	1,636,910	1,679,326	0	0	251	1,250	0	1,501	1,686,206
1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride	9,900	0	1,080	10,980	0	0	6,357	36	0	6,393	22,655
p-Chloroaniline	0	0	411	411	0	455	5,400	3,826	0	9,681	11,459
Chlorobenzene	5,742,719	2,870,143	11,527,191	20,140,053	1,605,990	589,367	2,803,074	8,139	21,747	5,028,317	26,343,646
1-Chloro-1,1-difluoroethane (HCFC-142b)	13,140	0	154,810	167,950	14,000	21	42,716	0	0	56,737	6,495,601
Chlorodifluoromethane (HCFC-22)	4,647,033	0	556,776	5,203,809	232,795	721	275,716	5	0	509,237	15,401,656
Chloroethane	3,909,753	12,244,253	28,988,635	45,142,641	155,710	39,841	490,834	762	1,926	689,073	48,384,121
Chloroform	6,039,162	8,887,218	13,453,310	28,379,690	668,897	189,452	1,860,389	329,533	0	3,048,271	41,656,082
Chloromethane	2,999,190	4,492,933	12,991,668	20,483,791	0	6,223	253,067	9,758	0	269,048	25,480,331
Chloromethyl methyl ether	0	0	8,220	8,220	0	0	0	0	0	0	11,137
3-Chloro-2-methyl-1-propene	0	0	345,271	345,271	0	0	52,209	103	0	52,312	420,590
Chlorophenols	2,486,786	0	207,215	2,694,001	0	670	8,698	0	0	9,368	2,822,844
Chloropicrin	29,902	0	365	30,267	0	64	370	0	0	434	42,513
Chloroprene	0	944,336	7,250,217	8,194,553	281,520	14,010	252,891	16,109	0	564,530	9,912,418

**Note** On-site Waste Management from Section and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. **Production-related Waste** from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number	Chemical	On-site Releases								Off-site	Total On- and Off-site Releases Pounds
		Air			On-site Land Releases					Releases	
		Fugitive or Nonpoint Air	Stack or Point Air	Surface	Underground Injection		RCRA	Other	Total	Transfers	
		Emissions Pounds	Emissions Pounds	Discharges Pounds	Class I Wells Pounds	Class II-V Wells Pounds	Subtitle C Landfills Pounds	On-site Land Releases Pounds	On-site Releases Pounds	Off-site to Disposal Pounds	
354-25-6	1-Chloro-1,1,2,2-tetra- fluoroethane (HCFC-124a)	4,677	591,789	65	0	0	0	0	596,531	0	596,531
2837-89-0	2-Chloro-1,1,1,2-tetrafluoro- ethane (HCFC-124)	238,752	665,722	961	0	0	0	0	905,435	0	905,435
1897-45-6 *	Chlorothalonil	12,307	3,423	22	0	0	0	1,670	17,422	253,395	270,817
75-88-7	2-Chloro-1,1,1-trifluoroethane (HCFC-133a)	250	33,963	0	0	0	0	0	34,213	0	34,213
75-72-9	Chlorotrifluoromethane (CFC-13)	1,750	7,600	250	0	0	0	0	9,600	0	9,600
5598-13-0 *	Chlorpyrifos methyl	505	1,505	0	0	0	3,653	0	5,663	0	5,663
64902-72-3 *	Chlorsulfuron	0	1	0	0	0	0	0	1	0	1
7440-47-3	Chromium	353,248	135,244	574,092	9	0	332,175	433,176	1,827,944	4,985,681	6,813,625
—	Chromium compounds	168,943	237,261	137,319	37,422	0	864,202	25,270,469	26,715,616	11,759,262	38,474,878
569-64-2	C.I. Basic Green 4	0	5	0	0	0	0	0	5	0	5
989-38-8	C.I. Basic Red 1	0	0	0	0	0	0	0	0	668	668
28407-37-6	C.I. Direct Blue 218	0	0	6	0	0	0	0	6	1,400	1,406
2832-40-8	C.I. Disperse Yellow 3	392	60	28	0	0	0	0	480	594	1,074
81-88-9	C.I. Food Red 15	0	0	0	0	0	0	0	0	0	0
7440-48-4	Cobalt	19,372	13,129	4,330	0	0	9,683	57,053	103,567	139,708	243,275
—	Cobalt compounds	3,994	26,931	27,960	15,917	0	29,357	191,277	295,436	559,381	854,817
7440-50-8 *	Copper	4,316,839	707,505	46,778	41,027	5	406,184	2,946,824	8,465,162	14,493,597	22,958,759
—	Copper compounds	1,198,319	666,754	62,013	298,693	14,683	968,892	47,098,824	50,308,178	6,935,031	57,243,209
8001-58-9 *	Croosote	382,479	555,535	9,114	0	0	460	250	947,838	7,333,126	8,280,964
120-71-8	p-Cresidine	1,665	1,800	0	0	0	0	0	3,465	0	3,465
108-39-4 *	m-Cresol	20,830	20,394	1,633	520,000	0	0	0	562,857	1,473	564,330
95-48-7	o-Cresol	1,998	6,293	845	440,000	0	0	0	449,136	4,257	453,393
106-44-5	p-Cresol	24,607	17,189	825	262,500	0	361	0	305,482	13,462	318,944
1319-77-3	Cresol (mixed isomers)	284,120	1,398,346	10,114	711,056	0	52	1,917	2,405,605	20,245	2,425,850
4170-30-3	Crotonaldehyde	41,397	16,256	1,600	61,900	0	0	0	121,153	0	121,153
98-82-8	Cumene	565,522	1,008,756	1,042	3,267	0	3	6,847	1,585,437	5,006	1,590,443
80-15-9	Cumene hydroperoxide	35,755	11,241	26	180,169	0	0	6,300	233,491	11,147	244,638
135-20-6	Cupferron	0	0	0	0	0	0	0	0	0	0
21725-46-2 *	Cyanazine	290	1,625	421	0	0	0	0	2,336	2,695	5,031
—	Cyanide compounds	125,836	723,335	107,054	3,477,384	0	2,049	74,052	4,509,710	95,181	4,604,891
1134-23-2 *	Cycloate	0	49	1	2	0	0	0	52	28	80
110-82-7	Cyclohexane	2,964,377	3,851,714	23,595	314,855	0	12	5,540	7,160,093	107,106	7,267,199
108-93-0	Cyclohexanol	66,799	133,202	122	3,630,080	0	0	74	3,830,277	3,221	3,833,498
68359-37-5 *	Cyfluthrin	8	18	0	0	0	0	350	376	0	376
94-75-7 *	2,4-D (acetic acid)	2,218	3,771	832	0	0	250	5	7,076	6,017	13,093
533-74-4 *	Dazomet	318	330	197	0	0	0	0	845	4,900	5,745
53404-60-7 *	Dazomet, sodium salt	0	0	0	0	0	0	0	0	250	250
94-82-6 *	2,4-DB	470	250	0	0	0	0	0	720	0	720
1929-73-3 *	2,4-D butoxyethyl ester	262	401	0	0	0	0	0	663	0	663
1163-19-5	Decabromodiphenyl oxide	13,728	31,880	3,675	0	0	13,000	187,838	250,121	620,047	870,168
13684-56-5 *	Desmedipham	15	0	0	0	0	0	0	15	0	15
1928-43-4 *	2,4-D 2-Ethylhexyl ester	2,160	1,065	5	0	0	0	0	3,230	2,077	5,307
101-80-4	4,4'-Diaminodiphenyl ether	9	7	182	0	0	0	0	198	53	251
95-80-7	2,4-Diaminotoluene	211	1,364	0	0	0	0	0	1,575	0	1,575
25376-45-8	Diaminotoluene (mixed isomers)	10,404	6,845	590	7,600	0	0	10	25,449	23,286	48,735
333-41-5 *	Diazinon	286	15,301	21	0	0	0	0	15,608	1,000	16,608
132-64-9	Dibenzofuran	22,012	17,242	62	0	0	0	265	39,581	28,986	68,567
106-93-4	1,2-Dibromoethane	6,503	2,207	7	24	0	0	1	8,742	0	8,742
124-73-2	Dibromotetrafluoroethane (Halon 2402)	5	5	0	0	0	0	0	10	0	10
84-74-2	Dibutyl phthalate	10,300	74,826	452	180,000	0	7	306	265,891	25,217	291,108

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

\*Pesticide



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
1-Chloro-1,1,2,2-tetrafluoroethane (HCFC-124a)	0	0	33,195	33,195	0	0	0	0	0	0	629,214
2-Chloro-1,1,1,2-tetrafluoroethane (HCFC-124)	184,882	0	183,025	367,907	226,600	0	0	0	0	226,600	1,539,206
Chlorothalonil	5,208	0	25,902	31,110	148	0	274,590	1,459	0	276,197	568,381
2-Chloro-1,1,1-trifluoroethane (HCFC-133a)	0	0	0	0	0	0	16,571	5	0	16,576	50,869
Chlorotrifluoromethane (CFC-13)	0	0	0	0	0	0	0	0	0	0	9,500
Chlorpyrifos methyl	2,692	0	0	2,692	0	0	5,500	0	0	5,500	17,969
Chlorsulfuron	0	0	0	0	0	0	9,807	0	0	9,807	9,808
Chromium	30,287,624	34,195	317,369	30,639,188	82,655,975	1,109	643,205	49,915	5,441	83,355,645	124,633,699
Chromium compounds	25,668,394	27,254	5,417,810	31,113,458	31,270,685	55,259	3,327,978	247,125	0	34,901,047	105,639,489
C I Basic Green 4	0	0	100	100	0	0	11,499	0	0	11,499	609
C I Basic Red 1	0	0	0	0	0	40	248	15	0	303	971
C I Direct Blue 218	0	0	639	639	0	0	0	79	0	79	2,119
C I Disperse Yellow 3	0	0	0	0	0	0	0	5,891	0	5,891	6,960
C I Food Red 15	0	0	0	0	0	0	0	5	0	5	0
Cobalt	3,778,210	0	147,007	3,925,217	6,699,148	0	21,256	6,533	47,000	6,773,937	11,312,611
Cobalt compounds	215,762	0	1,107,761	1,323,523	1,940,354	2,020	105,173	7,433	0	2,054,980	4,221,216
Copper	737,221,219	123,097	41,621,864	778,966,180	539,187,912	63,810	1,224,559	370,317	1,004	540,847,602	1,353,885,321
Copper compounds	189,656,521	59	5,817,034	195,473,614	194,626,529	19,948	1,884,588	156,261	17,159	196,704,485	456,506,872
Creosote	48,219,156	5,500	19,634,028	67,858,684	0	35,675	258,443	15,411	10,500	320,029	72,500,095
p-Cresidine	0	0	0	0	0	0	1,600	38,697	0	40,297	44,162
m-Cresol	2,104,414	789,240	229,581	3,123,235	820,576	38,925	24,217	3,261	0	886,979	4,578,595
o-Cresol	97,068	299,260	196,840	593,168	8	53,235	12,421	41,234	0	106,898	1,152,884
p-Cresol	90,880	430,589	468,502	989,971	500,574	115,535	20,308	388,390	0	1,024,807	2,335,909
Cresol (mixed isomers)	502,345	4,573,476	14,730,070	19,805,891	388,055	558,963	274,727	61,307	0	1,283,052	23,349,769
Crotonaldehyde	0	22,600	571,700	594,300	0	0	0	0	0	0	715,173
Cumene	16,061,751	9,440,085	38,743,335	64,245,171	153,825	1,191,125	88,661	29,547	0	1,463,158	67,186,433
Cumene hydroperoxide	0	0	543,481	543,481	0	12	1,937	175,887	0	177,836	1,016,533
Cupferron	0	679	0	679	0	0	90	0	0	90	769
Cyanazine	0	0	39,000	39,000	0	5	22,355	62	0	22,422	68,859
Cyanide compounds	588,476	120,114	10,946,174	11,654,764	31,823	22	404,941	236,134	0	672,920	16,757,529
Cycloate	0	0	0	0	0	0	1,006	0	0	1,006	1,086
Cyclohexane	61,438,279	8,021,506	33,944,668	103,404,453	507,862	2,657,437	1,800,730	8,400	6,909	4,981,338	116,046,627
Cyclohexanol	0	1,405,718	208,684	1,614,402	0	67,115	123,556	11,111	0	201,782	5,686,289
Cyfluthrin	0	0	1,110	1,110	0	0	1,223	10	0	1,233	2,729
2,4-D (acetic acid)	78,758	0	25,360	104,118	0	0	31,635	263	0	31,898	138,148
Dazomet	0	3	15,261	15,264	0	0	2,700	83	0	2,783	24,409
Dazomet, sodium salt	0	0	130	130	0	0	13,948	15	0	13,963	14,232
2,4-DB	0	0	0	0	0	0	792	0	0	792	826
2,4-D butoxyethyl ester	0	0	0	0	0	0	3,256	0	0	3,256	3,619
Decabromodiphenyl oxide	902,477	0	48,973	951,450	117,679	4,881	53,022	265,560	0	441,142	2,260,569
Desmedipham	0	0	0	0	0	0	492	0	0	492	507
2,4-D 2-Ethylhexyl ester	4,701	0	0	4,701	0	0	23,721	5	0	23,726	24,245
4,4'-Diaminodiphenyl ether	0	0	140	140	0	0	9,975	5	0	9,980	10,360
2,4-Diaminotoluene	0	0	66,836	66,836	0	0	279	0	0	279	68,690
Diaminotoluene (mixed isomers)	0	4,731,680	442,162	5,173,842	0	2,712,895	219,120	95,849	0	3,027,864	9,117,854
Diazinon	42,605	0	107,961	150,566	0	3,900	8,478	0	0	12,378	178,501
Dibenzofuran	183,852	190	491,323	675,365	4,601	500	132	500	0	5,733	738,244
1,2-Dibromoethane	0	0	11,202	11,202	0	3,301	27,431	0	0	30,732	50,530
Dibromotetrafluoroethane (Halon 2402)	96,000	0	0	96,000	0	0	0	0	0	0	96,010
Dibutyl phthalate	46,139	333,566	121,193	500,898	13,360	139,274	108,022	6,323	0	266,979	1,057,185

**Note** On-site Waste Management from Section and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. **Production-related Waste** from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number	Chemical	On-site Releases							Total On-site Releases Pounds	Off-site Releases Transfers Off-site to Disposal Pounds	Total On- and Off-site Releases Pounds
		Air			On-site Land Releases						
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
1918-00-9*	Dicamba	365	694	132	59,200	0	0	0	60,391	0	60,391
99-30-9*	Dichloran	2	8	0	0	0	0	0	10	0	10
95-50-1	1,2-Dichlorobenzene	186,171	101,181	5,324	4,900	0	382	2	297,960	17,759	315,719
541-73-1	1,3-Dichlorobenzene	1,743	3,375	897	0	0	0	0	6,015	0	6,015
106-46-7*	1,4-Dichlorobenzene	93,651	142,851	1,881	2,000	0	0	480	240,863	0	240,863
25321-22-6	Dichlorobenzene (mixed isomers)	239	13,808	0	0	0	0	0	14,047	10	14,057
91-94-1	3,3'-Dichlorobenzidine	1	1	0	0	0	0	0	2	5,550	5,552
612-83-9	3,3'-Dichlorobenzidine dihydrochloride	0	5	0	0	0	0	0	5	0	5
64969-34-2	3,3'-Dichlorobenzidine sulfate	0	0	0	0	0	0	0	0	0	0
75-27-4	Dichlorobromomethane	0	2,400	0	0	0	0	110	2,510	0	2,510
764-41-0	1,4-Dichloro-2-butene	50	3,060	0	3,400	0	0	0	6,510	0	6,510
110-57-6	trans-1,4-Dichloro-2-butene	137	0	0	0	0	0	0	137	0	137
1649-08-7	1,2-Dichloro-1,1-difluoro- ethane (HCFC-132b)	760	170	20	0	0	0	0	950	89	1,039
75-71-8	Dichlorodifluoromethane (CFC-12)	1,095,303	228,933	80	0	0	0	6,070	1,330,386	460	1,330,846
107-06-2	1,2-Dichloroethane	434,047	610,525	1,848	5,126	0	25,000	250	1,076,796	91,249	1,168,045
540-59-0	1,2-Dichloroethylene	3,075	5,119	37	0	0	0	0	8,231	0	8,231
1717-00-6	1,1-Dichloro-1-fluoroethane (HCFC-141b)	5,337,013	3,841,152	508	0	0	0	5,835	9,184,508	217,899	9,402,407
75-43-4	Dichlorofluoromethane (HCFC-21)	14,725	130,560	0	0	0	0	0	145,285	10,676	155,961
75-09-2	Dichloromethane	21,519,922	31,900,543	10,060	749,507	0	15	4,942	54,184,989	116,409	54,301,398
507-55-1	1,3-Dichloro-1,1,2,2,3-penta- fluoropropane (HCFC-225cb)	29,000	0	0	0	0	0	0	29,000	0	29,000
422-56-0	3,3-Dichloro-1,1,1,2,2-penta- fluoropropane (HCFC-225ca)	24,000	0	0	0	0	0	0	24,000	0	24,000
120-83-2	2,4-Dichlorophenol	2,705	412	53	15,390	0	0	0	18,560	0	18,560
78-87-5	1,2-Dichloropropane	224,371	290,057	1,855	0	0	0	150	516,433	5,330	521,763
10061-02-6	trans-1,3-Dichloropropene	810	30	0	0	0	0	0	840	0	840
78-88-6	2,3-Dichloropropene	510	540	19,900	0	0	0	0	20,950	0	20,950
542-75-6*	1,3-Dichloropropylene	8,686	761	1,270	0	0	0	0	10,717	0	10,717
76-14-2	Dichlorotetrafluoroethane (CFC-114)	699,501	146,953	4,936	0	0	0	0	851,390	2	851,392
34077-87-7	Dichlorotrifluoroethane	750	250	0	0	0	0	0	1,000	0	1,000
354-23-4	1,2-Dichloro-1,1,2-trifluoro- ethane (HCFC-123a)	66,400	2,600	250	0	0	0	0	69,250	0	69,250
306-83-2	2,2-Dichloro-1,1,1-trifluoro- ethane (HCFC-123)	193,631	35,500	250	0	0	0	4	229,385	0	229,385
62-73-7*	Dichlorvos	5	250	5	0	0	0	0	260	1,228	1,488
115-32-2*	Dicofol	460	0	0	0	0	0	0	460	250	710
77-73-6	Dicyclopentadiene	226,020	69,826	16,953	0	0	3	0	312,802	37,220	350,022
111-42-2	Diethanolamine	331,728	144,835	165,714	16,211	0	390	41,780	700,658	82,106	782,764
117-81-7	Di-(2-ethylhexyl) phthalate	80,785	383,644	274	0	0	264	70,047	535,014	1,762,843	2,297,857
64-67-5	Diethyl sulfate	3,024	184	0	0	0	0	0	3,208	47	3,255
35367-38-5*	Diflubenzuron	0	0	0	0	0	0	0	0	0	0
101-90-6	Diglycidyl resorcinol ether	255	255	0	0	0	0	0	510	0	510
94-58-6	Dihydrosafrole	533	300	0	0	0	0	0	833	0	833
—	Diisocyanates	523,201	281,078	261	0	0	29	33,199	837,768	1,357,637	2,195,405
55290-64-7*	Dimethupin	0	0	0	0	0	0	0	0	0	0
60-51-5*	Dimethoate	225	260	10	0	0	0	0	495	0	495
119-90-4	3,3'-Dimethoxybenzidine	0	0	0	0	0	0	0	0	0	0
20325-40-0	3,3'-Dimethoxybenzidine dihydrochloride	2	8	0	0	0	0	0	10	0	10

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

\*Pesticide



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Dicamba	895	0	95	990	0	0	375	5	0	380	61,139
Dichloran	0	0	55	55	0	0	0	250	0	250	95
1,2-Dichlorobenzene	6,431,032	612,089	318,912	7,362,033	2,890,994	587,976	2,685,125	4,368	0	6,168,463	13,824,617
1,3-Dichlorobenzene	1,793	0	9	1,802	884	0	1,489	796	0	3,169	11,002
1,4-Dichlorobenzene	4,249,806	354,424	130,406	4,734,636	0	12,038	509,105	79	0	521,222	5,496,709
Dichlorobenzene (mixed isomers)	0	595,086	260,043	855,129	0	13,115	20,133	0	0	33,248	902,613
3,3'-Dichlorobenzidine	0	0	6,000	6,000	0	0	46,000	250	0	46,250	57,400
3,3'-Dichlorobenzidine dihydrochloride	0	0	10,114	10,114	0	0	100,000	14	0	100,014	110,115
3,3'-Dichlorobenzidine sulfate	0	0	600	600	0	0	6,730	0	0	6,730	7,300
Dichlorobromomethane	0	0	0	0	0	0	0	0	0	0	2,500
1,4-Dichloro-2-butene	1,800,000	0	3,000,000	4,800,000	0	0	320,000	0	0	320,000	5,126,510
trans-1,4-Dichloro-2-butene	0	0	0	0	0	0	0	0	0	0	137
1,2-Dichloro-1,1-difluoroethane (HCFC-132b)	0	0	96,000	96,000	0	0	37,000	0	0	37,000	134,000
Dichlorodifluoromethane (CFC-12)	540,671	0	17,016	557,687	423,063	82	43,566	1	0	466,712	2,140,917
1,2-Dichloroethane	47,818,476	49,048,528	48,491,110	145,358,114	16,957,172	1,085,108	926,243	6,369	0	18,974,892	165,469,049
1,2-Dichloroethylene	620,000	1,560,000	1,828,252	4,008,252	3,109	0	8,701	0	0	11,810	4,051,845
1,1-Dichloro-1-fluoroethane (HCFC-141b)	389,753	0	2,069,813	2,459,566	232,507	279,804	1,101,604	2,904	0	1,616,819	13,501,000
Dichlorofluoromethane (HCFC-21)	0	0	0	0	0	0	201	0	0	201	152,760
Dichloromethane	112,064,937	5,598,974	23,207,510	140,871,421	11,799,944	3,005,556	11,903,667	640,294	1,815,884	29,165,345	223,690,940
1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb)	4,841	0	0	4,841	2,400	0	1,430	0	0	3,830	37,671
3,3-Dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca)	3,960	0	0	3,960	1,900	0	1,170	0	0	3,070	31,030
2,4-Dichlorophenol	1,240	3	420,660	421,903	0	0	0	0	0	0	440,459
1,2-Dichloropropane	37,213,000	22,560,000	5,117,425	64,890,425	0	0	142	1,513	0	1,655	65,413,342
trans-1,3-Dichloropropene	49,000	12,000,000	0	12,049,000	0	0	285	0	0	285	12,050,130
2,3-Dichloropropene	3,800,000	2,600,000	484,000	6,884,000	0	0	360,000	0	0	360,000	7,265,396
1,3-Dichloropropylene	3,036,700	14,000,000	573,241	17,609,941	0	4,724	53,855	0	0	58,579	17,678,872
Dichlorotetrafluoroethane (CFC-114)	100,880	0	1,631,367	1,732,247	200,686	0	16,154	0	0	216,840	2,808,241
Dichlorotrifluoroethane	0	0	716,409	716,409	0	0	0	0	0	0	717,377
1,2-Dichloro-1,1,2-trifluoroethane (HCFC-123a)	0	0	0	0	0	0	0	0	0	0	69,500
2,2-Dichloro-1,1,1-trifluoroethane (HCFC-123)	253,000	0	4,916	257,916	0	0	5,963	5	0	5,968	473,144
Dichlorvos	0	0	10	10	0	104	395	0	0	499	1,805
Dicofol	19	0	0	19	0	0	250	0	0	250	329
Dicyclopentadiene	457,892	1,890,677	724,443	3,073,012	189,076	2,314,192	159,097	262	0	2,662,627	6,007,500
Diethanolamine	14,024	56,991	2,093,114	2,164,129	92,356	215,991	356,576	1,540,734	0	2,205,657	5,162,230
Di-(2-ethylhexyl) phthalate	3,346,141	354,639	290,002	3,990,782	3,876,237	274,610	225,525	21,084	0	4,397,456	10,972,505
Diethyl sulfate	0	0	4,621	4,621	3,293,130	0	1,511	4,288	0	3,298,929	3,306,606
Diflubenzuron	0	0	0	0	0	0	0	0	0	0	0
Diglycidyl resorcinol ether	0	0	0	0	0	500	0	0	0	500	1,015
Dihydrosafrole	0	0	0	0	0	0	0	167	0	167	562
Dusocyanates	849,302	91,890	558,301	1,499,493	389,249	445,322	1,395,847	13,847	0	2,244,265	5,838,560
Dimethupin	0	0	0	0	0	0	0	0	0	0	0
Dimethoate	180	0	0	180	0	0	3,091	0	0	3,091	2,737
3,3'-Dimethoxybenzidine	0	0	0	0	0	0	0	0	0	0	0
3,3'-Dimethoxybenzidine dihydrochloride	0	0	100	100	0	0	0	5	0	5	110

Note On-site Waste Management from Section and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number	Chemical	On-site Releases								Off-site	Total On- and Off-site Releases Pounds
		Air			On-site Land Releases					Releases	
		Fugitive or	Stack or	Surface	Underground Injection		RCRA	Other	Total	Transfers	
		Nonpoint Air	Point Air	Water	Class I	Class II-V	Subtitle C	On-site Land	On-site	Off-site to	
		Emissions	Emissions	Discharges	Wells	Wells	Landfills	Releases	Releases	Disposal	
		Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
124-40-3	Dimethylamine	112,970	353,142	38,367	2,850	0	0	4,730	512,059	35,305	547,364
2300-66-5*	Dimethylamine dicamba	580	5	0	0	0	5	0	590	255	845
121-69-7	N,N-Dimethylaniline	17,736	48,557	128	0	0	0	0	66,421	0	66,421
119-93-7	3,3'-Dimethylbenzidine	3	3	25	0	0	0	0	31	229	260
612-82-8	3,3'-Dimethylbenzidine dihydrochloride	0	0	0	0	0	0	0	0	0	0
2524-03-0	Dimethyl chlorothiophosphate	5	5	0	0	0	0	0	10	0	10
68-12-2	N,N-Dimethylformamide	368,967	1,282,686	43,956	1,220,000	0	1,350	278	2,917,237	184,053	3,101,290
57-14-7	1,1-Dimethyl hydrazine	259	43	0	0	0	0	1	303	425	728
105-67-9*	2,4-Dimethylphenol	16,838	40,836	100	140,000	0	0	0	197,774	821	198,595
576-26-1	2,6-Dimethylphenol	1,853	652	37	35,000	0	0	0	37,542	0	37,542
131-11-3	Dimethyl phthalate	52,537	101,917	551	1,000	0	4	4	156,013	3,615	159,628
77-78-1	Dimethyl sulfate	4,977	819	0	0	0	0	0	5,796	0	5,796
99-65-0	m-Dinitrobenzene	13	408	83,436	0	0	310	0	84,167	0	84,167
528-29-0	o-Dinitrobenzene	2	52	1,067	0	0	40	0	1,161	0	1,161
100-25-4	p-Dinitrobenzene	1	14	29	0	0	11	0	55	0	55
88-85-7	Dinitrobutyl phenol	717	5	3,800	0	0	0	0	4,522	13,500	18,022
534-52-1	4,6-Dinitro-o-cresol	5	95	0	0	0	0	0	100	27,820	27,920
51-28-5	2,4-Dinitrophenol	151	31	65,869	0	0	0	0	66,051	2	66,053
121-14-2	2,4-Dinitrotoluene	1,888	3	349	0	0	0	0	2,240	0	2,240
606-20-2	2,6-Dinitrotoluene	471	1	94	0	0	0	0	566	0	566
25321-14-6	Dinitrotoluene (mixed isomers)	1,540	13,275	586	33,000	0	0	0	48,401	121	48,522
39300-45-3*	Diocap	0	0	0	0	0	0	0	0	0	0
123-91-1	1,4-Dioxane	41,019	78,937	226,998	0	0	0	5,409	352,363	479,388	831,751
122-39-4*	Diphenylamine	29,018	17,759	205	15,532	0	0	0	62,514	11,382	73,896
2164-07-0*	Dipotassium endosulf	39	4	0	0	0	0	0	43	0	43
138-93-2*	Dipotassium cyanodithiocarbamate	0	0	0	0	0	0	0	0	0	0
330-54-1*	Diuron	271	1,501	13	0	0	0	0	1,785	1,500	3,285
2439-10-3*	Dodine	5	5	0	0	0	0	0	10	0	10
120-36-5*	2,4-DP	257	255	0	0	0	5	0	517	39	556
2702-72-9*	2,4-D sodium salt	0	0	0	0	0	0	0	0	0	0
106-89-8	Epichlorohydrin	246,061	84,963	20,735	0	0	1	2,204	353,964	4,137	358,101
13194-48-4*	Ethioprop	250	616	0	0	0	0	108,933	109,799	250	110,049
110-80-5	2-Ethoxyethanol	66,539	125,923	6	0	0	0	0	192,468	250	192,718
140-88-5	Ethyl acrylate	88,053	98,738	199	0	0	0	516	187,506	32,734	220,240
100-41-4	Ethylbenzene	2,487,776	6,902,212	7,080	335,677	255	534	61,293	9,794,827	95,603	9,890,430
541-41-3	Ethyl chloroformate	4,295	446	5	0	0	0	5	4,751	0	4,751
759-94-4*	Ethyl dipropylthiocarbamate	6,706	619	2	29	0	0	0	7,356	590	7,946
74-85-1*	Ethylene	16,159,552	19,627,812	25,228	0	0	7,800	280	35,820,672	10,845	35,831,517
—	Ethylenebis(dithiocarbamic acid, salts and esters	1,062	59	0	0	0	0	0	1,121	3,100	4,221
107-21-1	Ethylene glycol	2,787,138	3,232,634	1,842,307	7,698,571	913	55,341	374,635	15,991,539	2,576,966	18,568,505
151-56-4	Ethyleneimine	0	2	0	0	0	0	0	2	0	2
75-21-8*	Ethylene oxide	436,537	352,902	4,474	22,200	0	0	551	816,664	1,048	817,712
96-45-7	Ethylene thiourea	5	263	0	0	0	0	0	268	4,071	4,339
75-34-3	Ethylene dichloride	7,786	14,164	11	0	0	0	0	21,961	0	21,961
52-85-7	Famphur	0	0	0	0	0	0	0	0	0	0
60168-88-9*	Fenarimol	0	0	0	0	0	0	0	0	0	0
13356-08-6*	Fenbutatin oxide	5	250	0	745	0	0	0	1,000	0	1,000
39515-41-8*	Fenprothrin	0	0	0	0	0	0	0	0	0	0
55-38-9*	Fenthion	0	0	0	0	0	0	0	0	1	1
51630-58-1*	Fenvalerate	1	0	0	0	0	0	0	1	0	1
67806-50-4	Fluazifop butyl	0	0	0	0	0	0	0	0	0	0
2164-17-2*	Fluometuron	270	717	0	0	0	0	0	987	2,505	3,492
7782-41-4	Fluorine	0	25,460	43,100	0	0	0	0	68,560	0	68,560

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

\*Pesticide



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Dimethylamine	494,604	8,000	2,626,306	3,128,910	0	1,633	134,626	179,127	0	315,386	3,987,348
Dimethylamine dicamba	11,863	0	0	11,863	0	0	0	0	0	0	13,044
N,N-Dimethylaniline	48,000	0	6,895	54,895	0	1,087,965	80,649	95,542	0	1,264,156	1,382,346
3,3'-Dimethylbenzidine	0	0	2,287	2,287	0	0	0	0	0	0	2,547
3,3'-Dimethylbenzidine dihydrochloride	0	0	0	0	0	0	0	0	0	0	0
Dimethyl chlorothiophosphate	0	0	0	0	0	0	0	0	0	0	10
N,N-Dimethylformamide	5,447,326	9,632,409	12,108,837	27,188,572	280,627	3,872,987	752,773	4,009,179	0	8,915,566	38,750,948
1,1-Dimethyl hydrazine	0	9,215	4,237	13,452	0	7,001	8,806	0	0	15,807	22,980
2,4-Dimethylphenol	33,354	1,836,216	562,773	2,432,343	58,775	90,569	23,610	5,675	0	178,629	2,808,945
2,6-Dimethylphenol	4,100	263,030	8,200	275,330	0	14,755	2,831	0	0	17,586	330,416
Dimethyl phthalate	0	225,020	360,632	585,652	0	84,755	16,715	53,702	0	155,172	866,200
Dimethyl sulfate	100,000	0	76,354	176,354	77,756	0	0	5	0	77,761	259,207
m-Dinitrobenzene	0	0	750,922	750,922	0	0	77	0	0	77	835,166
o-Dinitrobenzene	0	0	468,906	468,906	0	0	10	0	0	10	470,077
p-Dinitrobenzene	0	0	29,076	29,076	0	0	3	0	0	3	29,134
Dinitrobutyl phenol	0	267,404	7,701	275,105	0	0	340	0	0	340	293,447
4,6-Dinitro-o-cresol	0	716,801	29,000	745,801	0	0	8,390	626	0	9,016	762,305
2,4-Dinitrophenol	0	319,777	1,207,434	1,527,211	0	1	0	0	0	1	1,593,115
2,4-Dinitrotoluene	0	51,527	35,270	86,797	840	0	0	0	0	840	103,418
2,6-Dinitrotoluene	0	1,711	23,500	25,211	0	0	26	0	0	26	25,803
Dinitrotoluene (mixed isomers)	0	0	221,517	221,517	0	0	11,385	83,000	0	94,385	821,262
Dinocap	0	0	0	0	0	0	0	0	0	0	0
1,4-Dioxane	5,592,026	3,126,659	1,074,367	9,793,052	846	1,371,301	22,070	160,497	0	1,554,714	12,186,086
Diphenylamine	1,200,000	2,190,000	38,849	3,428,849	25,237	421,527	231,730	7,683	0	686,177	4,188,562
Dipotassium endosulf	0	0	0	0	0	0	250	0	0	250	55
Disodium cyanodithionimido-carbonate	0	0	0	0	0	0	0	0	0	0	0
Diuron	0	0	0	0	0	0	1,385	250	0	1,635	7,636
Dodme	0	0	0	0	0	0	500	0	0	500	368
2,4-DP	4,256	0	0	4,256	0	0	253	0	0	253	4,822
2,4-D sodium salt	0	0	3,956	3,956	0	0	0	0	0	0	3,956
Epichlorohydrin	20,158,532	5,863,590	2,992,084	29,014,206	2	75,430	1,443,664	11,471	0	1,530,567	30,901,434
Ethoprop	3	0	0	3	0	0	1,105	0	0	1,105	110,256
2-Ethoxyethanol	6,210	480,076	662,210	1,148,496	22,801	163,808	82,677	78,269	0	347,555	1,617,777
Ethyl acrylate	284,024	7,177,162	16,524,991	23,986,177	45,497	792,458	329,056	24,090	0	1,191,101	25,394,505
Ethylbenzene	33,064,962	31,512,229	60,433,909	125,011,100	5,339,992	8,905,167	1,685,706	76,581	0	16,007,446	154,127,108
Ethyl chloroformate	0	0	11,600	11,600	0	0	0	0	0	0	16,271
Ethyl dipropylthiocarbamate	0	0	0	0	0	0	9,610	5	0	9,615	19,099
Ethylene	194,529,481	490,573,955	483,574,781	1,168,678,217	13,317	13,028,335	1,112,185	261	0	14,154,098	1,216,494,526
Ethylenebisdithiocarbamic acid, salts and esters	0	0	0	0	0	5	14,780	882	0	15,667	24,984
Ethylene glycol	378,289,176	6,653,981	57,466,450	442,409,607	110,548,356	17,019,781	6,086,887	16,587,111	44,588	150,286,723	615,585,898
Ethyleneimine	0	0	22,000	22,000	0	0	0	0	0	0	22,002
Ethylene oxide	114,788	28,135	13,246,872	13,389,795	6,664	0	963	117,227	0	124,854	14,316,592
Ethylene thiourea	0	0	0	0	2,735	0	2,815	1	0	5,551	9,645
Ethylene dichloride	1,300,000	140,773	2,410,240	3,851,013	0	0	18,514	0	0	18,514	3,891,561
Famphur	0	0	0	0	0	0	4,416	5	0	4,421	12,242
Fenarimol	0	0	0	0	0	0	0	0	0	0	0
Fenbutatin oxide	0	0	0	0	0	0	0	0	0	0	1,000
Fenpropathrin	0	0	0	0	0	0	0	0	0	0	0
Fenthion	7	0	8	15	0	0	3,271	0	0	3,271	3,287
Fenvalerate	0	0	0	0	0	0	3,994	0	0	3,994	3,995
Fluazfop butyl	0	0	0	0	0	0	0	0	0	0	0
Fluometuron	0	0	0	0	0	5	14,035	235	0	14,275	18,576
Fluorine	0	0	3,005	3,005	0	0	0	0	0	0	71,327

**Note** On-site Waste Management from Section and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. **Production-related Waste** from Section 8 of Form R (total excludes remedial and catastrophic quantities)





Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number	Chemical	On-site Releases								Off-site Releases	Total On- and Off-site Releases Pounds
		Air			On-site Land Releases					Transfers Off-site to Disposal Pounds	
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Class I Wells Pounds	Injection Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds	Total On-site Releases Pounds		
51-21-8	Fluorouracil	0	0	0	0	0	250	0	250	250	500
69409-94-5*	Fluvalinate	0	0	0	0	0	0	0	0	0	0
133-07-3*	Folpet	252	51	0	0	0	0	0	303	2,444	2,747
72178-02-0	Fomesafen	255	250	0	0	0	0	0	505	2,501	3,006
50-00-0*	Formaldehyde	1,779,994	9,639,206	320,003	9,403,275	0	755	113,651	21,256,884	329,509	21,586,393
64-18-6	Formic acid	216,458	1,897,322	84,133	11,001,260	0	5	3,005	13,202,183	103,871	13,306,054
76-13-1	Freon 113	992,423	409,756	786	0	0	0	0	1,402,965	1,147	1,404,112
—	Glycol ethers	8,347,921	31,823,871	143,511	99,208	0	1,000	57,625	40,473,136	653,180	41,126,316
76-44-8*	Heptachlor	198	0	5	0	0	0	0	203	0	203
118-74-1	Hexachlorobenzene	115	105	274	717	0	0	0	1,211	23,449	24,660
87-68-3	Hexachloro-1,3-butadiene	1,374	1,007	256	952	0	0	0	3,589	310	3,899
77-47-4	Hexachlorocyclopentadiene	7,451	515	0	250	0	0	0	8,216	1,000	9,216
67-72-1	Hexachloroethane	2,122	759	32	2,024	0	0	0	4,937	471	5,408
110-54-3	n-Hexane	22,361,785	49,482,089	218,217	101,579	0	547	23,365	72,187,582	291,798	72,479,380
51235-04-2*	Hexazinone	17	283	3,075	0	0	0	0	3,375	250	3,625
67485-29-4*	Hydramethylnon	5	5	0	0	0	0	0	10	0	10
302-01-2	Hydrazine	7,797	2,646	23	0	0	0	250	10,716	18,549	29,265
10034-93-2	Hydrazine sulfate	0	0	0	350,000	0	0	0	350,000	0	350,000
7647-01-0*	Hydrochloric acid	1,934,070	63,180,765	4,985	260,005	0	0	23,148	65,402,973	236,994	65,639,967
74-90-8	Hydrogen cyanide	74,893	2,311,807	105	528,513	0	3	0	2,915,321	1,164	2,916,485
7664-39-3	Hydrogen fluoride	3,508,122	8,955,387	10,691	0	2,620	0	36,834	12,513,654	553,050	13,066,704
123-31-9	Hydroquinone	13,974	14,039	2,652	290,000	0	0	0	320,665	2,628	323,293
55406-53-6*	3-Iodo-2-propynyl butyl-carbamate	3,375	255	15	0	0	0	292	3,937	6,505	10,442
13463-40-6	Iron pentacarbonyl	1,280	99	0	0	0	0	0	1,379	0	1,379
78-84-2	Isobutyraldehyde	106,793	88,280	1,791	2,374	0	0	1	199,239	1,000	200,239
25311-71-1*	Isopfenphos	1,505	670	0	0	0	1,536	0	3,711	0	3,711
67-63-0*	Isopropyl alcohol (manufacturing)	289,954	770,538	0	0	0	0	0	1,060,492	8,296	1,068,788
80-05-7	4,4'-Isopropylidenediphenol	112,706	71,321	4,803	25,000	0	250,130	1,257	465,217	320,605	785,822
77501-63-4*	Lactofen	1,256	206	0	0	0	0	0	1,462	250	1,712
7439-92-1	Lead	192,275	425,787	12,233	0	0	124,959	3,286,129	4,041,383	1,743,638	5,785,021
—	Lead compounds	434,594	752,764	50,186	794	0	1,657,584	9,910,784	12,806,706	21,476,996	34,283,702
58-89-9*	Lindane	255	255	5	0	0	0	250	765	276	1,041
330-55-2*	Linuron	10	5	5	0	0	0	0	20	250	270
554-13-2	Lithium carbonate	3,703	11,475	260	210	0	4,000	8,540	28,188	160,793	188,981
121-75-5*	Malathion	821	1,784	10	0	0	0	0	2,615	0	2,615
108-31-6	Maleic anhydride	65,216	500,783	15	10	0	1,000	0	567,024	10,666	577,690
109-77-3	Malononitrile	0	250	0	475,997	0	0	0	476,247	0	476,247
12427-38-2*	Maneb	0	0	0	0	0	0	0	0	250	250
7439-96-5	Manganese**	6,751,776	384,254	117,375	1	7	44,526	9,995,845	17,293,784	13,905,393	31,199,177
—	Manganese compounds	806,259	1,020,847	1,901,227	14,880	2,808	4,583,105	35,566,390	43,895,516	26,664,625	70,560,141
93-65-2	Mecoprop	520	1,170	0	0	0	250	5	1,945	3,896	5,841
149-30-4	2-Mercaptobenzothiazole	604	9,668	30	52,000	0	0	0	62,302	205,531	267,833
7439-97-6	Mercury	10,144	4,037	468	0	0	6	531	15,186	4,272	19,458
—	Mercury compounds	2,011	905	73	9	0	0	0	2,998	21,612	24,610
150-50-5	Mephos	200	0	0	0	0	0	0	200	0	200
126-98-7	Methacrylonitrile	943	2	0	206,110	0	0	0	207,055	0	207,055
137-42-8*	Metham sodium	2,107	1,342	4	0	0	0	2	3,455	15,937	19,392
67-56-1	Methanol	27,987,712	178,370,259	7,353,977	23,801,105	499,383	10,041	1,921,624	239,944,101	1,411,828	241,355,929
94-74-6*	Methoxone	271	761	250	0	0	250	0	1,532	4,778	6,310
72-43-5*	Methoxychlor	10	15	0	0	0	0	0	25	0	25
109-86-4	2-Methoxyethanol	115,723	749,517	11,672	0	0	0	0	876,912	489	877,401
96-33-3	Methyl acrylate	70,888	116,348	8,145	147	0	0	162	195,690	32,136	227,826
1634-04-4	Methyl tert-butyl ether	952,626	2,170,463	103,615	176,424	750	0	26,568	3,430,446	243,220	3,673,666

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

\*Pesticide

\*\* One facility reported 6,211,171 pounds of fugitive air emissions of manganese in error for 1996, the correct amount is 750 pounds. Fugitive air emissions for manganese should be 541,355 pounds.



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Fluorouracil	930	0	0	930	0	0	0	0	0	0	930
Fluvalinate	0	0	0	0	0	0	0	0	0	0	0
Folpet	0	0	1,501	1,501	0	0	234	0	0	234	4,248
Fomesafen	0	0	0	0	0	0	5	0	0	5	4,801
Formaldehyde	87,248,040	8,433,075	71,530,408	167,211,523	40,083	212,122	701,402	1,888,772	0	2,842,379	191,563,245
Formic acid	883,880	6,705,732	158,130,642	165,720,254	988	2,216,791	177,878	2,899,291	0	5,294,948	184,631,875
Freon 113	692,774	74,113	219,059,366	219,826,253	114,875	53,651	1,074,322	255	0	1,243,103	222,533,621
Glycol ethers	195,662,187	43,392,075	27,509,395	266,563,657	3,320,310	14,836,166	2,299,832	11,095,899	2,530	31,554,737	341,156,273
Heptachlor	0	0	2,206	2,206	0	0	16,073	32	0	16,105	18,514
Hexachlorobenzene	7,100	240,000	2,132,566	2,379,666	1	2,215	42,146	0	0	44,362	2,448,643
Hexachloro-1,3-butadiene	0	66,000	6,107,496	6,173,496	0	0	277,522	2	0	277,524	6,455,792
Hexachlorocyclopentadiene	0	0	246,437	246,437	0	800	55,082	1,580	0	57,462	312,981
Hexachloroethane	0	939,000	4,600,732	5,539,732	0	71,034	120,921	0	0	191,955	5,736,137
n-Hexane	226,946,357	27,541,392	183,924,283	438,412,032	10,711,026	15,066,284	3,265,794	92,888	0	29,135,992	539,616,121
Hexazinone	0	0	4,091	4,091	0	0	213,513	250	0	213,763	220,925
Hydramethylnon	0	0	0	0	0	0	0	5	0	5	5
Hydrazine	0	300	338,596	338,896	1	65	1,961	3,733	0	5,760	373,612
Hydrazine sulfate	0	0	0	0	0	0	0	0	0	0	350,000
Hydrochloric acid	73,213,533	120,000	684,523,200	757,856,733	3,106,585	11,450	3,357,319	2,025,449	59,564	8,560,367	833,864,867
Hydrogen cyanide	73,467	33,847,854	27,343,220	61,264,541	0	250	3,316	1,380	0	4,946	64,188,841
Hydrogen fluoride	113,956,854	0	102,386,943	216,343,797	300,265	6,692	2,063,848	336,467	0	2,707,272	232,944,508
Hydroquinone	962	1,298,419	388,600	1,687,981	0	47,951	99,588	32,930	0	180,469	2,189,143
3-Iodo-2-propynyl butyl-carbamate	6,193	0	340	6,533	76,936	1,183	3,665	13,342	0	95,126	112,013
Iron pentacarbonyl	0	0	0	0	0	0	0	0	0	0	1,379
Isobutyraldehyde	5,109	2,316,637	555,954	2,877,700	4,110	492,237	50,743	73,213	0	620,303	3,738,528
Isofenphos	9,948	0	0	9,948	0	0	2,162	0	0	2,162	17,526
Isopropyl alcohol (manufacturing)	125,634	3,274,940	146,031	3,546,605	10,631	430,297	23,421	142,613	36,060	643,022	4,936,742
4,4'-Isopropylidenediphenol	102,400	8,712,328	998,531	9,813,259	1,620	75,268	57,588	19,576	0	154,052	10,791,340
Lactofen	13	0	0	13	0	0	4,040	0	0	4,040	5,408
Lead	209,065,669	89,267	2,403,298	211,558,234	36,000,051	5,320	2,016,537	19,579	189,780	38,231,267	255,641,888
Lead compounds	396,430,669	0	1,350,570	397,781,239	283,323,678	68,985	12,061,469	27,932	538,834	296,020,898	752,768,994
Lmdane	371	0	0	371	0	0	1,388	0	0	1,388	2,031
Linuron	0	0	0	0	0	0	250	0	0	250	234
Lithium carbonate	35,836	0	0	35,836	0	0	4,450	10	0	4,460	220,432
Malathion	104	0	0	104	0	0	1,957	0	0	1,957	4,634
Maleic anhydride	6,847	3,333,330	36,712,857	40,053,034	7,307	98,199	1,311,988	3,017	0	1,420,511	42,033,547
Malononitrile	0	0	21	21	0	0	0	0	0	0	432,995
Maneb	0	0	0	0	0	0	1,108	0	0	1,108	1,322
Manganese	32,636,249	0	371,283	33,007,532	90,014,975	36,070	1,314,531	72,506	40,863	91,478,945	133,772,704
Manganese compounds	134,562,338	21,216	899,859	135,483,413	52,316,073	223,482	6,349,936	323,137	20,000	59,232,628	263,481,976
Mecoprop	1,972	0	990	2,962	0	0	2,747	5	0	2,752	10,648
2-Mercaptobenzothiazole	5,630	0	144,750	150,380	19,118	800,000	12,313	929	0	832,360	1,245,056
Mercury	803,882	0	4,114	807,996	23,748	0	6,586	5	0	30,339	860,054
Mercury compounds	46,348	0	1	46,349	2,000	500	7,855	10	0	10,365	79,595
Merphos	0	0	0	0	0	0	0	0	0	0	200
Methacrylonitrile	0	0	503	503	0	0	0	0	0	0	583,083
Metham sodium	35,780	0	121	35,901	0	557	5,938	1	0	6,496	61,733
Methanol	537,583,324	331,508,259	950,729,426	1,819,821,009	17,478,098	90,419,383	37,230,842	81,631,668	13	226,760,004	2,290,480,930
Methoxone	8,591	0	45	8,636	0	0	1,191	5	0	1,196	16,012
Methoxychlor	0	0	0	0	0	0	1,250	0	0	1,250	818
2-Methoxyethanol	1,704,300	146,744	2,181,353	4,032,397	11,084	1,304,325	97,388	741,640	0	2,154,437	7,042,511
Methyl acrylate	1,010,001	908,315	1,479,300	3,397,616	10,018	313,548	79,773	15,322	0	418,661	4,042,978
Methyl tert-butyl ether	1,693,888	807,055	2,525,427	5,026,370	283,774	1,853,551	604,850	253,430	0	2,995,605	12,689,501

**Note.** On-site Waste Management from Section and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. **Production-related Waste** from Section 8 of Form R (total excludes remedial and catastrophic quantities).



Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number	Chemical	On-site Releases								Off-site Releases	Total On- and Off-site Releases Pounds
		Air			Underground Injection		On-site Land Releases			Transfers Off-site to Disposal Pounds	
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds	Surface Water Discharges Pounds	Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds	Total On-site Releases Pounds		
79-22-1	Methyl chlorocarbonate	2,350	87	5	0	0	0	5	2,447	0	2,447
101-14-4	4,4'-Methylenebis(2-chloro-aniline)	251	255	0	0	0	0	750	1,256	5	1,261
101-61-1	4,4'-Methylenebis(N,N-dimethyl) benzeneamine	0	1	0	0	0	0	0	1	0	1
74-95-3	Methylene bromide	85,043	14,249	0	0	0	0	0	99,292	0	99,292
101-77-9	4,4'-Methylenedianiline	8,227	1,535	23	41,120	0	0	0	50,905	19,591	70,496
78-93-3	Methyl ethyl ketone	20,641,669	38,426,835	74,989	432,767	5	36,301	103,297	59,715,863	247,023	59,962,886
60-34-4	Methyl hydrazine	250	250	0	0	0	0	0	500	0	500
74-88-4	Methyl iodide	20,141	45,084	0	23,500	0	0	0	88,725	3,300	92,025
108-10-1	Methyl isobutyl ketone	4,570,658	14,312,039	22,569	162,000	0	3	4,855	19,072,124	35,672	19,107,796
624-83-9	Methyl isocyanate	1,116	373	0	0	0	0	0	1,489	0	1,489
556-61-6 *	Methyl isothiocyanate	41	41	0	0	0	0	0	82	0	82
75-86-5	2-Methylacetonitrile	3,141	1,004	0	0	0	0	0	4,145	0	4,145
80-62-6	Methyl methacrylate	507,244	1,332,648	2,551	160,000	0	0	1,072	2,003,515	107,184	2,110,699
924-42-5	N-Methylolacrylamide	1,375	1,739	1,170	0	0	0	32	4,316	776	5,092
298-00-0 *	Methyl parathion	716	312	0	0	0	0	0	1,028	360	1,388
109-06-8	2-Methylpyridine	68,705	3,719	0	65,062	0	0	0	137,486	504	137,990
872-50-4	N-Methyl-2-pyrrolidone	1,579,639	1,510,899	52,339	2,905,944	1,760	40,336	26,613	6,117,530	550,926	6,668,456
21087-64-9 *	Metribuzin	2	1,010	5	0	0	0	0	1,017	0	1,017
7786-34-7	Mevinphos	0	0	0	0	0	0	0	0	0	0
2212-67-1 *	Molinate	315	271	1	0	0	0	0	587	4,405	4,992
1313-27-5	Molybdenum trioxide	159,992	36,366	28,004	209,900	0	38,627	33,026	505,915	628,643	1,134,558
76-15-3	Monochloropentafluoroethane (CFC-115)	67,620	3,105	2,155	0	0	0	0	72,880	1	72,881
505-60-2	Mustard gas	0	0	0	0	0	0	0	0	0	0
88671-89-0 *	Myclobutanil	0	0	0	0	0	0	0	0	0	0
142-59-6 *	Nabam	0	0	0	0	0	0	0	0	0	0
300-76-5 *	Naled	0	50	0	0	0	0	0	50	0	50
91-20-3 *	Naphthalene	1,281,814	1,576,524	11,737	285,877	0	23,379	278,134	3,457,465	576,597	4,034,062
134-32-7	alpha-Naphthylamine	0	0	0	0	0	0	0	0	0	0
7440-02-0	Nickel	256,602	125,211	28,163	4,225	0	54,458	206,208	674,867	3,480,910	4,155,777
—	Nickel compounds	78,907	246,069	60,646	86,028	250	101,549	3,597,373	4,170,822	4,757,894	8,928,716
—	Nicotine and salts	25,720	418,225	881	0	0	0	0	444,826	426,142	870,968
1929-82-4 *	Nitrapyrin	0	1	0	0	0	0	0	1	0	1
—	Nitrate compounds	12,981	334,102	117,714,518	39,398,312	250	3,415	3,710,521	161,174,099	2,590,615	163,764,714
7697-37-2	Nitric acid	628,830	2,453,528	221,434	17,483,972	0	64,756	111,735	20,964,255	1,477,976	22,442,231
139-13-9	Nitrilotriacetic acid	10	0	78	1,500	0	0	0	1,588	0	1,588
100-01-6	p-Nitroaniline	10,100	1,660	50	0	0	0	0	11,810	0	11,810
99-59-2	5-Nitro-o-anisidine	5	5	0	0	0	0	0	10	0	10
98-95-3	Nitrobenzene	23,351	15,888	951	193,527	0	45	1	233,763	3,825	237,588
55-63-0	Nitroglycerin	1,439	21,027	18,508	0	0	3	3,778	44,755	3,610	48,365
88-75-5	2-Nitrophenol	5	28	51	0	0	0	0	84	90	174
100-02-7 *	4-Nitrophenol	890	45	0	0	0	0	0	935	0	935
79-46-9	2-Nitropropane	19,226	15,062	2,790	0	0	0	0	37,078	0	37,078
86-30-6	N-Nitrosodiphenylamine	10	0	0	0	0	0	0	10	0	10
156-10-5	p-Nitrosodiphenylamine	24	0	0	0	0	0	0	24	420	444
59-89-2	N-Nitrosomorpholine	0	0	0	0	0	0	0	0	0	0
99-55-8	5-Nitro-o-toluidine	0	10	0	0	0	0	0	10	30	40
27314-13-2 *	Norflurazon	0	8	0	0	0	0	0	8	40,000	40,008
19044-88-3 *	Oryzalin	0	5	0	0	0	0	0	5	0	5
301-12-2 *	Oxydemeton methyl	0	0	0	0	0	0	0	0	0	0
19666-30-9 *	Oxydiazon	10	431	0	0	0	0	0	441	0	441
42874-03-3 *	Oxyfluorfen	0	0	0	0	0	0	0	0	0	0
10028-15-6	Ozone	39,814	661,906	0	0	0	0	0	701,720	0	701,720
123-63-7	Paraldehyde	12	23	0	0	0	0	0	35	0	35

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

\*Pesticide



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Methyl chlorocarbonate	0	0	4,110	4,110	0	0	0	0	0	0	6,580
4,4'-Methylenebis(2-chloro-aniline)	0	0	0	0	0	2,494	11,299	5	0	13,798	13,633
4,4'-Methylenebis(N,N-dimethyl) benzeneamine	0	0	0	0	0	0	0	0	0	0	1
Methylene bromide	1,211,800	0	270	1,212,070	0	0	0	0	0	0	1,311,362
4,4'-Methylenedianiline	2,900	52,414	83,357	138,671	0	2,235	55,191	2,023	0	59,449	263,947
Methyl ethyl ketone	61,050,421	92,654,090	68,944,661	222,649,172	20,101,826	37,076,309	4,887,309	598,327	70,490	62,734,261	350,937,478
Methyl hydrazine	0	0	44	44	0	0	5	0	0	5	429
Methyl iodide	0	1,900	341	2,241	0	0	27	0	0	27	94,229
Methyl isobutyl ketone	52,337,198	20,171,448	13,243,777	85,752,423	12,107,396	17,968,462	1,233,056	299,154	2,013	31,610,081	139,241,590
Methyl isocyanate	0	0	91,617	91,617	0	0	3,007	0	0	3,007	96,100
Methyl isothiocyanate	0	0	0	0	0	73	340	0	0	413	495
2-Methylacetonitrile	0	0	19,305	19,305	0	0	0	0	0	0	23,456
Methyl methacrylate	4,567,223	2,367,486	4,635,442	11,570,151	58,074	1,328,264	211,404	229,373	0	1,827,115	15,528,946
N-Methylolacrylamide	449	0	14,403	14,852	0	45,763	314	4,435	0	50,512	69,237
Methyl parathion	10	0	0	10	0	0	2,120	0	0	2,120	2,920
2-Methylpyridine	95,000	50,000	52,000	197,000	0	2,873	538	23,000	0	26,411	359,466
N-Methyl-2-pyrrolidone	1,034,445	373,437	4,842,383	6,250,265	6,671,779	2,295,296	1,684,956	1,124,740	0	11,776,771	24,986,689
Metribuzin	0	0	38,864	38,864	0	0	13,213	0	0	13,213	53,094
Mevinphos	0	0	0	0	0	0	0	0	0	0	0
Molinate	0	0	0	0	0	21	1,256	0	0	1,277	6,039
Molybdenum trioxide	6,529,490	0	31,277	6,560,767	2,736,322	3,276	360,880	63,951	0	3,164,429	11,204,989
Monochloropentafluoroethane (CFC-115)	110,000	0	68,635	178,635	0	0	14,262	0	0	14,262	265,778
Mustard gas	0	0	0	0	0	0	0	0	0	0	0
Myclobutanil	0	0	0	0	0	0	0	0	0	0	0
Nabam	0	0	0	0	0	0	0	0	0	0	0
Naled	0	0	500	500	0	0	3,176	5	0	3,181	3,700
Naphthalene	12,512,289	5,184,798	142,338,479	160,035,566	248,539	3,380,659	797,683	23,965	2,800	4,453,646	168,190,422
alpha-Naphthylamine	0	0	0	0	0	0	0	0	0	0	0
Nickel	34,302,930	16,476	996,941	35,316,347	73,839,083	70,582	2,060,315	86,328	3,650	76,059,958	116,797,060
Nickel compounds	8,360,348	37,998	2,719,330	11,117,676	25,082,239	1,379	864,624	93,795	8,651	26,050,688	60,211,166
Nicotine and salts	8,896	0	846,164	855,060	158,695	0	50,591	247,957	0	457,243	2,120,254
Nitrapyrin	0	0	0	0	0	550	130	0	0	680	681
Nitrate compounds	103,734,553	0	27,468,515	131,203,068	5,537,321	98,981	5,266,009	59,945,210	0	70,847,521	367,190,061
Nitric acid	24,081,964	165,558	269,641,370	293,888,892	2,610,233	346	11,575,491	3,851,407	25,118	18,062,595	333,654,906
Nitrolotracetic acid	0	0	1,017,756	1,017,756	0	0	0	18,000	0	18,000	1,037,344
p-Nitroaniline	0	0	460	460	0	0	89,720	15,850	0	105,570	118,970
5-Nitro-o-anisidine	0	0	0	0	0	0	0	5	0	5	5
Nitrobenzene	3,552,450	1,781,334	1,146,945	6,480,729	0	20,703	599,215	116	0	620,034	7,336,665
Nitroglycerin	18,000	0	315,442	333,442	0	36,584	15,809	217	0	52,610	424,506
2-Nitrophenol	0	53,000	75,000	128,000	0	0	20,900	47	0	20,947	149,179
4-Nitrophenol	0	12,990	60,000	72,990	0	1	476,030	169	0	476,200	549,931
2-Nitropropane	0	0	58,297	58,297	0	50	12,467	0	0	12,517	107,890
N-Nitrosodiphenylamine	0	0	47,762	47,762	0	230,000	120,000	0	0	350,000	397,772
p-Nitrosodiphenylamine	0	9,400	0	9,400	0	17,000	180	0	0	17,180	27,024
N-Nitrosomorpholine	0	0	0	0	0	0	23,600	0	0	23,600	24,000
5-Nitro-o-toluidine	0	0	0	0	0	0	0	0	0	0	40
Norflurazon	0	0	0	0	0	0	1,041	0	0	1,041	41,008
Oryzalin	0	0	0	0	0	0	51,800	0	0	51,800	52,003
Oxydemeton methyl	0	0	0	0	0	0	0	0	0	0	0
Oxydiazon	13,404	0	2,600	16,004	0	0	250	0	0	250	16,705
Oxyfluorfen	0	0	0	0	0	0	13,126	7,053	0	20,179	20,181
Ozone	0	0	2,221,877	2,221,877	0	0	0	0	0	0	2,908,498
Paraldehyde	0	48,566	230,000	278,566	0	5	0	0	0	5	278,606

Note On-site Waste Management from Section and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number	Chemical	On-site Releases								Off-site	Total On- and Off-site Releases Pounds
		Air			On-site Land Releases					Releases	
		Fugitive or	Stack or	Surface	Underground Injection		RCRA	Other	Total	Transfers	
		Nonpoint Air	Point Air	Water	Class I	Class II-V	Subtitle C	On-site Land	On-site	Off-site to	
		Emissions	Emissions	Discharges	Wells	Wells	Landfills	Releases	Releases	Disposal	
		Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1910-42-5 *	Paraquat dichloride	500	500	0	0	0	0	0	1,000	5	1,005
56-38-2 *	Parathion	0	0	0	0	0	0	0	0	0	0
1114-71-2 *	Pebulate	250	250	0	0	0	0	0	500	500	1,000
40487-42-1 *	Pendimethalin	1,470	760	22	0	0	750	140	3,142	0	3,142
76-01-7	Pentachloroethane	1,427	225	22	0	0	0	0	1,674	0	1,674
87-86-5 *	Pentachlorophenol	8,164	4,977	8,236	0	0	2,750	250	24,377	196,075	220,452
79-21-0 *	Peracetic acid	960	10,595	5	0	0	0	812	12,372	0	12,372
594-42-3	Perchloromethyl mercaptan	12	552	0	0	0	0	0	564	0	564
52645-53-1 *	Permethrin	981	514	0	0	0	0	0	1,495	1,250	2,745
85-01-8	Phenanthrene	14,517	113,917	103	0	0	1,855	4,461	134,853	89,038	223,891
108-95-2 *	Phenol	2,456,348	7,096,154	72,555	2,045,370	0	12,998	146,061	11,829,486	1,016,261	12,845,747
26092-80-2 *	Phenothrin	0	0	0	0	0	0	0	0	0	0
95-54-5	1,2-Phenylenediamine	22	494	3,000	0	0	26,940	0	30,456	8	30,464
108-45-2	1,3-Phenylenediamine	327	2,342	128,739	0	0	37,508	0	168,916	633	169,549
106-50-3	p-Phenylenediamine	3,416	564	409	0	0	1,308	0	5,697	0	5,697
90-43-7 *	2-Phenylphenol	55	4,052	1	0	0	0	250	4,358	1,789	6,147
57-41-0	Phenytol	0	0	0	0	0	0	0	0	12,800	12,800
75-44-5	Phosgene	6,635	9,648	0	5	0	0	0	16,288	0	16,288
7803-51-2	Phosphine	11,941	8,440	0	0	0	643	0	21,024	0	21,024
7664-38-2 *	Phosphoric acid	196,086	851,959	28,367,233	9,716	0	43,325	31,417,396	60,885,715	2,331,930	63,217,645
7723-14-0	Phosphorus (yellow or white)	24,359	1,577	255	0	0	0	2,057,524	2,083,715	19,839	2,103,554
85-44-9	Phthalic anhydride	59,978	367,260	174	0	0	0	0	427,412	103,707	531,119
1918-02-1 *	Picloram	521	1	0	0	0	0	0	522	0	522
88-89-1	Picric acid	0	0	0	94,031	0	0	0	94,031	0	94,031
51-03-6 *	Piperonyl butoxide	206	307	14	0	0	0	0	527	0	527
—	Polybrominated biphenyls	0	250	0	0	0	0	0	250	375	625
—	Polychlorinated alkanes	1,775	1,012	8,372	0	0	0	687	11,846	89,133	100,979
1336-36-3	Polychlorinated biphenyls (PCBs)	5	250	0	0	0	9,205	0	9,460	51,086	60,546
—	Polycyclic aromatic compounds	121,107	521,753	8,079	0	0	0	14,439	665,378	1,248,088	1,913,466
7758-01-2	Potassium bromate	5	0	0	0	0	0	0	5	0	5
128-03-0 *	Potassium dimethyldithio- carbamate	73	107	0	0	0	0	0	180	0	180
137-41-7 *	Potassium N-methyldithio- carbamate	0	0	0	0	0	0	0	0	0	0
41198-08-7 *	Profenofos	0	0	0	0	0	0	0	0	0	0
7287-19-6 *	Prometryn	1,015	283	27	0	0	0	0	1,325	500	1,825
23950-58-5 *	Pronamide	5	250	0	0	0	0	0	255	0	255
1918-16-7 *	Propachlor	0	250	0	0	0	0	0	250	1,200	1,450
1120-71-4	Propane sulfone	0	0	0	0	0	0	0	0	0	0
709-98-8 *	Propanil	500	2,877	250	0	0	0	0	3,627	0	3,627
2312-35-8 *	Propargite	5	255	0	0	0	0	0	260	0	260
107-19-7	Propargyl alcohol	1,799	6,964	0	285,166	0	0	0	293,929	576	294,505
31218-83-4 *	Propetamphos	5	5	0	0	0	250	0	260	1,000	1,260
60207-90-1 *	Propiconazole	5	5	0	0	0	0	0	10	1,332	1,342
123-38-6	Propionaldehyde	76,050	94,958	32,077	74,613	0	0	0	277,698	62	277,760
114-26-1 *	Propoxur	0	0	0	0	0	0	0	0	0	0
115-07-1	Propylene	10,546,131	15,859,826	7,133	0	0	750	1,708	26,415,548	2,181	26,417,729
75-55-8	Propyleneimine	366	36	0	0	0	0	0	402	0	402
75-56-9 *	Propylene oxide	226,160	354,701	45,393	12,141	0	0	335	638,730	39,230	677,960
110-36-1	Pyridine	47,611	43,568	908	428,000	0	1	0	520,088	775	520,863
91-22-5	Quinoline	12,053	10,921	20	32,000	0	0	466	55,460	5,072	60,532
106-51-4	Quinone	3,801	3,304	500	0	0	0	0	7,605	0	7,605
82-68-8 *	Quintozene	1,550	1,061	0	0	0	836	0	3,447	0	3,447
76578-14-8 *	Quizalofop-ethyl	1	0	0	0	0	0	0	1	0	1
10453-86-8 *	Resmethrin	1	0	0	0	0	0	0	1	0	1

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

\*Pesticide



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Paraquat dichloride	23	0	0	23	0	0	250	32	0	282	326
Parathion	0	0	0	0	0	0	0	0	0	0	0
Pebulate	0	0	0	0	0	0	250	0	0	250	820
Pendimethalin	600	0	150,000	150,600	0	0	5,108	0	0	5,108	160,138
Pentachloroethane	4,150,000	390,000	6,531,742	11,071,742	0	12,300	208,004	0	0	220,304	11,293,709
Pentachlorophenol	1,232,965	11,754	22,743	1,267,462	2,971	8,875	67,358	611	0	79,815	1,551,847
Peracetic acid	0	0	4,160	4,160	0	0	7,300	2,664	0	9,964	26,290
Perchloromethyl mercaptan	0	0	98,690	98,690	0	0	10	0	0	10	99,246
Permethrin	0	0	177	177	0	0	2,660	0	0	2,660	3,921
Phenanthrene	445,644	611,002	746,789	1,803,435	1,495	192,495	122,964	42	0	316,996	2,471,952
Phenol	40,787,213	27,483,437	25,790,593	94,061,243	120,652	3,787,203	3,556,740	3,280,289	0	10,744,884	117,406,441
Phenothrin	0	0	0	0	0	0	0	0	0	0	0
1,2-Phenylenediamine	0	0	136,000	136,000	0	0	930	15	0	945	167,409
1,3-Phenylenediamine	1,200	0	1,162,215	1,163,415	0	1,091	144,552	3,157	0	148,800	1,481,506
p-Phenylenediamine	0	0	303,611	303,611	0	0	22,030	5,850	0	27,880	339,489
2-Phenylphenol	0	92	705,215	705,307	0	0	250	24,662	0	24,912	732,897
Phenytol	0	0	0	0	0	0	250	0	0	250	13,050
Phosgene	0	200	17,249,349	17,249,549	0	0	2,270	0	0	2,270	17,268,049
Phosphine	0	0	350,643	350,643	0	0	0	0	0	0	371,022
Phosphoric acid	310,993,398	8,300	117,388,358	428,390,056	7,460,279	72,379	1,835,400	2,745,535	750	12,114,343	503,562,424
Phosphorus (yellow or white)	300	0	610,526	610,826	110,484	0	21,916	272	0	132,672	2,864,362
Phthalic anhydride	90,881	2,098,212	12,577,144	14,766,237	475	4,814,622	241,672	149,891	0	5,206,660	20,539,607
Picloram	0	0	26,464	26,464	0	0	0	0	0	0	26,986
Picric acid	0	136,931	1,779,450	1,916,381	0	0	21,015	0	0	21,015	2,031,427
Piperonyl butoxide	0	0	9	9	0	0	4,989	0	0	4,989	5,655
Polybrominated biphenyls	0	0	0	0	4,219	0	0	0	0	4,219	4,724
Polychlorinated alkanes	17,136	69,000	228,286	314,422	271,378	230,140	287,210	74,867	0	863,595	1,316,176
Polychlorinated biphenyls (PCBs)	0	0	0	0	59,972	250	243,194	0	0	303,416	52,237
Polycyclic aromatic compounds	1,202,404	16,190,102	2,909,759	20,302,265	8,743,647	73,385	4,641	624	0	8,822,297	31,063,793
Potassium bromate	0	0	0	0	0	0	0	0	0	0	8
Potassium dimethyldithiocarbamate	0	0	0	0	40,000	0	765	147,911	0	188,676	188,756
Potassium N-methyldithiocarbamate	0	0	0	0	0	0	43	0	0	43	43
Profenofos	0	0	0	0	0	0	0	0	0	0	0
Prometryn	0	0	827	827	0	5	56,565	12	0	56,582	60,636
Pronamide	8,800	0	0	8,800	0	0	500	0	0	500	9,670
Propachlor	0	0	0	0	0	0	8,450	15	0	8,465	9,900
Propane sultone	0	0	4	4	0	0	0	0	0	0	4
Propamyl	0	0	0	0	0	0	1,744	0	0	1,744	4,481
Propargite	0	0	0	0	0	3,808	11,970	105	0	15,883	15,893
Propargyl alcohol	5	211,930	333,937	545,872	0	289,545	11,256	24,937	0	325,738	1,166,171
Propetamphos	0	0	0	0	0	0	0	0	0	0	1,032
Propiconazole	0	0	0	0	0	0	0	0	0	0	3,055
Propionaldehyde	0	255,989	4,446,808	4,702,797	0	18,135	9	320,765	0	338,909	5,319,755
Propoxur	0	0	0	0	0	0	0	0	0	0	0
Propylene	60,407,279	567,598,551	302,585,973	930,591,803	0	215,250	272,632	6,315	250	494,447	957,526,443
Propyleneimine	0	0	1,734	1,734	0	0	0	0	0	0	2,136
Propylene oxide	3,780,004	18,451,509	13,284,599	35,516,112	255	250,033	1,871	206,725	0	458,884	36,848,356
Pyridine	7,426,653	1,278,558	886,200	9,591,411	31,550	260,552	252,608	355,442	0	900,152	11,009,790
Quinoline	15,881	34,652	91,001	141,534	2,180	34,429	17,015	255	0	53,879	255,277
Quinone	0	230,508	366,115	596,623	0	0	50,513	0	0	50,513	654,741
Quintozene	884	0	0	884	0	221,410	398,894	4	0	620,308	624,210
Quizalofop-ethyl	0	0	0	0	0	0	0	0	0	0	1
Resmethrin	0	0	0	0	0	0	600	0	0	600	601

**Note** On-site Waste Management from Section 6 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. **Production-related Waste** from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number	Chemical	On-site Releases								Off-site	Total On- and Off-site Releases Pounds
		Air			On-site Land Releases					Releases	
		Fugitive or	Stack or	Surface	Underground Injection	RCRA			Total		
		Nonpoint Air	Point Air	Water	Class I	Class II-V	Subtitle C	Other			
		Emissions	Emissions	Discharges	Wells	Wells	Landfills	Releases	On-site	Transfers	On-site
		Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Off-site to	Off-site
										Disposal	Releases
										Pounds	Pounds
81-07-2	Saccharin (manufacturing)	210	33	0	0	0	0	0	243	1,200	1,443
94-59-7	Saffrole	500	5	0	0	0	0	0	505	0	505
7782-49-2	Selenium	5	40	97	0	0	0	29	171	784	955
—	Selenium compounds	1,986	45,278	2,404	3,100	0	0	211,237	264,005	61,491	325,496
74051-80-2*	Sethoxydim	0	0	0	0	0	0	0	0	0	0
7440-22-4*	Silver	6,261	1,947	149	0	0	0	6,306	14,663	21,736	36,399
—	Silver compounds	3,016	13,375	8,147	370	0	0	45,693	70,601	10,132	80,733
122-34-9*	Simazine	1,007	3,584	93	0	0	0	0	4,684	54,457	59,141
26628-22-8	Sodium azide	1,110	20,203	268	0	0	111	5	21,697	133,449	155,146
1952-69-0*	Sodium dicamba	5	750	0	0	0	0	0	755	0	755
128-04-1*	Sodium dimethyldithio- carbamate	1,453	1,381	10	0	0	0	0	2,844	121,595	124,439
7632-00-0	Sodium nitrite	75,141	210,769	1,302,379	727,000	0	0	63,654	2,378,943	504,474	2,883,417
100-42-5	Styrene	10,917,192	31,011,969	12,864	228,317	0	90,680	176,010	42,437,032	3,251,349	45,688,381
96-09-3	Styrene oxide	7	24	0	0	0	0	0	31	0	31
7664-93-9*	Sulfuric acid	738,366	18,951,993	1,281	15,000	0	0	52,709	19,759,349	1,380,947	21,140,296
2699-79-8*	Sulfuryl fluoride	15,000	347,000	0	0	0	0	0	362,000	0	362,000
35400-43-2	Sulprofos	0	0	0	0	0	0	0	0	0	0
34014-18-1*	Tebuthiuron	0	5	0	0	0	0	0	5	0	5
3383-96-8*	Temephos	0	0	0	0	0	0	0	0	0	0
5902-51-2*	Terbacil	0	0	3,835	0	0	0	0	3,835	0	3,835
630-20-6	1,1,1,2-Tetrachloroethane	3,960	2,506	30	0	0	0	1	6,497	19	6,516
79-34-5	1,1,2,2-Tetrachloroethane	12,638	2,850	130	0	0	0	0	15,618	7	15,625
127-18-4	Tetrachloroethylene	3,095,666	4,765,504	1,311	13,436	0	26,000	4,442	7,906,359	22,071	7,928,430
961-11-5*	Tetrachlorvinphos	110	255	5	0	0	0	0	370	2,030	2,400
64-75-5	Tetracycline hydrochloride	5	250	0	0	0	0	0	255	0	255
7696-12-0*	Tetramethrin	0	0	0	0	0	0	0	0	0	0
—	Thallium compounds	0	0	0	0	0	0	0	0	0	0
148-79-8*	Thiabendazole	230	4,600	0	0	0	0	0	4,830	0	4,830
28249-77-6*	Thiobencarb	530	281	0	0	0	0	0	811	4,930	5,741
59669-26-0*	Thiodicarb	488	1,021	0	0	0	250	16,032	17,791	250	18,041
23564-06-9	Thiophanate ethyl	0	0	0	0	0	0	0	0	0	0
23564-05-8*	Thiophanate methyl	75	422	0	0	0	0	0	497	1,167	1,664
62-56-6	Thiourea	1,093	119	339	5,000	0	0	250	6,801	2,590	9,391
137-26-8*	Thiram	1,674	1,960	40	0	0	0	2,000	5,674	94,436	100,110
1314-20-1	Thorium dioxide	0	1	0	0	0	0	0	1	0	1
7550-45-0	Titanium tetrachloride	21,080	9,771	0	0	0	0	0	30,851	34,013	64,864
108-88-3	Toluene	41,711,487	83,670,741	68,697	325,920	3,355	143,008	414,152	126,337,360	1,022,535	127,359,895
584-84-9	Toluene-2,4-diisocyanate	3,247	4,086	0	0	0	0	192	7,525	3,586	11,111
91-08-7	Toluene-2,6-diisocyanate	6,262	7,404	0	0	0	0	48	13,714	897	14,611
26471-62-5	Toluenediisocyanate q(mixed isomers)	22,122	23,191	0	0	0	0	353	45,666	33,029	78,695
95-53-4	o-Toluidine	8,997	8,584	260	17,450	0	0	10	35,301	1,401	36,702
43121-43-3*	Triadimefon	0	0	0	0	0	0	0	0	0	0
2303-17-5*	Triallate	250	339	0	0	0	0	0	589	16,509	17,098
101200-48-0*	Trifluralin methyl	0	1	0	0	0	0	0	1	0	1
2155-70-6*	Tributyltin methacrylate	10	10	5	0	0	0	0	25	0	25
78-48-8*	S,S,S-Tributyltrithiophosphate	1,325	473	2	0	0	0	8	1,808	0	1,808
52-68-6*	Trichlorfon	0	0	0	0	0	0	0	0	0	0
76-02-8	Trichloroacetyl chloride	0	1	0	0	0	0	0	1	0	1
120-82-1	1,2,4-Trichlorobenzene	32,283	124,980	433	750	0	0	0	158,446	4,487	162,933
71-55-6	1,1,1-Trichloroethane	4,339,326	4,428,210	844	1,354	0	4,505	21,798	8,796,037	34,031	8,830,068
79-00-5	1,1,2-Trichloroethane	33,142	305,908	516	0	0	0	16	339,582	85	339,667
79-01-6	Trichloroethylene	10,665,331	10,606,835	541	1,291	0	5,550	17,590	21,297,138	76,327	21,373,465
75-69-4	Trichlorofluoromethane (CFC-11)	552,444	140,307	961	0	0	0	5,575	699,287	180	699,467

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

\*Pesticide



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Saccharin (manufacturing)	0	0	12,000	12,000	0	0	0	12	0	12	13,512
Safrole	0	0	4	4	0	0	0	134	0	134	234
Selenium	0	0	29	29	0	755	12,119	405	0	13,279	14,099
Selenium compounds	601,563	0	0	601,563	133,241	4,700	32,979	21	8,464	179,405	1,100,414
Sethoxydim	0	0	0	0	0	0	0	0	0	0	0
Silver	541,588	0	26,366	567,954	1,647,173	0	3,481	388	7	1,651,049	1,391,508
Silver compounds	638,500	0	3,967,716	4,606,216	1,408,111	0	32,081	2,260	250	1,442,702	5,976,018
Simazine	0	0	32,000	32,000	0	0	250	5	0	255	89,271
Sodium azide	91,031	0	78,892	169,923	1,603,236	0	2,216,294	709	0	3,820,239	4,152,824
Sodium dicamba	0	0	0	0	0	0	0	750	0	750	528
Sodium dimethyldithiocarbamate	200	0	400,906	401,106	1,780,555	0	372,577	157,075	0	2,310,207	2,832,939
Sodium nitrite	213,726	0	6,975,746	7,189,472	32,816	1	578,847	2,932,827	17,002	3,561,493	13,695,779
Styrene	19,962,598	21,544,063	15,021,756	56,528,417	1,154,843	7,704,571	2,798,362	264,473	900	11,923,149	113,542,563
Styrene oxide	0	35,337	0	35,337	0	861	0	0	0	861	36,230
Sulfuric acid	798,641,136	3,600	389,473,985	1,188,118,721	6,025,376	75	4,216,967	1,898,308	45	12,140,771	1,220,523,045
Sulfuryl fluoride	0	0	0	0	0	0	0	0	0	0	362,000
Sulprofos	0	0	0	0	0	0	0	0	0	0	0
Tebuthiuron	1	0	1,000	1,001	0	0	937	0	0	937	2,002
Temephos	0	0	0	0	0	0	0	0	0	0	0
Terbacil	0	0	2,983	2,983	0	0	7,547	0	0	7,547	14,365
1,1,1,2-Tetrachloroethane	2,500,000	0	2,836,903	5,336,903	0	140,000	237,704	0	0	377,704	5,721,626
1,1,2,2-Tetrachloroethane	4,808,000	924,000	11,024,249	16,756,249	2,380,211	0	248,014	90	0	2,628,315	19,400,145
Tetrachloroethylene	46,710,867	2,647,705	20,674,831	70,033,403	5,822,463	530,548	1,440,050	1,847	0	7,794,908	85,970,037
Tetrachlorvinphos	615	0	1,020	1,635	0	44,900	3,885	0	0	48,785	52,662
Tetracycline hydrochloride	0	0	0	0	0	0	500	250	0	750	450
Tetramethrin	0	0	0	0	0	0	0	0	0	0	0
Thallium compounds	0	0	0	0	0	0	5	0	0	5	10
Thiabendazole	0	0	5,700	5,700	0	0	1,126	140	0	1,266	11,766
Thiobencarb	380	0	0	380	0	0	0	0	0	0	5,444
Thiodicarb	57,100	0	41,632	98,732	0	0	38,921	5	0	38,926	136,033
Thiophanate ethyl	0	0	0	0	0	0	0	0	0	0	0
Thiophanate-methyl	9,400	0	0	9,400	0	0	5,613	0	0	5,613	16,646
Thiourea	4,665	0	664	5,329	0	0	11,073	254	0	11,327	31,767
Thiram	20,051	0	40	20,091	45,604	256	45,866	566	0	92,292	170,352
Thorium dioxide	22,000	0	0	22,000	0	0	0	2,200	0	2,200	24,200
Titanium tetrachloride	0	0	26,706,771	26,706,771	136,039	1	166,720	0	0	302,760	27,074,252
Toluene	968,269,305	187,671,839	395,302,542	1,551,243,686	22,885,031	79,191,567	22,051,736	599,828	60,979	124,789,141	1,816,226,231
Toluene-2,4-disocyanate	547	0	1,107	1,654	2,656	24,143	12,689	0	0	39,488	46,410
Toluene-2,6-disocyanate	137	0	150	287	7,081	3,065	11,151	0	0	21,297	42,840
Toluenedisocyanate (mixed isomers)	12,100	16,337,483	5,054,902	21,404,485	1,500	35,005	550,367	0	300	587,172	22,020,829
o-Toluidine	58	231,376	144,487	375,921	0	79,475	74,198	22,698	0	176,371	619,345
Triadimefon	0	0	0	0	0	0	0	0	0	0	0
Triallate	1,107	0	11,000	12,107	0	0	110,176	0	0	110,176	140,290
Tribenuron methyl	0	0	0	0	0	0	17,387	0	0	17,387	17,388
Tributyltin methacrylate	0	0	160	160	0	208	23,114	0	0	23,322	23,516
S,S,S-Tributyltrithiophosphate	0	0	33,373	33,373	0	0	116	0	0	116	35,097
Trichlorfon	0	0	0	0	0	0	0	0	0	0	0
Trichloroacetyl chloride	0	0	0	0	0	0	0	0	0	0	1
1,2,4-Trichlorobenzene	1,250,136	44,674	598,429	1,893,239	4,335	68,544	229,460	21,618	0	323,957	2,374,399
1,1,1-Trichloroethane	39,529,212	860,823	1,184,611	41,574,646	1,441,519	338,734	1,023,362	10,318	0	2,813,933	52,924,903
1,1,2-Trichloroethane	23,529,000	16,834,508	20,388,250	60,751,758	13,086,925	305,329	2,823,046	745	0	16,216,045	77,283,995
Trichloroethylene	118,520,604	2,050,829	5,358,265	125,929,698	6,669,733	761,582	1,606,178	86,392	0	9,123,885	156,902,484
Trichlorofluoromethane (CFC-11)	168,213	0	5,000	173,213	125,002	184,710	100,804	5	78,622	489,143	1,335,587

**Note** On-site Waste Management from Section and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. **Production-related Waste** from Section 8 of Form R (total excludes remedial and catastrophic quantities).





Table 2-21A. TRI On-site and Off-site Releases, by Chemical, 1996, Continued

CAS Number	Chemical	On-site Releases							Off-site Releases Transfers Off-site to Disposal Pounds	Total On- and Off-site Releases Pounds	
		Air		Surface Water Discharges Pounds	Underground Injection		On-site Land Releases				Total On-site Releases Pounds
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds		Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
88-06-2	2,4,6-Trichlorophenol	136	155	28	0	0	0	0	319	0	319
96-18-4	1,2,3-Trichloropropane	8,068	695	0	0	0	0	0	8,763	0	8,763
57213-69-1*	Triclopyr triethylammonium salt	0	6	0	0	0	0	0	6	0	6
121-44-8	Triethylamine	387,504	1,144,303	21,648	287,951	0	0	19,011	1,860,417	21,534	1,881,951
1582-09-8*	Trifluralin	11,153	4,453	87	0	0	310	0	16,003	51,678	67,681
26644-46-2*	Trifonone	0	0	0	0	0	0	0	0	0	0
95-63-6	1,2,4-Trimethylbenzene	2,752,443	4,667,587	9,570	2,697	0	5	29,942	7,462,244	135,485	7,597,729
639-58-7	Triphenyltin chloride	0	0	0	0	0	0	0	0	0	0
76-87-9*	Triphenyltin hydroxide	5	5	0	0	0	0	0	10	250	260
51-79-6	Urethane	496	12,042	0	0	0	0	0	12,538	3,675	16,213
7440-62-2	Vanadium (fume or dust)	452	1,249	4	0	0	0	16	1,721	38,641	40,362
50471-44-8*	Vinclozolin	0	0	0	0	0	0	0	0	0	0
108-05-4	Vinyl acetate	829,617	3,010,281	2,393	300,768	0	0	2,834	4,145,893	27,065	4,172,958
593-60-2	Vinyl bromide	240	5,600	0	0	0	0	0	5,840	0	5,840
75-01-4	Vinyl chloride	272,926	746,882	356	333	0	0	1	1,020,498	19,614	1,040,112
75-35-4	Vinylidene chloride	82,672	94,525	216	0	0	0	1	177,414	33	177,447
108-38-3	m-Xylene	450,550	525,195	635	45,239	0	250	93,127	1,114,996	3,275	1,118,271
95-47-6	o-Xylene	680,963	550,970	2,503	4,760	0	5	88,871	1,328,072	4,611	1,332,683
106-42-3	p-Xylene	839,254	1,997,026	477	1,010	0	5	88,799	2,926,571	1,114	2,927,685
1330-20-7*	Xylene (mixed isomers)	20,296,828	62,388,723	39,902	130,351	2,620	10,465	48,486	82,917,375	499,478	83,416,853
87-62-7	2,6-Xylydine	0	53	0	0	0	0	0	53	0	53
7440-66-6*	Zinc (fume or dust)	633,707	1,001,365	12,062	0	0	21,721	6,778,165	8,447,020	2,477,827	10,924,847
---	Zinc compounds	2,327,688	3,506,502	1,065,164	129,498	0	14,985,107	79,857,092	101,871,051	105,122,823	206,993,874
12122-67-7	Zineb	0	0	0	0	0	0	0	0	0	0
---	Mixtures and other trade name products	17,641	14,424	1,030	0	0	0	27,618	60,713	16,780	77,493
---	Trade secrets	500	255	0	0	0	0	0	755	0	755
Total		355,271,752	1,096,818,210	173,288,209	203,572,710	756,399	26,454,969	282,608,237	2,138,770,486	294,736,096	2,433,506,582

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

\*Pesticide



**Table 2-21B. TRI Other On-site Waste Management and Transfers Off-site for Further Waste Management, by Chemical, 1996, Continued**

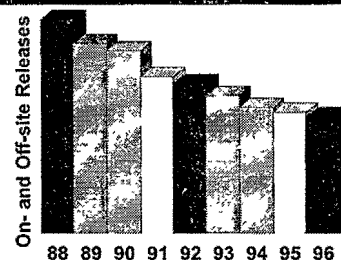
Chemical	Energy Recycled On-site Pounds	Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
2,4,6-Trichlorophenol	0	0	1,020,923	1,020,923	0	0	0	0	0	0	1,021,242
1,2,3-Trichloropropane	6,100,000	690,000	1,050,000	7,840,000	0	0	9,000,006	0	0	9,000,006	16,848,666
Triclopyr triethylammonium salt	0	0	8	8	0	0	82	0	0	82	96
Triethylamine	227,485	262,294	2,439,524	2,929,303	484,476	404,756	476,847	270,296	0	1,636,375	6,624,992
Trifluoromethane	71,149	0	13,000	84,149	0	0	111,790	5	0	111,795	286,572
Trifluoromethane	0	0	0	0	0	0	0	0	0	0	0
1,2,4-Trimethylbenzene	11,081,130	5,247,136	153,658,796	169,987,062	1,052,594	3,371,314	281,757	331,065	0	5,036,730	182,627,439
Triphenyltin chloride	0	0	1,400	1,400	0	0	0	0	0	0	1,400
Triphenyltin hydroxide	0	0	51,328	51,328	0	0	255	0	0	255	52,013
Urethane	0	0	0	0	0	0	175	0	0	175	15,642
Vanadium (fume or dust)	233,249	282	2,205	235,736	3,236	0	1,705	200	0	5,141	279,958
Vinclozolin	0	0	0	0	0	0	0	0	0	0	0
Vinyl acetate	651,835	13,459,144	19,970,650	34,081,629	47,199	11,097,329	1,949,118	144,887	0	13,238,533	52,673,663
Vinyl bromide	0	0	39	39	0	0	0	0	0	0	5,839
Vinyl chloride	144,257,010	34,902,139	34,549,160	213,708,309	108,475	17,000	57,390	734	0	183,599	214,928,242
Vinylidene chloride	1,540,000	81,000	5,944,435	7,565,435	26	45,180	36,107	90	0	81,403	7,919,564
m-Xylene	1,413,683	130,969	159,029,986	160,574,638	44,221	56,722	101,754	7,046	8,100	217,843	161,921,893
o-Xylene	90,138	14,825,694	96,322,096	111,237,928	192,724	781,724	509,146	424,692	0	1,908,286	114,697,510
p-Xylene	195,330	521,427	73,929,099	74,645,856	4,462	21,639	115,168	2,325	0	143,594	77,696,140
Xylene (mixed isomers)	110,754,065	146,026,399	81,266,575	338,047,039	43,676,875	68,512,589	7,986,520	487,905	8,590	120,672,479	561,418,451
2,6-Xyldine	0	36,684	0	36,684	0	0	0	0	0	0	36,737
Zinc (fume or dust)	25,204,044	0	2,192,517	27,396,561	63,284,353	48,635	7,925,233	18,590	47,444	71,324,255	110,397,651
Zinc compounds	84,991,928	102,429	3,458,463	88,552,820	235,687,595	323,618	35,124,148	410,791	23,997	271,570,149	563,263,361
Zineb	0	0	0	0	0	0	0	0	0	0	0
Mixtures and other trade name products	0	0	34,000	34,000	538,881	1,000	0	11,900	2,618	554,399	685,593
Trade secrets	0	0	0	0	0	0	750	2,379	0	3,129	2,630
<b>Total</b>	<b>7,842,595,142</b>	<b>2,761,739,445</b>	<b>7,139,861,921</b>	<b>17,744,196,508</b>	<b>2,150,593,994</b>	<b>477,056,570</b>	<b>290,096,828</b>	<b>235,813,508</b>	<b>3,306,380</b>	<b>3,156,867,280</b>	<b>23,416,340,713</b>

**Note** On-site Waste Management from Section and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).



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## Chapter 3



# Year-to-Year Comparison of Toxics Release Inventory Data

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This chapter compares TRI data for on- and off-site releases, on-site waste management, and transfers off-site for further waste management for the current and most recent year (1996 and 1995) and for recent years and the TRI baseline reporting year (1994-1996 and 1988). However, not all data were collected in 1988. This chapter therefore also looks at waste management data for recent years and the year that TRI began collecting such information (1994-1996 and 1991).

The discussion of “core” chemical lists, in the Introduction below, is important for accurate interpretation of these year-to-year comparisons, because of the important changes in TRI over time.

## Introduction

Because TRI data are collected annually, they can be used to measure the nation’s progress in reducing toxic chemical releases and other wastes managed by manufacturing facilities. This chapter attempts to measure such progress on a national, state, and chemical-specific basis. Industry-specific analyses of year-to-year change in TRI reporting appear in Chapters 4 through 10.

Tables in this chapter compare data for 1995 and 1996 to highlight recent changes in reporting. These tables give the first two-year view of TRI reporting since the addition of nearly 300 substances in reporting year 1995.

Other tables compare data for 1994 to 1996 with the 1988 data to measure progress from the beginning of the TRI. Although 1987 was the first year for TRI reporting, 1988 has been chosen as the baseline year for comparisons because of concerns about the data quality of industry’s submissions in the first year. In most sections of this chapter, the recent two-year data (1995-1996) are presented first, followed in a comparable table by the multi-year data (1988 and 1994-1996).

For the waste management activities, progress can be measured from 1991, when such data were added to TRI. This section analyzes first actual quantities for previous and current years (1991 and 1994-1996) followed by a comparison of facilities’ actual and projected data (1991, 1995-1996, and projections for 1997-1998).

Certain TRI reporting requirements have changed since the inception of the program—not only the addition of waste management data in 1991, but also the chemical expansion that nearly doubled the



TRI chemical list beginning with 1995 reporting. It is important to understand these and other changes and consider their implications when comparing TRI data across years.

## **“Core” Chemicals for Year-to-Year Comparisons**

EPA has the authority to add chemicals to the reporting list if they meet the statutory toxicity criteria and to delete chemicals from the list if EPA determines that they do not meet the toxicity criteria. Since 1987, EPA has deleted a number of chemicals from the list, added others, and modified the reporting requirements for others. The largest expansion has been the chemicals added for the 1995 reporting year, implementing Phase 1 of a three-part expansion of TRI (see Chapter 1 for additional information on TRI expansion).

Year-to-year comparisons must be based on a consistent set of chemicals to assure that any changes in releases or other waste management do not simply reflect the addition, deletion, or change in definition of reportable chemicals from one year to another. Data in this chapter represent facility reporting only for the “core” chemicals for the years being compared. The set of “core” chemicals differs depending on which years are represented in the tables.

### 1995-1996 Comparisons

Tables comparing data for 1995 and 1996 include all chemicals currently reportable to TRI; there was no change in TRI’s chemical coverage between these two years. Thus, these tables include the nearly 300 chemicals added to TRI beginning with reporting year 1995. Because the chemical list has not changed, 1996 totals for on- and off-site releases, other on-site waste management, and transfers off-site for further waste management are the same as the totals in Chapter 2.

### Multi-Year Comparisons

Tables for 1988 to 1996 include only chemicals that were reportable in all years from 1988 through

1996. These tables do not include, for example, chemicals added in 1990, 1991, 1994, or 1995. Also, for 1989, non-fibrous forms of aluminum oxide were removed from the list. Because of this modification, aluminum oxide is not included in any year-to-year comparison that includes the year 1988. As explained below, the reporting definitions for ammonia, hydrochloric acid, and sulfuric acid have changed, and they therefore are also not included in these tables. These tables summarize reporting for the 1988-1996 “core” chemicals.

Similarly, tables that compare data for 1991 to 1996 do not include chemicals added in 1994 or 1995. These tables analyze TRI data for only the chemicals that were on the TRI list, in the same form, for all years 1991-1996.

Because of this normalization process, done to assure accurate year-to-year comparisons, totals for 1996 in the multi-year tables differ from the 1996 totals in Chapter 2 and in the two-year tables in this chapter.

None of the tables includes any chemical deleted from the TRI list, regardless of the year it was deleted.

TRI data are reported as absolute amounts each year, not as changes in relation to production levels or other factors, such as source reduction activity, that might influence these amounts from year to year. The chapters that present industry-specific analyses, however, take a very basic look at changes in production as they may relate to increases and decreases in releases and other waste management of TRI chemicals.

### Reporting of Ammonia, Hydrochloric Acid, and Sulfuric Acid

As described in Box 3-1, reporting requirements for ammonia have changed. Also, ammonium sulfate and ammonium nitrate are no longer individually listed on TRI. The ammonia portion of these chemicals, however, remains on the TRI



**Box 3-1. An Explanation of the Modification to the Reporting Requirements for Aqueous Ammonia and the Delisting of Ammonium Sulfate (Solution) and Ammonium Nitrate (Solution)**

**An Explanation of the Modification to the  
Reporting Requirements for Aqueous Ammonia and the  
Delisting of Ammonium Sulfate (Solution) and Ammonium Nitrate (Solution)**

On June 30, 1995, EPA finalized four actions in response to a petition to delete ammonium sulfate (solution) from the list of toxic chemicals subject to reporting under EPCRA Section 313: (1) deleted the sulfate portion of ammonium sulfate (solution) from the list of toxic chemicals and made the ammonia portion reportable under the ammonia listing, (2) required that threshold and release determinations for aqueous ammonia be based on 10% of the total aqueous ammonia present in aqueous solutions of ammonia, (3) modified the ammonia listing by adding this qualifier: "ammonia (includes anhydrous ammonia and aqueous ammonia from water dissociable ammonium salts and other sources; 10% of total aqueous ammonia is reportable under this listing)," and (4) removed the specific listing for ammonium nitrate (solution), although the ammonia portion is still reportable under the ammonia listing and, as discussed below, ammonium nitrate is also reportable under the nitrate compounds category. All actions were effective for the 1994 reporting year (reports due July 1, 1995), except for deletion of the specific listing for ammonium nitrate (solution), which became effective with the 1995 reporting year.

In previous years, there was a great deal of confusion as to what should be reported under the ammonia listing, specifically over the sources of aqueous ammonia that must be included and how aqueous ammonia should be reported. Modifying the ammonia listing by adding the above qualifier should result in more consistent and accurate reporting under this listing since it clarifies what is reportable. The requirement to report only 10% of total aqueous ammonia under the ammonia listing takes into account the fact that one form of ammonia is relatively more toxic to aquatic organisms and that under many environmental conditions this form makes up no more than 10% of total aqueous ammonia. The 10% reporting limit for aqueous ammonia means that some facilities will no longer meet reporting thresholds and that the pounds of aqueous ammonia reported as released and transferred from the facilities that do report may be lower. It is important to remember that the 10% reporting limit only applies to aqueous ammonia; anhydrous ammonia is still 100% reportable.

Although ammonium sulfate (solution) has been deleted from the list, the aqueous ammonia from this chemical is still reportable under the ammonia listing. To determine the amount of aqueous ammonia from ammonium sulfate (solution) that should be added to the aqueous ammonia totals, the amount of ammonium sulfate (solution) is multiplied by 0.026. This represents 10% of the total aqueous ammonia present in ammonium sulfate (solution) since ammonia (as  $\text{NH}_3$ ) makes up 26% of ammonium sulfate.

The removal of the ammonium nitrate (solution) listing is reflected in this public data release. Like ammonium sulfate (solution), the aqueous ammonia from ammonium nitrate (solution) is reportable under the ammonia listing. To determine the amount of aqueous ammonia from ammonium nitrate (solution) that should be added to the aqueous ammonia totals, the amount of ammonium nitrate (solution) is multiplied by 0.021. This represents 10% of the total aqueous ammonia present in ammonium nitrate (solution) since ammonia (as  $\text{NH}_3$ ) makes up 21% of ammonium nitrate. In addition, ammonium nitrate is also reportable under the nitrate compounds category, which was added for the 1995 reporting year. Although this chemical is reportable under two listings, no double reporting of releases or transfers occurs since under the nitrate compounds category only the weight of the nitrate ion is included in calculations of releases and transfers.

To determine the quantity of total aqueous ammonia released to surface water, land, or underground injection, data users must multiply the reported quantity by 10. For example, to make use of the quantities reported for aqueous ammonia in any analysis of releases to surface waters, the reported amounts must be converted to total aqueous ammonia values. This is necessary in order to take into account site specific conditions of pH and temperature which determine the amount of total ammonia that will be present in the more aquatically toxic form. To convert the reported aqueous ammonia values to total ammonia, simply multiply amounts by 10.



Box 3-2. An Explanation of the Modification to the Reporting Requirements for Hydrochloric and Sulfuric Acid

**An Explanation of the Modification to the Reporting Requirements for Hydrochloric and Sulfuric Acid**

On June 30, 1995, EPA finalized a modification to the listing for sulfuric acid, and on July 25, 1996, EPA finalized the same modification to the listing for hydrochloric acid. These two chemical listings were modified by the addition of the following qualifier: "(acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size)." The modification to sulfuric acid was effective for the 1994 reporting year and the modification to hydrochloric acid was effective for the 1995 reporting year. EPA made these modifications in response to petitions to delist the non-aerosol forms of these chemicals. EPA determined that the non-aerosol forms did not meet the listing criteria of EPCRA Section 313(d) and therefore granted the petitions. These modifications mean that facilities are no longer required to report releases and transfers of non-aerosol forms of sulfuric and hydrochloric acid under EPCRA Section 313.

These changes in the reporting requirements for sulfuric and hydrochloric acid are reflected in the large reductions in reported amounts of these chemicals as compared to those in previous years' *TRI Public Data Release* reports. Most of these reductions result from the fact that solutions of these chemicals that do not become airborne are exempt from reporting. Thus there are large reductions in the amounts released, particularly quantities discharged to surface waters and injected underground and in amounts reported for most types of transfers. Since airborne forms are still covered by these listings, reported fugitive or nonpoint air emissions have not changed as much as other types of releases, and there has been little change in the stack or point air emission totals. In addition to lower reported releases and transfers, some facilities may no longer exceed reporting thresholds for the aerosol forms only and thus may not have to file a report.

list, and the nitrate ion portion of ammonium nitrate is reportable under the newly added nitrate compounds category (added as a category for the 1995 reporting year).

In addition, non-aerosol forms of hydrochloric acid and sulfuric acid have been removed from the list, hydrochloric acid with the 1995 reporting year and sulfuric acid in 1994 (see Box 3-2). This means that only airborne forms of these chemicals count towards the reporting threshold and release calculations, and releases of their non-aerosol forms are no longer reportable. Because of this modification to the reporting requirements, these chemicals are not included in multi-year comparisons in this chapter (tables with data for 1988 or for 1991).

**Threshold Changes**

Facilities are required to report for a particular chemical only if they meet the manufacture, process, or otherwise use thresholds for that chemical. The otherwise use threshold has remained 10,000 pounds since the inception of the program. However, the manufacture and process thresholds began at 75,000 pounds for 1987, dropped to 50,000

pounds for 1988, and dropped again to 25,000 pounds for 1989 and thereafter. Due in part to these declining thresholds, the number of facilities reporting to TRI and the number of forms filed increased from 1987 to 1988 and again from 1988 to 1989. These threshold changes may have affected the TRI data between 1988 and 1989, but would not affect data after 1989.

As explained in Chapter 1, facilities whose "total annual reportable amount" for a reportable chemical does not exceed 500 pounds can submit certification statements (Form As) instead of Form Rs (if they do not manufacture, process, or otherwise use more than 1 million pounds of the chemical). This change became effective in reporting year 1995. Form A certification statements identify the facility and chemical, but do not supply any amounts of releases or other waste management data. In prior years, facilities were required to report such amounts, and totals for 1988-1994 include their submissions. Nearly 6,500 Form A certification statements were submitted in 1995 and more than 7,200 in 1996—these do not provide releases or other waste management amounts. Thus, some



portion of any decrease in reported amounts from 1994 or earlier years would be attributable to the submission of these “certification” forms.

### Underground Injection and On-site Land Releases

In 1996, TRI began collecting data separately for types of underground injection and for on-site land releases to RCRA Subtitle C landfills. Instead of reporting a total for underground injection in Form R’s Section 5, facilities began reporting amounts injected into Class I wells separately from amounts injected into underground wells of other classes (II-V). RCRA Subtitle C landfills were separated out from other types of on-site land releases that are collected in Section 5. Because these releases were not broken out until 1996, they cannot be analyzed separately in the multi-year comparisons.

### On- and Off-site Waste Management

As described in Chapter 2, the federal Pollution Prevention Act of 1990 added to TRI the collection of additional on- and off-site waste management data (recycling, energy recovery, treatment, and releases). Data collection began in 1991. In this *1996 TRI Public Data Release*, on-site waste management—quantities of on-site recycling, energy recovery, and treatment—is presented in the summary tables. (Details of this new approach to data presentation appear in Chapter 1.) Because these data were not collected until 1991, comparisons cannot be drawn with 1988 data. Analysis of the full waste management data, on- and off-site, appear in tables that compare 1991 and 1994-1996 data.

### New Types of Off-site Transfers

Beginning with the 1991 reporting year, facilities were required to report transfers off-site for the purposes of recycling and energy recovery to TRI. Prior to 1991, facilities were required to report only transfers to POTWs and other off-site locations for the purposes of treatment and disposal. Because of this change in the reporting requirements, transfers off-site for further waste management for 1988 are not comparable to

such transfers for 1991 and beyond. Comparisons between 1988 and 1996 transfers in this chapter include only those transfer types that were reportable in 1988. Comparisons for 1991 to 1996 and for 1995 to 1996 include all transfer types reportable for 1991 and beyond.

## Reasons for Change

Box 3-3 provides reasons that a facility’s reported amounts may change from one year to another. Explanations for changes in reporting amounts include actual source reduction projects undertaken to reduce a facility’s generation of waste of a particular chemical, increases or decreases in production levels, changes in a facility’s methods of estimating or calculating reportable amounts (which does not indicate a corresponding change in actual releases and waste management), reporting errors in previous years for which the facility has not filed a revised submission, and others.

Apparent increases and decreases among industries can also result when facilities change the SIC codes they report from one year to another, reflecting new or discontinued facility operations or indicating a different understanding of how SIC codes relate to the facility’s business. This can occur among two-, three-, or four-digit SIC codes.

## TRI Data for 1995-1996 and for 1988, 1994-1996

### National Overview

#### On- and Off-site Releases

Reported releases of toxic chemicals to the environment, on- and off-site, decreased by 97.3 million pounds from 1995 to 1996, from 2.53 billion pounds to 2.43 billion pounds (see Table 3-1). This represents a decline of 3.8%. The greatest reduction occurred in reported air emissions (115.3 million pounds, or





**Box 3-3. Reasons Facility Release and Other Waste Management Estimates Change**

**Reasons Facility Release and Other Waste Management Estimates Change**

Some reported increases and decreases are real—that is, they reflect changes in the amounts of TRI chemicals actually released or otherwise managed in waste. Other reported increases and decreases are accounting or “paper” changes that do not reflect any actual change in releases or other waste management. Some examples follow.

**Real Changes**

Source reduction activities, such as process changes, elimination of spills and leaks, inventory control, improved maintenance, chemical substitution, and alternative methods of cleaning and degreasing can cause real reductions in the amount of waste generated and or managed.

The installation of pollution control equipment does not reduce the amount of waste generated, but may lead to real reductions in TRI chemicals released. However, if the pollution control does not destroy the reported chemical, it may merely shift waste from one type of waste management to another.

Production changes can cause real changes in the quantities of TRI chemicals released or otherwise managed as waste by facilities. Production-related waste is likely to increase when production increases and decrease when production decreases, although the relationship is not necessarily linear.

One-time events unrelated to normal production processes, such as accidental releases or clean-up operations, can cause a real but anomalous increase in the reporting year in which they occur and then a decrease from that abnormally high level the following year.

**“Paper” Changes**

Changes in estimation or calculation techniques can cause a change in the amount reported without a corresponding change in actual quantities released or otherwise managed as waste.

Clarifications of reporting instructions or changes in the way a facility interprets those instructions may cause a change in reported amounts without an actual change in quantities released or otherwise managed as waste.

Changes in the reporting definition of a particular chemical may cause a change in the reported amounts without an actual change in quantities released or otherwise managed as waste. For example, revising the definitions of sulfuric acid and hydrochloric acid to include only aerosol forms, as discussed in Chapter 4, will result in lower reports of releases, when non-aerosol forms are no longer reported.

Similarly, a facility’s use of the alternate threshold may result in a reported decrease without an actual reduction in releases if the facility begins to take advantage of an alternate manufacture, process, or otherwise use threshold of more than 1 million pounds. Beginning in the 1995 reporting year, some facilities whose “total annual reportable amount” for a reportable chemical does not exceed 500 pounds may use an alternate manufacture, process or otherwise use threshold of more than 1 million pounds of the chemical. If they do not exceed this alternate threshold, they no longer need to report amounts of releases or other waste management activities.

Apparent increases or decreases can occur if a facility makes a reporting error one year and does not submit a revision for that year, but does not repeat the error the following year.



**Table 3-1. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1995-1996**

	1995 Number	1996 Number	Change 1995-1996	
			Number	Percent
Total Facilities	22,378	21,626	-752	-3.4
Total Forms	74,523	71,381	-3,142	-4.2
Form Rs	68,054	64,147	-3,907	-5.7
Form As	6,469	7,234	765	11.8
	Pounds	Pounds	Pounds	Percent
<u>On-site Releases</u>				
Total Air Emissions	1,567,430,307	1,452,089,962	-115,340,345	-7.4
Fugitive Air	388,749,847	355,271,752	-33,478,095	-8.6
Point Source Air	1,178,680,460	1,096,818,210	-81,862,250	-6.9
Surface Water Discharges	159,768,195	173,288,209	13,520,014	8.5
Underground Injection	240,175,124	204,329,109	-35,846,015	-14.9
On-site Land Releases	282,979,493	309,063,206	26,083,713	9.2
Total On-site Releases	2,250,353,119	2,138,770,486	-111,582,633	-5.0
<u>Off-site Releases</u>				
Transfers Off-site to Disposal	280,432,818	294,736,096	14,303,278	5.1
Total On- and Off-site Releases	2,530,785,937	2,433,506,582	-97,279,355	-3.8
<u>Other On-site Waste Management</u>				
Recycled On-site	11,530,185,859	7,842,595,142	-3,687,590,717	-32.0
Energy Recovery On-site	2,837,073,887	2,761,739,445	-75,334,442	-2.7
Treated On-site	7,116,384,251	7,139,861,921	23,477,670	0.3
Total Other On-site Waste Management	21,483,643,997	17,744,196,508	-3,739,447,489	-17.4
<u>Transfers Off-site for Further Waste Management</u>				
Transfers to Recycling	2,237,556,735	2,150,593,994	-86,962,741	-3.9
Transfers to Energy Recovery	517,241,590	477,056,570	-40,185,020	-7.8
Transfers to Treatment	286,937,220	290,096,828	3,159,608	1.1
Transfers to POTWs	245,373,576	235,813,508	-9,560,068	-3.9
Other Off-site Transfers	2,394,496	3,306,380	911,884	38.1
Total Transfers Off-site for Further Waste Management	3,289,503,617	3,156,867,280	-132,636,337	-4.0

**Note:** On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required in 1995. Other Off-site Transfers are transfers reported without a valid waste management code.



a 7.4% decrease). Injection of TRI chemicals into underground wells decreased 35.8 million pounds, or 14.9%. Other release categories all showed increases for the two-year period: Discharges to surface water increased 13.5 million pounds (an 8.5% increase) and on-site releases to land increased 26.1 million pounds (9.2%). Altogether, on-site releases decreased 111.6 million pounds, or 5.0%, from 1995 to 1996. Off-site releases (transfers off-site to disposal) increased 14.3 million pounds, or 5.1%. Table 3-1 compares the 1996 TRI data to the 1995 data.

From 1988 to 1996, on- and off-site releases of the “core” chemicals reported to TRI in all years decreased by 1.53 billion pounds, a 45.6% decline. The largest decrease occurred in air emissions (1.10 billion pounds, or 49.8%). In percentage terms, surface water discharges showed the largest decrease (72.6%, or 119.4 million pounds). On-site releases decreased 1.41 billion pounds from 1988 to 1996, a 47.5% decrease. Off-site releases (transfers to disposal) decreased by 121.5 million pounds, or 31.4%. Table 3-2 and Figure 3-1 compare the 1996 TRI data to the 1988 data.

### Other On-site Waste Management

From 1995 to 1996, on-site waste management reported to TRI decreased 17.4%, or 3.74 billion pounds, as shown in Table 3-1. By far the greatest part of this decrease occurred in on-site recycling, a 32.0% decrease, or 3.69 billion pounds in 1996. In 1995, on-site recycling represented more than half (53.6%) of all on-site waste management. In 1996, on-site recycling was 44.2% of the total.

TRI did not collect on-site waste management data in 1988. As explained in Chapter 2, such data were added to TRI in 1991. Table 3-2 presents on-site recycling, energy recovery, and treatment data for 1994-1996. Total on-site waste management decreased from 14.22 billion pounds in 1994 to 13.68 billion pounds in 1995, and increased again to 14.04 billion pounds in 1996.

### Transfers Off-site for Further Waste Management

Reported transfers of TRI chemicals to off-site locations for further waste management decreased by 132.6 million pounds from 1995 to 1996 (see Table 3-1). This represents a decrease of 4.0%. Transfers to recycling decreased 87.0 million pounds (3.9% decrease). Transfers to energy recovery decreased 40.2 million pounds (7.8% decrease). Also decreasing were transfers to POTWs, by 9.6 million pounds, or 3.9%. The two remaining categories showed increases: transfers to treatment by 3.2 million pounds (1.1%) and other off-site transfers (those without valid waste management codes) by 912,000 pounds (38.1%).

Because transfers to recycling and energy recovery were not reportable in 1988, total transfers for 1996 cannot be compared to total transfers for 1988. However, transfers to POTWs and other off-site locations for the purposes of treatment have declined 37.5% since 1988 (see Table 3-2).

### Facilities and Forms

The number of facilities reporting to TRI decreased 3.4% from 1995 to 1996, from 22,378 to 21,626 (see Table 3-1). The number of individual chemical reports dropped 4.2%, from 74,523 in 1995 to 71,381 in 1996. However, the number of facilities and forms for 1996 is likely to rise somewhat over time due to late reporting and to resolution of outstanding data quality problems that may have prevented data entry of some submissions prior to the preparation of this report. Form A certification statements, described above and in Chapter 1, rose by 11.8% from 6,469 forms in 1995—the first year in which facilities could submit these certification statement forms—to 7,234 in 1996. This may reflect both increasing awareness of the reduced reporting option and more facilities meeting the alternative threshold for one or more chemicals.

The total number of facilities and forms increased from 1988 to 1989, probably as a result of the changes in reporting thresholds described earlier in this chapter, but has steadily decreased since 1989.



**Table 3-2. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1988 and 1994-1996**

	1988 Number	1994 Number	1995 Number	1996 Number	Change 1988-1996 Number Percent	
Total Facilities	20,436	20,946	20,356	19,726	-710	-3.5
Total Forms	62,711	63,488	61,885	59,799	-2,912	-4.6
Form Rs	62,711	63,488	56,693	53,934	—	—
Form As	—	—	5,192	5,865	—	—
	Pounds	Pounds	Pounds	Pounds	Pounds	Percent
<u>On-site Releases</u>						
Total Air Emissions	2,180,862,321	1,280,285,817	1,191,260,290	1,095,413,106	-1,085,449,215	-49.8
Fugitive Air	680,928,993	351,433,000	304,738,454	276,183,228	-404,745,765	-59.4
Point Source Air	1,499,933,328	928,852,817	886,521,836	819,229,878	-680,703,450	-45.4
Surface Water Discharges	164,551,386	39,794,843	35,918,865	45,144,135	-119,407,251	-72.6
Underground Injection	161,969,132	114,135,765	139,908,494	118,222,387	-43,746,745	-27.0
On-site Land Releases	459,114,111	289,341,251	272,424,588	299,979,550	-159,134,561	-34.7
Total On-site Releases	2,966,496,950	1,723,557,676	1,639,512,237	1,558,759,178	-1,407,737,772	-47.5
<u>Off-site Releases</u>						
Transfers Off-site to Disposal	386,461,584	259,228,230	255,777,935	265,005,866	-121,455,718	-31.4
Total On- and Off-site Releases	3,352,958,534	1,982,785,906	1,895,290,172	1,823,765,044	-1,529,193,490	-45.6
<u>Other On-site Waste Management</u>						
Recycled On-site	—	6,518,368,024	6,139,069,594	6,209,509,900	—	—
Energy Recovery On-site	—	3,138,177,326	2,688,189,212	2,585,785,910	—	—
Treated On-site	—	4,566,261,474	4,855,675,960	5,246,425,791	—	—
Total Other On-site Waste Management	—	14,222,806,824	13,682,934,766	14,041,721,601	—	—
<u>Transfers Off-site for Further Waste Management</u>						
Transfers to Recycling	—	2,200,760,073	2,173,558,832	2,094,268,207	—	—
Transfers to Energy Recovery	—	459,576,125	488,954,630	446,487,845	—	—
Transfers to Treatment	369,204,491	221,230,371	236,496,866	248,020,028	-121,184,463	-32.8
Transfers to POTWs	254,808,420	159,934,847	155,173,872	141,995,045	-112,813,375	-44.3
Other Off-site Transfers	43,279,087	5,094,462	2,186,886	3,078,759	—	—
Total Transfers Off-site for Further Waste Management	—	3,046,595,878	3,056,371,086	2,933,849,884	—	—

Note. Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. **On-site Releases** from Section 5 of Form R. **Off-site Releases** from Section 6 (transfers off-site to disposal) of Form R. **Other On-site Waste Management** from Section 8 of Form R. **Total Transfers Off-site for Further Waste Management** from Section 6 (excluding transfers off-site to disposal) of Form R. Form A certification statement reporting began in 1995 reporting year. Breakdown of Underground Injection and On-site Land Releases began in 1996 reporting year. Other On-site Waste Management began in 1991 reporting year. For 1994-1996, Other Off-site Transfers are transfers reported without a valid waste management code. For 1988, Other Off-site Transfers are transfers reported without a valid waste management code or codes not required to be reported in 1988.

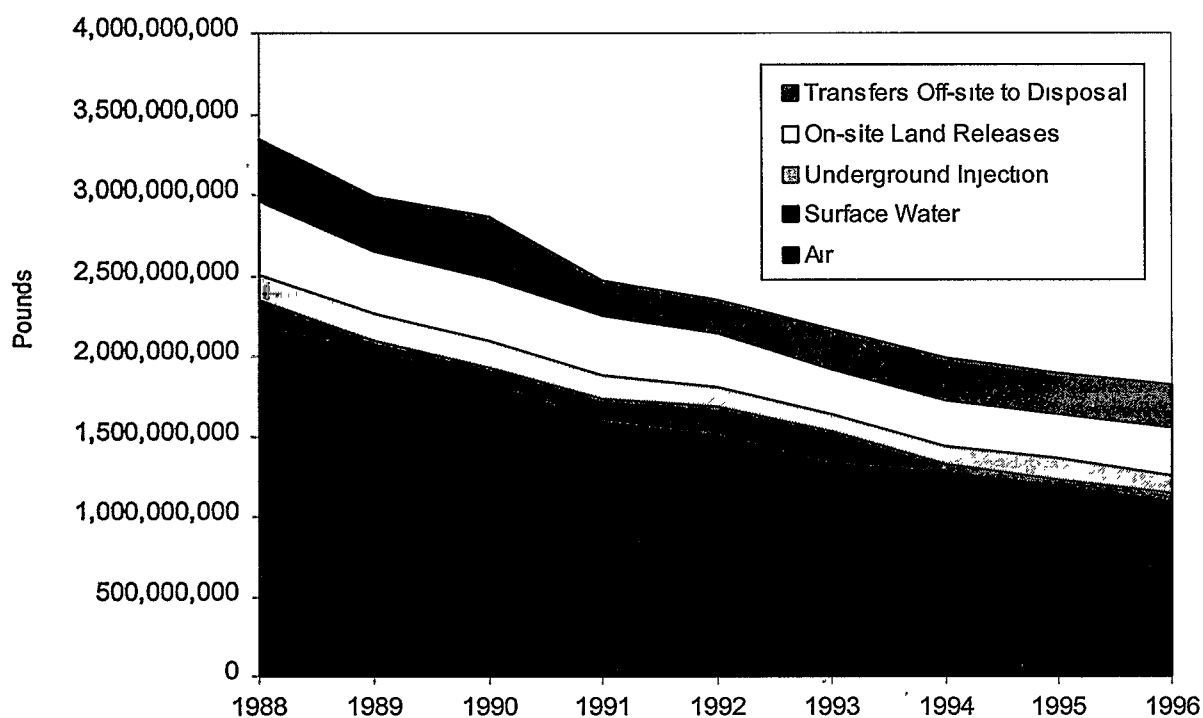


Figure 3-1. Distribution of TRI On-site and Off-site Releases, 1988-1996

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R.

## TRI Data by State for 1995-1996 and for 1988, 1994-1996

### On- and Off-site Releases

Table 3-3 compares the on- and off-site releases reported by each state and territory for 1995-1996.

A total of 38 states and territories reported net decreases in on- and off-site releases since 1995. The largest decrease was in Texas, 34.5 million pounds less in 1996 than in 1995 (an 11.4% reduction). Alabama

was the only other state with more than a 10-million-pound decrease, with 11.6 million pounds (10.2%). Other states ranking in the top five for largest decreases were Illinois (8.6 million pounds, or 7.4%), Michigan (7.2 million pounds, also 7.4%), and Tennessee (7.0 million pounds, or 6.4%). As discussed in Chapter 2, Texas also ranked first for total on- and off-site releases in 1996.

Seventeen states reported increases in on- and off-site releases from 1995 to 1996. They were led by Arizona, with releases 11.9 million pounds greater in



Table 3-3. Change in Total TRI On-site and Off-site Releases, by State, 1995-1996

State	Total On- and Off-site Releases		Change 1995-1996	
	1995 Pounds	1996 Pounds	Pounds	Percent
Alabama	114,569,098	102,922,534	-11,646,564	-10.2
Alaska	6,846,330	6,908,783	62,453	0.9
American Samoa	5,300	10,500	5,200	98.1
Arizona	36,029,888	47,964,210	11,934,322	33.1
Arkansas	36,666,519	34,032,075	-2,634,444	-7.2
California	53,371,343	50,082,638	-3,288,705	-6.2
Colorado	4,904,183	5,711,491	807,308	16.5
Connecticut	11,142,254	8,185,179	-2,957,075	-26.5
Delaware	4,581,541	3,660,020	-921,521	-20.1
District of Columbia	56,965	9,460	-47,505	-83.4
Florida	87,437,629	80,957,682	-6,479,947	-7.4
Georgia	59,899,944	58,831,731	-1,068,213	-1.8
Guam	3,100	3,000	-100	-3.2
Hawaii	656,692	540,267	-116,425	-17.7
Idaho	14,119,613	15,152,687	1,033,074	7.3
Illinois	116,268,362	107,663,656	-8,604,706	-7.4
Indiana	109,379,172	108,988,034	-391,138	-0.4
Iowa	37,563,633	33,308,409	-4,255,224	-11.3
Kansas	28,799,951	26,576,384	-2,223,567	-7.7
Kentucky	44,970,126	47,366,863	2,396,737	5.3
Louisiana	176,511,587	184,537,787	8,026,200	4.5
Maine	11,099,820	9,351,265	-1,748,555	-15.8
Maryland	18,089,205	13,098,751	-4,990,454	-27.6
Massachusetts	9,647,728	9,977,171	329,443	3.4
Michigan	97,347,294	90,158,602	-7,188,692	-7.4
Minnesota	24,266,126	20,970,579	-3,295,547	-13.6
Mississippi	59,125,820	54,846,362	-4,279,458	-7.2
Missouri	61,155,067	59,794,580	-1,360,487	-2.2
Montana	43,930,146	48,477,642	4,547,496	10.4
Nebraska	15,036,555	13,022,778	-2,013,777	-13.4
Nevada	3,901,466	3,766,636	-134,830	-3.5
New Hampshire	2,613,251	2,468,237	-145,014	-5.5
New Jersey	16,640,661	18,076,905	1,436,244	8.6
New Mexico	18,628,936	19,963,709	1,334,773	7.2
New York	42,167,744	35,654,003	-6,513,741	-15.4
North Carolina	90,688,050	85,174,574	-5,513,476	-6.1
North Dakota	2,932,908	2,325,120	-607,788	-20.7
Ohio	151,612,974	145,139,835	-6,473,139	-4.3
Oklahoma	29,935,400	26,421,809	-3,513,591	-11.7
Oregon*	24,114,188	29,735,693	5,621,505	23.3
Pennsylvania	127,359,536	122,423,185	-4,936,351	-3.9
Puerto Rico	10,013,489	8,548,778	-1,464,711	-14.6
Rhode Island	3,245,230	2,601,984	-643,246	-19.8
South Carolina	58,422,453	56,668,160	-1,754,293	-3.0
South Dakota	2,053,238	5,196,074	3,142,836	153.1
Tennessee	110,921,772	103,874,399	-7,047,373	-6.4
Texas	301,959,443	267,440,786	-34,518,657	-11.4
Utah	78,423,116	82,889,834	4,466,718	5.7
Vermont	672,785	462,849	-209,936	-31.2
Virgin Islands	1,493,257	1,506,139	12,882	0.9
Virginia	54,688,060	56,092,193	1,404,133	2.6
Washington	29,192,714	28,439,371	-753,343	-2.6
West Virginia	32,014,064	28,837,730	-3,176,334	-9.9
Wisconsin	42,573,080	47,023,091	4,450,011	10.5
Wyoming	11,037,131	9,664,368	-1,372,763	-12.4
Total	2,530,785,937	2,433,506,582	-97,279,355	-3.8

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

\* One facility in Oregon reported 6,211,171 pounds of fugitive air emissions in error for 1996, the correct amount is 750 pounds. The change for Oregon should be a decrease of 902,800 pounds or -3.7%.



1996 than in 1995, an increase of one third (33.1%). Louisiana had the second largest increase, 8.0 million pounds (4.5% increase).

Since 1988, 48 states and territories have reported decreasing on- and off-site releases of the 1988-1996 “core” chemicals. Table 3-4 presents on- and off-site releases for states and territories for 1988 and 1994-1996.

Texas had the largest decrease in releases for 1988-1996, reporting 131.1 million pounds less in 1996 than in 1988 (a 41.2% reduction). Louisiana was second with a decrease of 121.1 million pounds (48.3%). Indiana ranked third (93.1 million pounds, a 50.5% decrease) and Ohio fourth (86.9 million pounds, or 43.0%). In fifth place, California had a decrease of 78.3 million pounds (71.7%).

States with increases for 1988 to 1996 were led by Montana, with an 11.6-million-pound increase, or 32.5%, and Idaho, with a 3.4-million-pound increase, or 46.3%.

One facility in American Samoa reported during this time period, but only for ammonia, which is excluded from 1988-1996 comparisons because of changes in the reporting definition, as described above. No reports were received from the Northern Mariana Islands for any year 1988-1996.

## TRI Data by Chemical for 1995-1996 and for 1988, 1994-1996

From 1995 to 1996, the chemical with the largest decrease (in pounds) in on- and off-site releases was toluene, with 147.3 million pounds in 1995 and 127.4 million pounds in 1996. This 20.0-million-pound decrease represents a percentage change of 13.6%. The second-largest reported decrease occurred for 1,1,1-trichloroethane (TCA), an ozone depleter,

which decreased from 23.3 million pounds to 8.8 million pounds, or 62.0%. Production of TCA was banned effective January 1, 1996, along with many other ozone depleters.

Ranking third for 1995-1996 decreases was xylene, decreasing from 97.8 million pounds to 83.4 million pounds, or 14.7%. Hydrochloric acid was fourth, with 79.6 million pounds in 1995 and 65.6 million pounds in 1996, a reduction of 17.5%. (This represents reporting under a consistent reporting definition for hydrochloric acid, revised with the 1995 reporting year as detailed above.) Methanol, the chemical with the largest TRI releases, was fifth for decreases, from 255.1 million pounds in 1995 to 241.4 million pounds in 1996, a 5.4% decrease.

From 1995 to 1996, one chemical increased by more than 10 million pounds in on- and off-site releases. Zinc compounds ranked first with 188.8 million pounds of releases in 1995 and 207.0 million pounds in 1996. This represented an increase of 18.2 million pounds, or 9.6%. Manganese was reported as increasing by more than 10 million pounds; 19.8 million pounds to 31.2 million pounds, a difference of 11.4 million pounds or a 57.8% increase, but this includes a large error.<sup>1</sup>

Two chemicals had net increases of more than 6 million pounds: Copper, with a 6.3-million-pound increase (or 38.2%) and copper compounds, also a 6.3-million-pound increase (or 12.4%).

At the end of this chapter, Table 3-9 presents TRI data for all chemicals that were reportable (in the same form) for 1988 through 1996 and for which reports were received in at least one year.

From 1988 to 1996, reporting of on- and off-site releases for three chemicals decreased by more than 100 million pounds. Toluene had the largest reduction, as it did for 1995-1996. Reporting of toluene

<sup>1</sup> One facility reported 6.2 million pounds fugitive air emissions of manganese in error. Therefore, the 1996 figure for manganese should be 5.2 million pounds.



Table 3-4. Change in Total TRI On-site and Off-site Releases, by State, 1988 and 1994-1996

State	Total On- and Off-site Releases				Change 1988-1996	
	1988 Pounds	1994 Pounds	1995 Pounds	1996 Pounds	Pounds	Percent
Alabama	109,689,614	96,649,203	100,495,399	89,468,520	-20,221,094	-18.4
Alaska	3,714,569	1,095,396	2,164,144	1,683,698	-2,030,871	-54.7
American Samoa	0	0	0	0	0	—
Arizona	66,236,322	30,774,930	33,875,255	46,258,274	-19,978,048	-30.2
Arkansas	41,078,310	29,329,078	24,494,563	22,915,254	-18,163,056	-44.2
California	109,318,413	42,361,649	36,146,068	30,988,706	-78,329,707	-71.7
Colorado	15,736,129	4,080,707	3,489,143	3,690,197	-12,045,932	-76.5
Connecticut	37,799,558	11,219,092	8,643,867	6,387,666	-31,411,892	-83.1
Delaware	8,635,152	4,096,180	2,902,307	1,986,174	-6,648,978	-77.0
District of Columbia	500	55,560	56,965	9,460	8,960	1,792.0
Florida	61,526,840	71,434,211	52,110,580	46,914,430	-14,612,410	-23.7
Georgia	86,766,834	43,827,310	39,791,760	38,467,754	-48,299,080	-55.7
Guam	0	0	3,100	3,000	3,000	—
Hawaii	847,805	531,471	562,284	448,355	-399,450	-47.1
Idaho	7,348,539	9,148,741	10,081,185	10,752,902	3,404,363	46.3
Illinois	134,593,529	89,071,039	82,881,648	76,549,404	-58,044,125	-43.1
Indiana	184,554,149	82,653,253	88,801,423	91,418,953	-93,135,196	-50.5
Iowa	43,027,871	22,728,352	21,124,247	17,499,568	-25,528,303	-59.3
Kansas	30,301,296	17,408,245	17,611,936	17,569,997	-12,731,299	-42.0
Kentucky	66,443,750	32,512,132	30,569,980	30,940,570	-35,503,180	-53.4
Louisiana	250,845,496	114,823,665	122,286,440	129,789,110	-121,056,386	-48.3
Maine	15,355,970	6,879,400	6,593,629	5,273,360	-10,082,610	-65.7
Maryland	20,037,261	11,450,775	11,857,911	9,380,959	-10,656,302	-53.2
Massachusetts	31,878,653	9,950,179	8,351,331	8,951,366	-22,927,287	-71.9
Michigan	132,693,208	103,054,956	85,889,256	78,425,842	-54,267,366	-40.9
Minnesota	55,947,771	20,825,514	18,338,087	15,846,403	-40,101,368	-71.7
Mississippi	59,600,174	42,834,108	39,671,257	39,321,344	-20,278,830	-34.0
Missouri	90,703,961	56,771,910	50,552,453	49,769,859	-40,934,102	-45.1
Montana	35,629,903	46,459,564	42,643,724	47,204,182	11,574,279	32.5
Nebraska	16,935,710	13,734,915	11,171,399	8,880,693	-8,055,017	-47.6
Nevada	2,352,366	3,208,708	3,368,990	3,294,005	941,639	40.0
New Hampshire	13,865,650	2,394,720	1,939,853	1,749,609	-12,116,041	-87.4
New Jersey	45,018,440	14,024,665	12,399,476	10,644,699	-34,373,741	-76.4
New Mexico	30,386,119	17,230,438	17,945,764	18,339,076	-12,047,043	-39.6
New York	99,656,137	37,901,900	30,361,469	26,028,249	-73,627,888	-73.9
North Carolina	132,027,139	80,752,697	72,492,552	67,973,108	-64,054,031	-48.5
North Dakota	1,195,389	987,938	1,206,622	772,995	-422,394	-35.3
Ohio	202,151,571	116,095,889	122,236,396	115,227,944	-86,923,627	-43.0
Oklahoma	32,894,841	15,344,174	15,995,029	15,215,680	-17,679,161	-53.7
Oregon *	21,562,415	18,011,164	18,448,805	24,647,444	3,085,029	14.3
Pennsylvania	134,852,351	95,109,558	95,914,412	90,528,698	-44,323,653	-32.9
Puerto Rico	12,828,707	9,693,032	8,840,075	7,467,738	-5,360,969	-41.8
Rhode Island	7,712,568	6,789,350	3,017,334	2,452,269	-5,260,299	-68.2
South Carolina	66,070,190	47,639,871	48,112,037	47,373,602	-18,696,588	-28.3
South Dakota	2,393,242	2,108,149	1,871,676	1,364,448	-1,028,794	-43.0
Tennessee	126,484,405	104,914,555	94,684,331	88,190,525	-38,293,880	-30.3
Texas	318,631,665	199,765,449	205,724,168	187,485,411	-131,146,254	-41.2
Utah	123,835,686	67,175,197	69,143,942	73,876,112	-49,959,574	-40.3
Vermont	1,734,453	631,876	543,553	293,732	-1,440,721	-83.1
Virgin Islands	2,592,912	1,516,211	1,235,660	1,232,271	-1,360,641	-52.5
Virginia	112,328,804	43,828,869	40,612,569	40,555,452	-71,773,352	-63.9
Washington	28,273,090	20,770,473	22,336,381	21,889,503	-6,383,587	-22.6
West Virginia	39,415,713	20,852,490	19,678,685	17,444,543	-21,971,170	-55.7
Wisconsin	60,706,773	39,396,974	32,874,642	31,565,607	-29,141,166	-48.0
Wyoming	16,740,621	880,024	1,144,410	1,356,324	-15,384,297	-91.9
Total	3,352,958,534	1,982,785,906	1,895,290,172	1,823,765,044	-1,529,193,490	-45.6

**Note** Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. **On-site Releases** from Section 5 of Form R. **Off-site Releases** from Section 6 (transfers off-site to disposal) of Form R. One facility in

\* Oregon reported 6,211,171 pounds of fugitive air emissions in error for 1996, the correct amount is 750 pounds. The change for Oregon should be a decrease of 3,125,392 pounds or -14.5%.





decreased from 311.3 million pounds in 1988 to 127.4 million pounds in 1996, a net decrease of 184.0 million pounds or 59.1%. Total releases of 1,1,1-trichloroethane were 187.1 million pounds in 1988, but decreased to 8.8 million pounds in 1996; again, this reduction of 178.3 million pounds—or 95.3%—indicates the influence on TRI reporting of U.S. actions to reduce ozone depletion. The third chemical with a large decrease was phosphoric acid, with 182.6 million pounds in 1988 and 63.2 million pounds in 1996. This was a reduction of 119.4 million pounds, or 65.4%.

Another four chemicals had decreases in releases of more than 80 million pounds: methanol (decrease of 89.0 million pounds, or 26.9%), dichloromethane (87.0 million pounds, or 61.6%), methyl ethyl ketone (86.7 million pounds, or 59.1%), and xylene (82.9 million pounds, or 49.9%).

Chemicals with large increases from 1988 to 1996 in the amounts reported as released on- and off-site were zinc compounds (189.2 million pounds in 1988 to 207.0 million pounds in 1996, an increase of 9.4%) and copper compounds (42.5 million pounds in 1988 to 57.2 million pounds in 1996, a 34.7% increase). These were the only chemicals with increases of more than 10 million pounds. Reporting of styrene increased from 36.6 million pounds to 45.7 million pounds, a 9.1-million-pound increase, or 24.8%. Fourth was acetonitrile, for which reporting increased from 19.4 million pounds to 24.4 million pounds, an increase of 5.0 million pounds, or 25.9%. No other TRI chemical had an increase of more than 5 million pounds.

### **33/50 Program Chemicals, 1988-1996**

In 1991, EPA invited industry to participate in a program of voluntary reductions focused on 17 priority TRI chemicals. The program set its goals at a 33% reduction by 1992 and a 50% reduction by 1995 (from TRI's baseline year, 1988) in on-site releases and transfers, as they were reported to TRI at that time. (Off-site transfers to recycling and energy recovery were not required to be reported.)

The 33/50 Program met its 50% goal in 1994, one year early. Table 3-5 identifies the 17 chemicals and shows that, from 1988 to 1996, on-site releases and transfers off-site to treatment for these chemicals decreased by 895.5 million pounds, or 59.9%. This includes a reduction in the last year, 1995 to 1996, of 71.7 million pounds, or 10.7% of the 1995 level.

Table 3-6 compares the continued progress in reductions of 33/50 chemicals to changes in amounts reported for other TRI chemicals. From 1988 to 1996, reporting of on-site releases and transfers off-site to treatment and disposal for all TRI chemicals decreased 44.9%, from 4.02 billion pounds to 2.22 billion pounds. For chemicals not included in the 33/50 Program, the decrease was 36.0%, from 2.52 billion pounds to 1.62 billion pounds. This compares to the reduction of 59.9% in 33/50 chemicals, from 1.50 billion pounds to 600.6 million pounds. Even more striking is the comparison for 1995 to 1996, when TRI chemicals not included in the 33/50 Program decreased by less than 0.001% compared to the 10.7% reduction reported in 33/50 chemicals.

## **Waste Management Data, 1991-1995**

Quantities of TRI chemicals in production-related waste increased from 18.65 billion pounds in 1991 to 19.01 billion pounds in 1996 for the “core” chemicals that were reportable under the same definitions in years 1991-1996. As shown in Table 3-7, reporting of production-related waste has fluctuated. The 1.9% increase in production-related waste from 1991 to 1996 incorporates both a decrease (of 2.7%) from 1994 to 1995 and an increase (of 1.3%) from 1995 to 1996.

The largest net change since 1991 has occurred in reporting of on-site treatment, an increase of 918.9 million pounds, or 21.1%. The second largest



**Table 3-5. Change in Total On- and Off-site Releases and Transfers Off-site to Treatment and Disposal of 33/50 Chemicals, 1988-1996**

CAS Number	Chemical	Total On-site Releases and Transfers Off-site to Treatment and Disposal					
		1988 Pounds	1995 Pounds	1996 Pounds	Change 1995-1996 Pounds Percent	Change 1988-1996 Pounds Percent	
108-88-3	Toluene	367,449,485	168,931,167	150,072,438	-18,858,729	-11 2	-217,377,047
71-55-6	1,1,1-Trichloroethane	200,865,732	24,530,557	9,863,748	-14,666,809	-59 8	-191,001,984
95-47-6	Xylenes	212,866,804	119,377,865	98,446,738	-20,931,127	-17 5	-114,420,066
78-93-3	Methyl ethyl ketone	171,843,934	77,064,996	65,519,012	-11,545,984	-15 0	-106,324,922
75-09-2	Dichloromethane	155,419,301	71,011,461	68,661,243	-2,350,218	-3 3	-86,758,058
79-01-6	Trichloroethylene	62,584,822	27,164,039	23,066,035	-4,098,004	-15 1	-39,518,787
127-18-4	Tetrachloroethylene	42,451,389	11,918,276	9,370,327	-2,547,949	-21 4	-33,081,062
71-43-2	Benzene	36,801,410	11,672,344	10,307,367	-1,364,977	-11 7	-26,494,043
108-10-1	Methyl isobutyl ketone	44,964,661	23,989,593	20,642,019	-3,347,574	-14 0	-24,322,642
—	Chromium and chromium compounds	71,184,874	51,487,808	49,562,167	-1,925,641	-3 7	-21,622,707
67-66-3	Chloroform	29,803,069	12,713,113	11,968,700	-744,413	-5 9	-17,834,369
—	Lead and lead compounds	60,879,362	44,679,210	54,922,854	10,243,644	22 9	-5,956,508
—	Cyanides	11,990,259	9,650,382	8,167,147	-1,483,235	-15 4	-3,823,112
—	Nickel and nickel compounds	19,600,559	14,307,515	16,201,856	1,894,341	13 2	-3,398,703
56-23-5	Carbon tetrachloride	5,278,709	1,196,040	2,006,120	810,080	67 7	-3,272,589
—	Mercury and mercury compounds	316,652	243,370	58,524	-184,846	-76 0	-258,128
—	Cadmium and cadmium compounds	1,827,158	2,378,046	1,772,128	-605,918	-25 5	-55,030
Total for 33/50 Chemicals		1,496,128,180	672,315,782	600,608,423	-71,707,359	-10 7	-895,519,757

**Note** Does not include transfers off-site for recycling and energy recovery reported for 1995 and 1996

increase was in off-site recycling—419.7 million pounds, or 23.9%. Smaller increases occurred in on-site recycling (44.0 million pounds, or 0.7%) and off-site energy recovery (41.0 million pounds, or 9.2%). At the same time, the quantity released on- and off-site decreased by 653.6 million pounds, or 26.4%. Another large reported decrease occurred in on-site energy recovery, a 353.5-million-pound reduction, or 11.9%. The remaining decrease was in off-site treatment, 52.9 million pounds, or 12.1%.

As discussed in Chapter 2, information required by the Pollution Prevention Act (PPA) of 1990 can help facilities and the public assess progress in pollution prevention and in the management of TRI chemicals in waste. The data can be used to analyze trends in total quantities of TRI chemicals in waste to see if facilities are reducing the amount of waste generated. The data also can be used to examine trends in the quantities of TRI chemicals undergoing each waste management method to see whether facilities are making more environmentally

**Table 3-6. Total On-site Releases and Transfers Off-site to Treatment and Disposal of 33/50 Program Chemicals Compared to Other TRI Chemicals, 1988, 1990, 1995, and 1996**

Year	All TRI Chemicals (Excluding Additions/ Deletions) Pounds	TRI Chemicals Less 33/50 Chemicals Pounds	33/50 Chemicals Only Pounds
1988	4,020,250,532	2,524,122,352	1,496,128,180
1990	3,428,644,482	2,163,382,571	1,265,261,911
1995	2,289,147,796	1,616,832,014	672,315,782
1996	2,216,858,876	1,616,250,453	600,608,423
	Change Percent	Change Percent	Change Percent
1988-1990	-14 7	-14.3	-15.4
1990-1996	-35.3	-25.3	-52.5
1995-1996	-3 2	-0 0	-10 7
1988-1996	-44.9	-36 0	-59 9

**Note** Does not include transfers off-site for recycling and energy recovery reported 1991-1996. Also excludes delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, and aluminum oxide, ammonia, sulfuric acid and hydrochloric acid



Table 3-7. Quantities of TRI Chemicals in Waste, 1991 and 1994-1996.

Waste Management Activity	1991 Pounds	1994 Pounds	1995 Pounds	1996 Pounds
<u>Other On-site Waste Management</u>				
Recycled On-site	6,219,830,657	6,541,944,020	6,211,046,073	6,263,871,068
Energy Recovery On-site	2,959,059,632	3,147,931,154	2,700,753,684	2,605,551,388
Treated On-site	4,357,169,504	4,574,536,737	4,865,516,687	5,276,108,566
<u>Off-site Waste Management</u>				
Recycled Off-site	1,754,862,848	2,226,854,632	2,242,659,977	2,174,578,749
Energy Recovery Off-site	444,026,952	464,267,304	478,275,356	484,991,635
Treated Off-site	436,541,408	377,227,954	402,823,246	383,613,654
Quantity Released On- and Off-site	2,473,726,376	1,962,899,538	1,867,586,411	1,820,081,145
Total Production-related Waste	18,645,217,377	19,295,661,339	18,768,661,434	19,008,796,205
Non-Production-related Waste	22,371,664	56,355,873	31,751,324	31,674,613
Waste Management Activity	Change 1994-1995 Percent	Change 1995-1996 Percent	Change 1991-1996 Percent	
<u>Other On-site Waste Management</u>				
Recycled On-site	-5.1	0.9	0.7	
Energy Recovery On-site	-14.2	-3.5	-11.9	
Treated On-site	6.4	8.4	21.1	
<u>Off-site Waste Management</u>				
Recycled Off-site	0.7	-3.0	23.9	
Energy Recovery Off-site	3.0	1.4	9.2	
Treated Off-site	6.8	-4.8	-12.1	
Quantity Released On- and Off-site	-4.9	-2.5	-26.4	
Total Production-related Waste	-2.7	1.3	1.9	
Non-Production-related Waste	-43.7	-0.2	41.6	

Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, and ammonia, hydrochloric acid, and sulfuric acid

preferable choices as established in the waste management hierarchy.

In terms of the waste management hierarchy, the net increase of 363.6 million pounds in total production-related waste since 1991 reflects a decrease in quantities released, environmentally the least preferred action. The largest increase, however, occurred in on-site treatment, which is the next least preferable option in the hierarchy. Large-scale summary data cannot show whether these changes represent actual shifts in facility management of waste, but over time they can indicate whether national patterns show improvement in waste management options. (As explained in Chapter 2, facilities report each year the actual quantities for

the reporting year and the previous year and projected quantities for the two following years.)

Table 3-8, which shows actual and projected waste management data, further explores these relationships. Percentage distributions given in this table show the increase in on-site treatment from 23.4% of total production-related waste in 1991 to 27.8% in 1996 and the decrease in quantities released from 13.3% of all reported production-related waste in 1991 to 9.6% in 1996. Facility projections indicate that release quantities are expected to decrease to 8.7% of such waste by 1998. Projections for other waste management categories show fluctuation, but little further change overall in the relative roles of the waste management options.



Table 3-8. Actual and Projected Quantities of TRI Chemicals in Waste, 1991 and 1995-1998

Waste Management Activity	1991		1995		1996	
	Pounds	Percent	Pounds	Percent	Pounds	Percent
<u>On-site Waste Management</u>						
Recycled On-site	6,219,830,657	33.4	6,211,046,073	33.1	6,263,871,068	33.0
Energy Recovery On-site	2,959,059,632	15.9	2,700,753,684	14.4	2,605,551,388	13.7
Treated On-site	4,357,169,504	23.4	4,865,516,687	25.9	5,276,108,566	27.8
<u>Off-site Waste management</u>						
Recycled Off-site	1,754,862,848	9.4	2,242,659,977	11.9	2,174,578,749	11.4
Energy Recovery Off-site	444,026,952	2.4	478,275,356	2.5	484,991,635	2.6
Treated Off-site	436,541,408	2.3	402,823,246	2.1	383,613,654	2.0
Quantity Released On- and Off-site	2,473,726,376	13.3	1,867,586,411	10.0	1,820,081,145	9.6
Total Production-related Waste	18,645,217,377	100.0	18,768,661,434	100.0	19,008,796,205	100.0

Note. Does not include delisted chemicals, chemicals added in 1994 and 1995, and ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R. Data for 1991 from 1991 Form R, for 1995 from 1995 Form R, all other years from 1996 Form R.

Table 3-8. Actual and Projected Quantities of TRI Chemicals in Waste, 1991 and 1995-1998, Continued

Waste Management Activity	Projected			
	1997		1998	
	Pounds	Percent	Pounds	Percent
<u>On-site Waste Management</u>				
Recycled On-site	7,155,963,093	36.2	6,531,059,116	34.0
Energy Recovery On-site	2,686,966,274	13.6	2,677,802,762	13.9
Treated On-site	5,260,874,521	26.6	5,409,055,538	28.1
<u>Off-site Waste management</u>				
Recycled Off-site	2,086,134,370	10.6	2,114,848,177	11.0
Energy Recovery Off-site	440,389,476	2.2	437,650,271	2.3
Treated Off-site	379,327,939	1.9	374,810,122	2.0
Quantity Released On- and Off-site	1,763,884,928	8.9	1,670,541,743	8.7
Total Production-related Waste	19,773,540,601	100.0	19,215,767,729	100.0

Note. Does not include delisted chemicals, chemicals added in 1994 and 1995, and ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R. Data for 1991 from 1991 Form R, for 1995 from 1995 Form R, all other years from 1996 Form R.

As shown in Table 3-7, non-production related waste (resulting from catastrophic incidents or other one-time events) showed little change from 1995 to 1996, having decreased in 1995 for the first time since PPA reporting began. In previous years, non-production-related waste increased annually, to 56.4 million pounds in 1994, decreasing to 31.8 million pounds in 1995 and 31.7 million pounds in 1996. (Facilities do not project non-production related waste, as these events cannot reasonably be anticipated.)

## Chemical-Specific Data

Table 3-9 presents information for all TRI chemicals in the 1988-1995 "core" chemical list for which reports have been received in at least one year. On- and off-site releases, other on-site waste management, transfers off-site for further waste management, and total production-related waste are given for each chemical. Pesticides are denoted with an asterisk (\*) in front of the chemical name.



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases
			Air		Surface Water Discharges	Underground Injection	On-site Land Releases	Total On-site Releases	Transfers Off-site to Disposal	
			Fugitive or Nonpoint Air Emissions	Stack or Point Air Emissions						
			Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
75-07-0	Acetaldehyde	96	1,637,438	10,938,582	198,485	468,662	16,800	13,259,967	2,463	13,262,430
		95	1,621,964	11,566,763	227,116	605,886	155,360	14,177,089	1,099	14,178,188
		94	1,298,012	10,646,232	286,484	602,167	20,367	12,853,262	992	12,854,254
		88	2,689,238	4,260,011	98,236	2,219,105	194,958	9,461,548	24,930	9,486,478
60-35-5	Acetamide	96	5	14	2	1,169,000	0	1,169,021	0	1,169,021
		95	7	1	0	920,000	0	920,008	0	920,008
		94	8	19	1	466,000	0	466,028	0	466,028
		88	0	0	0	0	0	0	250	250
75-05-8	Acetonitrile	96	601,735	421,386	11,900	22,826,712	48	23,861,781	548,193	24,409,974
		95	697,817	323,025	7,474	27,836,181	12	28,864,509	10,892	28,875,401
		94	817,015	356,571	14,580	17,025,679	3,229	18,217,074	66,885	18,283,959
		88	1,408,588	786,151	42,223	16,739,010	1,790	18,977,762	416,333	19,394,095
107-02-8 *	Acrolein	96	928	81,348	550	100,360	0	183,186	0	183,186
		95	10,200	61,102	4	83,465	0	154,771	0	154,771
		94	9,454	55,291	440	107,999	0	173,184	0	173,184
		88	17,352	16,300	0	68,950	500	103,102	0	103,102
79-06-1	Acrylamide	96	2,751	8,949	3,653	5,748,154	149,156	5,912,663	301,575	6,214,238
		95	6,922	12,155	1,929	6,120,154	235	6,141,395	3,083	6,144,478
		94	8,815	7,164	2,677	5,198,814	155	5,217,625	3,891	5,221,516
		88	17,298	8,721	3,124	2,198,000	756	2,227,899	97,582	2,325,481
79-10-7	Acrylic acid	96	193,012	231,271	3,171	5,168,000	67	5,595,521	51,375	5,646,896
		95	273,364	253,846	2,648	7,840,000	47	8,369,905	35,421	8,405,326
		94	271,143	222,599	1,928	6,436,000	113	6,931,783	57,637	6,989,420
		88	585,041	215,005	16,646	22,262,010	15,950	23,094,652	134,139	23,228,791
107-13-1	Acrylonitrile	96	291,729	1,003,720	590	3,595,236	302	4,891,577	6,639	4,898,216
		95	290,055	1,235,391	7,137	5,193,028	618	6,726,229	4,917	6,731,146
		94	346,698	1,424,831	20,439	4,894,487	278	6,686,733	8,738	6,695,471
		88	1,028,194	3,767,967	6,531	4,562,713	2,150	9,367,555	151,450	9,519,005
107-05-1	Allyl chloride	96	56,007	24,141	9	0	0	80,157	0	80,157
		95	22,416	29,630	95	0	41	52,182	13	52,195
		94	149,565	51,919	7	0	2	201,493	37	201,530
		88	93,811	55,558	430	250	200	150,249	747	150,996
7429-90-5	Aluminum (fume or dust)	96	285,959	1,397,308	48,989	0	3,872,907	5,605,163	7,747,964	13,353,127
		95	257,661	1,722,662	36,693	250	1,872,483	3,889,749	6,143,170	10,032,919
		94	393,577	1,544,556	24,574	301	1,143,698	3,106,706	12,554,174	15,660,880
		88	1,226,731	2,455,267	91,518	250	3,177,625	6,951,391	14,368,041	21,319,432
60-09-3	4-Aminoazobenzene	96	0	0	0	203	0	203	0	203
		95	0	0	0	64	0	64	0	64
		94	0	1	0	350	0	351	0	351
		88	0	0	0	537	0	537	0	537
92-67-1	4-Aminobiphenyl	96	0	0	0	2	0	2	0	2
		95	0	0	0	2	0	2	0	2
		94	0	0	0	5	0	5	0	5
		88	0	10	0	4	0	14	0	14

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Acetaldehyde	96	178,600	12,168,237	21,603,608	33,950,445	43	144,723	311,747	346,698	0	803,211	47,988,233
	95	97,000	9,238,985	14,494,403	23,830,388	31,823	234,680	1,244,782	487,176	0	1,998,461	40,023,586
	94	142,000	8,137,832	14,761,363	23,041,195	28,005	260,346	432,543	460,301	0	1,181,195	37,029,612
	88	NA	NA	NA	NA	NA	NA	161,761	160,438	0	NA	NA
Acetamide	96	0	98,900	1	98,901	0	0	411	0	0	411	1,269,087
	95	0	1,000	0	1,000	0	0	323	0	0	323	921,088
	94	0	119,600	1	119,601	0	0	846	0	0	846	586,224
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Acetonitrile	96	22,263,727	24,163,715	12,010,669	58,438,111	1,736,000	6,436,847	3,730,563	911,800	0	12,815,210	96,460,892
	95	9,409,962	23,070,787	9,254,608	41,735,357	2,071,155	4,700,840	4,212,558	925,614	0	11,910,167	83,670,046
	94	7,391,440	26,477,192	13,032,752	46,901,384	1,741,949	5,784,394	3,841,992	1,046,688	0	12,415,023	77,427,032
	88	NA	NA	NA	NA	NA	NA	3,772,221	600,450	214,260	NA	NA
Acrolein	96	0	3,641,691	6,126,756	9,768,447	0	27,729	39	0	0	27,768	9,971,496
	95	4,800	3,752,847	5,168,260	8,925,907	0	43,323	11,361	0	0	54,684	9,135,170
	94	6,600	3,192,350	823,436	4,022,386	0	11,893	3,857	0	0	15,750	4,211,138
	88	NA	NA	NA	NA	NA	NA	250	250	0	NA	NA
Acrylamide	96	307	90,400	137,990	228,697	4	22,780	27,346	65,280	0	115,410	6,525,693
	95	4,037	820	314,544	319,401	0	43,729	39,747	176,069	0	259,545	6,715,488
	94	2,449	0	526,024	528,473	0	41,953	50,620	82,086	0	174,659	5,926,711
	88	NA	NA	NA	NA	NA	NA	14,458	13,540	0	NA	NA
Acrylic acid	96	4,427,743	27,444,611	27,724,878	59,597,232	96,828	3,738,960	1,107,155	19,688	0	4,962,631	70,187,482
	95	3,339,863	26,544,419	26,793,759	56,678,041	34,867	5,194,184	426,232	53,283	0	5,708,566	70,615,140
	94	2,734,524	22,104,705	29,453,465	54,292,694	71,070	5,364,877	472,260	37,103	0	5,945,310	67,263,265
	88	NA	NA	NA	NA	NA	NA	108,914	23,262	0	NA	NA
Acrylonitrile	96	12,680,622	3,485,381	10,463,883	26,629,886	517	317,693	1,013,860	88,141	0	1,420,211	32,917,197
	95	12,408,043	3,342,652	10,633,989	26,384,684	69,716	716,574	939,112	143,393	0	1,868,795	35,012,080
	94	11,344,298	3,189,640	12,636,213	27,170,151	100	425,084	835,026	169,644	0	1,429,854	35,250,820
	88	NA	NA	NA	NA	NA	NA	1,388,052	955,739	0	NA	NA
Allyl chloride	96	260,000	2,300,000	504,432	3,064,432	0	360	487,384	11	0	487,755	3,640,974
	95	520,000	186,000	750,979	1,456,979	0	1,506	413,027	11	0	414,544	1,922,258
	94	489,720	180,000	576,888	1,246,608	0	15,149	462,055	14	0	477,218	1,929,965
	88	NA	NA	NA	NA	NA	NA	208,328	14,900	0	NA	NA
Aluminum (fume or dust)	96	15,382,373	0	18,105,328	33,487,701	22,941,895	88,524	152,126	12,754	0	23,195,299	68,452,437
	95	38,589,375	0	15,628,491	54,217,866	17,973,633	164,914	304,707	11,484	0	18,454,738	88,371,586
	94	13,922,952	0	15,344,096	29,267,048	21,676,523	245,466	147,542	9,417	0	22,078,948	68,179,035
	88	NA	NA	NA	NA	NA	NA	2,457,125	15,217	12,756	NA	NA
4-Aminoazobenzene	96	0	0	0	0	0	0	99	0	0	99	302
	95	0	0	3	3	0	0	0	0	0	0	67
	94	0	0	3,000	3,000	0	0	0	0	0	0	3,351
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
4-Aminobiphenyl	96	0	0	91,000	91,000	0	0	103	0	0	103	91,105
	95	0	0	91,000	91,000	0	0	0	0	0	0	91,002
	94	0	0	91,400	91,400	0	0	0	0	0	0	91,405
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA

**Note:** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
62-53-3	Aniline	96	111,741	133,351	16,217	835,298	781	1,097,388	21,071	1,118,459
		95	115,922	85,545	8,943	1,221,381	4,193	1,435,984	21,546	1,457,530
		94	148,070	153,836	8,835	1,664,033	1,554	1,976,328	126,195	2,102,523
		88	323,900	388,869	16,105	3,582,975	12,822	4,324,671	346,206	4,670,877
90-04-0	o-Anisidine	96	1,443	74	28	0	0	1,545	1	1,546
		95	966	65	74	0	0	1,105	3	1,108
		94	891	63	80	0	30	1,064	1	1,065
		88	501	1,792	285	0	250	2,828	3	2,831
104-94-9	p-Anisidine	96	0	0	0	0	0	0	0	0
		95	0	5	0	0	0	5	0	5
		94	0	10	5	0	0	15	0	15
		88	0	10	250	0	250	510	0	510
120-12-7	Anthracene	96	23,583	40,617	122	0	661	64,983	51,041	116,024
		95	28,596	52,875	4,942	0	939	87,352	48,140	135,492
		94	20,796	48,314	341	0	15,028	84,479	60,186	144,665
		88	144,123	55,700	4,382	0	10,905	215,110	204,665	419,775
7440-36-0	Antimony	96	2,905	7,962	5,388	0	9,480	25,735	217,968	243,703
		95	4,892	24,676	6,592	0	18,786	54,946	85,701	140,647
		94	4,741	18,635	98,466	0	10,226	132,068	104,519	236,587
		88	10,789	59,127	11,114	2,100	903,916	987,046	568,925	1,555,971
—	Antimony compounds	96	32,345	70,385	34,886	13,908	1,974,528	2,126,052	4,201,352	6,327,404
		95	41,687	64,090	29,346	11,332	1,168,668	1,315,123	3,080,779	4,395,902
		94	42,718	51,723	45,687	40,224	1,267,941	1,448,293	4,300,313	5,748,606
		88	58,941	106,587	31,178	9,200	1,935,018	2,140,924	2,184,568	4,325,492
7440-38-2	Arsenic	96	32,882	6,590	421	0	98,758	138,651	47,420	186,071
		95	2,444	4,408	363	0	27,351	34,566	43,208	77,774
		94	9,272	7,937	1,009	0	4,883	23,101	47,647	70,748
		88	2,608	5,079	1,282	0	181,267	190,236	62,664	252,900
—	Arsenic compounds	96	75,960	39,486	4,047	61,280	1,751,028	1,931,801	1,196,069	3,127,870
		95	68,982	55,623	4,936	55,000	1,325,583	1,510,124	1,346,886	2,857,010
		94	11,290	67,572	7,602	60,400	1,954,360	2,101,224	1,702,657	3,803,881
		88	43,461	223,791	6,243	27,400	4,946,184	5,247,079	1,402,790	6,649,869
1332-21-4	Asbestos (friable)	96	1,398	1,362	2	0	479,559	482,321	3,316,112	3,798,433
		95	1,055	2,590	1	0	131,404	135,050	4,101,565	4,236,615
		94	3,080	2,882	260	0	288,146	294,368	4,064,593	4,358,961
		88	11,043	37,453	10,699	0	2,111,880	2,171,075	12,135,707	14,306,782
7440-39-3	Barium	96	9,579	33,400	2,482	0	306,932	352,393	574,589	926,982
		95	35,972	55,114	6,279	0	219,823	317,188	313,310	630,498
		94	76,327	5,845	6,064	0	267,704	355,940	222,758	578,698
		88	174,401	92,410	18,650	0	6,721,686	7,007,147	1,663,835	8,670,982
—	Barium compounds	96	84,002	215,467	89,385	750	1,533,385	1,922,989	4,127,184	6,050,173
		95	60,790	96,792	53,867	0	665,762	877,211	4,481,703	5,358,914
		94	102,967	289,082	53,836	250	641,257	1,087,392	5,066,718	6,154,110
		88	152,892	873,780	104,302	2,773	5,651,655	6,785,402	16,386,093	23,171,495

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production- related Waste Pounds
Aniline	96	8,838,234	6,189,043	3,641,917	18,669,194	0	314,762	381,821	1,113,702	0	1,810,285	21,595,574
	95	7,243,251	7,419,516	3,746,207	18,408,974	0	355,000	230,110	986,966	0	1,572,076	21,486,235
	94	6,149,837	7,272,647	3,009,125	16,431,609	0	1,130,313	592,205	1,542,912	0	3,265,430	21,781,728
	88	NA	NA	NA	NA	NA	NA	468,311	2,106,510	16,050	NA	NA
o-Anisidine	96	0	1,465	3,992	5,457	0	0	0	6,251	0	6,251	13,254
	95	0	143	14,704	14,847	0	0	0	5,100	0	5,100	21,008
	94	0	100	14,166	14,266	0	0	0	2,171	0	2,171	17,497
	88	NA	NA	NA	NA	NA	NA	0	768	0	NA	NA
p-Anisidine	96	0	0	0	0	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	0	5	0	5	18
	94	0	0	96	96	0	0	0	5	0	5	118
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Anthracene	96	214,266	112,111	1,257,051	1,583,428	9,722	210,273	4,782	345	0	225,122	1,916,943
	95	205,705	183,121	1,693,057	2,081,883	16,937	201,453	2,667	654	0	221,711	2,423,973
	94	357,802	134,382	198,373	690,557	38,652	183,999	10,210	630	0	233,491	1,056,011
	88	NA	NA	NA	NA	NA	NA	73,023	20,419	1,250	NA	NA
Antimony	96	3,549,028	109,302	1,220,051	4,878,381	2,939,941	33,085	155,173	22,558	2	3,150,759	8,273,867
	95	3,201,021	0	819,533	4,020,554	5,600,035	1,730	71,999	27,386	5	5,701,155	9,848,835
	94	2,370,185	0	2,409,099	4,779,284	3,103,007	3,165	22,943	55,605	0	3,184,720	8,029,694
	88	NA	NA	NA	NA	NA	NA	22,979	40,228	500	NA	NA
Antimony compounds	96	6,138,043	0	94,818	6,232,861	2,874,865	63,927	747,146	94,398	0	3,780,336	15,280,785
	95	5,371,981	0	79,189	5,451,170	3,247,034	49,141	818,434	85,994	0	4,200,603	13,648,769
	94	5,525,114	0	160,038	5,685,152	3,570,429	31,974	571,795	82,033	951	4,257,182	15,461,361
	88	NA	NA	NA	NA	NA	NA	138,456	67,108	1,450	NA	NA
Arsenic	96	1,191,541	0	70,004	1,261,545	751,303	0	95,712	303	0	847,318	2,276,319
	95	1,072,279	7,700	13,030	1,093,009	189,754	2,650	46,620	68	0	239,092	1,394,987
	94	1,580,322	0	14,150	1,594,472	836,449	0	10,738	181	0	847,368	2,602,086
	88	NA	NA	NA	NA	NA	NA	1,020	1,928	35	NA	NA
Arsenic compounds	96	4,931,812	0	92,028	5,023,840	368,156	326	1,718,792	229	0	2,087,503	9,549,085
	95	2,445,203	0	227,628	2,672,831	423,946	752	1,295,253	248	0	1,720,199	6,740,533
	94	1,806,460	0	263,695	2,070,155	296,314	3	1,044,606	306	0	1,341,229	6,837,981
	88	NA	NA	NA	NA	NA	NA	11,887	3,126	9,573	NA	NA
Asbestos (friable)	96	142,589	0	519,822	662,411	0	0	75	752	0	827	4,348,203
	95	291,000	0	1,548,870	1,839,870	0	0	5	752	0	757	5,355,222
	94	484,280	0	521,499	1,005,779	0	0	260	2	0	262	5,055,780
	88	NA	NA	NA	NA	NA	NA	170,934	68,148	1,010,000	NA	NA
Barium	96	58,305	220,321	75,212	353,838	92,646	3,253	167,142	1,629	0	264,670	1,496,638
	95	14,719	0	43,195	57,914	160,557	509	104,123	4,164	250	269,603	856,700
	94	23,305	0	1,956	25,261	127,098	19	6,050	5,925	0	139,092	719,102
	88	NA	NA	NA	NA	NA	NA	89,045	205,209	10,412	NA	NA
Barium compounds	96	37,172,801	200	6,877,708	44,050,709	2,771,996	224,870	1,592,618	392,151	2,941	4,984,576	54,816,803
	95	26,551,729	200	6,224,067	32,775,996	1,695,448	92,593	1,449,696	386,873	0	3,624,610	43,872,544
	94	15,172,953	0	4,133,323	19,306,276	1,638,023	98,204	1,525,482	207,260	332	3,469,301	29,700,319
	88	NA	NA	NA	NA	NA	NA	828,870	823,073	297,371	NA	NA

Note Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)





Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
98-87-3	Benzal chloride	96	1,158	8	0	0	0	1,166	0	1,166
		95	1,095	17	0	0	0	1,112	0	1,112
		94	163	12	0	0	0	175	0	175
		88	5,252	6	0	0	0	5,258	7,308	12,566
55-21-0	Benzamide	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	250	250	250	250	0	1,000	750	1,750
71-43-2	Benzene	96	3,365,712	4,753,759	27,376	312,766	76,157	8,535,770	65,750	8,601,520
		95	4,020,284	5,259,238	21,301	282,642	18,582	9,602,047	71,391	9,673,438
		94	5,427,931	4,297,733	22,310	223,103	25,568	9,996,645	203,685	10,200,330
		88	20,664,086	11,677,898	46,732	825,035	125,228	33,338,979	396,880	33,735,859
92-87-5	Benzidine	96	No reports received							
		95	No reports received							
		94	250	0	0	0	0	250	0	250
		88	No reports received							
98-07-7	Benzoic trichloride	96	7,925	66	16	0	0	8,007	0	8,007
		95	6,446	50	0	0	0	6,496	250	6,746
		94	2,832	36	0	0	0	2,868	0	2,868
		88	24,542	421	0	0	0	24,963	9,777	34,740
98-88-4	Benzoyl chloride	96	16,874	1,829	0	0	0	18,703	2,370	21,073
		95	14,882	1,867	0	0	0	16,749	1,460	18,209
		94	11,719	1,972	0	0	0	13,691	250	13,941
		88	28,295	4,719	0	130,000	250	163,264	2,399	165,663
94-36-0	Benzoyl peroxide	96	325	1,694	10	0	1,655	3,684	6,352	10,036
		95	351	1,692	5	0	10,345	12,393	4,760	17,153
		94	946	1,021	5	0	3,635	5,607	10,936	16,543
		88	4,063	2,231	0	5,350	36,050	47,694	23,954	71,648
100-44-7	Benzyl chloride	96	13,695	5,697	324	660	173	20,549	4,824	25,373
		95	12,700	6,961	40	0	247	19,948	3,870	23,818
		94	16,856	6,321	49	23	126	23,375	246	23,621
		88	30,689	12,640	640	0	500	44,469	9,687	54,156
7440-41-7	Beryllium	96	9	850	31	0	31,240	32,130	1,590	33,720
		95	3	832	26	0	22,189	23,050	6,943	29,993
		94	1	898	36	0	22,860	23,795	9,617	33,412
		88	550	2,213	74	0	37,000	39,837	3,155	42,992
—	Beryllium compounds	96	30	365	1	0	16,188	16,584	1,440	18,024
		95	0	360	2	0	23,000	23,362	1,600	24,962
		94	0	610	2	0	17,000	17,612	2,300	19,912
		88	1	861	17	0	12,000	12,879	6,900	19,779
92-52-4	Biphenyl	96	409,862	237,574	9,779	31,558	29,272	718,045	34,962	753,007
		95	493,906	237,842	6,242	30,337	71,864	840,191	37,988	878,179
		94	549,141	79,745	3,733	48,302	5,198	686,119	29,055	715,174
		88	631,591	579,701	88,197	82,760	222,297	1,604,546	227,492	1,832,038

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
Benzal chloride	96	0	0	110,000	110,000	0	780,000	180	5	0	780,185	891,348
	95	0	0	2,800	2,800	0	260,000	0	5	0	260,005	263,905
	94	0	0	7,200	7,200	0	54,000	0	0	0	54,000	61,375
	88	NA	NA	NA	NA	NA	NA	95,878	0	0	NA	NA
Benzamide	96	No reports received										
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Benzene	96	61,704,353	15,645,404	64,991,646	142,341,403	531,327	2,196,809	1,491,143	214,698	6	4,433,983	156,110,718
	95	57,794,042	20,222,877	55,735,616	133,752,535	421,128	1,579,514	1,780,401	218,505	0	3,999,548	147,817,270
	94	47,933,639	23,033,715	32,391,288	103,358,642	555,386	1,657,760	2,146,156	210,855	250	4,570,407	118,003,004
	88	NA	NA	NA	NA	NA	NA	1,892,869	1,165,252	7,430	NA	NA
Benzidine	96	No reports received										
	95	No reports received										
	94	0	0	0	0	0	0	0	0	0	0	16
	88	No reports received										
Benzoic trichloride	96	0	0	150,000	150,000	0	12,000	44	5	0	12,049	170,025
	95	0	0	150,000	150,000	0	0	3,018	5	0	3,023	159,275
	94	0	0	120,000	120,000	0	12	0	0	0	12	122,874
	88	NA	NA	NA	NA	NA	NA	12,795	0	0	NA	NA
Benzoyl chloride	96	0	0	1,998,467	1,998,467	0	138	630,473	6	0	630,617	2,650,142
	95	0	0	1,676,545	1,676,545	0	80	592,289	5	0	592,374	2,309,965
	94	0	0	1,639,368	1,639,368	0	0	496,694	75	0	496,769	2,149,967
	88	NA	NA	NA	NA	NA	NA	358,570	180	0	NA	NA
Benzoyl peroxide	96	11,580	0	36,266	47,846	6,000	3,760	6,842	38,772	0	55,374	113,431
	95	4,600	863	54,214	59,677	10,800	2,671	11,884	32,842	0	58,197	128,634
	94	6,805	0	50,900	57,705	9,000	2,097	24,166	21,318	0	56,581	128,776
	88	NA	NA	NA	NA	NA	NA	38,600	69,946	0	NA	NA
Benzyl chloride	96	19,000	20,600	258,415	298,015	0	559,486	1,608	1,581	0	562,675	882,915
	95	1,000	25,481	256,947	283,428	0	430,300	9,565	1,894	0	441,759	746,173
	94	972	0	210,199	211,171	0	401,125	538	6,347	0	408,010	640,364
	88	NA	NA	NA	NA	NA	NA	89,160	41,553	0	NA	NA
Beryllium	96	38,389	0	921	39,310	93,078	0	3,257	0	0	96,335	166,725
	95	39,689	0	780	40,469	9,618	0	423	0	0	10,041	80,283
	94	39,964	0	780	40,744	13,751	0	19	0	0	13,770	87,812
	88	NA	NA	NA	NA	NA	NA	3	4	0	NA	NA
Beryllium compounds	96	0	0	0	0	18,050	0	1,309	1	0	19,360	36,966
	95	7	0	0	7	24,005	0	990	1	0	24,996	49,559
	94	8	0	0	8	312,617	0	1,060	1	0	313,678	335,897
	88	NA	NA	NA	NA	NA	NA	1,391	3	0	NA	NA
Biphenyl	96	161,010	1,094,809	3,058,232	4,314,051	527,079	243,039	513,754	404,785	0	1,688,657	6,793,939
	95	268,053	1,088,381	963,993	2,320,427	161,181	346,055	205,982	402,012	380	1,115,610	4,314,849
	94	456,329	1,074,140	712,220	2,242,689	161,084	309,207	389,864	296,466	0	1,156,621	4,145,833
	88	NA	NA	NA	NA	NA	NA	252,521	1,446,614	0	NA	NA

**Note.** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
111-44-4	Bis(2-chloroethyl) ether	96	799	2,119	6	0	0	2,924	16	2,940
		95	373	191	3	0	0	567	0	567
		94	2,835	395	7	0	0	3,237	0	3,237
		88	4,322	600	1,351	0	0	6,273	0	6,273
542-88-1	Bis(chloromethyl) ether	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	5	250	0	0	0	255	5	260
		88	1	0	0	0	0	1	0	1
108-60-1	Bis(2-chloro-1- methylethyl) ether	96	520	4,100	44	0	3	4,667	0	4,667
		95	2,710	3,420	0	0	0	6,130	0	6,130
		94	1,800	3,090	3,026	0	1	7,917	0	7,917
		88	7,944	15	30,000	0	0	37,959	0	37,959
75-25-2	Bromoform	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	0	0	8,600	0	0	8,600	0	8,600
74-83-9	* Bromomethane	96	414,088	1,885,755	7	303	6	2,300,159	0	2,300,159
		95	386,154	2,215,580	14	3,817	0	2,605,565	0	2,605,565
		94	483,863	2,197,112	13	0	0	2,680,988	0	2,680,988
		88	428,777	2,356,018	0	1,546	0	2,786,341	0	2,786,341
106-99-0	1,3-Butadiene	96	1,429,487	1,296,809	11,001	1,000	263	2,738,560	4,790	2,743,350
		95	1,436,010	1,613,728	5,393	0	277	3,055,408	4,892	3,060,300
		94	1,680,098	1,260,880	7,118	0	396	2,948,492	6,846	2,955,338
		88	4,059,260	2,945,362	522,504	1,500	7,817	7,536,443	185,398	7,721,841
141-32-2	Butyl acrylate	96	105,689	108,649	712	0	2,165	217,215	50,540	267,755
		95	117,625	111,143	2,919	0	559	232,246	73,301	305,547
		94	126,139	139,101	218	0	52	265,510	62,877	328,387
		88	165,186	246,676	3,528	0	602	415,992	18,766	434,758
71-36-3	n-Butyl alcohol	96	4,906,789	17,938,341	61,936	2,452,006	6,134	25,365,206	304,582	25,669,788
		95	5,669,583	20,034,108	115,353	2,263,357	4,631	28,087,032	286,766	28,373,798
		94	6,523,855	21,971,251	52,481	1,777,216	3,922	30,328,725	136,044	30,464,769
		88	8,977,430	28,737,791	128,130	3,006,660	175,819	41,025,830	924,519	41,950,349
78-92-2	sec-Butyl alcohol	96	320,953	929,317	6,920	120,169	490	1,377,849	18,769	1,396,618
		95	281,548	616,484	6,782	136,172	2,805	1,043,791	18,376	1,062,167
		94	479,494	506,823	5,902	143,443	5	1,135,667	32,282	1,167,949
		88	400,126	697,037	122,291	0	2,600	1,222,054	21,351	1,243,405
75-65-0	tert-Butyl alcohol	96	494,612	272,590	30,430	1,007,213	758	1,805,603	42,468	1,848,071
		95	508,686	149,132	20,183	1,082,071	751	1,760,823	30,783	1,791,606
		94	648,074	330,360	179,786	691,738	111	1,850,069	70,466	1,920,535
		88	1,207,440	366,697	14,989	674,798	818	2,264,742	56,502	2,321,244
106-88-7	1,2-Butylene oxide	96	5,499	7,198	45	0	0	12,742	12	12,754
		95	3,658	7,425	1	0	0	11,084	5	11,089
		94	5,341	4,702	210	0	0	10,253	0	10,253
		88	34,973	64,958	3,500	0	250	103,681	898	104,579

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
Bis(2-chloroethyl) ether	96	0	573,000	960,300	1,533,300	180,000	407,512	34,692	2,382	0	624,586	2,160,836
	95	0	302,700	0	302,700	146,118	203,775	86,019	2,874	0	438,786	742,056
	94	0	40,000	105,800	145,800	186,472	162,623	5,045	2,846	0	356,986	506,014
	88	NA	NA	NA	NA	NA	NA	27,265	9,621	0	NA	NA
Bis(chloromethyl) ether	96	0	0	6,500	6,500	0	0	0	0	0	0	6,500
	95	0	0	13,000	13,000	0	0	0	0	0	0	13,000
	94	0	0	13,135	13,135	0	0	0	0	0	0	13,192
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Bis(2-chloro-1- methylethyl) ether	96	13,000,000	0	8,934,000	21,934,000	0	0	0	0	0	0	21,938,700
	95	5,200,000	8,540,000	10,840,000	24,580,000	0	0	0	0	0	0	24,586,100
	94	3,100,000	7,800,000	7,500,000	18,400,000	0	0	0	0	0	0	18,407,900
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Bromoform	96	No reports received										
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Bromomethane	96	39,200	207,750	454,397	701,347	0	190	0	0	0	190	3,001,785
	95	165,182	101,000	4,876,073	5,142,255	0	380	0	0	0	380	7,720,636
	94	772,910	79,000	108,195	960,105	0	100	750	0	0	850	3,639,105
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
1,3-Butadiene	96	5,953,022	37,128,076	61,528,326	104,609,424	7,241,635	3,409	92,020	670	0	7,337,734	120,423,280
	95	5,513,939	32,353,920	57,784,775	95,652,634	7,011,736	34,521	96,020	705	0	7,142,982	112,314,831
	94	5,600,731	40,521,985	44,835,914	90,958,630	7,328,960	166,970	400,339	537	0	7,896,806	109,670,111
	88	NA	NA	NA	NA	NA	NA	178,855	44,874	1,934	NA	NA
Butyl acrylate	96	93,695	1,902,440	3,155,076	5,151,211	90,081	308,058	59,934	112,122	0	570,195	5,979,902
	95	173,995	4,059,201	4,173,410	8,406,606	207,463	1,143,538	109,335	121,191	0	1,581,527	10,285,070
	94	140,109	3,776,871	1,586,926	5,503,906	107,082	182,031	85,812	107,496	0	482,421	6,308,918
	88	NA	NA	NA	NA	NA	NA	585,394	34,604	525	NA	NA
n-Butyl alcohol	96	7,330,808	22,248,666	39,477,166	69,056,640	2,929,058	7,807,862	1,222,863	1,862,777	11,000	13,833,560	109,092,615
	95	8,438,943	24,665,663	37,948,908	71,053,514	3,280,860	8,620,705	1,553,556	1,789,211	755	15,245,087	114,345,938
	94	26,401,711	16,120,208	26,420,738	68,942,657	2,651,817	7,760,665	2,218,675	1,819,029	297	14,450,483	113,966,981
	88	NA	NA	NA	NA	NA	NA	6,841,449	4,524,613	424,570	NA	NA
sec-Butyl alcohol	96	472,175	20,272,772	2,060,170	22,805,117	143,765	3,500,087	86,670	56,350	0	3,786,872	27,617,067
	95	748,440	13,041,102	2,249,797	16,039,339	24,670	6,221,727	39,689	59,663	0	6,345,749	23,519,105
	94	410,890	10,476,065	1,727,242	12,614,197	44,064	5,307,090	75,307	37,320	0	5,463,781	19,179,277
	88	NA	NA	NA	NA	NA	NA	74,574	41,108	134,802	NA	NA
tert-Butyl alcohol	96	437,181	53,474,091	2,117,278	56,028,550	12,084	8,386,360	184,233	1,151,656	0	9,734,333	68,708,742
	95	466,023	64,310,733	2,447,778	67,224,534	2,256	27,928,818	973,977	837,780	0	29,742,831	98,721,229
	94	473,322	35,610,614	1,648,219	37,732,155	1,356	29,854,068	1,202,299	743,825	0	31,801,548	71,316,735
	88	NA	NA	NA	NA	NA	NA	328,523	1,539,726	110,250	NA	NA
1,2-Butylene oxide	96	0	46,792	350,376	397,168	0	263,538	20,558	0	0	284,096	690,769
	95	0	0	329,270	329,270	990	326,640	93	0	0	327,723	671,351
	94	0	47,000	3,300,131	3,347,131	2,650	364,065	0	10	0	366,725	3,719,712
	88	NA	NA	NA	NA	NA	NA	250	0	0	NA	NA

**Note:** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
123-72-8	Butyraldehyde	96	128,227	155,403	441	43,344	46	327,461	37	327,498
		95	120,634	170,806	821	149,783	10	442,054	41	442,095
		94	133,044	146,824	875	87,047	0	367,790	1,038	368,828
		88	691,404	1,527,288	3,812	1,997	31	2,224,532	117,741	2,342,273
7440-43-9	Cadmium	96	1,926	2,849	1,010	0	51,420	57,205	39,864	97,069
		95	2,480	9,459	458	0	19,938	32,335	62,120	94,455
		94	2,651	7,412	1,264	0	4,146	15,473	59,259	74,732
		88	9,300	13,130	2,598	0	94,602	119,630	131,879	251,509
---	Cadmium compounds	96	5,964	33,925	3,614	82	502,027	545,612	898,688	1,444,300
		95	7,177	24,692	645	109	358,773	391,396	1,648,173	2,039,569
		94	6,435	34,355	775	170	337,743	379,478	1,864,419	2,243,897
		88	23,099	77,163	1,549	2,409	294,877	399,097	982,168	1,381,265
156-62-7	Calcium cyanamide	96	1	1	0	0	0	2	0	2
		95	5	5	0	0	0	10	0	10
		94	0	5	0	0	0	5	0	5
		88	12,000	600	0	0	66,000	78,600	0	78,600
133-06-2	* Captan	96	519	12,106	5	5	0	12,635	2,191	14,826
		95	520	6,760	5	0	5	7,290	3,868	11,158
		94	1,522	6,971	5	0	5	8,503	1,237	9,740
		88	4,066	10,803	750	5,100	1,000	21,719	12,434	34,153
63-25-2	* Carbaryl	96	1,270	11,662	54	0	2,685	15,671	2,848	18,519
		95	1,022	6,802	10	0	1,060	8,894	26,861	35,755
		94	2,668	4,749	10	0	255	7,682	16,491	24,173
		88	2,515	5,408	877	0	500	9,300	6,198	15,498
75-15-0	Carbon disulfide	96	3,212,583	69,569,637	66,555	3,788	270	72,852,833	19,097	72,871,930
		95	3,457,834	80,662,696	39,864	3,985	265	84,164,644	2,949	84,167,593
		94	3,876,738	80,233,890	56,136	4,305	80	84,171,149	1,672	84,172,821
		88	3,139,255	120,970,649	39,501	13,400	43,436	124,206,241	58,473	124,264,714
56-23-5	Carbon tetrachloride	96	140,533	210,317	215	44,515	0	395,580	9,245	404,825
		95	140,135	254,041	717	53,966	0	448,859	7,735	456,594
		94	235,473	415,625	1,223	12,654	0	664,975	50,791	715,766
		88	1,101,201	2,694,047	15,627	98,050	14,759	3,923,684	49,703	3,973,387
463-58-1	Carbonyl sulfide	96	610,328	19,241,733	0	0	0	19,852,061	0	19,852,061
		95	86,530	17,483,365	0	0	0	17,569,895	0	17,569,895
		94	77,490	17,845,497	0	0	0	17,922,987	0	17,922,987
		88	7,643	25,946,460	0	0	0	25,954,103	0	25,954,103
120-80-9	Catechol	96	2,480	2,826	24,475	0	2,222	32,003	239	32,242
		95	1,328	2,129	24,747	0	3,729	31,933	563	32,496
		94	1,483	1,878	26,585	0	1,332	31,278	1,568	32,846
		88	2,448	1,341	320,546	0	84,332	408,667	89,474	498,141
133-90-4	Chloramben	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	250	1,168	250	0	0	1,668	1,159	2,827

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year					Total On-site Waste Manage- ment Pounds					Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
		Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds		Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds		
Butyraldehyde	96	0	2,757,675	1,905,739	4,663,414	3,405	26,894	22,351	258,800	0	311,450	5,333,341
	95	0	2,545,861	1,982,004	4,527,865	1,300	22,070	13,746	155,918	0	193,034	5,161,657
	94	0	520,034	1,561,850	2,081,884	0	17,281	6,555	203,094	0	226,930	2,675,042
	88	NA	NA	NA	NA	NA	NA	6,197	371,633	0	NA	NA
Cadmium	96	504,123	0	67,708	571,831	395,287	0	34,693	570	1	430,551	1,078,869
	95	1,471,697	29,191	91,725	1,592,613	503,545	633	31,250	815	4,610	540,853	2,255,875
	94	935,480	0	73,842	1,009,322	715,739	0	9,628	599	0	725,966	1,885,171
	88	NA	NA	NA	NA	NA	NA	83,296	7,894	2,441	NA	NA
Cadmium compounds	96	7,831,833	0	68,747	7,900,580	710,242	1,613	192,918	2,577	0	907,350	10,221,593
	95	8,221,108	0	86,561	8,307,669	1,292,820	2,233	162,037	3,385	41,925	1,502,400	11,856,105
	94	3,889,693	0	29,448	3,919,141	1,959,902	2,748	160,927	2,421	0	2,125,998	8,282,944
	88	NA	NA	NA	NA	NA	NA	86,534	13,719	500	NA	NA
Calcium cyanamide	96	0	0	0	0	0	0	0	0	0	0	1
	95	0	0	0	0	0	0	0	0	0	0	6
	94	0	0	0	0	0	0	0	0	0	0	5
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Captan	96	4,079	0	9,500	13,579	0	0	2,081	0	0	2,081	28,694
	95	5,070	0	9,834	14,904	0	0	999	3	255	1,257	23,455
	94	10,794	0	9,700	20,494	0	0	2,410	26	0	2,436	29,383
	88	NA	NA	NA	NA	NA	NA	511	250	750	NA	NA
Carbaryl	96	46,121	458,932	437,614	942,667	0	0	67,982	5	0	67,987	984,715
	95	36,618	0	467,593	504,211	0	0	6,385	5	0	6,390	544,793
	94	24,234	0	420,867	445,101	0	0	5,222	1	0	5,223	470,214
	88	NA	NA	NA	NA	NA	NA	27,582	171	0	NA	NA
Carbon disulfide	96	19,122,418	6,776,413	23,478,038	49,376,869	395	297,411	24,954	292,225	0	614,985	123,183,876
	95	20,874,450	5,775,132	16,592,458	43,242,040	250	372,531	108,021	351,949	0	832,751	128,714,727
	94	22,399,099	2,787,953	18,673,450	43,860,502	426	205,993	31,113	359,388	0	596,920	128,715,577
	88	NA	NA	NA	NA	NA	NA	154,315	159,369	0	NA	NA
Carbon tetrachloride	96	2,073,632	1,050,017	41,816,616	44,940,265	128,727	26,337	1,600,815	480	0	1,756,359	45,991,160
	95	1,677,422	317,149	52,783,870	54,778,441	364,083	50,065	738,973	473	0	1,153,594	56,361,154
	94	1,835,424	138,871	14,290,324	16,264,619	850,623	17,314	1,172,832	574	0	2,041,343	18,942,128
	88	NA	NA	NA	NA	NA	NA	1,300,058	5,014	250	NA	NA
Carbonyl sulfide	96	0	1,805,617	14,041,155	15,846,772	0	0	5,900	0	0	5,900	35,818,382
	95	0	1,508,252	14,242,854	15,751,106	0	0	16,000	0	0	16,000	34,179,368
	94	0	749,467	13,410,115	14,159,582	0	0	18,000	0	0	18,000	32,103,297
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Catechol	96	0	10,927,849	3,729,029	14,656,878	0	32,112	19,160	34,644	0	85,916	14,752,655
	95	0	7,329,290	1,481,057	8,810,347	0	94,900	961	92,901	0	188,762	9,027,783
	94	2,040	5,614,396	1,571,419	7,187,855	0	9,318	2,805	83,490	0	95,613	7,305,016
	88	NA	NA	NA	NA	NA	NA	14,744	245,399	250	NA	NA
Chloramben	96	No reports received				NA	NA	0	0	0	NA	NA
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA							

**Note:** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).

Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

On-site Releases									Off-site Releases	Total On- and Off-site Releases Pounds
CAS Number	Chemical	Year	Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
57-74-9	Chlordane	96	660	0	95	0	0	755	0	755
		95	823	0	22	0	0	845	0	845
		94	1,300	0	13	0	0	1,313	0	1,313
		88	2,695	3	4	4,262	0	6,964	0	6,964
7782-50-5	* Chlorine	96	1,119,170	65,308,331	465,787	74,196	312,638	67,280,122	21,045	67,301,167
		95	1,049,905	64,719,424	432,218	74,124	14,213	66,289,884	40,771	66,330,655
		94	1,297,509	58,578,266	502,396	74,311	63,097	60,515,579	15,133	60,530,712
		88	4,722,032	128,363,569	6,622,187	107,624	430,047	140,245,459	1,003,531	141,248,990
10049-04-4	* Chlorine dioxide	96	20,395	1,189,230	0	0	0	1,209,625	0	1,209,625
		95	16,727	1,286,799	5	0	0	1,303,531	0	1,303,531
		94	16,914	1,484,137	0	0	0	1,501,051	2	1,501,053
		88	1,277,556	10,973,494	2,350	0	41,000	12,294,400	41,750	12,336,150
79-11-8	Chloroacetic acid	96	5,620	812	2	0	250	6,684	255	6,939
		95	5,619	855	11,121	0	0	17,595	600	18,195
		94	5,983	710	10,178	0	950	17,821	603	18,424
		88	21,660	5,159	850	10	0	27,679	2,506	30,185
108-90-7	Chlorobenzene	96	775,735	402,361	2,086	68,701	5	1,248,888	106,844	1,355,732
		95	553,142	525,711	1,850	27,405	5	1,108,113	92,582	1,200,695
		94	746,012	702,475	2,206	72,000	16	1,522,709	94,624	1,617,333
		88	2,032,791	2,343,096	98,354	84,457	4,127	4,562,825	117,624	4,680,449
75-00-3	Chloroethane	96	1,130,568	1,422,692	285	92	0	2,553,637	0	2,553,637
		95	1,221,405	1,536,944	2,320	0	116	2,760,785	0	2,760,785
		94	1,285,967	1,641,444	767	110	147	2,928,435	8	2,928,443
		88	2,148,305	2,738,910	27,448	1,510	1	4,916,174	32,260	4,948,434
67-66-3	Chloroform	96	3,086,308	6,235,110	340,396	45,387	32,709	9,739,910	38,868	9,778,778
		95	3,333,191	6,942,723	330,352	33,276	4,297	10,643,839	6,636	10,650,475
		94	3,493,811	7,548,078	376,502	80,002	11,779	11,510,172	68,688	11,578,860
		88	7,790,990	18,197,619	1,114,965	36,000	68,647	27,208,221	143,124	27,351,345
74-87-3	Chloromethane	96	772,463	3,685,312	803	99,705	80	4,558,363	392	4,558,755
		95	849,575	3,534,174	57,425	50,198	35	4,491,407	1,557	4,492,964
		94	1,002,143	3,917,650	59,653	50,707	15	5,030,168	1,565	5,031,733
		88	3,515,698	8,051,949	115,985	165,250	0	11,848,882	59,140	11,908,022
107-30-2	Chloromethyl methyl ether	96	199	2,642	7	0	0	2,848	70	2,918
		95	11	2,854	10	0	0	2,875	70	2,945
		94	11	2,728	5	0	0	2,744	70	2,814
		88	33	3,000	0	0	0	3,033	0	3,033
—	Chlorophenols	96	1,851	2,924	13	113,554	0	118,342	2,290	120,632
		95	1,960	3,037	30	105,687	0	110,714	940	111,654
		94	1,991	6,630	39	94,236	1	102,897	383	103,280
		88	2,154	419	272	71,554	0	74,399	2	74,401
126-99-8	Chloroprene	96	112,905	913,190	5	120,000	8,640	1,154,740	8,640	1,163,380
		95	109,218	874,670	0	60,000	5,104	1,048,992	7,102	1,056,094
		94	125,385	968,771	2	59,600	3,997	1,157,755	6,391	1,164,146
		88	234,228	1,713,780	287	68,792	0	2,017,087	0	2,017,087

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\*Pesticide



Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
Chlordane	96	0	0	4,150	4,150	0	0	1	83	0	84	4,989
	95	0	0	5,150	5,150	0	0	0	95	0	95	6,090
	94	0	0	5,200	5,200	0	0	6	100	0	106	6,610
	88	NA	NA	NA	NA	NA	NA	74,170	23	6,639	NA	NA
Chlorine	96	82,275,726	4,000	259,753,478	342,033,204	751,987	10,348	1,011,185	567,079	0	2,340,599	411,400,655
	95	84,997,609	499	220,213,392	305,211,500	1,791,982	1,196	303,388	444,899	0	2,541,465	374,496,229
	94	81,815,961	1,303,020	220,121,041	303,240,022	2,832,926	4,310	343,537	838,752	5,005	4,024,530	367,708,233
	88	NA	NA	NA	NA	NA	NA	2,995,507	3,100,697	0	NA	NA
Chlorine dioxide	96	2,242,600	0	50,907,468	53,150,068	0	0	0	16,000	0	16,000	54,522,783
	95	2,446,060	0	40,375,897	42,821,957	0	0	0	250	0	250	44,147,268
	94	2,388,780	0	69,813,113	72,201,893	0	0	0	296	0	296	73,723,716
	88	NA	NA	NA	NA	NA	NA	0	2,650	0	NA	NA
Chloroacetic acid	96	42,416	0	1,636,910	1,679,326	0	0	251	1,250	0	1,501	1,686,206
	95	25,013	0	1,331,388	1,356,401	0	0	2,654	500	0	3,154	1,376,839
	94	38,482	0	1,229,602	1,268,084	0	250	5,406	1,015	0	6,671	1,289,574
	88	NA	NA	NA	NA	NA	NA	6,900	10,727	0	NA	NA
Chlorobenzene	96	5,742,719	2,870,143	11,527,191	20,140,053	1,605,990	589,367	2,803,074	8,139	21,747	5,028,317	26,343,646
	95	9,123,869	1,978,757	11,231,684	22,334,310	1,017,180	1,367,467	1,726,505	2,169	0	4,113,321	27,410,267
	94	15,489,324	1,533,627	7,863,711	24,886,662	1,084,976	625,394	1,119,835	1,922	0	2,832,127	29,209,528
	88	NA	NA	NA	NA	NA	NA	4,925,431	578,774	0	NA	NA
Chloroethane	96	3,909,753	12,244,253	28,988,635	45,142,641	155,710	39,841	490,834	762	1,926	689,073	48,384,121
	95	2,321,094	13,500,359	28,073,797	43,895,250	156,726	46,034	490,733	760	0	694,253	47,348,783
	94	1,388,619	20,215,866	26,027,122	47,631,607	174,502	59,459	360,204	760	0	594,925	51,119,585
	88	NA	NA	NA	NA	NA	NA	431,010	180	0	NA	NA
Chloroform	96	6,039,162	8,887,218	13,453,310	28,379,690	668,897	189,452	1,860,389	329,533	0	3,048,271	41,656,082
	95	5,138,816	17,187,219	17,351,138	39,677,173	175,944	103,428	1,644,237	418,401	0	2,342,010	52,626,590
	94	5,492,781	10,972,419	19,871,561	36,336,761	351,182	101,775	1,969,037	437,920	0	2,859,914	50,668,511
	88	NA	NA	NA	NA	NA	NA	1,204,786	1,226,573	20,365	NA	NA
Chloromethane	96	2,999,190	4,492,933	12,991,668	20,483,791	0	6,223	253,067	9,758	0	269,048	25,480,331
	95	2,803,788	4,421,896	14,313,676	21,539,360	0	4,233	238,170	2,980	0	245,383	26,267,441
	94	2,333,832	3,794,405	12,100,977	18,229,214	0	7,239	358,585	2,242	0	368,066	23,631,941
	88	NA	NA	NA	NA	NA	NA	45,292	54,223	0	NA	NA
Chloromethyl methyl ether	96	0	0	8,220	8,220	0	0	0	0	0	0	11,137
	95	0	0	15,900	15,900	0	0	0	0	0	0	18,809
	94	0	0	14,600	14,600	0	0	0	0	0	0	17,406
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Chlorophenols	96	2,486,786	0	207,215	2,694,001	0	670	8,698	0	0	9,368	2,822,844
	95	2,919,075	0	237,484	3,156,559	0	6,380	25,112	1,350	0	32,842	3,299,018
	94	2,822,928	0	230,113	3,053,041	17,232	0	26,914	1,494	0	45,640	3,221,039
	88	NA	NA	NA	NA	NA	NA	1,970,910	2,650	0	NA	NA
Chloroprene	96	0	944,336	7,250,217	8,194,553	281,520	14,010	252,891	16,109	0	564,530	9,912,418
	95	0	26,280	4,233,572	4,259,852	481,972	9,105	126,850	11,571	0	629,498	5,939,325
	94	0	26,064	4,137,812	4,163,876	1,155,305	96,000	50,800	16,571	0	1,318,676	6,640,834
	88	NA	NA	NA	NA	NA	NA	18,749	62,000	0	NA	NA

Note: Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)





Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
1897-45-6	* Chlorothalonil	96	12,307	3,423	22	0	1,670	17,422	253,395	270,817
		95	4,710	2,730	35	0	750	8,225	97,420	105,645
		94	1,472	2,668	21	0	250	4,411	227,473	231,884
		88	19,455	9,021	250	0	0	28,726	396,274	425,000
7440-47-3	Chromium	96	353,248	135,244	574,092	9	765,351	1,827,944	4,985,681	6,813,625
		95	266,162	347,460	17,731	33	1,114,860	1,746,246	4,790,613	6,536,859
		94	476,887	166,222	20,745	48	1,174,905	1,838,807	4,955,330	6,794,137
		88	369,217	195,579	75,192	2,249	9,280,857	9,923,094	10,442,555	20,365,649
—	Chromium compounds	96	168,943	237,261	137,319	37,422	26,134,671	26,715,616	11,759,262	38,474,878
		95	175,001	405,230	137,235	60,747	21,445,118	22,223,331	16,823,294	39,046,625
		94	174,954	367,968	159,649	38,061	21,428,384	22,169,016	11,131,091	33,300,107
		88	257,115	505,795	326,027	52,653	30,934,406	32,075,996	11,539,547	43,615,543
569-64-2	C.I. Basic Green 4	96	0	5	0	0	0	5	0	5
		95	0	5	0	0	0	5	0	5
		94	0	10	0	0	0	10	0	10
		88	500	250	0	0	0	750	250	1,000
989-38-8	C.I. Basic Red 1	96	0	0	0	0	0	0	668	668
		95	0	0	0	0	0	0	668	668
		94	4	4	0	0	0	8	668	676
		88	No reports received							
16071-86-6	C.I. Direct Brown 95	96	No reports received							
		95	0	0	0	0	0	0	0	0
		94	No reports received							
		88	No reports received							
2832-40-8	C.I. Disperse Yellow 3	96	392	60	28	0	0	480	594	1,074
		95	450	0	27	0	0	477	1,061	1,538
		94	238	0	26	0	0	264	2,597	2,861
		88	398	0	302	0	0	700	899	1,599
81-88-9	C.I. Food Red 15	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	0	0	0	0	0	0	0	0
		88	250	0	0	0	0	250	0	250
3118-97-6	C.I. Solvent Orange 7	96	No reports received							
		95	No reports received							
		94	0	0	0	0	0	0	350	350
		88	No reports received							
97-56-3	C.I. Solvent Yellow 3	96	No reports received							
		95	0	0	0	0	0	0	0	0
		94	No reports received							
		88	250	0	0	0	0	250	0	250
842-07-9	C.I. Solvent Yellow 14	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	0	0	0	0	0	0	0	0

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\*Pesticide



Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production- related Waste Pounds
Chlorothalonil	96	5,208	0	25,902	31,110	148	0	274,590	1,459	0	276,197	568,381
	95	5,339	0	24,716	30,055	0	2,564	141,072	1,264	0	144,900	274,594
	94	5,243	0	4,823	10,066	0	15	7,551	505	0	8,071	248,875
	88	NA	NA	NA	NA	NA	NA	3,660	541	0	NA	NA
Chromium	96	30,287,624	34,195	317,369	30,639,188	82,655,975	1,109	643,205	49,915	5,441	83,355,645	124,633,699
	95	29,870,462	9,781,278	398,204	40,049,944	95,324,323	131,060	2,323,968	50,626	5	97,829,982	145,601,783
	94	39,401,588	59,818	585,749	40,047,155	109,947,008	26,534	493,291	73,730	88,015	110,628,578	160,288,818
	88	NA	NA	NA	NA	NA	NA	1,218,879	414,983	816,778	NA	NA
Chromium compounds	96	25,668,394	27,254	5,417,810	31,113,458	31,270,685	55,259	3,327,978	247,125	0	34,901,047	105,639,489
	95	36,671,498	44,280	94,214,040	130,929,818	37,281,624	70,227	3,188,159	308,616	32,950	40,881,576	212,626,985
	94	36,200,636	65,702	78,535,679	114,802,017	39,195,007	67,481	4,870,079	356,674	0	44,489,241	192,739,335
	88	NA	NA	NA	NA	NA	NA	2,660,432	1,678,116	414,494	NA	NA
C.I. Basic Green 4	96	0	0	100	100	0	0	11,499	0	0	11,499	609
	95	0	0	110	110	0	0	499	0	0	499	619
	94	0	0	0	0	0	0	499	0	0	499	509
	88	NA	NA	NA	NA	NA	NA	0	1,320	0	NA	NA
C.I. Basic Red 1	96	0	0	0	0	0	40	248	15	0	303	971
	95	0	0	0	0	0	250	250	250	0	750	1,011
	94	0	0	0	0	0	114	132	274	0	520	960
	88	No reports received										
C.I. Direct Brown 95	96	No reports received										
	95	0	0	0	0	0	0	0	5	0	5	0
	94	No reports received										
	88	No reports received										
C.I. Disperse Yellow 3	96	0	0	0	0	0	0	0	5,891	0	5,891	6,960
	95	0	0	1,061	1,061	0	0	0	5,194	0	5,194	7,660
	94	0	0	2,496	2,496	0	0	0	2,488	0	2,488	7,840
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
C.I. Food Red 15	96	0	0	0	0	0	0	0	5	0	5	0
	95	0	0	0	0	0	0	0	5	0	5	0
	94	0	0	0	0	0	0	0	0	0	0	0
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
C.I. Solvent Orange 7	96	No reports received										
	95	No reports received										
	94	450	0	0	450	0	0	0	284	0	284	1,084
	88	No reports received										
C.I. Solvent Yellow 3	96	No reports received										
	95	0	0	0	0	0	0	0	0	0	0	0
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
C.I. Solvent Yellow 14	96	No reports received										
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA

Note: Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
7440-48-4	Cobalt	96	19,372	13,129	4,330	0	66,736	103,567	139,708	243,275
		95	13,903	21,333	17,295	0	48,334	100,865	189,432	290,297
		94	21,931	23,629	6,824	0	35,030	87,414	154,962	242,376
		88	22,439	21,566	16,744	0	213,204	273,953	226,686	500,639
—	Cobalt compounds	96	3,994	26,931	27,960	15,917	220,634	295,436	559,381	854,817
		95	5,948	22,388	70,392	22,657	180,417	301,802	265,072	566,874
		94	10,723	22,295	106,479	1,750	133,602	274,849	411,596	686,445
		88	11,081	45,329	63,662	18,500	38,960	177,532	253,578	431,110
7440-50-8	* Copper	96	4,316,839	707,505	46,778	41,032	3,353,008	8,465,162	14,493,597	22,958,759
		95	459,847	742,889	43,233	29,787	1,672,083	2,947,839	13,662,926	16,610,765
		94	408,423	789,551	55,980	19,944	996,963	2,270,861	12,886,324	15,157,185
		88	320,707	1,204,354	115,631	15,651	10,466,175	12,122,518	15,152,628	27,275,146
—	Copper compounds	96	1,198,319	666,754	62,013	313,376	48,067,716	50,308,178	6,935,031	57,243,209
		95	1,498,263	1,185,959	84,849	264,852	40,657,368	43,691,291	7,246,434	50,937,725
		94	3,240,343	2,132,773	85,954	214,308	41,698,098	47,371,476	9,993,952	57,365,428
		88	2,336,180	821,017	185,292	165,957	29,683,607	33,192,053	9,319,212	42,511,265
120-71-8	p-Cresidine	96	1,665	1,800	0	0	0	3,465	0	3,465
		95	1,706	2,900	0	0	0	4,606	2,200	6,806
		94	881	130	81	0	50	1,142	3,000	4,142
		88	5,400	1,680	250	0	750	8,080	4,700	12,780
108-39-4	* m-Cresol	96	20,830	20,394	1,633	520,000	0	562,857	1,473	564,330
		95	28,042	19,958	1,675	680,000	0	729,675	3,218	732,893
		94	35,097	18,973	4,072	610,000	0	668,142	15,923	684,065
		88	5,860	12,572	283	0	455	19,170	13,503	32,673
95-48-7	o-Cresol	96	1,998	6,293	845	440,000	0	449,136	4,257	453,393
		95	4,077	8,348	82	590,000	0	602,507	5,257	607,764
		94	12,085	3,359	1,990	660,000	0	677,434	8,335	685,769
		88	45,557	44,236	448	0	1,667	91,908	12,458	104,366
106-44-5	p-Cresol	96	24,607	17,189	825	262,500	361	305,482	13,462	318,944
		95	26,764	18,669	1,066	342,500	0	388,999	3,168	392,167
		94	34,350	31,783	2,020	301,900	0	370,053	10,617	380,670
		88	6,286	634,417	1,143	152,000	62,291	856,137	643	856,780
1319-77-3	Cresol (mixed isomers)	96	284,120	1,398,346	10,114	711,056	1,969	2,405,605	20,245	2,425,850
		95	339,937	1,266,623	15,011	648,882	2,350	2,272,803	47,059	2,319,862
		94	359,443	1,447,089	11,607	808,900	4,828	2,631,867	71,541	2,703,408
		88	400,427	378,678	6,764	1,804,060	4,512	2,594,441	483,488	3,077,929
98-82-8	Cumene	96	565,522	1,008,756	1,042	3,267	6,850	1,585,437	5,006	1,590,443
		95	710,170	1,158,941	1,490	9,403	1,102	1,881,106	70,457	1,951,563
		94	835,164	1,236,577	6,369	8,940	942	2,087,992	25,761	2,113,753
		88	2,160,167	3,079,791	3,201	30,165	8,591	5,281,915	83,287	5,365,202
80-15-9	Cumene hydroperoxide	96	35,755	11,241	26	180,169	6,300	233,491	11,147	244,638
		95	51,819	21,079	68	280,000	3,400	356,366	68,728	425,094
		94	78,772	57,806	176	280,000	2,500	419,254	71,597	490,851
		88	178,787	13,736	1,784	371,000	250	565,557	22,944	588,501

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Cobalt	96	3,778,210	0	147,007	3,925,217	6,699,148	0	21,256	6,533	47,000	6,773,937	11,312,611
	95	3,573,917	0	379,265	3,953,182	9,962,672	10	21,575	17,095	0	10,001,352	15,934,148
	94	3,129,055	0	165,446	3,294,501	9,140,347	5	848,470	21,855	0	10,010,677	15,867,916
	88	NA	NA	NA	NA	NA	NA	27,673	8,843	27,823	NA	NA
Cobalt compounds	96	215,762	0	1,107,761	1,323,523	1,940,354	2,020	105,173	7,433	0	2,054,980	4,221,216
	95	222,882	0	1,394,877	1,617,759	1,533,439	1,854	83,042	8,063	0	1,626,398	3,800,271
	94	524,605	0	713,923	1,238,528	1,472,975	1,893	112,921	8,446	5,949	1,602,184	3,493,602
	88	NA	NA	NA	NA	NA	NA	88,079	28,369	263	NA	NA
Copper	96	737,221,219	123,097	41,621,864	778,966,180	539,187,912	63,810	1,224,559	370,317	1,004	540,847,602	1,353,885,321
	95	637,552,730	506	42,497,780	680,051,016	535,501,327	45,426	1,155,022	197,633	500	536,899,908	1,241,896,665
	94	621,435,903	1,000	35,342,238	656,779,141	549,481,338	38,402	1,141,554	141,219	8,274	550,810,787	1,219,890,870
	88	NA	NA	NA	NA	NA	NA	4,066,439	313,756	1,568,263	NA	NA
Copper compounds	96	189,656,521	59	5,817,034	195,473,614	194,626,529	19,948	1,884,588	156,261	17,159	196,704,485	456,506,872
	95	215,008,080	0	60,463,597	275,471,677	185,233,297	26,764	2,020,510	164,003	505	187,445,079	515,268,856
	94	259,442,385	0	164,445,063	423,887,448	150,229,819	64,615	2,149,528	148,183	199,764	152,791,909	655,687,102
	88	NA	NA	NA	NA	NA	NA	5,931,794	437,156	1,670,071	NA	NA
p-Cresidine	96	0	0	0	0	0	0	1,600	38,697	0	40,297	44,162
	95	0	0	0	0	0	0	13,000	41,611	0	54,611	58,417
	94	0	0	1,063	1,063	0	0	2,200	28,896	0	31,096	36,114
	88	NA	NA	NA	NA	NA	NA	0	37,750	0	NA	NA
m-Cresol	96	2,104,414	789,240	229,581	3,123,235	820,576	38,925	24,217	3,261	0	886,979	4,578,595
	95	2,309,373	615,425	329,024	3,253,822	1,503,813	17,854	81,671	7,837	0	1,611,175	5,600,600
	94	2,204,055	578,235	250,558	3,032,848	684,191	21,207	48,433	14,624	0	768,455	4,441,965
	88	NA	NA	NA	NA	NA	NA	125,737	7,165	0	NA	NA
o-Cresol	96	97,068	299,260	196,840	593,168	8	53,235	12,421	41,234	0	106,898	1,152,884
	95	171,098	304,801	184,032	659,931	3,888	320	34,578	85,123	0	123,909	1,392,082
	94	178,409	486,957	170,623	835,989	4,178	11,520	27,062	99,457	0	142,217	1,663,266
	88	NA	NA	NA	NA	NA	NA	75,565	40,703	2,500	NA	NA
p-Cresol	96	90,880	430,589	468,502	989,971	500,574	115,535	20,308	388,390	0	1,024,807	2,335,909
	95	137,136	454,288	226,234	817,658	900,001	58,381	54,724	931,786	0	1,944,892	3,154,982
	94	169,555	518,695	170,207	858,457	450,009	44,592	32,831	1,723,189	0	2,250,621	3,487,312
	88	NA	NA	NA	NA	NA	NA	26,377	744,568	250	NA	NA
Cresol (mixed isomers)	96	502,345	4,573,476	14,730,070	19,805,891	388,055	558,963	274,727	61,307	0	1,283,052	23,349,769
	95	1,052,270	5,045,270	8,558,967	14,656,507	187,657	597,791	1,082,227	79,401	0	1,947,076	18,828,100
	94	1,680,845	4,071,623	7,757,585	13,510,053	337,998	577,126	257,485	62,226	0	1,234,835	17,325,871
	88	NA	NA	NA	NA	NA	NA	847,303	358,242	8,738	NA	NA
Cumene	96	16,061,751	9,440,085	38,743,335	64,245,171	153,825	1,191,125	88,661	29,547	0	1,463,158	67,186,433
	95	17,285,493	6,815,013	6,951,773	31,052,279	57,755	1,381,089	146,451	26,657	0	1,611,952	34,711,941
	94	14,355,165	5,680,434	7,480,372	27,515,971	96,410	627,986	186,863	24,194	0	935,453	30,693,309
	88	NA	NA	NA	NA	NA	NA	126,382	203,279	0	NA	NA
Cumene hydroperoxide	96	0	0	543,481	543,481	0	12	1,937	175,887	0	177,836	1,016,533
	95	0	0	482,755	482,755	0	6	4,062	17,343	0	21,411	938,956
	94	0	0	796,774	796,774	0	738	2,353	768	0	3,859	1,298,297
	88	NA	NA	NA	NA	NA	NA	2,572	5,250	0	NA	NA

**Note** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
135-20-6	Cupferron	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	2	9	0	0	0	11	0	11
		88	140	780	0	0	0	920	0	920
—	Cyanide compounds	96	125,836	723,335	107,054	3,477,384	76,101	4,509,710	95,181	4,604,891
		95	168,727	905,434	89,466	4,429,640	18,580	5,611,847	149,438	5,761,285
		94	125,281	901,153	102,633	3,239,418	13,955	4,382,440	142,896	4,525,336
		88	525,618	721,774	195,244	3,707,326	107,208	5,257,170	581,430	5,838,600
110-82-7	Cyclohexane	96	2,964,377	3,851,714	23,595	314,855	5,552	7,160,093	107,106	7,267,199
		95	3,496,665	4,590,835	19,108	238,200	10,809	8,355,617	105,429	8,461,046
		94	3,567,580	5,164,858	32,012	192,409	18,138	8,974,997	25,359	9,000,356
		88	5,278,415	8,706,227	20,071	334,471	38,190	14,377,374	211,575	14,588,949
94-75-7 *	2,4-D (acetic acid)	96	2,218	3,771	832	0	255	7,076	6,017	13,093
		95	2,580	4,308	1,083	250	4,325	12,546	17,430	29,976
		94	5,797	3,772	133	250	300	10,252	96,785	107,037
		88	3,289	3,731	549	3,789	38,000	49,358	68,422	117,780
1163-19-5	Decabromodiphenyl oxide	96	13,728	31,880	3,675	0	200,838	250,121	620,047	870,168
		95	17,378	21,905	3,846	11	201,698	244,838	686,811	931,649
		94	16,151	153,971	1,958	40	298,191	470,311	990,381	1,460,692
		88	7,500	22,104	500	292	21,450	51,846	555,181	607,027
615-05-4	2,4-Diaminobenzonitrile	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	0	0	0	0	0	0	0	0
39156-41-7	2,4-Diaminobenzonitrile sulfate	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	0	0	0	0	0	0	0	0
101-80-4	4,4'-Diaminodiphenyl ether	96	9	7	182	0	0	198	53	251
		95	5	18	359	0	0	382	120	502
		94	14	102	1,653	0	12	1,781	122	1,903
		88	0	216	585	0	0	801	142	943
95-80-7	2,4-Diaminotoluene	96	211	1,364	0	0	0	1,575	0	1,575
		95	250	250	0	0	0	500	0	500
		94	250	1,767	0	0	0	2,017	0	2,017
		88	2,900	88	250	0	0	3,238	0	3,238
25376-45-8	Diaminotoluene (mixed isomers)	96	10,404	6,845	590	7,600	10	25,449	23,286	48,735
		95	4,372	5,222	5,522	7,050	55	22,221	28,625	50,846
		94	15,213	6,500	3,666	7,700	57	33,136	9,719	42,855
		88	15,202	5,895	3,288	174,000	295	198,680	289,591	488,271
132-64-9	Dibenzofuran	96	22,012	17,242	62	0	265	39,581	28,986	68,567
		95	12,284	6,420	2,843	0	220	21,767	19,824	41,591
		94	15,416	9,070	41	0	1,589	26,116	26,616	52,732
		88	46,687	24,406	1,510	0	9,929	82,532	181,799	264,331

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production- related Waste Pounds
Cupferron	96	0	679	0	679	0	0	90	0	0	90	769
	95	0	0	0	0	0	0	5,648	0	0	5,648	5,648
	94	0	0	0	0	0	17,811	0	78	0	17,889	17,900
	88	NA	NA	NA	NA	NA	NA	4,275	780	0	NA	NA
Cyanide compounds	96	588,476	120,114	10,946,174	11,654,764	31,823	22	404,941	236,134	0	672,920	16,757,529
	95	664,976	19,000	9,103,523	9,787,499	25,208	3,523	481,387	230,705	500	741,323	16,220,623
	94	720,386	54,000	11,905,939	12,680,325	26,218	8,094	417,807	164,436	9,104	625,659	17,702,907
	88	NA	NA	NA	NA	NA	NA	1,964,387	1,162,387	150,909	NA	NA
Cyclohexane	96	61,438,279	8,021,506	33,944,668	103,404,453	507,862	2,657,437	1,800,730	8,400	6,909	4,981,338	116,046,627
	95	54,772,521	10,345,060	23,801,493	88,919,074	1,589,125	16,825,499	1,058,702	5,022	0	19,478,348	105,309,693
	94	61,583,742	14,348,519	18,729,599	94,661,860	1,532,896	2,689,551	2,416,126	17,888	0	6,656,461	109,849,256
	88	NA	NA	NA	NA	NA	NA	2,691,889	146,667	37,400	NA	NA
2,4-D (acetic acid)	96	78,758	0	25,360	104,118	0	0	31,635	263	0	31,898	138,148
	95	29,200	0	23,780	52,980	0	0	31,590	20	0	31,610	105,065
	94	66,526	0	16,416	82,942	0	0	45,410	38	0	45,448	170,498
	88	NA	NA	NA	NA	NA	NA	23,335	27,952	0	NA	NA
Decabromodiphenyl oxide	96	902,477	0	48,973	951,450	117,679	4,881	53,022	265,560	0	441,142	2,260,569
	95	992,673	0	32,138	1,024,811	139,936	18,826	64,977	249,108	0	472,847	2,426,235
	94	1,049,121	0	32,504	1,081,625	169,003	30,860	64,923	396,137	0	660,923	2,995,825
	88	NA	NA	NA	NA	NA	NA	76,150	19,090	1,284	NA	NA
2,4-Diaminoanisole	96	No reports received										
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	250	0	NA	NA
2,4-Diaminoanisole sulfate	96	No reports received										
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	250	0	NA	NA
4,4'-Diamino- diphenyl ether	96	0	0	140	140	0	0	9,975	5	0	9,980	10,360
	95	0	0	4,929	4,929	0	0	380,169	5	0	380,174	385,595
	94	11,210	0	15,028	26,238	0	0	9,574	10	0	9,584	37,711
	88	NA	NA	NA	NA	NA	NA	0	179	0	NA	NA
2,4-Diaminotoluene	96	0	0	66,836	66,836	0	0	279	0	0	279	68,690
	95	0	0	7,192	7,192	0	0	29,774	0	0	29,774	37,621
	94	0	0	23,406	23,406	0	480	64,350	0	0	64,830	90,280
	88	NA	NA	NA	NA	NA	NA	0	1,200	0	NA	NA
Diaminotoluene (mixed isomers)	96	0	4,731,680	442,162	5,173,842	0	2,712,895	219,120	95,849	0	3,027,864	9,117,854
	95	0	755,917	362,357	1,118,274	0	386,996	1,925,458	8,720	0	2,321,174	3,476,562
	94	0	3,218,550	1,204,855	4,423,405	321	354,950	507,953	160,640	0	1,023,864	5,492,594
	88	NA	NA	NA	NA	NA	NA	456,114	2,951	250	NA	NA
Dibenzofuran	96	183,852	190	491,323	675,365	4,601	500	132	500	0	5,733	738,244
	95	74,646	113	405,125	479,884	27,735	270	42	503	0	28,550	544,075
	94	93,923	11,000	56,711	161,634	26,485	0	135	508	0	27,128	232,573
	88	NA	NA	NA	NA	NA	NA	51,985	47,726	250	NA	NA

Note Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
106-93-4	1,2-Dibromoethane	96	6,503	2,207	7	24	1	8,742	0	8,742
		95	7,858	4,514	306	0	256	12,934	3	12,937
		94	11,417	3,995	2,788	12	325	18,537	251	18,788
		88	34,119	29,223	1,011	6,882	259	71,494	27,924	99,418
84-74-2	Dibutyl phthalate	96	10,300	74,826	452	180,000	313	265,891	25,217	291,108
		95	24,984	99,248	3,981	390,000	1,402	519,615	25,920	545,535
		94	27,787	65,298	2,327	280,000	750	376,162	68,502	444,664
		88	169,836	34,222	14,339	350,000	6,395	574,792	113,068	687,860
95-50-1	1,2-Dichlorobenzene	96	186,171	101,181	5,324	4,900	384	297,960	17,759	315,719
		95	151,821	119,701	3,789	26,000	11,521	312,832	28,228	341,060
		94	98,285	147,364	2,812	2,900	24,287	275,648	38,095	313,743
		88	206,072	324,463	11,624	20,000	13,354	575,513	38,266	613,779
541-73-1	1,3-Dichlorobenzene	96	1,743	3,375	897	0	0	6,015	0	6,015
		95	2,975	4,553	526	0	0	8,054	0	8,054
		94	1,565	8,207	547	0	0	10,319	0	10,319
		88	5,782	9,500	1,281	0	0	16,563	290	16,853
106-46-7 *	1,4-Dichlorobenzene	96	93,651	142,851	1,881	2,000	480	240,863	0	240,863
		95	118,239	126,323	1,287	0	3,100	248,949	3,328	252,277
		94	114,935	142,276	1,595	2,000	1,100	261,906	0	261,906
		88	103,870	1,787,549	6,153	4,000	1,300	1,902,872	750	1,903,622
25321-22-6	Dichlorobenzene (mixed isomers)	96	239	13,808	0	0	0	14,047	10	14,057
		95	210	5,233	0	0	0	5,443	9	5,452
		94	316	3,726	0	0	0	4,042	9	4,051
		88	20,169	143,515	40	0	0	163,724	19,672	183,396
91-94-1	3,3'-Dichloro- benzidine	96	1	1	0	0	0	2	5,550	5,552
		95	5	6	0	0	0	11	2,400	2,411
		94	5	5	0	0	0	10	1,255	1,265
		88	250	5	752	0	0	1,007	209,785	210,792
75-27-4	Dichlorobromo- methane	96	0	2,400	0	0	110	2,510	0	2,510
		95	0	2,300	0	0	50	2,350	0	2,350
		94	0	0	0	0	0	0	0	0
		88	13,440	0	0	0	0	13,440	0	13,440
107-06-2	1,2-Dichloroethane	96	434,047	610,525	1,848	5,126	25,250	1,076,796	91,249	1,168,045
		95	582,589	651,808	5,194	24,339	256	1,264,186	23,671	1,287,857
		94	667,791	1,204,381	7,501	34,296	15	1,913,984	75,642	1,989,626
		88	1,574,325	3,040,854	40,527	1,452,084	2,166	6,109,956	166,131	6,276,087
540-59-0	1,2-Dichloroethylene	96	3,075	5,119	37	0	0	8,231	0	8,231
		95	3,907	4,620	270	0	0	8,797	0	8,797
		94	7,796	7,813	23	0	0	15,632	6	15,638
		88	16,552	109,926	95	0	1	126,574	87,614	214,188
75-09-2	Dichloromethane	96	21,519,922	31,900,543	10,060	749,507	4,957	54,184,989	116,409	54,301,398
		95	23,064,126	34,905,022	28,620	1,140,335	2,064	59,140,167	176,467	59,316,634
		94	25,350,704	38,217,450	52,289	960,942	50,845	64,632,230	314,976	64,947,206
		88	49,679,087	79,480,442	349,960	1,478,833	157,156	131,145,478	10,154,983	141,300,461

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\* Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production- related Waste Pounds
1,2-Dibromoethane	96	0	0	11,202	11,202	0	3,301	27,431	0	0	30,732	50,530
	95	0	60	34,174	34,234	0	18	72,467	5	0	72,490	118,458
	94	5,015	1,800	13,532	20,347	116	2	73,737	0	0	73,855	90,170
	88	NA	NA	NA	NA	NA	NA	5,937	253	0	NA	NA
Dibutyl phthalate	96	46,139	333,566	121,193	500,898	13,360	139,274	108,022	6,323	0	266,979	1,057,185
	95	51,458	1,060,538	314,761	1,426,757	26,704	175,700	104,738	5,294	0	312,436	2,145,916
	94	41,908	281,706	146,432	470,046	23,901	239,872	159,366	4,228	0	427,367	1,327,615
	88	NA	NA	NA	NA	NA	NA	157,156	36,523	1,618	NA	NA
1,2-Dichlorobenzene	96	6,431,032	612,089	318,912	7,362,033	2,890,994	587,976	2,685,125	4,368	0	6,168,463	13,824,617
	95	5,527,161	344,610	172,717	6,044,488	3,626,506	767,516	2,658,651	6,481	0	7,059,154	12,774,401
	94	4,477,061	303,389	168,885	4,949,335	2,518,203	777,347	2,153,033	20,607	0	5,469,190	10,708,752
	88	NA	NA	NA	NA	NA	NA	1,947,856	64,118	53,683	NA	NA
1,3-Dichlorobenzene	96	1,793	0	9	1,802	884	0	1,489	796	0	3,169	11,002
	95	5,068	0	10	5,078	1,130	0	3,102	1,401	0	5,633	18,437
	94	823	44,000	14	44,837	7,632	0	1,858	0	0	9,490	63,976
	88	NA	NA	NA	NA	NA	NA	250	40	0	NA	NA
1,4-Dichlorobenzene	96	4,249,806	354,424	130,406	4,734,636	0	12,038	509,105	79	0	521,222	5,496,709
	95	5,355,345	42,157	73,030	5,470,532	35,020	7,081	624,348	5	0	666,454	6,390,445
	94	5,373,248	19,398	26,180	5,418,826	7,531	2,730	272,784	3,303	0	286,348	5,925,804
	88	NA	NA	NA	NA	NA	NA	138,132	37,997	0	NA	NA
Dichlorobenzene (mixed isomers)	96	0	595,086	260,043	855,129	0	13,115	20,133	0	0	33,248	902,613
	95	0	266,997	79,032	346,029	0	5,175	3,684	0	0	8,859	360,330
	94	0	20,649	26,032	46,681	0	2,566	211	0	0	2,777	53,003
	88	NA	NA	NA	NA	NA	NA	104,706	182,663	0	NA	NA
3,3'-Dichloro- benzidine	96	0	0	6,000	6,000	0	0	46,000	250	0	46,250	57,400
	95	0	0	14,000	14,000	0	22,000	1,600	250	0	23,850	40,301
	94	0	0	19,435	19,435	0	12,000	14,500	260	0	26,760	47,106
	88	NA	NA	NA	NA	NA	NA	14,420	617	0	NA	NA
Dichlorobromo- methane	96	0	0	0	0	0	0	0	0	0	0	2,500
	95	0	0	0	0	0	0	0	0	0	0	2,300
	94	0	0	0	0	0	0	0	0	0	0	0
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
1,2-Dichloroethane	96	47,818,476	49,048,528	48,491,110	145,358,114	16,957,172	1,085,108	926,243	6,369	0	18,974,892	165,469,049
	95	59,314,824	32,517,232	74,728,291	166,560,347	15,120,314	592,769	1,953,356	12,846	0	17,679,285	187,166,011
	94	33,973,210	32,728,879	64,344,004	131,046,093	15,625,934	636,747	1,180,057	11,853	0	17,454,591	150,452,423
	88	NA	NA	NA	NA	NA	NA	1,617,555	1,477,242	228,000	NA	NA
1,2-Dichloroethylene	96	620,000	1,560,000	1,828,252	4,008,252	3,109	0	8,701	0	0	11,810	4,051,845
	95	310,000	2,871,400	4,680,089	7,861,489	6,200	0	2,234	0	0	8,434	7,878,334
	94	510,000	2,426,000	4,430,024	7,366,024	2,400	26,100	28	0	0	28,528	7,409,648
	88	NA	NA	NA	NA	NA	NA	125,744	0	0	NA	NA
Dichloromethane	96	112,064,937	5,598,974	23,207,510	140,871,421	11,799,944	3,005,556	11,903,667	640,294	1,815,884	29,165,345	223,690,940
	95	84,922,346	5,240,223	25,514,607	115,677,176	14,298,727	3,344,770	10,893,108	799,579	2,140	29,338,324	204,254,965
	94	60,311,603	12,358,018	18,985,711	91,655,332	20,830,237	3,780,724	11,515,906	824,947	6,817	36,958,631	198,579,448
	88	NA	NA	NA	NA	NA	NA	11,198,082	1,831,154	1,089,604	NA	NA

**Note** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).





Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
120-83-2	2,4-Dichlorophenol	96	2,705	412	53	15,390	0	18,560	0	18,560
		95	3,173	407	245	15,900	0	19,725	0	19,725
		94	3,045	794	61	10,860	0	14,760	1,815	16,575
		88	535	868	107	17,700	2	19,212	350	19,562
78-87-5	1,2-Dichloropropane	96	224,371	290,057	1,855	0	150	516,433	5,330	521,763
		95	235,605	380,865	4,344	0	20	620,834	1,364	622,198
		94	303,857	405,690	3,609	215	12	713,383	699	714,082
		88	315,478	1,079,826	23,785	0	3,400	1,422,489	1,131	1,423,620
542-75-6 *	1,3-Dichloro- propylene	96	8,686	761	1,270	0	0	10,717	0	10,717
		95	20,801	10,466	193	0	0	31,460	0	31,460
		94	21,509	3,161	86	0	0	24,756	0	24,756
		88	39,790	14,800	250	0	0	54,840	0	54,840
62-73-7 *	Dichlorvos	96	5	250	5	0	0	260	1,228	1,488
		95	5	250	5	0	0	260	250	510
		94	768	513	5	0	0	1,286	7,037	8,323
		88	1,050	0	0	0	0	1,050	505	1,555
115-32-2 *	Dicofol	96	460	0	0	0	0	460	250	710
		95	500	250	0	0	0	750	250	1,000
		94	255	0	0	0	0	255	0	255
		88	593	750	0	0	0	1,343	15,786	17,129
111-42-2	Diethanolamine	96	331,728	144,835	165,714	16,211	42,170	700,658	82,106	782,764
		95	272,197	87,930	302,582	18,502	40,399	721,610	453,857	1,175,467
		94	193,558	99,981	222,337	81,164	169,713	766,753	345,062	1,111,815
		88	443,507	198,081	438,213	238,317	133,456	1,451,574	372,707	1,824,281
117-81-7	Di-(2-ethylhexyl) phthalate	96	80,785	383,644	274	0	70,311	535,014	1,762,843	2,297,857
		95	196,105	337,990	867	0	19,705	554,667	2,995,108	3,549,775
		94	130,493	332,268	957	0	5,308	469,026	1,985,373	2,454,399
		88	181,545	1,035,768	2,776	3,091	20,748	1,243,928	3,629,163	4,873,091
64-67-5	Diethyl sulfate	96	3,024	184	0	0	0	3,208	47	3,255
		95	6,846	132	0	0	0	6,978	250	7,228
		94	6,305	622	10	0	5	6,942	0	6,942
		88	8,436	2,191	0	0	250	10,877	0	10,877
119-90-4	3,3'-Dimethoxy- benzidine	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	3	0	5	0	0	8	0	8
		88	No reports received							
121-69-7	N,N-Dimethylaniline	96	17,736	48,557	128	0	0	66,421	0	66,421
		95	7,200	27,212	388	0	0	34,800	435	35,235
		94	5,441	16,651	584	0	0	22,676	0	22,676
		88	18,448	80,457	19,967	0	250	119,122	772	119,894
119-93-7	3,3'-Dimethyl- benzidine	96	3	3	25	0	0	31	229	260
		95	No reports received							
		94	No reports received							
		88	No reports received							

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production- related Waste Pounds
2,4-Dichlorophenol	96	1,240	3	420,660	421,903	0	0	0	0	0	0	440,459
	95	1,460	3	336,936	338,399	0	0	0	0	0	0	358,119
	94	1,412	0	125,546	126,958	0	0	0	0	0	0	139,538
	88	NA	NA	NA	NA	NA	NA	12,559	6	0	NA	NA
1,2-Dichloropropane	96	37,213,000	22,560,000	5,117,425	64,890,425	0	0	142	1,513	0	1,655	65,413,342
	95	56,000,000	28,380,000	11,573,182	95,953,182	0	0	3,591	4,116	0	7,707	96,581,303
	94	55,000,024	25,700,000	20,023,630	100,723,654	0	1	2,037	253	0	2,291	101,437,925
	88	NA	NA	NA	NA	NA	NA	3,782	136,775	0	NA	NA
1,3-Dichloro- propylene	96	3,036,700	14,000,000	573,241	17,609,941	0	4,724	53,855	0	0	58,579	17,678,872
	95	4,892,986	11,930,000	969,916	17,792,902	470	123	2,476	0	0	3,069	17,827,670
	94	26,057,000	22,800,000	6,280,671	55,137,671	5,007	1,703	11,934	0	0	18,644	55,180,157
	88	NA	NA	NA	NA	NA	NA	2,738	0	0	NA	NA
Dichlorvos	96	0	0	10	10	0	104	395	0	0	499	1,805
	95	33	0	10	43	0	250	1,000	0	0	1,250	1,426
	94	80	0	63	143	0	250	755	0	0	1,005	2,117
	88	NA	NA	NA	NA	NA	NA	1,011	0	0	NA	NA
Dicofol	96	19	0	0	19	0	0	250	0	0	250	329
	95	150	0	0	150	0	0	250	0	0	250	527
	94	270	0	0	270	0	0	250	0	0	250	441
	88	NA	NA	NA	NA	NA	NA	9,380	0	0	NA	NA
Diethanolamine	96	14,024	56,991	2,093,114	2,164,129	92,356	215,991	356,576	1,540,734	0	2,205,657	5,162,230
	95	27,718	102,766	2,841,679	2,972,163	155,597	733,052	170,817	1,464,088	0	2,523,554	6,619,178
	94	38,462	103,860	2,635,988	2,778,310	268,541	432,845	295,008	1,503,182	0	2,499,576	5,797,088
	88	NA	NA	NA	NA	NA	NA	733,874	2,002,497	221,811	NA	NA
Di-(2-ethylhexyl) phthalate	96	3,346,141	354,639	290,002	3,990,782	3,876,237	274,610	225,525	21,084	0	4,397,456	10,972,505
	95	2,630,089	100,013	557,557	3,287,659	3,840,273	263,015	265,924	21,170	0	4,390,382	11,582,932
	94	3,045,333	150,969	630,340	3,826,642	5,919,351	284,164	213,799	29,857	0	6,447,171	12,857,342
	88	NA	NA	NA	NA	NA	NA	825,367	169,896	117,050	NA	NA
Diethyl sulfate	96	0	0	4,621	4,621	3,293,130	0	1,511	4,288	0	3,298,929	3,306,606
	95	0	0	3,370	3,370	6,420,000	415	1,655	3,480	0	6,425,550	6,415,618
	94	0	0	4,082	4,082	6,180,000	76	1,892	4,565	0	6,186,533	6,117,958
	88	NA	NA	NA	NA	NA	NA	0	890	0	NA	NA
3,3'-Dimethoxy- benzidine	96	0	0	0	0	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	0	0	0	0	0
	94	0	0	483	483	0	0	0	33	0	33	524
	88	No reports received										
N,N-Dimethylaniline	96	48,000	0	6,895	54,895	0	1,087,965	80,649	95,542	0	1,264,156	1,382,346
	95	50,535	0	2,154	52,689	0	745,704	83,476	121,258	0	950,438	1,107,575
	94	52,500	0	50,972	103,472	0	640,609	73,839	145,372	0	859,820	1,055,971
	88	NA	NA	NA	NA	NA	NA	465,397	287,483	0	NA	NA
3,3'-Dimethyl- benzidine	96	0	0	2,287	2,287	0	0	0	0	0	0	2,547
	95	No reports received										
	94	No reports received										
	88	No reports received										

**Note** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
57-14-7	1,1-Dimethyl - hydrazine	96	259	43	0	0	1	303	425	728
		95	261	38	0	0	0	299	5	304
		94	721	26	0	0	0	747	5	752
		88	2,206	2,117	10	0	0	4,333	8,855	13,188
105-67-9 *	2,4-Dimethylphenol	96	16,838	40,836	100	140,000	0	197,774	821	198,595
		95	15,696	37,101	33	79,000	5	131,835	17	131,852
		94	17,252	40,496	704	64,000	250	122,702	1,448	124,150
		88	1,661	9,927	484	24,703	399	37,174	1,500	38,674
131-11-3	Dimethyl phthalate	96	52,537	101,917	551	1,000	8	156,013	3,615	159,628
		95	116,214	222,873	275	1,000	5	340,367	2,524	342,891
		94	67,703	199,555	266	1,200	5	268,729	3,802	272,531
		88	113,841	421,215	4,335	390	504	540,285	93,358	633,643
77-78-1	Dimethyl sulfate	96	4,977	819	0	0	0	5,796	0	5,796
		95	5,154	1,278	1	0	0	6,433	0	6,433
		94	5,356	1,421	300	0	0	7,077	0	7,077
		88	9,176	1,630	610	0	50	11,466	0	11,466
534-52-1	4,6-Dinitro-o-cresol	96	5	95	0	0	0	100	27,820	27,920
		95	20	125	0	4,649	0	4,794	7,220	12,014
		94	6	84	5	0	0	95	5,953	6,048
		88	259	15	266	0	2	542	46,648	47,190
51-28-5	2,4-Dinitrophenol	96	151	31	65,869	0	0	66,051	2	66,053
		95	111	1	2,000	0	0	2,112	0	2,112
		94	121	2	2,312	36,900	9	39,344	70	39,414
		88	12,386	8,439	98,692	86,200	257	205,974	110,285	316,259
121-14-2	2,4-Dinitrotoluene	96	1,888	3	349	0	0	2,240	0	2,240
		95	1,871	3	231	0	0	2,105	94	2,199
		94	1,848	51	399	0	0	2,298	255	2,553
		88	15,533	77,724	12,055	106,400	14,961	226,673	124,281	350,954
606-20-2	2,6-Dinitrotoluene	96	471	1	94	0	0	566	0	566
		95	468	1	126	0	0	595	0	595
		94	503	13	374	0	0	890	0	890
		88	6,074	81,523	957	27,000	0	115,554	30,882	146,436
123-91-1	1,4-Dioxane	96	41,019	78,937	226,998	0	5,409	352,363	479,388	831,751
		95	115,046	108,098	216,689	0	5,736	445,569	352,996	798,565
		94	121,159	109,760	305,771	0	2,266	538,956	16,115	555,071
		88	361,259	251,374	203,320	0	11,702	827,655	10,954	838,609
106-89-8	Epichlorohydrin	96	246,061	84,963	20,735	0	2,205	353,964	4,137	358,101
		95	209,269	112,130	26,937	0	18,874	367,210	893	368,103
		94	271,224	119,913	3,486	0	754	395,377	183	395,560
		88	506,142	200,965	4,917	68,750	2,524	783,298	307	783,605
110-80-5	2-Ethoxyethanol	96	66,539	125,923	6	0	0	192,468	250	192,718
		95	88,677	134,263	891	0	0	223,831	12,595	236,426
		94	78,298	154,656	104	0	2	233,060	0	233,060
		88	281,053	2,150,257	120,164	0	52	2,551,526	71,142	2,622,668

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
1,1-Dimethyl hydrazine	96	0	9,215	4,237	13,452	0	7,001	8,806	0	0	15,807	22,980
	95	0	0	3,639	3,639	57	0	10	0	0	67	4,008
	94	0	0	2,604	2,604	46	0	3,308	0	0	3,354	6,716
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
2,4-Dimethylphenol	96	33,354	1,836,216	562,773	2,432,343	58,775	90,569	23,610	5,675	0	178,629	2,808,945
	95	37,140	1,573,273	397,965	2,008,378	30,368	50,737	67,100	6,412	0	154,617	2,296,426
	94	48,340	1,287,320	334,334	1,669,994	46,074	43,599	28,001	6,161	0	123,835	1,920,163
	88	NA	NA	NA	NA	NA	NA	1,250	7,964	0	NA	NA
Dimethyl phthalate	96	0	225,020	360,632	585,652	0	84,755	16,715	53,702	0	155,172	866,200
	95	4,288	253,605	356,058	613,951	800	70,353	52,335	168,561	0	292,049	1,248,809
	94	8,873	192,701	437,415	638,989	5,276	88,147	14,290	95,856	0	203,569	1,057,852
	88	NA	NA	NA	NA	NA	NA	44,454	508,821	0	NA	NA
Dimethyl sulfate	96	100,000	0	76,354	176,354	77,756	0	0	5	0	77,761	259,207
	95	0	1	352,841	352,842	171,230	0	3	0	0	171,233	529,610
	94	0	3	209,888	209,891	35,803	0	0	10	0	35,813	251,590
	88	NA	NA	NA	NA	NA	NA	0	1,000	0	NA	NA
4,6-Dinitro-o-cresol	96	0	716,801	29,000	745,801	0	0	8,390	626	0	9,016	762,305
	95	0	452,120	18,000	470,120	0	410	12,600	2,127	0	15,137	491,860
	94	0	1,057,120	13,000	1,070,120	0	74	10,186	640	0	10,900	1,086,866
	88	NA	NA	NA	NA	NA	NA	259,448	19	0	NA	NA
2,4-Dinitrophenol	96	0	319,777	1,207,434	1,527,211	0	1	0	0	0	1	1,593,115
	95	0	556,712	1,160,000	1,716,712	0	9	219	0	0	228	1,719,044
	94	0	276,162	880,000	1,156,162	0	0	12,375	0	0	12,375	1,207,928
	88	NA	NA	NA	NA	NA	NA	567,365	1,000	0	NA	NA
2,4-Dinitrotoluene	96	0	51,527	35,270	86,797	840	0	0	0	0	840	103,418
	95	0	42,345	27,115	69,460	0	9	1,381	0	0	1,390	73,050
	94	0	992	19,715	20,707	0	1,187	0	0	0	1,187	24,192
	88	NA	NA	NA	NA	NA	NA	2,055	700,000	0	NA	NA
2,6-Dinitrotoluene	96	0	1,711	23,500	25,211	0	0	26	0	0	26	25,803
	95	0	6,160	9,180	15,340	0	1	118	0	0	119	16,054
	94	0	248	16,626	16,874	0	156	0	0	0	156	17,920
	88	NA	NA	NA	NA	NA	NA	703	170,000	0	NA	NA
1,4-Dioxane	96	5,592,026	3,126,659	1,074,367	9,793,052	846	1,371,301	22,070	160,497	0	1,554,714	12,186,086
	95	74,293	1,975,960	1,019,104	3,069,357	13,524	1,196,939	87,738	232,060	0	1,530,261	5,370,266
	94	117,534	1,190,953	1,266,311	2,574,798	23,697	619,260	75,289	329,212	0	1,047,458	4,160,395
	88	NA	NA	NA	NA	NA	NA	199,402	203,103	925	NA	NA
Epichlorohydrin	96	20,158,532	5,863,590	2,992,084	29,014,206	2	75,430	1,443,664	11,471	0	1,530,567	30,901,434
	95	13,263,282	4,331,319	4,191,552	21,786,153	120	170,813	994,600	11,300	0	1,176,833	23,253,866
	94	6,701,226	432,000	9,786,735	16,919,961	0	183,888	880,789	38,615	0	1,103,292	18,420,190
	88	NA	NA	NA	NA	NA	NA	690,257	73,385	0	NA	NA
2-Ethoxyethanol	96	6,210	480,076	662,210	1,148,496	22,801	163,808	82,677	78,269	0	347,555	1,617,777
	95	2,300	512,864	1,253,431	1,768,595	1,715	178,000	49,982	389,516	0	619,213	2,573,541
	94	7,000	622,137	736,710	1,365,847	304,696	315,815	34,335	355,198	0	1,010,044	2,507,459
	88	NA	NA	NA	NA	NA	NA	366,979	196,286	250	NA	NA

**Note.** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases
			Air		Surface Water Discharges	Underground Injection	On-site Land Releases	Total On-site Releases	Transfers Off-site to Disposal	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
140-88-5	Ethyl acrylate	96	88,053	98,738	199	0	516	187,506	32,734	220,240
		95	97,225	110,219	542	0	523	208,509	10,182	218,691
		94	92,394	104,838	253	0	18	197,503	20,051	217,554
		88	126,521	119,461	1,211	0	265	247,458	7,110	254,568
100-41-4	Ethylbenzene	96	2,487,776	6,902,212	7,080	335,932	61,827	9,794,827	95,603	9,890,430
		95	2,696,880	7,506,909	9,346	475,234	19,174	10,707,543	164,501	10,872,044
		94	3,310,504	8,778,324	10,957	633,869	54,259	12,787,913	299,813	13,087,726
		88	3,210,068	4,508,713	15,970	72,914	175,180	7,982,845	421,334	8,404,179
541-41-3	Ethyl chloroformate	96	4,295	446	5	0	5	4,751	0	4,751
		95	1,650	370	5	0	5	2,030	0	2,030
		94	3,106	435	5	0	5	3,551	0	3,551
		88	11,880	2,023	0	0	0	13,903	0	13,903
74-85-1 *	Ethylene	96	16,159,552	19,627,812	25,228	0	8,080	35,820,672	10,845	35,831,517
		95	14,252,193	19,831,923	27,574	0	16	34,111,706	1,771	34,113,477
		94	15,128,256	19,662,090	27,690	0	0	34,818,036	17	34,818,053
		88	22,997,664	27,512,725	15,214	17,203	13,250	50,556,056	11,432	50,567,488
107-21-1	Ethylene glycol	96	2,787,138	3,232,634	1,842,307	7,699,484	429,976	15,991,539	2,576,966	18,568,505
		95	3,591,238	3,681,932	806,343	12,554,675	850,294	21,484,482	1,468,773	22,953,255
		94	5,331,705	4,647,882	831,925	4,958,550	1,069,218	16,839,280	1,683,636	18,522,916
		88	4,094,037	9,124,302	3,747,561	7,927,570	736,344	25,629,814	2,595,526	28,225,340
151-56-4	Ethyleneimine	96	0	2	0	0	0	2	0	2
		95	0	3	0	0	0	3	0	3
		94	0	0	0	0	0	0	0	0
		88	250	250	0	0	0	500	0	500
75-21-8 *	Ethylene oxide	96	436,537	352,902	4,474	22,200	551	816,664	1,048	817,712
		95	432,181	413,876	5,225	130,000	2,208	983,490	8,663	992,153
		94	401,303	327,158	2,088	8,100	785	739,434	5,421	744,855
		88	923,731	3,708,003	44,851	11,125	54,700	4,742,410	20,663	4,763,073
96-45-7	Ethylene thiourea	96	5	263	0	0	0	268	4,071	4,339
		95	5	520	0	0	0	525	16,165	16,690
		94	5	524	0	0	0	529	2,819	3,348
		88	0	500	0	0	0	500	2,250	2,750
2164-17-2 *	Fluometuron	96	270	717	0	0	0	987	2,505	3,492
		95	275	521	0	0	0	796	2,355	3,151
		94	290	542	0	0	0	832	2,335	3,167
		88	250	250	0	0	0	500	3,700	4,200
50-00-0 *	Formaldehyde	96	1,779,994	9,639,206	320,003	9,403,275	114,406	21,256,884	329,509	21,586,393
		95	1,794,851	9,942,916	274,073	7,313,034	132,415	19,457,289	210,738	19,668,027
		94	1,966,258	9,934,767	388,770	7,739,510	149,116	20,178,421	249,121	20,427,542
		88	3,104,302	9,155,886	904,546	9,608,524	494,111	23,267,369	1,409,999	24,677,368
76-13-1	Freon 113	96	992,423	409,756	786	0	0	1,402,965	1,147	1,404,112
		95	1,676,952	931,484	3,829	6	0	2,612,271	2,560	2,614,831
		94	3,602,795	1,738,146	1,504	0	0	5,342,445	20,434	5,362,879
		88	46,974,941	23,407,650	32,894	5,965	27,799	70,449,249	1,924,043	72,373,292

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
Ethylacrylate	96	284,024	7,177,162	16,524,991	23,986,177	45,497	792,458	329,056	24,090	0	1,191,101	25,394,505
	95	79	8,159,780	487,840	8,647,699	32,449	1,392,322	65,529	29,764	0	1,520,064	10,350,562
	94	119	7,563,754	480,893	8,044,766	46,359	1,613,608	50,466	26,959	0	1,737,392	9,921,318
	88	NA	NA	NA	NA	NA	NA	101,345	27,656	250	NA	NA
Ethylbenzene	96	33,064,962	31,512,229	60,433,909	125,011,100	5,339,992	8,905,167	1,685,706	76,581	0	16,007,446	154,127,108
	95	24,687,044	40,925,948	23,835,843	89,448,835	5,076,880	11,536,465	1,708,445	64,976	0	18,386,766	119,133,053
	94	19,085,208	37,831,602	16,549,964	73,466,774	5,021,693	9,077,404	1,944,638	60,853	750	16,105,338	102,493,584
	88	NA	NA	NA	NA	NA	NA	2,356,770	511,285	269,164	NA	NA
Ethylchloroformate	96	0	0	11,600	11,600	0	0	0	0	0	0	16,271
	95	0	0	3,300	3,300	0	0	0	0	0	0	5,280
	94	0	0	9,289	9,289	0	10	761	0	0	771	13,310
	88	NA	NA	NA	NA	NA	NA	69,600	0	0	NA	NA
Ethylene	96	194,529,481	490,573,955	483,574,781	1,168,678,217	13,317	13,028,335	1,112,185	261	0	14,154,098	1,216,494,526
	95	196,803,539	489,114,835	495,562,836	1,181,481,210	3	10,615,177	2,116,256	267	0	12,731,703	1,227,844,079
	94	336,088,862	622,560,405	379,721,676	1,338,370,943	0	9,961,635	25,854	563	0	9,988,052	1,384,679,742
	88	NA	NA	NA	NA	NA	NA	29,887	250	0	NA	NA
Ethylene glycol	96	378,289,176	6,653,981	57,466,450	442,409,607	110,548,356	17,019,781	6,086,887	16,587,111	44,588	150,286,723	615,585,898
	95	335,925,025	5,926,147	65,623,434	407,474,606	128,107,827	13,213,485	16,060,644	19,243,543	0	176,625,499	605,522,865
	94	269,678,744	15,499,587	63,631,998	348,810,329	121,046,470	7,687,505	16,304,972	16,892,568	0	161,931,515	528,313,865
	88	NA	NA	NA	NA	NA	NA	14,505,355	17,420,231	465,625	NA	NA
Ethyleneimine	96	0	0	22,000	22,000	0	0	0	0	0	0	22,002
	95	0	0	34,000	34,000	0	0	0	0	0	0	34,003
	94	0	0	0	0	0	0	0	0	0	0	0
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Ethylene oxide	96	114,788	28,135	13,246,872	13,389,795	6,664	0	963	117,227	0	124,854	14,316,592
	95	124,261	16,940	9,641,229	9,782,430	5,205	0	786	57,079	0	63,070	10,817,831
	94	2,689,212	68,940	7,616,740	10,374,892	6,177	1	6,630	103,723	0	116,531	11,247,215
	88	NA	NA	NA	NA	NA	NA	1,250	362,521	0	NA	NA
Ethylene thiourea	96	0	0	0	0	2,735	0	2,815	1	0	5,551	9,645
	95	1	0	1	2	840	0	6,280	5	0	7,125	23,401
	94	0	0	1	1	780	0	8,240	5	0	9,025	12,205
	88	NA	NA	NA	NA	NA	NA	250	500	0	NA	NA
Fluometuron	96	0	0	0	0	0	5	14,035	235	0	14,275	18,576
	95	0	0	0	0	0	5	27,300	225	0	27,530	22,548
	94	0	0	0	0	0	0	2,009	255	0	2,264	4,840
	88	NA	NA	NA	NA	NA	NA	19,100	2,300	0	NA	NA
Formaldehyde	96	87,248,040	8,433,075	71,530,408	167,211,523	40,083	212,122	701,402	1,888,772	0	2,842,379	191,563,245
	95	75,909,072	6,768,162	68,561,312	151,238,546	57,001	436,028	688,468	2,340,020	2	3,521,519	174,068,150
	94	75,021,993	6,820,638	77,569,178	159,411,809	49,281	283,343	710,619	2,703,261	0	3,746,504	183,527,799
	88	NA	NA	NA	NA	NA	NA	1,326,663	4,382,254	3,580	NA	NA
Freon 113	96	692,774	74,113	219,059,366	219,826,253	114,875	53,651	1,074,322	255	0	1,243,103	222,533,621
	95	2,355,210	0	250,260,926	252,616,136	890,932	101,543	515,135	31,220	0	1,538,830	256,832,833
	94	6,928,804	148,908	280,047,264	287,124,976	1,953,208	163,558	963,217	39,023	0	3,119,006	295,689,092
	88	NA	NA	NA	NA	NA	NA	4,037,767	104,441	300,965	NA	NA

**Note** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

		On-site Releases							Off-site Releases	Total
CAS Number	Chemical	Year	Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	On- and Off-site Releases Pounds
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
—	Glycol ethers	96	8,347,921	31,823,871	143,511	99,208	58,625	40,473,136	653,180	41,126,316
		95	9,280,583	35,011,350	183,996	132,064	25,145	44,633,138	773,959	45,407,097
		94	10,674,431	38,787,593	256,770	128,096	50,880	49,897,770	707,262	50,605,032
		88	10,479,172	38,222,062	284,687	362,198	105,185	49,453,304	1,478,290	50,931,594
76-44-8	* Heptachlor	96	198	0	5	0	0	203	0	203
		95	203	0	6	0	0	209	0	209
		94	830	0	3	0	0	833	0	833
		88	54,292	3	2	0	0	54,297	0	54,297
118-74-1	Hexachlorobenzene	96	115	105	274	717	0	1,211	23,449	24,660
		95	477	89	6,458	480	0	7,504	6,975	14,479
		94	346	112	269	204	0	931	940,478	941,409
		88	3,602	443	4	410	0	4,459	443,541	448,000
87-68-3	Hexachloro-1,3-butadiene	96	1,374	1,007	256	952	0	3,589	310	3,899
		95	2,287	1,023	661	434	0	4,405	252	4,657
		94	1,189	221	351	201	0	1,962	430	2,392
		88	2,043	465	153	220	0	2,881	19,640	22,521
77-47-4	Hexachlorocyclopentadiene	96	7,451	515	0	250	0	8,216	1,000	9,216
		95	8,196	115	6	250	0	8,567	2,600	11,167
		94	7,675	1,248	1	250	0	9,174	0	9,174
		88	77,902	415	6	2,131	0	80,454	28,470	108,924
67-72-1	Hexachloroethane	96	2,122	759	32	2,024	0	4,937	471	5,408
		95	3,097	11,454	3,330	1,378	0	19,259	1,208	20,467
		94	4,736	1,515	447	326	0	7,024	352,559	359,583
		88	2,949	16,128	11	520	1	19,609	128,504	148,113
302-01-2	Hydrazine	96	7,797	2,646	23	0	250	10,716	18,549	29,265
		95	10,322	3,598	3	0	5	13,928	23,504	37,432
		94	11,544	4,847	292	250	29	16,962	4,600	21,562
		88	27,510	7,689	2,149	0	29	37,377	24,522	61,899
10034-93-2	Hydrazine sulfate	96	0	0	0	350,000	0	350,000	0	350,000
		95	0	0	0	260,000	0	260,000	0	260,000
		94	0	2	0	230,000	0	230,002	0	230,002
		88	290	882	0	355,000	0	356,172	0	356,172
74-90-8	Hydrogen cyanide	96	74,893	2,311,807	105	528,513	3	2,915,321	1,164	2,916,485
		95	106,824	2,375,132	763	683,154	3	3,165,876	326	3,166,202
		94	73,817	2,208,809	712	860,568	6	3,143,912	802	3,144,714
		88	131,604	977,673	2,300	1,737,850	1,761	2,851,188	1,001	2,852,189
7664-39-3	Hydrogen fluoride	96	3,508,122	8,955,387	10,691	2,620	36,834	12,513,654	553,050	13,066,704
		95	3,226,504	7,799,276	8,702	3,845	24,078	11,062,405	1,012,893	12,075,298
		94	2,670,376	5,995,447	14,989	2,174	33,443	8,716,429	761,422	9,477,851
		88	3,725,362	11,006,932	189,928	250	13,002	14,935,474	3,467,471	18,402,945
123-31-9	Hydroquinone	96	13,974	14,039	2,652	290,000	0	320,665	2,628	323,293
		95	14,351	2,999	5,093	340,005	43	362,491	4,406	366,897
		94	16,200	28,861	4,457	456,762	42	506,322	3,396	509,718
		88	3,601	6,733	7,211	375,400	530	393,475	6,835	400,310

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
Glycol ethers	96	195,662,187	43,392,075	27,509,395	266,563,657	3,320,310	14,836,166	2,299,832	11,095,899	2,530	31,554,737	341,156,273
	95	197,150,993	42,745,970	30,599,270	270,496,233	3,595,114	14,078,617	2,959,988	10,270,267	510	30,904,496	345,892,187
	94	198,883,751	20,308,790	33,488,218	252,680,759	4,282,450	14,474,545	4,307,399	11,122,579	14,932	34,201,905	336,725,899
	88	NA	NA	NA	NA	NA	NA	5,797,914	8,981,781	540,276	NA	NA
Heptachlor	96	0	0	2,206	2,206	0	0	16,073	32	0	16,105	18,514
	95	0	0	3,850	3,850	0	0	822	29	0	851	4,910
	94	0	0	3,900	3,900	0	0	4,300	77	0	4,377	9,130
	88	NA	NA	NA	NA	NA	NA	51,935	37	0	NA	NA
Hexachlorobenzene	96	7,100	240,000	2,132,566	2,379,666	1	2,215	42,146	0	0	44,362	2,448,643
	95	6,200	0	2,865,008	2,871,208	1	0	433,736	1	0	433,738	3,318,505
	94	6,700	19,398	2,151,738	2,177,836	1	0	65,263	250	0	65,514	3,184,039
	88	NA	NA	NA	NA	NA	NA	521,558	160	0	NA	NA
Hexachloro- 1,3-butadiene	96	0	66,000	6,107,496	6,173,496	0	0	277,522	2	0	277,524	6,455,792
	95	0	133,000	6,778,662	6,911,662	13	0	163,218	2	0	163,233	7,081,089
	94	260,000	170,000	4,445,710	4,875,710	0	0	60,084	6	0	60,090	4,937,778
	88	NA	NA	NA	NA	NA	NA	3,513,001	300	0	NA	NA
Hexachlorocyclo- pentadiene	96	0	0	246,437	246,437	0	800	55,082	1,580	0	57,462	312,981
	95	0	0	272,865	272,865	0	0	24,199	709	0	24,908	308,856
	94	0	0	249,000	249,000	0	1,250	27,672	1,303	0	30,225	287,930
	88	NA	NA	NA	NA	NA	NA	590,845	852	0	NA	NA
Hexachloroethane	96	0	939,000	4,600,732	5,539,732	0	71,034	120,921	0	0	191,955	5,736,137
	95	4,800	1,232,400	4,875,108	6,112,308	0	75,132	107,678	0	0	182,810	6,326,781
	94	325,000	199,270	11,185,582	11,709,852	0	61,000	18,745	0	0	79,745	12,157,576
	88	NA	NA	NA	NA	NA	NA	532,352	260	0	NA	NA
Hydrazine	96	0	300	338,596	338,896	1	65	1,961	3,733	0	5,760	373,612
	95	300	0	42,532	42,832	57	0	2,551	4,668	0	7,276	89,400
	94	150	0	101,373	101,523	46	0	4,960	4,960	0	9,966	131,823
	88	NA	NA	NA	NA	NA	NA	36,582	1,218	0	NA	NA
Hydrazine sulfate	96	0	0	0	0	0	0	0	0	0	0	350,000
	95	0	0	1,900	1,900	0	0	0	1,900	0	1,900	263,800
	94	0	0	2,300	2,300	0	0	0	2,300	0	2,300	234,602
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Hydrogen cyanide	96	73,467	33,847,854	27,343,220	61,264,541	0	250	3,316	1,380	0	4,946	64,188,841
	95	72,134	33,141,239	25,143,135	58,356,508	0	250	179	10,124	0	10,553	61,508,025
	94	75,303	33,577,954	21,259,822	54,913,079	0	250	770	7,033	0	8,053	58,042,596
	88	NA	NA	NA	NA	NA	NA	21,200	337	250	NA	NA
Hydrogen fluoride	96	113,956,854	0	102,386,943	216,343,797	300,265	6,692	2,063,848	336,467	0	2,707,272	232,944,508
	95	92,471,855	0	102,990,169	195,462,024	183,734	9,426	2,467,803	384,089	0	3,045,052	210,446,832
	94	67,498,455	37,909	116,833,727	184,370,091	212,513	0	2,533,474	349,379	0	3,095,366	196,597,904
	88	NA	NA	NA	NA	NA	NA	2,841,628	508,939	64,252	NA	NA
Hydroquinone	96	962	1,298,419	388,600	1,687,981	0	47,951	99,588	32,930	0	180,469	2,189,143
	95	960	1,000,833	512,185	1,513,978	0	37,786	41,092	59,568	0	138,446	2,001,326
	94	3,802	1,068,662	361,348	1,433,812	0	3,900	29,043	150,987	0	183,930	2,122,405
	88	NA	NA	NA	NA	NA	NA	303,106	512,180	0	NA	NA

**Note** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)





Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

On-site Releases									Off-site Releases	Total On- and Off-site Releases Pounds
CAS Number	Chemical	Year	Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
78-84-2	Isobutyraldehyde	96	106,793	88,280	1,791	2,374	1	199,239	1,000	200,239
		95	111,667	144,612	752	44,075	47	301,153	0	301,153
		94	167,790	207,317	472	72,553	0	448,132	69,306	517,438
		88	178,740	507,178	773	60	1	686,752	0	686,752
67-63-0 *	Isopropyl alcohol (manufacturing)	96	289,954	770,538	0	0	0	1,060,492	8,296	1,068,788
		95	358,745	602,930	0	0	0	961,675	2,577	964,252
		94	288,363	708,538	0	0	250	997,151	1,550	998,701
		88	790,482	1,210,915	1,900	0	14	2,003,311	247,039	2,250,350
80-05-7	4,4'-Isopropylidene-diphenol	96	112,706	71,321	4,803	25,000	251,387	465,217	320,605	785,822
		95	119,924	35,675	5,809	82,000	86,697	330,105	420,944	751,049
		94	137,408	100,540	18,260	99,184	288,032	643,424	392,926	1,036,350
		88	119,870	107,056	126,385	0	424,117	777,428	444,560	1,221,988
7439-92-1	Lead	96	192,275	425,787	12,233	0	3,411,088	4,041,383	1,743,638	5,785,021
		95	341,568	387,091	10,600	0	2,342,855	3,082,114	2,094,016	5,176,130
		94	96,752	321,472	12,519	0	501,484	932,227	1,697,238	2,629,465
		88	484,036	644,006	61,791	5	6,648,946	7,838,784	10,728,220	18,567,004
—	Lead compounds	96	434,594	752,764	50,186	794	11,568,368	12,806,706	21,476,996	34,283,702
		95	386,089	912,312	52,451	912	12,341,966	13,693,730	17,001,174	30,694,904
		94	510,322	892,360	54,990	1,263	14,652,126	16,111,061	20,743,194	36,854,255
		88	355,487	1,178,369	180,368	2,755	20,035,359	21,752,338	14,254,774	36,007,112
58-89-9 *	Lindane	96	255	255	5	0	250	765	276	1,041
		95	255	255	0	0	0	510	20	530
		94	280	299	5	0	5	589	42	631
		88	251	7	0	0	0	258	56	314
108-31-6	Maleic anhydride	96	65,216	500,783	15	10	1,000	567,024	10,666	577,690
		95	74,881	262,953	18	5	1,406	339,263	14,429	353,692
		94	77,053	171,413	312	5	2,288	251,071	23,262	274,333
		88	126,174	550,604	12,580	240,000	250	929,608	132,148	1,061,756
12427-38-2 *	Maneb	96	0	0	0	0	0	0	250	250
		95	5	268	0	0	0	273	2,461	2,734
		94	255	17	0	0	0	272	13,553	13,825
		88	1,000	1,265	250	0	0	2,515	5,285	7,800
7439-96-5	Manganese**	96	6,751,776	384,254	117,375	8	10,040,371	17,293,784	13,905,393	31,199,177
		95	459,936	228,440	116,527	17	8,278,350	9,083,270	10,682,340	19,765,610
		94	570,041	238,758	88,911	10	8,493,774	9,391,494	13,053,613	22,445,107
		88	1,046,438	538,636	321,992	255	20,229,826	22,137,147	17,886,739	40,023,886
—	Manganese compounds	96	806,259	1,020,847	1,901,227	17,688	40,149,495	43,895,516	26,664,625	70,560,141
		95	703,419	2,108,367	806,071	3,590	41,279,762	44,901,209	22,874,466	67,775,675
		94	1,121,570	1,858,160	747,825	5,930	37,738,053	41,471,538	22,637,683	64,109,221
		88	583,222	1,217,749	681,469	6,816,070	84,226,474	93,524,984	18,063,196	111,588,180

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide

\*\* One facility reported 6,211,171 pounds of fugitive air emissions of manganese in error for 1996, the correct amount is 750 pounds. Fugitive air emissions for manganese should be 541,355 pounds.



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Isobutyraldehyde	96	5,109	2,316,637	555,954	2,877,700	4,110	492,237	50,743	73,213	0	620,303	3,738,528
	95	0	1,193,119	609,409	1,802,528	10,927	567,584	96,600	0	0	675,111	2,756,713
	94	2,485	2,208,563	576,124	2,787,172	1,696	626,772	53,037	45,433	0	726,938	4,052,043
	88	NA	NA	NA	NA	NA	NA	30,260	713	0	NA	NA
Isopropyl alcohol (manufacturing)	96	125,634	3,274,940	146,031	3,546,605	10,631	430,297	23,421	142,613	36,060	643,022	4,936,742
	95	62,894	2,684,671	141,356	2,888,921	44,266	75,604	228,374	3,221	0	351,465	4,042,971
	94	453,686	10,322,798	59,212	10,835,696	39,579	313,270	34,654	1,570	0	389,073	12,249,034
	88	NA	NA	NA	NA	NA	NA	319,961	161,751	129,407	NA	NA
4,4'-Isopropylidene-diphenol	96	102,400	8,712,328	998,531	9,813,259	1,620	75,268	57,588	19,576	0	154,052	10,791,340
	95	56,348	5,024,865	824,095	5,905,308	2,377	408,778	67,242	21,011	0	499,408	6,706,334
	94	37,084	8,838,789	1,580,295	10,456,168	2,507	54,939	100,155	19,360	0	176,961	11,668,954
	88	NA	NA	NA	NA	NA	NA	995,810	31,135	1,000	NA	NA
Lead	96	209,065,669	89,267	2,403,298	211,558,234	36,000,051	5,320	2,016,537	19,579	189,780	38,231,267	255,641,888
	95	211,398,723	49,836	1,716,276	213,164,835	63,275,977	6,469	1,677,977	20,327	760	64,981,510	281,754,384
	94	119,686,070	72,187	1,236,916	120,995,173	56,055,348	12,515	710,963	28,297	200,000	57,007,123	170,455,619
	88	NA	NA	NA	NA	NA	NA	2,901,988	122,508	254,573	NA	NA
Lead compounds	96	396,430,669	0	1,350,570	397,781,239	283,323,678	68,985	12,061,469	27,932	538,834	296,020,898	752,768,994
	95	501,675,271	0	28,909,640	530,584,911	291,908,760	62,461	5,813,316	38,036	1,257,760	299,080,333	861,699,138
	94	529,552,647	0	25,904,461	555,457,108	296,946,451	72,421	5,384,260	61,251	21,250	302,485,633	892,011,110
	88	NA	NA	NA	NA	NA	NA	2,254,991	91,167	680,019	NA	NA
Lindane	96	371	0	0	371	0	0	1,388	0	0	1,388	2,031
	95	326	0	0	326	0	0	3,197	0	0	3,197	3,804
	94	344	0	0	344	0	0	2,462	5	0	2,467	1,358
	88	NA	NA	NA	NA	NA	NA	130	0	0	NA	NA
Maleic anhydride	96	6,847	3,333,330	36,712,857	40,053,034	7,307	98,199	1,311,988	3,017	0	1,420,511	42,033,547
	95	4,940	3,222,121	38,357,136	41,584,197	0	102,756	1,142,938	10,660	0	1,256,354	43,186,754
	94	3,585	2,616,255	30,265,310	32,885,150	750	140,204	881,930	4,813	0	1,027,697	34,166,072
	88	NA	NA	NA	NA	NA	NA	1,725,648	556,373	1,150	NA	NA
Maneb	96	0	0	0	0	0	0	1,108	0	0	1,108	1,322
	95	525	0	0	525	0	5	6,500	0	0	6,505	17,189
	94	956	0	30	986	0	0	1,698	0	0	1,698	3,321
	88	NA	NA	NA	NA	NA	NA	2,077	1,470	0	NA	NA
Manganese	96	32,636,249	0	371,283	33,007,532	90,014,975	36,070	1,314,531	72,506	40,863	91,478,945	133,772,704
	95	31,576,342	0	172,660	31,749,002	68,216,519	345	1,387,885	75,627	750	69,681,126	125,812,908
	94	27,204,672	0	346,024	27,550,696	71,853,235	900	481,453	53,334	2,293,473	74,682,395	118,946,464
	88	NA	NA	NA	NA	NA	NA	4,208,789	132,683	3,506,111	NA	NA
Manganese compounds	96	134,562,338	21,216	899,859	135,483,413	52,316,073	223,482	6,349,936	323,137	20,000	59,232,628	263,481,976
	95	149,594,893	0	995,502	150,590,395	50,102,271	196,541	3,927,517	325,542	520,320	55,072,191	282,983,315
	94	83,535,732	0	448,995	83,984,727	51,769,536	45,052	3,948,329	402,382	5	56,165,304	200,727,123
	88	NA	NA	NA	NA	NA	NA	1,376,268	1,843,549	423,308	NA	NA

Note. Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
7439-97-6	Mercury	96	10,144	4,037	468	0	537	15,186	4,272	19,458
		95	8,689	4,466	192	0	1,016	14,363	6,103	20,466
		94	7,745	3,424	175	0	1,351	12,695	12,590	25,285
		88	15,791	7,114	1,397	0	13,279	37,581	218,830	256,411
—	Mercury compounds	96	2,011	905	73	9	0	2,998	21,612	24,610
		95	2,009	1,147	136	6	0	3,298	201,972	205,270
		94	2,012	704	151	7	0	2,874	26,121	28,995
		88	1,006	1,370	9	27	0	2,412	17,133	19,545
67-56-1	Methanol	96	27,987,712	178,370,259	7,353,977	24,300,488	1,931,665	239,944,101	1,411,828	241,355,929
		95	30,527,851	184,446,778	8,744,922	27,732,642	1,642,777	253,094,970	1,956,755	255,051,725
		94	31,855,868	183,181,548	10,892,290	25,093,326	2,591,219	253,614,251	2,313,539	255,927,790
		88	48,119,910	211,331,593	17,128,114	26,587,686	11,911,136	315,078,439	15,291,235	330,369,674
72-43-5 *	Methoxychlor	96	10	15	0	0	0	25	0	25
		95	0	0	0	0	0	0	0	0
		94	5	5	0	0	0	10	0	10
		88	47,721	83,310	252	0	258	131,541	8	131,549
109-86-4	2-Methoxyethanol	96	115,723	749,517	11,672	0	0	876,912	489	877,401
		95	147,418	705,410	12,407	0	5	865,240	285	865,525
		94	160,528	464,427	15,898	0	20	640,873	58,369	699,242
		88	1,148,256	4,751,413	40,520	750	7	5,940,946	57,362	5,998,308
96-33-3	Methyl acrylate	96	70,888	116,348	8,145	147	162	195,690	32,136	227,826
		95	71,308	172,606	5,962	159	0	250,035	865	250,900
		94	93,969	165,346	480	95	89	259,979	6,318	266,297
		88	332,710	110,786	1,687	200	30,260	475,643	4,765	480,408
1634-04-4	Methyl tert-butyl ether	96	952,626	2,170,463	103,615	177,174	26,568	3,430,446	243,220	3,673,666
		95	931,449	2,361,051	78,554	15,238	3,799	3,390,091	47,841	3,437,932
		94	937,468	2,197,131	92,140	29,645	2,225	3,258,609	117,753	3,376,362
		88	617,340	1,970,907	21,499	14,400	370	2,624,516	4,602	2,629,118
101-14-4	4,4'-Methylenebis (2-chloroaniline)	96	251	255	0	0	750	1,256	5	1,261
		95	250	10	0	0	0	260	5	265
		94	10	10	0	0	0	20	1,300	1,320
		88	250	0	0	0	0	250	0	250
101-61-1	4,4'-Methylenebis-(N,N-dimethyl) benzencamine	96	0	1	0	0	0	1	0	1
		95	5	5	0	0	0	10	0	10
		94	No reports received							
		88	250	0	0	0	7,000	7,250	1,150	8,400
74-95-3	Methylene bromide	96	85,043	14,249	0	0	0	99,292	0	99,292
		95	22,539	40,552	0	0	0	63,091	0	63,091
		94	36,765	35,080	0	5,700	0	77,545	0	77,545
		88	34,468	23,255	0	0	0	57,723	0	57,723
101-77-9	4,4'-Methylene-dianiline	96	8,227	1,535	23	41,120	0	50,905	19,591	70,496
		95	8,546	1,791	63	23,110	0	33,510	9,673	43,183
		94	6,669	3,073	725	26,064	0	36,531	4,103	40,634
		88	36,804	93,461	2,599	460,250	1,140	594,254	141,538	735,792

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Mercury	96	803,882	0	4,114	807,996	23,748	0	6,586	5	0	30,339	860,054
	95	919,909	0	6,307	926,216	58,206	0	11,589	19	871	70,685	1,013,276
	94	838,500	0	11,065	849,565	21,223	0	3,807	10	0	25,040	898,285
	88	NA	NA	NA	NA	NA	NA	38,548	1,364	0	NA	NA
Mercury compounds	96	46,348	0	1	46,349	2,000	500	7,855	10	0	10,365	79,595
	95	125,287	0	0	125,287	0	505	5,150	5	0	5,660	155,583
	94	90,242	0	0	90,242	3,690	0	49	5	0	3,744	122,769
	88	NA	NA	NA	NA	NA	NA	256	528	0	NA	NA
Methanol	96	537,583,324	331,508,259	950,729,426	1,819,821,009	17,478,098	90,419,383	37,230,842	81,631,668	13	226,760,004	2,290,480,930
	95	492,685,076	366,619,613	952,409,011	1,811,713,700	23,230,686	94,697,025	31,480,405	89,876,995	109,611	239,394,722	2,308,772,421
	94	537,196,179	340,464,428	926,310,614	1,803,971,221	16,371,121	76,670,657	32,373,837	95,365,543	0	220,781,158	2,297,772,873
	88	NA	NA	NA	NA	NA	NA	40,029,552	121,263,646	3,570,258	NA	NA
Methoxychlor	96	0	0	0	0	0	0	1,250	0	0	1,250	818
	95	0	0	0	0	0	0	0	0	0	0	0
	94	0	0	0	0	0	0	5	0	0	5	16
	88	NA	NA	NA	NA	NA	NA	6,551	0	0	NA	NA
2-Methoxyethanol	96	1,704,300	146,744	2,181,353	4,032,397	11,084	1,304,325	97,388	741,640	0	2,154,437	7,042,511
	95	3,925,200	240,658	3,353,957	7,519,815	0	1,916,061	126,573	1,076,268	0	3,118,902	11,492,979
	94	2,297,809	532,775	4,596,214	7,426,798	4,300	1,628,616	201,086	1,131,051	0	2,965,053	11,051,353
	88	NA	NA	NA	NA	NA	NA	826,153	622,102	715	NA	NA
Methyl acrylate	96	1,010,001	908,315	1,479,300	3,397,616	10,018	313,548	79,773	15,322	0	418,661	4,042,978
	95	910,001	736,924	2,134,388	3,781,313	40,769	184,341	92,773	23,261	0	341,144	4,374,845
	94	940,001	161,043	1,382,130	2,483,174	25,098	358,071	98,412	3,260	0	484,841	3,238,381
	88	NA	NA	NA	NA	NA	NA	14,040	14,886	0	NA	NA
Methyl tert-butyl ether	96	1,693,888	807,055	2,525,427	5,026,370	283,774	1,853,551	604,850	253,430	0	2,995,605	12,689,501
	95	847,718	228,033	2,884,118	3,959,869	32,986	1,361,095	422,145	101,520	0	1,917,746	9,296,983
	94	238,880	661,761	3,313,924	4,214,565	17,434	923,399	546,944	95,945	0	1,583,722	9,235,476
	88	NA	NA	NA	NA	NA	NA	93,575	7,713	0	NA	NA
4,4'-Methylenebis-(2-chloroaniline)	96	0	0	0	0	0	2,494	11,299	5	0	13,798	13,633
	95	720	0	36	756	0	2,017	10,684	5	0	12,706	13,010
	94	720	0	75	795	0	5,848	2,389	5	0	8,242	10,083
	88	NA	NA	NA	NA	NA	NA	6,250	0	0	NA	NA
4,4'-Methylenebis-(N,N-dimethyl) benzeneamine	96	0	0	0	0	0	0	0	0	0	0	1
	95	0	0	0	0	0	0	0	0	0	0	10
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Methylene bromide	96	1,211,800	0	270	1,212,070	0	0	0	0	0	0	1,311,362
	95	677,059	0	51,903	728,962	0	0	0	979	0	979	792,225
	94	2,000,000	0	97,228	2,097,228	6,200	1,300	250	1,114	0	8,864	2,183,572
	88	NA	NA	NA	NA	NA	NA	0	6,097	0	NA	NA
4,4'-Methylene-dianiline	96	2,900	52,414	83,357	138,671	0	2,235	55,191	2,023	0	59,449	263,947
	95	2,300	17,801	87,919	108,020	0	17,264	92,309	2,026	0	111,599	256,155
	94	1,900	92,806	50,125	144,831	0	6,295	174,060	1,889	0	182,244	362,444
	88	NA	NA	NA	NA	NA	NA	139,349	7,399	0	NA	NA

**Note** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

On-site Releases										Off-site Releases	Total On- and Off-site Releases
CAS Number	Chemical	Year	Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds			
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds							
78-93-3	Methyl ethyl ketone	96	20,641,669	38,426,835	74,989	432,772	139,598	59,715,863	247,023	59,962,886	
		95	25,026,991	44,718,128	65,520	556,607	87,856	70,455,102	217,811	70,672,913	
		94	27,584,056	52,002,109	108,385	575,848	38,168	80,308,566	432,013	80,740,579	
		88	41,981,304	99,116,021	92,076	255,955	166,597	141,611,953	5,014,725	146,626,678	
60-34-4	Methyl hydrazine	96	250	250	0	0	0	500	0	500	
		95	250	250	0	0	0	500	0	500	
		94	278	260	0	0	0	538	0	538	
		88	2,774	153	1	0	0	2,928	1,450	4,378	
74-88-4	Methyl iodide	96	20,141	45,084	0	23,500	0	88,725	3,300	92,025	
		95	20,747	871	0	10,000	0	31,618	8,600	40,218	
		94	30,383	11	0	0	0	30,394	2,450	32,844	
		88	5,691	3,253	5	250	0	9,199	250	9,449	
108-10-1	Methyl isobutyl ketone	96	4,570,658	14,312,039	22,569	162,000	4,858	19,072,124	35,672	19,107,796	
		95	5,632,099	16,147,952	51,292	158,600	7,041	21,996,984	86,316	22,083,300	
		94	6,873,386	18,571,736	80,177	131,600	12,201	25,669,100	75,549	25,744,649	
		88	13,049,874	18,985,959	762,108	116,650	31,770	32,946,361	1,966,238	34,912,599	
624-83-9	Methyl isocyanate	96	1,116	373	0	0	0	1,489	0	1,489	
		95	1,344	314	0	0	0	1,658	0	1,658	
		94	18,730	1,005	0	0	0	19,735	0	19,735	
		88	9,649	586	0	0	64	10,299	8,400	18,699	
80-62-6	Methyl methacrylate	96	507,244	1,332,648	2,551	160,000	1,072	2,003,515	107,184	2,110,699	
		95	587,582	1,397,414	2,172	120,000	1,056	2,108,224	217,267	2,325,491	
		94	645,184	1,799,162	4,664	120,000	69	2,569,079	356,283	2,925,362	
		88	1,346,194	2,284,375	28,437	327,220	8,119	3,994,345	276,567	4,270,912	
90-94-8	Michler's ketone	96	No reports received								
		95	0	1,577	0	0	0	1,577	0	1,577	
		94	0	814	0	0	0	814	0	814	
		88	450	650	0	0	0	1,100	0	1,100	
1313-27-5	Molybdenum trioxide	96	159,992	36,366	28,004	209,900	71,653	505,915	628,643	1,134,558	
		95	135,886	46,901	63,555	333,730	85,442	665,514	1,013,638	1,679,152	
		94	140,505	37,066	60,848	161,340	71,814	471,573	389,855	861,428	
		88	37,672	73,523	139,021	197,115	97,238	544,569	573,624	1,118,193	
505-60-2	Mustard gas	96	0	0	0	0	0	0	0	0	
		95	No reports received								
		94	No reports received								
		88	No reports received								
91-20-3 *	Naphthalene	96	1,281,814	1,576,524	11,737	285,877	301,513	3,457,465	576,597	4,034,062	
		95	1,317,092	1,323,405	43,311	33,569	32,090	2,749,467	474,106	3,223,573	
		94	1,502,159	1,311,249	28,557	88,200	47,014	2,977,179	496,501	3,473,680	
		88	3,424,748	1,740,678	22,518	50,946	123,697	5,362,587	1,359,184	6,721,771	
134-32-7	alpha-Naphthyl- amine	96	0	0	0	0	0	0	0	0	
		95	0	0	0	0	0	0	0	0	
		94	5	5	0	0	0	10	0	10	
		88	336	254	101	0	0	691	0	691	

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Methylethyl ketone	96	61,050,421	92,654,090	68,944,661	222,649,172	20,101,826	37,076,309	4,887,309	598,327	70,490	62,734,261	350,937,478
	95	66,080,000	112,447,288	69,359,019	247,886,307	20,676,316	42,619,807	5,883,761	502,492	5,830	69,688,206	388,842,410
	94	66,166,777	99,848,117	62,563,008	228,577,902	22,251,090	46,566,320	6,215,882	410,996	1,000	75,445,288	386,256,481
	88	NA	NA	NA	NA	NA	NA	22,189,902	964,168	2,063,186	NA	NA
Methylhydrazine	96	0	0	44	44	0	0	5	0	0	5	429
	95	0	0	20	20	0	0	5	0	0	5	425
	94	0	0	500	500	0	0	863	0	0	863	1,401
	88	NA	NA	NA	NA	NA	NA	1,250	0	0	NA	NA
Methyliodide	96	0	1,900	341	2,241	0	0	27	0	0	27	94,229
	95	0	140	19,376	19,516	0	0	760	0	0	760	60,463
	94	0	160	180	340	0	250	250	0	0	500	33,633
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Methylisobutyl ketone	96	52,337,198	20,171,448	13,243,777	85,752,423	12,107,396	17,968,462	1,233,056	299,154	2,013	31,610,081	139,241,590
	95	52,704,238	26,719,664	17,795,698	97,219,600	16,296,708	18,211,033	1,503,755	398,672	3,866	36,414,034	156,105,242
	94	54,886,123	37,411,855	16,642,751	108,940,729	17,960,367	18,858,606	1,661,585	488,749	4,022	38,973,329	172,657,005
	88	NA	NA	NA	NA	NA	NA	6,075,272	1,509,030	2,467,760	NA	NA
Methylisocyanate	96	0	0	91,617	91,617	0	0	3,007	0	0	3,007	96,100
	95	0	0	66,939	66,939	0	0	0	0	0	0	68,597
	94	0	0	71,030	71,030	0	0	0	0	0	0	90,761
	88	NA	NA	NA	NA	NA	NA	314	0	0	NA	NA
Methyl methacrylate	96	4,567,223	2,367,486	4,635,442	11,570,151	58,074	1,328,264	211,404	229,373	0	1,827,115	15,528,946
	95	4,665,497	2,050,094	5,218,371	11,933,962	20,750	1,437,140	458,692	255,983	0	2,172,565	16,345,705
	94	4,667,970	3,020,865	2,970,916	10,659,751	22,185	1,342,473	723,917	285,764	0	2,374,339	15,969,194
	88	NA	NA	NA	NA	NA	NA	2,787,477	191,071	37,511	NA	NA
Michler's ketone	96	No reports received				0	436	0	0	0	436	2,013
	95	0	0	0	0	0	145	0	0	0	145	1,144
	94	0	0	0	0	0	145	0	0	0	145	1,144
	88	NA	NA	NA	NA	NA	NA	33,519	0	0	NA	NA
Molybdenum trioxide	96	6,529,490	0	31,277	6,560,767	2,736,322	3,276	360,880	63,951	0	3,164,429	11,204,989
	95	6,243,774	0	19,964	6,263,738	2,495,746	3,530	220,729	60,213	0	2,780,218	10,617,804
	94	5,571,077	0	13,950	5,585,027	2,984,416	0	326,967	62,262	0	3,373,645	9,831,702
	88	NA	NA	NA	NA	NA	NA	7,336	34,044	20,000	NA	NA
Mustard gas	96	0	0	0	0	0	0	0	0	0	0	0
	95	No reports received				0	0	0	0	0	0	0
	94	No reports received				0	0	0	0	0	0	0
	88	No reports received				0	0	0	0	0	0	0
Naphthalene	96	12,512,289	5,184,798	142,338,479	160,035,566	248,539	3,380,659	797,683	23,965	2,800	4,453,646	168,190,422
	95	10,946,885	5,220,914	16,633,226	32,801,025	296,695	1,875,387	1,121,640	18,209	0	3,311,931	39,175,942
	94	16,696,301	6,052,030	7,601,983	30,350,314	435,645	1,201,639	560,103	22,421	0	2,219,808	35,853,786
	88	NA	NA	NA	NA	NA	NA	536,139	800,227	31,000	NA	NA
alpha-Naphthylamine	96	0	0	0	0	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	0	0	0	0	0
	94	0	0	0	0	0	0	0	0	0	0	2
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA

**Note:** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
7440-02-0	Nickel	96	256,602	125,211	28,163	4,225	260,666	674,867	3,480,910	4,155,777
		95	142,710	183,202	24,692	6,370	370,869	727,843	2,948,350	3,676,193
		94	438,211	145,909	31,496	7,080	389,400	1,012,096	3,334,751	4,346,847
		88	270,257	182,000	90,386	14,295	1,225,251	1,782,189	6,425,642	8,207,831
--	Nickel compounds	96	78,907	246,069	60,646	86,278	3,698,922	4,170,822	4,757,894	8,928,716
		95	108,278	154,268	53,279	107,886	2,363,360	2,787,071	5,645,254	8,432,325
		94	105,713	133,984	67,724	55,861	1,364,254	1,727,536	5,199,060	6,926,596
		88	155,735	117,282	132,233	224,968	2,384,332	3,014,550	3,910,015	6,924,565
7697-37-2	Nitric acid	96	628,830	2,453,528	221,434	17,483,972	176,491	20,964,255	1,477,976	22,442,231
		95	649,742	1,670,051	46,591	18,755,717	236,033	21,358,134	4,818,362	26,176,496
		94	667,544	1,775,622	167,504	18,269,660	510,050	21,390,380	3,537,114	24,927,494
		88	1,111,293	7,166,891	1,380,565	25,485,680	1,330,695	36,475,124	7,929,318	44,404,442
139-13-9	Nitrilotriacetic acid	96	10	0	78	1,500	0	1,588	0	1,588
		95	1	0	34	2,900	0	2,935	0	2,935
		94	8	5	2,748	500	0	3,261	0	3,261
		88	1,000	1,500	5,100	0	5,100	12,700	250	12,950
99-59-2	5-Nitro-o-anisidine	96	5	5	0	0	0	10	0	10
		95	5	5	0	0	0	10	0	10
		94	5	5	0	0	0	10	0	10
		88	No reports received						0	10
98-95-3	Nitrobenzene	96	23,351	15,888	951	193,527	46	233,763	3,825	237,588
		95	17,106	8,377	874	330,344	43	356,744	961	357,705
		94	34,194	6,762	1,999	815,285	226	858,466	2,290	860,756
		88	22,616	18,663	7,283	819,000	3,538	871,100	69,570	940,670
55-63-0	Nitroglycerin	96	1,439	21,027	18,508	0	3,781	44,755	3,610	48,365
		95	1,678	24,399	13,300	0	0	39,377	0	39,377
		94	1,842	34,233	11,544	0	0	47,619	6	47,625
		88	2,280	50,103	2,746	0	11,640	66,769	2	66,771
88-75-5	2-Nitrophenol	96	5	28	51	0	0	84	90	174
		95	5	33	50	0	0	88	0	88
		94	0	18	67	0	0	85	0	85
		88	32,152	1,537	1	0	2	33,692	13,100	46,792
100-02-7 *	4-Nitrophenol	96	890	45	0	0	0	935	0	935
		95	910	35	0	0	0	945	0	945
		94	920	81	0	0	0	1,001	3	1,004
		88	7,642	213	0	6,300	7	14,162	70	14,232
79-46-9	2-Nitropropane	96	19,226	15,062	2,790	0	0	37,078	0	37,078
		95	21,057	10,208	3,000	0	0	34,265	0	34,265
		94	22,842	14,381	3,300	0	0	40,523	0	40,523
		88	208,303	181,082	4,300	257,000	0	650,685	4,785	655,470
62-75-9	N-Nitrosodimethylamine	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	0	0	0	0	0	0	0	0

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\*Pesticide



Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
Nickel	96	34,302,930	16,476	996,941	35,316,347	73,839,083	70,582	2,060,315	86,328	3,650	76,059,958	116,797,060
	95	38,109,558	127	1,546,633	39,656,318	74,608,906	1,348	788,853	81,257	516	75,480,880	120,203,518
	94	42,963,374	0	1,507,253	44,470,627	78,093,672	3,057	1,141,452	96,522	9,930	79,344,633	132,276,475
	88	NA	NA	NA	NA	NA	NA	1,178,986	252,701	279,905	NA	NA
Nickel compounds	96	8,360,348	37,998	2,719,330	11,117,676	25,082,239	1,379	864,624	93,795	8,651	26,050,688	60,211,166
	95	14,062,245	0	5,627,326	19,689,571	32,722,124	5,841	1,226,740	100,876	755	34,056,336	63,764,851
	94	20,805,120	0	6,323,439	27,128,559	33,072,512	1,034	1,543,496	123,675	0	34,740,717	68,491,797
	88	NA	NA	NA	NA	NA	NA	1,886,744	652,442	217,385	NA	NA
Nitric acid	96	24,081,964	165,558	269,641,370	293,888,892	2,610,233	346	11,575,491	3,851,407	25,118	18,062,595	333,654,906
	95	53,735,834	250,245	248,606,746	302,592,825	3,472,782	255	11,289,777	4,585,207	23,808	19,371,829	349,605,792
	94	34,802,605	23,000	264,650,252	299,475,857	3,238,193	3	10,934,203	3,435,700	0	17,608,999	342,099,085
	88	NA	NA	NA	NA	NA	NA	18,442,846	22,432,957	48,202	NA	NA
Nitritotriacetic acid	96	0	0	1,017,756	1,017,756	0	0	0	18,000	0	18,000	1,037,344
	95	2,500	0	969,141	971,641	0	0	1,872	0	0	1,872	976,448
	94	1,840	0	398,169	400,009	0	0	2,080	0	0	2,080	405,350
	88	NA	NA	NA	NA	NA	NA	190,753	254,859	0	NA	NA
5-Nitro-o-anisidine	96	0	0	0	0	0	0	0	5	0	5	5
	95	0	0	0	0	0	0	0	5	0	5	5
	94	0	0	0	0	0	0	0	5	0	5	0
	88	No reports received										
Nitrobenzene	96	3,552,450	1,781,334	1,146,945	6,480,729	0	20,703	599,215	116	0	620,034	7,336,665
	95	3,677,200	1,479,583	1,297,715	6,454,498	0	77,514	627,862	219	0	705,595	7,525,649
	94	4,190,550	2,131,609	1,035,708	7,357,867	3,603	24,351	458,135	289	0	486,378	8,699,337
	88	NA	NA	NA	NA	NA	NA	1,301,075	5,671	750	NA	NA
Nitroglycerin	96	18,000	0	315,442	333,442	0	36,584	15,809	217	0	52,610	424,506
	95	24,151	0	428,538	452,689	0	35,138	21,914	203	0	57,255	551,674
	94	14,210	0	303,371	317,581	38,586	0	92,713	263	0	131,562	471,272
	88	NA	NA	NA	NA	NA	NA	3,581	53	0	NA	NA
2-Nitrophenol	96	0	53,000	75,000	128,000	0	0	20,900	47	0	20,947	149,179
	95	0	28,000	120,000	148,000	0	6	24,011	58	0	24,075	171,400
	94	0	0	348,379	348,379	0	0	20,189	180	0	20,369	369,453
	88	NA	NA	NA	NA	NA	NA	1,600	149,000	0	NA	NA
4-Nitrophenol	96	0	12,990	60,000	72,990	0	1	476,030	169	0	476,200	549,931
	95	0	10,469	65,000	75,469	0	3	574,817	176	0	574,996	651,222
	94	0	0	73,000	73,000	0	0	583,000	186	0	583,186	657,000
	88	NA	NA	NA	NA	NA	NA	0	560,428	0	NA	NA
2-Nitropropane	96	0	0	58,297	58,297	0	50	12,467	0	0	12,517	107,890
	95	0	140,000	63,028	203,028	520	314	0	0	0	834	237,652
	94	0	1,584	79,484	81,068	3,300	1,779	29	0	0	5,108	126,474
	88	NA	NA	NA	NA	NA	NA	8,910	3,000	0	NA	NA
N-Nitrosodimethyl- amine	96	No reports received										
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA

**Note** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. **Production-related Waste** from Section 8 of Form R (total excludes remedial and catastrophic quantities)





Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
86-30-6	N-Nitrosodiphenyl-amine	96	10	0	0	0	0	10	0	10
		95	10	0	0	0	0	10	0	10
		94	0	0	0	0	0	0	0	0
		88	0	0	27	34,000	0	34,027	0	34,027
156-10-5	p-Nitrosodiphenyl-amine	96	24	0	0	0	0	24	420	444
		95	24	0	0	0	0	24	520	544
		94	24	0	0	0	0	24	0	24
		88	15	0	0	2,000	0	2,015	180	2,195
59-89-2	N-Nitroso-morpholine	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	No reports received							
		88	No reports received							
56-38-2 *	Parathion	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	1,142	5	0	0	0	1,147	15,027	16,174
		88	2,258	1,007	750	0	250	4,265	3,959	8,224
87-86-5 *	Pentachlorophenol	96	8,164	4,977	8,236	0	3,000	24,377	196,075	220,452
		95	1,825	4,441	3,146	0	250	9,662	23,942	33,604
		94	4,511	17,112	1,458	0	250	23,331	24,343	47,674
		88	8,133	5,896	2,465	20,000	3,717	40,211	518,105	558,316
79-21-0 *	Peracetic acid	96	960	10,595	5	0	812	12,372	0	12,372
		95	998	6,849	15	0	582	8,444	0	8,444
		94	693	5,148	15	0	270	6,126	0	6,126
		88	766	4,687	55	0	0	5,508	0	5,508
108-95-2 *	Phenol	96	2,456,348	7,096,154	72,555	2,045,370	159,059	11,829,486	1,016,261	12,845,747
		95	2,352,099	6,934,596	70,419	3,823,235	171,609	13,351,958	1,280,771	14,632,729
		94	2,532,937	5,986,787	121,480	3,224,053	172,240	12,037,497	1,584,155	13,621,652
		88	4,544,746	6,167,990	259,230	4,661,319	1,882,485	17,515,770	2,536,030	20,051,800
106-50-3	p-Phenylenediamine	96	3,416	564	409	0	1,308	5,697	0	5,697
		95	3,466	974	856	0	653	5,949	0	5,949
		94	2,845	2,098	1,260	0	2,624	8,827	0	8,827
		88	2,210	111,680	826	4,716	0	119,432	64,452	183,884
90-43-7 *	2-Phenylphenol	96	55	4,052	1	0	250	4,358	1,789	6,147
		95	61	27,002	10	0	5	27,078	5,656	32,734
		94	7,784	35,223	15	0	2	43,024	1,507	44,531
		88	9,010	1,620	480	0	0	11,110	250	11,360
75-44-5	Phosgene	96	6,635	9,648	0	5	0	16,288	0	16,288
		95	7,802	8,092	0	5	0	15,899	0	15,899
		94	7,726	7,950	0	5	0	15,681	0	15,681
		88	3,839	17,764	500	250	0	22,353	480	22,833
7664-38-2 *	Phosphoric acid	96	196,086	851,959	28,367,233	9,716	31,460,721	60,885,715	2,331,930	63,217,645
		95	439,393	814,110	20,402,951	7,340	35,898,123	57,561,917	2,045,261	59,607,178
		94	284,442	752,955	20,900,639	45,616	58,985,481	80,969,133	2,603,268	83,572,401
		88	727,787	1,235,954	122,647,164	53,711	52,615,971	177,280,587	5,303,543	182,584,130

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\*Pesticide



Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
N-Nitrosodiphenyl- amine	96	0	0	47,762	47,762	0	230,000	120,000	0	0	350,000	397,772
	95	0	0	0	0	0	0	337,000	0	0	337,000	340,010
	94	0	0	0	0	0	0	200,000	0	0	200,000	200,000
	88	NA	NA	NA	NA	NA	NA	300	0	0	NA	NA
p-Nitrosodiphenyl- amine	96	0	9,400	0	9,400	0	17,000	180	0	0	17,180	27,024
	95	0	8,600	0	8,600	0	15,000	65	0	0	15,065	24,209
	94	0	9,100	0	9,100	0	16,000	0	0	0	16,000	25,124
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
N-Nitroso- morpholine	96	0	0	0	0	0	0	23,600	0	0	23,600	24,000
	95	0	0	0	0	0	0	0	0	0	0	0
	94	No reports received										
	88	No reports received										
Parathion	96	0	0	0	0	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	0	0	0	0	0
	94	0	0	0	0	0	0	1,035	0	0	1,035	17,518
	88	NA	NA	NA	NA	NA	NA	1,321	0	0	NA	NA
Pentachlorophenol	96	1,232,965	11,754	22,743	1,267,462	2,971	8,875	67,358	611	0	79,815	1,551,847
	95	1,888,603	9,151	6,780	1,904,534	360	14,354	49,742	900	0	65,356	2,032,895
	94	105,705	0	42,203	147,908	250	24,982	44,970	1,798	0	72,000	297,533
	88	NA	NA	NA	NA	NA	NA	27,568	4,728	0	NA	NA
Peracetic acid	96	0	0	4,160	4,160	0	0	7,300	2,664	0	9,964	26,290
	95	13,833	0	12,884	26,717	0	0	10,300	2,396	0	12,696	47,440
	94	21,060	0	84,180	105,240	0	0	0	2,138	0	2,138	113,126
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Phenol	96	40,787,213	27,483,437	25,790,593	94,061,243	120,652	3,787,203	3,556,740	3,280,289	0	10,744,884	117,406,441
	95	41,534,425	28,593,814	34,275,169	104,403,408	380,614	3,728,168	3,235,121	3,771,514	2,500	11,117,917	129,424,375
	94	38,572,804	19,384,426	33,732,420	91,689,650	494,671	3,383,588	2,916,629	2,968,474	500	9,763,862	115,362,112
	88	NA	NA	NA	NA	NA	NA	3,668,466	6,046,640	328,571	NA	NA
p-Phenylenediamine	96	0	0	303,611	303,611	0	0	22,030	5,850	0	27,880	339,489
	95	0	0	364,868	364,868	0	0	16,312	4,150	0	20,462	390,707
	94	0	43,000	915,974	958,974	0	0	23,968	3,600	0	27,568	995,278
	88	NA	NA	NA	NA	NA	NA	53,471	6,277	0	NA	NA
2-Phenylphenol	96	0	92	705,215	705,307	0	0	250	24,662	0	24,912	732,897
	95	0	530	1,027,544	1,028,074	0	0	0	3,626	0	3,626	1,062,729
	94	0	110	423,403	423,513	0	0	121	3,537	0	3,658	470,013
	88	NA	NA	NA	NA	NA	NA	0	6,400	0	NA	NA
Phosgene	96	0	200	17,249,349	17,249,549	0	0	2,270	0	0	2,270	17,268,049
	95	0	430,034	15,138,316	15,568,350	0	0	2,414	0	0	2,414	15,586,631
	94	0	380	14,086,721	14,087,101	0	0	158	0	0	158	14,101,558
	88	NA	NA	NA	NA	NA	NA	1,040	0	0	NA	NA
Phosphoric acid	96	310,993,398	8,300	117,388,358	428,390,056	7,460,279	72,379	1,835,400	2,745,535	750	12,114,343	503,562,424
	95	216,200,620	14,792	353,698,632	569,914,044	11,427,354	61,289	1,843,577	3,411,362	250	16,743,832	642,804,823
	94	207,308,181	12,000	388,288,677	595,608,858	9,473,740	45,269	2,215,316	3,881,545	505	15,616,375	673,564,806
	88	NA	NA	NA	NA	NA	NA	3,270,219	13,846,442	743,381	NA	NA

Note Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
7723-14-0	Phosphorus (yellow or white)	96	24,359	1,577	255	0	2,057,524	2,083,715	19,839	2,103,554
		95	22,588	6,033	3,661	0	1,871,801	1,904,083	23,650	1,927,733
		94	27,686	4,148	9,391	0	1,705,016	1,746,241	13,767	1,760,008
		88	9,049	11,559	11,322	0	3,893,674	3,925,604	195,013	4,120,617
85-44-9	Phthalic anhydride	96	59,978	367,260	174	0	0	427,412	103,707	531,119
		95	74,240	530,376	711	0	674	606,001	76,916	682,917
		94	98,631	331,535	362	0	0	430,528	105,924	536,452
		88	126,906	423,003	1,040	0	1,265	552,214	3,976,682	4,528,896
88-89-1	Picric acid	96	0	0	0	94,031	0	94,031	0	94,031
		95	219	2	0	49,256	0	49,477	0	49,477
		94	2	2	2	43,958	2	43,966	0	43,966
		88	251	1	251	1,362,180	250	1,362,933	0	1,362,933
—	Polybrominated biphenyls	96	0	250	0	0	0	250	375	625
		95	0	0	0	0	0	0	0	0
		94	0	0	0	0	0	0	250	250
		88	250	0	0	0	0	250	0	250
1336-36-3	Polychlorinated biphenyls (PCBs)	96	5	250	0	0	9,205	9,460	51,086	60,546
		95	0	0	0	0	0	0	34,432	34,432
		94	0	0	0	0	0	0	94,962	94,962
		88	6	0	10	0	752	768	488,732	489,500
1120-71-4	Propane sulfone	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	0	0	0	0	0	0	0	0
		88	0	0	0	0	0	0	0	0
123-38-6	Propionaldehyde	96	76,050	94,958	32,077	74,613	0	277,698	62	277,760
		95	82,023	133,118	27,012	101,432	0	343,585	0	343,585
		94	337,833	146,634	21	66,352	0	550,840	26,948	577,788
		88	399,253	868,586	1,156	930	0	1,269,925	0	1,269,925
114-26-1 *	Propoxur	96	0	0	0	0	0	0	0	0
		95	0	5	0	0	0	5	0	5
		94	0	4	0	0	0	4	31	35
		88	250	0	0	0	0	250	250	500
115-07-1	Propylene	96	10,546,131	15,859,826	7,133	0	2,458	26,415,548	2,181	26,417,729
		95	11,358,424	16,221,476	4,047	0	169	27,584,116	298	27,584,414
		94	12,762,146	9,079,043	4,635	0	0	21,845,824	269	21,846,093
		88	18,647,105	13,594,694	10,003	0	0	32,251,802	3,320	32,255,122
75-55-8	Propyleneimine	96	366	36	0	0	0	402	0	402
		95	564	36	0	0	0	600	0	600
		94	216	265	0	0	0	481	0	481
		88	250	250	0	0	0	500	0	500
75-56-9 *	Propylene oxide	96	226,160	354,701	45,393	12,141	335	638,730	39,230	677,960
		95	345,822	498,174	29,934	22,577	4,403	900,910	8,633	909,543
		94	356,231	740,955	12,695	22,195	6,151	1,138,227	48,801	1,187,028
		88	896,638	2,783,577	112,503	1,113,780	11,630	4,918,128	16,626	4,934,754

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued.**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
Phosphorus (yellow or white)	96	300	0	610,526	610,826	110,484	0	21,916	272	0	132,672	2,864,362
	95	1,091	0	5,052	6,143	26,059	0	147,492	505	0	174,056	2,108,747
	94	1,208	0	39,006	40,214	183,473	0	55,407	258	0	239,138	2,010,517
	88	NA	NA	NA	NA	NA	NA	14,074	646	946	NA	NA
Phthalic anhydride	96	90,881	2,098,212	12,577,144	14,766,237	475	4,814,622	241,672	149,891	0	5,206,660	20,539,607
	95	421,574	2,420,922	18,689,501	21,531,997	1,261	4,951,064	335,251	51,793	0	5,339,369	27,599,067
	94	527,847	2,152,095	18,908,160	21,588,102	2,781	4,342,281	243,593	9,483	0	4,598,138	26,553,835
	88	NA	NA	NA	NA	NA	NA	2,877,574	53,441	21,803	NA	NA
Picric acid	96	0	136,931	1,779,450	1,916,381	0	0	21,015	0	0	21,015	2,031,427
	95	0	53,393	1,261,618	1,315,011	0	2	0	0	0	2	1,364,490
	94	0	387,228	285,129	672,357	0	13	836	0	0	849	717,172
	88	NA	NA	NA	NA	NA	NA	14,000	0	0	NA	NA
Polybrominated biphenyls	96	0	0	0	0	4,219	0	0	0	0	4,219	4,724
	95	0	0	0	0	2,720	0	0	0	0	2,720	2,720
	94	0	0	0	0	0	0	0	0	0	0	899
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Polychlorinated biphenyls (PCBs)	96	0	0	0	0	59,972	250	243,194	0	0	303,416	52,237
	95	0	0	0	0	0	0	645,345	0	0	645,345	72,736
	94	0	0	0	0	0	0	934,464	0	0	934,464	181,185
	88	NA	NA	NA	NA	NA	NA	5,149,843	250	23,550	NA	NA
Propane sulfone	96	0	0	4	4	0	0	0	0	0	0	4
	95	0	0	16	16	0	0	0	0	0	0	16
	94	0	0	0	0	0	0	0	0	0	0	0
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Propionaldehyde	96	0	255,989	4,446,808	4,702,797	0	18,135	9	320,765	0	338,909	5,319,755
	95	0	898,697	2,348,789	3,247,486	0	5,565	36	87,484	0	93,085	3,679,694
	94	0	667,541	1,069,325	1,736,866	0	12,994	1	1,760	0	14,755	2,326,064
	88	NA	NA	NA	NA	NA	NA	1,600	761	0	NA	NA
Propoxur	96	0	0	0	0	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	1,500	250	250	2,000	1,085
	94	0	0	0	0	0	0	1,805	140	0	1,945	1,977
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Propylene	96	60,407,279	567,598,551	302,585,973	930,591,803	0	215,250	272,632	6,315	250	494,447	957,526,443
	95	6,713,304	487,153,246	254,049,252	747,915,802	0	3,132,286	80,240	5	0	3,212,531	778,768,655
	94	190,030,400	643,226,119	246,950,683	1,080,207,202	0	2,159,280	280,113	5	0	2,439,398	1,103,464,417
	88	NA	NA	NA	NA	NA	NA	1,521,069	500	0	NA	NA
Propyleneimine	96	0	0	1,734	1,734	0	0	0	0	0	0	2,136
	95	0	0	1,433	1,433	0	0	0	0	0	0	2,033
	94	0	0	1,748	1,748	0	0	0	0	0	0	2,133
	88	NA	NA	NA	NA	NA	NA	0	250	0	NA	NA
Propylene oxide	96	3,780,004	18,451,509	13,284,599	35,516,112	255	250,033	1,871	206,725	0	458,884	36,848,356
	95	3,091	17,981,778	14,366,911	32,351,780	0	281,155	36,882	350,949	0	668,986	33,966,184
	94	11,716	2,874,364	13,870,297	16,756,377	66	5,164	6,148	374,871	4	386,253	18,088,342
	88	NA	NA	NA	NA	NA	NA	1,091	386,355	35	NA	NA

**Note:** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)

Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
110-86-1	Pyridine	96	47,611	43,568	908	428,000	1	520,088	775	520,863
		95	64,172	35,332	830	453,900	4	554,238	321	554,559
		94	70,153	36,301	1,409	358,200	0	466,063	1,201	467,264
		88	143,881	107,918	2,158	491,775	1,125	746,857	40,699	787,556
91-22-5	Quinoline	96	12,053	10,921	20	32,000	466	55,460	5,072	60,532
		95	7,537	3,875	20	13,000	405	24,837	3,744	28,581
		94	7,665	19,757	35	63,000	571	91,028	5,054	96,082
		88	31,633	17,717	502	0	896	50,748	6,242	56,990
106-51-4	Quinone	96	3,801	3,304	500	0	0	7,605	0	7,605
		95	3,800	3,301	1,500	0	0	8,601	0	8,601
		94	9,900	2,101	1,600	0	0	13,601	0	13,601
		88	4,600	6,700	140	0	0	11,440	0	11,440
82-68-8 *	Quintozene	96	1,550	1,061	0	0	836	3,447	0	3,447
		95	914	510	0	0	800	2,224	192	2,416
		94	1,771	787	0	0	0	2,558	161	2,719
		88	750	314	0	0	0	1,064	12,625	13,689
81-07-2	Saccharin (manufacturing)	96	210	33	0	0	0	243	1,200	1,443
		95	90	9	0	0	0	99	1,500	1,599
		94	60	20	0	0	0	80	1,400	1,480
		88	250	500	0	0	0	750	750	1,500
94-59-7	Safrole	96	500	5	0	0	0	505	0	505
		95	250	5	0	0	0	255	0	255
		94	No reports received		0	0	0	0	0	0
		88	250	250	0	0	0	500	0	500
7782-49-2	Selenium	96	5	40	97	0	29	171	784	955
		95	5	1,445	92	0	23	1,565	25	1,590
		94	88	367	113	0	7	575	20	595
		88	2,251	14,031	1,168	0	127,508	144,958	2,617	147,575
—	Selenium compounds	96	1,986	45,278	2,404	3,100	211,237	264,005	61,491	325,496
		95	2,680	58,766	2,184	3,640	219,133	286,403	73,959	360,362
		94	3,576	50,984	2,470	3,410	278,924	339,364	25,229	364,593
		88	2,251	12,255	250	3,400	45,750	63,906	61,116	125,022
7440-22-4 *	Silver	96	6,261	1,947	149	0	6,306	14,663	21,736	36,399
		95	6,223	3,070	161	0	250	9,704	8,397	18,101
		94	7,052	3,648	176	250	270	11,396	3,958	15,354
		88	11,480	36,508	1,654	0	39,510	89,152	3,263	92,415
—	Silver compounds	96	3,016	13,375	8,147	370	45,693	70,601	10,132	80,733
		95	2,282	13,642	6,284	380	30,425	53,013	2,492	55,505
		94	2,732	15,367	6,580	140	28,843	53,662	10,462	64,124
		88	5,991	9,415	8,684	250	11,550	35,890	3,139	39,029
100-42-5	Styrene	96	10,917,192	31,011,969	12,864	228,317	266,690	42,437,032	3,251,349	45,688,381
		95	12,181,207	28,944,513	4,570	209,945	147,921	41,488,156	4,255,354	45,743,510
		94	13,932,696	26,545,550	54,884	250,861	227,778	41,011,769	4,301,253	45,313,022
		88	12,959,020	21,326,995	59,069	165	242,941	34,588,190	2,011,796	36,599,986

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year.

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production- related Waste Pounds
Pyridine	96	7,426,653	1,278,558	886,200	9,591,411	31,550	260,552	252,608	355,442	0	900,152	11,009,790
	95	5,974,830	1,713,719	348,352	8,036,901	14,008	185,968	190,110	291,689	0	681,775	9,272,661
	94	1,791,787	2,109,851	404,033	4,305,671	4,178	129,674	177,365	350,839	0	662,056	5,431,533
	88	NA	NA	NA	NA	NA	NA	56,729	275,083	0	NA	NA
Quinoline	96	15,881	34,652	91,001	141,534	2,180	34,429	17,015	255	0	53,879	255,277
	95	1,750	302,003	222,705	526,458	2,243	251	16,365	250	0	19,109	572,024
	94	2,168	280,592	51,342	334,102	4,178	7,500	38,602	260	0	50,540	478,080
	88	NA	NA	NA	NA	NA	NA	4,945	6,406	0	NA	NA
Quinone	96	0	230,508	366,115	596,623	0	0	50,513	0	0	50,513	654,741
	95	0	179,870	130,500	310,370	0	1,328	30,173	0	0	31,501	350,472
	94	0	9,868	130,000	139,868	0	0	26,186	0	0	26,186	180,055
	88	NA	NA	NA	NA	NA	NA	280	250	0	NA	NA
Quinoline	96	884	0	0	884	0	221,410	398,894	4	0	620,308	624,210
	95	863	0	0	863	0	0	759,393	88	0	759,481	762,701
	94	6,328	13,000	17	19,345	0	0	543,692	1,012	0	544,704	565,034
	88	NA	NA	NA	NA	NA	NA	0	250	0	NA	NA
Saccharin (manufacturing)	96	0	0	12,000	12,000	0	0	0	12	0	12	13,512
	95	0	0	9,700	9,700	0	0	0	10	0	10	11,310
	94	0	0	10,000	10,000	0	0	0	10	0	10	11,529
	88	NA	NA	NA	NA	NA	NA	0	7,900	0	NA	NA
Safrole	96	0	0	4	4	0	0	0	134	0	134	234
	95	0	0	1	1	0	0	0	5	0	5	6
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	250	0	NA	NA
Selenium	96	0	0	29	29	0	755	12,119	405	0	13,279	14,099
	95	1,604	0	23	1,627	4,604	0	1,200	2,276	0	8,080	10,026
	94	0	0	0	0	28,325	0	1,200	15	0	29,540	30,124
	88	NA	NA	NA	NA	NA	NA	3,145	1,250	500	NA	NA
Selenium compounds	96	601,563	0	0	601,563	133,241	4,700	32,979	21	8,464	179,405	1,100,414
	95	590,805	0	2	590,807	158,278	19	49,393	288	0	207,978	1,106,541
	94	343,313	0	0	343,313	136,856	255	31,492	307	0	168,910	873,271
	88	NA	NA	NA	NA	NA	NA	1,631	1,860	0	NA	NA
Silver	96	541,588	0	26,366	567,954	1,647,173	0	3,481	388	7	1,651,049	1,391,508
	95	563,576	0	87,462	651,038	1,378,373	1	6,416	142	0	1,384,932	1,920,661
	94	330,239	0	99,763	430,002	855,546	13	36,779	596	0	892,934	1,262,704
	88	NA	NA	NA	NA	NA	NA	23,875	3,624	0	NA	NA
Silver compounds	96	638,500	0	3,967,716	4,606,216	1,408,111	0	32,081	2,260	250	1,442,702	5,976,018
	95	327,846	0	3,966,504	4,294,350	1,000,476	0	22,365	2,069	0	1,024,910	5,396,624
	94	291,857	0	2,958,879	3,250,736	1,492,721	0	5,876	2,808	16,232	1,517,637	4,739,314
	88	NA	NA	NA	NA	NA	NA	8,986	8,078	2,830	NA	NA
Styrene	96	19,962,598	21,544,063	15,021,756	56,528,417	1,154,843	7,704,571	2,798,362	264,473	900	11,923,149	113,542,563
	95	9,297,615	20,674,599	14,031,180	44,003,394	652,462	9,047,200	3,938,713	118,840	1,000	13,758,215	103,087,135
	94	7,612,033	27,512,188	12,924,097	48,048,318	1,433,692	5,469,504	4,039,222	117,912	5	11,060,335	103,307,046
	88	NA	NA	NA	NA	NA	NA	5,696,394	479,835	1,260,446	NA	NA

**Note:** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
96-09-3	Styrene oxide	96	7	24	0	0	0	31	0	31
		95	1	12	0	0	0	13	0	13
		94	6	84	0	0	0	90	0	90
		88	511	1,803	0	0	0	2,314	750	3,064
79-34-5	1,1,2,2-Tetrachloro- ethane	96	12,638	2,850	130	0	0	15,618	7	15,625
		95	4,904	3,371	2,222	0	0	10,497	7	10,504
		94	10,227	2,257	1,517	26	0	14,027	52	14,079
		88	25,904	17,961	1,903	0	29	45,797	128,750	174,547
127-18-4	Tetrachloroethylene	96	3,095,666	4,765,504	1,311	13,436	30,442	7,906,359	22,071	7,928,430
		95	4,588,748	4,950,002	2,407	20,481	6	9,561,644	72,961	9,634,605
		94	4,894,036	5,712,830	3,877	4,051	4,349	10,619,143	74,980	10,694,123
		88	16,335,782	19,786,515	33,314	72,250	82,144	36,310,005	1,385,378	37,695,383
961-11-5 *	Tetrachlorvinphos	96	110	255	5	0	0	370	2,030	2,400
		95	20	606	5	0	0	631	4,200	4,831
		94	15	398	5	0	0	418	2,948	3,366
		88	250	1	0	0	0	251	9,270	9,521
7440-28-0	Thallium	96	No reports received							
		95	5	250	0	0	755	1,010	0	1,010
		94	5	250	0	0	755	1,010	0	1,010
		88	No reports received							
—	Thallium compounds	96	0	0	0	0	0	0	0	0
		95	No reports received							
		94	163	8	0	0	3,695	3,866	5	3,871
		88	1	252	0	0	250	503	1,000	1,503
62-55-5	Thioacetamide	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	250	250	0	0	0	500	0	500
62-56-6	Thiourea	96	1,093	119	339	5,000	250	6,801	2,590	9,391
		95	872	758	1,487	5,000	250	8,367	4,269	12,636
		94	1,155	2,017	3,539	5,000	250	11,961	2,572	14,533
		88	1,504	500	16,951	5,940	750	25,645	2,303	27,948
1314-20-1	Thorium dioxide	96	0	1	0	0	0	1	0	1
		95	0	1	0	0	0	1	0	1
		94	0	0	0	0	0	0	0	0
		88	230	1,350	0	0	0	1,580	677,549	679,129
7550-45-0	Titanium tetra- chloride	96	21,080	9,771	0	0	0	30,851	34,013	64,864
		95	15,877	4,422	0	0	0	20,299	32,282	52,581
		94	16,051	6,298	0	0	0	22,349	150	22,499
		88	38,614	40,054	0	0	1,400	80,068	0	80,068
108-88-3	Toluene	96	41,711,487	83,670,741	68,697	329,275	557,160	126,337,360	1,022,535	127,359,895
		95	52,433,574	93,577,558	53,291	310,691	85,798	146,460,912	881,153	147,342,065
		94	58,505,358	111,884,283	82,778	490,840	180,247	171,143,506	951,120	172,094,626
		88	106,246,178	193,156,221	196,957	1,473,666	643,668	301,716,690	9,615,791	311,332,481

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide

Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
Styrene oxide	96	0	35,337	0	35,337	0	861	0	0	0	861	36,230
	95	0	35,337	0	35,337	0	0	0	0	0	0	35,350
	94	23	35,337	0	35,360	0	884	0	0	0	884	36,330
	88	NA	NA	NA	NA	NA	NA	0	250	0	NA	NA
1,1,2,2-Tetrachloro- ethane	96	4,808,000	924,000	11,024,249	16,756,249	2,380,211	0	248,014	90	0	2,628,315	19,400,145
	95	6,200,000	846,600	13,754,898	20,801,498	2,233,342	880	150,072	0	0	2,384,294	23,196,547
	94	4,740,000	958,000	8,551,216	14,249,216	2,227,120	0	40,807	0	0	2,267,927	16,530,040
	88	NA	NA	NA	NA	NA	NA	74,982	400	0	NA	NA
Tetrachloroethylene	96	46,710,867	2,647,705	20,674,831	70,033,403	5,822,463	530,548	1,440,050	1,847	0	7,794,908	85,970,037
	95	46,322,863	8,622,647	26,279,022	81,224,532	6,622,064	780,737	2,192,750	14,997	75,924	9,686,472	100,619,857
	94	54,725,520	11,881,690	21,513,333	88,120,543	7,456,148	857,453	2,062,148	62,059	250	10,438,058	109,883,260
	88	NA	NA	NA	NA	NA	NA	4,059,045	558,691	138,270	NA	NA
Tetrachloroethylenes	96	615	0	1,020	1,635	0	44,900	3,885	0	0	48,785	52,662
	95	330	0	1,020	1,350	0	47,000	4,230	0	0	51,230	56,988
	94	16,075	3	0	16,078	0	21,100	19,104	7	0	40,211	59,201
	88	NA	NA	NA	NA	NA	NA	40,210	2	0	NA	NA
Thallium	96	No reports received										
	95	688,093	0	0	688,093	3,852	0	190	5	0	4,047	692,166
	94	27,482	0	0	27,482	5,040	0	250	5	0	5,295	32,167
	88	No reports received										
Thallium compounds	96	0	0	0	0	0	0	5	0	0	5	10
	95	No reports received										
	94	0	0	0	0	0	0	0	0	0	0	3,865
	88	NA	NA	NA	NA	NA	NA	250	6	0	NA	NA
Thioacetamide	96	No reports received										
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	250	0	0	NA	NA
Thiourea	96	4,665	0	664	5,329	0	0	11,073	254	0	11,327	31,767
	95	7,082	0	18,535	25,617	0	0	11,917	761	0	12,678	48,136
	94	0	0	3,860	3,860	0	0	1,821	1,860	0	3,681	19,787
	88	NA	NA	NA	NA	NA	NA	2,511	26,634	0	NA	NA
Thorium dioxide	96	22,000	0	0	22,000	0	0	0	2,200	0	2,200	24,200
	95	26,000	0	0	26,000	0	0	0	2,600	0	2,600	28,601
	94	0	0	0	0	0	0	0	0	0	0	0
	88	NA	NA	NA	NA	NA	NA	0	250	0	NA	NA
Titanium tetra- chloride	96	0	0	26,706,771	26,706,771	136,039	1	166,720	0	0	302,760	27,074,252
	95	0	0	23,836,598	23,836,598	129,787	0	2,914	0	0	132,701	24,021,959
	94	0	0	23,244,683	23,244,683	3,500	0	317,482	0	0	320,982	23,587,693
	88	NA	NA	NA	NA	NA	NA	1,667,045	0	0	NA	NA
Toluene	96	968,269,305	187,671,839	395,302,542	1,551,243,686	22,885,031	79,191,567	22,051,736	599,828	60,979	124,789,141	1,816,226,231
	95	1,006,140,873	214,676,316	214,503,254	1,435,320,443	24,390,666	76,581,609	20,733,577	850,357	5,168	122,561,377	1,701,961,019
	94	975,483,694	248,371,338	131,360,050	1,355,215,082	24,116,181	80,639,446	21,906,681	899,650	7,112	127,569,070	1,645,649,122
	88	NA	NA	NA	NA	NA	NA	47,861,093	3,593,521	4,662,390	NA	NA

Note Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R Other Off-site Transfers are transfers reported without valid waste management codes Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).





Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
584-84-9	Toluene-2,4-diisocyanate	96	3,247	4,086	0	0	192	7,525	3,586	11,111
		95	3,666	4,139	0	0	0	7,805	611	8,416
		94	9,705	25,736	0	0	0	35,441	3,523	38,964
		88	46,634	118,428	0	0	1,040	166,102	36,178	202,280
91-08-7	Toluene-2,6-diisocyanate	96	6,262	7,404	0	0	48	13,714	897	14,611
		95	984	2,060	0	0	0	3,044	153	3,197
		94	3,019	5,484	0	0	0	8,503	935	9,438
		88	153,253	338,939	0	0	510	492,702	9,444	502,146
95-53-4	o-Toluidine	96	8,997	8,584	260	17,450	10	35,301	1,401	36,702
		95	9,597	3,229	256	22,140	12	35,234	55	35,289
		94	9,823	3,765	534	30,300	6	44,428	302	44,730
		88	19,196	27,726	1,902	250	5,024	54,098	670	54,768
52-68-6 *	Trichlorfon	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	5	2	9	0	0	16	19	35
		88	250	3	0	0	0	253	487	740
120-82-1	1,2,4-Trichlorobenzene	96	32,283	124,980	433	750	0	158,446	4,487	162,933
		95	31,221	137,269	259	12,500	0	181,249	41,648	222,897
		94	30,090	137,190	970	15,200	830	184,280	52,908	237,188
		88	438,009	1,094,904	31,628	7,408	3,073	1,575,022	164,144	1,739,166
71-55-6	1,1,1-Trichloroethane	96	4,339,326	4,428,210	844	1,354	26,303	8,796,037	34,031	8,830,068
		95	11,002,844	12,088,982	1,118	126	38,470	23,131,540	124,363	23,255,903
		94	20,302,319	18,436,204	2,283	102	2,350	38,743,258	186,024	38,929,282
		88	93,139,461	87,702,388	95,624	1,000	204,923	181,143,396	5,947,875	187,091,271
79-00-5	1,1,2-Trichloroethane	96	33,142	305,908	516	0	16	339,582	85	339,667
		95	38,919	241,428	870	0	0	281,217	84	281,301
		94	41,179	268,933	914	0	0	311,026	166	311,192
		88	618,608	1,122,834	5,303	0	89	1,746,834	19,810	1,766,644
79-01-6	Trichloroethylene	96	10,665,331	10,606,835	541	1,291	23,140	21,297,138	76,327	21,373,465
		95	12,375,423	13,667,466	1,477	550	3,577	26,048,493	57,670	26,106,163
		94	14,951,392	15,698,688	1,671	288	4,417	30,656,456	95,090	30,751,546
		88	26,168,376	29,775,360	13,801	390	21,186	55,979,113	1,466,469	57,445,582
95-95-4	2,4,5-Trichlorophenol	96	No reports received							
		95	No reports received							
		94	No reports received							
		88	1	90	0	0	0	91	20	111
88-06-2	2,4,6-Trichlorophenol	96	136	155	28	0	0	319	0	319
		95	135	26	210	0	0	371	0	371
		94	116	83	65	0	0	264	0	264
		88	0	250	50	12,000	0	12,300	10	12,310
1582-09-8 *	Trifluralin	96	11,153	4,453	87	0	310	16,003	51,678	67,681
		95	13,318	3,826	92	0	8,250	25,486	24,490	49,976
		94	15,715	3,253	6	0	250	19,224	23,116	42,340
		88	2,020	1,257	601	0	0	3,878	40,557	44,435

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production-related Waste Pounds
Toluene-2,4-dio-cyanate	96	547	0	1,107	1,654	2,656	24,143	12,689	0	0	39,488	46,410
	95	427	37,664	3,311	41,402	1,400	23,160	11,636	0	0	36,196	84,238
	94	584	58,686	3,733	63,003	59,100	26,282	30,181	0	0	115,563	214,052
	88	NA	NA	NA	NA	NA	NA	193,439	500	3	NA	NA
Toluene-2,6-dio-cyanate	96	137	0	150	287	7,081	3,065	11,151	0	0	21,297	42,840
	95	107	9,416	652	10,175	0	3,705	1,546	0	0	5,251	22,933
	94	99	14,672	833	15,604	8,922	6,232	1,489	0	0	16,643	52,589
	88	NA	NA	NA	NA	NA	NA	45,287	250	0	NA	NA
o-Toluidine	96	58	231,376	144,487	375,921	0	79,475	74,198	22,698	0	176,371	619,345
	95	49	95,623	94,846	190,518	0	139,297	107,218	20,406	0	266,921	492,577
	94	49	362,900	154,844	517,793	0	110,648	179,767	131,476	0	421,891	984,266
	88	NA	NA	NA	NA	NA	NA	31,500	15,172	0	NA	NA
Trichlorfon	96	0	0	0	0	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	0	0	0	0	0
	94	70	0	211	281	0	0	174	0	0	174	481
	88	NA	NA	NA	NA	NA	NA	1,079	215	0	NA	NA
1,2,4-Trichloro-benzene	96	1,250,136	44,674	598,429	1,893,239	4,335	68,544	229,460	21,618	0	323,957	2,374,399
	95	40,745	2,400	1,137,925	1,181,070	10,541	107,929	345,503	82,831	0	546,804	1,876,411
	94	36,737	28,219	734,646	799,602	10,715	42,171	460,393	101,302	0	614,581	1,596,193
	88	NA	NA	NA	NA	NA	NA	734,243	262,676	0	NA	NA
1,1,1-Trichloro-ethane	96	39,529,212	860,823	1,184,611	41,574,646	1,441,519	338,734	1,023,362	10,318	0	2,813,933	52,924,903
	95	60,014,479	3,487,698	1,108,250	64,610,427	3,725,741	1,017,815	1,270,732	3,922	0	6,018,210	93,609,675
	94	71,998,974	4,231,763	1,045,943	77,276,680	7,026,161	1,849,346	2,322,122	6,454	72,131	11,276,214	126,983,394
	88	NA	NA	NA	NA	NA	NA	12,158,277	305,358	1,310,826	NA	NA
1,1,2-Trichloro-ethane	96	23,529,000	16,834,508	20,388,250	60,751,758	13,086,925	305,329	2,823,046	745	0	16,216,045	77,283,995
	95	18,699,000	12,061,000	24,559,416	55,319,416	11,918,217	200,626	3,251,456	9,000	0	15,379,299	70,877,737
	94	14,275,000	10,640,000	25,716,768	50,631,768	11,159,898	135,425	4,706,326	3,100	0	16,004,749	66,990,296
	88	NA	NA	NA	NA	NA	NA	239,032	750	1,000	NA	NA
Trichloroethylene	96	118,520,604	2,050,829	5,358,265	125,929,698	6,669,733	761,582	1,606,178	86,392	0	9,123,885	156,902,484
	95	154,222,220	2,514,155	5,218,927	161,955,302	8,570,263	1,166,015	1,042,803	15,073	0	10,794,154	199,585,656
	94	248,180,707	3,549,858	5,990,328	257,720,893	8,353,927	1,206,853	2,392,033	50,325	363,668	12,366,806	300,844,953
	88	NA	NA	NA	NA	NA	NA	4,693,074	85,652	360,514	NA	NA
2,4,5-Trichloro-phenol	96	No reports received										
	95	No reports received										
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
2,4,6-Trichloro-phenol	96	0	0	1,020,923	1,020,923	0	0	0	0	0	0	1,021,242
	95	0	0	1,294,115	1,294,115	0	0	0	0	0	0	1,294,486
	94	0	0	1,060,598	1,060,598	0	0	0	0	0	0	1,060,862
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Trifluralin	96	71,149	0	13,000	84,149	0	0	111,790	5	0	111,795	286,572
	95	2,107	0	99,980	102,087	0	5	82,914	5	500	83,424	233,348
	94	1,220	0	100,295	101,515	0	0	11,252	250	0	11,502	144,073
	88	NA	NA	NA	NA	NA	NA	149,989	371	0	NA	NA

**Note:** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities).



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

		On-site Releases							Off-site Releases	Total
CAS Number	Chemical	Year	Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	On- and Off-site Releases Pounds
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
95-63-6	1,2,4-Trimethyl-benzene	96	2,752,443	4,667,587	9,570	2,697	29,947	7,462,244	135,485	7,597,729
		95	2,556,977	4,990,181	8,432	1,042	43,916	7,600,548	41,005	7,641,553
		94	2,628,405	5,309,194	9,171	187	14,957	7,961,914	58,889	8,020,803
		88	2,037,740	2,227,462	10,088	7,964	61,583	4,344,837	200,616	4,545,453
51-79-6	Urethane	96	496	12,042	0	0	0	12,538	3,675	16,213
		95	124	0	0	0	0	124	3,750	3,874
		94	11,050	0	0	0	0	11,050	4,274	15,324
		88	140,500	4,623	0	0	0	145,123	1,350	146,473
7440-62-2	Vanadium (fume or dust)	96	452	1,249	4	0	16	1,721	38,641	40,362
		95	1,397	3,952	5	0	31,222	36,576	17,463	54,039
		94	902	5,421	3,000	0	31,700	41,023	7,938	48,961
		88	3,145	14,033	4,704	0	87,296	109,178	91,559	200,737
108-05-4	Vinyl acetate	96	829,617	3,010,281	2,393	300,768	2,834	4,145,893	27,065	4,172,958
		95	1,074,152	3,030,400	8,269	783,829	1,717	4,898,367	41,783	4,940,150
		94	1,474,604	2,920,935	1,386	648,667	1,775	5,047,367	111,072	5,158,439
		88	1,470,618	4,616,879	10,021	2,109,851	18,889	8,226,258	21,811	8,248,069
593-60-2	Vinyl bromide	96	240	5,600	0	0	0	5,840	0	5,840
		95	43,460	11,470	0	0	0	54,930	0	54,930
		94	220	2,400	0	0	0	2,620	0	2,620
		88	4,000	950	400	0	0	5,350	0	5,350
75-01-4	Vinyl chloride	96	272,926	746,882	356	333	1	1,020,498	19,614	1,040,112
		95	322,618	722,047	525	33	1	1,045,224	15,645	1,060,869
		94	340,498	725,846	377	1	6	1,066,728	20,740	1,087,468
		88	421,882	1,017,307	2,051	53	4,409	1,445,702	4,555	1,450,257
75-35-4	Vinylidene chloride	96	82,672	94,525	216	0	1	177,414	33	177,447
		95	52,166	125,343	392	0	0	177,901	260	178,161
		94	35,324	130,372	215	0	0	165,911	2,031	167,942
		88	104,552	191,801	3,462	170	429	300,414	44,281	344,695
108-38-3	m-Xylene	96	450,550	525,195	635	45,239	93,377	1,114,996	3,275	1,118,271
		95	379,028	364,459	892	569	13,318	758,266	8,650	766,916
		94	691,696	289,548	893	250	2,708	985,095	150,720	1,135,815
		88	1,480,104	982,939	2,566	0	18,045	2,483,654	107,746	2,591,400
95-47-6	o-Xylene	96	680,963	550,970	2,503	4,760	88,876	1,328,072	4,611	1,332,683
		95	765,610	564,177	869	569	485	1,331,710	1,152	1,332,862
		94	910,532	492,003	1,148	250	2,959	1,406,892	7,030	1,413,922
		88	1,613,292	628,522	2,786	250	22,461	2,267,311	52,881	2,320,192
106-42-3	p-Xylene	96	839,254	1,997,026	477	1,010	88,804	2,926,571	1,114	2,927,685
		95	1,104,441	1,819,471	532	569	29,401	2,954,414	1,261	2,955,675
		94	808,402	2,612,682	9,690	250	587	3,431,611	3,295	3,434,906
		88	1,653,660	4,339,083	3,200	0	49,226	6,045,169	31,108	6,076,277
1330-20-7	* Xylene (mixed isomers)	96	20,296,828	62,388,723	39,902	132,971	58,951	82,917,375	499,478	83,416,853
		95	23,070,078	73,905,928	33,805	93,396	101,457	97,204,664	573,629	97,778,293
		94	26,115,298	84,673,110	44,078	313,711	243,345	111,389,542	868,326	112,257,868
		88	35,175,598	123,800,493	204,480	144,728	558,257	159,883,556	6,455,161	166,338,717

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Management Pounds	Total Production- related Waste Pounds
1,2,4-Trimethyl benzene	96	11,081,130	5,247,136	153,658,796	169,987,062	1,052,594	3,371,314	281,757	331,065	0	5,036,730	182,627,439
	95	12,135,506	4,669,750	26,125,744	42,931,000	1,072,018	2,933,728	333,459	195,328	0	4,534,533	55,524,929
	94	16,832,171	5,241,054	10,670,867	32,744,092	1,125,700	2,342,592	269,521	145,264	0	3,883,077	44,406,087
	88	NA	NA	NA	NA	NA	NA	330,046	501,717	41,463	NA	NA
Urethane	96	0	0	0	0	0	0	175	0	0	175	15,642
	95	0	0	0	0	0	0	0	1,165	0	1,165	5,907
	94	0	0	0	0	0	0	0	6,939	0	6,939	22,015
	88	NA	NA	NA	NA	NA	NA	3,558	260	0	NA	NA
Vanadium (fume or dust)	96	233,249	282	2,205	235,736	3,236	0	1,705	200	0	5,141	279,958
	95	164,454	217	0	164,671	5,618	0	7	310	0	5,935	267,595
	94	135,004	0	0	135,004	7,336	0	33,476	0	0	40,812	224,029
	88	NA	NA	NA	NA	NA	NA	1,858	0	0	NA	NA
Vinyl acetate	96	651,835	13,459,144	19,970,650	34,081,629	47,199	11,097,329	1,949,118	144,887	0	13,238,533	52,673,663
	95	311,385	15,379,353	19,205,133	34,895,871	533,326	6,534,074	8,913,415	274,652	0	16,255,467	56,361,995
	94	6,488,533	14,222,230	13,844,895	34,555,658	253,854	10,392,381	4,378,761	218,412	0	15,243,408	55,389,278
	88	NA	NA	NA	NA	NA	NA	354,698	2,319,733	20,015	NA	NA
Vinyl bromide	96	0	0	39	39	0	0	0	0	0	0	5,839
	95	0	0	36	36	0	0	0	0	0	0	54,946
	94	0	0	13	13	0	0	0	0	0	0	2,613
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Vinyl chloride	96	144,257,010	34,902,139	34,549,160	213,708,309	108,475	17,000	57,390	734	0	183,599	214,928,242
	95	118,321,038	23,368,507	40,034,145	181,723,690	134,144	20,853	58,973	308	0	214,278	182,942,803
	94	301,099,066	12,684,596	39,918,964	353,702,626	68,273	14,301	158,536	326	0	241,436	354,986,436
	88	NA	NA	NA	NA	NA	NA	669,044	17,104	2,188	NA	NA
Vinylidene chloride	96	1,540,000	81,000	5,944,435	7,565,435	26	45,180	36,107	90	0	81,403	7,919,564
	95	1,438,000	190,253	6,614,873	8,243,126	55	102,442	86,499	301	0	189,297	8,592,258
	94	400,000	16,000	9,393,764	9,809,764	140	250	223,917	287	0	224,594	10,200,106
	88	NA	NA	NA	NA	NA	NA	360,958	3,303	0	NA	NA
m-Xylene	96	1,413,683	130,969	159,029,986	160,574,638	44,221	56,722	101,754	7,046	8,100	217,843	161,921,893
	95	1,917,515	4,141,480	3,100,716	9,159,711	27,725	233,672	130,247	13,587	0	405,231	10,315,397
	94	609,436	4,422,579	771,485	5,803,500	30,875	45,869	8,847	3,331	0	88,922	7,024,513
	88	NA	NA	NA	NA	NA	NA	113,311	19,708	115	NA	NA
o-Xylene	96	90,138	14,825,694	96,322,096	111,237,928	192,724	781,724	509,146	424,692	0	1,908,286	114,697,510
	95	317,695	15,563,897	2,213,038	18,094,630	60,208	1,848,523	465,724	381,025	0	2,755,480	22,254,843
	94	423,414	37,094,809	1,394,758	38,912,981	51,482	2,555,757	265,893	61,941	0	2,935,073	43,345,283
	88	NA	NA	NA	NA	NA	NA	95,764	44,023	12,864	NA	NA
p-Xylene	96	195,330	521,427	73,929,099	74,645,856	4,462	21,639	115,168	2,325	0	143,594	77,696,140
	95	468,689	2,168,729	645,579	3,282,997	8,845	4,048	3,831	5,106	0	21,830	6,249,139
	94	763,332	1,670,795	379,950	2,814,077	2,105	19,608	3,669	1,457	0	26,839	6,252,518
	88	NA	NA	NA	NA	NA	NA	48,320	752	0	NA	NA
Xylene (mixed isomers)	96	110,754,065	146,026,399	81,266,575	338,047,039	43,676,875	68,512,589	7,986,520	487,905	8,590	120,672,479	561,418,451
	95	134,886,919	141,797,405	81,906,637	358,590,961	43,915,996	70,744,984	15,005,250	532,294	7,055	130,205,579	580,933,456
	94	124,458,050	175,633,688	60,730,962	360,822,700	40,062,229	76,344,656	8,707,862	645,862	6,755	125,767,364	598,733,979
	88	NA	NA	NA	NA	NA	NA	27,191,660	4,160,974	3,852,727	NA	NA

**Note** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



Table 3-9. TRI On-site and Off-site Releases, by Chemical, 1988 and 1994-1996, Continued

CAS Number	Chemical	Year	On-site Releases						Off-site Releases	Total On- and Off-site Releases Pounds
			Air		Surface Water Discharges Pounds	Underground Injection Pounds	On-site Land Releases Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
			Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds						
87-62-7	2,6-Xylydine	96	0	53	0	0	0	53	0	53
		95	54	221	0	0	0	275	0	275
		94	59	122	66	0	0	247	0	247
		88	0	337	1,537	0	0	1,874	0	1,874
7440-66-6	* Zinc (fume or dust)	96	633,707	1,001,365	12,062	0	6,799,886	8,447,020	2,477,827	10,924,847
		95	744,226	1,272,522	53,260	0	6,403,941	8,473,949	3,528,326	12,002,275
		94	758,961	886,234	28,123	5	8,462,321	10,135,644	2,273,314	12,408,958
		88	1,944,168	1,511,769	849,544	140,010	25,617,365	30,062,856	29,642,266	59,705,122
—	Zinc compounds	96	2,327,688	3,506,502	1,065,164	129,498	94,842,199	101,871,051	105,122,823	206,993,874
		95	1,884,468	2,740,761	1,057,008	212,844	85,479,436	91,374,517	97,453,223	188,827,740
		94	1,839,780	3,047,802	1,318,328	196,748	78,725,112	85,127,770	90,128,232	175,256,002
		88	3,245,883	4,017,072	1,200,859	109,555	113,363,711	121,937,080	67,269,507	189,206,587
12122-67-7	Zineb	96	0	0	0	0	0	0	0	0
		95	0	0	0	0	0	0	0	0
		94	No reports received							
		88	250	1,000	0	0	0	1,250	2,600	3,850
—	Mixtures and other trade name products	96	17,641	14,424	1,030	0	27,618	60,713	16,780	77,493
		95	126,289	207,905	3,171	0	0	337,365	4,400	341,765
		94	194,941	43,069	23,120	0	3,442	264,572	11,498	276,070
		88	628,029	2,822,591	59,210	0	16,099	3,525,929	10,661,927	14,187,856
—	Trade secrets	96	500	255	0	0	0	755	0	755
		95	250	5	0	0	0	255	0	255
		94	0	470	0	0	0	470	0	470
		88	0	0	0	0	0	0	0	0
Total		96	276,183,228	819,229,878	45,144,135	118,222,387	299,979,550	1,558,759,178	265,005,866	1,823,765,044
		95	304,738,454	886,521,836	35,918,865	139,908,494	272,424,588	1,639,512,237	255,777,935	1,895,290,172
		94	351,433,000	928,852,817	39,794,843	114,135,765	289,341,251	1,723,557,676	259,228,230	1,982,785,906
		88	680,923,993	1,499,933,328	164,551,386	161,969,132	459,114,111	2,966,496,950	386,461,584	3,352,958,534

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994 and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 and Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases (for RCRA Subtitle C landfills) began in 1996 reporting year

\*Pesticide



**Table 3-9. TRI Other On-site Waste Management, Transfers Off-site for Further Waste Management, and Total Production-related Waste, 1988 and 1994-1996, Continued**

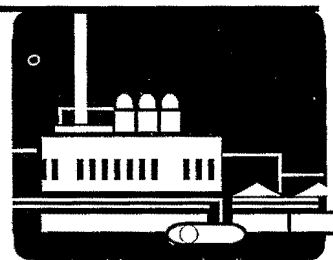
Chemical	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Manage- ment Pounds	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Waste Manage- ment Pounds	Total Production- related Waste Pounds
2,6-Xyldine	96	0	36,684	0	36,684	0	0	0	0	0	0	36,737
	95	0	8,000	303	8,303	0	0	22	236	0	258	8,786
	94	0	22,015	1,362	23,377	0	0	459	263	0	722	24,337
	88	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA
Zinc (fume or dust)	96	25,204,044	0	2,192,517	27,396,561	63,284,353	48,635	7,925,233	18,590	47,444	71,324,255	110,397,651
	95	27,846,197	0	1,696,402	29,542,599	78,693,641	29,564	6,446,275	34,920	0	85,204,400	124,898,533
	94	20,042,768	0	2,214,523	22,257,291	81,773,312	146,891	689,740	38,623	250	82,648,816	118,220,791
	88	NA	NA	NA	NA	NA	NA	7,667,102	835,961	4,776,287	NA	NA
Zinc compounds	96	84,991,928	102,429	3,458,463	88,552,820	235,687,595	323,618	35,124,148	410,791	23,997	271,570,149	563,263,361
	95	130,617,139	446,100	4,159,476	135,222,715	229,346,855	397,948	10,929,317	576,717	84,100	241,334,937	567,599,634
	94	163,633,079	58,249	3,685,691	167,377,019	250,149,063	411,395	10,346,123	503,802	1,755,480	263,165,863	585,129,661
	88	NA	NA	NA	NA	NA	NA	16,971,970	1,577,974	1,455,138	NA	NA
Zineb	96	0	0	0	0	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	0	0	0	0	0
	94	No reports received										
	88	NA	NA	NA	NA	NA	NA	250	0	0	NA	NA
Mixtures and other trade name products	96	0	0	34,000	34,000	538,881	1,000	0	11,900	2,618	554,399	685,593
	95	8,025	96,280,793	72,738,249	169,027,067	19,282	373,381	279,375	42,946	0	714,984	170,100,659
	94	313,923	259,823,536	27,855	260,165,314	16,656	981,824	74,132	2,149	1,450	1,076,211	261,493,601
	88	NA	NA	NA	NA	NA	NA	749,408	186,938	190,046	NA	NA
Trade secrets	96	0	0	0	0	0	0	750	2,379	0	3,129	2,630
	95	0	0	0	0	0	0	0	0	0	0	40
	94	1,600,000	0	166,452	1,766,452	597,825	750	0	0	0	598,575	2,365,127
	88	NA	NA	NA	NA	NA	NA	19,000	0	0	NA	NA
Total	96	6,209,509,900	2,585,785,910	5,246,425,791	14,041,721,601	2,094,268,207	446,487,845	248,020,028	141,995,045	3,078,759	2,933,849,884	18,891,598,534
	95	6,139,069,594	2,688,189,212	4,855,675,960	13,682,934,766	2,173,558,832	488,954,630	236,496,866	155,173,872	2,186,886	3,056,371,086	18,658,358,849
	94	6,518,368,024	3,138,177,326	4,566,261,474	14,222,806,824	2,200,760,073	459,576,125	221,230,371	159,934,847	5,094,462	3,046,595,878	19,232,528,369
	88	NA	NA	NA	NA	NA	NA	369,204,491	254,808,420	43,279,087	NA	NA

**Note:** Other On-site Waste Management from Section 8 and Transfers Off-site for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management codes. Production-related Waste from Section 8 of Form R (total excludes remedial and catastrophic quantities)



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## Chapter 4



# Industry Reporting to the Toxics Release Inventory: Overview

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This *1996 TRI Public Data Release* presents a more in-depth examination of industry reporting to TRI than the summary analyses offered in previous years. This overview chapter looks briefly at TRI data by industrial sector and at basic economic data for the sectors. The next five chapters take a closer look at five priority sectors: pulp and paper (SIC code 26), chemical manufacturing (SIC code 28), petroleum (SIC code 29), primary metals (SIC code 33), and electrical equipment (SIC code 36). A similar view of reporting by federal facilities follows in Chapter 10. (Box 4-1 lists the industry sectors by SIC code; Box 4-2 explains SIC codes and their use in TRI.)

As noted in Chapter 1, EPA plans to complete and release the remaining 15 industry chapters in the summer of 1998.

## TRI Data by Industry, 1996

In 1996, across all industries, 21,626 facilities submitted 71,381 forms to TRI, as shown in Table 4-1. (Facilities submit one Form R or the Form A certification statement for each chemical). The

21,098 forms submitted by the chemical manufacturing sector amounted to 29.6% of all 1996 TRI forms. This is three times as many forms as submitted by the second largest industry sector, fabricated metals, which filed 7,416 forms, or 10.4% of the total. Primary metals submitted 6,603 forms (9.3%). The fourth largest number of forms came from the multiple-codes group, those with more than one two-digit SIC code (see Box 4-2). Federal facilities reported on a total of 378 forms.

### On- and Off-site Releases

Reporting by the chemical industry (SIC code 28), which by definition primarily produces chemicals or manufactures products by processing chemicals, dominates most categories of TRI data. As shown in Table 4-2, 785.2 million pounds of on- and off-site releases were reported in chemical manufacturing for 1996. This represented 32.3% of all such releases. Primary metals (SIC code 33) reported the second largest amount, 564.5 million pounds, or 23.2% of the total, and producers of pulp, paper, and paper products (SIC code 26) were third, with 227.6 million pounds, or 9.4%. Ranking fourth was the multiple-codes category, with 120.8 million pounds, or 5.0%. Federal facilities reported a total





Box 4-1. Standard Industrial Classification (SIC) Codes

**Standard Industrial Classification (SIC) Codes**

- 20 Food and kindred products**  
Manufacture or processing of foods and beverages for human consumption, and related products, such as manufactured ice, chewing gum, vegetable and animal fats and oils, and prepared feeds for animals and fowls.
- 21 Tobacco products**  
Manufacture of cigarettes, cigars, smoking and chewing tobacco, snuff, and reconstituted tobacco. Stemming and redrying tobacco. Manufacture of non-tobacco cigarettes.
- 22 Textile mill products**  
Preparation of fiber and subsequent manufacture of yarn, thread, braids, twine, and cordage. Manufacture of broadwoven fabrics, narrow woven fabrics, knit fabrics, and carpets and rugs from yarn. Dyeing and finishing of fiber, yarn, fabrics, and knit apparel. Coating, waterproofing or otherwise treating fabrics. Integrated manufacture of knit apparel and other finished articles from yarn. Manufacture of felt goods, lace goods, nonwoven fabrics, and miscellaneous textiles.
- 23 Apparel and other finished products made from fabrics and similar materials**  
Production of clothing. Fabrication of products by cutting and sewing purchased woven or knit textile fabrics and related materials, such as leather, rubberized fabrics, plastics, and furs. Manufacture of clothing by cutting and joining (e.g., by adhesives) material such as paper and nonwoven textiles.
- 24 Lumber and wood products, except furniture**  
Cutting timber and pulpwood. Also, merchant sawmills, lath mills, shingle mills, cooperage stock mills, planing mills, and plywood mills and veneer mills engaged in producing lumber and wood basic materials. Manufacture of finished articles made entirely or mainly of wood or related materials.
- 25 Furniture and fixtures**  
Manufacture of household, office, public building, and restaurant furniture, and office and store fixtures.
- 26 Paper and allied products**  
Manufacture of pulps from wood and other cellulose fibers and from rags. Manufacture of paper and paperboard. Manufacture of paper and paperboard into converted products, such as paper coated off the paper machine, paper bags, paper boxes, and envelopes. Manufacture of bags from plastics film and sheet.
- 27 Printing, publishing, and allied industries**  
Printing by one or more common processes, such as letterpress, lithography (including offset), gravure, or screen. Bookbinding, platemaking, and other services performed for the printing trade. Publishing newspapers, books, and periodicals (whether or not the establishment also prints them).
- 28 Chemicals and allied products**  
Production of basic chemicals. Manufacture of products by predominantly chemical processes. (Three general classes of products: 1) basic chemicals, such as acids, alkalis, salts, and organic chemicals; 2) chemical products to be used in further manufacture, such as synthetic fibers, plastics materials, dry colors, and pigments; 3) finished chemical products to be used for ultimate consumption, such as drugs, cosmetics, and soaps, or to be used as materials or supplies in other industries, such as paints, fertilizers, and explosives.)
- 29 Petroleum refining and related industries**  
Producing gasoline, kerosene, distillate fuel oils, residual fuel oils, and lubricants, through fractionation or straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking, or other processes. (Establishments also produce aliphatic and aromatic chemicals as byproducts.)
- 30 Rubber and miscellaneous plastics products**  
Manufacture of products, not elsewhere classified, from plastics resins and from natural, synthetic, or reclaimed rubber, gutta percha, balata, or gutta siak. Includes manufacture of tires.



## Box 4-1. Standard Industrial Classification (SIC) Codes, Continued

- 31 Leather and leather products**  
Tanning, currying, and finishing hides and skins, Converting leather Manufacture of finished leather and artificial leather products and some similar products made of other materials.
- 32 Stone, clay, glass, and concrete products**  
Manufacture of flat glass and other glass products, cement, structural clay products, pottery, concrete and gypsum products, cut stone, abrasive and asbestos products, and other products from materials taken principally from the earth in the form of stone, clay, and sand. (May include mining and quarrying activities operated by manufacturing establishments in this group.)
- 33 Primary metal industries**  
Smelting and refining ferrous and nonferrous metals from ore, pig, or scrap Rolling, drawing, and alloying metals. Manufacture of castings and other basic metal products. Manufacture of nails, spikes, and insulated wire and cable. Includes production of coke.
- 34 Fabricated metal products, except machinery and transportation equipment**  
Fabrication of ferrous and nonferrous metal products, such as metal cans, tinware, handtools, cutlery, general hardware, non-electric heating apparatus, fabricated structural metal products, metal forgings, metal stampings, ordnance (except vehicles and guided missiles), and a variety of metal and wire products, not elsewhere classified.
- 35 Industrial and commercial machinery and computer equipment**  
Manufacture of industrial and commercial machinery and equipment and computers. Manufacture of engines and turbines; farm and garden machinery; construction, mining, and oil field machinery; elevators and conveying equipment; hoists, cranes, monorails, and industrial trucks and tractors; metalworking machinery; special industry machinery; general industrial machinery; computer and peripheral equipment and office machinery; and refrigeration and service industry machinery.
- 36 Electronic and other electrical equipment and components, except computer equipment**  
Manufacture of machinery, apparatus, and supplies for the generation, storage, transmission, transformation, and utilization of electrical energy. Manufacture of electricity distribution equipment, electrical industrial apparatus, household appliances, electrical lighting and wiring equipment, radio and television receiving equipment, communications equipment, electronic components and accessories, and other electrical equipment and supplies.
- 37 Transportation equipment**  
Manufacture of equipment for transportation of passengers and cargo by land, air, and water. Includes motor vehicles, aircraft, guided missiles and space vehicles, ships, boats, railroad equipment, and miscellaneous transportation equipment, such as motorcycles, bicycles, and snowmobiles.
- 38 Measuring, analyzing and controlling instruments, photographic, medical, and optical goods; watches and clocks**  
Manufacture of instruments (including professional and scientific) for measuring, testing, analyzing, and controlling, and their associated sensors and accessories; optical instruments and lenses, surveying and drafting instruments; hydrological, hydrographic, meteorological, and geophysical equipment; search, detection, navigation, and guidance systems and equipment; surgical, medical, and dental instruments, equipment, and supplies; ophthalmic goods; photographic equipment and supplies; watches and clocks.
- 39 Miscellaneous manufacturing industries**  
Manufacture of products not classified in any other major manufacturing group. Includes jewelry, silverware, and plated ware; musical instruments; dolls, toys, games, and sporting and athletic goods; pens, pencils, and artists' materials; buttons, costume novelties, and miscellaneous notions; brooms and brushes; caskets; and other miscellaneous products."

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



Box 4-2. An Explanation of SIC Codes and TRI

### An Explanation of SIC Codes and TRI

SIC codes are the Standard Industrial Classification (SIC) codes used throughout the federal government to classify economic activity by industry. Facilities in the manufacturing sectors, that is, SIC codes 20 through 39, are required to report to TRI. (As explained in Chapter 1, additional industries will begin reporting with the 1998 reporting year.) Box 4-1 lists the two-digit SIC codes in manufacturing and the primary activities of the industry sectors they designate.

On TRI Form Rs and certification statements, Form As, 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). Tables in this chapter present data aggregated at the two-digit level.

TRI facilities may report up to six four-digit SIC codes that describe their operations. They submit one Form R or Form A certification statement for each chemical they are reporting. If all the processes or operations that are associated with a facility's releases or other waste management of a TRI chemical can be described by one SIC code, then only one SIC code is reported on the form. If several economic activities, designated by different SIC codes, describe the specific operations at a facility that are associated with releases or other waste management of a TRI chemical, then the facility will report those SIC codes (up to six) on the form it submits for that chemical.

Industrial facilities often conduct inter-related operations. They may, for example, manufacture distinct products using common or related feedstocks. Such products may be classified in similar but separate categories in the SIC system. Thus, many forms submitted to TRI contain more than one industrial classification. When TRI data are analyzed by industry—that is, by SIC code—forms that report more than one SIC code must be categorized separately because they do not fall into the individual industry groups. This affects analyses at the four-digit level, as presented in Chapters 5 through 9, and it affects analyses when data are aggregated at the two-digit level, as in this chapter.

**Four-digit Multiple SIC Codes:** Forms that report multiple SIC codes within the same two-digit SIC code are categorized as “multiple codes” in the analyses of TRI data in Chapters 5 through 9. A facility that produces the pulp used in making paper and also produces paper itself, for example, will report both SIC code 2611, representing pulp mills, and SIC code 2621, representing paper mills, on the TRI form. In the analyses in Chapter 5 of TRI reporting in the pulp and paper sector (SIC code 26), data from these forms are included in the “multiple-codes” category. In some industrial sectors, such as chemical manufacturing (SIC code 28, analyzed in Chapter 6), the majority of TRI reporting occurs on forms with multiple SIC codes at the four-digit level.

**Two-digit Multiple SIC Codes:** In this chapter, the “multiple codes” category represents forms that report in more than one *two-digit* SIC code. For example, a facility may refine petroleum (SIC code 29) and then use that feedstock in the manufacture of chemicals (SIC code 28); it will report SIC codes in both of these sectors on its TRI forms (such as SIC codes 2911, petroleum refining, and 2869, industrial organic chemicals). Data from these forms are classified in the “multiple codes” category in this chapter, where the tables analyze the TRI data at the two-digit level. In this chapter, TRI forms from the pulp and paper mill would be included in SIC code 26, because both of its four-digit SIC codes fall within SIC code 26.

On forms with more than one SIC code, any SIC code that is not within manufacturing (that is, not within the SIC code range 20 to 39) is ignored when assigning a form to an industry category. For example, a form with the SIC code 2642 (manufacture of envelopes) and SIC code 5112 (wholesale trade – stationery and office supplies) would be included in SIC code 2642 in Chapter 5 and in SIC code 26 in this chapter.

**Federal Facilities:** Federal facilities report the SIC codes that describe their activity; these may or may not fall within the manufacturing categories, SIC codes 20 to 39, that have reported to TRI since its inception. (As explained in Chapter 1, additional industries will begin reporting with the 1998 reporting year.) Tables in this chapter incorporate amounts submitted by federal facilities in the SIC codes they reported, just as is done for private sector facilities. In each table, a separate summary of federal facilities' data is presented as well, following the totals.



Table 4-1. TRI Facilities and Forms, by Industry, 1996

SIC Code	Industry	Total Facilities Number	Total Forms Number	Form Rs Number	Form As Number
20	Food	1,993	3,541	2,545	996
21	Tobacco	29	61	61	0
22	Textiles	307	657	622	35
23	Apparel	25	51	49	2
24	Lumber	765	1,926	1,446	480
25	Furniture	453	1,250	1,224	26
26	Paper	491	2,363	2,250	113
27	Printing	241	483	475	8
28	Chemicals	3,855	21,098	18,288	2,810
29	Petroleum	401	3,231	2,990	241
30	Plastics	1,824	3,747	3,404	343
31	Leather	89	223	209	14
32	Stone/Clay/Glass	640	1,716	1,517	199
33	Primary Metals	1,902	6,603	6,138	465
34	Fabricated Metals	2,883	7,416	6,895	521
35	Machinery	1,087	2,791	2,619	172
36	Electrical Equip	1,233	3,121	3,031	90
37	Transportation Equip	1,248	4,331	4,117	214
38	Measure /Photo	291	707	661	46
39	Miscellaneous	362	766	710	56
	Multiple Codes 20-39	1,271	4,520	4,195	325
	No Codes 20-39	236	779	701	78
	Total	21,626	71,381	64,147	7,234
	Federal Facilities	133	378	350	28

Note Facilities/forms that reported more than one 2-digit SIC code within the range 20 to 39 are assigned to the "multiple" category. Facilities/forms with no 2-digit SIC code within the range of 20 to 39 are assigned to the "no codes 20-39" category.

Table 4-2. TRI On-site and Off-site Releases, by Industry, 1996

SIC Code	Industry	On-site Releases								Off-site Releases	Total On- and Off-site Releases
		Air		Surface Water Discharges	Underground Injection		On-site Releases to Land			Transfers Off-site to Disposal	
		Fugitive or Nonpoint Air Emissions Pounds	Stack or Point Air Emissions Pounds		Class I Wells	Class II-V Wells	RCRA Subtitle C Landfills	Other On-site Land Releases	Total On-site Releases Pounds		
20	Food	21,810,437	47,255,169	8,983,229	1,010	29,548	28,506	4,438,103	82,546,002	757,393	83,303,395
21	Tobacco	61,394	3,453,344	179,701	0	0	0	0	3,694,439	458,133	4,152,572
22	Textiles	3,217,057	13,125,828	348,877	0	0	0	173,620	16,865,382	462,148	17,327,530
23	Apparel	130,287	1,663,532	7,320	0	0	0	534	1,801,673	63,177	1,864,850
24	Lumber	4,636,576	23,856,213	76,874	0	0	6,039	9,807	28,585,509	7,657,171	36,242,680
25	Furniture	4,813,779	30,910,342	43	0	0	0	26,641	35,750,805	125,858	35,876,663
26	Paper	18,227,534	185,722,017	16,008,715	0	0	602,265	4,160,489	224,721,020	2,842,352	227,563,372
27	Printing	13,782,537	14,579,092	1,670	0	0	0	13,650	28,376,949	89,070	28,466,019
28	Chemicals	93,363,107	299,070,993	90,420,803	200,317,453	197,441	2,689,697	68,276,606	754,336,100	30,842,063	785,178,163
29	Petroleum	27,968,469	24,132,610	10,567,225	2,310,233	8,664	5,685	1,236,941	66,229,827	2,657,431	68,887,258
30	Plastics	27,540,757	77,774,998	27,815	750	0	48,918	398,367	105,791,605	10,617,686	116,409,291
31	Leather	747,962	1,906,965	53,526	0	0	0	6,611	2,715,064	1,526,825	4,241,889
32	Stone/Clay/Glass	1,870,677	28,158,910	45,443	500	500	105,977	2,416,616	32,598,623	6,141,803	38,740,426
33	Primary Metals	38,722,723	105,958,141	31,988,843	930,779	0	22,192,029	193,591,686	393,384,201	171,150,982	564,535,183
34	Fabricated Metals	23,613,262	45,578,614	351,080	563	7	204,331	572,609	70,320,466	19,933,901	90,254,367
35	Machinery	6,665,652	12,373,145	34,089	0	0	7,144	121,101	19,201,131	2,859,589	22,060,720
36	Electrical Equip	6,351,489	17,401,668	1,462,615	22	5	210,430	225,890	25,652,119	16,113,258	41,765,377
37	Transportation Equip	28,283,393	74,410,242	224,148	0	0	86,685	618,616	103,623,084	7,729,685	111,352,769
38	Measure /Photo	2,698,043	10,503,368	1,297,561	0	0	0	2,531	14,501,503	848,568	15,350,071
39	Miscellaneous	1,929,982	7,478,283	2,364	0	0	11,957	8,189	9,430,775	839,283	10,270,058
	Multiple Codes 20-39	26,982,381	66,599,536	10,964,363	11,400	10	180,840	5,680,956	110,419,486	10,359,532	120,779,018
	No Codes 20-39	1,854,254	4,905,200	241,905	0	520,224	74,466	628,674	8,224,723	660,188	8,884,911
	Total	355,271,752	1,096,818,210	173,288,209	203,572,710	756,399	26,454,969	282,608,237	2,138,770,486	294,736,096	2,433,506,582
	Federal Facilities	2,463,277	1,831,564	384,602	0	505,541	23,516	681,351	5,889,851	612,797	6,502,648

Note On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category. Forms with no 2-digit SIC code within the range of 20 to 39 are assigned to the "no codes 20-39" category.



of 6.5 million pounds of on- and off-site releases, representing 0.3% of the total.

In 1996, chemical manufacturing reported the largest totals in air emissions, surface water discharges, and on-site underground injection. Primary metals facilities reported the largest amounts of on-site land releases and off-site releases (transfers off-site to disposal). Figure 4-1 displays on- and off-site releases for the industries with the largest total releases.

## Other On-site Waste Management

Of the 17.74 billion pounds reported in other on-site waste management in 1996, the chemical industry accounted for 8.33 billion pounds, or 47.0% of the total (see Table 4-3). This industry also led all three types of on-site waste management, reporting 45% or more of on-site recycling (3.73 billion pounds reported by chemical manufacturers), energy recovery (1.35 billion pounds), and treatment (3.25 billion pounds). Federal facilities reported 21.8 million pounds of on-site waste management, or 0.1% of the total.

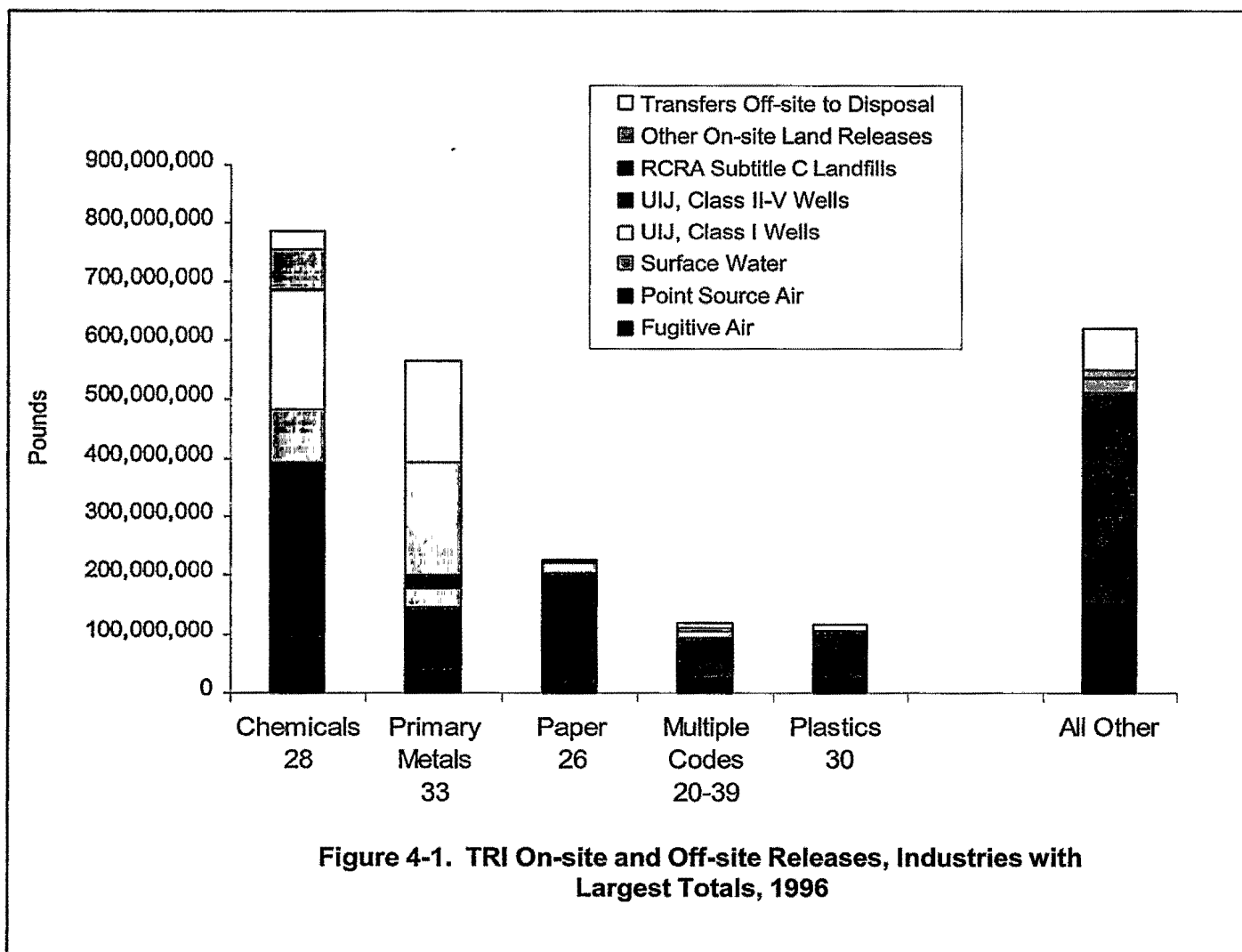


Figure 4-1. TRI On-site and Off-site Releases, Industries with Largest Totals, 1996

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category UIJ = underground injection



Table 4-3. TRI Other On-site Waste Management, by Industry, 1996

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
20	Food	216,405,632	411,710	75,715,014	292,532,356
21	Tobacco	9,753	0	1,329,064	1,338,817
22	Textiles	13,085,659	5,326,659	23,627,782	42,040,100
23	Apparel	190,976	600	1,049,762	1,241,338
24	Lumber	50,544,925	1,538,386	23,482,107	75,565,418
25	Furniture	2,841,917	37,467	1,181,030	4,060,414
26	Paper	104,481,896	184,352,318	1,022,099,101	1,310,933,315
27	Printing	168,501,410	203,536	61,721,672	230,426,618
28	Chemicals	3,731,246,814	1,348,429,666	3,254,527,247	8,334,203,727
29	Petroleum	153,400,536	603,601,392	1,305,533,526	2,062,535,454
30	Plastics	162,062,640	19,598,143	39,036,343	220,697,126
31	Leather	604,322	0	3,620,694	4,225,016
32	Stone/Clay/Glass	149,823,758	445,258,980	22,702,838	617,785,576
33	Primary Metals	2,092,485,352	49,768,460	625,844,126	2,768,097,938
34	Fabricated Metals	148,030,876	20,976,980	113,727,254	282,735,110
35	Machinery	49,613,047	130,702	9,438,553	59,182,302
36	Electrical Equip	148,298,966	11,424,647	78,313,464	238,037,077
37	Transportation Equip.	16,523,234	1,458,959	29,517,152	47,499,345
38	Measure /Photo	3,960,735	938,685	37,645,252	42,544,672
39	Miscellaneous	16,533,257	3,362,337	4,770,453	24,666,047
	Multiple Codes 20-39	609,928,425	40,337,718	388,721,568	1,038,987,711
	No Codes 20-39	4,021,012	24,582,100	16,257,919	44,861,031
	Total	7,842,595,142	2,761,739,445	7,139,861,921	17,744,196,508
	Federal Facilities	12,169,917	7,700	9,650,204	21,827,821

**Note** Other On-site Waste Management from Section 8 of Form R. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category. Forms with no 2-digit SIC code within the range of 20 to 39 are assigned to the "no codes 20-39" category.

For on-site recycling, primary metals reported the second largest amount, with 2.09 billion pounds, or 26.7% of the total. Petroleum production (SIC code 29) was second for on-site energy recovery, with 603.6 million pounds (21.9%), and for on-site treatment, with 1.31 billion pounds (18.3%).

Figure 4-2 shows on-site waste management for the industries with the largest such totals.

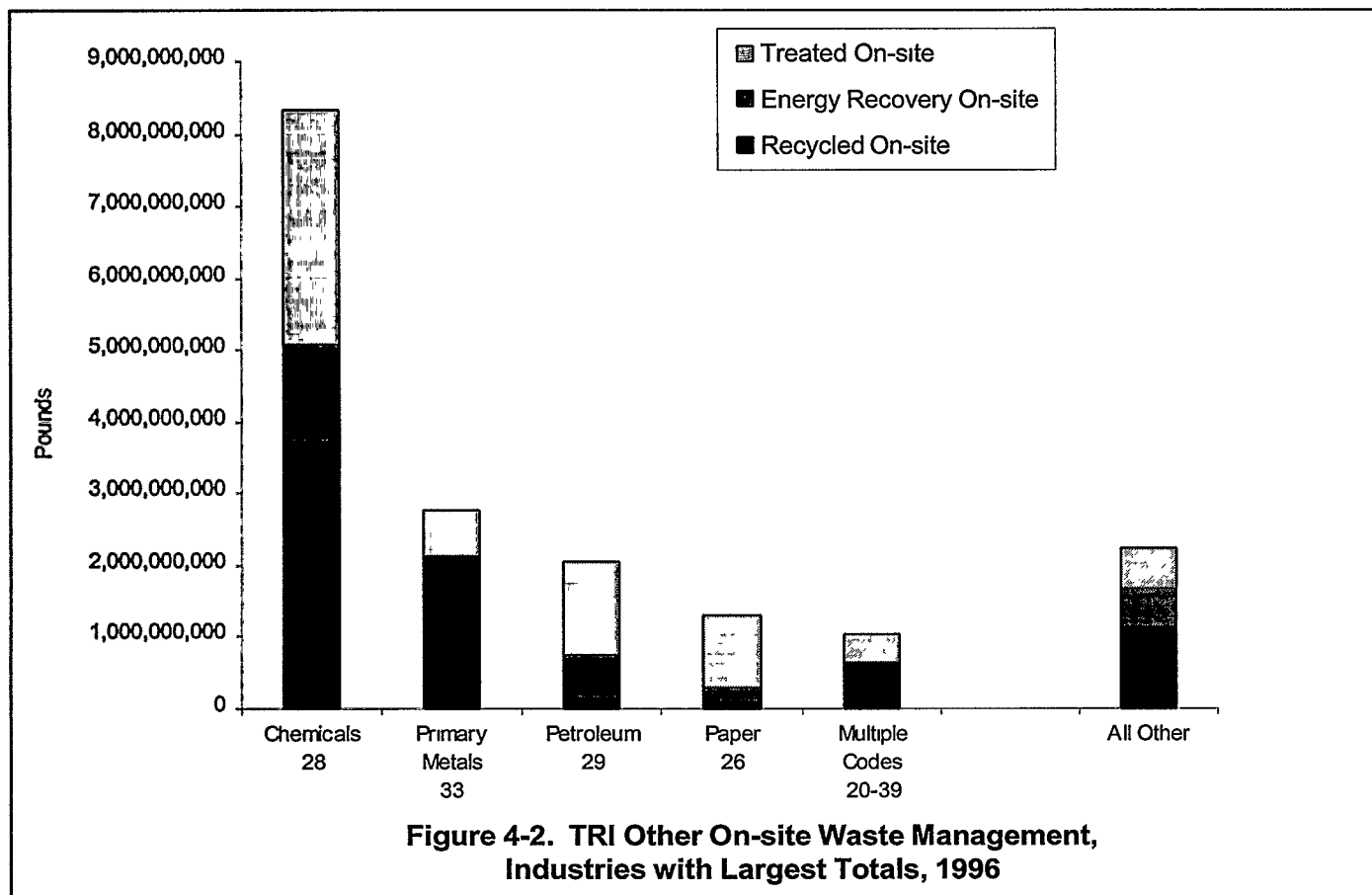
## Transfers Off-site for Further Waste Management

As in other aspects of the data, chemical manufacturing accounted for the largest portion of transfers off-site for further waste management in 1996. As seen in Table 4-4, the chemicals industry reported 898.9 million pounds of such transfers, or

28.5% of the total. Primary metals was again second with 876.0 million pounds, or 27.7%. Ranking third was electrical equipment (SIC code 36) with 372.7 million pounds, 11.8%. Federal facilities, with 19.5 million pounds (almost all of which were transfers to recycling), reported 0.6% of the total.

Primary metals reported the largest transfers off-site to recycling, with 796.1 million pounds. Chemical manufacturing led the other categories, with 378.4 million pounds transferred to energy recovery, 154.3 million pounds to treatment, and 109.5 million pounds to POTWs (sewage treatment).

Figure 4-3 presents off-site transfers for further waste management for the sectors with the largest totals.



Note: Other On-site Waste Management from Section 8 of Form R. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category.

## Economic Overview, by Industry, 1996

Although 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, they also have limitations. Chapter 1 discusses some of these. One such limitation is lack of information on non-TRI sources of releases of TRI chemicals. Chapter 2 attempts to set TRI data for some types of chemicals (fertilizers, pesticides, and volatile organic chemicals) in the context of larger environmental releases, not reported to TRI.

This year's industry-by-industry view of TRI reporting addresses another limitation—that TRI data alone do not distinguish industry-specific

factors that influence the chemicals, amounts, and types of releases and waste management facilities report. Each industry chapter in this volume and in the volume scheduled for publication in summer 1998 offers some economic, technological, and regulatory information for that sector as a context for the data reported to TRI.

For each two-digit SIC code, Table 4-5 presents value of shipments and employment for 1996. These basic economic data suggest the relative size of the industrial sectors that report to TRI (additional sectors will begin reporting in 1999 for the 1998 reporting year). Economic analyses make use of value of shipments data as one way to indicate the size of industrial sectors, because no direct comparison can be drawn among products of those sectors. The dollar value of shipments



Table 4-4. TRI Transfers Off-site for Further Waste Management, by Industry, 1996

SIC Code	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
20	Food	1,816,235	267,672	1,286,750	20,311,887	750	23,683,294
21	Tobacco	165,113	0	56,491	267,349	0	488,953
22	Textiles	1,013,876	1,926,069	523,939	2,287,565	0	5,751,449
23	Apparel	1,440	139,653	535	255	0	141,883
24	Lumber	515,208	2,299,252	491,157	32,799	12,036	3,350,452
25	Furniture	6,453,880	5,612,741	601,162	383,502	6,295	13,057,580
26	Paper	2,180,119	7,495,656	9,983,082	40,311,407	0	59,970,264
27	Printing	3,642,455	3,670,369	382,262	242,411	0	7,937,497
28	Chemicals	256,639,247	378,369,918	154,280,145	109,463,055	104,516	898,856,881
29	Petroleum	18,553,327	657,071	2,150,251	4,788,134	1	26,148,784
30	Plastics	11,817,283	6,750,688	3,169,307	2,890,863	24,575	24,652,716
31	Leather	337,555	167,073	29,024	1,290,230	0	1,823,882
32	Stone/Clay/Glass	3,672,150	2,865,219	2,987,594	1,019,855	16,497	10,561,315
33	Primary Metals	796,078,608	5,643,584	66,153,726	7,859,057	263,705	875,998,680
34	Fabricated Metals	303,449,098	13,729,060	12,677,769	6,597,522	88,546	336,541,995
35	Machinery	64,012,061	2,530,890	1,316,961	4,168,245	2,025,681	74,053,838
36	Electrical Equip	345,621,345	8,084,043	7,294,538	10,998,130	694,794	372,692,850
37	Transportation Equip	164,986,403	13,944,925	8,676,026	5,577,802	8,146	193,193,302
38	Measure /Photo	12,245,918	2,366,341	2,480,361	930,896	44,588	18,068,104
39	Miscellaneous	17,835,260	2,479,411	516,301	635,395	0	21,466,367
	Multiple Codes 20-39	135,247,125	15,615,643	14,128,226	15,248,528	15,500	180,255,022
	No Codes 20-39	4,310,288	2,441,292	911,221	508,621	750	8,172,172
	Total	2,150,593,994	477,056,570	290,096,828	235,813,508	3,306,380	3,156,867,280
	Federal Facilities	18,553,503	304,101	590,337	71,893	0	19,519,834

Note Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category. Forms with no 2-digit SIC code within the range of 20 to 39 are assigned to the "no codes 20-39" category. Other Off-site Transfers are transfers reported without a valid waste management code.

provides a rough common measure between, say, production of 10,000 pairs of shoes and production of 500,000 loaves of bread. Table 4-5 also includes total production-related waste reported to TRI for 1996, to allow approximate comparisons with the economic activity of the sectors. Percentages indicate the relative contribution of each sector to total employment and production (measured by the dollar-value of shipments) and to the total quantity of TRI chemicals in production-related waste reported to TRI. The ratio of total production-related waste to shipments, in the last column, compares the reported TRI quantities in each two-digit sector with that sector's production level for 1996. Many factors influence the differences in TRI reporting among industrial sectors. Relating TRI quantities to the dollar value of each sector's products takes into account one measure of the differences among sectors in their level of production in 1996.

In 1996, as shown in Table 4-5, chemical manufacturing accounted for 4.8% of U.S. manufacturing employment, 9.9% of the value of shipments in U.S. manufacturing, and 45.6% of the total production-related waste reported to TRI. Chemical manufacturing had the highest ratio of production-related waste to value of shipments, 27,303 pounds per million dollar-value. With 4.8% of the value of shipments and 19.0% of total production-related waste, primary metals production had the second-highest ratio, 23,467 pounds of production-related waste per million dollar-value of shipments. Petroleum production was third, with 12,367 pounds per million dollar-value.



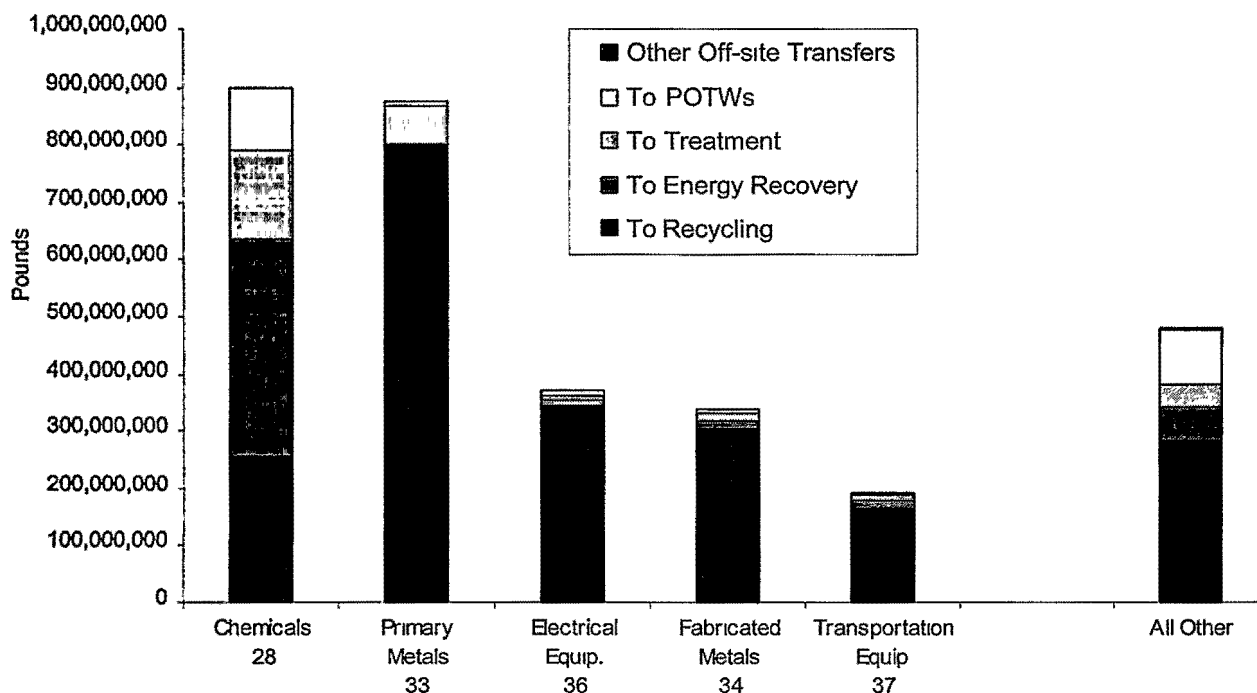
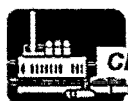


Figure 4-3. TRI Transfers Off-site for Further Waste Management, Industries with Largest Totals, 1996

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R.

## Year-by-Year Comparisons, by Industry

Comparisons of TRI data across reporting years are made on the basis of “core” chemicals that were reportable in all years with the same reporting definitions. This assures that apparent increases or decreases from one year to another are not the result of changes in the list of TRI chemicals. Chapter 3 explains the multi-year comparisons; an understanding of these issues is essential for accurate interpretation of the multi-year data presented in this and other industry chapters.

Progress is measured from TRI’s designated baseline year, 1988, for on-site releases and off-

site transfer types that have been collected since TRI began. On- and off-site waste management data, authorized under the federal Pollution Prevention Act of 1990, have been collected since 1991. This chapter presents industry data for the appropriate comparison years, as well as data for the most recent two years, 1995 and 1996.

### On- and Off-site Releases, 1995-1996

Table 4-6 summarizes on- and off-site releases by industry for 1995 and 1996. The net change for the two-year period was a decrease of 97.3 million pounds, or 3.8%.

With the largest releases in 1996, chemical manufacturing also had the largest decrease in



Table 4-5. Employees, Value of Shipments, and Total Production-related Waste, by Industry, 1996

SIC Code	Industry	Employees		Value of Shipments		TRI Total Production-related Waste		Production-related Waste per Value of Shipments Pounds per Million Dollar-Value
		Number	Percent	(\$000)	Percent	Pounds	Percent	
20	Food	1,516,600	8.8	461,324,200	12.4	397,557,868	1.8	862
21	Tobacco	31,400	0.2	34,481,700	0.9	5,921,753	0.0	172
22	Textiles	576,400	3.3	80,242,000	2.2	64,609,067	0.3	805
23	Apparel	864,900	5.0	77,628,100	2.1	3,273,589	0.0	42
24	Lumber	738,700	4.3	106,518,100	2.9	110,972,285	0.5	1,042
25	Furniture	514,500	3.0	55,696,700	1.5	57,823,940	0.3	1,038
26	Paper	630,600	3.6	160,661,000	4.3	1,599,797,509	7.3	9,958
27	Printing	1,515,000	8.7	195,435,200	5.3	266,207,152	1.2	1,362
28	Chemicals	824,400	4.8	367,441,800	9.9	10,032,390,027	45.6	27,303
29	Petroleum	106,000	0.6	174,284,600	4.7	2,155,301,359	9.8	12,367
30	Plastics	1,017,900	5.9	150,467,500	4.0	369,790,262	1.7	2,458
31	Leather	77,200	0.4	9,308,500	0.3	10,168,880	0.0	1,092
32	Stone/Clay/Glass	520,400	3.0	82,441,300	2.2	668,768,984	3.0	8,112
33	Primary Metals	687,400	4.0	178,297,800	4.8	4,184,091,672	19.0	23,467
34	Fabricated Metals	1,483,000	8.6	214,006,300	5.8	716,239,652	3.3	3,347
35	Machinery	1,980,500	11.4	381,793,700	10.3	169,485,752	0.8	444
36	Electrical Equip	1,556,500	9.0	320,614,700	8.6	679,402,239	3.1	2,119
37	Transportation Equip	1,466,900	8.5	465,172,200	12.5	355,169,310	1.6	764
38	Measure /Photo.	820,700	4.7	151,015,900	4.1	76,477,512	0.3	506
39	Miscellaneous	397,300	2.3	48,596,800	1.3	57,640,501	0.3	1,186
Total		17,326,300	100.0	3,715,428,100	100.0	21,981,089,313	100.0	5,916

**Note:** Employees and Value of Shipments from U.S. Census Bureau, 1996 Annual Survey of Manufactures. Total Production-related Waste from Section 8 (total of 8.1 through 8.7, Column B) of TRI Form R for 1995. Total Production-related Waste does not include forms reporting more than one 2-digit SIC code and forms reporting SIC codes outside the 20-to-39 range.

Table 4-6. Change in Total TRI On-site and Off-site Releases, by Industry, 1995-1996

SIC Code	Industry	Total On- and Off-site Releases			
		1995 Pounds	1996 Pounds	Change 1995-1996 Pounds	Percent
20	Food	86,466,520	83,303,395	-3,163,125	-3.7
21	Tobacco	2,034,129	4,152,572	2,118,443	104.1
22	Textiles	18,501,494	17,327,530	-1,173,964	-6.3
23	Apparel	1,287,024	1,864,850	577,826	44.9
24	Lumber	34,834,946	36,242,680	1,407,734	4.0
25	Furniture	41,779,889	35,876,663	-5,903,226	-14.1
26	Paper	238,316,638	227,563,372	-10,753,266	-4.5
27	Printing	31,156,331	28,466,019	-2,690,312	-8.6
28	Chemicals	844,232,213	785,178,163	-59,054,050	-7.0
29	Petroleum	64,140,915	68,887,258	4,746,343	7.4
30	Plastics	127,167,993	116,409,291	-10,758,702	-8.5
31	Leather	4,475,689	4,241,889	-233,800	-5.2
32	Stone/Clay/Glass	32,323,553	38,740,426	6,416,873	19.9
33	Primary Metals	524,040,619	564,535,183	40,494,564	7.7
34	Fabricated Metals	97,038,621	90,254,367	-6,784,254	-7.0
35	Machinery	26,202,906	22,060,720	-4,142,186	-15.8
36	Electrical Equip	40,455,697	41,765,377	1,309,680	3.2
37	Transportation Equip	121,154,521	111,352,769	-9,801,752	-8.1
38	Measure /Photo.	17,858,774	15,350,071	-2,508,703	-14.0
39	Miscellaneous	13,868,918	10,270,058	-3,598,860	-25.9
Multiple Codes 20-39		152,530,504	120,779,018	-31,751,486	-20.8
No Codes 20-39		10,918,043	8,884,911	-2,033,132	-18.6
Total		2,530,785,937	2,433,506,582	-97,279,355	-3.8
Federal Facilities		7,801,971	6,502,648	-1,299,323	-16.7

**Note:** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category. Forms with no 2-digit SIC code within the range of 20 to 39 are assigned to the "no codes 20-39" category.



releases from 1995 to 1996. This reduction was 59.1 million pounds, or 7.0%. The second-largest reduction was reported in the multiple-codes category, a 31.8-million-pound decrease, or 20.8%. Two industries also reporting decreases of more than 10 million pounds were plastics (SIC code 30; 10.8 million pounds, or 8.5%) and paper (also with 10.8 million pounds, or 4.5%).

With the second-largest total releases in 1996, primary metals had the largest increase from 1995 to 1996. Reporting 40.5 million pounds more in on- and off-site releases in 1996 than in 1995, this sector had an increase of 7.7%. Ranking second for 1995-1996 increases was the manufacture of stone/clay/glass products (SIC code 32), an increase of 6.4 million pounds, or 19.9%.

From 1995 to 1996, thirteen industry sectors reported decreases, as did the multiple-codes category and a category which includes all the forms that failed to report an SIC code. Federal facilities reported a decrease of 1.3 million pounds, or 16.7%. In comparison, seven sectors reported increases.

### On- and Off-site Releases, 1988 and 1994-1996

From 1988 to 1996, on- and off-site releases decreased from 3.35 billion pounds to 1.82 billion pounds, as shown in Table 4-7 which summarizes release data for all sectors. This amounted to a reduction of 1.53 billion pounds, or 45.6%.

Chemical manufacturing contributed more than one third (35.0%) of this reduction. On- and off-site releases for the chemical manufacturing sector were 1.05 billion pounds in 1988, but decreased by more than half (51.0%) to 513.0 million pounds in 1996. This reduction of 534.7 million pounds was by far the largest decrease among the sectors. The second-largest reported

decrease occurred in the multiple-codes category, from 308.4 million pounds in 1988 to 91.2 billion pounds in 1996 (217.2 million pounds, or 70.4%). In two other sectors, the net reduction totaled more than 100 million pounds each: Primary metals reported 629.4 million pounds in 1988 and 496.7 million pounds in 1996, a difference of 132.7 million pounds or a 21.1% reduction. Makers of transportation equipment (SIC code 37) reported 208.4 million pounds in 1988 and 105.2 million pounds in 1996, a decrease of 103.2 million pounds, or 49.5%.

From 1988 to 1996, on- and off-site releases decreased for all but one of the sectors. The exception was apparel (SIC code 23), for which releases increased from 1.0 million pounds in 1988 to 1.7 million pounds in 1996, a 69.8% increase. Federal facilities were not required to report before the 1994 reporting year. They reported a 48.3% decrease (3.8 million pounds) from 1994 to 1996.

### Actual and Projected Quantities of TRI Chemicals in Waste, 1995-1998

Table 4-8 presents the change in total production-related waste projected by industries through 1998. As described in Chapter 2, 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.

In 1996, projections for production-related waste amounted to an increase of 3.2% by 1998. Apparel, plastics, and industrial machinery were the sectors projecting the largest percentage decreases by 1998; these were 28.5% reduction for apparel, 24.3% for plastics, and 17.9% for machinery. Food and beverage processors projected the greatest percentage increase, 83.1%. No other industry projected a net change—either increase or decrease—of more than 10%. Federal facilities projected an increase of 108.2 million pounds, or 227%. Much of this increase is due to one facility—the U.S. Army facility in Radford,



Table 4-7. Change in Total On-site and Off-site Releases, by Industry, 1988 and 1994-1996

SIC Code	Industry Pounds	Total On- and Off-site Releases				Change 1988-1996	
		1988 Pounds	1994 Pounds	1995 Pounds	1996 Pounds	Pounds	Percent
20	Food	8,377,717	6,013,560	5,120,357	5,120,503	-3,257,214	-38.9
21	Tobacco	341,927	134,771	95,226	73,415	-268,512	-78.5
22	Textiles	35,798,377	16,346,332	15,655,607	15,280,411	-20,517,966	-57.3
23	Apparel	1,025,697	1,380,947	1,259,986	1,741,831	716,134	69.8
24	Lumber	32,981,807	32,986,266	30,434,637	27,116,641	-5,865,166	-17.8
25	Furniture	62,363,120	52,134,945	41,530,300	35,651,541	-26,711,579	-42.8
26	Paper	207,603,004	185,334,196	178,774,984	172,799,131	-34,803,873	-16.8
27	Printing	61,187,518	34,386,679	30,895,852	28,269,786	-32,917,732	-53.8
28	Chemicals	1,047,782,223	537,482,685	539,600,255	513,043,111	-534,739,112	-51.0
29	Petroleum	72,780,821	46,877,100	42,593,318	43,076,652	-29,704,169	-40.8
30	Plastics	158,313,799	125,462,108	114,765,358	105,358,191	-52,955,608	-33.4
31	Leather	13,023,617	5,104,391	4,026,421	3,813,502	-9,210,115	-70.7
32	Stone/Clay/Glass	40,539,364	17,359,182	19,053,390	23,263,716	-17,275,648	-42.6
33	Primary Metals	629,353,951	433,885,649	455,029,353	496,662,641	-132,691,310	-21.1
34	Fabricated Metals	160,369,759	99,572,056	90,440,941	77,610,533	-82,759,226	-51.6
35	Machinery	69,747,296	27,120,215	22,851,633	19,162,054	-50,585,242	-72.5
36	Electrical Equip	132,719,036	36,671,754	31,457,129	33,753,037	-98,965,999	-74.6
37	Transportation Equip	208,391,846	128,139,353	114,746,256	105,231,558	-103,160,288	-49.5
38	Measure./Photo.	58,084,824	14,328,227	12,955,213	10,358,619	-47,726,205	-82.2
39	Miscellaneous	32,592,710	15,350,168	13,285,855	9,843,403	-22,749,307	-69.8
	Multiple Codes 20-39	308,351,079	149,011,079	122,436,826	91,157,789	-217,193,290	-70.4
	No Codes 20-39	11,229,042	17,704,243	8,281,275	5,376,979	-5,852,063	-52.1
	Total	3,352,958,534	1,982,785,906	1,895,290,172	1,823,765,044	-1,529,193,490	-45.6
	Federal Facilities	NA	7,920,210	5,907,355	4,091,563	NA	NA

Note Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category. Forms with no 2-digit SIC code within the range of 20 to 39 are assigned to the "no codes 20-39" category. NA: Federal facilities not required to report before 1994.

Table 4-8. Actual and Projected Total Production-related Waste, by Industry, 1996-1998

SIC Code	Industry Pounds	Total Production-related Waste				
		Current Year 1996 Pounds	Projected		Change	
			1997 Pounds	1998 Pounds	1996-1997 Percent	1996-1998 Percent
20	Food	397,557,868	653,060,717	727,957,465	64.3	83.1
21	Tobacco	5,921,753	6,058,749	6,208,774	2.3	4.8
22	Textiles	64,609,067	63,000,446	59,903,878	-2.5	-7.3
23	Apparel	3,273,589	2,670,153	2,341,081	-18.4	-28.5
24	Lumber	110,972,285	112,364,213	105,247,446	1.3	-5.2
25	Furniture	57,823,940	55,286,126	55,415,684	-4.4	-4.2
26	Paper	1,599,797,509	1,607,516,198	1,592,387,416	0.5	-0.5
27	Printing	266,207,152	271,986,787	273,386,005	2.2	2.7
28	Chemicals	10,032,390,027	10,353,025,860	10,711,018,548	3.2	6.8
29	Petroleum	2,155,301,359	2,149,256,710	2,154,256,626	-0.3	-0.0
30	Plastics	369,790,262	317,102,112	279,769,639	-14.2	-24.3
31	Leather	10,168,880	9,620,096	9,379,954	-5.4	-7.8
32	Stone/Clay/Glass	668,768,984	655,757,904	661,882,280	-1.9	-1.0
33	Primary Metals	4,184,091,672	4,157,446,855	4,098,770,311	-0.6	-2.0
34	Fabricated Metals	716,239,652	686,697,161	685,478,273	-4.1	-4.3
35	Machinery	169,485,752	154,171,333	139,198,996	-9.0	-17.9
36	Electrical Equip	679,402,239	688,507,504	709,503,469	1.3	4.4
37	Transportation Equip	355,169,310	349,768,654	352,591,138	-1.5	-0.7
38	Measure /Photo	76,477,512	75,297,949	75,531,810	-1.5	-1.2
39	Miscellaneous	57,640,501	57,076,721	57,369,703	-1.0	-0.5
	Multiple codes 20-39	1,344,788,998	2,035,461,325	1,328,724,148	51.4	-1.2
	No codes 20-39	90,462,402	83,350,294	86,893,334	-7.9	-3.9
	Total	23,416,340,713	24,544,483,867	24,173,215,978	4.8	3.2
	Federal Facilities	47,591,818	43,616,949	155,744,502	-8.4	227.3

Note Data from Section 8 (Total of 8.1 through 8.7) of Form R for 1996. Prior year is Column A, current year is Column B, 1997 is Column C and 1998 is Column D. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category. Forms with no 2-digit SIC code within the range of 20 to 39 are assigned to the "no codes 20-39" category. NA: Federal facilities not required to report before 1994.



Table 4-9. Total Production-related Waste, by Industry, 1991 and 1994-1996

SIC Code	Industry Pounds	Total Production-related Waste					
		1991 Pounds	1994 Pounds	1995 Pounds	1996 Pounds	Change	
						1995-1996 Percent	1991-1996 Percent
20	Food	63,066,268	72,118,666	71,156,494	70,151,157	-1.4	11.2
21	Tobacco	51,405,093	238,686	150,596	107,615	-28.5	-99.8
22	Textiles	51,580,594	49,696,040	46,439,252	46,960,548	1.1	-9.0
23	Apparel	2,340,880	2,450,405	2,081,936	2,983,859	43.3	27.5
24	Lumber	68,482,868	62,445,982	117,713,741	108,000,702	-8.3	57.7
25	Furniture	62,158,973	69,100,903	64,657,002	57,110,926	-11.7	-8.1
26	Paper	1,401,164,200	1,390,873,031	1,317,034,610	1,305,706,645	-0.9	-6.8
27	Printing	259,904,658	238,262,543	291,227,127	265,137,838	-9.0	2.0
28	Chemicals	7,588,654,698	7,960,775,406	7,945,305,210	7,944,446,007	-0.0	4.7
29	Petroleum	1,171,406,294	1,272,138,197	1,006,857,742	1,812,421,303	80.0	54.7
30	Plastics	457,662,674	511,959,880	498,365,536	338,869,255	-32.0	-26.0
31	Leather	18,010,356	8,750,968	7,542,055	6,287,054	-16.6	-65.1
32	Stone/Clay/Glass	945,494,178	1,003,550,335	835,143,656	642,733,737	-23.0	-32.0
33	Primary Metals	2,306,289,254	3,125,155,465	3,201,648,708	3,247,781,282	1.4	40.8
34	Fabricated Metals	639,270,669	802,980,329	676,733,941	676,808,105	0.0	5.9
35	Machinery	220,732,830	168,142,108	154,403,423	159,614,838	3.4	-27.7
36	Electrical Equip.	663,918,802	547,072,102	592,043,373	612,154,741	3.4	-7.8
37	Transportation Equip.	382,686,549	413,901,849	377,430,033	334,876,290	-11.3	-12.5
38	Measure./Photo.	114,962,999	73,269,084	73,757,533	67,302,183	-8.8	-41.5
39	Miscellaneous	59,754,379	62,368,995	55,563,414	55,967,458	0.7	-6.3
	Multiple Codes 20-39	1,948,479,575	1,243,934,543	1,344,098,604	1,175,283,275	-12.6	-39.7
	No Codes 20-39	167,790,586	216,475,822	89,307,448	78,091,387	-12.6	-53.5
	<b>Total</b>	<b>18,645,217,377</b>	<b>19,295,661,339</b>	<b>18,768,661,434</b>	<b>19,008,796,205</b>	<b>1.3</b>	<b>1.9</b>
	Federal Facilities	NA	36,195,048	77,626,788	46,040,436	-40.7	NA

Note. Does not include delisted chemicals, chemicals added in 1994 and 1995, and ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 (Total of 8 1 through 8.7, Column B) of Form R of year indicated. Forms that reported more than one 2-digit SIC code within the range of 20 to 39 are assigned to the "multiple" category. Forms with no 2-digit SIC code within the range of 20 to 39 are assigned to the "no codes 20-39" category.

Virginia, which projected an increase in nitric acid of 115.0 million pounds in on-site recycling and treatment. Without this form, the projection by federal facilities would be a decrease of 24.3%.

## Waste Management Data, 1991 and 1995-1996

As discussed in Chapter 3, total production-related waste has fluctuated since 1991, when TRI began collecting waste management data. From 1995 to 1996, production-related waste increased 1.3%. Overall, from 1991 to 1996, production-related waste has increased 1.9%. Table 4-9 reviews these changes by industry.

Forms with multiple SIC codes reported the largest decrease in production-related waste: a decrease of 773.2 million pounds from 1.95 billion pounds in 1991 to 1.18 billion pounds in 1996. This

represented a 39.7% decrease. Other industries with large overall decreases were stone/clay/glass products, with a decrease of 302.8 million pounds (32.0%) from 945.5 million pounds to 642.7 million pounds, and plastics, with a decrease of 118.8 million pounds (26.0%) from 457.7 million pounds to 338.9 million pounds.

Primary metals reported the largest increase in production-related waste from 1991 to 1996, 941.5 million pounds. With 2.31 billion pounds reported in 1991 and 3.25 billion pounds in 1996, this constituted a 40.8% increase. Second was petroleum, with an increase of 641.0 million pounds, or 54.7% (from 1.17 billion pounds in 1991 to 1.81 billion pounds in 1996). Third for increases was chemicals, with an increase of 355.8 million pounds, or 4.7% (from 7.59 billion pounds to 7.94 billion pounds).



These six industries, with the largest increases and decreases, were the only industries with changes of more than 100 million pounds across the five years. Federal facilities were not required to report in 1991.

## Economic Overview, by Industry, Multi-Year Comparisons

1996 was the sixth year in a relatively long period of moderate expansion in the United States economy. The economy as a whole grew at a rate of 2.8% for the year, as measured by real gross domestic product (*Economic Report of the President*, February 1998). Manufacturing output grew at a rate of 1.0% for the year, somewhat slower than in the previous several years.

Table 4-10 presents production indexes for each industrial sector from 1989 to 1996. These indexes measure real output (unlike the value of shipments data). As shown in the table, production increased 17.6% from 1989 to 1996 for U.S. manufacturing overall. Table 4-11 compares the change in manufacturing production since 1989 with the change in TRI on- and off-site releases and transfers off-site for treatment. As shown in Table 4-11, reported amounts of these TRI releases and transfers have steadily decreased since 1989, even as manufacturing production recovered from small decreases in the early years of the period and expanded through 1996. Overall, while manufacturing production increased 17.6% from 1989 to 1996, TRI on- and off-site releases and transfers off-site for treatment decreased 39.0%.

Table 4-10. Industrial Production Indexes by Industry, 1989-1996

SIC Code	Industry	1989	1990	1991	1992	1993	1994	1995	1996
Total Index		100 0	99.9	97.9	101 0	104 4	109 7	113 2	116 4
Manufacturing		100 0	99 5	97.2	101 0	104 7	110 5	114 3	117.6
20	Food	100 0	101 1	102 6	104 3	106 5	108 1	110 2	110 9
21	Tobacco	100 0	100 0	93 8	94 9	79 7	98 4	100 8	100 2
22	Textiles	100 0	96 6	96 1	103 6	109.3	114 8	113 9	110 6
24	Lumber	100.0	97 4	90 6	95 9	96 7	101 5	101 8	105 3
25	Furniture	100 0	98 5	92 6	97 7	102 2	105 4	106 1	106.3
26	Paper	100 0	100 6	101 5	104 8	109 0	113 6	115 2	113 2
27	Printing	100 0	99 6	95 7	96 6	97 4	97 1	96 4	95 2
28	Chemicals	100 0	102 3	101.4	105 2	106 2	109 5	112.0	114 4
29	Petroleum	100 0	101 0	99 8	100 7	103 6	103 7	105 2	107 3
30	Plastics	100 0	101 1	99 5	109.6	117 1	127.3	130 4	132 2
31	Leather	100 0	96 3	87.9	89.4	90 3	83 6	76 6	71 5
32	Stone/Clay/Glass	100.0	97 8	90 5	93 1	95 1	100 5	101 6	103 4
33	Primary Metals	100.0	99 1	92 2	95.3	100 6	107.7	110 3	111 6
34	Fabricated Metals	100 0	96 6	91 8	95 4	99 6	106.9	110 4	113 2
35	Machinery	100.0	97 2	92 6	97.1	106.7	121 7	137 3	151.8
36	Electrical Equip	100 0	102 2	104 4	116.6	128 2	147.2	172 7	190 3
37	Transportation Equip	100 0	97 3	91 8	95.1	98 7	102 2	99.9	101.0
38	Measure /Photo	100 0	100 2	101 6	101.8	102 4	101.7	102.2	104 7

Note: 1989=100 Beginning 1990, data for production indexes based on 1987 Standard Industrial Classification (SIC), earlier years based on 1977 SIC Data not provided for apparel industry (SIC code 23)

From 1997 Statistical Abstract of the United States No. 1227 Industrial Production Indexes, by Industry: 1980 to 1996 (Source: Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, monthly, and Industrial Production and Capacity Utilization, Statistical Release G-17, monthly)



**Table 4-11. Cumulative Change in Manufacturing Production and in TRI Releases and Transfers Off-site to Treatment and Disposal, 1989-1996**

	1989-1990	1989-1991	1989-1992	1989-1993	1989-1994	1989-1995	1989-1996
Manufacturing Production	-0.5	-2.8	1.0	4.7	10.5	14.3	17.6
TRI Releases and Transfers Off-site to Treatment and Disposal	-5.7	-19.7	-23.9	-30.1	-34.8	-37.0	-39.0

**Note:** Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. Cumulative change in manufacturing production based on 1997 *Statistical Abstract of the United States No. 1227 Industrial Production Indexes, by Industry: 1980 to 1996* (Source: Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin Monthly*, and *Industrial Production and Capacity Utilization, Statistical Release G. 17, monthly*). TRI Releases from Section 5 and Transfers Off-site to Treatment and Disposal from Section 6 of TRI Form R (excludes transfers to recycling and energy recovery reported 1991 through 1996)

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## **Chapter 5**



# ***Toxics Release Inventory Data for Pulp and Paper (SIC Code 26)***

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## **A Look at the Paper and Allied Products Industry (SIC Code 26)**

The pulp and paper industry, SIC code 26, manufactures pulp, paper, and paper products such as boxes and bags. Primary products in the sector are pulp (SIC code 261), paper (SIC code 262), and paperboard (SIC code 263). Secondary products are paperboard containers and boxes (SIC code 265) and other converted paper and paperboard products (SIC code 267). Box 5-1 lists industrial activities at the four-digit SIC code level for Paper and Allied Products, SIC code 26. In TRI, SIC codes are given as reported by the facilities; these may differ from information in economic and other data collections.

Pulp and paper manufacturers shipped \$160.7 billion in products in 1996, down from a peak of \$173.7 billion in 1995 (in current dollars). Employment in 1996 was 630,600. Most U.S. paper is sold in the United States, but exports have contributed to the industry's growth over the last decade. By 1992, U.S. exports had overtaken those of Sweden and Finland to place the United States second only to Canada in its share of the world

export market. At the same time, the domestic market is strong: United States consumes more paper and paper products per person than any other country. U.S. production of paper and paper products grew more rapidly than manufacturing as a whole from 1989 to 1995, but declined in 1996. Overall, because production slowed in 1996, the pulp and paper sector increased production 13.2% from 1989 to 1996, compared to 17.6% for all manufacturing sectors (see Chapter 4, Table 4-10).

As is evident in the analyses presented in this chapter, the primary products—pulp, paper, and paperboard—are generally associated with larger releases and other waste management of TRI chemicals. Among secondary products, miscellaneous coated and laminated paper manufacturing (SIC code 2672) represents another large source.

### **Pulp, Paper, and Paperboard**

Pulp and paper mills tend to be large, employing more than 100 workers, and capital intensive. Economically, pulp, paper, and paperboard mills represent about a third of the sector—\$65.3 billion in shipments in 1996 and employment of 186,200. Paper mills alone account for most of this economic activity (\$39.6 billion in shipments; 116,400





**Box 5-1. SIC Code 26, Paper and Allied Products: Codes and Classifications**

SIC Code	Industry Descriptions
<b>261 Pulp Mills</b>	
2611 Pulp Mills	Manufacture of pulp from wood, rags, linters, wastepaper, and straw.
<b>262 Paper Mills</b>	
2621 Paper Mills	Manufacture of paper and converted paper products from wood and other fiber pulp.
<b>263 Paperboard Mills</b>	
2631 Paperboard Mills	Manufacture of paperboard and converted paperboard products from wood and other fiber pulp
<b>265 Paperboard Containers and Boxes</b>	
2652 Setup Paperboard Boxes	Manufacture of setup paperboard boxes from purchased paperboard.
2653 Corrugated and Solid Fiber Boxes	Manufacture of corrugated and solid fiber boxes and related products from purchased paperboard of fiber stock
2655 Fiber Cans, Tubes, Drums, and Similar Products	Manufacture of fiber cans, cones, drums, and similar products from purchased materials.
2656 Sanitary Food Containers, Except Folding	Manufacture of nonfolding food containers from special foodboard
2657 Folding Paperboard Boxes, Including Sanitary	Manufacture of folding paperboard boxes from purchased paperboard.
<b>267 Converted Paper Products, Except Boxes</b>	
2671 Packaging Paper and Plastics Film, Coated and Laminated	Manufacture of coated or laminated flexible materials made of paper, plastics film, metal foil, and like materials for packaging purposes.
2672 Coated and Laminated Paper, nec*	Manufacture of miscellaneous coated, laminated, or processed paper and film from purchased paper, except for packaging
2673 Plastics, Foil, and Coated Paper Bags	Manufacture of bags of unsupported plastics film, coated paper, metal foil, or combinations of these materials
2674 Uncoated Paper and Multiwall Bags	Manufacture of uncoated paper bags or multiwall bags and sacks
2675 Die-Cut Paper and Paperboard and Cardboard	Die-cutting purchased paper and paperboard and manufacture of cardboard by laminating, lining, or surface-coating paperboard.
2676 Sanitary Paper Products	Manufacture of sanitary paper products from purchased paperboard
2677 Envelopes	Manufacture of all types of envelopes from purchased paper and paperboard
2678 Stationery, Tablets, and Related Products	Manufacture of stationery, tablets, fillers, and related items from purchased paper.
2679 Converted Paper and Paperboard Products, nec*	Manufacture of miscellaneous converted paper or paperboard products

Sources: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual, 1987* Standard Industrial Classification (SIC) codes and industry descriptions.

\*nec: not elsewhere classified

employees). Paper mills produced 95% of U.S.-made paper in 1992, which represents a high degree of concentration; in many industrial sectors, production tends to be more diversified among manufacturers of related products. (In economic analyses, integrated mills that produce both pulp and paper are generally counted as paper mills if they primarily ship paper or paper products.)

Overall, the pulp and paper sector is the country's largest industrial process water user. Although there are fewer pulp mills and they represent a smaller economic segment (\$5.5 billion in shipments; 15,000 employed) of the pulp and paper sector, pulping processes are the sector's primary source of air emissions and water discharges of pollutants. Chemical pulping (to digest a material, typically wood, into its fibrous cellulose constituents) is the most widely used pulping method (85% in 1991);



much less pulp is produced by mechanical or semi-chemical processes. Kraft chemical pulping, an alkaline process whose active components are primarily sodium sulfide and sodium hydroxide, is the sector's greatest source of air pollutants. Less frequently, sulfite pulping, an acid process, is used. Its main components are calcium, sodium, magnesium, or ammonium sulfites.

For many paper grades, bleaching follows pulping. Traditional chlorine bleaching generates chlorinated byproducts—chloroform, dioxins, furans—that pose particular environmental concerns for their persistence, bioaccumulatability, and toxicity. Increasingly, pulp and paper mills have substituted chlorine dioxide for chlorine in bleaching processes. Use of chlorine dioxide results in less formation of chlorinated organics and in lower chemical consumption. As discussed later in this chapter, a major influence on this trend has been EPA's new "Cluster Rule," which combines air and water regulations for pulp and paper. The rule was proposed in December 1993 and made final in November 1997. During the four years that it was under public debate, it helped focus attention on two alternatives to traditional chlorine bleaching: a Totally Chlorine Free (TCF) process or an Elemental Chlorine Free (ECF) process. Substitution of chlorine dioxide, accepted in the final Cluster Rule, is considered an ECF process.

The ECF process makes fewer chlorine atoms available for reactions with environmentally harmful effects, but it also alters other patterns of chemical use and chemical releases in pulp- and papermaking. Methanol or "wood alcohol," the chemical with the largest TRI releases (principally air emissions) from this sector, is formed in the chemical pulping process as wood chips are "cooked" to dissolve the lignin bonds that hold cellulose fibers together. In the ECF process, however, methanol is used as a feedstock in the production of chlorine dioxide, which some mills manufacture on-site. Generation of chlorine dioxide also produces chlorine as a by-product, and this process chlorine may be used as a feedstock to

generate hypochlorous acid, another bleaching agent (and not a TRI chemical).

## Products Made from Paper and Paperboard

A greater number of facilities convert paper and paperboard to other products than those that mill pulp, paper, or paperboard. These facilities tend to be smaller and more labor intensive. Economically, the largest single segment of the pulp and paper sector is the miscellaneous converted paper products industry (SIC code 267), which shipped \$54.9 billion in 1996 and employed 232,400. These facilities manufacture goods from purchased paper or paperboard; they may also press and mold pulp to form (non-art) papier-mâché articles. Production of paperboard containers and boxes (SIC code 265) is the third largest segment of the sector. Manufacturers in SIC code 265 shipped \$40.4 billion in products in 1996, employing 212,000. From purchased materials, these facilities make paperboard, corrugated and solid fiber boxes, fiber cans and drums, food containers (from special food board), and folding paperboard boxes.

As seen in the analyses below, coated and laminated paper products are also associated with significant reporting of releases and other waste management of TRI chemicals. Coatings are applied to paper to enhance its optical or printing properties—to give it gloss, brightness, whiteness, or color. Nearly all magazines, for example, are printed on coated paper. Coatings may also be used to strengthen the physical properties of paper or paperboard, making products such as packaging sturdier or more resistant to moisture. Clays (and kaolin), plastics, adhesives, and other substances are used. Constituents of coatings may include mineral pigments (for brightness or color), a binder such as latex to adhere the pigment to the paper surface, and water-soluble polymers to control dispersion of the pigments and viscosity of the coating. Blade coating is a common coating process in which paper is fed through a liquid coating, past a blade that scrapes off the excess, and through an



Table 5-1. Summary of TRI Information by 4-digit SIC Code, 1996: Pulp and Paper, SIC Code 26

Total On- and Off-site Releases Rank	Total Production-related Waste Rank	SIC Code	Industry	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds
4	2	2611	Pulp Mills	26	209	8	21,932,096	33,842	21,965,938
3	3	2621	Paper Mills	110	467	26	36,769,466	892,255	37,661,721
2	4	2631	Paperboard Mills	56	304	22	43,028,170	9,869	43,038,039
14	13	2653	Corrugated & Solid Fiber Boxes	12	14	3	12	755	767
12	7	2655	Fiber Cans, Drums & Similar Products	5	7	0	80,703	6,973	87,676
10	12	2656	Sanitary Food Containers	3	4	0	193,014	0	193,014
8	10	2657	Folding Paperboard Boxes	13	19	0	467,546	0	467,546
6	6	2671	Paper Coated & Laminated, Packaging	46	100	4	9,608,263	115,960	9,724,223
5	5	2672	Paper Coated & Laminated, nec*	70	227	10	11,207,875	202,065	11,409,940
11	11	2673	Bags: Plastics, Laminated, & Coated	5	6	0	102,805	1	102,806
13	14	2674	Bags: Uncoated Paper & Multiwall	3	3	12,011	0	0	12,011
15	15	2676	Sanitary Paper Products	2	2	0	251	0	251
9	8	2679	Converted Paper Products, nec*	17	35	0	382,597	59,235	441,832
1	1		Multiple within SIC 26	115	952	39	100,737,511	950,647	101,688,158
7	9		Invalid SIC Code within SIC 26	8	14	1	198,700	570,750	769,450
			Total for SIC Code 26	491	2,363	113	224,721,020	2,842,352	227,563,372

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R.

Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents). Facilities/forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category

\*nec: not elsewhere classified.

oven for drying. Pollutants associated with various coating materials and processes have included emissions of volatile organic compounds (VOCs) and discharges of wastewater containing solvents, colorants, and other contaminants. Environmental improvements in the industry include conversion from solvent-based to aqueous systems and installation of recovery systems to allow at least partial reuse of wastewater.

## Other Environmental Developments

The environmental change in the paper industry that is most visible to the public is its recycling of end products to raw material. The United States recovers, consumes, and exports more recovered paper and paperboard than any other country. The environmental efficiency of reclaiming fiber from paper and paper goods varies with the quality of the type and source of the material. Pulping secondary fiber involves removing contaminants (including ink). These may be minimal, in paper waste from

the mill itself, but much greater, for example, in post-consumer newsprint. Paper and paperboard mills consumed 28.9 million metric tons of recovered paper and paperboard in 1996, one-third of the raw material used.

Consumer interest in both recycled paper and environmentally preferable bleaching methods have played a role in encouraging change in pulp and paper manufacture. Paper purchases for publications that bear the "printed on recycled paper" imprint represents one such market influence. One of the largest customers in the paper business, both directly and through its contractors, is the federal government, which under Executive Order 12873 requires a minimum recycled fiber content in federal purchases of uncoated printing and writing papers. At its signing in October 1993, the Executive Order required a 50% post-consumer recycled fiber content; in March 1996, this was lowered to 20%.



Table 5-1. Summary of TRI Information by 4-digit SIC Code, 1996: Pulp and Paper, SIC Code 26, Continued

SIC Code	Industry	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
2611	Pulp Mills	211,720,535	8,303,203	242,078,450	1,280
2621	Paper Mills	193,379,505	4,553,512	236,590,779	9,636
2631	Paperboard Mills	191,881,823	283,495	235,196,403	162
2653	Corrugated & Solid Fiber Boxes	18,680	21,753	51,023	0
2655	Fiber Cans, Drums & Similar Products	10,859,516	12,655	10,966,853	0
2656	Sanitary Food Containers	0	15	192,659	0
2657	Folding Paperboard Boxes	828,700	91,207	1,360,592	0
2671	Paper Coated & Laminated, Packaging	22,433,886	2,787,302	34,999,337	2,564
2672	Paper Coated & Laminated, nec*	108,593,862	6,575,875	127,057,521	7,095
2673	Bags, Plastics, Laminated, & Coated	338,791	49,940	489,765	0
2674	Bags: Uncoated Paper & Multiwall	0	800	12,531	0
2676	Sanitary Paper Product	0	0	271	0
2679	Converted Paper Products, nec*	1,418,524	396,966	2,352,923	0
	Multiple within SIC 26	568,689,710	36,585,046	706,569,400	22,037
	Invalid SIC Code within SIC 26	769,783	308,495	1,879,002	0
	Total for SIC Code 26	1,310,933,315	59,970,264	1,599,797,509	42,774

Note. On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R.

Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents). Facilities/forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category.

\*nec. not elsewhere classified.

## 1996 TRI Data for Pulp and Paper

Table 5-1 summarizes TRI reporting by the pulp and paper sector. Nearly 2,400 TRI reporting forms were submitted for 1996 from this sector. Of the forms submitted in pulp and paper manufacturing, 4.8% (113) were Forms A certification statements, certifying that a facility's total annual reportable amount of a TRI chemical was less than 500 pounds for the year and that the facility did not manufacture, process, or otherwise use more than 1 million pounds. (The Form A certification statement is explained in Chapter 1.) In TRI overall, Form A certification statements were 10.1% of all forms.

Many mills produce both pulp and paper or paperboard. These integrated mills thus manufacture products that are classified separately in the Standard Industrial Classification (SIC) system. These facilities report on their TRI forms

more than one SIC code within SIC code 26. Facilities that produce both pulp and paper, for example, will report both SIC code 2611 (pulp mills) and SIC code 2621 (paper mills). This "multiple-codes" category represents a significant portion of the economic activity and the TRI reporting in this sector. Of the 2,363 forms submitted in pulp and paper, 952 reported more than one SIC code within SIC code 26. As shown in Table 5-1, this category—forms reporting multiple SIC codes—represented the largest source of releases (on- and off-site), waste management (on- and off-site), and total production-related waste from the pulp and paper sector. (Box 4-2 in Chapter 4 further explains reporting of multiple SIC codes and its affect on the analyses presented in the TRI data release.)

This multiple-codes category reported 44.7% of total on- and off-site releases, 43.4% of other on-site waste management, 61.0% of transfers off-site for further waste management, 44.2% of total production-related waste, and 51.5% of non-production-related waste (see Table 5-1). Table 5-2



Table 5-2. Multiple SIC Codes, 1996: Pulp and Paper, SIC Code 26

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
2611 2621	136	2	8,975,936	873,633	9,849,569	9,695,759	690,301	20,020,543	0
2611 2621 2631	766	36	90,807,651	72,794	90,880,445	557,361,671	35,892,435	683,960,076	22,004
2611 2621 2631 2653	34	1	599,552	405	599,957	1,428,592	720	2,027,244	0
2611 2621 2631 2679	1	0	48,800	0	48,800	47,916	0	96,316	0
2611 2621 2674	1	0	6	0	6	639	0	645	0
2611 2631	4	0	36,246	3,810	40,056	9,609	0	48,745	33
2621 2631 2643	6	0	220,043	5	220,048	88,324	0	308,424	0
2621 2671	1	0	250	0	250	32,000	0	32,300	0
2621 2672	1	0	380	0	380	25,200	890	26,460	0
2631 2655	1	0	48,647	0	48,647	0	0	48,647	0
2673 2674	1	0	0	0	0	0	700	0	0
<b>Total for SIC Code 26</b>	<b>952</b>	<b>39</b>	<b>100,737,511</b>	<b>950,647</b>	<b>101,688,158</b>	<b>568,689,710</b>	<b>36,585,046</b>	<b>706,569,400</b>	<b>22,037</b>

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

further examines multiple-code reporting within SIC code 26. A total of 766 forms reported pulp (SIC code 2611), paper (SIC code 2621), and paperboard (SIC code 2631) combined; they represented 96.8% (684.0 million pounds) of total production-related waste from forms reporting multiple codes within SIC code 26.

As shown in Table 5-1, forms with SIC codes in one of the three primary pulp and paper industries reported the largest amounts in all categories, after the multiple-code submissions. Pulp mills reported more on-site waste management (211.7 million pounds), transfers off-site for further waste management (8.3 million pounds), and total production-related waste (242.1 million pounds). Paper mills reported more off-site releases (transfers off-site to disposal; 892,000 pounds). Paperboard mills reported more on-site releases (43.0 million pounds). Among the remaining industries—that is, those manufacturing secondary products in the sector—miscellaneous coated and laminated paper products (SIC code 2672) reported the largest amounts in all categories.

## On- and Off-site Releases

Air emissions represented 89.6% of all on- and off-site releases reported in the pulp and paper sector, as shown in Table 5-3 and Figure 5-1. Forms with multiple SIC codes in SIC code 26 accounted for 44.3% (90.3 million pounds) of these releases to air. Paperboard mills were second with 20.0% (40.7 million pounds), paper mills were third with 16.1% (32.8 million pounds), and pulp mills fourth with 8.8% (17.9 million pounds). Figure 5-2 illustrates the distribution of on- and off-site releases for the industries (four-digit SIC code) with the sector's largest releases.

Although pulping processes generate larger air emissions than the processes that produce paper or paperboard, mills that produce only primarily pulp represent economically a smaller portion of the sector than integrated facilities or those predominantly making paper or paperboard. Air emissions reported to TRI by facilities reporting multiple codes within SIC code 26 would typically include emissions from pulping processes. Reporting by paperboard or paper mills may also include releases generated by pulping.

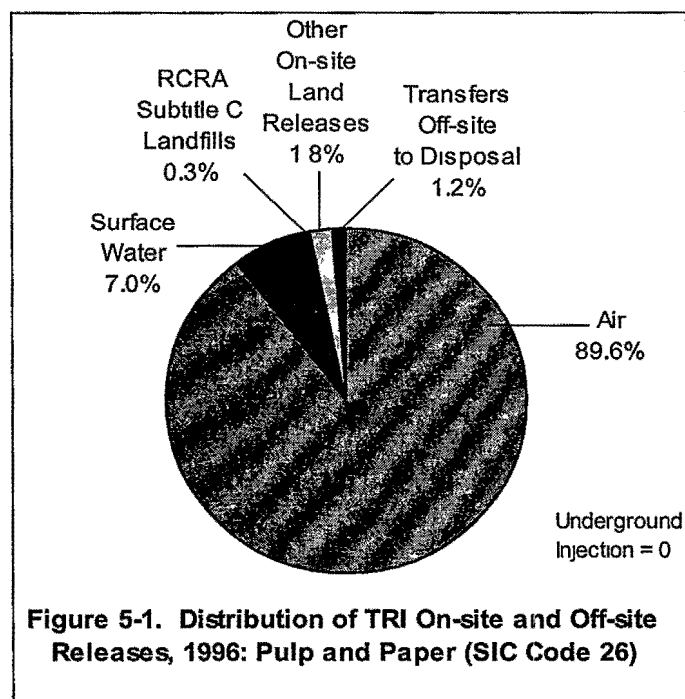


Table 5-3. TRI On-site and Off-site Releases, 1996: Pulp and Paper, SIC Code 26 (in Rank Order)

SIC Code	Industry	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		
	Multiple within SIC Code 26	90,321,259	8,017,014	0	0	586,232	1,813,006	100,737,511	950,647	101,688,158	
2631	Paperboard Mills	40,742,828	461,527	0	0	1,124	1,822,691	43,028,170	9,869	43,038,039	
2621	Paper Mills	32,786,451	3,500,361	0	0	3,909	478,745	36,769,466	892,255	37,661,721	
2611	Pulp Mills	17,893,140	4,001,232	0	0	0	37,724	21,932,096	33,842	21,965,938	
2672	Paper Coated & Laminated, nec*	11,203,293	259	0	0	0	4,323	11,207,875	202,065	11,409,940	
2671	Paper Coated & Laminated, Packaging	9,593,263	0	0	0	11,000	4,000	9,608,263	115,960	9,724,223	
	Invalid SIC Code within SIC Code 26	198,700	0	0	0	0	0	198,700	570,750	769,450	
2657	Folding Paperboard Boxes	467,537	9	0	0	0	0	467,546	0	467,546	
2679	Converted Paper Products, nec*	382,597	0	0	0	0	0	382,597	59,235	441,832	
2656	Sanitary Food Containers	193,014	0	0	0	0	0	193,014	0	193,014	
2673	Bags Plastics, Laminated, & Coated	102,805	0	0	0	0	0	102,805	1	102,806	
2655	Fiber Cans, Drums & Similar Products	52,390	28,313	0	0	0	0	80,703	6,973	87,676	
2674	Bags Uncoated Paper & Multiwall	12,011	0	0	0	0	0	12,011	0	12,011	
2653	Corrugated & Solid Fiber Boxes	12	0	0	0	0	0	12	755	767	
2676	Sanitary Paper Products	251	0	0	0	0	0	251	0	251	
	Total for SIC Code 26	203,949,551	16,008,715	0	0	602,265	4,160,489	224,721,020	2,842,352	227,563,372	

**Note:** On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category.

\*nec not elsewhere classified.



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

Multiple-code reporting also accounted for half (50.1%, or 8.0 million pounds) of the surface water discharges in this sector and half (50.4%, or 2.4 million pounds) of on-site land releases. One-third (33.4%, or 951,000 pounds) of off-site releases (transfers off-site to disposal) also came from these forms.

## Other On-site Waste Management

Treatment was the largest category in other on-site waste management, with 1.02 billion pounds out of the total of 1.31 billion pounds, as shown in Table 5-4 and Figure 5-3. Forms with multiple SIC codes within SIC code 26 led reporting of other on-site waste management, with 568.7 million pounds, and most of that waste was treated (492.8 million pounds).

The multiple-code category also accounted for the largest quantities burned on-site for energy recovery (69.8 million pounds), but miscellaneous coated and laminated paper products (SIC code 2672) reported the largest on-site recycling (56.7 million pounds). Figure 5-4 illustrates the distribution of on-site waste management reporting for the top industries in the pulp and paper sector.

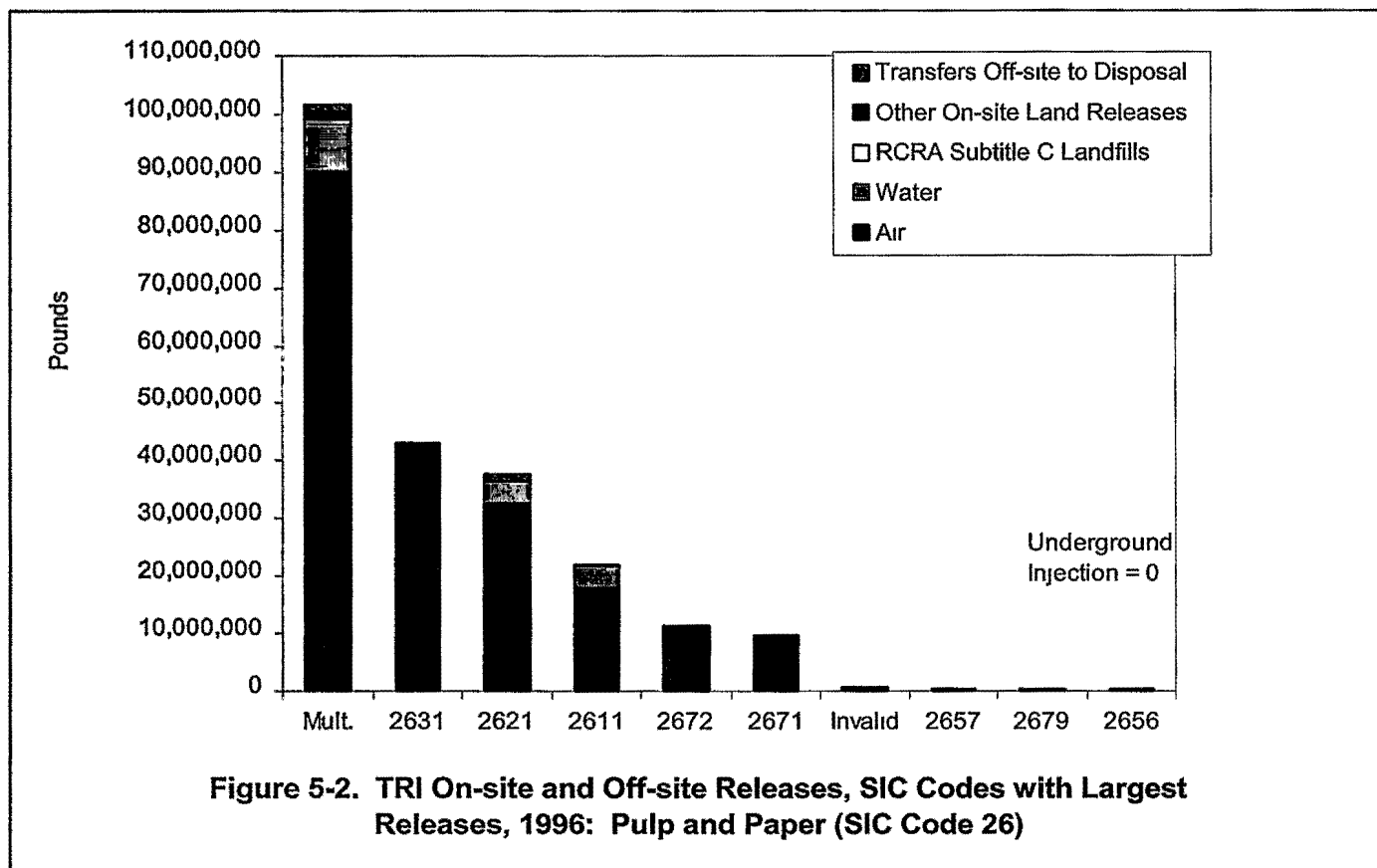


Figure 5-2. TRI On-site and Off-site Releases, SIC Codes with Largest Releases, 1996: Pulp and Paper (SIC Code 26)

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category. Invalid SIC codes are codes beginning "26" that do not exist in the current Standard Industrial Classification code system.

Table 5-4. TRI Other On-site Waste Management, 1996: Pulp and Paper, SIC Code 26 (in Rank Order)

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
	Multiple within SIC Code 26	6,066,039	69,801,636	492,822,035	568,689,710
2611	Pulp Mills	35,000	31,784,370	179,901,165	211,720,535
2621	Paper Mills	6,133,772	50,379,888	136,865,845	193,379,505
2631	Paperboard Mills	6,989,656	14,285,518	170,606,649	191,881,823
2672	Paper Coated & Laminated, nec*	56,740,600	15,252,509	36,600,753	108,593,862
2671	Paper Coated & Laminated, Packaging	17,179,884	1,242,037	4,011,965	22,433,886
2655	Fiber Cans, Drums & Similar Products	10,859,516	0	0	10,859,516
2679	Converted Paper Products, nec*	5,278	1,224,663	188,583	1,418,524
2657	Folding Paperboard Boxes	325,488	381,697	121,515	828,700
	Invalid SIC Code within SIC Code 26	142,853	0	626,930	769,783
2673	Bags: Plastics, Laminated, & Coated	3,810	0	334,981	338,791
2653	Corrugated & Solid Fiber Boxes	0	0	18,680	18,680
2656	Sanitary Food Containers	0	0	0	0
2674	Bags: Uncoated Paper & Multiwall	0	0	0	0
2676	Sanitary Paper Products	0	0	0	0
Total for SIC Code 26		104,481,896	184,352,318	1,022,099,101	1,310,933,315

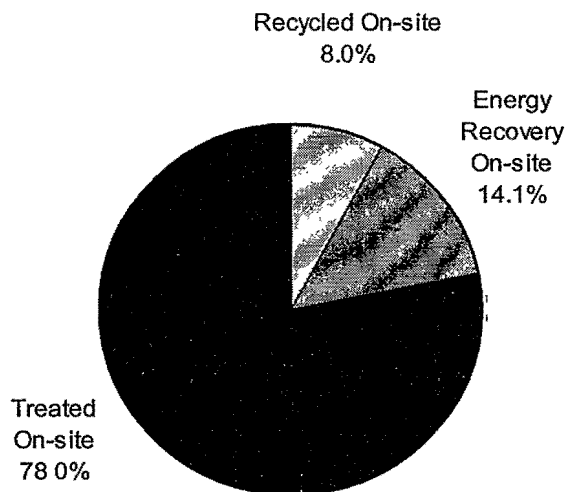
Note: Other On-site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



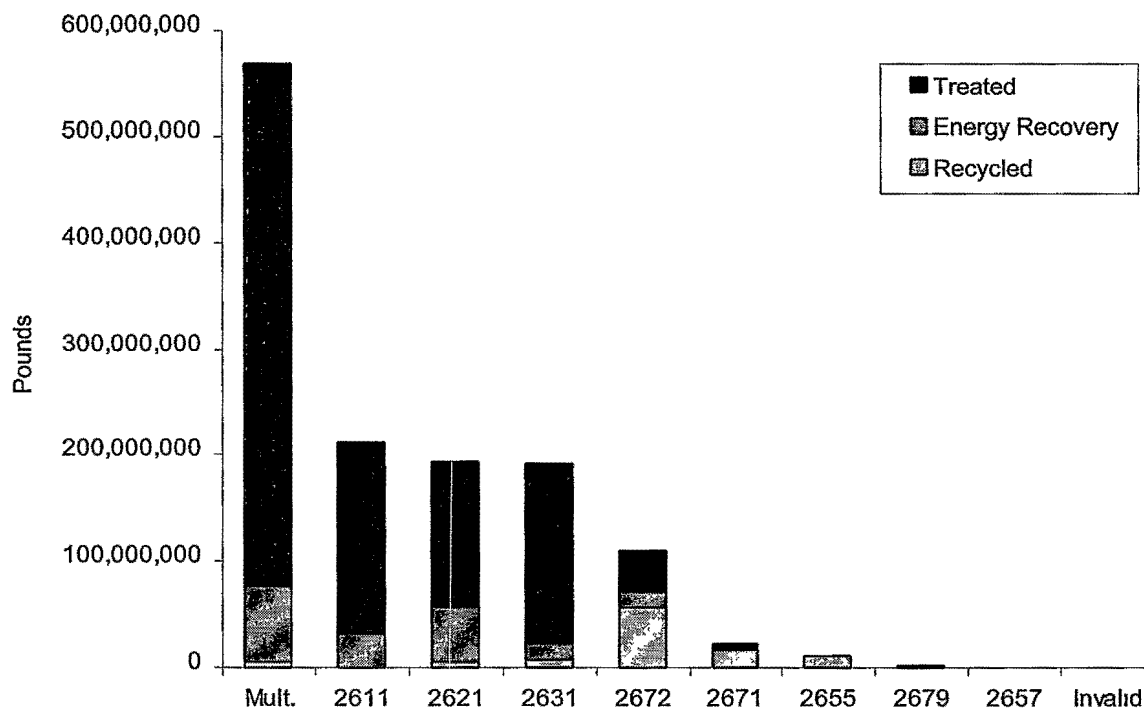
## Transfers Off-site for Further Waste Management

In this sector, transfers off-site for further waste management play a relatively small role, as evident in Table 5-1. Of the 60.0 million pounds of such transfers in this sector, 40.3 million pounds (67.2%) were sent to Publicly Owned Treatment Works (sewage treatment plants), as shown in Table 5-5 and Figure 5-5. The multiple-codes category accounted for 35.8 million pounds of transfers to POTWs, as shown in Figure 5-6. Pulp, paper, and paperboard mills usually operate their own wastewater treatment plants; after treatment, wastewater would be discharged to a surface water body (river or other stream, lake, etc.). Mills without their own treatment plants may remove solid waste (total suspended solids, or TSS) before discharging wastewater to a POTW.



**Figure 5-3. Distribution of TRI Other On-site Waste Management, 1996: Pulp and Paper (SIC Code 26)**

Note: Data from Section 8 of Form R



**Figure 5-4. TRI Other On-site Waste Management, SIC Codes with Largest Totals, 1996: Pulp and Paper (SIC Code 26)**

Note: Other On-site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC Code 26 are assigned to the "multiple" category. Invalid SIC codes are codes beginning "26" that do not exist in the current Standard Industrial Classification code system.





Table 5-5. TRI Transfers Off-site for Further Waste Management, 1996: Pulp and Paper, SIC Code 26 (in Rank Order)

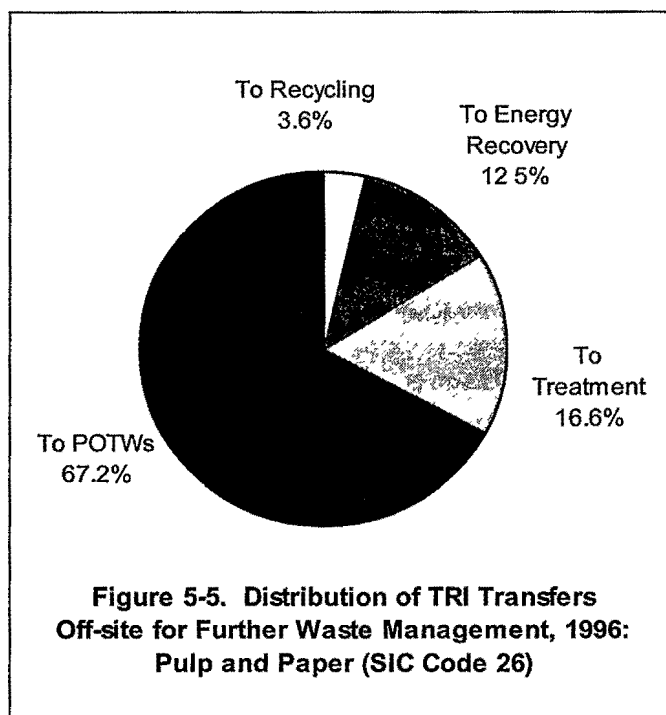
SIC Code	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Transfers for Further Waste Management Pounds
	Multiple within SIC Code 26	5,035	576,435	191,595	35,811,981	0	36,585,046
2611	Pulp Mills	0	17,369	8,285,079	755	0	8,303,203
2672	Paper Coated & Laminated, nec*	792,718	5,110,849	648,843	23,465	0	6,575,875
2621	Paper Mills	47,833	44,939	429,597	4,031,143	0	4,553,512
2671	Paper Coated & Laminated, Packaging	1,003,072	1,511,239	188,552	84,439	0	2,787,302
2679	Converted Paper Products, nec*	259,250	108,615	22,496	6,605	0	396,966
	Invalid SIC Code within SIC Code 26	25,502	40,363	189,120	53,510	0	308,495
2631	Paperboard Mills	427	170	1,021	281,877	0	283,495
2657	Folding Paperboard Boxes	33,328	35,817	20,383	1,679	0	91,207
2673	Bags: Plastics, Laminated, & Coated	0	49,845	92	3	0	49,940
2653	Corrugated & Solid Fiber Boxes	12,954	0	500	8,299	0	21,753
2655	Fiber Cans, Drums & Similar Products	0	0	5,804	6,851	0	12,655
2674	Bags: Uncoated Paper & Multiwall	0	0	0	800	0	800
2656	Sanitary Food Containers	0	15	0	0	0	15
2676	Sanitary Paper Products	0	0	0	0	0	0
	Total for SIC Code 26	2,180,119	7,495,656	9,983,082	40,311,407	0	59,970,264

Note: Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers reported without valid waste management code. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category  
\*nec. not elsewhere classified.

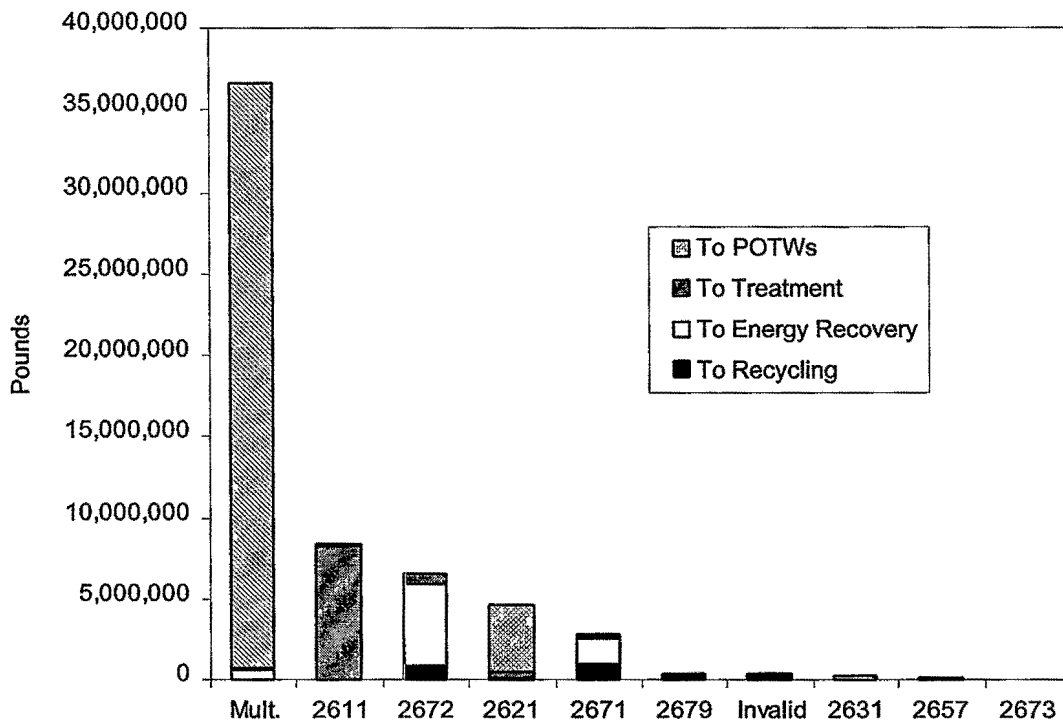
Pulp mills were responsible for the largest reported transfers off-site to treatment (other than POTWs), with 8.3 million pounds. Manufacturers of secondary products accounted for the largest transfers in the other two categories: producers of coated and laminated paper packaging (SIC code 2671) reported the largest transfers to recycling (1.0 million pounds), and miscellaneous coated and laminated paper products (SIC code 2672) reported the largest transfers to energy recovery (5.1 million pounds).

## 1996 TRI Data by State for Pulp and Paper

Papermaking depends on wood and water, and mills are located where these resources are greatest: primarily the eastern United States and the Great



Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R



**Figure 5-6. TRI Transfers Off-site for Further Waste Management, SIC Codes with Largest Totals, 1996: Pulp and Paper (SIC Code 26)**

**Note:** Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category. Invalid SIC codes are codes beginning "26" that do not exist in the current Standard Industrial Classification code system

Lakes region. The Pacific Northwest also has papermaking facilities. TRI data for this sector bear out this geographic distribution. (See Table 5-6). Facilities that purchase paper and paperboard for manufacturing of secondary products do not depend on local natural resources and are more geographically dispersed.

Alabama reported the largest total on- and off-site releases (20.9 million pounds), other on-site waste management (143.6 million pounds), and total production-related waste (164.5 million pounds) in this sector. Ranking second for on- and off-site releases was Louisiana (19.3 million pounds). Georgia ranked second for other on-site waste management (122.8 million pounds) and total production-related waste (139.5 million pounds). Alabama and Louisiana also had the largest amounts of on-site releases. Maine reported 852,000 pounds of off-site releases, followed by

Pennsylvania with 590,000 pounds. The top state for off-site transfers for further waste management was Oregon, with 9.3 million pounds, followed by Wisconsin, with 8.7 million pounds.

Map 5-1 shows the geographic distribution of total on- and off-site releases in the pulp and paper sector.

## 1996 TRI Data by Chemical for Pulp and Paper

By far the chemical most reported to TRI by the pulp and paper sector is methanol, which is formed in the chemical pulping process. (This chemical



Table 5-6. Summary of TRI Information by State, 1996: Pulp and Paper, SIC Code 26

State	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
Alabama	14	164	12	20,755,031	97,868	20,852,899	143,627,020	127,271	164,514,393	3,595
Alaska	1	7	2	1,878,162	0	1,878,162	0	5,800	1,852,700	0
Arizona	3	12	2	2,008,485	0	2,008,485	392,629	0	2,399,281	0
Arkansas	10	80	0	6,395,761	0	6,395,761	66,311,376	21,387	72,513,907	0
California	16	46	1	2,386,545	3,195	2,389,740	8,477,753	359,797	11,468,888	0
Colorado	2	2	0	8,000	0	8,000	62,908	63,308	129,216	0
Connecticut	4	10	1	73,238	0	73,238	1,502,307	86,911	1,660,254	0
Delaware	2	2	1	28,313	6,973	35,286	10,770,876	6,851	10,819,864	0
Florida	9	90	3	10,250,215	28,568	10,278,783	90,291,475	5,219,466	107,283,399	0
Georgia	18	147	10	16,566,607	14,116	16,580,723	122,849,240	173,129	139,496,700	4,647
Idaho	1	3	0	21,400	0	21,400	0	0	21,400	0
Illinois	22	52	2	993,725	127,715	1,121,440	6,058,764	752,227	7,921,948	0
Indiana	14	32	4	2,102,832	489	2,103,321	198,439	243,032	2,571,054	40
Iowa	5	15	0	955,523	0	955,523	4,911,836	518,872	6,656,156	0
Kansas	1	1	0	0	5	5	0	5,705	5,700	0
Kentucky	10	49	1	3,700,246	8,253	3,708,499	32,835,188	95,414	36,835,749	5
Louisiana	12	111	6	19,310,611	5,586	19,316,197	97,399,836	119	116,553,119	7,804
Maine	16	125	10	7,130,280	852,056	7,982,336	70,050,075	291,038	78,348,888	550
Maryland	5	22	0	1,731,930	39,000	1,770,930	11,614,663	2,927,414	16,313,162	0
Massachusetts	23	46	0	746,646	1,940	748,586	7,031,432	2,025,107	9,785,544	144
Michigan	24	78	2	8,334,924	11,908	8,346,832	39,385,628	4,153,687	51,871,831	20
Minnesota	13	41	1	1,625,212	253	1,625,465	12,789,113	4,592,981	19,012,509	0
Mississippi	9	65	0	8,933,628	31,057	8,964,685	56,719,525	500	65,754,811	0
Missouri	4	4	0	98,509	750	99,259	0	1,540	98,509	0
Montana	1	15	0	1,965,900	0	1,965,900	6,597,550	511	8,584,833	0
New Hampshire	5	19	1	856,830	1,000	857,830	6,606,722	4,888	7,488,773	0
New Jersey	13	44	4	642,556	39,716	682,272	10,518,224	2,333,372	13,568,498	0
New Mexico	1	2	0	700	0	700	3,650	0	4,350	0
New York	22	62	2	4,500,203	22,285	4,522,488	23,713,942	211,807	28,337,216	0
North Carolina	14	94	7	12,785,011	251,785	13,036,796	106,318,605	156,937	119,206,877	4,900
Ohio	34	120	7	7,332,676	172,747	7,505,423	23,057,798	2,352,338	33,036,937	3,500
Oklahoma	2	21	3	3,952,647	250	3,952,897	7,667,456	2,850	11,623,120	0
Oregon	12	59	7	4,924,923	219,134	5,144,057	45,905,541	9,279,406	60,296,847	40
Pennsylvania	24	97	5	7,489,613	589,848	8,079,461	20,875,529	4,094,453	33,188,196	0
Rhode Island	2	4	0	147,942	0	147,942	201,685	13,220	362,900	0
South Carolina	10	108	2	16,631,184	129,377	16,760,561	82,089,955	76,854	98,999,356	5,635
Tennessee	23	76	1	7,804,475	0	7,804,475	21,002,218	878,339	29,739,330	0
Texas	8	73	1	7,872,967	250	7,873,217	51,083,083	5,019,696	63,807,869	55
Vermont	2	2	0	49,035	0	49,035	0	0	49,000	0
Virginia	14	72	0	13,091,297	6,743	13,098,040	32,040,755	5,223,040	50,067,176	8,553
Washington	12	85	4	5,998,866	1,260	6,000,126	38,292,157	0	44,180,486	813
Wisconsin	54	206	11	12,638,372	178,225	12,816,597	51,678,362	8,650,997	73,366,763	2,473
<b>Total for SIC Code 26</b>	<b>491</b>	<b>2,363</b>	<b>113</b>	<b>224,721,020</b>	<b>2,842,352</b>	<b>227,563,372</b>	<b>1,310,933,315</b>	<b>59,970,264</b>	<b>1,599,797,509</b>	<b>42,774</b>

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents)

also accounts for one tenth of on-and off-site releases reported to TRI by all industries, as indicated in Chapter 2.) Methanol in air reacts to form formaldehyde, contributing to air pollution. It poses less of a problem when transferred to POTWs, as it degrades readily in sewage treatment.

The pulp and paper sector reported 227.6 million pounds of on- and off-site releases in 1996, including 119.8 million pounds of methanol (see Table 5-7 ). For 13 of the top 15 chemicals in this sector, including methanol, air emissions dominated reporting of releases. The two exceptions were nitrate compounds (7.0 million pounds discharged to surface water) and zinc compounds (1.9 million

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Table 5-7. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1996: Pulp and Paper, SIC Code 26 (in Rank Order)

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	112,492,061	5,817,694	0	0	7,883	1,418,012	119,735,650	102,566	119,838,216
7647-01-0	Hydrochloric acid	21,843,939	0	0	0	0	0	21,843,939	0	21,843,939
108-88-3	Toluene	16,439,790	265	0	0	0	3,673	16,443,728	204,601	16,648,329
7664-41-7	Ammonia	10,358,746	1,901,004	0	0	2,805	21,290	12,283,845	39,288	12,323,133
7664-93-9	Sulfuric acid	11,999,332	0	0	0	0	19	11,999,351	0	11,999,351
67-66-3	Chloroform	7,649,685	224,602	0	0	155	7,158	7,881,600	3,180	7,884,780
—	Nitrate compounds	2	6,980,623	0	0	3,415	1,872	6,985,912	17,560	7,003,472
75-07-0	Acetaldehyde	6,778,998	146,148	0	0	121	15,537	6,940,804	1,234	6,942,038
—	Zinc compounds	441,810	360,781	0	0	575,823	1,853,834	3,232,248	1,062,037	4,294,285
78-93-3	Methyl ethyl ketone	2,739,632	33,216	0	0	412	2,956	2,776,216	23,403	2,799,619
50-00-0	Formaldehyde	1,544,388	31,105	0	0	505	5,151	1,581,149	17,776	1,598,925
7782-50-5	Chlorine	1,377,925	30,568	0	0	0	5	1,408,498	0	1,408,498
108-95-2	Phenol	1,300,448	14,451	0	0	83	3,076	1,318,058	6,421	1,324,479
10049-04-4	Chlorine dioxide	1,116,235	0	0	0	0	0	1,116,235	0	1,116,235
107-21-1	Ethylene glycol	1,021,509	20,006	0	0	0	359	1,041,874	0	1,041,874
	Subtotal	197,104,500	15,560,463	0	0	591,202	3,332,942	216,589,107	1,478,066	218,067,173
	Total for SIC Code 26	203,949,551	16,008,715	0	0	602,265	4,160,489	224,721,020	2,842,352	227,563,372

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

pounds of other on-site land releases), and these chemicals led these on-site release categories. The majority of the discharges of nitrates to surface waters were reported by forms with multiple SIC codes in SIC code 26 (4.3 million pounds of the 7.0-million-pound total), followed by paper mills (SIC code 2621) with 2.3 million pounds. Paperboard mills (SIC code 2631) reported 1.1 million pounds of the 1.9 million pounds of zinc compounds in on-site land releases that were not to RCRA subtitle C landfills. More zinc compounds were also released off-site (1.1 million pounds transferred off-site to disposal) than any other chemical in pulp and paper reporting.

## OSHA Carcinogens

Pulp and paper releases, on- and off-site, of chemicals designated as OSHA carcinogens totaled 18.9 million pounds in 1996, as shown in Table 5-8

(OSHA carcinogens and the bases for their designation appear in Box 2-4 in Chapter 2.) The large majority (17.7 million pounds) was released to air. Consistent with their overall role, forms with multiple codes in SIC code 26 reported the largest amount of these air emissions, 8.3 million pounds. Figure 5-7 shows the on- and off-site releases of the four-digit SIC codes with the largest OSHA carcinogen releases.

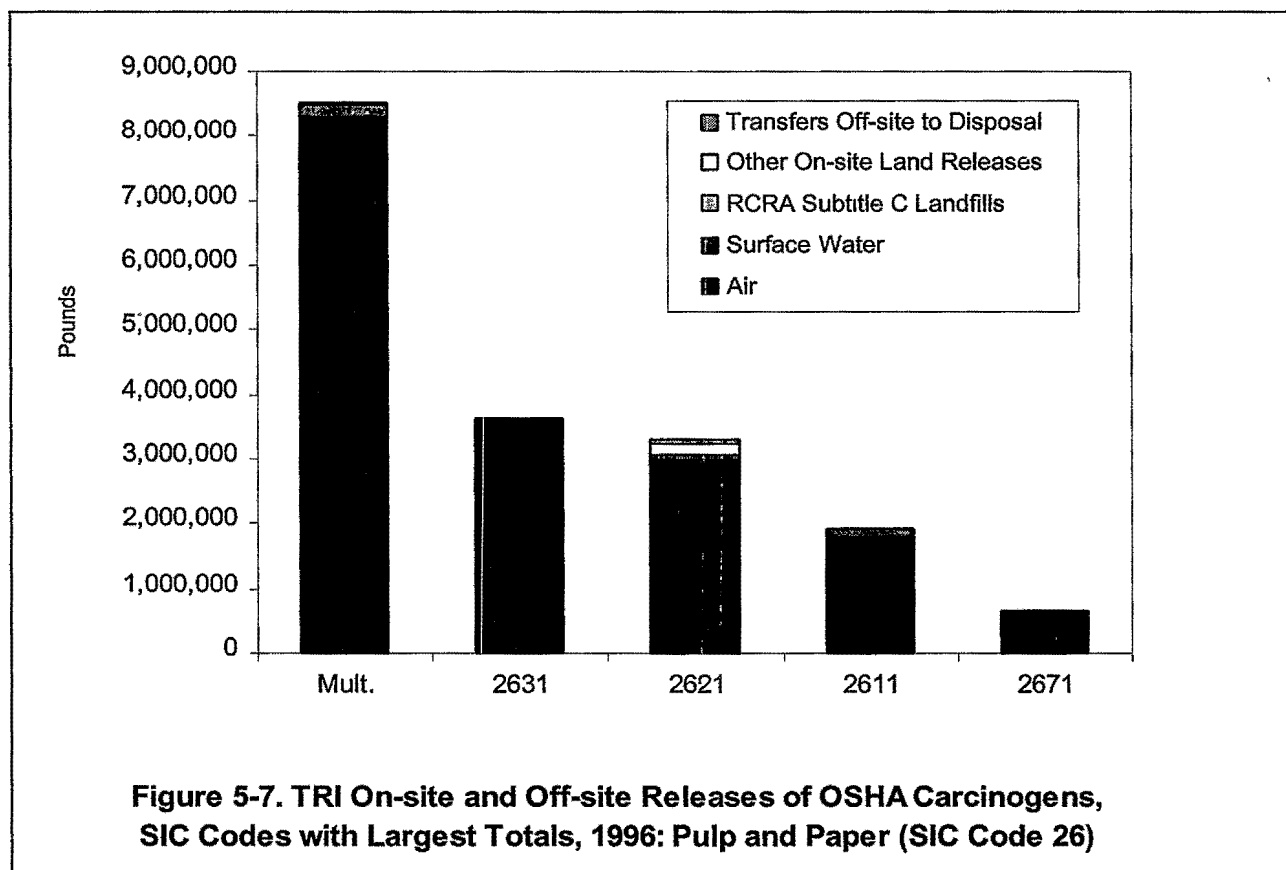
Three of the top 15 chemicals for on- and off-site releases in the pulp and paper sector (listed in Table 5-7) are OSHA carcinogens: chloroform, acetaldehyde, and formaldehyde. These three chemicals accounted for 16.4 million pounds of the 18.9 million pounds of OSHA carcinogens presented in Table 5-8. The OSHA carcinogens with the next highest on- and off-site releases were dichloromethane (746,000 pounds) and asbestos (571,000 pounds).

**Table 5-8. TRI On-site and Off-site Releases of OSHA Carcinogens by 4-digit SIC Code, 1996: Pulp and Paper, SIC Code 26 (in Rank Order)**

SIC Code	Industry	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 Pounds	Off-site to Disposal Pounds	
	Multiple within SIC 26	8,307,585	178,593	0	0	623	25,080	8,511,881	1,808		8,513,689
2631	Paperboard Mills	3,550,460	26,346	0	0	96	37,458	3,614,360	7,452		3,621,812
2621	Paper Mills	3,001,438	71,765	0	0	62	164,631	3,237,896	61,275		3,299,171
2611	Pulp Mills	1,807,592	126,976	0	0	0	107	1,934,675	255		1,934,930
2671	Paper Coated & Laminated, Packaging	646,431	0	0	0	0	0	646,431	0		646,431
	Invalid SIC Code within SIC 26	11,873	0	0	0	0	0	11,873	570,000		581,873
2672	Paper Coated & Laminated, nec*	317,138	0	0	0	0	10	317,148	1,659		318,807
2679	Converted Paper Products, nec*	26,079	0	0	0	0	0	26,079	0		26,079
2676	Sanitary Paper Products	250	0	0	0	0	0	250	0		250
	Subtotal	17,668,846	403,680	0	0	781	227,286	18,300,593	642,449		18,943,042
	Total for SIC Code 26	203,949,551	16,008,715	0	0	602,265	4,160,489	224,721,020	2,842,352		227,563,372

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category.

\*nec not elsewhere classified.

**Figure 5-7. TRI On-site and Off-site Releases of OSHA Carcinogens, SIC Codes with Largest Totals, 1996: Pulp and Paper (SIC Code 26)**

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4 digit SIC code within SIC code 26 are assigned to the "multiple" category



# 1996 TRI Chemicals in Waste for Pulp and Paper

The pulp and paper sector reported a total of 1.60 billion pounds of TRI chemicals in production-related waste for 1996, as shown in Table 5-9 and Figure 5-8. On-site treatment amounted to 1.02 billion pounds, or 63.9% of the total. Quantities released on- and off-site were the second largest category, with 228.3 million pounds, or 14.3% of the total.

The multiple-code category accounted for most of the total production-related waste (706.6 million pounds, or 44.2% of the total). Multiple-code reporting led four waste management categories: on-site energy recovery (69.8 million pounds, or 37.9%), on-site treatment (492.8 million pounds, or 48.2%), off-site treatment (36.1 million pounds, or 71.9%), and quantities released on- and off-site (101.2 million pounds, or 44.3%). Miscellaneous coated and laminated paper products (SIC code 2672) had the largest quantities in the remaining

categories: 56.7 million pounds recycled on-site (54.3% of all on-site recycling), 1.2 million pounds (45.7%) recycled off-site, and 5.2 million pounds (68.2%) sent for energy recovery off-site.

Distribution of production-related waste for these and other top industries in the sector appear in Figure 5-9.

## Projected Quantities of TRI Chemicals in Waste

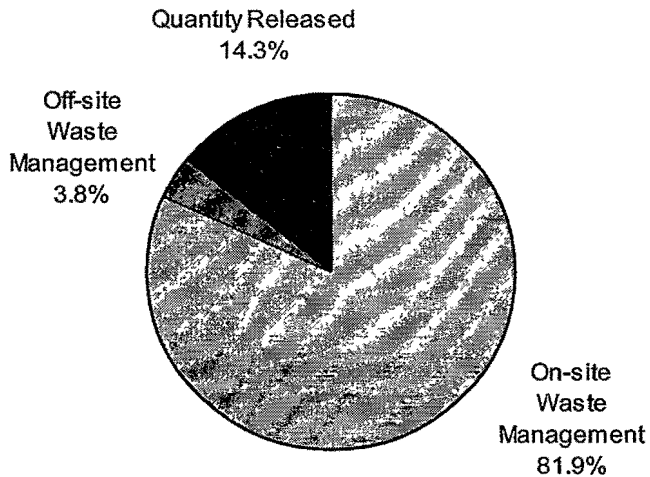
Table 5-10 and Figure 5-10 summarize the pulp and paper sector's projections for on- and off-site waste management through 1998. (As explained in Chapter 2, facilities not only report current data but project waste management quantities for the next two years in their TRI submissions.) Little change is projected overall: a decrease of 0.5% in total production-related waste over the two-year period. The greatest percentage changes projected are reductions in off-site recycling (decrease of 15.6% by 1998) and quantities released (decrease of 5.7% by 1998). Although small, such decreases represent movement in the direction of fewer releases, indicative of movement up the waste management

Table 5-9. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1996: Pulp and Paper, SIC Code 26 (in Rank Order)

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Recycled Off-site Pounds	Energy Recovery Off-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site Pounds	Total Production related Waste Pounds	Non-Production related Waste Pounds
	Multiple within SIC Code 26	6,066,039	69,801,636	492,822,035	5,745	575,699	36,095,976	101,202,270	706,569,400	22,037
2611	Pulp Mills	35,000	31,784,370	179,901,165	0	17,502	8,286,999	22,053,414	242,078,450	1,280
2621	Paper Mills	6,133,772	50,379,888	136,865,845	45,674	56,166	4,170,099	38,939,335	236,590,779	9,636
2631	Paperboard Mills	6,989,656	14,285,518	170,606,649	265	170	282,580	43,031,565	235,196,403	162
2672	Paper Coated & Laminated, nec*	56,740,600	15,252,509	36,600,753	1,246,769	5,181,354	592,421	11,443,115	127,057,521	7,095
2671	Paper Coated & Laminated, Packaging	17,179,884	1,242,037	4,011,965	1,012,822	1,522,208	422,823	9,607,598	34,999,337	2,564
2655	Fiber Cans, Drums & Similar Products	10,859,516	0	0	0	2,535	10,303	94,499	10,966,853	0
2679	Converted Paper Products, nec*	5,278	1,224,663	188,583	345,050	97,839	28,525	462,985	2,352,923	0
	Invalid SIC Code within SIC Code 26	142,853	0	626,930	25,502	58,336	274,025	751,356	1,879,002	0
2657	Folding Paperboard Boxes	325,488	381,697	121,515	33,328	30,984	22,038	445,542	1,360,592	0
2673	Bags: Plastics, Laminated, & Coated	3,810	0	334,981	0	49,845	94	101,035	489,765	0
2656	Sanitary Food Containers	0	0	0	0	10	0	192,649	192,659	0
2653	Corrugated & Solid Fiber Boxes	0	0	18,680	12,572	0	17,869	1,902	51,023	0
2674	Bags, Uncoated Paper & Multiwall	0	0	0	0	0	0	12,531	12,531	0
2676	Sanitary Paper Products	0	0	0	0	0	0	271	271	0
	<b>Total for SIC Code 26</b>	<b>104,481,896</b>	<b>184,352,318</b>	<b>1,022,099,101</b>	<b>2,727,727</b>	<b>7,592,648</b>	<b>50,203,752</b>	<b>228,340,067</b>	<b>1,599,797,509</b>	<b>42,774</b>

Note. Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category

\*nec: not elsewhere classified.



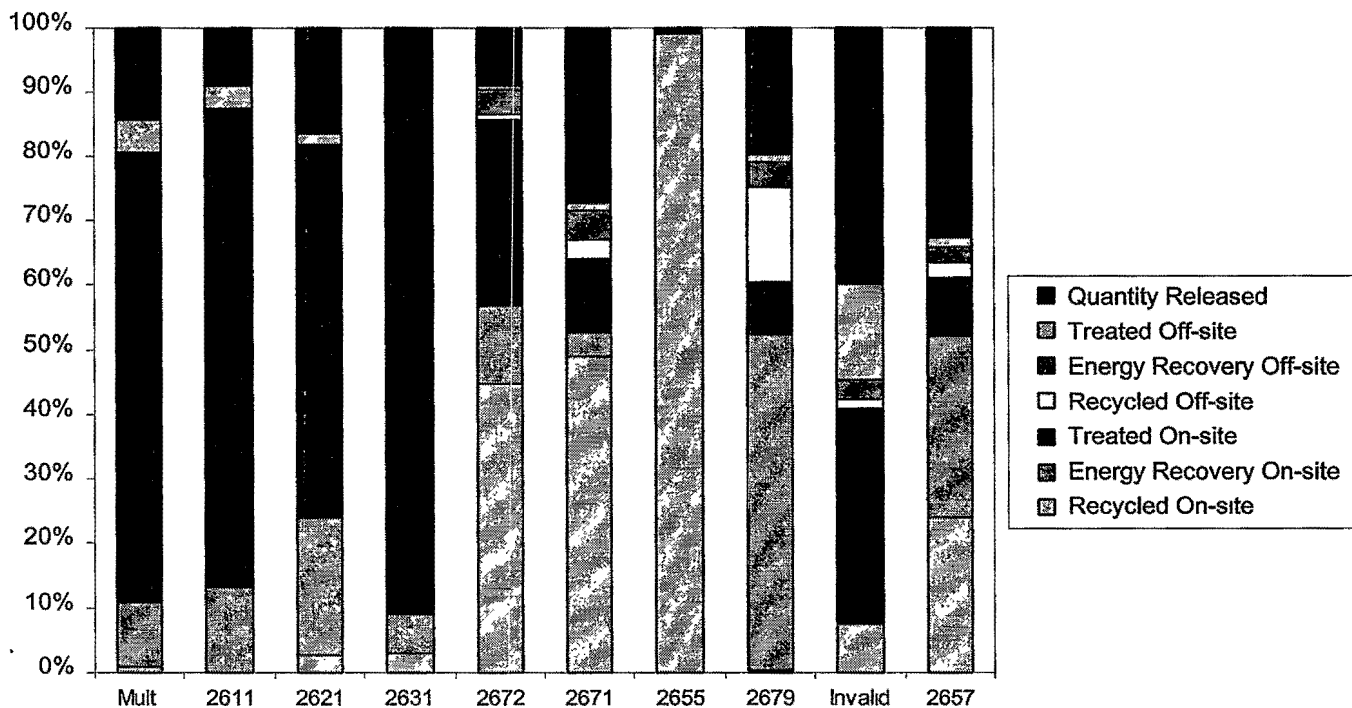
**Figure 5-8. Distribution of TRI Production-Related Waste, 1996: Pulp and Paper (SIC Code 26)**

Note: Data from Section 8 of Form R

hierarchy (explained in Chapter 2). However, none of the individual waste management options shows a shift of as much as 1 percent in its proportion of the total. The largest projected change is in quantities released, from 14.3% of total production-related waste in 1996 to 13.5% of the total in 1998.

## Source Reduction Activity

Fifteen percent of the TRI reporting forms submitted in this sector indicated at least one source reduction activity during 1996. Table 5-11 shows that the miscellaneous coated and laminated paper products (SIC code 2672) industry submitted 103 of these forms (28.9% of the total), and another 102 (28.7%) were multiple-codes forms. As noted above, all categories of waste management in 1996 were also led by one or the other of these two groups. Their level of reported source reduction



**Figure 5-9. Distribution of Production-related Waste, 1996: Pulp and Paper (SIC Code 26)**

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC Code within SIC code 26 are assigned to the "multiple" category. Invalid SIC codes are codes beginning "26" that do not exist in the current Standard Industrial Classification code system





Table 5-10. Current Year and Projected Quantities of TRI Chemicals in Waste, 1996-1998: Pulp and Paper, SIC Code 26

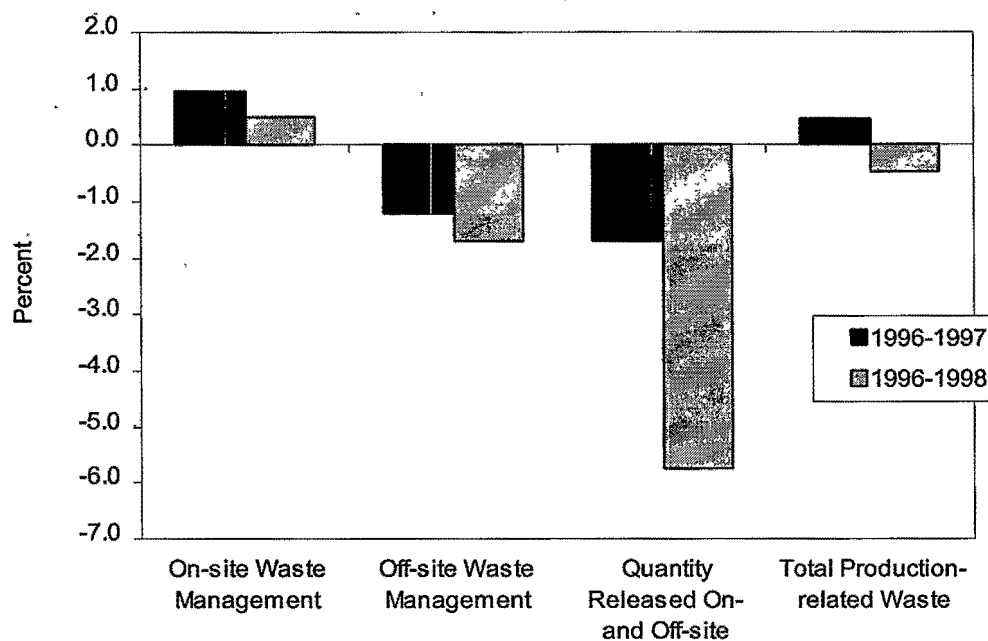
Waste Management Activity	Current Year 1996		Projected 1997		Projected 1998	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
<u>On-site Waste Management</u>						
Recycled On-site	104,481,896	6.5	107,831,592	6.7	108,023,890	6.8
Energy Recovery On-site	184,352,318	11.5	186,117,201	11.6	188,005,678	11.8
Treated On-site	1,022,099,101	63.9	1,029,332,137	64.0	1,021,637,616	64.2
<u>Off-site Waste Management</u>						
Recycled Off-site	2,727,727	0.2	2,259,426	0.1	2,303,286	0.1
Energy Recovery Off-site	7,592,648	0.5	7,312,419	0.5	7,268,002	0.5
Treated Off-site	50,203,752	3.1	50,225,678	3.1	49,921,228	3.1
Quantity Released On- and Off-site	228,340,067	14.3	224,437,745	14.0	215,227,716	13.5
Total Production-related Waste for SIC Code 26	1,599,797,509	100.0	1,607,516,198	100.0	1,592,387,416	100.0
Waste Management Activity	Projected Change		Projected Change		Projected Change	
	1996-1997 Percent		1997-1998 Percent		1996-1998 Percent	
<u>On-site Waste Management</u>						
Recycled On-site	3.2		0.2		3.4	
Energy Recovery On-site	1.0		1.0		2.0	
Treated On-site	0.7		-0.7		-0.0	
<u>Off-site Waste Management</u>						
Recycled Off-site	-17.2		1.9		-15.6	
Energy Recovery Off-site	-3.7		-0.6		-4.3	
Treated Off-site	0.0		-0.6		-0.6	
Quantity Released On- and Off-site	-1.7		-4.1		-5.7	
Total Production-related Waste for SIC Code 26	0.5		-0.9		-0.5	

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996.

activity suggests that efforts are underway to reduce those quantities.

Improvements in operating practices were the most commonly reported source reduction activity for the sector overall and for miscellaneous coated and laminated products. Process modifications, closely

followed by raw material modifications, were the most frequent activities for multiple-codes forms. These modifications are likely to reflect facilities' changes in bleaching practices and use of recycled fiber as feedstock, described at the beginning of this chapter.



**Figure 5-10. Projected Percentage Changes in Quantities of TRI Chemicals in Waste, 1996-1998: Pulp and Paper (SIC Code 26)**

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996.

**Table 5-11. Number of Forms Reporting Source Reduction Activity, 1996: Pulp and Paper, SIC Code 26**

SIC Code	Industry	Forms Reporting Source Reduction Activities			Category of Source Reduction Activity							
		Total Forms Number	Percent of All Forms 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
2611	Pulp Mills	209	15	7.2	1	0	2	9	4	0	0	1
2621	Paper Mills	467	61	13.1	29	5	2	16	14	0	0	6
2631	Paperboard Mills	304	18	5.9	12	0	1	3	4	0	0	1
2653	Corrugated & Solid Fiber Boxes	14	2	14.3	0	0	0	0	1	0	0	1
2655	Fiber Cans, Drums & Similar Products	7	2	28.6	2	0	0	0	0	0	0	0
2656	Sanitary Food Containers	4	3	75.0	0	0	0	2	0	0	1	0
2657	Folding Paperboard Boxes	19	10	52.6	4	2	0	7	1	2	0	0
2671	Paper Coated & Laminated, Packag	100	23	23.0	7	0	0	13	4	0	5	4
2672	Paper Coated & Laminated, nec*	227	103	45.4	46	15	13	35	32	8	10	21
2673	Bags, Plastics, Laminated, & Coate	6	3	50.0	2	0	2	3	0	0	2	0
2674	Bags, Uncoated Paper & Multwall	3	0	0.0	0	0	0	0	0	0	0	0
2676	Sanitary Paper Products	2	0	0.0	0	0	0	0	0	0	0	0
2679	Converted Paper Products, nec*	35	8	22.9	7	1	0	3	2	0	0	0
	Multiple within SIC Code 26	952	102	10.7	31	0	21	38	41	0	0	2
	Invalid SIC Code within SIC Code 26	14	6	42.9	4	0	2	2	3	0	0	0
	<b>Total for SIC Code 26</b>	<b>2,363</b>	<b>356</b>	<b>15.1</b>	<b>145</b>	<b>23</b>	<b>43</b>	<b>131</b>	<b>106</b>	<b>10</b>	<b>18</b>	<b>36</b>

Note: Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category

\*nec not elsewhere classified



## Year-to-Year Comparisons for Pulp and Paper

### 1995-1996 TRI Data for Pulp and Paper

#### On- and Off-site Releases

From 1995 to 1996, the number of TRI forms submitted with pulp and paper SIC codes changed very little (decrease of 0.5%), as shown on Table 5-12. The number of Form A certification statements, certifying that a chemical's annual reportable amount was less than 500 pounds for the year, rose sharply, by 21.5%, although, as mentioned earlier, they represent a relatively small proportion of pulp and paper reporting. The increase from 1995 to 1996 may reflect growing awareness of the Form A certification statement, which was introduced in reporting year 1995.

On- and off-site releases from forms in the pulp and paper sector totaled 4.5% less (a 10.8-million-pound decrease) in 1996 than in 1995. All release types showed decreases except on-site land releases (the smallest on-site release category in pulp and paper), for which the increase was 39.6%, or 1.4 million pounds. Air emissions decreased 4.4% (9.5 million pounds), and surface water discharges 13.9% (2.6 million pounds). Off-site releases (transfers off-site to disposal) decreased 1.9% (56,000 pounds). Figure 5-11 depicts these changes.

#### Other On-site Waste Management

Pulp and paper reporting of on-site waste management, which also appears in Table 5-12 decreased from 1.45 billion pounds in 1995 to 1.31 billion pounds in 1996 (a reduction of 143.5 million pounds, or 9.9%). The largest reduction, in both pounds and percent, occurred in on-site treatment, which was also by far the largest on-site waste

management activity reported. On-site treatment decreased by 125.6 million pounds (10.9%).

#### Transfers Off-site for Further Waste Management

Among off-site waste management categories, transfers to recycling decreased by 59.0% (3.1 million pounds), to energy recovery by 11.7% (991,000 pounds), and to POTWs by 4.1% (1.7 million pounds). These more than offset an 11.1% increase (1.0 million pounds) in transfers to treatment. Overall, transfers off-site for waste management showed a reduction of 7.5% (4.8 million pounds). These data also are shown in Table 5-12.

### 1988-1996 TRI Data for Pulp and Paper

As explained in Chapter 3, comparisons from the 1988 TRI baseline year to the current year rely on the list of "core" TRI chemicals that were reportable, with the same reporting definition, in all years. These multi-year comparisons also review only the data elements that were collected in all years, which excludes from this section any analysis that distinguishes RCRA subtitle C landfills from other land releases as well as analysis based on the types of underground injection wells. On-site waste management data and transfers off-site to recycling and to energy recovery have been collected only since 1991; these data are included, but cannot be compared across the full 1988-1996 period.

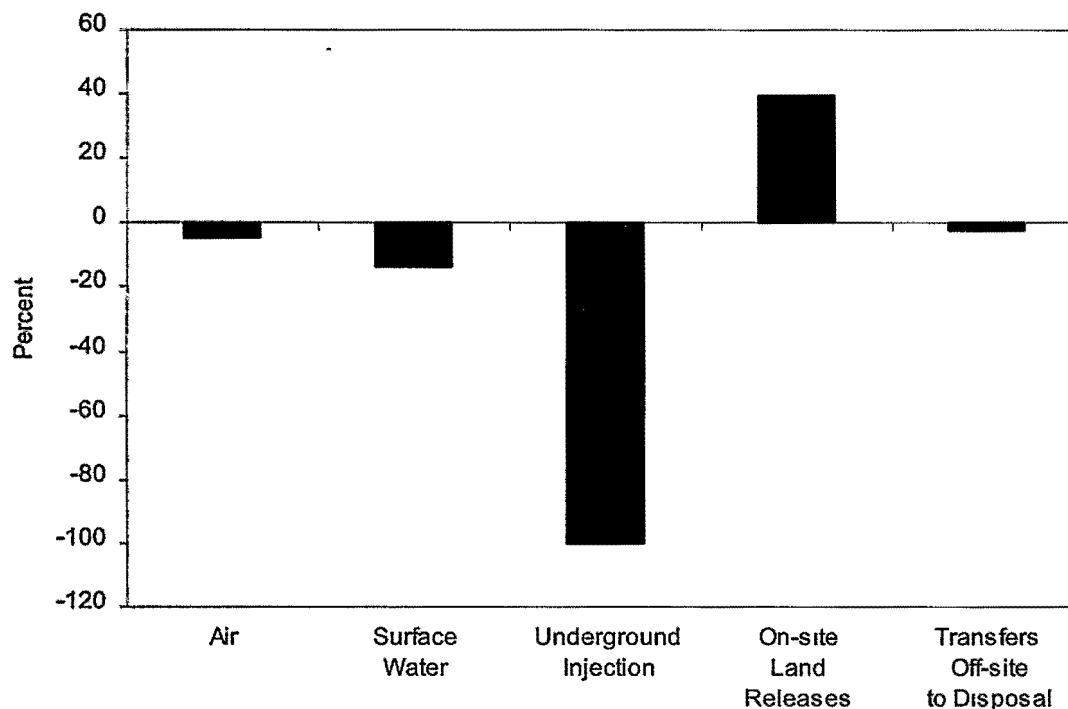
The number of forms reporting pulp and paper SIC codes increased just 0.4% from 1988 to 1996, as presented in Table 5-13. On- and off-site releases decreased by 16.8%, or 34.8 million pounds, and decreases occurred in all release media, as shown in Figure 5-13. Although total air emissions decreased 10.9% (19.3 million pounds), point source air emissions, which represent the majority of the sector's releases to air, increased by 2.0% (2.8 million pounds). Fugitive emissions are much smaller than point source emissions, in pulp and



**Table 5-12. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1995-1996: Pulp and Paper, SIC Code 26**

	1995 Number	1996 Number	Change 1995 to 1996 Percent
Total Facilities	499	491	-1.6
Total Forms	2,376	2,363	-0.5
Form Rs	2,283	2,250	-1.4
Form As	93	113	21.5
	Pounds	Pounds	Percent
<u>On-site Releases</u>			
Total Air Emissions	213,416,038	203,949,551	-4.4
Fugitive Air	18,471,222	18,227,534	-1.3
Point Source Air	194,944,816	185,722,017	-4.7
Surface Water Discharges	18,589,715	16,008,715	-13.9
Underground Injection	1	0	-100.0
On-site Land Releases	3,412,215	4,762,754	39.6
Total On-site Releases	235,417,969	224,721,020	-4.5
<u>Off-site Releases</u>			
Transfers Off-site to Disposal	2,898,669	2,842,352	-1.9
Total On- and Off-site Releases	238,316,638	227,563,372	-4.5
<u>Other On-site Waste Management</u>			
Recycled On-site	111,186,182	104,481,896	-6.0
Energy Recovery On-site	195,522,094	184,352,318	-5.7
Treated On-site	1,147,676,784	1,022,099,101	-10.9
Total Other On-site Waste Management	1,454,385,060	1,310,933,315	-9.9
<u>Transfers Off-site for Further Waste Management</u>			
Transfers to Recycling	5,312,494	2,180,119	-59.0
Transfers to Energy Recovery	8,486,707	7,495,656	-11.7
Transfers to Treatment	8,984,893	9,983,082	11.1
Transfers to POTWs	42,016,984	40,311,407	-4.1
Other Off-site Transfers	500	0	-100.0
Total Transfers Off-site for Further Waste Management	64,801,578	59,970,264	-7.5

**Note** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code. Breakdown of Underground Injection and On-site Land Releases not required in 1995.



**Figure 5-11. Percentage Change in On-site and Off-site Releases, 1995-1996:  
Pulp and Paper (SIC Code 26)**

**Note:** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required in 1995

paper reporting, but a reduction in this category of 56.6% (22.1 million pounds) was responsible for the overall decrease in releases to air. Air emissions are the largest release type for this sector.

Surface water discharges decreased 47.0%, or 6.3 million pounds, and on-site land releases 54.8%, or 5.7 million pounds. Underground injection is not a common practice for producers of pulp, paper, and paper products; 3,000 pounds were reported in 1988 and none in 1996. Off-site releases (transfers off-site to disposal) decreased 56.1%, or 3.5 million pounds, from 1988 to 1996.

Other on-site waste management and off-site transfers to recycling and energy recovery generally show decreases from 1994 to 1996. These data were not collected in 1988.

For the 1988-1996 period, transfers to treatment decreased 17.6%, or 2.1 million pounds, and

transfers to POTWs decreased 23.8%, or 11.8 million pounds.

Overall, production and employment have increased steadily for the pulp and paper sector since 1988. TRI facilities report absolute amounts of waste managed and of environmental releases, not adjusted for changes in production levels. In the face of increasing production in the pulp and paper sector, all categories of releases except for point source air emissions have been decreasing. As noted below, several facilities whose point source air emissions have increased substantially have indicated that changes in estimation methods may account for their increases.

## Changes in SIC Codes

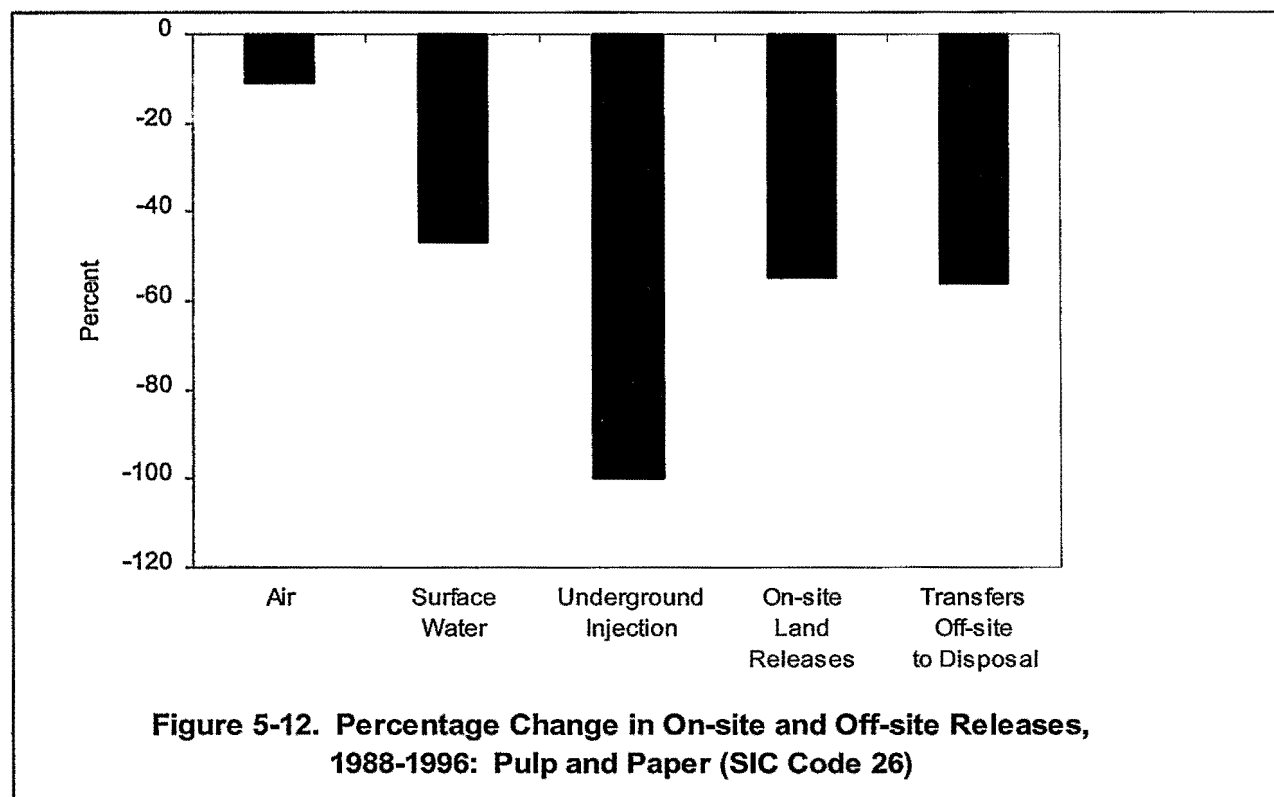
As indicated in facility descriptions below, some facilities report different SIC codes over time. This



**Table 5-13. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1988 and 1994-1996: Pulp and Paper, SIC Code 26**

	1988 Number	1994 Number	1995 Number	1996 Number	Change 1988 to 1996 Percent
Total Facilities	583	485	454	442	-24.2
Total Forms	1,695	1,728	1,699	1,702	0.4
Form Rs	1,695	1,728	1,621	1,612	-4.9
Form As	NA	NA	78	90	NA
	Pounds	Pounds	Pounds	Pounds	Percent
<u>On-site Releases</u>					
Total Air Emissions	177,539,505	169,135,711	165,752,539	158,242,712	-10.9
Fugitive Air	39,029,648	18,353,172	17,109,401	16,925,410	-56.6
Point Source Air	138,509,857	150,782,539	148,643,138	141,317,302	2.0
Surface Water Discharges	13,428,239	8,737,180	6,915,889	7,122,861	-47.0
Underground Injection	3,000	0	1	0	-100.0
On-site Land Releases	10,477,576	4,703,446	3,379,785	4,733,209	-54.8
Total On-site Land Releases	201,448,320	182,576,337	176,048,214	170,098,782	-15.6
<u>Off-site Releases</u>					
Transfers Off-site to Disposal	6,154,684	2,757,859	2,726,770	2,700,349	-56.1
Total On- and Off-site Releases	207,603,004	185,334,196	178,774,984	172,799,131	-16.8
<u>Other On-site Waste Management</u>					
Recycled On-site	NA	114,052,368	102,008,012	101,993,861	NA
Energy Recovery On-site	NA	208,119,465	192,136,378	181,656,398	NA
Treated On-site	NA	813,613,851	781,472,942	791,772,336	NA
Other On-site Waste Management	NA	1,135,785,684	1,075,617,332	1,075,422,595	NA
<u>Transfers Off-site for Further Waste Management</u>					
Transfers to Recycling	NA	1,825,356	4,941,255	1,785,672	NA
Transfers to Energy Recovery	NA	8,893,323	8,359,226	7,365,719	NA
Transfers to Treatment	11,882,811	8,872,329	8,933,628	9,792,359	-17.6
Transfers to POTWs	49,614,880	40,603,471	41,018,284	37,800,017	-23.8
Other Off-site Transfers	110,559	20	500	0	-100.0
Total Transfers Off-site for Further Waste Management	NA	60,194,499	63,252,893	56,743,767	NA

**Note** Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. **On-site Releases** from Section 5 of Form R and **Off-site Releases** from Section 6 (transfers off-site to disposal) of Form R. **Other On-site Waste Management** from Section 8 of Form R. **Transfers Off-site for Further Waste Management** from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required before 1996. For 1994-1996, Other Off-site Transfers are transfers reported without a valid waste management code. For 1988, Other Off-site Transfers are transfers reported without a valid waste management code or codes not required to be reported in 1988. NA: not required to be reported in that year.



Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers to off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required before 1996

may reflect new or discontinued lines of production, or it may represent a different understanding of how SIC code designations relate to a facility's business activities. These changes can contribute—sometimes largely—to apparent increases or decreases across comparison years in the amounts reported by the four-digit, or even two-digit, SIC codes.

#### 1988-1996 Data for Four-Digit Industries in Pulp and Paper

Tables 5-14 through 5-16 summarize data for 1988 and 1994-1996 for industries at the four-digit SIC code level within SIC code 26. The tables present, respectively, on- and off-site releases, other on-site waste management, and transfers off-site for further waste management.

#### **On- and Off-site Releases**

Industries with the largest reductions from 1988 to 1996 in on- and off-site releases, shown in Table 5-

14, were pulp mills (13.8 million pounds), folding paperboard boxes (SIC code 2657; 5.9 million pounds), and paper mills (5.1 million pounds). Pulp mills' reported reductions occurred largely in surface water discharges, an 8.0-million-pound decrease. Nearly all the reporting—and therefore the reduction—in the folding paperboard box industry was in air emissions. Paper mills' reported reductions reflect decreases in all on- and off-site release types, except surface water discharges. These were a 3.2-million-pound decrease in air emissions, 986,000 pounds in on-site land releases, and 1.2 million pounds in transfers to disposal. The increase in surface water discharges amounted to 311,000 pounds.

The largest increases in on- and off-site releases were reported by paperboard mills (16.2 million pounds), the multiple-codes category (9.5 million pounds), and miscellaneous coated and laminated paper products (SIC code 2672; 3.7 million



Table 5-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Pulp and Paper, SIC Code 26

SIC Code	Industry	Year	On-site Releases				Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds		Transfers Off-site to Disposal Pounds	
2611	Pulp Mills	96	14,333,846	3,180,712	0	37,034	17,551,592	33,567	17,585,159
		95	13,256,345	2,812,347	0	23,543	16,092,235	35,036	16,127,271
		94	13,798,141	5,058,755	0	722,884	19,579,780	403,520	19,983,300
		88	18,941,121	11,152,700	0	788,262	30,882,083	538,165	31,420,248
2621	Paper Mills	96	21,617,109	907,376	0	470,939	22,995,424	876,612	23,872,036
		95	24,280,757	961,199	0	287,035	25,528,991	739,564	26,268,555
		94	26,966,389	1,262,590	0	298,920	28,527,899	1,360,778	29,888,677
		88	24,862,352	596,834	0	1,456,720	26,915,906	2,030,208	28,946,114
2631	Paperboard Mills	96	33,915,800	278,237	0	1,819,525	36,013,562	9,854	36,023,416
		95	34,212,228	342,352	0	1,324,492	35,879,072	16,846	35,895,918
		94	31,079,516	384,869	0	1,920,844	33,385,229	27,663	33,412,892
		88	16,085,631	317,172	0	3,341,198	19,744,001	79,476	19,823,477
2652	Setup Paperboard Boxes	96	No reports received						
		95	No reports received						
		94	No reports received						
		88	60,100	0	0	0	60,100	0	60,100
2653	Corrugated & Solid Fiber Boxes	96	5	0	0	0	5	250	255
		95	27,135	0	0	750	27,885	0	27,885
		94	11,865	0	0	0	11,865	0	11,865
		88	351,837	0	0	750	352,587	1,402	353,989
2655	Fiber Cans, Drums & Similar Products	96	52,390	28,313	0	0	80,703	6,973	87,676
		95	65,390	30,295	0	0	95,685	5,873	101,558
		94	195,005	31,901	0	0	226,906	0	226,906
		88	339,685	82,134	0	0	421,819	20,118	441,937
2656	Sanitary Food Containers	96	193,014	0	0	0	193,014	0	193,014
		95	900,094	5	0	0	900,099	0	900,099
		94	868,150	5	0	0	868,155	0	868,155
		88	180,136	0	0	0	180,136	0	180,136
2657	Folding Paperboard Boxes	96	230,736	0	0	0	230,736	0	230,736
		95	409,252	0	0	0	409,252	0	409,252
		94	849,173	0	0	0	849,173	8,034	857,207
		88	5,988,680	28	0	57	5,988,765	171,712	6,160,477
2671	Paper Coated & Laminated, Packaging	96	8,889,347	0	0	15,000	8,904,347	115,960	9,020,307
		95	9,368,762	0	0	0	9,368,762	389	9,369,151
		94	11,059,037	0	0	0	11,059,037	27,439	11,086,476
		88	7,697,115	725	0	0	7,697,840	107,420	7,805,260
2672	Paper Coated & Laminated, nec*	96	10,705,154	259	0	4,179	10,709,592	201,460	10,911,052
		95	11,345,150	32	0	0	11,345,182	58,029	11,403,211
		94	14,409,303	72	0	0	14,409,375	98,526	14,507,901
		88	7,117,574	2,009	0	0	7,119,583	81,301	7,200,884
2673	Bags, Plastics, Laminated, & Coated	96	66,912	0	0	0	66,912	1	66,913
		95	85,616	0	0	521	86,137	521	86,658
		94	173,845	0	0	0	173,845	0	173,845
		88	1,672,380	0	0	0	1,672,380	0	1,672,380

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category.

\*nec: not elsewhere classified





Table 5-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994 1996: Pulp and Paper, SIC Code 26, Continued

SIC Code	Industry	Year	On-site Releases				Total On-site Releases Pounds	Off-site Releases Transfers Off-site to Disposal Pounds	Total On- and Off-site Releases
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds			
2674	Bags: Uncoated Paper & Multiwall	96	9,581	0	0	0	9,581	0	9,581
		95	0	0	0	0	0	0	0
		94	18,757	0	0	0	18,757	0	18,757
		88	41,432	0	0	0	41,432	0	41,432
2675	Dic-cut Paper & Board	96	No reports received						
		95	No reports received						
		94	No reports received						
		88	18,309	0	0	0	18,309	0	18,309
2676	Sanitary Paper Products	96	251	0	0	0	251	0	251
		95	1	0	0	0	1	0	1
		94	No reports received						
		88	4,000	0	0	0	4,000	0	4,000
2677	Envelopes	96	No reports received						
		95	11,000	0	0	0	11,000	0	11,000
		94	16,000	0	0	0	16,000	0	16,000
		88	146,191	0	0	0	146,191	2,828	149,019
2679	Converted Paper Products, nec*	96	382,347	0	0	0	382,347	59,235	441,582
		95	356,899	90	0	40	357,029	32,303	389,332
		94	289,776	130	0	70	289,976	40,992	330,968
		88	721,542	0	0	0	721,542	40,901	762,443
	Multiple within SIC Code 26	96	67,681,120	2,727,964	0	2,386,532	72,795,616	826,437	73,622,053
		95	70,523,401	2,769,569	1	1,743,404	75,036,375	1,263,207	76,299,582
		94	68,001,532	1,998,858	0	1,760,728	71,761,118	777,559	72,538,677
		88	57,632,502	1,240,017	3,000	4,553,681	63,429,200	653,869	64,083,069
	Invalid SIC Code within SIC 26	96	165,100	0	0	0	165,100	570,000	735,100
		95	910,509	0	0	0	910,509	575,002	1,485,511
		94	1,399,222	0	0	0	1,399,222	13,348	1,412,570
		88	35,678,918	36,620	0	336,908	36,052,446	2,427,284	38,479,730
	Total for SIC Code 26	96	158,242,712	7,122,861	0	4,733,209	170,098,782	2,700,349	172,799,131
		95	165,752,539	6,915,889	1	3,379,785	176,048,214	2,726,770	178,774,984
		94	169,135,711	8,737,180	0	4,703,446	182,576,337	2,757,859	185,334,196
		88	177,539,505	13,428,239	3,000	10,477,576	201,448,320	6,154,684	207,603,004

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

pounds). Paperboard mills' reporting reflects a 17.8-million-pound increase in air emissions, with small decreases in other release types. Miscellaneous coated and laminated paper products showed a net 3.6-million-pound increase in air emissions from 1988 to 1996, but with decreases in the more recent years.

Changes in releases reported in the multiple-codes category were more diverse, in keeping with the varied (and changing) industrial activities this category encompasses. This also accounts for greater fluctuation from year to year than tends to appear within single four-digit SIC code reporting. Air emissions from the multiple-codes category increased 10.0 million pounds and surface water discharges 1.5 million pounds, while on-site land



Table 5-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Pulp and Paper, SIC Code 26

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
2611	Pulp Mills	96	35,000	29,384,370	128,239,524	157,658,894
		95	46,000	28,276,597	114,087,556	142,410,153
		94	310,500	34,515,762	171,685,300	206,511,562
		88	NA	NA	NA	NA
2621	Paper Mills	96	6,122,772	50,379,888	105,208,777	161,711,437
		95	3,300,751	46,332,981	107,506,747	157,140,479
		94	2,999,098	56,954,932	118,990,238	178,944,268
		88	NA	NA	NA	NA
2631	Paperboard Mills	96	6,986,006	14,285,518	105,224,436	126,495,960
		95	7,016,965	19,933,994	113,389,532	140,340,491
		94	110,140	18,109,806	110,429,446	128,649,392
		88	NA	NA	NA	NA
2652	Setup Paperboard Boxes	96	No reports received			
		95	No reports received			
		94	No reports received			
		88	NA	NA	NA	NA
2653	Corrugated & Solid Fiber Boxes	96	0	0	7,000	7,000
		95	22,458	0	0	22,458
		94	0	0	0	0
		88	NA	NA	NA	NA
2655	Fiber Cans, Drums & Similar Products	96	10,859,516	0	0	10,859,516
		95	11,527,460	0	0	11,527,460
		94	12,593,447	0	0	12,593,447
		88	NA	NA	NA	NA
2656	Sanitary Food Containers	96	0	0	0	0
		95	0	0	0	0
		94	0	0	0	0
		88	NA	NA	NA	NA
2657	Folding Paperboard Boxes	96	283,999	381,697	104,028	769,724
		95	307,494	406,765	56,437	770,696
		94	214,992	463,761	129,114	807,867
		88	NA	NA	NA	NA
2671	Paper Coated & Laminated, Packaging	96	17,179,884	1,207,970	3,849,068	22,236,922
		95	17,808,737	717,998	4,451,800	22,978,535
		94	18,759,927	815,836	4,981,529	24,557,292
		88	NA	NA	NA	NA
2672	Paper Coated & Laminated, nec*	96	56,646,740	15,205,961	35,117,530	106,970,231
		95	55,829,669	12,135,115	29,606,898	97,571,682
		94	58,790,769	12,687,009	26,846,418	98,324,196
		88	NA	NA	NA	NA
2673	Bags: Plastics, Laminated, & Coated	96	3,810	0	334,981	338,791
		95	0	0	9,706	9,706
		94	0	0	60,964	60,964
		88	NA	NA	NA	NA
2674	Bags: Uncoated Paper & Multiwall	96	0	0	0	0
		95	0	0	0	0
		94	0	0	0	0
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category

\*nec: not elsewhere classified.



Table 5-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Pulp and Paper, SIC Code 26, Continued

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
2675	Die-cut Paper & Board	96	No reports received			
		95	No reports received			
		94	No reports received			
		88	NA	NA	NA	NA
2676	Sanitary Paper Products	96	0	0	0	0
		95	0	0	500	500
		94	No reports received			
		88	NA	NA	NA	NA
2677	Envelopes	96	No reports received			
		95	0	0	0	0
		94	0	0	0	0
		88	NA	NA	NA	NA
2679	Converted Paper Products, nec*	96	5,242	1,224,663	155,283	1,385,188
		95	3,276	446,406	95,189	544,871
		94	3,276	630,936	44,100	678,312
		88	NA	NA	NA	NA
	Multiple within SIC Code 26	96	3,728,039	69,586,331	412,904,779	486,219,149
		95	4,447,176	83,886,522	412,069,091	500,402,789
		94	9,287,268	83,891,930	378,439,477	471,618,675
		88	NA	NA	NA	NA
	Invalid SIC Code within SIC Code 26	96	142,853	0	626,930	769,783
		95	1,698,026	0	199,486	1,897,512
		94	10,982,951	49,493	2,007,265	13,039,709
		88	NA	NA	NA	NA
	Total for SIC Code 26	96	101,993,861	181,656,398	791,772,336	1,075,422,595
		95	102,008,012	192,136,378	781,472,942	1,075,617,332
		94	114,052,368	208,119,465	813,613,851	1,135,785,684
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category  
 \*nec: not elsewhere classified.

releases decreased 2.2 million pounds. Transfers off-site to disposal reported on multiple-codes forms increased 173,000 pounds.

### Other On-site Waste Management

The pulpmaking industry reported the largest net decrease in other on-site waste management since 1994 (on-site waste management data were not collected in 1988): 48.9 million pounds, or 23.7%, as shown in Table 5-15. Paper mills followed with a 17.2-million-pound decrease, or 9.6%. For pulp mills, decreases appeared in all three waste

management types: recycling, energy recovery, and treatment. Decreases in energy recovery and treatment more than offset increased on-site recycling in paper-mill reporting.

Two industry groups reported large increases in on-site waste management: multiple-codes (14.6 million pounds) and miscellaneous coated and laminated paper products (8.6 million pounds). In both cases, on-site treatment was the primary source of the increase.

Table 5-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Pulp and Paper, SIC Code 26

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
2611	Pulp Mills	96	0	17,369	8,282,879	500	0	8,300,748
		95	0	10,194	7,293,965	250	0	7,304,409
		94	5,800	14,569	7,320,525	500	0	7,341,394
		88	NA	NA	2,396,000	3,552,900	0	NA
2621	Paper Mills	96	47,833	44,939	427,305	4,009,332	0	4,529,409
		95	3,469,350	32,089	340,135	3,008,643	250	6,850,467
		94	200,303	33,521	379,589	2,901,438	10	3,514,861
		88	NA	NA	1,013,298	14,957,763	250	NA
2631	Paperboard Mills	96	0	170	770	218,500	0	219,440
		95	0	133,668	2,462	397,361	0	533,491
		94	9,310	250	0	132,914	0	142,474
		88	NA	NA	57,190	11,147,669	0	NA
2652	Setup Paperboard Boxes	96	No reports received					
		95	No reports received					
		94	No reports received					
		88	NA	NA	2,430	0	0	NA
2653	Corrugated & Solid Fiber Boxes	96	10,800	0	0	253	0	11,053
		95	17,749	1,159	0	1,414	0	20,322
		94	0	0	0	0	0	0
		88	NA	NA	500	2,750	0	NA
2655	Fiber Cans, Drums & Similar Products	96	0	0	5,804	6,851	0	12,655
		95	888	169	0	7,051	0	8,108
		94	599	297	7,232	11,157	0	19,285
		88	NA	NA	9,623	22,807	2,080	NA
2656	Sanitary Food Containers	96	0	15	0	0	0	15
		95	861	1,670	3,294	620	0	6,445
		94	0	1,570	6,770	1,000	0	9,340
		88	NA	NA	1,000	500	0	NA
2657	Folding Paperboard Boxes	96	33,328	30,036	8,194	1,679	0	73,237
		95	66,055	100,892	22,294	5,705	0	194,946
		94	43,598	228,603	29,501	791	0	302,493
		88	NA	NA	455,440	28,920	0	NA
2671	Paper Coated & Laminated, Packaging	96	642,478	1,486,970	160,912	60,299	0	2,350,659
		95	401,457	1,454,765	325,468	57,788	0	2,239,478
		94	541,933	1,532,659	420,459	56,120	0	2,551,171
		88	NA	NA	689,920	4,898	0	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category

\*nec: not elsewhere classified



Table 5-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Pulp and Paper, SIC Code 26, Continued

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
2672	Paper Coated & Laminated, nec*	96	761,446	5,016,562	648,192	23,465	0	6,449,665
		95	664,424	5,306,950	565,053	23,994	0	6,560,421
		94	653,230	4,977,553	439,277	21,104	0	6,091,164
		88	NA	NA	526,057	27,282	19,641	NA
2673	Bags: Plastics, Laminated, & Coated	96	0	49,845	92	3	0	49,940
		95	0	7,920	0	3	0	7,923
		94	0	97,194	0	508	0	97,702
		88	NA	NA	109,685	0	4,500	NA
2674	Bags: Uncoated Paper & Multiwall	96	0	0	0	800	0	800
		95	0	0	0	250	0	250
		94	1,500	913	101	250	0	2,764
		88	NA	NA	11,923	0	0	NA
2675	Dic-cut Paper & Board	96	No reports received					
		95	No reports received					
		94	No reports received					
		88	NA	NA	0	0	0	NA
2676	Sanitary Paper Products	96	0	0	0	0	0	0
		95	0	0	0	0	0	0
		94	No reports received					
		88	NA	NA	0	0	0	NA
2677	Envelopes	96	No reports received					
		95	0	0	2,100	0	0	2,100
		94	0	0	960	0	0	960
		88	NA	NA	14,800	0	3,500	NA
2679	Converted Paper Products, nec*	96	259,250	108,615	22,496	6,355	0	396,716
		95	65,000	129,432	1,357	250	0	196,039
		94	0	45,799	1,499	250	0	47,548
		88	NA	NA	87,901	2,584	0	NA
	Multiple within SIC Code 26	96	5,035	570,835	191,595	33,470,470	0	34,237,935
		95	77,707	805,898	274,399	37,511,563	250	38,669,817
		94	107,088	1,457,130	182,580	37,472,823	10	39,219,631
		88	NA	NA	456,326	19,541,022	40,922	NA
	Invalid SIC Code within SIC Code 26	96	25,502	40,363	44,120	1,510	0	111,495
		95	177,764	374,420	103,101	3,392	0	658,677
		94	261,995	503,265	83,836	4,616	0	853,712
		88	NA	NA	6,050,718	325,785	39,666	NA
	Total for SIC Code 26	96	1,785,672	7,365,719	9,792,359	37,800,017	0	56,743,767
		95	4,941,255	8,359,226	8,933,628	41,018,284	500	63,252,893
		94	1,825,356	8,893,323	8,872,329	40,603,471	20	60,194,499
		88	NA	NA	11,882,811	49,614,880	110,559	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 26 are assigned to the "multiple" category

\*nec: not elsewhere classified.



## Transfers Off-site for Further Waste Management

As shown in Table 5-16, paper mills and pulp mills reported the largest increases since 1994 in transfers off-site for further waste management (data for some types of off-site transfers were not collected in 1988). The three-year increase was approximately 1.0 million pounds each for paper mills and pulp mills. Multiple-codes reporting, on the other hand, amounted to a 5.0-million-pound decrease.

### Facilities with Large Increases and Decreases in Releases, 1988-1996

The paper industry's National Council for Air and Stream Improvement (NCASI) performed a study at selected paper mills to test known and suspected sources of chemical emissions. Numerous sources of methanol not previously considered by the industry as a whole (such as specific types of tanks, vents, filters, washers and vacuums) were discovered. As a result, in 1994, NCASI published revised emission factors for estimating releases. International Paper Company, in Mansfield, Louisiana (SIC code 2631), responded to the NCASI study by modifying its Point Source Discharge (PSD) permit to incorporate the additional sources of methanol emissions. International Paper attributes its rank as the top facility for increases in on- and off-site releases (net increase of 3.3 million pounds and a 3.1-million-pound increase in methanol) to the fact that it was one of the first plants to use the data from the NCASI study in reporting methanol emissions to TRI.

Methanol accounts for 93.4% of the increases in on- and off-site releases for the five pulp and paper facilities with the largest reported increases. Most of these increases were reported as point source air emissions. Several facilities attribute the increase to improved calculations for estimating methanol emissions, including the facilities with the second, third, and fourth largest increases. Mead Coated Board in Cottonton, Alabama (SIC code 2631),

ranked second with a net increase of 2.7 million pounds and a methanol increase of 2.4 million. In addition to improved estimations of emissions, Mead reports that its mill has more than doubled in production capacity since 1988.

International Paper in Pineville, Louisiana (multiple codes 2621 and 2631 in 1988 and SIC code 2631 in 1996), ranked third with a net increase of 2.3 million pounds and a methanol increase of 2.2 million. International Paper in Georgetown, South Carolina (multiple codes 2611 and 2621), ranked fourth with a net increase of 2.25 million pounds and a methanol increase of 2.0 million pounds. Both facilities cited new emission factors.

Weyerhaeuser Co. in Valliant, Oklahoma (SIC code 2631), was the fifth-ranked facility for increases in on- and off-site releases from 1988 to 1996, with a net increase of 2.0 million pounds. This reflected a 2.1-million-pound increase in releases of methanol, principally in air emissions.

Methanol was also the chemical responsible for two of the five largest *decreases* in total releases. Westvaco Corporation, Luke, Maryland (SIC code 2621), was first for decreases with a 4.3-million-pound reduction. The facility reported a 2.2-million-pound reduction in the amount of methanol released to air. Much of the decrease is attributed to the installation of a condensate stripper, equipment designed to reduce the amount of methanol present in point source emissions.

Inland Eastex in Evadale, Texas (SIC code 2631), was second in decreases of releases (3.4 million pounds). The facility, which had a 3.3-million-pound reduction in methanol air releases, credits two factors for the reduction. The first is implementation of more accurate estimations of emissions of methanol to air. The second is a change in the pulping process: replacing a batch pulping system with a continuous process. During batch processing, large amounts of methanol, created in process, were released as point source air emissions as batches moved to other systems. In the



continuous pulping system, small amounts of processed pulp are continuously fed from the system, reducing the methanol by-product. [This methanol is treated on-site in non-condensable gas (NCG) incinerators and is largely responsible for ranking the Inland Eastex facility as a top increaser in production-related waste. See **Facilities with Large Increases and Decreases in Waste Management, 1991-1996**, later in this chapter, for more information.]

New equipment was responsible for the decrease in point source emissions of toluene at facilities with the third and fourth largest reductions in total releases. Toluene is used in paper coating. 3M in Saint Paul, Minnesota (SIC code 2641 in 1988 and multiple codes 2672 and 3291 in 1996), ranked third with a net decrease of 3.3 million pounds, attributes some of its 2.0 million pound decrease in toluene emissions to the installation of a thermal oxidizer. The fourth-ranked facility was 3M in Knoxville, Iowa (SIC code 2641 in 1988; SIC code 2672 in 1996), with an overall decrease of 3.1 million pounds. The Knoxville facility reduced its toluene air emissions by 2.4 million pounds between 1988 and 1996. This reduction was also attributed to installation of new equipment: a thermal oxidizer, fume incinerators, and solvent recovery unit.

#### **Other Apparent Increases and Decreases in Releases, 1988-1996**

In the TRI database, there are other facilities with large apparent increases and decreases, which have been identified as reporting errors or plant closures. Because these are errors or plant closures and not actual changes in the data, these facilities are not discussed in detail here. There is one such pulp and paper facility:

Simpson Paper Company, Eureka, California, decrease of 7.8 million pounds, closed in 1993.

## **1991-1996 Waste Management Data for Pulp and Paper**

Table 5-17 summarizes on- and off-site waste management data for the pulp and paper sector for 1991, when TRI began collecting this information, and the three most recent years (1994-1996). Total production-related waste decreased from 1.40 billion pounds to 1.31 billion pounds from 1991 to 1996, a decrease of 6.8%. The largest constituent of this reduction was on-site treatment which decreased from 845.4 million pounds to 791.8 million pounds, or 6.3%. This amounts to a net reduction of 53.6 million pounds in on-site treatment for the five years. The largest percentage reduction appeared in off-site recycling, 50.3%, or a net decrease of 2.4 million pounds. Figure 5-13 shows the percentage changes for on- and off-site waste management types.

Pulp and paper mills have responded to EPA rules calling for phase-out of chlorine-bleaching processes in accomplishing some of these reductions. This is reflected in reporting on source reduction activity, where raw material and process modifications were cited along with changes in operating practices. The overall decrease in production-related waste has been due to decreases in recycled waste, both on- and off-site, as well as decreases in releases. Projections of production-related waste levels for future years indicate little change (see Table 5-10), but the data do show continued reductions in off-site recycling and quantities released offset by increases in on-site recycling and energy recovery, indicative of movement up the waste management hierarchy (explained in Chapter 2).

#### ***Facilities with Large Increases and Decreases in Waste Management, 1991-1996***

The top-ranked facility for increases in production-related waste, Inland Eastex in Evadale, Texas (SIC code 2631), had an 11.0-million-pound increase in methanol over the comparison years (1991-1996), primarily in on-site treatment of this chemical. The

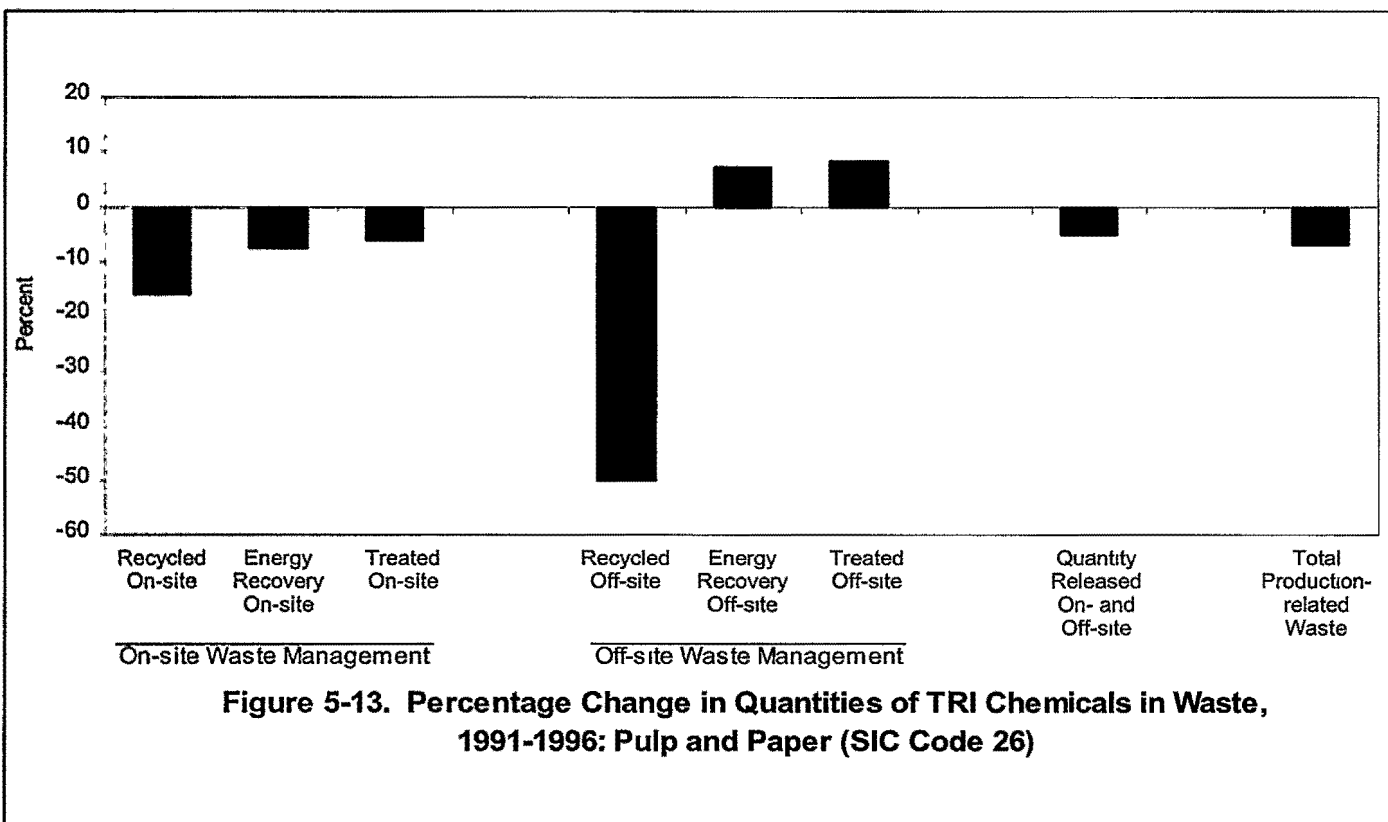


Table 5-17. TRI Waste Management Data, 1991, 1994-1996: Pulp and Paper, SIC Code 26

Waste Management Activity	1991 Pounds	1994 Pounds	1995 Pounds	1996 Pounds
<u>On-site Waste Management</u>				
Recycled On-site	121,418,915	114,052,368	102,008,012	101,993,861
Energy Recovery On-site	196,378,970	208,119,465	192,136,378	181,656,398
Treated On-site	845,365,139	813,613,851	781,472,942	791,772,336
Total On-site Waste Management	1,163,163,024	1,135,785,684	1,075,617,332	1,075,422,595
<u>Off-site Waste Management</u>				
Recycled Off-site	4,691,290	2,978,238	4,980,588	2,333,824
Energy Recovery Off-site	6,956,626	8,912,570	8,202,107	7,467,239
Treated Off-site	43,833,328	49,365,428	49,859,053	47,442,115
Total Off-site Waste Management	55,481,244	61,256,236	63,041,748	57,243,178
Quantity Released On- and Off-site	182,519,932	193,831,111	178,375,530	173,040,872
Total Production-related Waste	1,401,164,200	1,390,873,031	1,317,034,610	1,305,706,645
Non- Production-related Waste	119,867	72,923	10,227	33,929
Waste Management Activity	Change 1994-1995 Percent	Change 1995-1996 Percent	Change 1991-1996 Percent	
<u>On-site Waste Management</u>				
Recycled On-site	-10.6	-0.0	-16.0	
Energy Recovery On-site	-7.7	-5.5	-7.5	
Treated On-site	-4.0	1.3	-6.3	
Total On-site Waste Management	-5.3	-0.0	-7.5	
<u>Off-site Waste Management</u>				
Recycled Off-site	67.2	-53.1	-50.3	
Energy Recovery Off-site	-8.0	-9.0	7.3	
Treated Off-site	1.0	-4.8	8.2	
Total Off-site Waste Management	2.9	-9.2	3.2	
Quantity Released On- and Off-site	-8.0	-3.0	-5.2	
Total Production-related Waste	-5.3	-0.9	-6.8	
Non- Production-related Waste	-86.0	231.8	-71.7	

Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated.





**Figure 5-13. Percentage Change in Quantities of TRI Chemicals in Waste, 1991-1996: Pulp and Paper (SIC Code 26)**

Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated

facility's total increase in production-related waste was 19.1 million pounds. As noted above, this facility also reported a 3.3-million-pound *decrease* in on- and off-site *releases* of methanol.

Some of the largest increases and decreases in production-related waste at pulp and paper facilities resulted in part from the sector's preparation for finalization of the "Cluster Rule," which occurred November 14, 1997. The Cluster Rule combined regulations from the Clean Air and Clean Water Acts. It set air standards (National Emission Standards for Hazardous Air Pollutants, NESHAPs) and effluent guidelines for pulp and paper production. One part of the rule calls for the phase-out of chlorine as a paper-bleaching agent. Substituting chlorine dioxide for chlorine in this

process is associated with substantial increases in chlorine dioxide and decreases in chlorine as components of production-related waste. Methanol is used in chlorine dioxide generation, and consequently, some facilities that produce chlorine dioxide on-site have reported increases of methanol in production-related waste.

Chlorine dioxide increased 15.6 million pounds between 1991 and 1996 at the facility ranked second for increases, the James River Paper Company in Clatskanie, Oregon (multiple codes 2611 and 2621), which had a net increase of 17.9 million pounds. The increase in chlorine dioxide was reported as on-site treatment. This facility also reported a 5.2-million-pound increase in methanol (in on-site energy recovery). Chlorine dioxide has



replaced chlorine as a bleaching agent at the facility.

The third-ranked facility for increases (14.7 million pounds) is Georgia-Pacific in Ashdown, Arkansas (SIC code 2611). Production at this facility has nearly doubled, resulting in an increased amount of methanol generated during the pulping and bleaching process. Consequently, on-site treatment of methanol grew by 13.4 million pounds.

Fourth-ranked Rayonier Specialty Pulp of Jesup, Georgia (SIC code 2611), credited most of its increase in production-related waste (14.6 million pounds) to an improved method of estimating methanol in waste. The increase for methanol was 17.3 million pounds; the chemical is primarily treated on-site.

Georgia-Pacific Paper Operations in Crossett, Arkansas (SIC code 2611 in 1991 and multiple codes 2611 and 2621 in 1996), ranked fifth in increases. The facility has substituted chlorine dioxide for chlorine as a bleaching agent and uses methanol in chlorine dioxide generation. The facility notes that some of the increase in on-site treatment of methanol may be due to this process change. Its overall increase was 9.5 million pounds, and the increase for methanol was 9.1 million pounds.

Methanol and chlorine accounted for the majority of large decreases in production-related waste at pulp and paper facilities. Boise Cascade Corporation, De Ridder, Louisiana (multiple codes 2611 and 2621), reported 21.1 million pounds less chlorine over the comparison years (1991-1996). The facility's overall decrease was 26.4 million pounds, ranking it first. Rayonier Inc., Port Angeles, Washington (SIC code 2611), ranked second in decreases with a net 17.5 million pounds. Chlorine in production-related waste decreased 16.4 million pounds at this facility, which has subsequently closed (February 1997). Decreases at the Boise Cascade and Rayonier facilities were also in on-site treatment.

Stone Container Corporation in Panama City, Florida (multiple codes 2611 and 2621), ranked third in decreases of production-related waste with a net 15.8-million-pound reduction. The facility reported a 16.2-million-pound decrease in methanol due to improved estimation methods and a slight decrease in production from 1991 to 1996. U.S. Alliance Coosa Pines in Coosa Pines, Alabama (multiple codes 2611 and 2621), reported a decrease in on-site treatment of methanol of 11.9 million pounds. This decrease is also attributed to improved estimation methods. The fourth-ranked Coosa Pines facility had an overall decrease of 12.7 million pounds.

### **Other Apparent Increases and Decreases in Production-related Waste, 1991-1996**

In the TRI database, there are other facilities with large apparent increases and decreases, which have been identified as reporting errors or plant closures. Because these are errors or plant closures and not actual changes in the data, these facilities are not discussed in detail here. There is one such pulp and paper facility:

Champion International Corporation,  
Courtland, Alabama, decrease of 43.3  
million pounds, reporting error.

### **Facilities Contacted for Explanations (alphabetical by facility):**

3M, Knoxville, Iowa: Harlan Petty, March 11, 1998 (explanation provided)

3M, St. Paul, Minnesota: Ade Babatunde, March 11, 1998 (explanation provided)

Boise Cascade Corp., De Ridder, Louisiana (no explanation provided)

Champion International Corp., Courtland, Alabama: Sandra McGee, March 24, 1998 (explanation provided)

Georgia-Pacific Paper Operations, Crossett, Arkansas: Scott Bailey, March 9, 1998 (explanation provided)



Georgia-Pacific, Ashdown, Arkansas: Bill Fischer, March 9, 1998 (explanation provided)

Inland Eastex, Evadale, Texas: Bill Martin, March 11, 1998 (explanation provided)

International Paper Company, Mansfield, Louisiana: Jay Wilson, March 9, 1998 (explanation provided)

International Paper, Pineville, Louisiana: Brent Croom, March 9, 1998 (explanation provided)

International Paper, Georgetown, South Carolina: Owen Parker, March 9, 1998 (explanation provided)

James River Paper, Clatskanie, Oregon: Daniel Radonski, March 9 1998 (explanation provided)

Mead Coated Board, Cottonton, Alabama: Robert Swint, March 9, 1998 (explanation provided)

Rayonier Specialty Pulp, Jesup, Georgia: Gerald DeWitt, March 9, 1998 (explanation provided)

Rayonier Inc., Port Angeles, Washington (no explanation provided)

Simpson Paper, Eureka, California: Fritz Graff, March 10, 1998 (explanation provided)

Stone Container Corporation, Panama City, Florida: David Riley March 9, 1998 (explanation provided)

U.S. Alliance Coosa Pines, Coosa Pines, Alabama: Bob Wilson, March 9, 1998 (explanation provided)

Westvaco Corporation, Luke, Maryland: George Shoemaker, March 10, 1998 (explanation provided)

Weyerhaeuser Company, Valliant, Oklahoma (no explanation provided)

### Sources

Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987: Standard Industrial Classification (SIC) codes and industry descriptions.

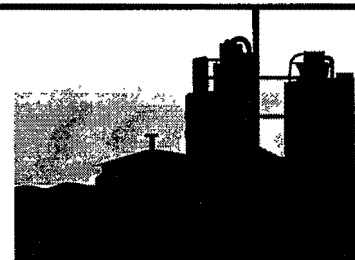
U.S. *Industry & Trade Outlook '98*, DRI/McGraw Hill, Standard & Poor's, and U.S. Department of Commerce, International Trade Administration, 1998: economic analyses, also provides some information on environment and industrial processes for selected industries.

U.S. Census Bureau, *1996 Annual Survey of Manufactures: Statistics for Industry Groups and Industries*, M96(AS)-1, February 1998 <<http://www.census.gov/prod/www/titles.html#mm>>: value of shipments and employment. Supplemental data from U.S. Census Bureau <<http://www.census.gov>> for some industries.

U.S. Environmental Protection Agency, Office of Enforcement and Compliance Assurance, Office of Compliance, *Profile of the Pulp and Paper Industry*, Sector Notebook Project, EPA/310-R-95-015, September 1995 <<http://es.epa.gov/occa/sector/index.html>>: industry processes and technologies, pollutant sources, and selected economic data.

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## Chapter 6



# ***Toxics Release Inventory Data for Chemical Manufacturing (SIC Code 28)***

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## **A Look at the Chemicals and Allied Products Industry (SIC Code 28)**

The chemical manufacturing industry, SIC code 28, primarily produces chemicals or manufactures products largely by chemical processes. Products fall into three general classes:

- ◆ Basic chemicals, such as acids, alkalies, salts, and organic chemicals;
- ◆ Chemical products to be used in further manufacture, such as synthetic fibers, plastics materials, dry colors, and pigments; and
- ◆ Finished chemical products that will either be consumed (such as drugs, cosmetics, and soaps) or used as materials or supplies in other industries (such as paints, fertilizers, and explosives).

Standard Industrial Classification (SIC) codes, listed in Box 6-1, distinguish eight major categories for this sector. In TRI, SIC codes are given as

reported by the facilities; these may differ from information in economic and other data collections.

The value of shipments for products from the chemical manufacturing sector was \$367.44 billion in 1996 and \$361.16 billion in 1995 (in current dollars). This sector employed 824,400 in 1996. Since 1989, production in the chemical manufacturing sector has risen moderately, 14.4% compared to 17.6% for manufacturing as a whole (see Chapter 4, Table 4-10).

The chemical industry is the United States' largest manufacturing sector, comprising more than 10% of U.S. gross domestic product (GDP) from manufacturing (and 2% of total GDP). It is also one of the largest exporters; exports grew from a little over 10% of product shipments in 1983 to 17% in 1995. Chemical production has become increasingly globalized, conducting both production and research and development internationally. Foreign investment in U.S. plants and ownership by U.S. companies of production facilities worldwide also make trade increasingly important for the economic performance of the industry. More than a third (estimated 35% to 37%) of U.S. production facilities are foreign-owned. At the same time, the United States stands as the world's largest consumer of chemicals, \$318 billion worth in 1995. (This analysis excludes the manufacture of plastics



**Box 6-1. SIC Code 28, Chemicals and Allied Products: Codes and Classifications**

SIC Code	Industry Descriptions
<b>281 Industrial Inorganic Chemicals</b>	
2812 Alkalies and Chlorine	Manufacture of alkalies and chlorine.
2813 Industrial Gases	Manufacture of industrial gases (including organic) for sale in compressed, liquid, and solid forms
2816 Inorganic Pigments	Manufacture of inorganic pigments, including black pigments (except carbon black), white pigments, and color pigments.
2819 Industrial Inorganic Chemicals, nec*	Manufacture of miscellaneous industrial inorganic chemicals [More than 175 are listed ]
<b>282 Plastics Materials and Synthetic Resins, Synthetic Rubber, Cellulosic and Other Manmade Fibers, Except Glass</b>	
2821 Plastics Materials, Synthetic Resins, and Nonvulcanizable Elastomers	Manufacture of synthetic resins, plastics materials, and nonvulcanizable elastomers, including cellulose plastics materials, phenolic and other tar acid resins, urea and melamine resins, vinyl resins, styrene resins, alkyd resins, acrylic resins, polyethylene resins, polypropylene resins; rosin modified resins, and others
2822 Synthetic Rubber (Vulcanizable Elastomers)	Manufacture of synthetic rubber by polymerization or copolymerization Elastomers include copolymers of butadiene and styrene, or butadiene and acrylonitrile, polybutadienes, chloroprene rubbers, and isobutylene-isoprene copolymers
2823 Cellulosic Manmade Fibers	Manufacture of cellulosic fibers in the form of monofilament, yarn, staple, or tow suitable for further manufacture on spindles, looms, knitting machines, or other textile processing equipment
2824 Manmade Organic Fibers, Except Cellulosic	Manufacture of manmade organic fibers, except cellulosic, in the form of monofilament, yarn, staple, or tow suitable for further manufacture on spindles, looms, knitting machines, or other textile processing equipment
<b>283 Drugs</b>	
2833 Medicinal Chemicals and Botanical Products	Manufacture of bulk organic and inorganic medicinal chemicals and their derivatives. Processing (grading, grinding, and milling) of bulk botanical drugs and herbs.
2834 Pharmaceutical Preparations	Manufacture, fabrication, or processing of drugs in pharmaceutical preparations for human or veterinary use
2835 In Vitro and In Vivo Diagnostic Substances	Manufacture of in vitro and in vivo diagnostic substances—chemical, biological, or radioactive substances used in diagnosing or monitoring human or veterinary health by identifying and measuring normal or abnormal constituents of body fluids or tissues
2836 Biological Products, Except Diagnostic Substances	Production of bacterial and virus vaccines, toxoids, and analogous products (such as allergenic extracts), serums, plasmas, and other blood derivatives for human or veterinary use, other than in vitro and in vivo diagnostic substances Includes production of microbiological products for other uses
<b>284 Soap, Detergents, and Cleaning Preparations; Perfumes, Cosmetics, and Other Toilet Preparations</b>	
2841 Soap and Other Detergents, Except Specialty Cleaners	Manufacture of soap, synthetic organic detergents, inorganic alkaline detergents, or any combination thereof Production of crude and refined glycerin from vegetable and animal fats and oils
2842 Specialty Cleaning, Polishing, and Sanitation Preparations	Manufacture of furniture, metal, and other polishes, waxes and dressings for fabricated leather and other materials, household, institutional, and industrial plant disinfectants, nonpersonal deodorants; drycleaning preparations, household bleaches; and other sanitation preparations

\* nec: not elsewhere classified.



## Box 6-1. SIC Code 28, Chemicals and Allied Products: Codes and Classifications, Continued

SIC Code	Industry Descriptions
2843 Surface Active Agents, Finishing Agents, Sulfonated Oils and Assistants	Production of surface active preparations for use as wetting agents, emulsifiers, and penetrants Production of sulfonated oils and fats and related products.
2844 Perfumes, Cosmetics, and Other Toilet Preparations	Manufacture of perfumes (natural and synthetic), cosmetics, and other toilet preparations Blending and compounding of perfume bases
<b>285 Paints, Varnishes, Lacquers, Enamels, and Allied Products</b>	
2851 Paints, Varnishes, Lacquers, Enamels, and Allied Products	Manufacture of paints (in paste and ready-mixed forms), varnishes, lacquers, enamels and shellac; putties, wood fillers, and sealers, paint and varnish removers; paint brush cleaners; and allied paint products
<b>286 Industrial Organic Chemicals</b>	
2861 Gum and Wood Chemicals	Manufacture of hardwood and softwood distillation products, wood and gum naval stores, charcoal, natural dyestuffs, and natural tanning materials.
2865 Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments	Manufacture of cyclic organic crudes and intermediates, and organic dyes and pigments. Includes aromatic chemicals (such as benzene, toluene, xylenes, naphthalene), synthetic organic dyes, and synthetic organic pigments.
2869 Industrial Organic Chemicals, nec*	Manufacture of miscellaneous industrial organic chemicals.
<b>287 Agricultural Chemicals</b>	
2873 Nitrogenous Fertilizers	Manufacture of nitrogenous fertilizer materials or mixed fertilizers from nitrogenous materials.
2874 Phosphatic Fertilizers	Manufacture of phosphatic fertilizer materials or mixed fertilizers from phosphatic materials.
2875 Fertilizers, Mixing Only	Mixing fertilizers from purchased fertilizer materials.
2879 Pesticides and Agricultural Chemicals, nec*	Formulation and preparation of ready-to-use agricultural and household pest control chemicals, including insecticides, fungicides, and herbicides, from technical chemicals or concentrates Production of concentrates for further processing before use as agricultural pesticides.
<b>289 Miscellaneous Chemical Products</b>	
2891 Adhesives and Sealants	Manufacture of industrial and household adhesives, glues, caulking compounds, sealants, linoleum, tile, and rubber cements.
2892 Explosives	Manufacture of explosives
2893 Printing Ink	Manufacture of printing ink, including gravure ink, screen process ink, and lithographic ink
2895 Carbon Black	Manufacture of carbon black (channel and furnace black)
2899 Chemicals and Chemical Preparations, nec*	Manufacture of miscellaneous chemical preparations

Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual, 1987* Standard Industrial Classification (SIC) codes and industry descriptions

\* nec: not elsewhere classified.



materials and resins, SIC code 282, but similar trends pertain in that industry as well.)

The biggest consumers of the chemical manufacturing sector's output are the producers of motor vehicles (and equipment) and of metal. Other large customers are the agriculture, health care, construction materials, and electronics sectors, followed by the chemical industry itself—purchasing chemical products for use in further manufacture. Plastics end users include producers of packaging, construction, motor vehicles, and consumer durables.

## Industrial Organic Chemicals

Of the industry groups within the chemical manufacturing sector, industrial organics manufacturing—alone or in combination with production of plastics materials—represents the largest source of releases and other waste management of chemicals reported to TRI, as evident in the analyses presented later in this chapter. Economically, production of industrial organic chemicals (SIC code 286) is the second largest segment of the chemical manufacturing sector, after drugs and pharmaceuticals (SIC code 283). Industrial organics manufacturers shipped \$75.67 billion in products in 1996, about 20% of the sector's total, while employing 125,900, which was 15% of the sector's employment. Production of organics and of plastics is growing in Asian countries (such as China and South Korea) and in the Middle East (Saudi Arabia, for example). Mexico, South America, and Asia, however, offer expanding markets for U.S. products. A significant impact on trade in organics has also been attributed to implementation of the North American Free Trade Agreement (NAFTA); nearly 20% of U.S. organics exports are shipped to Canada and Mexico.

Most organic chemical products are primary petrochemicals (chemicals derived from petroleum or from natural gas). Most are used as intermediates in the production of other chemicals. Chemical

products include aromatics, such as benzene, toluene, and xylenes; solvents such as methanol; chlorinated solvents, such as carbon tetrachloride and perchloroethylene; cyclic intermediates such as cumene, cyclohexane, and styrene; and numerous others. Organic chemicals that represent finished products include dyes and organic pigments, and pesticides and other non-fertilizer agricultural products.

The industry uses and produces large numbers of chemicals in large amounts. Typically, multiple feedstocks ("building blocks") are combined in a series of reaction steps to produce both intermediates and end-products. Most reactions occur at high temperatures, involve metals as catalysts, and include one or two additional reaction components. A second operation separates the desired product from by-products, by settling, distillation, refrigeration, or other separation techniques. A third operation may further process the final product into a saleable form, by spray drying or pelletizing, for example. By-products may also be sold, and they may be managed as waste in some years and sold in others, depending on market economics. Plastics, drugs, soaps and detergents, paints, and agricultural chemicals are typical end-products manufactured from industrial organics.

The abundance of chemicals, especially petrochemicals, and the diversity of processes means that no one pattern of environmental releases or other management of chemicals in waste—or pollution prevention techniques—characterizes the industrial organics industry or even an individual facility. Feedstocks, processes, equipment, and maintenance practices determine a facility's releases, and these are seldom static. The Chemical Manufacturers' Association has listed some 130 pollution prevention opportunities to be found in process, product, or equipment modifications (*Designing Pollution Prevention into the Process—Research, Development and Engineering*, reproduced in *Profile of the Organic Chemical*



*Industry*, EPA Sector Notebook Project, 57-71; see Sources).

## Plastics Materials and Synthetics

Producers of plastics materials and synthetics (SIC code 282) were the third largest economic segment of the chemical manufacturing sector, with \$59.57 billion in shipments and 115,100 employees in 1996. These represent approximately 15% of the sector's totals. As with chemical manufacturing overall, the plastics materials industry has become increasingly globalized; production has been shifting into the developing regions, drawn by their rapidly expanding markets. At the same time, manufacture in the more developed countries has been moving toward specialty and higher-value-added products.

Plastics resins are made from organic chemicals and, as noted in the analyses of TRI data in this chapter, a substantial portion of TRI forms report SIC codes in both plastics materials and resins (SIC code 2821) and miscellaneous industrial organics (SIC code 2869). (Products manufactured from these resins are classified in SIC code 30, rubber and miscellaneous plastics products.) There are two categories of resins: thermoplastics that can be reheated and remolded repeatedly and thermosets that can be heated and molded once. Thermoplastics, which include polyethylene, polypropylene, polyvinyl chloride, and polystyrene, dominate, accounting for 87% of the plastics market in 1996. Polymerization—a process of reactions that bond small repeating molecules into large molecules—is central to the production of plastics materials. Operations involved in forming polymers include purifying the reactants, polymerization itself (application of catalysts, heat, and pressure), separation and recovery of the polymer from the reaction mass, and extrusion of the polymer into pellets. Potential releases from production of plastics materials and resins include volatile organic compounds (VOCs), unreacted monomers, off-spec or contaminated polymers, and wastewater from equipment cleaning.

## Drugs and Pharmaceuticals

In 1996, drugs and pharmaceuticals (SIC code 283) accounted for the largest share—about one quarter—of the sector's value of shipments (\$86.53 billion) and employment (213,200). Pharmaceutical production differs from much of the rest of the chemical manufacturing sector. The industry manufactures, in bulk, pharmaceutical intermediates and active ingredients, which are further processed into finished products. Often, small quantities of product must be extracted from large volumes of raw materials. Batch processing<sup>1</sup> is far more common in manufacturing drug products than in chemical manufacturing as a whole. Chemical synthesis, involving many intermediate stages and reactions, is the most common process in the manufacture of bulk pharmaceuticals. Pharmaceutical standards set more stringent limits for some operations than may apply elsewhere in chemical manufacturing—on cleaning equipment between batches, for example. Similarly, solvents used in pharmaceutical manufacture are not reused, to maintain standards for purity.

## 1996 TRI Data for Chemical Manufacturing

Table 6-1 summarizes TRI data for the chemical manufacturing sector for 1996. Chemical manufacturers submitted 21,098 forms, out of 71,381 total for TRI in 1996. Of the forms submitted in chemical manufacturing, 13.3% (2,810) were Form A certification statements, certifying that a facility's total annual reportable amount of a TRI chemical was less than 500

<sup>1</sup> Batch processing indicates that products are manufactured in discrete batches, this means generally that inputs are first put into the system, processing is conducted while the system is closed, and products are extracted when the process ends. In contrast, continuous processing indicates a system where inputs are continuously added, processes are ongoing, and products are continuously extracted. In batch processing, releases are more likely to occur at the beginning and end of the process, when the system is opened to add inputs or remove product. Cleaning the equipment between batches also often generates releases of toxic chemicals.





Table 6-1. Summary of TRI Information by 4-digit SIC Code, 1996: Chemical Manufacturing, SIC Code 28

Total On- and Off-site Releases Rank	Total Production- related Waste Rank	SIC Code	Industry	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds
22	21	2812	Alkalies & Chlorine	20	63	6	640,550	8,892	649,442
21	24	2813	Industrial Gases	67	122	18	819,463	0	819,463
8	11	2816	Inorganic Pigments	39	176	23	14,455,853	4,441,778	18,897,631
4	5	2819	Industrial Inorganic Chemicals, nec*	262	828	69	36,488,285	2,992,232	39,480,517
5	3	2821	Plastics Materials & Resins	311	1,813	180	29,039,345	1,110,634	30,149,979
12	12	2822	Synthetic Rubber	21	123	10	9,862,729	147,079	10,009,808
7	18	2823	Cellulosic Manmade Fibers	3	12	0	21,117,760	0	21,117,760
25	7	2824	Organic Fibers, Noncellulosic	10	34	9	491,968	44,140	536,108
16	14	2833	Medicinals & Botanicals	37	180	13	2,806,345	31,067	2,837,412
10	10	2834	Pharmaceutical Preparations	111	340	18	12,889,489	178,440	13,067,929
31	29	2835	Diagnostic Substances	14	24	5	16,878	1,100	17,978
30	31	2836	Biological Products Exc. Diagnostic	8	13	1	33,818	0	33,818
28	27	2841	Soap & Other Detergents	84	231	65	58,168	3,074	61,242
26	26	2842	Polishes & Sanitation Goods	161	423	128	240,325	15,400	255,725
24	23	2843	Surface Active Agents	55	259	81	622,261	5,681	627,942
27	30	2844	Toilet Preparations	40	68	17	60,532	62,239	122,771
13	13	2851	Paints & Allied Products	566	2,974	317	8,449,510	608,480	9,057,990
14	20	2861	Gum & Wood Chemicals	15	41	5	8,957,557	500	8,958,057
11	9	2865	Cyclic Crudes & Intermediates	91	667	111	9,313,598	1,318,042	10,631,640
2	2	2869	Industrial Organic Chemicals, nec*	334	2,601	264	126,108,529	8,854,506	134,963,035
3	8	2873	Nitrogenous Fertilizers	45	234	10	46,419,739	334,206	46,753,945
6	4	2874	Phosphatic Fertilizers	28	105	7	29,490,014	1,010	29,491,024
19	25	2875	Fertilizers, Mixing Only	64	213	74	1,678,603	2,000	1,680,603
18	6	2879	Agricultural Chemicals, nec*	111	759	205	2,082,246	306,983	2,389,229
17	19	2891	Adhesives & Sealants	188	615	115	2,246,144	163,331	2,409,475
20	17	2892	Explosives	32	79	7	1,470,670	755	1,471,425
23	22	2893	Printing Ink	115	254	45	632,091	1,689	633,780
9	16	2895	Carbon Black	19	79	7	16,855,773	755	16,856,528
15	15	2899	Chemical Preparations, nec*	290	1,186	344	2,679,848	2,311,623	4,991,471
1	1		Multiple within SIC 28	700	6,542	643	368,254,227	7,896,176	376,150,403
29	28		Invalid SIC Code within SIC 28	14	40	13	53,782	251	54,033
			Total for SIC Code 28	3,855	21,098	2,810	754,336,100	30,842,063	785,178,163

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site for disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site for disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except. Non-production-related Waste (remedial/catastrophic incidents). Facilities/forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category  
\*nec: not elsewhere classified.

pounds for the year and that the facility did not manufacture, process, or otherwise use more than 1 million pounds. (The Form A certification statement is explained in Chapter 1.)

Forms that reported more than one four-digit SIC code within SIC code 28 are the largest group in chemical manufacturing. A significant portion of the chemical manufacturing sector conducts more than one economic activity, as designated in the Standard Industrial Classification (SIC) system. Many facilities in this sector manufacture products

classified in separate but similar categories. For example, some facilities manufacture industrial inorganic chemicals and inorganic fertilizers. Others produce both industrial organic chemicals and organic dyes and pigments. This occurs to such a large degree in chemical manufacturing that the multiple-codes category is overall the largest segment of the sector. (Box 4-2 in Chapter 4 further explains reporting of multiple SIC codes and its affect on the analyses presented in the TRI data release.)



Table 6-1. Summary of TRI Information by 4-digit SIC Code, 1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Code	Industry	Total Other On-site Waste Management Pounds	Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
2812	Alkalies & Chlorine	10,209,572	1,640,186	12,496,408	144
2813	Industrial Gases	2,041,818	348,439	3,098,233	9,089
2816	Inorganic Pigments	121,820,104	2,381,438	143,209,221	575
2819	Industrial Inorganic Chemicals, nec*	242,263,281	18,574,376	298,761,439	146,108
2821	Plastics Materials & Resins	645,309,591	130,341,411	806,534,910	106,630
2822	Synthetic Rubber	85,197,178	14,381,774	115,581,021	28,616
2823	Cellulosic Manmade Fibers	7,020,000	835	28,083,000	0
2824	Organic Fibers, Noncellulosic	225,655,928	4,521,488	230,701,490	0
2833	Medicinals & Botanicals	33,782,868	27,056,801	63,749,829	78
2834	Pharmaceutical Preparations	64,272,053	79,918,722	158,265,118	39,991
2835	Diagnostic Substances	122,000	307,458	477,866	0
2836	Biological Products Exc Diagnostic	173,098	117,651	309,357	0
2841	Soap & Other Detergents	351,788	532,832	919,277	100
2842	Polishes & Sanitation Goods	685,552	371,348	1,281,309	13,192
2843	Surface Active Agents	2,471,936	2,390,172	4,668,368	6,735
2844	Toilet Preparations	39,342	290,789	469,340	0
2851	Paints & Allied Products	45,195,376	54,484,497	109,809,047	10,206
2861	Gum & Wood Chemicals	3,647,269	87,795	12,705,271	1,210
2865	Cyclic Crudes & Intermediates	125,087,026	29,451,711	165,050,442	22,971
2869	Industrial Organic Chemicals, nec*	1,850,422,083	137,545,758	2,131,447,740	3,351,020
2873	Nitrogenous Fertilizers	142,604,266	1,054,819	189,839,104	583,329
2874	Phosphatic Fertilizers	321,225,953	30	350,438,184	283,328
2875	Fertilizers, Mixing Only	115,846	155,994	1,833,438	0
2879	Agricultural Chemicals, nec*	264,412,207	12,718,434	279,005,337	48,114
2891	Adhesives & Sealants	8,073,622	7,176,760	16,804,457	1,958
2892	Explosives	36,190,072	24,308	37,693,600	1,100
2893	Printing Ink	2,512,819	2,715,638	5,782,633	105,730
2895	Carbon Black	29,074,757	40	45,929,245	0
2899	Chemical Preparations, nec*	40,128,008	6,409,652	50,421,374	29,918
	Multiple within SIC 28	4,024,088,800	363,308,016	4,766,348,743	4,627,743
	Invalid SIC Code within SIC	9,514	547,709	675,226	10
	Total for SIC Code 28	8,334,203,727	898,856,881	10,032,390,027	9,417,895

Note On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site for disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site for disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents) Facilities/forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category

\*nec not elsewhere classified

In 1996, there were 6,542 forms that reported more than one SIC code within SIC code 28. This was 31.0% of all forms in the chemical manufacturing sector. [This multiple-codes category had more than twice the number of forms submitted than the industry with the second largest number of forms, which was paints (SIC code 2851, with 2,974 forms). Third was miscellaneous industrial organic chemicals (SIC code 2869) with 2,601.]

As shown in Table 6-1, the multiple-codes group ranked first in the chemical manufacturing sector

for total on- and off-site releases and for total production-related waste. On- and off-site releases reported on these forms totaled 376.2 million pounds, or 47.9% of the sector's total. Multiple-code reporting of production-related waste totaled 4.77 billion pounds, or 47.5%. Forms with multiple SIC codes also reported the largest amounts of on-site waste management (4.02 billion pounds) and transfers off-site for further waste management (363.3 million pounds). Only in off-site releases (transfers off-site to disposal) did multiple-codes forms account for the second largest amount (7.9



Table 6-2. Multiple SIC Codes, 1996: Chemical Manufacturing, SIC Code 28

SIC Code Combinations						Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production- related Waste Pounds	Non- Production- related Waste Pounds
2812	2813	2819	2821	2869	2891	133	9	813,229	145,360	958,589	92,389,377	5,073,057	99,260,4762	2,922
2812	2813	2842				190	10	1,627,737	5,294	1,633,031	177,353,033	117,918	179,095,068	3,722
2812	2813	2869				2	0	44,442	0	44,442	7,907	7,500	58,692	1,161
2812	2816	2869				9	0	22,425	4,117	26,542	632,925	20,042	679,492	0
2812	2819					190	6	9,504,907	235,743	9,740,650	257,076,151	98,411	266,929,658	30,759
2812	2819	2821	2865	2869		6	1	2,597	0	2,597	1,073,300	226,269	1,302,176	0
2812	2819	2869				118	11	2,162,784	13,392	2,176,176	7,782,395	11,188,642	21,291,152	1,034
2812	2821	2869				12	1	31,262	0	31,262	3,251,154	18,487	3,300,937	22
2812	2869					7	0	1,118	15,017	16,135	8,186	3,580	27,652	0
2813	2819	2865	2869	2899		5	0	2,038	0	2,038	113,660	90	115,788	0
2813	2819	2869	2873	2899		27	0	168,561	255,905	424,466	1,027,308	830,955	2,296,495	541
2816	2819					39	2	11,610,586	158,518	11,769,104	124,145	265,360	12,124,550	0
2816	2821	2899				2	0	5,313	0	5,313	0	1,691	7,004	0
2816	2869					42	5	522,326	1,625	523,951	791,768	272,709	2,076,644	3,550
2819	2821	2834	2869	2879		14	1	5,975	70	6,045	1,486,774	9,661	1,501,922	287
2819	2821	2865	2869			1	0	140	0	140	0	0	140	0
2819	2821	2869				6	0	3,213	2,388	5,601	169,600	78,150	252,154	0
2819	2833	2869				9	0	37,161	0	37,161	43,985	1,135,795	1,216,023	0
2819	2834	2869	2873	2879		6	0	35	0	35	0	1,572	15,607	0
2819	2841	2843				41	3	119,404	520,149	639,553	36,480	301,538	548,172	427,993
2819	2843	2869	2899			41	8	1,247,311	16,534	1,263,845	916,240	251,059	2,426,126	0
2819	2865	2869				101	7	5,356,330	321,689	5,678,019	2,768,553	2,339,643	11,118,359	1,874
2819	2865	2869	2879			18	0	195,012	236,665	431,677	1,667,386	292,736	2,388,348	0
2819	2869					176	14	4,450,006	676,876	5,126,882	26,282,121	1,920,444	33,364,811	12,229
2819	2869	2879				54	4	884,557	264,041	1,148,598	91,541,968	17,598,031	110,030,804	16,436
2819	2869	2879	2899			6	0	111	4,787	4,898	53,227	78,840	137,125	0
2819	2873					194	27	67,432,668	13,811	67,446,479	78,723,236	24,694,588	175,743,068	2,275
2819	2879					6	1	7,452	264,688	272,140	26,370	312,253	610,594	2,469
2819	2879	2869				3	2	0	250	250	130	15	284	0
2819	2892					27	6	21,703	64,058	85,761	24,921	1,564,993	1,567,646	2,961
2821	2822	2869				42	2	680,896	2,704	683,600	30,984,085	1,267,285	32,937,053	202
2821	2823	2865	2869	2893		4	1	920	0	920	3,355	250	4,305	0
2821	2824					19	1	408,856	617	409,473	44,451,583	207	44,865,605	190
2821	2834	2869				38	2	461,560	91,054	552,614	5,078,426	211,982	5,916,950	81
2821	2843	2865	2869			2	0	84,222	0	84,222	779,998	80	864,300	0
2821	2843	2879				3	1	260	0	260	0	15,883	15,893	0
2821	2851					192	25	1,354,187	94,250	1,448,437	59,342,694	3,004,218	63,792,268	37,858
2821	2865	2869	2879			448	37	15,721,687	202,987	15,924,674	213,871,069	10,678,787	239,257,548	157,209
2821	2865	2893				1	0	0	668	668	0	303	971	0
2821	2869					1,194	99	52,941,527	837,784	53,779,311	1,148,337,585	106,212,921	1,305,680,838	3,452,925
2821	2869	2879				7	0	1,335	23,240	24,575	418,000	281,736	727,582	0
2821	2869	2899				4	0	23,007	0	23,007	345,271	52,312	420,590	0
2821	2879					3	0	215	4,350	4,565	0	2,460	13,384	0
2821	2879	2891				10	2	596	0	596	0	666	862	0
2821	2891					52	5	1,077,102	19,948	1,097,050	9,656,850	1,527,729	12,299,164	14,947
2822	2865	2869	2873			127	8	6,973,168	14,449	6,987,617	40,989,604	2,410,838	50,264,145	3,058
2822	2869	2879				3	0	350,024	420	350,444	9,400	17,180	377,024	0

Note: On-site Releases from Section 5 of Form R. Other On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

Table 6-2. Multiple SIC Codes, 1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Code Combinations	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
2824 2869	9	3	36,473	0	36,473	227,039	1,132	264,604	0
2831 2833 2834	44	0	19,914,438	431	19,914,869	33,503,656	3,128,838	56,475,054	1,100
2833									
2834 2836	1	0	255	0	255	0	750	450	
2833 2834 2836 2879	1	0	5	0	5	0	7,005	7,160	0
2833 2869 2879	3	0	10	0	10	31	78	114	5
2833 2879	1	0	4,830	0	4,830	5,700	140	10,640	0
2834 2835 2836	21	2	251,509	7	251,516	8,237,954	3,054,879	11,537,674	527
2834 2836 2879	1	0	0	1	1	15	3,271	3,287	0
2834 2869	27	6	40,143	233	40,376	1,917,817	659,102	2,616,923	0
2834 2879	4	0	1,540	3,258	4,798	5,145	38,500	47,408	96
2834 2892	1	0	0	0	0	4,400	0	4,400	0
2841 2842	91	13	810,243	7,577	817,820	249,811,749	55,446	250,694,343	905
2841 2869 2899	14	2	10,627	3,306	13,933	5,099	766,171	782,754	880
2842 2879 2899	366	73	1,687,620	774,214	2,461,834	9,295,053	8,131,864	19,821,274	21,528
2843 2844	141	9	2,601,870	15,701	2,617,571	39,577,945	252,304	42,623,706	11,152
2851 2891	75	2	3,942,281	212,462	4,154,743	15,665,848	6,257,755	26,070,220	7,344
2861 2899	27	6	284,946	4,032	288,978	19,995,203	1,514,225	21,798,740	16,505
2865 2869	809	58	36,829,362	1,224,458	38,053,820	1,059,752,821	85,425,226	1,183,287,433	233,905
2865 2869 2879	1	0	44	0	44	0	0	44	0
2865 2869 2879 2899	3	0	105,767	504	106,271	171,000	26,378	301,733	780
2865 2873 2879	6	1	7	5,550	5,557	12,600	204,780	222,703	0
2869 2879	72	7	425,227	7,795	433,022	5,164,286	274,013	5,885,326	150
2869 2899	16	1	68,236	664	68,900	463,129	1,119,871	1,650,952	0
2873 2874	10	2	3,091	12,545	15,636	0	265	12,909	0
2873 2879	521	92	104,810,739	276,507	105,087,246	153,224,089	2,916,781	261,713,553	90,217
2875 2879	35	4	19,182	415,386	434,568	1,105,695	177,776	1,679,143	343
2879 2899	608	61	10,045,817	418,097	10,463,914	126,302,306	54,902,600	191,910,747	45,601
Total for SIC Code 28	6,542	643	368,254,227	7,896,176	376,150,403	4,024,088,800	363,308,016	4,766,348,743	4,627,743

Note: On-site Releases from Section 5 of Form R. Other On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except Non-production-related Waste (remedial/catastrophic incidents).

million pounds), behind miscellaneous industrial organic chemicals (SIC code 2869; 8.9 million pounds). This industry (miscellaneous industrial organic chemicals, SIC code 2869) was second in all other categories presented in Table 6-1.

Although drug manufacture constitutes the largest economic activity in this sector, pharmaceutical preparations (SIC code 2834) ranked 10th for both total on- and off-site releases (with 13.1 million pounds) and total production-related waste (with

158.3 million pounds). For transfers off-site for further waste management, however, it ranked fourth (79.9 million pounds).

### Multiple Codes within SIC Code 28

Table 6-2 further examines reporting of multiple SIC codes within SIC code 28. The combination filing the largest number of forms was plastics materials and resins (SIC code 2821) with miscellaneous industrial organics (SIC code 2869).



This combination submitted 1,194 forms and, within the multiple-codes category, accounted for the largest amount of other on-site waste management (1.15 billion pounds), transfers off-site for further waste management (106.2 million pounds), and total production-related waste (1.31 billion pounds). Cyclic organic crudes and intermediates and organic dyes and pigments (SIC code 2865) and miscellaneous industrial organics (SIC code 2869) also reported, in combination, large quantities of on-site waste management (1.06 billion pounds) and production-related waste (1.18 billion pounds). This group also reported the largest off-site releases (transfers to disposal), with 1.2 million pounds. There were 809 forms with this combination.

The multiple-code combination with the largest total on- and off-site releases occurred in agricultural chemical production: nitrogenous fertilizers (SIC code 2873) and pesticides and other agricultural chemicals (SIC code 2879). On- and off-site releases for this combination were 105.1 million pounds.

Miscellaneous industrial organics (SIC code 2869) appeared in 41 of the 74 multiple-codes combinations.

## On- and Off-site Releases

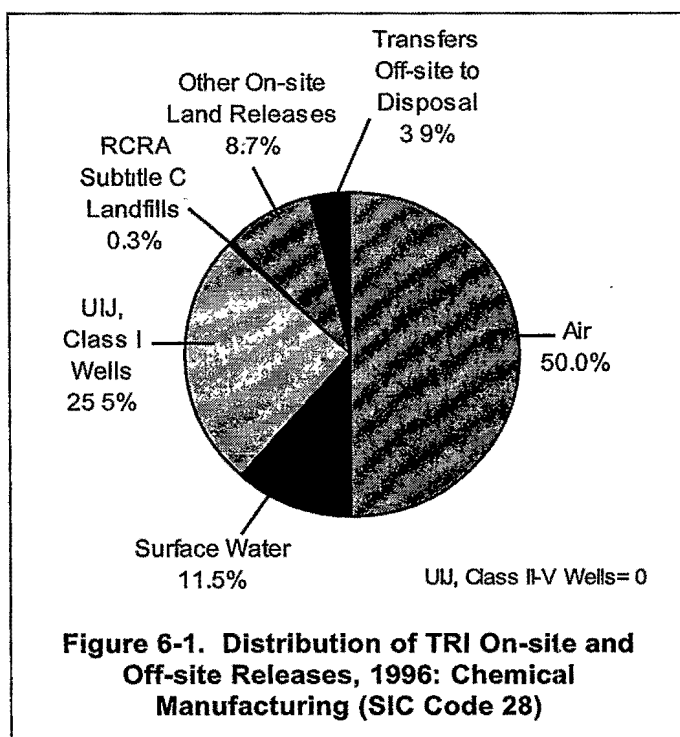
Half (50.0%) of all on- and off-site releases reported in the chemical manufacturing sector were air emissions, 392.4 million pounds out of 785.2 million pounds of total releases (see Table 6-3 and

Table 6-3. TRI On-site and Off-site Releases, 1996: Chemical Manufacturing, SIC Code 28 (in Rank Order)

SIC Code	Industry	Total Air Emissions Pounds	Surface Water Discharges Pounds	On-site Land Releases			Other On-site Land Releases Pounds	Total On-site Releases Pounds	Off-site Releases	Total On- and Off-site Releases Pounds
				Underground Injection Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds			Transfers Off-site to Disposal Pounds	
	Multiple within SIC 28	161,112,769	60,399,711	122,029,684	0	2,572,553	22,139,510	368,254,227	7,896,176	376,150,403
2869	Industrial Organic Chemicals, nec*	44,631,009	15,092,188	65,810,868	2,600	90,034	481,830	126,108,529	8,854,506	134,963,035
2873	Nitrogenous Fertilizers	40,836,139	3,651,272	1,787,075	400	0	144,853	46,419,739	334,206	46,753,945
2819	Industrial Inorganic Chemicals, nec*	10,171,797	2,358,781	0	192,133	16,631	23,748,943	36,488,285	2,992,232	39,480,517
2821	Plastics Materials & Resins	27,354,038	1,657,131	0	0	1,200	26,976	29,039,345	1,110,634	30,149,979
2874	Phosphatic Fertilizers	9,572,419	2,962,896	0	0	0	16,954,699	29,490,014	1,010	29,491,024
2823	Cellulosic Manmade Fibers	20,368,225	105,100	0	0	0	644,435	21,117,760	0	21,117,760
2816	Inorganic Pigments	10,123,521	516,030	561,173	0	0	3,255,129	14,455,853	4,441,778	18,897,631
2895	Carbon Black	16,855,013	760	0	0	0	0	16,855,773	755	16,856,528
2834	Pharmaceutical Preparations	5,491,123	607,654	6,592,625	0	0	198,087	12,889,489	178,440	13,067,929
2865	Cyclic Crudes & Intermediates	5,823,856	741,352	2,679,000	0	0	69,390	9,313,598	1,318,042	10,631,640
2822	Synthetic Rubber	9,537,587	62,303	225,800	0	0	37,039	9,862,729	147,079	10,009,808
2851	Paints & Allied Products	8,415,949	2,562	0	0	1,500	29,499	8,449,510	608,480	9,057,990
2861	Gum & Wood Chemicals	8,956,801	756	0	0	0	0	8,957,557	500	8,958,057
2899	Chemical Preparations, nec*	2,304,856	54,386	0	2,308	717	317,581	2,679,848	2,311,623	4,991,471
2833	Medicinals & Botanicals	1,850,539	952,473	0	0	0	3,333	2,806,345	31,067	2,837,412
2891	Adhesives & Sealants	2,227,570	2	0	0	0	18,572	2,246,144	163,331	2,409,475
2879	Agricultural Chemicals, nec*	1,454,031	39,700	573,228	0	3,760	11,527	2,082,246	306,983	2,389,229
2875	Fertilizers, Mixing Only	1,671,508	3,250	0	0	0	3,845	1,678,603	2,000	1,680,603
2892	Explosives	261,025	1,199,900	0	0	0	9,745	1,470,670	755	1,471,425
2813	Industrial Gases	801,391	5,705	0	0	2,792	9,575	819,463	0	819,463
2812	Alkalies & Chlorine	480,802	184	0	0	6	159,558	640,550	8,892	649,442
2893	Printing Ink	631,490	1	0	0	250	350	632,091	1,689	633,780
2843	Surface Active Agents	600,529	47	21,395	0	0	290	622,261	5,681	627,942
2824	Organic Fibers, Noncellulosic	447,807	5,544	36,605	0	0	2,012	491,968	44,140	536,108
2842	Polishes & Sanitation Goods	238,040	1,025	0	0	250	1,010	240,325	15,400	255,725
2844	Toilet Preparations	55,692	90	0	0	0	4,750	60,532	62,239	122,771
2841	Soap & Other Detergents	54,100	0	0	0	0	4,068	58,168	3,074	61,242
	Invalid SIC Code within SIC 28	53,778	0	0	0	4	0	53,782	251	-54,033
2836	Biological Products Exc. Diagnostic	33,818	0	0	0	0	0	33,818	0	33,818
Total for SIC Code 28		392,417,222	90,420,803	200,317,453	197,441	2,689,697	68,276,606	754,319,222	30,840,963	785,160,185

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers of Form R). Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



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

Figure 6-1). Forms with multiple codes in SIC code 28 reported the largest air emissions, 161.1 million pounds, which was 41.1% of total air emissions from chemical manufacturing.

Underground injection of 200.5 million pounds—99.9% of it into Class I wells—was the second largest release type, representing 25.5% of all releases. Surface water discharges were 90.4 million pounds (11.5% of releases). On-site land releases were 71.0 million pounds—2.7 million pounds to RCRA subtitle C landfills and 68.3 million pounds to other on-site land releases. This made on-site land releases 9.0% of total on- and off-site releases. Off-site releases (transfers off-site to disposal) totaled 30.8 million pounds, or 3.9%. Multiple-codes forms led all release types except, as indicated above, off-site releases.

As discussed in Chapter 4, the chemical manufacturing sector has reported the largest amounts in most categories of TRI reporting,

including most types of on- and off-site releases (see Tables 4-2 through 4-4 in Chapter 4). This is especially true of underground injection, where the 200.3 million pounds reported as injected into Class I wells by chemical manufacturing represented 98.4% of all such injection reported to TRI.<sup>2</sup> (Forms in chemical manufacturing reported 197,000 pounds of injection into Class II-V wells, which represents 26.1% of the national total. Types of underground injection are explained in Chapter 2.)

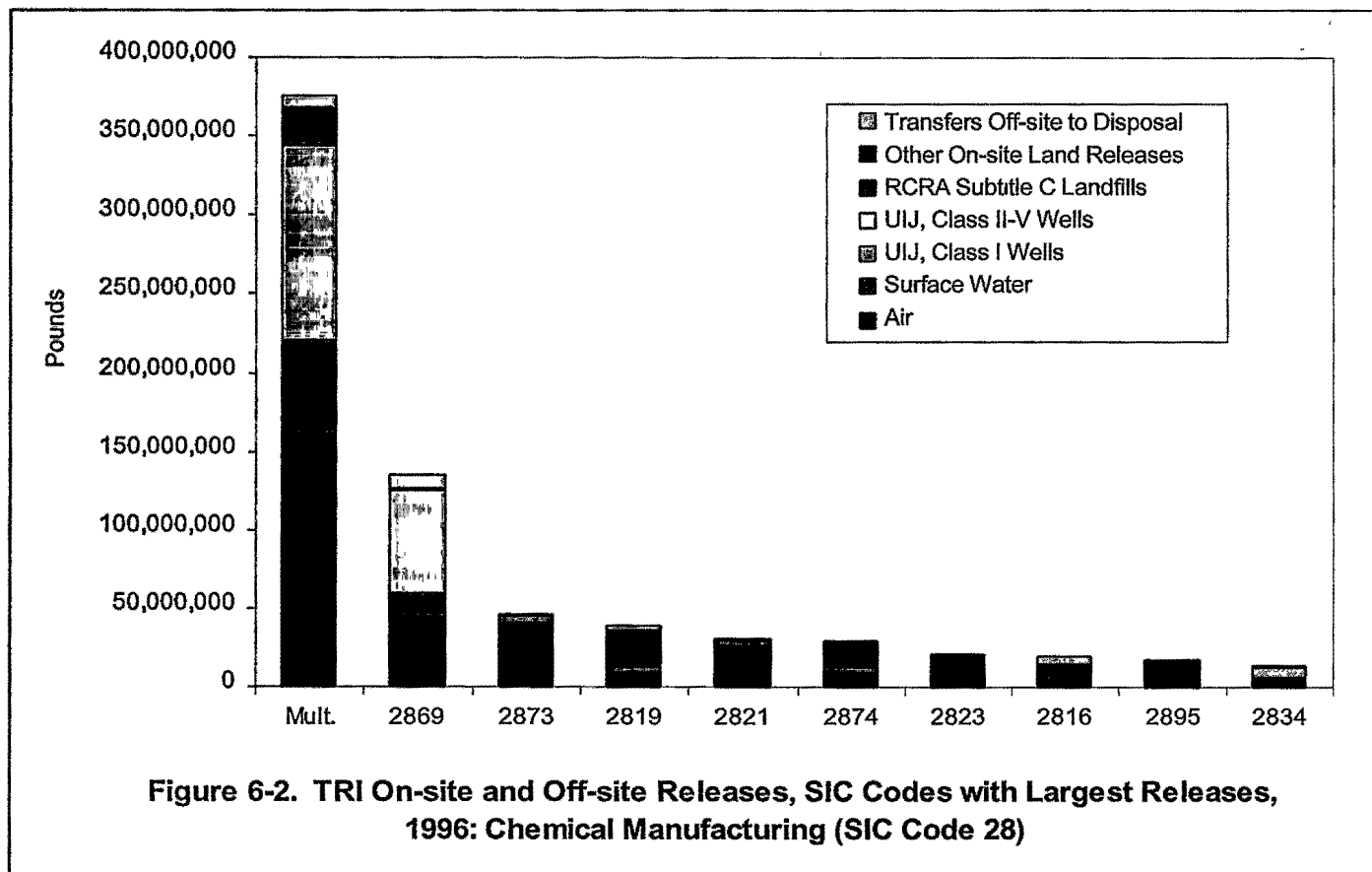
Table 6-3 provides on- and off-site release data for all industries in SIC code 28. Figure 6-2 illustrates the distribution by four-digit SIC code of chemical manufacturing releases.

## Other On-site Waste Management

Recycling was the largest on-site waste management method in chemical manufacturing, with 3.73 billion pounds (44.8%), followed by treatment with 3.25 billion pounds (39.1%), and energy recovery with 1.35 billion pounds (16.2%). On-site waste management data appear in Table 6-4 and their distribution is illustrated in Figure 6-3.

For all types of on-site waste management—recycling, energy recovery, and treatment—multiple-codes forms reported the largest quantities in the chemical manufacturing sector and miscellaneous industrial organic chemicals (SIC code 2869) the second largest (see Table 6-4). Together, they accounted for 2.37 billion pounds of on-site recycling (63.6% of the sector's total), 1.18 billion pounds of on-site energy recovery (87.4%), and 2.32 billion pounds of on-site treatment (71.4%). Total other on-site waste management for the multiple-codes forms (4.02 billion pounds) and the miscellaneous industrial organics (1.85 billion pounds) amounted to 70.5% of on-site waste

<sup>2</sup> It is important to note that companies using underground injection as a method of disposal have suggested that underground injection is not a "release" to the environment and should not be counted in release totals. However, it should be noted that underground injection is clearly included in the EPCRA definition of "release."



Note: On-Site Releases from Section 5 of Form R. Off-site releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category. UIJ = underground injection.

management in this sector. Figure 6-4 illustrates the distribution of on-site waste management reporting for the top 10 industries in the chemical manufacturing sector.

### Transfers Off-site for Further Waste Management

Transfers to energy recovery were the largest off-site transfer type in chemical manufacturing, with 378.4 million pounds (42.1% of the total), as shown in Table 6-5 and illustrated in Figure 6-5. Next largest was recycling, with 256.6 million pounds (28.6%). A total of 154.3 million pounds (17.2%) was transferred to treatment and 109.5 million pounds to POTWs (12.2%).

Forms with multiple codes in SIC code 28 led all transfers off-site for further waste management. The multiple-codes category reported 40.4% of the off-site transfers (363.3 million pounds of the 898.9-million-pound total) and more than 35% of each transfer type. (See Table 6-5 and Figure 6-6.)

## 1996 TRI Data by State for Chemical Manufacturing

The large role of petrochemicals in the chemical manufacturing sector explains some of the geographic distribution of releases and waste management reported to TRI. In 1996, Texas led all



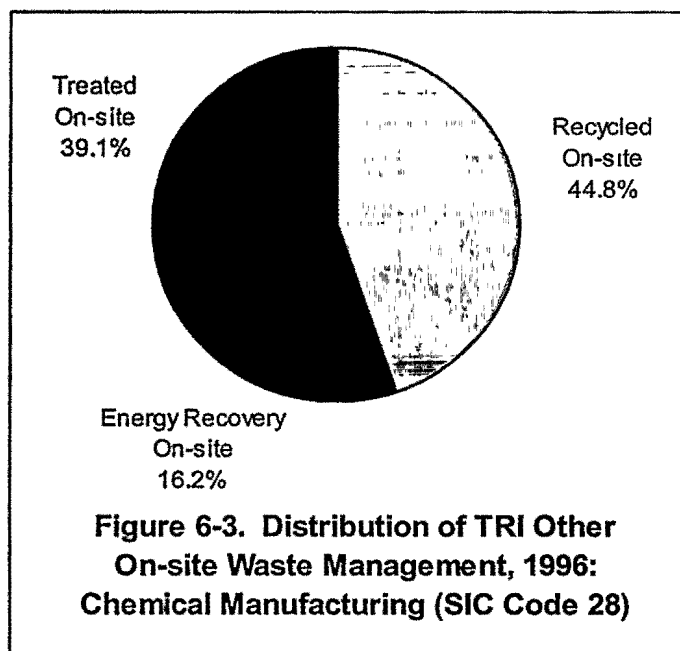
Table 6-4. TRI Other On-site Waste Management, 1996: Chemical Manufacturing, SIC Code 28 (in Rank Order)

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
	Multiple within SIC 28	1,782,454,512	616,054,351	1,625,579,937	4,024,088,800
2869	Industrial Organic Chemicals, nec*	590,176,326	563,072,761	697,172,996	1,850,422,083
2821	Plastics Materials & Resins	286,924,305	102,190,602	256,194,684	645,309,591
2874	Phosphatic Fertilizers	316,143,932	0	5,082,021	321,225,953
2879	Agricultural Chemicals, nec*	235,140,169	312,932	28,959,106	264,412,207
2819	Industrial Inorganic Chemicals, nec*	121,761,254	11,623,000	108,879,027	242,263,281
2824	Organic Fibers, Noncellulosic	5,824,384	0	219,831,544	225,655,928
2873	Nitrogenous Fertilizers	117,479,132	7,287,494	17,837,640	142,604,266
2865	Cyclic Crudes & Intermediates	57,690,916	22,222,730	45,173,380	125,087,026
2816	Inorganic Pigments	22,341,985	0	99,478,119	121,820,104
2822	Synthetic Rubber	41,133,955	12,218,500	31,844,723	85,197,178
2834	Pharmaceutical Preparations	27,505,526	1,329,261	35,437,266	64,272,053
2851	Paints & Allied Products	36,489,898	114,045	8,591,433	45,195,376
2899	Chemical Preparations, nec*	35,520,982	976,540	3,630,486	40,128,008
2892	Explosives	26,283,771	0	9,906,301	36,190,072
2833	Medicinals & Botanicals	13,031,122	2,222,500	18,529,246	33,782,868
2895	Carbon Black	0	7,998,571	21,076,186	29,074,757
2812	Alkalies & Chlorine	522,299	0	9,687,273	10,209,572
2891	Adhesives & Sealants	6,862,357	796,479	414,786	8,073,622
2823	Cellulosic Manmade Fibers	6,820,000	0	200,000	7,020,000
2861	Gum & Wood Chemicals	0	9,900	3,637,369	3,647,269
2893	Printing Ink	166,026	0	2,346,793	2,512,819
2843	Surface Active Agents	639,549	0	1,832,387	2,471,936
2813	Industrial Gases	99,517	0	1,942,301	2,041,818
2842	Polishes & Sanitation Goods	52,008	0	633,544	685,552
2841	Soap & Other Detergents	37,279	0	314,509	351,788
2836	Biological Products Exc. Diagnostic	24,464	0	148,634	173,098
2835	Diagnostic Substances	0	0	122,000	122,000
2875	Fertilizers, Mixing Only	115,746	0	100	115,846
2844	Toilet Preparations	100	0	39,242	39,342
	Invalid SIC Code within SIC 28	5,300	0	4,214	9,514
	Total for SIC Code 28	3,731,246,814	1,348,429,666	3,254,527,247	8,334,203,727

Note: Other On-site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec not elsewhere classified





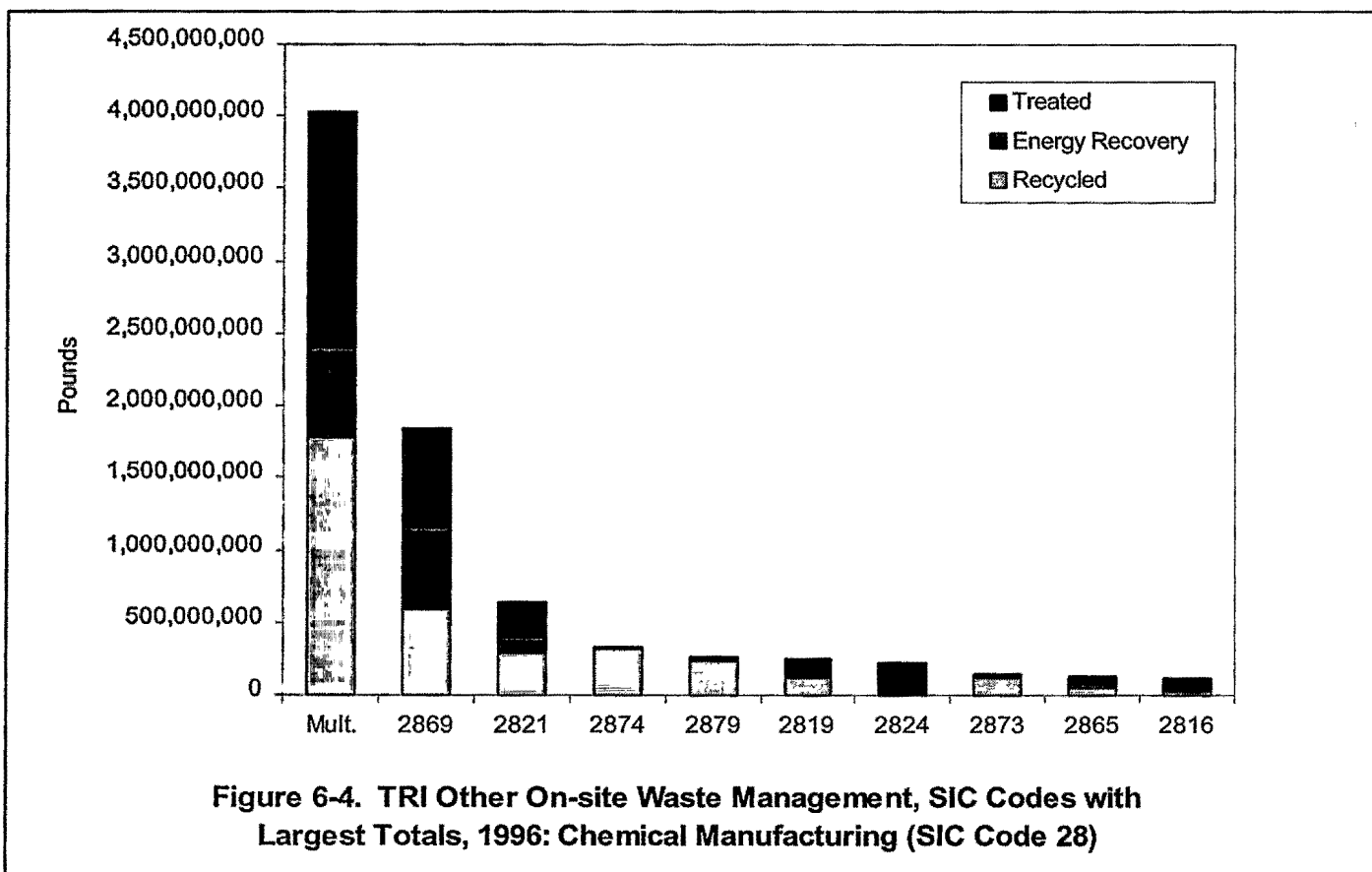
**Figure 6-3. Distribution of TRI Other On-site Waste Management, 1996: Chemical Manufacturing (SIC Code 28)**

Note: Data from Section 8 of Form R

states and territories in all categories summarized in Table 6-6.

Texas' 202.2 million pounds of total on- and off-site releases was 25.8% of the sector's total of 785.2 million pounds. Louisiana was second with 148.9 million pounds, or 19.0%. For on-site releases, Texas was also first (with 193.0 million pounds, or 25.6%) and Louisiana second (147.8 million pounds, or 19.6%). For off-site releases (transfers to disposal), Texas reported 9.2 million pounds (30.0%) and Ohio was second with 6.0 million pounds (19.5%).

For other on-site waste management, Texas reported 2.73 billion pounds, or 32.8% of the total. Louisiana followed with 1.56 billion pounds, or 18.7%. Transfers off-site for further waste



**Figure 6-4. TRI Other On-site Waste Management, SIC Codes with Largest Totals, 1996: Chemical Manufacturing (SIC Code 28)**

Note: Other On-Site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC Code 28 are assigned to the "multiple" category.

**Table 6-5. TRI Transfers Off-site for Further Waste Management, 1996: Chemical Manufacturing, SIC Code 28 (in Rank Order)**

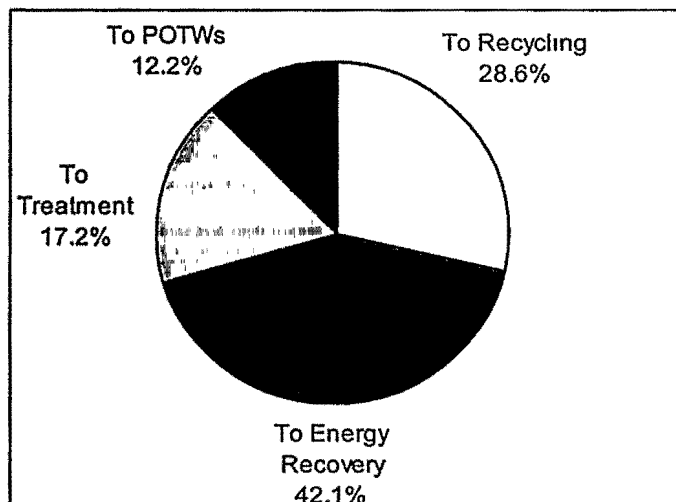
SIC Code	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Transfers for Further Waste Management Pounds
	Multiple within SIC 28	107,208,728	135,922,272	68,337,839	51,838,464	713	363,308,016
2869	Industrial Organic Chemicals, nec*	18,767,560	70,621,180	25,877,851	22,270,248	8,919	137,545,758
2821	Plastics Materials & Resins	67,603,104	50,449,412	8,320,583	3,968,312	0	130,341,411
2834	Pharmaceutical Preparations	7,193,129	48,588,394	20,497,843	3,558,808	80,548	79,918,722
2851	Paints & Allied Products	17,386,095	32,441,404	3,808,181	848,057	760	54,484,497
2865	Cyclic Crudes & Intermediates	4,203,666	6,713,095	5,335,285	13,199,665	0	29,451,711
2833	Medicinals & Botanicals	606,897	18,788,469	2,439,764	5,221,671	0	27,056,801
2819	Industrial Inorganic Chemicals, nec*	8,583,527	311,463	7,694,808	1,984,078	500	18,574,376
2822	Synthetic Rubber	9,063,698	2,139,422	2,890,414	288,240	0	14,381,774
2879	Agricultural Chemicals, nec*	6,612,868	2,794,757	3,202,883	107,926	0	12,718,434
2891	Adhesives & Sealants	620,984	3,871,511	2,605,423	78,842	0	7,176,760
2899	Chemical Preparations, nec*	776,677	1,798,717	2,044,257	1,790,001	0	6,409,652
2824	Organic Fibers, Noncellulosic	4,468,347	3,364	6,217	43,560	0	4,521,488
2893	Printing Ink	1,315,638	1,021,091	287,777	91,132	0	2,715,638
2843	Surface Active Agents	101,873	762,231	64,972	1,461,096	0	2,390,172
2816	Inorganic Pigments	483,903	0	76,589	1,820,946	0	2,381,438
2812	Alkalies & Chlorine	18,222	1,588,333	33,376	255	0	1,640,186
2873	Nitrogenous Fertilizers	782,046	0	93,496	179,277	0	1,054,819
	Invalid SIC Code within SIC 28	500,000	32,242	12,910	2,557	0	547,709
2841	Soap & Other Detergents	251,591	14,511	48,027	218,703	0	532,832
2842	Polishes & Sanitation Goods	1,920	50,794	144,955	173,679	0	371,348
2813	Industrial Gases	9,260	167,302	159,281	0	12,596	348,439
2835	Diagnostic Substances	68,619	128,788	77,788	32,263	0	307,458
2844	Toilet Preparations	0	54,919	32,416	202,974	480	290,789
2875	Fertilizers, Mixing Only	0	0	155,739	255	0	155,994
2836	Biological Products Exc Diagnostic	3,980	51,247	4,298	58,126	0	117,651
2861	Gum & Wood Chemicals	6,075	55,000	3,940	22,780	0	87,795
2892	Explosives	840	0	23,213	255	0	24,308
2823	Cellulosic Manmade Fibers	0	0	0	835	0	835
2895	Carbon Black	0	0	20	20	0	40
2874	Phosphatic Fertilizers	0	0	0	30	0	30
	Total for SIC Code 28	256,639,247	378,369,918	154,280,145	109,463,055	104,516	898,856,881

**Note:** Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers reported without valid waste management code. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the multiple category.

\*nec: not elsewhere classified

management were 161.4 million pounds in Texas, or 18.0%, and 102.4 million pounds in second-ranked Michigan, or 11.4%. Production-related waste totaled 3.11 billion pounds in Texas, or 31.0%, again followed by Louisiana, with 1.76 billion pounds, or 17.6%. Finally, non-production related waste (from one-time events such as catastrophic events or clean-up actions) was 3.8 million pounds in Texas, or 40.9% of the total, and 3.1 million pounds in North Carolina, or 33.2%.

Map 6-1 illustrates the geographic distribution of total on- and off-site releases in the chemical manufacturing sector.

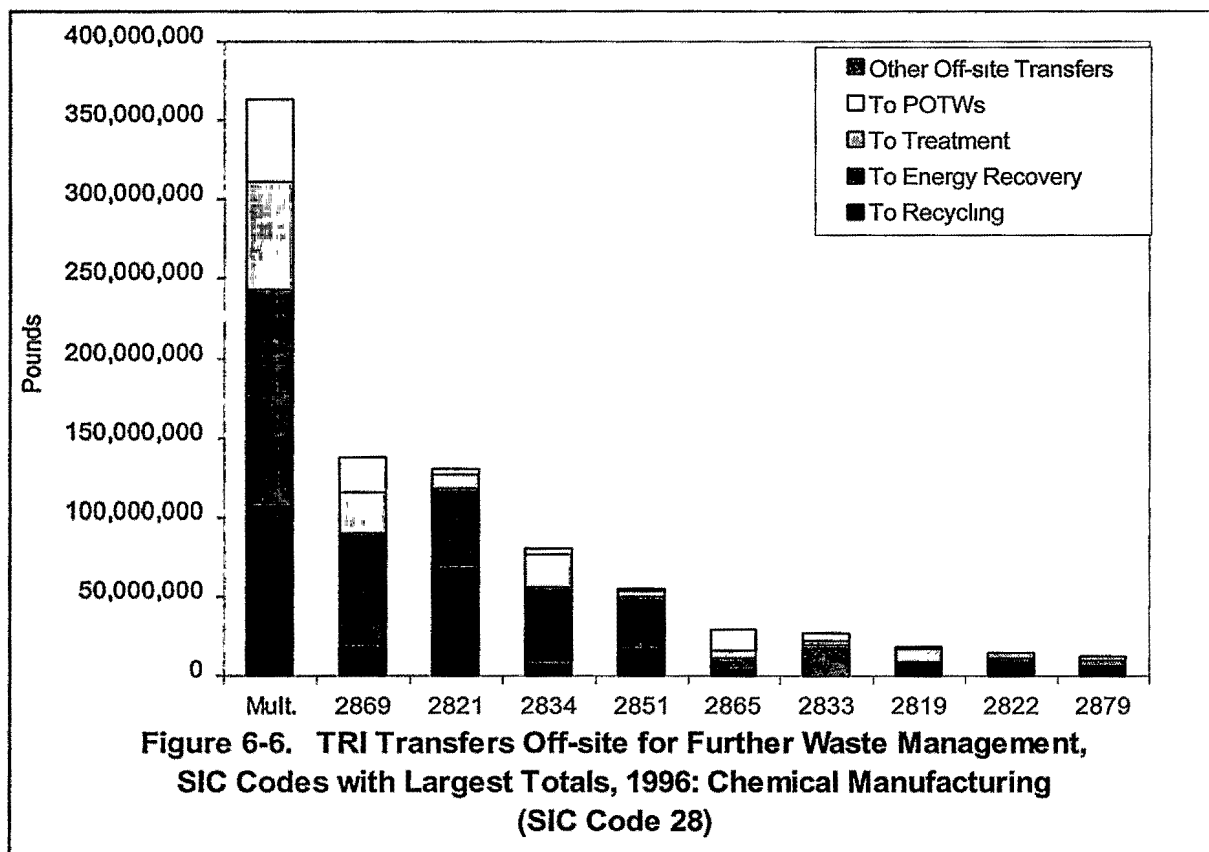


**Figure 6-5. Distribution of TRI Transfers Off-site for Further Waste Management, 1996: Chemical Manufacturing (SIC Code 28)**

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code

## 1996 TRI Data by Chemical for Chemical Manufacturing

In 1996, the chemical with the largest on- and off-site releases in the chemical manufacturing sector was ammonia, with 108.4 million pounds, as shown in Table 6-7. Ammonia is used in many chemical manufacturing processes and is the building block for all synthetic nitrogen products. Its prevalence, its volatility, and its solubility in water allow it to be readily released to the air and water. Ammonia is used to produce fertilizers, plastics, explosives, and pharmaceuticals. It is also used as a catalyst in phenol-formaldehyde condensation and in urea-formaldehyde condensation to make synthetic resin.



**Figure 6-6. TRI Transfers Off-site for Further Waste Management, SIC Codes with Largest Totals, 1996: Chemical Manufacturing (SIC Code 28)**

Note: Off-site transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-Site Transfers reported without valid waste management code. Forms with more than one 4-digit SIC code within SIC Code 28 are assigned to the "multiple" category.

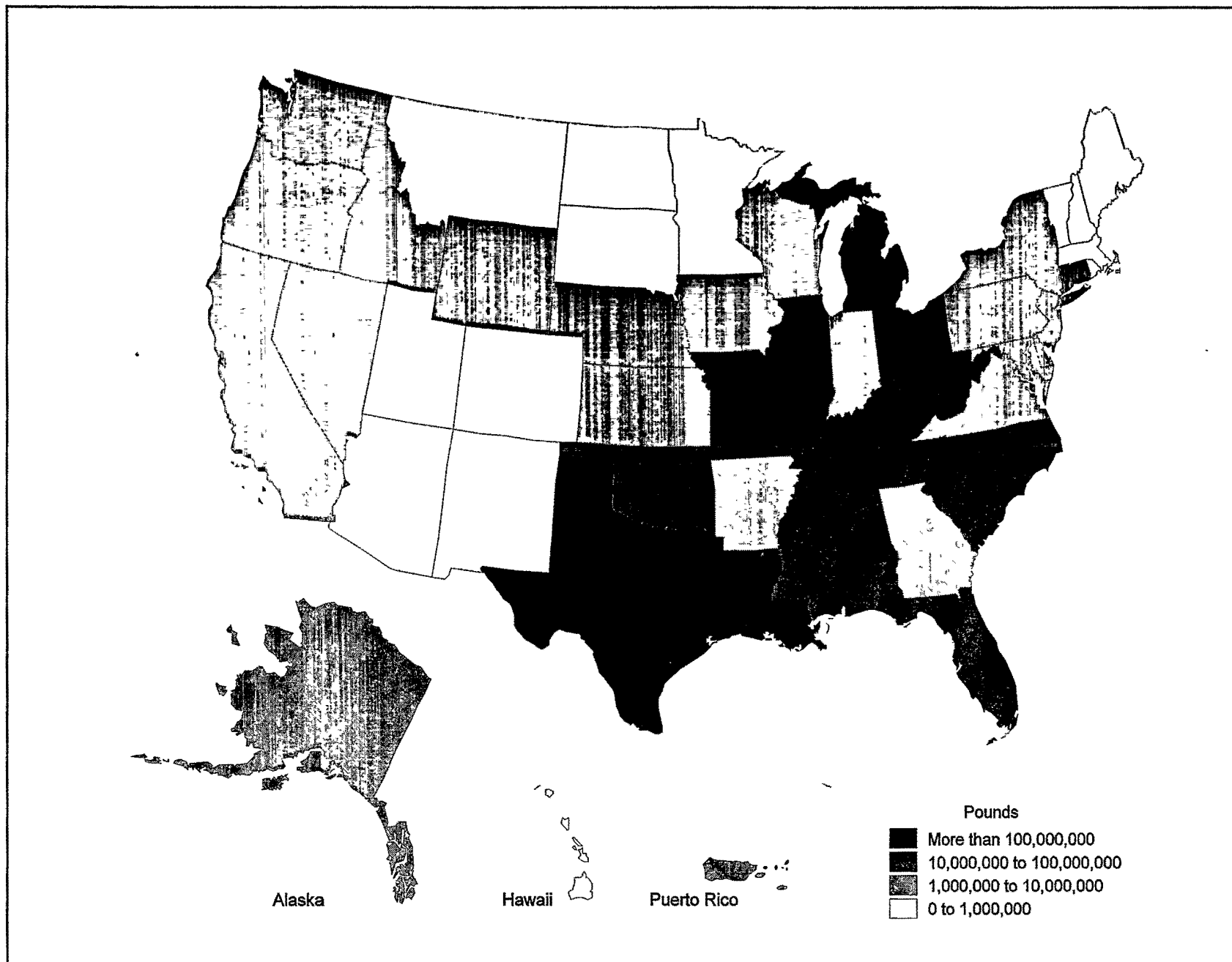


Table 6-6. Summary of TRI Information by State, 1996: Chemical Manufacturing, SIC Code 28

State	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
Alabama	69	471	67	36,256,912	618,444	36,875,356	250,719,277	13,106,050	301,255,192	39,208
Alaska	1	10	0	4,715,420	0	4,715,420	3,097,400	213,885	8,064,924	79,000
Arizona	27	86	20	295,602	532	296,134	17,464,982	73,119	17,827,545	11,695
Arkansas	41	247	45	7,755,860	563,398	8,319,258	138,750,132	10,025,280	157,174,263	690
California	272	1,010	151	5,144,883	437,621	5,582,504	44,171,522	15,901,758	65,480,518	31,123
Colorado	27	85	17	548,274	36,600	584,874	1,137,926	4,500,603	6,212,306	18,003
Connecticut	34	212	21	1,803,958	301,459	2,105,417	83,049,612	6,539,897	91,515,575	35,399
Delaware	28	115	13	1,611,092	95,248	1,706,340	50,223,316	5,475,792	57,389,695	13,173
Florida	123	427	68	48,420,645	95,750	48,516,395	159,224,567	4,360,732	211,803,901	286,570
Georgia	175	774	191	8,822,284	309,370	9,131,654	295,389,027	10,859,002	315,272,953	16,693
Hawaii	1	1	0	0	0	0	0	0	0	0
Idaho	7	34	0	8,953,540	3,752	8,957,292	311,332	192,258	9,519,439	17,401
Illinois	258	1,467	234	18,228,475	2,007,116	20,235,591	224,612,209	46,075,506	290,294,227	53,675
Indiana	96	506	45	7,180,851	752,513	7,933,364	137,780,619	11,824,299	158,072,740	37,534
Iowa	48	240	27	5,428,228	232,511	5,660,739	23,193,730	5,110,249	33,536,843	248,954
Kansas	44	223	21	5,568,820	2,583,171	8,151,991	102,119,940	7,371,316	117,658,339	86,434
Kentucky	61	494	60	13,606,273	437,860	14,044,133	160,630,831	17,041,020	191,396,937	177,483
Louisiana	132	1,281	69	147,821,794	1,038,973	148,860,767	1,560,078,542	53,892,930	1,762,618,869	185,930
Maine	2	4	0	6,029	2,453	8,482	8,005,992	0	8,014,463	0
Maryland	50	223	36	3,992,318	132,040	4,124,358	33,735,292	4,053,887	42,004,515	0
Massachusetts	86	360	52	620,604	44,640	665,244	3,140,409	6,405,744	10,384,191	1,401
Michigan	104	679	55	12,295,482	290,770	12,586,252	68,888,478	102,378,648	184,487,426	21,431
Minnesota	54	175	51	472,427	3,111	475,538	505,820	205,778	1,296,660	4
Mississippi	38	218	40	12,694,232	79,087	12,773,319	198,939,835	3,858,053	215,184,731	9,835
Missouri	112	553	88	14,947,833	401,901	15,349,734	88,072,868	37,367,152	139,818,581	31,252
Montana	9	37	0	87,065	18,587	105,652	436,810	58,151	612,619	323
Nebraska	19	77	10	1,930,166	4,305	1,934,471	3,523,664	1,913,577	7,384,385	54,947
Nevada	15	41	11	2,400,670	29,430	2,430,100	7,398,289	14,953	9,842,473	6,527
New Hampshire	9	37	14	30,863	30,032	60,895	15,306,040	182,739	15,521,122	17,279
New Jersey	232	1,144	169	7,829,079	1,068,310	8,897,389	159,943,534	58,590,419	226,465,823	54,597
New Mexico	4	17	8	33,156	1,250	34,406	11,371	2,250	45,967	0
New York	137	571	63	5,719,738	366,079	6,085,817	95,307,476	13,491,976	115,161,129	24,768
North Carolina	129	708	91	32,475,407	1,185,449	33,660,856	375,245,123	47,646,908	454,231,180	3,129,279
North Dakota	4	12	8	250	0	250	200	1,108	1,608	0
Ohio	275	1,465	200	30,621,467	6,027,879	36,649,346	177,158,047	58,594,420	272,028,935	57,892
Oklahoma	34	140	20	11,159,256	53,367	11,212,623	38,671,234	292,512	50,147,842	43,307
Oregon	33	135	18	1,351,214	2,505	1,353,719	19,144,069	328,357	20,806,580	119
Pennsylvania	174	944	127	3,879,566	395,310	4,274,876	83,378,130	23,497,561	108,503,955	17,618
Puerto Rico	61	232	10	3,846,230	67,233	3,913,463	15,811,291	23,691,207	44,345,288	11,567
Rhode Island	15	77	25	87,486	206	87,692	472,528	663,999	1,223,317	0
South Carolina	98	635	94	11,037,662	532,273	11,569,935	203,546,248	46,793,640	262,971,728	211,508
South Dakota	1	8	0	327,250	0	327,250	1,403,000	107,864	1,876,794	0
Tennessee	96	570	86	42,381,294	144,701	42,525,995	132,709,522	11,587,305	186,704,773	50,085
Texas	353	2,961	274	192,978,481	9,248,340	202,226,821	2,730,560,792	161,375,551	3,113,819,489	3,849,979
Utah	22	77	19	704,294	1,573	705,867	1,732,810	437,742	2,607,566	1,120
Vermont	1	8	0	13,248	0	13,248	91,192	5,450	107,961	0
Virginia	71	305	39	9,297,224	208,173	9,505,397	292,462,637	21,774,807	324,643,920	36,096
Washington	38	129	19	1,548,356	305,705	1,854,061	47,498,047	447,036	49,305,658	410,222
West Virginia	39	398	10	18,080,942	593,162	18,674,104	266,860,761	36,979,022	322,581,703	37,063
Wisconsin	88	427	114	1,061,348	89,280	1,150,628	10,485,453	23,518,514	35,074,119	711
Wyoming	8	48	10	8,262,552	594	8,263,146	1,801,801	26,855	10,089,260	0
Total for SIC Code 28	3,855	21,098	2,810	754,336,100	30,842,063	785,178,163	8,334,203,727	898,856,881	10,032,390,027	9,417,895

**Note** On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents)

Map 6-1. Total On- and Off-site Releases, 1996: Chemical Manufacturing, SIC Code 28



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

**Table 6-7. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1996: Chemical Manufacturing, SIC Code 28 (in Rank Order)**

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	
7664-41-7	Ammonia	80,117,508	3,673,351	22,370,883	192,283	425,318	709,001	107,488,344	875,871	108,364,215
---	Nitrate compounds	271,349	52,991,156	39,398,312	250	0	252,836	92,913,903	1,063,493	93,977,396
67-56-1	Methanol	39,338,505	781,457	23,656,675	0	1,908	403,078	64,181,623	1,212,076	65,393,699
75-15-0	Carbon disulfide	60,152,700	66,151	3,788	0	0	270	60,222,909	19,097	60,242,006
7664-38-2	Phosphoric acid	612,359	28,358,221	9,316	0	250	25,611,553	54,591,699	416,763	55,008,462
74-85-1	Ethylene	31,368,678	22,190	0	0	0	0	31,390,868	2,953	31,393,821
75-05-8	Acetonitrile	970,241	10,600	22,826,712	0	11	5	23,807,569	544,920	24,352,489
---	Chromium compounds	49,852	23,413	33,944	0	26,034	21,514,596	21,647,839	461,427	22,109,266
115-07-1	Propylene	19,966,587	83	0	0	0	370	19,967,040	1,044	19,968,084
7697-37-2	Nitric acid	1,273,268	170,657	17,483,860	0	513	14,199	18,942,497	287,553	19,230,050
108-88-3	Toluene	15,011,903	23,173	154,308	2,600	119,079	4,340	15,315,403	487,821	15,803,224
---	Manganese compounds	188,249	575,935	11,480	2,308	250	6,450,091	7,228,313	7,624,113	14,852,426
107-21-1	Ethylene glycol	3,010,513	474,268	7,698,571	0	821	224,868	11,409,041	2,027,535	13,436,576
64-18-6	Formic acid	2,023,649	80,119	11,001,260	0	5	3,005	13,108,038	101,851	13,209,889
7647-01-0	Hydrochloric acid	11,596,245	4,969	260,005	0	0	1,051	11,862,270	17,333	11,879,603
	Subtotal	265,951,606	87,255,743	144,909,114	197,441	574,189	55,189,263	554,077,356	15,143,850	569,221,206
	Total for SIC Code 28	392,434,100	90,420,803	200,317,453	197,441	2,689,697	68,276,606	754,336,100	30,842,063	785,178,163

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

Air emissions were the largest type of on- or off-site release reported by the chemical industry and the largest release for seven of the top 15 chemicals in this industry: ammonia, methanol, carbon disulfide, ethylene, propylene, toluene, and hydrochloric acid (see Table 6-7). The 257.6 million pounds of air emissions of these seven chemicals were two-thirds (65.6%) of all air emissions in the sector. Nitrate compounds and phosphoric acid were discharged to surface waters in the largest amounts, 53.0 million pounds and 28.4 million pounds, respectively. These two chemicals accounted for 90.0% of the sector's on-site releases to water.

Nitrate compounds was also the largest chemical for injection to Class I wells, with 39.4 million pounds. Ammonia, methanol, and acetonitrile also had more than 20 million pounds each of such underground injection, and these four chemicals together (totaling 108.3 million pounds) represented 54.0% of the sector's underground injection to Class I wells.

Forms in chemical manufacturing reported more phosphoric acid (25.6 million pounds) and chromium compounds (21.5 million pounds) in

other on-site land releases than any other TRI chemical. These two chemicals accounted for 69.0% of the sector's other on-site land releases. On-site disposal in RCRA subtitle C landfills was only 3.8% of all on-site land releases in the sector, and this category was led by ammonia with 425,000 pounds. Manganese compounds were sent off-site for disposal (off-site releases) in the largest amount (7.6 million pounds); more of this chemical was released off-site than in all its on-site releases (totaling 7.2 million pounds). Manganese compounds accounted for 24.7% of all chemical manufacturing off-site releases.

## OSHA Carcinogens

On- and off-site releases of chemicals designated as OSHA carcinogens totaled 65.1 million pounds, or 8.3% of all releases in the chemical manufacturing sector in 1996, as shown on Table 6-8. (OSHA carcinogens and the bases for their designation appear in Box 2-4 in Chapter 2.) Two OSHA carcinogens had releases of more than 10 million pounds each: formaldehyde (11.9 million pounds) and dichloromethane (10.5 million pounds). The three carcinogens with the next largest releases in



**Table 6-8. TRI On-site and Off-site Releases of OSHA Carcinogens by 4-digit SIC Code, 1996: Chemical Manufacturing, SIC Code 28 (In Rank Order)**

SIC Code	Industry	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 Pounds	Off-site to Disposal Pounds	
	Multiple within SIC 28	14,668,339	468,583	15,774,009	0	286,539	457,720	31,655,190	1,342,263		32,997,453
2869	Industrial Organic Chemicals, nec*	5,123,084	44,255	6,763,011	0	10,471	22,541	11,963,362	1,232,139		13,195,501
2821	Plastics Materials & Resins	7,906,776	120,739	0	0	0	5,217	8,032,732	96,644		8,129,376
2834	Pharmaceutical Preparations	2,589,380	337	1,123,150	0	0	10,699	3,723,566	69,036		3,792,602
2822	Synthetic Rubber	1,642,179	938	0	0	0	17,334	1,660,451	33,446		1,693,897
2865	Cyclic Crudes & Intermediates	1,010,827	5,911	10,400	0	0	712	1,027,850	391,569		1,419,419
2899	Chemical Preparations, nec*	179,314	34	0	0	0	0	179,348	502,108		681,456
2819	Industrial Inorganic Chemicals, nec*	40,140	2,220	0	0	13,181	444,289	499,830	138,264		638,094
2879	Agricultural Chemicals, nec*	471,431	1,586	73,406	0	755	538	547,716	81,011		628,727
2891	Adhesives & Sealants	598,335	0	0	0	0	8,096	606,431	564		606,995
2851	Paints & Allied Products	460,100	754	0	0	0	4,250	465,104	12,671		477,775
2833	Medicinals & Botanicals	448,557	9,545	0	0	0	200	458,302	5,000		463,302
2824	Organic Fibers, Noncellulosic	92,724	0	19,091	0	0	0	111,815	3,300		115,115
2812	Alkalies & Chlorine	80,746	9	0	0	0	0	80,755	8,736		89,491
2843	Surface Active Agents	53,212	6	0	0	0	13	53,231	536		53,767
2873	Nitrogenous Fertilizers	19,885	805	490	0	0	570	21,750	19,300		41,050
2842	Polishes & Sanitation Goods	35,228	0	0	0	0	0	35,228	2,905		38,133
2895	Carbon Black	35,900	5	0	0	0	0	35,905	5		35,910
2813	Industrial Gases	17,400	0	0	0	776	0	18,176	0		18,176
2861	Gum & Wood Chemicals	4,794	250	0	0	0	0	5,044	0		5,044
2875	Fertilizers, Mixing Only	2,771	0	0	0	0	0	2,771	0		2,771
2835	Diagnostic Substances	2,436	0	0	0	0	0	2,436	0		2,436
2892	Explosives	2,250	0	0	0	0	0	2,250	0		2,250
2841	Soap & Other Detergents	2,161	0	0	0	0	0	2,161	0		2,161
2836	Biological Products Exc. Diagnostic	1,950	0	0	0	0	0	1,950	0		1,950
2816	Inorganic Pigments	274	161	0	0	0	0	435	851		1,286
	Invalid SIC Code within SIC 28	762	0	0	0	0	0	762	0		762
2844	Toilet Preparations	700	0	0	0	0	0	700	0		700
2893	Printing Ink	502	0	0	0	0	0	502	5		507
	Subtotal	35,492,157	656,138	23,763,557	0	311,722	972,179	61,195,753	3,940,353		65,136,106
	Total for SIC Code 28	392,434,100	90,420,803	200,317,453	197,441	2,689,697	68,276,606	754,336,100	30,842,063		785,178,163

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

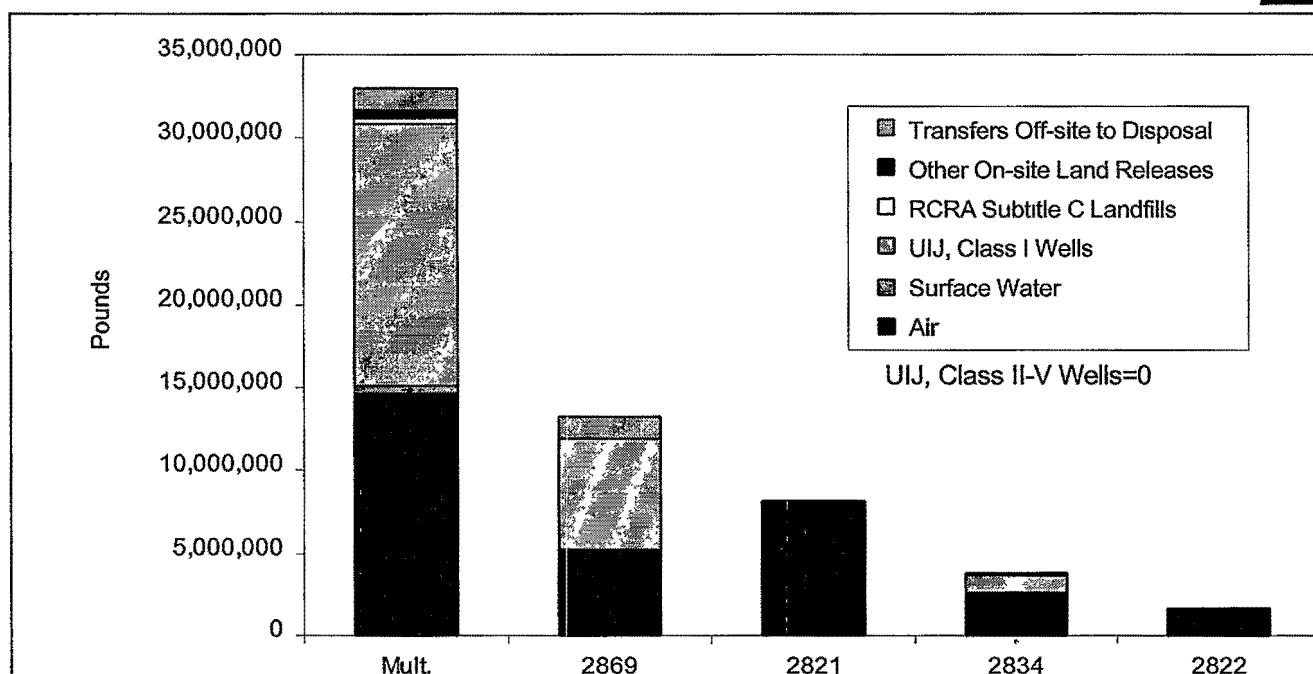
this sector were acrylamide (6.2 million pounds), styrene (5.2 million pounds), and acrylonitrile (4.9 million pounds). None of the OSHA carcinogens ranked among the top 15 TRI chemicals for total releases in this sector (presented in Table 6-7).

Forms with multiple SIC codes in SIC 28 reported half of the OSHA carcinogen releases in the chemical manufacturing sector—33.0 million pounds, or 50.7%. Miscellaneous industrial organic chemical manufacturing (SIC code 2869) accounted for another 13.2 million pounds, or 20.3%. Emissions to air were 14.7 million pounds for multiple codes and 5.1 million pounds for miscellaneous industrial organic chemicals. Figure 6-7 shows the on- and off-site releases of the four-digit SIC codes with the largest OSHA carcinogen releases.

## 1996 TRI Chemicals in Waste for Chemical Manufacturing

Table 6-9 and Figure 6-8 present waste management data for all chemical manufacturing industries. Production-related waste totaled 10.03 billion pounds in 1996.

Forms with multiple SIC codes within SIC 28 led all waste management categories in 1996. Forms reporting the miscellaneous industrial organic chemicals SIC code (2869) were second in all categories, except off-site recycling (where plastics



**Figure 6-7. TRI On-site and Off-site Releases of OSHA Carcinogens, SIC Codes with Largest Totals, 1996: Chemical Manufacturing (SIC Code 28)**

Notes: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category UIJ= underground injection

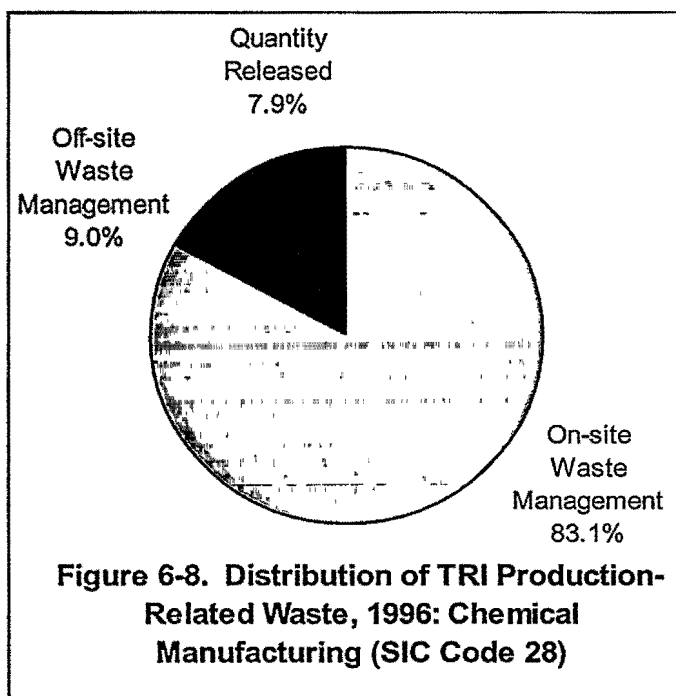
**Table 6-9. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1996: Chemical Manufacturing, SIC Code 28 (in Rank Order)**

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Recycled Off-site Pounds	Energy Recovery Off-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site Pounds	Total Production-related Waste Pounds	Non Production-related Waste Pounds
	Multiple within SIC 28	1,782,454,512	616,054,351	1,625,579,937	105,373,291	137,039,894	120,186,512	379,660,246	4,766,348,743	4,627,743
2869	Industrial Organic Chemicals, nec*	590,176,326	563,072,761	697,172,996	18,783,258	74,783,716	49,793,691	137,664,992	2,131,447,740	3,351,020
2821	Plastics Materials & Resins	286,924,305	102,190,602	256,194,684	67,720,050	45,711,839	16,864,052	30,929,378	806,534,910	106,630
2874	Phosphatic Fertilizers	316,143,932	0	5,082,021	0	0	29	29,212,202	350,438,184	283,328
2819	Industrial Inorganic Chemicals, nec*	121,761,254	11,623,000	108,879,027	8,464,006	304,681	8,389,844	39,339,627	298,761,439	146,108
2879	Agricultural Chemicals, nec*	235,140,169	312,932	28,959,106	6,612,794	2,798,301	2,937,897	2,244,138	279,005,337	48,114
2824	Organic Fibers, Noncellulosic	5,824,384	0	219,831,544	4,468,347	12,003	49,449	515,763	230,701,490	0
2873	Nitrogenous Fertilizers	117,479,132	7,287,494	17,837,640	910,518	0	199,773	46,124,547	189,839,104	583,329
2865	Cyclic Crudes & Intermediates	57,690,916	22,222,730	45,173,380	4,203,666	4,527,167	20,812,154	10,420,429	165,050,442	22,971
2834	Pharmaceutical Preparations	27,505,526	1,329,261	35,437,266	7,231,689	51,537,812	22,186,093	13,037,471	158,265,118	39,991
2816	Inorganic Pigments	22,341,985	0	99,478,119	515,583	9,500	1,877,824	18,986,210	143,209,221	575
2822	Synthetic Rubber	41,133,955	12,218,500	31,844,723	14,868,428	2,307,731	3,155,855	10,051,829	115,581,021	28,616
2851	Paints & Allied Products	36,489,898	114,045	8,591,433	17,208,162	32,962,450	4,804,061	9,638,998	109,809,047	10,206
2833	Medicinals & Botanicals	13,031,122	2,222,500	18,529,246	647,032	18,698,199	5,646,306	4,975,424	63,749,829	78
2899	Chemical Preparations, nec*	35,520,982	976,540	3,630,486	752,911	1,970,260	3,730,664	3,839,531	50,421,374	29,918
2895	Carbon Black	0	7,998,571	21,076,186	0	0	24	16,834,464	45,929,245	0
2892	Explosives	26,283,771	0	9,906,301	7,300	0	30,589	1,465,639	37,693,600	1,100
2823	Cellulosic Manmade Fibers	6,820,000	0	200,000	0	0	85	21,062,915	28,083,000	0
2891	Adhesives & Sealants	6,862,357	796,479	414,786	960,450	3,875,872	1,492,714	2,401,799	16,804,457	1,958
2861	Gum & Wood Chemicals	0	9,900	3,637,369	6,075	55,000	26,950	8,969,977	12,705,271	1,210
2812	Alkalies & Chlorine	522,299	0	9,687,273	18,222	1,588,333	31,105	649,176	12,496,408	144
2893	Printing Ink	166,026	0	2,346,793	1,232,402	936,454	449,048	651,910	5,782,633	105,730
2843	Surface Active Agents	639,549	0	1,832,387	46,855	755,608	564,152	829,817	4,668,368	6,735
2813	Industrial Gases	99,517	0	1,942,301	9,260	165,302	75,362	806,491	3,098,233	9,089
2875	Fertilizers, Mixing Only	115,746	0	100	0	0	53,681	1,663,911	1,833,438	0
2842	Polishes & Sanitation Goods	52,008	0	633,544	2,673	45,007	322,588	225,489	1,281,309	13,192
2841	Soap & Other Detergents	37,279	0	314,509	255,659	20,111	230,686	61,033	919,277	100
	Invalid SIC Code within SIC 28	5,300	0	4,214	500,000	28,575	65,609	71,528	675,226	10
2835	Diagnostic Substances	0	0	122,000	68,519	134,258	134,546	18,543	477,866	0
2844	Toilet Preparations	100	0	39,242	0	60,778	209,819	159,401	469,340	0
2836	Biological Products Exc Diagnostic	24,464	0	148,634	0	26,669	52,527	57,063	309,357	0
Total for SIC Code 28		3,731,246,814	1,348,429,666	3,254,527,247	260,867,150	380,355,520	264,373,689	792,589,941	10,032,390,027	9,417,895

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category

\*nec: not elsewhere classified

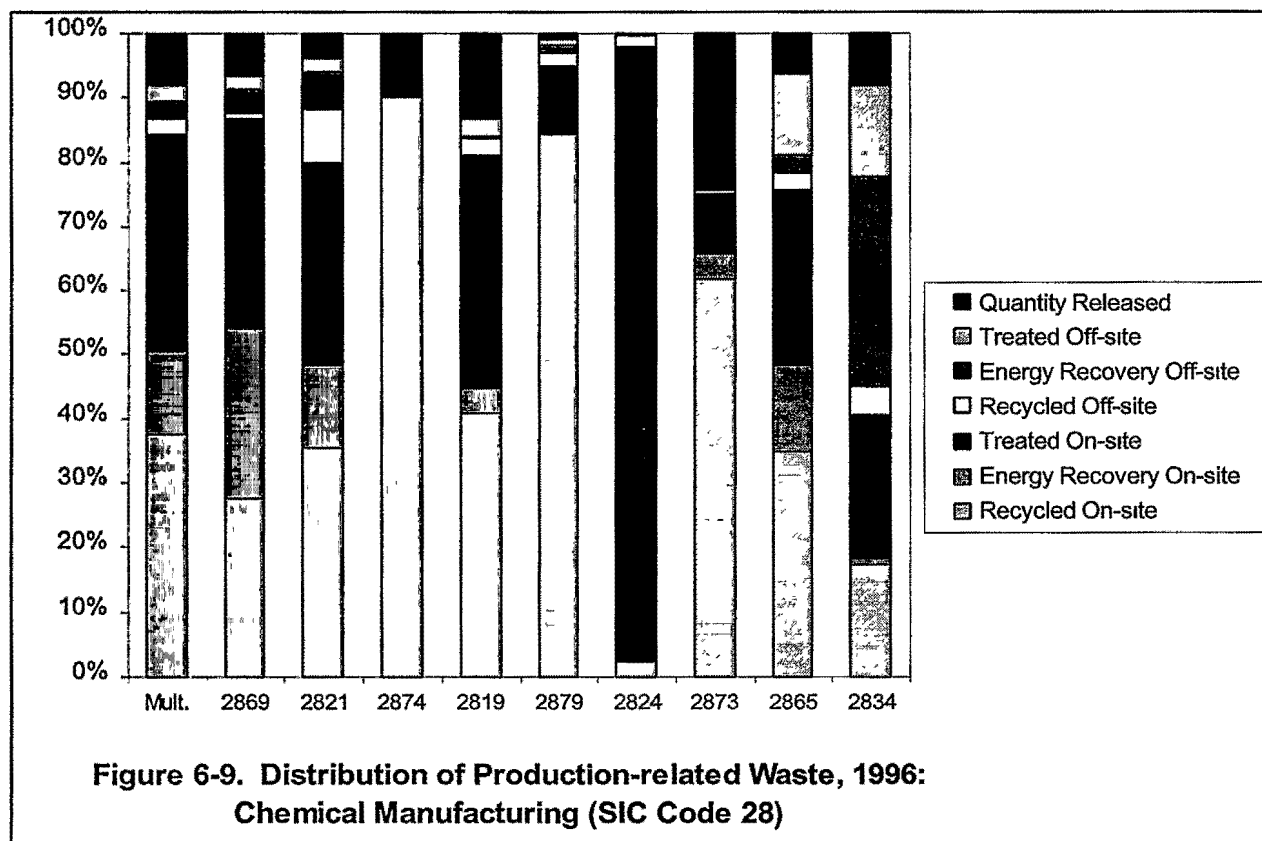




Note: Data from Section 8 of Form R.

materials and resins, SIC code 2861 was second). Together, the multiple-codes group and the miscellaneous industrial organics chemicals industry accounted for 68.8% (6.90 billion pounds) of the sector's production-related waste (see Table 6-9).

For multiple-codes reporting, the largest quantities of chemicals in production-related waste were managed by on-site recycling, 1.78 billion pounds. On-site treatment followed with 1.63 billion pounds. These two categories of multiple-code reporting accounted for one third (34.0%) of all production-related waste reported by the chemical manufacturing sector. Distribution of production-related waste for the top industries in the sector appears in Figure 6-9.



Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC Code 28 are assigned to the "multiple" category.



**Table 6-10. Current Year and Projected Quantities of TRI Chemicals in Waste, 1996-1998: Chemical Manufacturing, SIC Code 28**

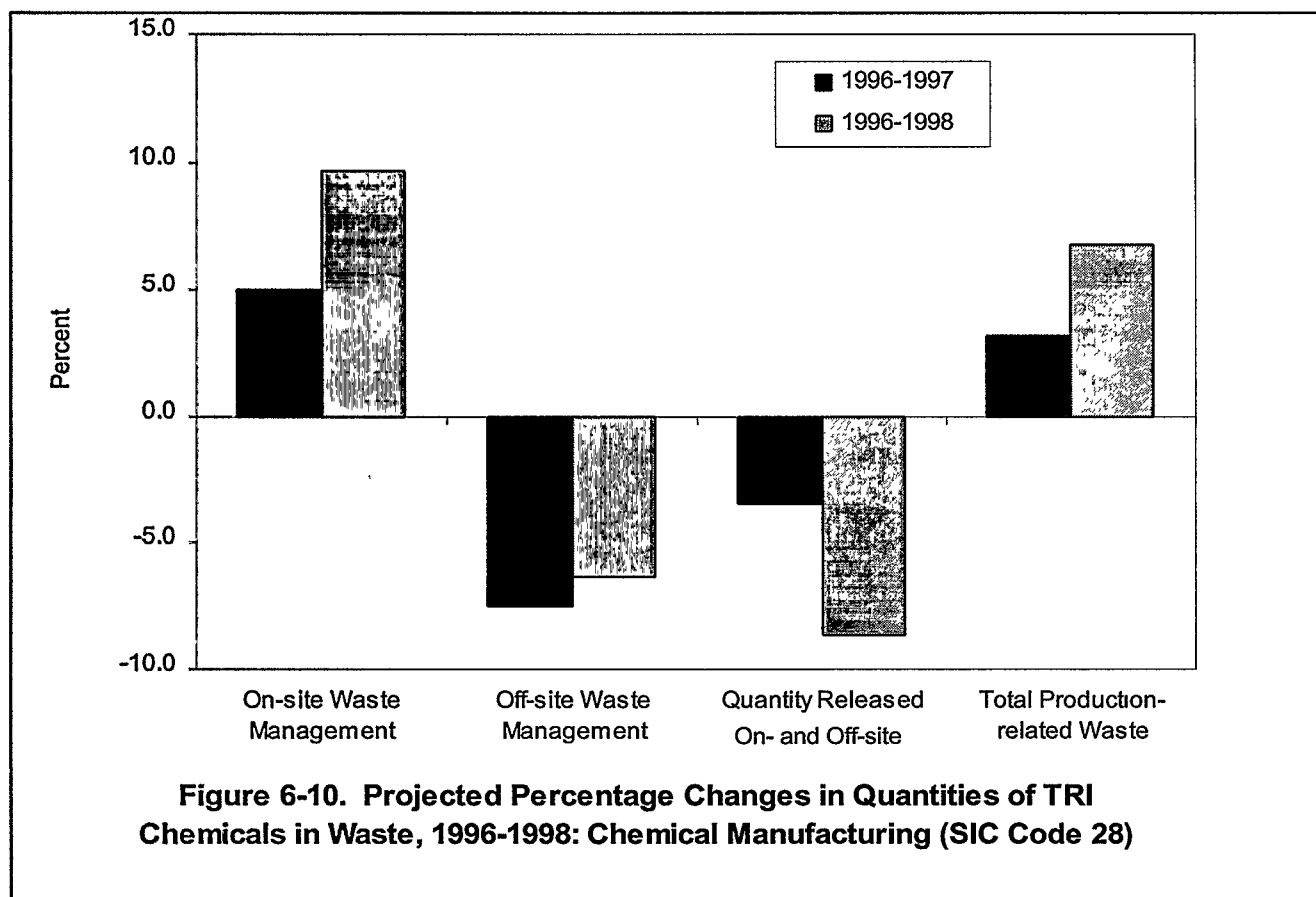
Waste Management Activity	Current Year 1996		Projected 1997		Projected 1998	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
<u>On-site Waste Management</u>						
Recycled On-site	3,731,246,814	37.2	4,037,270,795	39.0	4,239,492,141	39.6
Energy Recovery On-site	1,348,429,666	13.4	1,424,116,977	13.8	1,393,016,262	13.0
Treated On-site	3,254,527,247	32.4	3,288,538,187	31.8	3,506,074,427	32.7
<u>Off-site Waste Management</u>						
Recycled Off-site	260,867,150	2.6	246,415,014	2.4	259,445,976	2.4
Energy Recovery Off-site	380,355,520	3.8	339,566,297	3.3	337,139,694	3.1
Treated Off-site	264,373,689	2.6	251,579,501	2.4	251,783,800	2.4
Quantity Released On- and Off-site	792,589,941	7.9	765,539,089	7.4	724,066,248	6.8
Total Production-related Waste for SIC Code 28	10,032,390,027	100.0	10,353,025,860	100.0	10,711,018,548	100.0
Waste Management Activity	Projected Change		Projected Change		Projected Change	
	1996-1997	Percent	1997-1998	Percent	1996-1998	Percent
<u>On-site Waste Management</u>						
Recycled On-site		8.2		5.0		13.6
Energy Recovery On-site		5.6		-2.2		3.3
Treated On-site		1.0		6.6		7.7
<u>Off-site Waste Management</u>						
Recycled Off-site		-5.5		5.3		-0.5
Energy Recovery Off-site		-10.7		-0.7		-11.4
Treated Off-site		-4.8		0.1		-4.8
Quantity Released On- and Off-site		-3.4		-5.4		-8.6
Total Production-related Waste for SIC Code 28		3.2		3.5		6.8

**Note** Current year and projected year amounts are all taken from Section 8 of Form R for 1996

## Projected Quantities of TRI Chemicals in Waste

Projections by the chemical manufacturing sector show that on-site recycling is expected to increase by 13.6% through 1998 and on-site treatment by 7.7%. Off-site energy recovery is projected to

decrease by 11.4% over that period and quantities released on- and off-site to decrease by 8.6%. Less than 5% change is expected in on-site energy recovery (3.3% increase) and off-site treatment (4.8% decrease). Current year and projected waste management data for chemical manufacturing are given in Table 6-10 and percentage changes are



Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996

illustrated in Figure 6-10. (As explained in Chapter 2, facilities not only report current data but project waste management quantities for the next two years in their TRI submissions.)

The projections indicate that quantities released would decrease from 7.9% of all production-related waste in 1996 to 6.8% in 1998, and on-site recycling would increase from 37.2% of the sector's production-related waste to 39.6%, as shown in Table 6-10. This points to possible improvement in managing TRI chemicals in waste, by moving up the waste management hierarchy. In that hierarchy, as explained in Chapter 2, recycling is the preferred management option for waste that is not prevented or cannot be prevented in the first place.

## Source Reduction Activity

Of the 21,098 forms reporting chemical manufacturing SIC codes, 3,940 (18.7%) forms indicated at least one source reduction activity implemented in 1996, as shown in Table 6-11. The largest number, 1,094, came from multiple-codes reporting, followed by 890 from manufacture of paints and varnishes (SIC code 2851). These were 16.7% of the forms reporting multiple SIC codes within SIC code 28 and 29.9% of the forms for paints and allied products. Activities to reduce volatile organic chemicals in paint manufacture and in paint products are likely to account for the high standing of the paint industry in this regard. Improvements in operating practices and modifications in process were the highest categories in the sector, among multiple-codes forms, and for paints and allied products.

Table 6-11. Number of Forms Reporting Source Reduction Activity, 1996: Chemical Manufacturing, SIC Code 28

Category of Source Reduction Activity												
SIC Code	Industry	Forms Reporting Source Reduction Activities			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
		Total Forms Number	Number	Percent of All Forms Percent								
2812	Alkalies & Chlorine	63	14	22.2	0	1	7	2	4	0	0	0
2813	Industrial Gases	122	27	22.1	8	1	6	1	12	3	0	1
2816	Inorganic Pigments	176	36	20.5	22	3	9	7	12	0	0	2
2819	Industrial Inorganic Chemicals, nec*	828	135	16.3	56	7	48	4	68	2	0	1
2821	Plastics Materials & Resins	1,813	394	21.7	173	43	107	50	180	8	2	13
2822	Synthetic Rubber	123	37	30.1	11	0	25	0	11	0	0	0
2823	Cellulosic Manmade Fibers	12	4	33.3	1	0	1	0	2	0	0	0
2824	Organic Fibers, Noncellulosic	34	5	14.7	0	0	1	3	1	0	0	0
2833	Medicinals & Botanicals	180	34	18.9	14	1	9	5	15	3	0	0
2834	Pharmaceutical Preparations	340	58	17.1	32	2	11	9	30	3	2	3
2835	Diagnostic Substances	24	6	25.0	4	3	0	0	2	0	0	0
2836	Biological Products Exc Diagnostic	13	2	15.4	1	0	0	0	1	0	0	0
2841	Soap & Other Detergents	231	28	12.1	20	3	12	2	14	2	0	0
2842	Polishes & Sanitation Goods	423	76	18.0	40	11	26	16	18	10	0	17
2843	Surface Active Agents	259	42	16.2	19	6	13	6	16	0	0	4
2844	Toilet Preparations	68	12	17.6	3	2	2	3	5	0	2	1
2851	Paints & Allied Products	2,974	890	29.9	448	192	162	191	325	86	2	209
2861	Gum & Wood Chemicals	41	2	4.9	1	0	2	0	0	0	0	0
2865	Cyclic Crudes & Intermediates	667	97	14.5	35	1	44	4	50	0	0	2
2869	Industrial Organic Chemicals, nec*	2,601	365	14.0	157	15	166	20	121	12	0	8
2873	Nitrogenous Fertilizers	234	37	15.8	13	0	16	5	14	0	0	0
2874	Phosphatic Fertilizers	105	18	17.1	11	0	6	1	6	0	0	1
2875	Fertilizers, Mixing Only	213	12	5.6	1	3	6	0	0	0	0	2
2879	Agricultural Chemicals, nec*	759	90	11.9	66	6	24	1	28	6	0	5
2891	Adhesives & Sealants	615	141	22.9	46	36	39	29	38	11	1	21
2892	Explosives	79	23	29.1	13	0	10	1	4	0	0	0
2893	Printing Ink	254	59	23.2	14	28	6	24	13	5	0	16
2895	Carbon Black	79	17	21.5	12	4	0	5	4	0	0	0
2899	Chemical Preparations, nec*	1,186	180	15.2	90	30	37	25	66	14	0	16
Multiple within SIC 28		6,542	1,094	16.7	460	72	447	93	449	30	2	42
Invalid SIC Code within SIC 28		40	5	12.5	3	0	1	0	3	0	0	0
Total for SIC Code 28		21,098	3,940	18.7	1,774	470	1,243	507	1,512	195	11	364

Note: Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category

\*nec: not elsewhere classified

## Year-to-Year Comparisons for Chemical Manufacturing

### 1995-1996 TRI Data for Chemical Manufacturing

#### On- and Off-site Releases

From 1995 to 1996, on- and off-site releases reported by the chemical manufacturing sector decreased from 844.2 million pounds to 785.2 million pounds, a reduction of 59.1 million pounds or 7.0%. The largest reduction, in both pounds and percent, occurred in reported underground injection, which decreased 34.5 million pounds, or 14.7%.

Reported air emissions were reduced by 29.5 million pounds, or 7.0%; both fugitive and point source air emissions decreased. Increases were reported in surface water discharges (2.2 million pounds, a 2.5% increase), on-site land releases (1.5 million pounds, or 2.2%), and off-site releases (transfers to disposal; 1.2 million pounds or 4.0%). Table 6-12 presents 1995 and 1996 reporting by the chemical manufacturing sector, and Figure 6-11 illustrates the changes by release type.

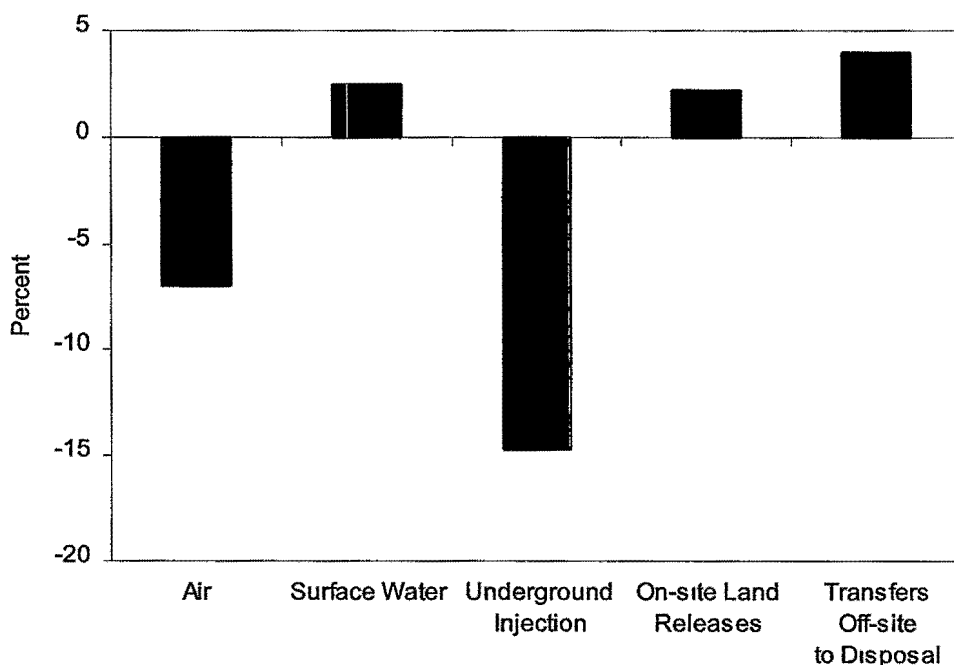
Also indicated on Table 6-12 is a 2.5% decrease from 1995 to 1996 in the number of forms submitted by this industry. At the same time, Form A certification statements from chemical manufacturing increased 11.4%. (The Form A certification statement is explained in Chapter 1.) This may reflect more widespread awareness of the



Table 6-12. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1995-1996: Chemical Manufacturing, SIC Code 28

	1995 Number	1996 Number	Change 1995 to 1996 Percent
Total Facilities	3,905	3,855	-1.3
Total Forms	21,644	21,098	-2.5
Form Rs	19,122	18,288	-4.4
Form As	2,522	2,810	11.4
	Pounds	Pounds	Percent
<u>On-site Releases</u>			
Total Air Emissions	421,919,788	392,434,100	-7.0
Fugitive Air	98,579,277	93,363,107	-5.3
Point Source Air	323,340,511	299,070,993	-7.5
Surface Water Discharges	88,184,358	90,420,803	2.5
Underground Injection	235,053,481	200,514,894	-14.7
On-site Land Releases	69,423,353	70,966,303	2.2
Total On-site Releases	814,580,980	754,336,100	-7.4
<u>Off-site Releases</u>			
Transfers Off-site to Disposal	29,651,233	30,842,063	4.0
Total On- and Off-site Releases	844,232,213	785,178,163	-7.0
<u>Other On-site Waste Management</u>			
Recycled On-site	3,324,704,960	3,731,246,814	12.2
Energy Recovery On-site	1,277,579,401	1,348,429,666	5.5
Treated On-site	3,829,359,360	3,254,527,247	-15.0
Total Other On-site Waste Management	8,431,643,721	8,334,203,727	-1.2
<u>Transfers Off-site for Further Waste Management</u>			
Transfers to Recycling	236,051,192	256,639,247	8.7
Transfers to Energy Recovery	410,316,527	378,369,918	-7.8
Transfers to Treatment	158,936,820	154,280,145	-2.9
Transfers to POTWs	114,761,842	109,463,055	-4.6
Other Off-site Transfers	117,929	104,516	-11.4
Total Transfers Off-site for Further Waste Management	920,184,310	898,856,881	-2.3

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required in 1995. Other Off-site Transfers are transfers reported without a valid waste management code.



**Figure 6-11. Percentage Change in On-site and Off-site Releases, 1995-1996: Chemical Manufacturing (SIC Code 28)**

**Note:** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-Site Land Releases and Underground Injection not required in 1995.

Form A certification statement in its second year of availability.

### Other On-site Waste Management

Chemical manufacturing reporting of on-site waste management also appears in Table 6-12. In 1995, on-site waste management in this sector totaled 8.43 billion pounds, and in 1996, 8.33 billion pounds. This constituted a 1.2% decrease. Much greater change occurred, however, within the three waste management methods—a 12.2% increase in on-site recycling, from 3.32 billion pounds to 3.73 billion pounds; a 5.5% increase in on-site energy recovery, from 1.28 billion pounds to 1.35 billion pounds; and, offsetting these, a 15.0% decrease in on-site waste treatment, from 3.83 billion pounds to 3.25 billion pounds.

### Transfers Off-site for Further Waste Management

Transfers off-site for further waste management decreased 21.3 million pounds (2.3%), from 920.2 million pounds to 898.9 million pounds. Off-site recycling was the only waste management option with an increase, which was 20.6 million pounds more in 1996 than in 1995, an 8.7% increase. Off-site energy recovery had the largest decrease, 31.9 million pounds (7.8% decrease). Transfers to treatment decreased by 4.7 million pounds and transfers to POTWs by 5.3 million pounds (2.9% and 4.6%, respectively). Table 6-12 provides these off-site transfer data for the two-year period.

### **1988-1996 TRI Data for Chemical Manufacturing**

As explained in Chapter 3, comparisons from the 1988 TRI baseline year to the current year rely on



the list of “core” TRI chemicals that were reportable, with the same reporting definition, in all years. These multi-year comparisons also review only the data elements that were collected in all years, which excludes from this section any analysis that distinguishes RCRA subtitle C landfills from other land releases as well as analysis based on the types of underground injection wells. On-site waste management data and transfers off-site to recycling and to energy recovery have been collected only since 1991; these data are included, but cannot be compared across the full 1988-1996 period.

The number of forms submitted with chemical industry SIC codes has remained relatively stable since 1988, decreasing just 0.4% through 1996. Use of the Form A certification statement, however, is evident in the 13.5% decrease in Form Rs since 1988. Table 6-13 summarizes 1988-1996 reporting for the chemical manufacturing sector, illustrated in Figure 6-12.

Since 1988, on- and off-site releases reported in this sector have decreased by half (51.0%), from 1.05 billion pounds to 513.0 million pounds. This was a reduction of 534.7 million pounds. Much of this reduction occurred in air emissions, which decreased 315.9 million pounds or 54.0%. The largest percentage reduction occurred in surface water discharges—77.0%, or 108.0 million pounds. Underground injection decreased by 43.1 million pounds (27.1%), on-site land releases by 27.6 million pounds (28.6%), and off-site releases (transfers to disposal) by 40.1 million pounds (60.3%).

On-site waste management data were not collected in TRI before 1991. Table 6-13 presents these data for recent years. Since 1994, other on-site waste management has shown a slight increase, 0.3%, in the chemical manufacturing sector, an increase of 18.0 million pounds. Much larger change has occurred in the three waste management methods within this category: On-site recycling decreased by 164.4 million pounds from 1994 to 1996, a

reduction of 5.2%. On-site treatment also decreased, by 99.6 million pounds, or 4.0%. On-site energy recovery, however, increased by 282.0 million pounds, a 30.0% increase.

Off-site transfers to treatment and to POTWs decreased by 26.1% (45.1 million) and 49.8% (65.5 million), respectively, from 1988 to 1996. Data for off-site transfers to recycling and energy recovery also were not collected until 1991; for the recent years shown in Table 6-13, these amounts fluctuated.

Production in the chemical manufacturing sector increased through most of this period; employment has fluctuated, but has remained above 1988 levels in all years but one (1994). TRI facilities report absolute amounts of waste managed and of environmental releases, not those adjusted for changes in production levels. As production in the chemical manufacturing sector has increased, however, all types of releases have decreased (see Table 6-13). Overall, the sector’s releases have decreased by half since TRI’s baseline year.

### Changes in SIC Codes

As indicated in facility descriptions below, some facilities report different SIC codes over time. This may reflect new or discontinued lines of production, or it may represent a different understanding of how SIC code designations relate to a facility’s business activities. These changes can contribute—sometimes largely—to apparent increases or decreases across comparison years in the amounts reported by the four-digit, or even two-digit, SIC codes.

## **1988-1996 Data for Four-Digit Industries in Chemical Manufacturing**

Tables 6-14 through 6-16 present data by four-digit SIC codes in chemical manufacturing (SIC code 28) for on- and off-site releases, other on-site waste management, and transfers off-site for further waste management.

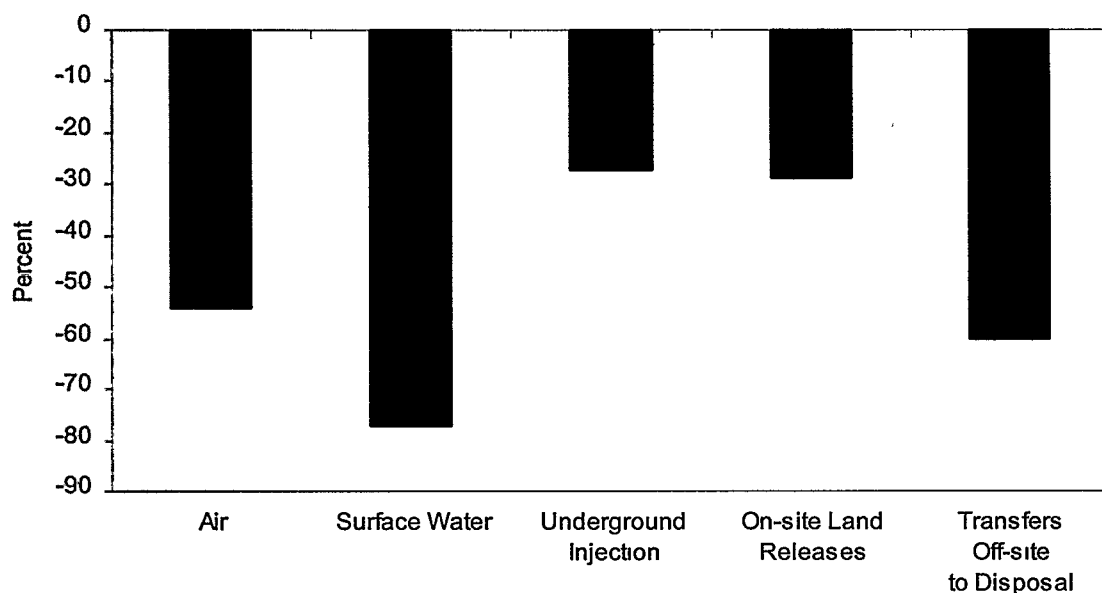


**Table 6-13. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28**

	1988 Number	1994 Number	1995 Number	1996 Number	Change 1988 to 1996 Percent
Total Facilities	3,673	3,704	3,643	3,619	-1.5
Total Forms	17,048	17,717	17,335	16,977	-0.4
Form Rs	17,048	17,717	15,369	14,742	-13.5
Form As	NA	NA	1,966	2,235	NA
	Pounds	Pounds	Pounds	Pounds	Percent
<u>On-site Releases</u>					
Total Air Emissions	584,784,741	301,408,689	288,356,923	268,929,786	-54.0
Fugitive Air	159,041,536	87,247,201	76,063,740	71,956,588	-54.8
Point Source Air	425,743,205	214,161,488	212,293,183	196,973,198	-53.7
Surface Water Discharges	140,266,541	26,512,984	24,573,671	32,250,242	-77.0
Underground Injection	159,374,099	112,392,443	136,571,844	116,260,191	-27.1
On-site Land Releases	96,789,189	71,848,513	66,421,814	69,148,399	-28.6
Total On-site Land Releases	981,214,570	512,162,629	515,924,252	486,588,618	-50.4
<u>Off-site Releases</u>					
Transfers Off-site to Disposal	66,567,653	25,320,056	23,676,003	26,454,493	-60.3
Total On- and Off-site Releases	1,047,782,223	537,482,685	539,600,255	513,043,111	-51.0
<u>Other On-site Waste Management</u>					
Recycled On-site	NA	3,162,659,917	2,745,605,831	2,998,270,797	NA
Energy Recovery On-site	NA	941,022,092	1,161,480,350	1,222,975,556	NA
Treated On-site	NA	2,475,723,968	2,647,593,460	2,376,129,409	NA
Total Other On-site Waste Management	NA	6,579,405,977	6,554,679,641	6,597,375,762	NA
<u>Transfers Off-site for Further Waste Management</u>					
Transfers to Recycling	NA	243,979,329	219,963,159	238,369,136	NA
Transfers to Energy Recovery	NA	352,005,525	385,420,395	351,356,029	NA
Transfers to Treatment	172,345,850	130,367,058	141,685,154	127,282,487	-26.1
Transfers to POTWs	131,623,520	78,172,560	74,572,446	66,139,592	-49.8
Other Off-site Transfers	16,517,434	426,569	117,679	12,748	-99.9
Total Transfers Off-site for Further Waste Management	NA	804,951,041	821,758,833	783,159,992	NA

**Note** Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. **On-site Releases** from Section 5 of Form R and **Off-site Releases** from Section 6 (transfers off-site to disposal) of Form R. **Other On-site Waste Management** from Section 8 of Form R. **Transfers Off-site for Further Waste Management** from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required before 1996. For 1994-1996, Other Off-site Transfers are transfers reported without a valid waste management code. For 1988, Other Off-site Transfers are transfers reported without a valid waste management code or codes not required to be reported in 1988. NA = not required to be reported in that year.





**Figure 6-12. Percentage Change in On-site and Off-site Releases, 1988-1996: Chemical Manufacturing (SIC Code 28)**

**Note:** Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required before 1996.

### On- and Off-site Releases

Forms with multiple SIC codes in SIC code 28 reported a net decrease of 293.2 million pounds in on- and off-site releases from 1988 to 1996, a 56.2% reduction (see Table 6-14). Decreases in on-site release media for this group ranged from a 35.5% reduction in land releases to a 79.0% decrease in surface water discharges. Off-site releases (transfers to disposal) for multiple codes in SIC code 28 decreased 75.5%.

The second largest reduction in on- and off-site releases was reported in miscellaneous industrial organic chemical production (SIC code 2869), a decrease of 66.1 million pounds, or 41.2%. Most of this reduction appeared in air emissions, which were 50.7 million pounds less in 1996 than in 1988 (decrease of 57.2%).

The industry with the greatest increase in on- and off-site releases from 1988 to 1996 was gum and wood chemical production (SIC code 2861), which had relatively little reporting in 1988. This industrial organic category increased by 8.5 million pounds, and most of the increase occurred in reporting of air emissions.

Table 6-14 summarizes release data for 1988 and 1994-1996 for all four-digit SIC codes in chemical manufacturing.

### Other On-site Waste Management

In other on-site waste management, an agricultural chemical industry reported the largest decrease since 1994 (these data were not collected in 1988). This was production of phosphatic fertilizers (SIC code 2874), with a reduction of 139.6 million pounds, or 33.7%. In this industry, on-site treatment decreased 259.9 million pounds for 1994-1996,



**Table 6-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28**

SIC Code	Industry	Year	On-site Releases				Total On-site Releases Pounds	Off-site Releases	
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds		Transfers Off-site to Disposal Pounds	Total On- and Off-site Releases Pounds
2812	Alkalies & Chlorine	96	349,893	184	0	159,564	509,641	8,793	518,434
		95	209,077	18,984	0	5,780	233,841	188	234,029
		94	359,777	245	0	142	360,164	389	360,553
		88	857,579	8,636	0	9,702	875,917	40,735	916,652
2813	Industrial Gases	96	355,151	4,976	0	2,689	362,816	0	362,816
		95	352,392	2,086	0	0	354,478	29,470	383,948
		94	162,895	2,101	0	0	164,996	21,100	186,096
		88	728,866	6,437	3,563	0	738,866	28,701	767,567
2816	Inorganic Pigments	96	8,733,593	384,030	0	3,255,125	12,372,748	4,441,778	16,814,526
		95	8,703,214	161,591	0	3,806,845	12,671,650	2,437,262	15,108,912
		94	9,223,873	112,174	500	2,580,000	11,916,547	2,209,274	14,125,821
		88	21,899,938	25,993	6,500,000	3,602,527	32,028,458	4,491,486	36,519,944
2819	Industrial Inorganic Chemicals, nec*	96	4,276,137	240,331	0	23,393,206	27,909,674	2,928,517	30,838,191
		95	4,951,230	24,461	0	21,436,265	26,411,956	3,487,878	29,899,834
		94	5,627,638	121,115	0	20,606,295	26,355,048	3,255,091	29,610,139
		88	16,788,211	295,253	31,618	17,325,871	34,440,953	11,050,974	45,491,927
2821	Plastics Materials & Resins	96	24,127,141	585,634	0	25,687	24,738,462	741,364	25,479,826
		95	24,010,059	595,425	0	196,778	24,802,262	1,219,756	26,022,018
		94	24,490,800	623,654	0	24,044	25,138,498	1,017,120	26,155,618
		88	45,267,692	1,226,439	86,000	72,537	46,652,668	2,205,805	48,858,473
2822	Synthetic Rubber	96	5,622,330	5,098	222,400	22,039	5,871,867	121,169	5,993,036
		95	5,131,941	4,935	0	14,026	5,150,902	168,397	5,319,299
		94	6,968,680	46,643	0	27,770	7,043,093	142,123	7,185,216
		88	14,864,643	21,618	0	28,867	14,915,128	713,212	15,628,340
2823	Cellulosic Manmade Fibers	96	20,322,125	47,400	0	644,435	21,013,960	0	21,013,960
		95	25,972,265	51,800	0	265	26,024,330	830,000	26,854,330
		94	24,432,265	48,150	0	0	24,480,415	1,407,400	25,887,815
		88	40,431,047	71,339	0	3,576,750	44,079,136	56,000	44,135,136
2824	Organic Fibers, Noncellulosic	96	446,886	69	24,341	0	471,296	41,640	512,936
		95	898,444	14,735	14,760	750	928,689	86,554	1,015,243
		94	779,355	16,000	72,005	750	868,110	20,154	888,264
		88	3,151,229	88,176	25,455	750	3,265,610	164,195	3,429,805
2833	Medicinals & Botanicals	96	1,290,867	42,426	0	200	1,333,493	27,365	1,360,858
		95	1,144,006	24,668	0	346	1,169,020	38,493	1,207,513
		94	2,020,032	38,138	0	160	2,058,330	36,030	2,094,360
		88	8,633,996	4,838,145	0	102,654	13,574,795	1,229,709	14,804,504
2834	Pharmaceutical Preparations	96	4,737,110	158,403	5,383,115	14,477	10,293,105	155,785	10,448,890
		95	6,687,408	132,049	8,405,770	20	15,225,247	100,519	15,325,766
		94	7,964,088	414,194	6,746,235	20	15,124,537	347,938	15,472,475
		88	20,315,322	56,524	3,643,650	11,960	24,027,456	1,912,858	25,940,314
2835	Diagnostic Substances	96	16,728	0	0	0	16,728	1,100	17,828
		95	45,261	0	0	0	45,261	0	45,261
		94	16,253	0	0	0	16,253	0	16,253
		88	69,542	4,749	0	0	74,291	0	74,291
2836	Biological Products Exc. Diagnostic	96	11,458	0	0	0	11,458	0	11,458
		95	8,653	0	0	0	8,653	750	9,403
		94	5,174	0	0	0	5,174	0	5,174
		88	10,150	0	0	0	10,150	750	10,900

**Note.** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



Table 6-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Code	Industry	Year	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 Pounds	Releases to Land Pounds			
2841	Soap & Other Detergents	96	36,863	0	0	4,068	40,931	3,074	44,005
		95	352,104	250	0	5	352,359	186,548	538,907
		94	215,685	0	0	10	215,695	161,112	376,807
		88	377,176	500	0	3,264	380,940	247,864	628,804
2842	Polishes & Sanitation Goods	96	223,850	515	0	1,260	225,625	13,165	238,790
		95	196,491	750	0	500	197,741	17,677	215,418
		94	226,378	1,277	0	1,003	228,658	16,801	245,459
		88	753,382	1,000	0	1,000	755,382	157,687	913,069
2843	Surface Active Agents	96	400,831	7	21,312	290	422,440	5,681	428,121
		95	979,054	17	19,539	31	998,641	9,513	1,008,154
		94	981,722	178	15,348	33,996	1,031,244	19,730	1,050,974
		88	1,842,271	59,763	0	500	1,902,534	127,390	2,029,924
2844	Toilet Preparations	96	50,387	90	0	4,750	55,227	62,239	117,466
		95	41,170	250	0	1,300	42,720	50,478	93,198
		94	28,685	250	0	875	29,810	30,700	60,510
		88	106,841	293	0	250	107,384	40,114	147,498
2851	Paints & Allied Products	96	8,282,377	2,542	0	29,064	8,313,983	595,936	8,909,919
		95	8,736,423	337	0	18,693	8,755,453	672,563	9,428,016
		94	9,867,259	3,828	0	14,633	9,885,720	678,799	10,564,519
		88	20,322,888	425,062	750	22,836	20,771,536	4,867,860	25,639,396
2861	Gum & Wood Chemicals	96	8,904,577	751	0	0	8,905,328	500	8,905,828
		95	7,519,835	750	0	0	7,520,585	0	7,520,585
		94	7,522,855	1,005	0	0	7,523,860	0	7,523,860
		88	349,380	3,500	0	1,850	354,730	2,600	357,330
2865	Cyclic Crudes & Intermediates	96	4,804,610	54,237	2,644,000	68,177	7,571,024	1,103,358	8,674,382
		95	4,162,154	175,688	3,045,300	73,358	7,456,500	1,131,449	8,587,949
		94	4,967,713	224,092	4,466,154	191,861	9,849,820	1,030,857	10,880,677
		88	10,683,698	122,517	66,557	103,684	10,976,456	866,192	11,842,648
2869	Industrial Organic Chemicals, nec*	96	37,979,817	275,680	48,825,414	508,435	87,589,346	6,940,586	94,529,932
		95	36,794,081	360,930	52,147,291	564,642	89,866,944	4,988,362	94,855,306
		94	41,701,804	443,340	39,000,641	736,179	81,881,964	3,869,933	85,751,897
		88	88,675,121	1,214,359	64,050,959	837,095	154,777,534	5,900,926	160,678,460
2873	Nitrogenous Fertilizers	96	3,191,124	118,464	725	13,826	3,324,139	334,206	3,658,345
		95	3,096,652	175,847	6,848	11,419	3,290,766	214,991	3,505,757
		94	2,844,898	258,550	1,637	134,296	3,239,381	55,819	3,295,200
		88	10,646,761	558,096	383	156,668	11,361,908	9,000	11,370,908
2874	Phosphatic Fertilizers	96	126,079	2,947,246	0	16,865,765	19,939,090	1,010	19,940,100
		95	152,050	17,926	0	17,673,379	17,843,355	1,010	17,844,365
		94	91,868	1,166,821	0	23,321,961	24,580,650	515	24,581,165
		88	99,235	843,836	0	33,710,082	34,653,153	88,769	34,741,922
2875	Fertilizers, Mixing Only	96	25,294	3,000	0	2,158	30,452	2,000	32,452
		95	33,050	3,365	0	3,250	39,665	8,066	47,731
		94	35,814	2,510	0	3,000	41,324	6,538	47,862
		88	30,249	2,750	0	111,137	144,136	16,422	160,558
2879	Agricultural Chemicals, nec*	96	1,223,687	12,276	510,696	13,326	1,759,985	176,286	1,936,271
		95	1,174,838	11,843	470,876	3,125	1,660,682	123,289	1,783,971
		94	1,321,040	8,113	556,363	2,937	1,888,453	366,341	2,254,794
		88	2,830,376	61,412	708,023	6,374	3,606,185	2,153,370	5,759,555

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

Table 6-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Code	Industry	Year	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 Pounds	Releases to Land Pounds		Transfers Off-site to Disposal Pounds	
2891	Adhesives & Sealants	96	1,844,806	2	0	10,086	1,854,894	81,180	1,936,074
		95	2,061,388	1,155	0	550	2,063,093	93,933	2,157,026
		94	2,034,770	785	0	550	2,036,105	347,171	2,383,276
		88	2,979,592	5,000	0	16,134	3,000,726	307,893	3,308,619
2892	Explosives	96	182,587	25,788	0	500	208,875	250	209,125
		95	82,441	18,015	0	750	101,206	5,052	106,258
		94	125,577	16,606	0	601	142,784	3,413	146,197
		88	334,923	45,663	0	97,899	478,485	736	479,221
2893	Printing Ink	96	600,939	1	0	500	601,440	1,249	602,689
		95	848,114	8	0	253	848,375	26,486	874,861
		94	940,786	121	0	250	941,157	31,564	972,721
		88	1,478,224	1,073	0	540	1,479,837	549,106	2,028,943
2895	Carbon Black	96	16,852,992	760	0	0	16,853,752	755	16,854,507
		95	17,814,340	760	0	0	17,815,100	755	17,815,855
		94	20,084,024	760	0	0	20,084,784	1,510	20,086,294
		88	13,445,853	3,000	0	0	13,448,853	0	13,448,853
2899	Chemical Preparations, nec*	96	1,769,488	8,864	2,308	318,298	2,098,958	2,265,053	4,364,011
		95	2,087,379	1,800	0	2,008	2,091,187	895,828	2,987,015
		94	2,001,227	8,979	0	86,945	2,097,151	1,029,219	3,126,370
		88	3,040,466	9,557	140,996	65,295	3,256,314	1,156,953	4,413,267
	Multiple within SIC Code 28	96	112,088,232	27,331,468	58,625,880	23,790,470	221,836,050	6,400,453	228,236,503
		95	124,008,313	22,773,231	72,461,460	22,607,476	241,850,480	6,848,481	248,698,961
		94	124,278,507	22,953,335	61,533,560	24,080,235	232,845,637	9,073,022	241,918,659
		88	247,972,949	130,163,280	80,334,325	36,912,791	495,383,345	26,078,225	521,461,570
	Invalid SIC Code within SIC 28	96	51,827	0	0	4	51,831	1	51,832
		95	103,096	15	0	0	103,111	2,255	105,366
		94	87,247	20	0	0	87,267	140,393	227,660
		88	5,797,141	102,571	3,781,820	10,172	9,691,704	2,102,121	11,793,825
	Total for SIC Code 28	96	268,929,786	32,250,242	116,260,191	69,148,399	486,588,618	26,454,493	513,043,111
		95	288,356,923	24,573,671	136,571,844	66,421,814	515,924,252	23,676,003	539,600,255
		94	301,408,689	26,512,984	112,392,443	71,848,513	512,162,629	25,320,056	537,482,685
		88	584,784,741	140,266,541	159,374,099	96,789,189	981,214,570	66,567,653	1,047,782,223

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified

partly offset by a 120.2 million pound increase in on-site recycling. (See Table 6-15.) Plastics materials and resins (SIC code 2821) had the second-largest decrease, 137.9 million pounds or 18.8%. On-site recycling of 144.4 million pounds less in 1996 than in 1994 accounted for this reduction. No other industry reduced its other on-site waste management by more than 100 million pounds from 1994 to 1996.

Miscellaneous industrial organics (SIC code 2869) reported the largest increase in on-site waste management from 1994 to 1996, 255.7 million pounds, or 21.0%, followed by multiple codes with 96.7 million pounds, or 3.1%. (These were the groups ranking second and first, respectively, for decreases in on and off-site releases since 1988.) For miscellaneous industrial organics (SIC code 2869), all on-site waste management methods increased (34.5 million pounds recycled, 184.4 million pounds burned for energy recovery, and



Table 6-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
2812	Alkalies & Chlorine	96	517,179	0	9,221,223	9,738,402
		95	866,310	0	9,239,585	10,105,895
		94	1,929,134	0	7,661,577	9,590,711
		88	NA	NA	NA	NA
2813	Industrial Gases	96	90,142	0	848,924	939,066
		95	160,618	0	563,229	723,847
		94	115,669	0	688,908	804,577
		88	NA	NA	NA	NA
2816	Inorganic Pigments	96	8,835,185	0	39,040,454	47,875,639
		95	52,421,329	0	39,245,139	91,666,468
		94	106,211	0	34,927,376	35,033,587
		88	NA	NA	NA	NA
2819	Industrial Inorganic Chemicals, nec*	96	88,585,575	11,623,000	46,038,317	146,246,892
		95	89,751,430	3,757,000	78,708,610	172,217,040
		94	90,598,190	10,939,000	72,447,775	173,984,965
		88	NA	NA	NA	NA
2821	Plastics Materials & Resins	96	285,437,883	96,161,214	213,217,148	594,816,245
		95	268,141,314	78,784,152	211,380,712	558,306,178
		94	429,839,410	82,144,669	220,695,428	732,679,507
		88	NA	NA	NA	NA
2822	Synthetic Rubber	96	41,133,955	9,077,700	15,158,012	65,369,667
		95	41,577,648	624,140	7,441,637	49,643,425
		94	38,276,477	516,240	4,800,983	43,593,700
		88	NA	NA	NA	NA
2823	Cellulosic Manmade Fibers	96	6,820,000	0	200,000	7,020,000
		95	9,980,000	0	450,000	10,430,000
		94	7,900,000	0	200,000	8,100,000
		88	NA	NA	NA	NA
2824	Organic Fibers, Noncellulosic	96	5,824,384	0	219,291,544	225,115,928
		95	34,545,304	474,140	252,319,809	287,339,253
		94	22,403,675	231,040	284,596,399	307,231,114
		88	NA	NA	NA	NA
2833	Medicinals & Botanicals	96	12,855,822	2,122,300	7,687,640	22,665,762
		95	5,632,383	2,242,900	6,208,128	14,083,411
		94	6,032,477	1,490,000	5,475,453	12,997,930
		88	NA	NA	NA	NA
2834	Pharmaceutical Preparations	96	20,335,443	1,248,818	8,805,574	30,389,835
		95	18,423,181	1,527,141	12,690,793	32,641,115
		94	14,916,317	1,602,778	15,223,405	31,742,500
		88	NA	NA	NA	NA
2835	Diagnostic Substances	96	0	0	122,000	122,000
		95	0	0	91,090	91,090
		94	454	0	51,500	51,954
		88	NA	NA	NA	NA

Note. Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category

\*nec: not elsewhere classified.



Table 6-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
2836	Biological Products Exc. Diagnostic	96	24,464	0	148,634	173,098
		95	26,371	0	200,909	227,280
		94	0	0	231,568	231,568
		88	NA	NA	NA	NA
2841	Soap & Other Detergents	96	19,611	0	193,499	213,110
		95	24,801	0	325,163	349,964
		94	30,641	0	361,580	392,221
		88	NA	NA	NA	NA
2842	Polishes & Sanitation Goods	96	47,439	0	555,871	603,310
		95	49,783	0	1,047,533	1,097,316
		94	145,860	0	356,911	502,771
		88	NA	NA	NA	NA
2843	Surface Active Agents	96	639,549	0	292,963	932,512
		95	618,838	0	384,863	1,003,701
		94	673,251	0	443,719	1,116,970
		88	NA	NA	NA	NA
2844	Toilet Preparations	96	100	0	1,000	1,100
		95	5,341	0	91	5,432
		94	5,104	0	92,633	97,737
		88	NA	NA	NA	NA
2851	Paints & Allied Products	96	36,470,885	114,045	8,554,884	45,139,814
		95	38,800,995	102,481	7,759,189	46,662,665
		94	38,037,709	79,619	5,915,323	44,032,651
		88	NA	NA	NA	NA
2861	Gum & Wood Chemicals	96	0	9,900	3,631,369	3,641,269
		95	0	13,500	51,023	64,523
		94	23,000	13,500	228,925	265,425
		88	NA	NA	NA	NA
2865	Cyclic Crudes & Intermediates	96	43,447,651	11,232,987	34,054,085	88,734,723
		95	43,658,776	11,919,756	25,053,974	80,632,506
		94	47,903,702	22,630,002	27,221,973	97,755,677
		88	NA	NA	NA	NA
2869	Industrial Organic Chemicals, nec*	96	429,710,927	537,624,985	506,812,851	1,474,148,763
		95	375,107,848	497,899,802	494,409,694	1,367,417,344
		94	395,206,881	353,184,000	470,049,097	1,218,439,978
		88	NA	NA	NA	NA
2873	Nitrogenous Fertilizers	96	867,416	564,598	1,135,923	2,567,937
		95	496,264	608,174	1,152,971	2,257,409
		94	692,794	608,273	1,120,706	2,421,773
		88	NA	NA	NA	NA
2874	Phosphatic Fertilizers	96	270,473,032	0	4,282,753	274,755,785
		95	164,801,788	0	228,668,000	393,469,788
		94	150,232,388	0	264,154,500	414,386,888
		88	NA	NA	NA	NA

Note Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified



Table 6-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28, Continued

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
2875	Fertilizers, Mixing Only	96	15,856	0	100	15,956
		95	24,352	0	3,806	28,158
		94	24,877	0	3,084	27,961
		88	NA	NA	NA	NA
2879	Agricultural Chemicals, nec*	96	232,709,918	312,932	20,684,378	253,707,228
		95	208,677,688	378,989	21,684,474	230,741,151
		94	206,671,578	0	18,264,876	224,936,454
		88	NA	NA	NA	NA
2891	Adhesives & Sealants	96	6,807,371	796,479	400,559	8,004,409
		95	3,593,710	529,784	451,242	4,574,736
		94	4,038,024	967,107	560,283	5,565,414
		88	NA	NA	NA	NA
2892	Explosives	96	11,890,000	0	9,680,931	21,570,931
		95	40,580,000	0	12,193,969	52,773,969
		94	22,504,730	0	7,123,725	29,628,455
		88	NA	NA	NA	NA
2893	Printing Ink	96	165,026	0	2,346,664	2,511,690
		95	205,085	0	1,955,363	2,160,448
		94	296,853	0	1,768,414	2,065,267
		88	NA	NA	NA	NA
2895	Carbon Black	96	0	7,998,571	20,142,170	28,140,741
		95	0	6,289,183	25,719,596	32,008,779
		94	0	3,023,543	19,732,590	22,756,133
		88	NA	NA	NA	NA
2899	Chemical Preparations, nec*	96	33,905,171	350,540	2,122,426	36,378,137
		95	30,913,108	205,760	1,950,013	33,068,881
		94	46,854,142	1,144,755	1,782,515	49,781,412
		88	NA	NA	NA	NA
	Multiple within SIC Code 28	96	1,460,635,513	543,737,487	1,201,453,299	3,205,826,299
		95	1,314,597,803	556,123,448	1,205,561,430	3,076,282,681
		94	1,637,112,600	462,447,566	1,009,542,321	3,109,102,487
		88	NA	NA	NA	NA
	Invalid SIC Code within SIC 28	96	5,300	0	4,214	9,514
		95	1,923,763	0	681,425	2,605,188
		94	87,769	0	421	88,190
		88	NA	NA	NA	NA
	Total for SIC Code 28	96	2,998,270,797	1,222,975,556	2,376,129,409	6,597,375,762
		95	2,745,605,831	1,161,480,350	2,647,593,460	6,554,679,641
		94	3,162,659,917	941,022,092	2,475,723,968	6,579,405,977
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



**Table 6-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28**

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
2812	Alkalies & Chlorine	96	7,935	1,588,333	28,768	250	0	1,625,286
		95	3,533	0	12,329	35,401	0	51,263
		94	0	0	13,765	0	0	13,765
		88	NA	NA	44,745	32,362	0	NA
2813	Industrial Gases	96	9,260	167,302	115,533	0	0	292,095
		95	58,137	100,000	224,603	0	0	382,740
		94	15,000	30,000	21,240	277	0	66,517
		88	NA	NA	107,808	3,332	0	NA
2816	Inorganic Pigments	96	483,443	0	75,779	10,696	0	569,918
		95	525,379	611	219,569	11,357	0	756,916
		94	419,858	1,118	286,172	11,304	0	718,452
		88	NA	NA	384,736	737,935	395,314	NA
2819	Industrial Inorganic Chemicals, nec*	96	5,704,944	298,325	7,165,638	172,880	250	13,342,037
		95	3,311,633	268,287	4,031,316	211,194	0	7,822,430
		94	3,606,542	154,379	4,329,959	137,278	0	8,228,158
		88	NA	NA	1,912,334	846,238	84,619	NA
2821	Plastics Materials & Resins	96	61,397,915	41,777,048	7,845,595	3,150,700	0	114,171,258
		95	35,194,147	35,713,502	23,067,200	4,017,043	130	97,992,022
		94	56,746,257	34,453,498	10,898,145	2,871,190	828	104,969,918
		88	NA	NA	19,260,090	4,642,893	473,610	NA
2822	Synthetic Rubber	96	8,362,060	964,314	2,390,609	100,329	0	11,817,312
		95	7,478,112	15,283,874	265,044	19,067	0	23,046,097
		94	8,144,060	1,023,619	1,977,787	20,469	0	11,165,935
		88	NA	NA	857,449	21,807	0	NA
2823	Cellulosic Manmade Fibers	96	0	0	0	85	0	85
		95	0	0	0	250	0	250
		94	0	0	0	250	0	250
		88	NA	NA	20,460	0	0	NA
2824	Organic Fibers, Noncellulosic	96	4,468,347	2,063	250	43,560	0	4,514,220
		95	4,899,058	259,379	825	45,649	0	5,204,911
		94	14,000	2,932	17,642	365	0	34,939
		88	NA	NA	65,629	68,266	0	NA
2833	Medicinals & Botanicals	96	497,460	17,478,404	2,266,869	4,985,431	0	25,228,164
		95	1,035,688	9,601,486	4,644,196	6,130,334	0	21,411,704
		94	2,033,469	9,627,810	7,164,891	6,355,570	0	25,181,740
		88	NA	NA	10,986,850	6,255,279	0	NA
2834	Pharmaceutical Preparations	96	6,915,155	45,646,574	19,180,835	3,202,517	1,926	74,947,007
		95	9,047,881	45,675,723	13,794,672	2,249,105	11,899	70,779,280
		94	11,596,555	36,739,730	12,083,437	3,281,710	590	63,702,022
		88	NA	NA	3,334,700	3,144,131	4,888,730	NA
2835	Diagnostic Substances	96	68,619	128,788	77,788	32,263	0	307,458
		95	7,496	102,781	95,609	36,165	0	242,051
		94	56,878	18,640	34,800	53,274	0	163,592
		88	NA	NA	3,766	392,764	0	NA
2836	Biological Products Exc Diagnostic	96	3,980	51,247	4,298	58,126	0	117,651
		95	0	34,560	7,334	61,990	0	103,884
		94	13,250	3,850	2,450	26,187	0	45,737
		88	NA	NA	2,600	56,291	0	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified





## Chapter 6 — TRI Data for Chemical Manufacturing

**Table 6-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28, Continued**

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
2841	Soap & Other Detergents	96	209,591	14,511	45,858	171,761	0	441,721
		95	485,853	9,681	52,649	2,952,744	5	3,500,932
		94	270,787	15,845	60,847	2,580,295	0	2,927,774
		88	NA	NA	188,258	332,418	0	NA
2842	Polishes & Sanitation Goods	96	1,920	40,268	142,614	85,071	0	269,873
		95	11,454	42,744	141,695	74,230	0	270,123
		94	15,475	103,898	92,942	110,496	0	322,811
		88	NA	NA	87,977	171,340	2,622	NA
2843	Surface Active Agents	96	82,661	762,231	64,972	917,363	0	1,827,227
		95	32,143	725,814	232,719	882,345	0	1,873,021
		94	39,546	465,311	54,348	972,503	0	1,531,708
		88	NA	NA	15,156	2,072,073	205	NA
2844	Toilet Preparations	96	0	52,639	32,357	190,222	480	275,698
		95	0	32,811	21,928	115,732	0	170,471
		94	0	6,536	14,826	112,594	0	133,956
		88	NA	NA	127,963	481,239	500	NA
2851	Paints & Allied Products	96	17,091,643	32,322,008	3,387,301	805,374	760	53,607,086
		95	14,509,680	38,389,824	4,359,367	1,193,625	7,800	58,460,296
		94	17,053,252	40,380,949	5,170,412	1,406,271	2,042	64,012,926
		88	NA	NA	18,126,270	2,526,420	4,030,249	NA
2861	Gum & Wood Chemicals	96	6,075	0	3,940	22,780	0	32,795
		95	0	0	2,550	39,800	0	42,350
		94	0	0	8,000	16,549	0	24,549
		88	NA	NA	17,809	60,846	0	NA
2865	Cyclic Crudes & Intermediates	96	2,742,345	6,693,958	5,162,542	10,606,440	0	25,205,285
		95	2,974,562	7,639,986	2,923,657	10,276,169	0	23,814,374
		94	2,095,343	8,155,867	2,036,979	12,771,984	0	25,060,173
		88	NA	NA	6,470,580	19,612,919	2,470	NA
2869	Industrial Organic Chemicals, nec*	96	17,775,153	66,179,053	19,669,813	16,495,683	8,919	120,128,621
		95	19,924,884	89,123,583	22,096,691	18,547,915	0	149,693,073
		94	18,712,650	86,571,880	21,921,206	17,548,683	423,109	145,177,528
		88	NA	NA	18,857,857	26,178,527	784,684	NA
2873	Nitrogenous Fertilizers	96	767,389	0	93,000	32,677	0	893,066
		95	767,402	0	0	21,279	0	788,681
		94	1,049,401	0	85,000	26,441	0	1,160,842
		88	NA	NA	250	1,700	0	NA
2874	Phosphatic Fertilizers	96	0	0	0	30	0	30
		95	0	0	0	148	0	148
		94	0	0	0	180	0	180
		88	NA	NA	0	532	0	NA
2875	Fertilizers, Mixing Only	96	0	0	17,398	255	0	17,653
		95	1,500	0	13,322	1,005	0	15,827
		94	0	0	2,940	1,005	0	3,945
		88	NA	NA	0	0	160,000	NA
2879	Agricultural Chemicals, nec*	96	6,612,868	2,720,224	2,539,914	79,770	0	11,952,776
		95	4,066,210	3,124,010	2,228,748	74,328	760	9,494,056
		94	4,000,280	1,756,262	1,807,507	24,046	0	7,588,095
		88	NA	NA	4,270,317	287,827	86,250	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



**Table 6-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Chemical Manufacturing, SIC Code 28, Continued**

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
2891	Adhesives & Sealants	96	543,785	3,488,474	2,317,631	44,939	0	6,394,829
		95	526,953	3,900,457	1,615,076	37,951	0	6,080,437
		94	1,532,428	4,219,576	2,107,578	39,063	0	7,898,645
		88	NA	NA	2,250,323	146,166	471,547	NA
2892	Explosives	96	840	0	10,063	0	0	10,903
		95	85,302	0	148,794	0	0	234,096
		94	304,497	0	337,025	750	0	642,272
		88	NA	NA	321,360	314	14,106	NA
2893	Printing Ink	96	1,315,638	1,021,091	286,766	69,374	0	2,692,869
		95	966,085	738,655	457,780	2,764	5	2,165,289
		94	1,292,278	702,116	332,730	5,762	0	2,332,886
		88	NA	NA	524,990	24,146	33,785	NA
2895	Carbon Black	96	0	0	20	20	0	40
		95	0	1,000	0	20	0	1,020
		94	0	1,000	0	20	0	1,020
		88	NA	NA	8,000	0	0	NA
2899	Chemical Preparations, nec*	96	476,638	1,569,505	1,873,179	1,278,401	0	5,197,723
		95	533,449	2,917,506	1,866,327	438,064	250	5,755,596
		94	624,023	3,316,665	1,670,225	409,409	0	6,020,322
		88	NA	NA	2,274,681	3,414,917	26,719	NA
	Multiple within SIC Code 28	96	102,323,472	128,357,427	52,470,497	23,580,875	413	306,732,684
		95	112,817,910	131,569,754	59,024,249	27,089,789	96,830	330,598,532
		94	114,044,900	124,134,343	57,812,379	29,383,542	0	325,375,164
		88	NA	NA	79,020,590	58,064,209	5,060,175	NA
	Invalid SIC Code within SIC 28	96	500,000	32,242	12,660	1,720	0	546,622
		95	698,708	164,367	136,905	6,983	0	1,006,963
		94	298,600	119,701	21,826	5,093	0	445,220
		88	NA	NA	2,802,302	2,046,629	1,849	NA
	Total for SIC Code 28	96	238,369,136	351,356,029	127,282,487	66,139,592	12,748	783,159,992
		95	219,963,159	385,420,395	141,685,154	74,572,446	117,679	821,758,833
		94	243,979,329	352,005,525	130,367,058	78,172,560	426,569	804,951,041
		88	NA	NA	172,345,850	131,623,520	16,517,434	NA

**Note:** Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 28 are assigned to the "multiple" category.

\*nec: not elsewhere classified

36.8 million pounds treated). Multiple-code forms reported a 191.9-million-pound increase in on-site treatment and an 81.3-million-pound increase in energy recovery, partly offset by a reduction of 176.5 million pounds in recycling. Table 6-15 supplies on-site waste management data for all industries in SIC code 28.

### Transfers Off-site for Further Waste Management

As shown in Table 6-16, the chemical manufacturing industries with the largest reductions since 1994 in transfers off-site for further waste management were miscellaneous industrial organics (SIC code 2869)—25.0 million pounds, or 17.3% decrease—and multiple codes—18.6 million pounds, or 5.7%. (Data for some types of transfers were not collected in 1988.) One other industry in



this sector reported more than 10 million pounds in reductions for the three-year period: paints and varnishes (SIC code 2851) had a decrease of 10.4 million pounds, or 16.3%. Pharmaceutical preparations (SIC code 2834) reported the largest increase from 1994 to 1996 in transfers off-site for further waste management. This was an increase of 11.2 million pounds or 17.7%. The second largest increase was reported in plastics materials and resins (SIC code 2821), 9.2 million pounds, or 8.8%.

Data on off-site transfers for all four-digit SIC codes in chemical manufacturing appear in Table 6-16.

#### *Facilities with Large Increases and Decreases in Releases, 1988-1996*

Huntsman Petrochemical Corporation in Port Arthur, Texas (multiple SIC codes 2819, 2865, and 2869), ranked first for increases in total on- and off-site releases from 1988 to 1996, with a net increase of 8.3 million pounds. Point source air releases of propylene increased from 3,700 pounds in 1988 to 7.9 million pounds in 1996, and this accounted for 95.5% of the total increase at the facility for all chemicals. The Huntsman facility, purchased from Texaco in 1996, manufactures ethylene and propylene to sell as chemical feedstock. A large cooling tower containing propylene developed a leak in mid-1995, resulting in the increase in emissions. The leak was repaired in 1997.

FMC Corporation in Pocatello, Idaho (SIC code 2819), had the second largest increase in releases, 4.3 million pounds. As a result of coming into compliance with an EPA enforcement action and modifying its methods for estimating land releases, FMC Corporation's numbers increased dramatically (from 203,040 pounds for on-site land releases in 1988 to 4.1 million pounds in 1996). FMC Corporation now plans to modify its 1988 submission for the amount of zinc compounds released to land to reflect an estimation technique similar to that used in the 1996 submission. The

revised 1988 releases to land will total over 3.9 million pounds. Consequently, the increase in releases to land between 1988 and 1996 will drop from 3.9 million pounds to 21,000 pounds.

Monsanto Company in Luling, Louisiana (multiple SIC codes 2865, 2873, 2879 in 1988 and multiple SIC codes 2819, 2834, 2869, 2873, 2879 in 1996), ranked third with a 4.1-million-pound increase in releases. This was almost entirely due to an increase in the amount of formaldehyde injected to underground wells as a result of production increases over this period. (Because of the changes to the definition for reporting ammonia to TRI, releases of the chemical are not included in the 1988-to-1996 comparison. However, during this period, the TRI data reflect a reduction in ammonia emissions to air of 4.1 million pounds by the facility.) The Monsanto facility dropped one SIC code (2865) and added three others (2819, 2834, and 2869) between 1988 and 1996. Monsanto attributes this to a change in products manufactured at the facility.

The top two facilities for decreases in releases from 1988 to 1996 were IMC-Agrico plants. Both manufacture phosphoric acid for use in production of phosphate fertilizers. Large quantities of gypsum are generated as by-product in the process. When rainwater comes in contact with the gypsum, stockpiled in uncovered outdoor stacks, it flushes out residual phosphoric acid. This phosphoric acid is reported as discharges to water. Significant reductions in the amount of phosphoric acid reported to TRI have resulted from reducing the surface area of some stacks and from covering the stacks with grass-covered clay. Additionally, evaporation ponds built on top of inactive stacks were lined with a synthetic material, preventing some water from entering the stacks. A system was also implemented to collect water from within the stacks and recycle the phosphoric acid contained within. IMC-Agrico Company in Uncle Sam, Louisiana (51.0-million-pound overall reduction; multiple SIC codes 2819 and 2874 in 1988 and SIC code 2874 in 1996), reported a 51.2-million-pound



reduction in the discharge of phosphoric acid to water between 1988 and 1996. IMC-Agrico Company in Saint James, Louisiana (37.3-million-pound overall reduction; multiple codes 2873 and 2874 in 1988 and 2819, 2873, and 2874 in 1996), reported a 37.6 million-pound reduction in discharges to water.

### Other Apparent Increases and Decreases in Releases, 1988-1996

In the TRI database, there are other facilities with large apparent increases and decreases, which have been identified as reporting errors or plant closures. Because these are errors or plant closures and not actual changes in the data, these facilities are not discussed in detail here. These include:

Angus Chemical Company, Sterlington, Louisiana, increase of 6.0 million pounds, EPA error in TRI database.

Hoechst-Celanese Polyester, Wilmington, North Carolina, decrease of 25.1 million pounds, reporting error.

Avtex Fibers Front Royal, Inc., Front Royal, Virginia, decrease of 37.7 million pounds, closed in 1989.

## 1991-1996 Waste Management Data for Chemical Manufacturing

Table 6-17 summarizes on- and off-site waste management data for the chemical manufacturing sector for 1991 and 1994-1996; these data were first collected in 1991. Total production-related waste increased 4.7%, from 7.59 billion pounds to 7.94 billion pounds over the six years, for the 1991-1996 "core" chemicals. For the more recent years (1994-1996), production-related waste has decreased, from 7.96 billion in 1994 to 7.94 billion in 1996.

Figure 6-13 shows the percentage changes for on- and off-site waste management types. The largest

component of the 1991-1996 change was an increase in on-site recycling of 365.3 million pounds, a 13.8% increase. The two other methods of on-site waste management also increased: energy recovery by 210.1 million pounds (20.3% increase) and treatment by 61.7 million pounds (2.7% increase). This meant an overall increase of 637.1 million pounds in on-site waste management (10.6% increase).

Smaller increases were reported in off-site recycling (7.4 million pounds, a 3.2% increase) and off-site energy recovery (34.9 million pounds, a 10.8% increase). Off-site treatment, however, decreased 60.5 million pounds, a 24.0% reduction. Thus, off-site waste management showed a net decrease from 1991 to 1996 of 18.3 million pounds, or 2.3%.

The quantity released on- and off-site decreased by 263.0 million pounds in reporting by the chemical manufacturing sector. This was a reduction of one-third (33.6%). Non-production-related waste decreased 6.5 million pounds, or 42.8%, for the period.

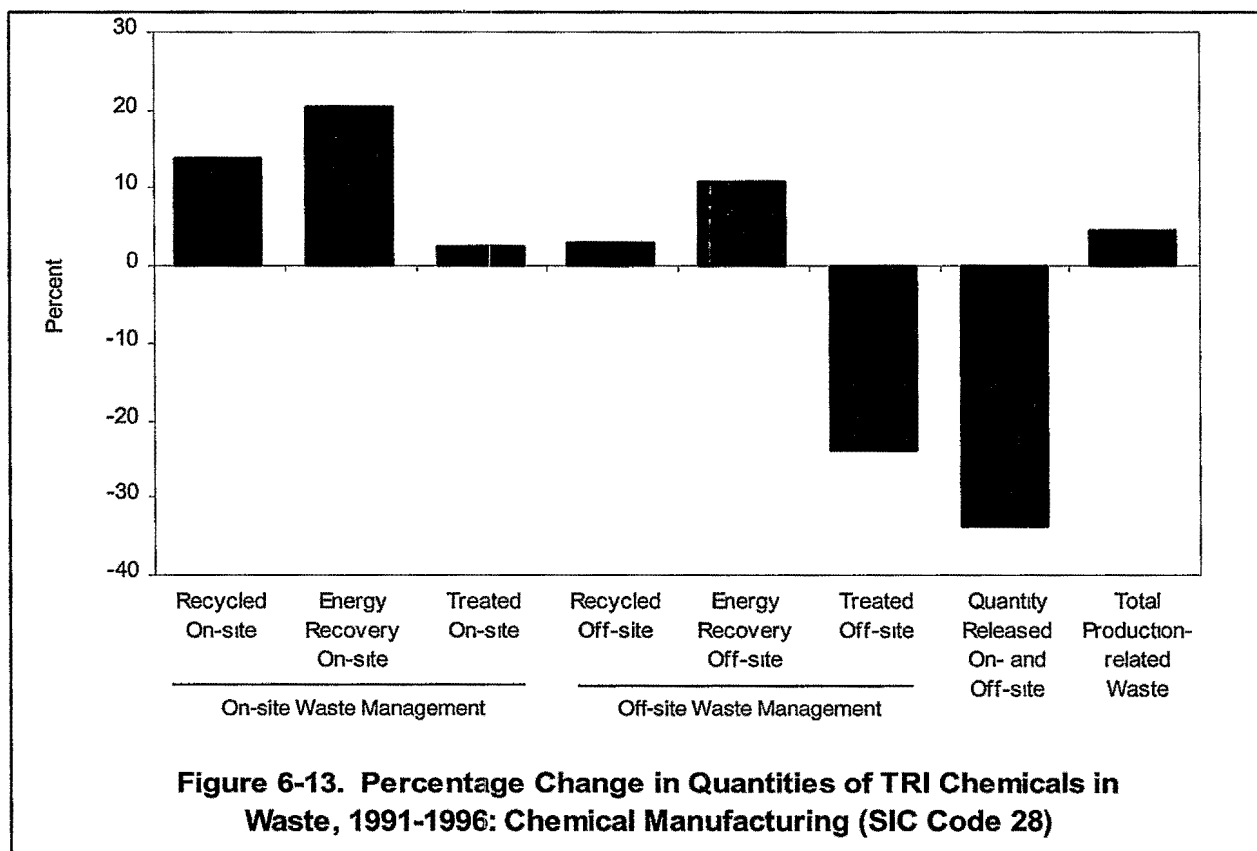
Overall, increases in production-related waste over this period have been driven by increases in on-site waste management methods, especially recycling and energy recovery. At the same time, the quantities reported as released on- and off-site have decreased. These changes suggest improvements in managing TRI chemicals in waste in accordance with the waste management hierarchy, explained in Chapter 2. Some facilities with large increases, however, attribute those increases, at least in part, to increasing production or to new production (from operations brought on line during this period). Projected waste management data in the chemical manufacturing sector indicate that this movement up the waste management hierarchy is expected to continue (see Table 6-10).



Table 6-17. TRI Waste Management Data, 1991, 1994-1996: Chemical Manufacturing, SIC Code 28

Waste Management Activity	1991 Pounds	1994 Pounds	1995 Pounds	1996 Pounds
<u>On-site Waste Management</u>				
Recycled On-site	2,637,884,279	3,171,240,288	2,752,600,663	3,003,186,108
Energy Recovery On-site	1,032,619,127	949,676,347	1,173,017,653	1,242,694,636
Treated On-site	2,324,438,700	2,483,582,506	2,657,033,238	2,386,119,008
Total On-site Waste Management	5,994,942,106	6,604,499,141	6,582,651,554	6,631,999,752
<u>Off-site Waste Management</u>				
Recycled Off-site	235,099,698	250,059,982	230,078,692	242,512,053
Energy Recovery Off-site	323,954,599	355,348,505	373,574,617	358,824,204
Treated Off-site	252,241,377	202,571,473	209,926,880	191,698,876
Total Off-site Waste Management	811,295,674	807,979,960	813,580,189	793,035,133
Quantity Released On- and Off-site	782,416,918	548,296,305	549,073,467	519,411,122
Total Production-related Waste	7,588,654,698	7,960,775,406	7,945,305,210	7,944,446,007
Non- Production-related Waste	15,130,942	6,419,535	6,757,987	8,655,298
Waste Management Activity	Change 1994-1995 Percent	Change 1995-1996 Percent	Change 1991-1996 Percent	
<u>On-site Waste Management</u>				
Recycled On-site	-13.2	9.1	13.8	
Energy Recovery On-site	23.5	5.9	20.3	
Treated On-site	7.0	-10.2	2.7	
Total On-site Waste Management	-0.3	0.7	10.6	
<u>Off-site Waste Management</u>				
Recycled Off-site	-8.0	5.4	3.2	
Energy Recovery Off-site	5.1	-3.9	10.8	
Treated Off-site	3.6	-8.7	-24.0	
Total Off-site Waste Management	0.7	-2.5	-2.3	
Quantity Released On- and Off-site	0.1	-5.4	-33.6	
Total Production-related Waste	-0.2	-0.0	4.7	
Non- Production-related Waste	5.3	28.1	-42.8	

Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated.



Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated.

### *Facilities with Large Increases and Decreases in Waste Management, 1991-1996*

Four of the five top facilities showing increases in production-related waste reported their largest increases in on-site recycling. Novartis Crop Protection, Inc. in St. Gabriel, Louisiana (multiple codes 2819, 2869, and 2879 in 1988 and 2819, 2865, 2869, and 2879 in 1996) ranked first in increases of production-related waste between 1991 and 1996, with a net increase of 459.0 million pounds. This is largely due to an increase in on-site recycling of toluene. Toluene is used in several processes at the facility as a solvent. In one case, it is used to transport a chemical intermediate from

one production unit to another. It is then separated from the intermediate and returned to the first production operation for reuse. Beginning in 1993, the toluene reused between the two sequential processes was reported as on-site recycling. Consequently, reported amounts of toluene recycled on-site increased by 458.3 million pounds between comparison years. Novartis noted that the increase in reporting does not indicate a change in the amount of toluene used.<sup>3</sup>

Four of the top five facilities cited production increases (including new facilities) to explain all or part of their increases in waste management quantities from 1991 to 1996. The number-two-ranked facility for increases, Zeneca, Inc., in Pasadena, Texas (181.4-million-pound increase; SIC code 2879), reported a 181.5 million pound

<sup>3</sup> There are no TRI regulatory definitions of recycling. Facilities may use their own interpretations for purposes of reporting to TRI. Changes in facility interpretations do not represent a change in guidance by EPA on how to report recycling.



increase in glycol ethers recycled on-site. Reasons for this change included a mistake in calculating the 1991 value and a production increase that affected the amount of the chemical used in process (it is used as a solvent). Formosa Plastics Corporation in Point Comfort, Texas (multiple SIC codes 2821 and 2869), reported no on-site recycling of propylene in 1991 and 57.7 million pounds in 1996, contributing to the facility's number three ranking (102.1-million-pound overall increase). The plant, which uses propylene as feedstock for the production of polypropylene resin, began operation in 1994, and thus there were no data for this facility in comparison year 1991.

The facility with the fourth largest increase in total production-related waste (98.4 million pounds) was Texaco Chemical, Inc., Port Neches, Texas (no code reported in 1991 and SIC code 2869 in 1996). Huntsman Petrochemical Corporation purchased the facility, built by Texaco between 1992 and 1994, in 1994; however, the facility reported to TRI under the facility name, Texaco Chemical, for the 1995 and 1996 reporting years. Methyl tertiary-butyl ether (MTBE) is produced at the plant and is sold as a gasoline additive. MTBE raises both the octane and the oxygen content of automobile gasoline. The use of oxygenated gasoline results in reduced amounts of carbon monoxide in exhaust. Tert-butyl alcohol, a feedstock for MTBE production, had a reported increase of 22.0 million pounds to on-site energy recovery. Propylene, used in the manufacture of propylene oxide, had an increase of 25.0 million pounds in on-site energy recovery. The propylene oxide product is used in the manufacture of polyurethane. Unrecoverable propylene and tert-butyl alcohol remain after the production processes and are burned in boilers or industrial furnaces (BIFs) as fuel. The facility did not report to TRI prior to reporting year 1995, and consequently, there are no data for comparison year 1991.

Fifth-ranked Hoechst-Celanese Polyester in Wilmington, North Carolina (SIC code 2869), reported an increase of 93.3 million pounds of methanol recycled on-site. The overall methanol

increase, 92.9% of the facility's total increase of 98.3 million pounds, was due to growth in production and inclusion of a product that had not previously been considered in TRI reporting.

All of the top four facilities showing decreases in production-related waste reported large reductions in on-site recycling. Lubrizol Corporation, Pasadena, Texas (SIC code 2869) reported a 143.0 million pound decrease in acrylonitrile recycling on-site (and an overall reduction of 217.1 million pounds in production-related waste). The decrease was due to a change in the facility's interpretation of on-site recycling. Acrylonitrile is used as a "carrier fluid" in one process at the plant. It is recovered and reused within that process (at no point in the process is it removed). This does not meet the Lubrizol facility's current interpretation of the definition of on-site recycling, which is that on-site recycling is constituted by removing a chemical from a main production process and then returning it. Because the acrylonitrile is part of a closed loop process, Lubrizol does not interpret the activity as on-site recycling. The facility uses acrylonitrile as a feedstock for production of a monomer that is a precursor in acrylic fiber manufacturing.<sup>4</sup>

Ranking second, Tennessee Eastman in Kingsport, Tennessee (multiple codes 2821, 2823, 2865, and 2869 in 1991 and multiple codes 2821, 2823, 2865, 2869, and 2893 in 1996), had a 174.0-million-pound reduction of methanol (and a 200.2-million-pound reduction overall), in on-site recycling. Carolina Eastman in Eastman Columbia, South Carolina (multiple codes 2821 and 2865), ranked third due to a 122.0-million-pound decrease in the amount of methanol reported as recycled on-site. Its overall reduction was 123.9 million pounds.

The fourth-ranked facility showing decreases in production-related waste (overall reduction of 103.7 million pounds), PCS Phosphate Company,

<sup>4</sup> There are no TRI regulatory definitions of recycling. Facilities may use their own interpretations for purposes of reporting to TRI. Changes in these interpretations do not represent a change in guidance by EPA on how to report recycling



Inc., Aurora, North Carolina (SIC code 2874), reported an increase of 110.6 million pounds of phosphoric acid recycled on-site. This facility also reported a 208.3-million-pound decrease in phosphoric acid treated on-site. The net decrease for phosphoric acid was 103.8 million pounds. PCS Phosphate treats its gypsum by-product to remove and neutralize the residual phosphoric acid. The facility has also improved techniques to recover rainwater runoff from the gypsum stacks.

#### **Other Apparent Increases and Decreases in Production-Related Waste, 1991-1996**

In the TRI database, there are other facilities with large apparent increases and decreases, which have been identified as reporting errors or plant closures. Because these are errors or plant closures and not actual changes in the data, these facilities are not discussed in detail here. There is one such facility in the chemical manufacturing sector:

Shintech, Inc., Freeport, Texas, decrease of 152.7 million pounds, reporting error.

#### **Facilities Contacted for Explanations (alphabetical by facility):**

Angus Chemical Company, Sterlington, Louisiana: Chet Chiles, March 18, 1998 (explanation provided)

Carolina Eastman, Eastman Columbia, South Carolina (no explanation provided)

FMC Corporation, Pocatello, Idaho: Kelly Packard and Jim Rice, March 18 and 19, 1998 (explanation provided)

Formosa Plastics Corporation, Point Comfort, Texas: Jim Shephard, April 17, 1998 (explanation provided)

Hoechst-Celanese Polyester, Wilmington, North Carolina: Larry Joh, March 16, 1998, and Karen Harbaugh, March 17, 1998 (explanation provided)

Huntsman Petrochemical Corporation, Port Arthur, Texas: Bill Forbes, March 18, 1998 (explanation provided)

IMC-Agrico Company, Saint James, Louisiana: Samuel Reed, March 16, 1998 (explanation provided)

IMC-Agrico Company, Uncle Sam, Louisiana: John Wen, March 16, 1998 (explanation provided)

Lubrizol Corporation, Pasadena, Texas: Bill Henry, March 20, 1998 (explanation provided)

Monsanto Company, Luling, Louisiana: Bill Rhodes, March 18 and April 9, 1998 (explanation provided)

Novartis Crop Protection, Inc., St. Gabriel, Louisiana: Kim Pagel, March 16 and 20, 1998 (explanation provided)

PCS Phosphate, Aurora, North Carolina: Leon Montgomery, March 16, 1998 (explanation provided)

Texaco Chemical, Inc., Port Neches, Texas: Bill Forbes (Huntsman Petrochemical Corporation), March 17 and 20, 1998 (explanation provided)

Tennessee Eastman, Kingsport, Tennessee (no explanation provided)

Zeneca, Inc., Pasadena, Texas: Jeanetta Daly, March 16, 1998 (explanation provided)





### Sources

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*U.S. Industry & Trade Outlook '98*, DRI/McGraw Hill, Standard & Poor's, and U.S. Department of Commerce, International Trade Administration, 1998: economic analyses, also provides some information on environment and industrial processes for selected industries.

U.S. Census Bureau, *1996 Annual Survey of Manufactures: Statistics for Industry Groups and Industries*, M96(AS)-1, February 1998 <<http://www.census.gov/prod/www/titles.html#mm>>: value of shipments and employment. Supplemental data from U.S. Census Bureau <<http://www.census.gov>> for some industries.

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## Chapter 7



# ***Toxics Release Inventory Data for Petroleum Refining (SIC Code 29)***

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## **A Look at the Petroleum Refining and Related Industries (SIC Code 29)**

The petroleum refining industry, SIC code 29, manufactures:

- ◆ Fuels—motor gasoline, diesel and distillate fuel oil, liquefied petroleum gas, jet fuel, residual fuel oil, kerosene and coke;
- ◆ Finished non-fuel products—solvents, lubricating oils, greases, petroleum wax, petroleum jelly, asphalt, and coke; and
- ◆ Chemical industry feedstocks—naphtha, ethane, propane, butane, ethylene, propylene, butylenes, butadiene, benzene, toluene, and xylene.

Box 7-1 lists Standard Industrial Classification (SIC) codes for the sector. In TRI, SIC codes are given as reported by the facilities; these may differ from information in economic and other data collections.

Petroleum refineries and related industries shipped \$174.3 billion in products in 1996 and \$151.4 billion in 1995 (in current dollars). The 1996 level surpassed the recent peak in value of shipments of \$172.6 billion in 1990 (also current dollars). Although the petroleum refining industry constitutes a large share of the total value of shipments of the U.S. economy, it comprises only a few hundred facilities (these are counted differently in various sources). Smaller facilities that specialize in production of a single petroleum product may employ as few as 10 people, while the more numerous and larger crude oil processing facilities maintain large staffs. Employment for the sector in 1996 was 106,000.

From 1989 to 1996, production in this sector increased 7.3%, compared to 17.6% for all U.S. manufacturing. During that time, production in SIC code 29 increased in every year but 1991. (See Chapter 4, Table 4-10.)

The largest segment of SIC code 29 is petroleum refining itself (SIC code 291). Refining facilities shipped \$158.07 billion in 1996 and employed 67,200 people. Refining made up 90.7% of the total



**Box 7-1. SIC Code 29, Petroleum Refining and Related Industries: Codes and Classifications**

SIC Code	Industrial Activity
291 2911	Petroleum Refining Production of gasoline, kerosene, distillate and residual fuel oils and lubricants
295 2951	Asphalt Paving and Roofing Materials Asphalt Paving Mixtures and Blocks asphalt and tar. Manufacture of asphalt and tar paving mixtures; and paving blocks made of asphalt and tar.
2952	Asphalt Felts and Coatings and roofing cements and coatings Manufacture, from purchased materials of asphalt and other saturated felts
299 2992	Products of Petroleum and Coal Lubricating Oils and Greases purchased mineral, animal, and vegetable materials. Blending, compounding, and re-refining lubrication oils and greases from
2999	Products of Petroleum and Coal, nec* petroleum and coal products. Manufacture of packaged fuel, powdered fuel, and other miscellaneous

Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual, 1987*. Standard Industrial Classification (SIC) codes and industry descriptions.

\*nec: not elsewhere classified.

value of shipments in SIC code 29 in 1996. As indicated in the SIC designations in Box 7-1, the sector has just two other major groups: asphalt paving and roofing materials (SIC code 295) and miscellaneous petroleum and coal products (SIC code 299, primarily lubricants).

Petroleum refineries supply about 40% of the total energy used in the United States and nearly all of the energy for transportation. The United States accounts for over one-quarter of the world's petroleum consumption—18.41 million barrels per day in 1996. About half of the crude oil used in the United States is imported. Refineries exported about 4% of their petroleum products in 1994.

Petroleum refining separates and transforms crude oil—physically, thermally, or chemically—into major distillation fractions (or components—fractions of crude oil are usually composed of compounds with similar properties). These are further separated and converted into finished petroleum products, in the three major categories

identified at the beginning of this chapter: fuels, finished non-fuel products, and chemical industry feedstocks. About 90% of the petroleum products used in the United States are fuels. Crude oil contains many hydrocarbons, in mixture, with small amounts of impurities, and its composition can vary significantly. Operations at petroleum refineries differ, given the composition of the crude oil they process and their particular products. “For these reasons,” one analysis points out, “no two refineries are alike.” Operations at a given refinery may also differ over time as crude oil of different composition is used.

Basic steps in the refining process begin with desalting, to remove from the crude oil corrosive salts along with some of the metals and suspended solids. Distillation, which follows, involves heating, vaporization, fractionation, condensation, and cooling. Distillation at atmospheric pressure separates lighter fractions; distillation at very low pressure (vacuum distillation) separates heavier fractions. Both are complex processes with



numerous output streams, and these may feed back into the process, into previous processes, into other processes, or into finished products. Downstream processes further refine fractions by cracking—that is, breaking large hydrocarbon molecules into smaller, lighter molecules. Catalytic cracking (using heat, pressure, and a catalyst) has become more common than thermal cracking. Other downstream methods include catalytic reforming, isomerization, polymerization, solvent extractions, dewaxing, and others.

SIC code 29 facilities use and manage large quantities of chemicals, and their complex operations give rise to many potential sources of environmental release. The major sources of chemical releases are air emissions (fugitive emissions from leaking equipment, emissions from process heaters used to heat process streams or generate steam, emissions from refining processes themselves) and wastewater (cooling water, process water, sanitary sewage water, and storm water).

A number of environmental concerns in the manufacture of petroleum and its products are not presently covered by TRI. These range from oil tanker spills (monitored in U.S. waters by the U.S. Coast Guard), to gasoline storage in underground tanks at service stations, to tailpipe emissions from cars and trucks.

## 1996 TRI Data for Petroleum Refining

Table 7-1 summarizes TRI reporting for the petroleum refining sector (SIC code 29). More than 3,200 TRI reporting forms were submitted for 1996. Of these, 241 (or 7.5% of all forms submitted in this sector) were Form A certification statements, certifying that a facility's total annual reportable amount of a TRI chemical was less than 500 pounds for the year and that the facility did not manufacture, process, or otherwise use more than 1 million pounds. (The Form A certification statement is explained in Chapter 1.)

Almost 80% of the forms in SIC code 29 were submitted by refineries (SIC code 2911), by far the largest segment of the sector in nearly all TRI reporting areas. Refineries reported 91.6% of total on- and off-site releases, 99.2% of other on-site waste management, 40.5% of transfers off-site for further waste management, 98.2% of total production-related waste, and close to 100% of non-production-related waste. For only one category were refineries ranked second. Lubricating oils and greases (SIC code 2992) reported 58.4% of transfers off-site for further waste management.

Some facilities in the petroleum sector engage in more than one manufacturing activity, as designated in the Standard Industrial Classification (SIC) system. Such facilities will then report more than one SIC code on their TRI forms. (Box 4-2 in Chapter 4 further explains reporting of multiple SIC codes and its affect on the analyses presented in the TRI data release.) This multiple-codes reporting in TRI is much smaller in the petroleum refining sector (SIC code 29) than in many other manufacturing sectors. Table 7-2 examines multiple-code reporting within SIC code 29. Ninety-three TRI forms reported more than one SIC code in SIC code 29 in 1996, 2.9% of all forms in the sector, a smaller percentage than in many sectors. Of these, 72 reported both petroleum refining (SIC code 2911) and miscellaneous products of petroleum and coal (SIC code 2999).

## On- and Off-site Releases

Air emissions represented 75.6% of all on- and off-site releases reported in the petroleum refining sector, as shown in Table 7-3 and Figure 7-1. The petroleum refining segment (SIC code 2911) accounted for 90.3% (47.0 million pounds) of these releases to air. Miscellaneous petroleum and coal products (SIC code 2999) was second with 5.5% (2.9 million pounds). Figure 7-2 illustrates the distribution of on-and off-site releases for the industries (four-digit SIC code) in this sector.



Table 7-1. Summary of TRI Information by 4-digit SIC Code, 1996: Petroleum Refining, SIC Code 29

Total On- and Off-site Releases Rank	Total Production-related Waste Rank	SIC Code	Industry	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds
1	1	2911	Petroleum Refining	165	2,582	93	60,851,253	2,234,680	63,085,933
7	7	2951	Asphalt Paving Mixtures & Blocks	10	16	6	4,816	0	4,816
6	5	2952	Asphalt Felts & Coatings	45	94	15	52,524	10,751	63,275
4	2	2992	Lubricating Oils & Greases	147	362	109	495,989	242,177	738,166
2	4	2999	Petroleum & Coal Products, nec*	21	80	13	2,868,906	2,500	2,871,406
3	3		Multiple within SIC 29	10	93	4	1,949,289	91,323	2,040,612
5	6		Invalid SIC Code within SIC 29	3	4	1	7,050	76,000	83,050
			Total for SIC Code 29	401	3,231	241	66,229,827	2,657,431	68,887,258

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except: Non-production-related Waste (remedial/catastrophic incidents) Forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

Table 7-2. Multiple SIC Codes, 1996: Petroleum Refining, SIC Code 29

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Number	Non-Production-related Waste Number
2911 2951	4	0	2,036	248	2,284	9,130	5,972	17,353	0
2911 2951 2992	8	0	489,695	9,480	499,175	464,922	250	956,422	0
2911 2999	72	0	1,447,992	70,935	1,518,927	8,681,868	156,731	10,291,783	0
2952 2992	9	4	9,566	10,660	20,226	1,205	4,112	22,560	0
Total for SIC Code 29	93	4	1,949,289	91,323	2,040,612	9,157,125	167,065	11,288,118	0

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except: Non-production-related Waste (remedial/catastrophic incidents).

Table 7-3. TRI On-site and Off-site Releases, 1996: Petroleum Refining, SIC Code 29 (in Rank Order)

SIC Code	Industry	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases Transfers Off-site to Disposal Pounds	Total On- & Off-site Releases Pounds
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
2911	Petroleum Refining	47,029,821	10,295,051	2,310,233	8,664	5,685	1,201,799	60,851,253	2,234,680	63,085,933
2999	Petroleum & Coal Products, nec*	2,851,452	17,454	0	0	0	0	2,868,906	2,500	2,871,406
	Multiple within SIC 29	1,693,194	253,726	0	0	0	2,369	1,949,289	91,323	2,040,612
2992	Lubricating Oils & Greases	487,536	680	0	0	0	7,773	495,989	242,177	738,166
	Invalid SIC Code within SIC 29	7,050	0	0	0	0	0	7,050	76,000	83,050
2952	Asphalt Felts & Coatings	27,210	314	0	0	0	25,000	52,524	10,751	63,275
2951	Asphalt Paving Mixtures & Blocks	4,816	0	0	0	0	0	4,816	0	4,816
	Total for SIC Code 29	52,101,079	10,567,225	2,310,233	8,664	5,685	1,236,941	66,229,827	2,657,431	68,887,258

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the multiple category.

\*nec: not elsewhere classified.

Table 7-1. Summary of TRI Information by 4-digit SIC Code, 1996: Petroleum Refining, SIC Code 29, Continued

SIC Code	Industry	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Total Non-Production-related Waste Pounds
2911	Petroleum Refining	2,045,870,460	10,587,404	2,117,356,607	1,786,042
2951	Asphalt Paving Mixtures & Blocks	1,874	0	6,708	0
2952	Asphalt Felts & Coatings	151,088	16,150	240,075	0
2992	Lubricating Oils & Greases	4,914,579	15,260,110	20,904,718	256
2999	Petroleum & Coal Products, nec*	2,384,328	109,745	5,357,523	159
	Multiple within SIC 29	9,157,125	167,065	11,288,118	0
	Invalid SIC Code within SIC 29	56,000	8,310	147,610	0
	Total for SIC Code 29	2,062,535,454	26,148,784	2,155,301,359	1,786,457

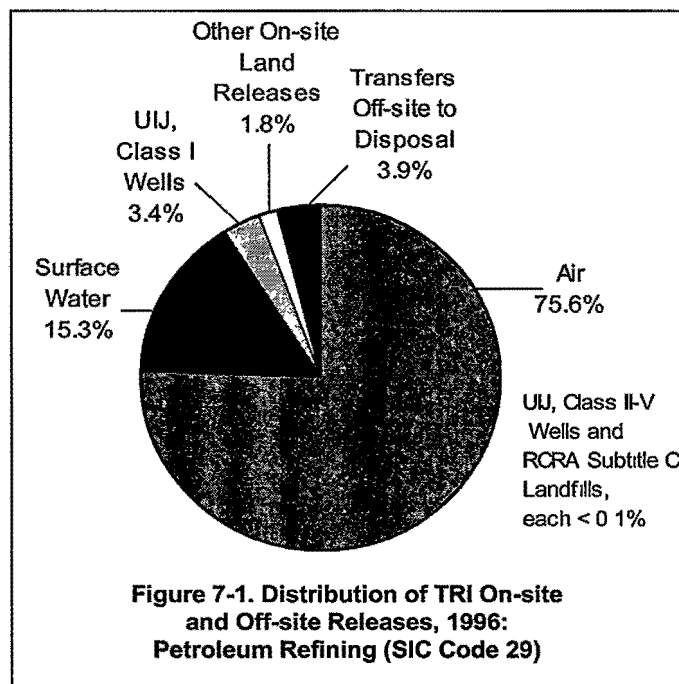
Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except: Non-production-related Waste (remedial/catastrophic incidents) Facilities/forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

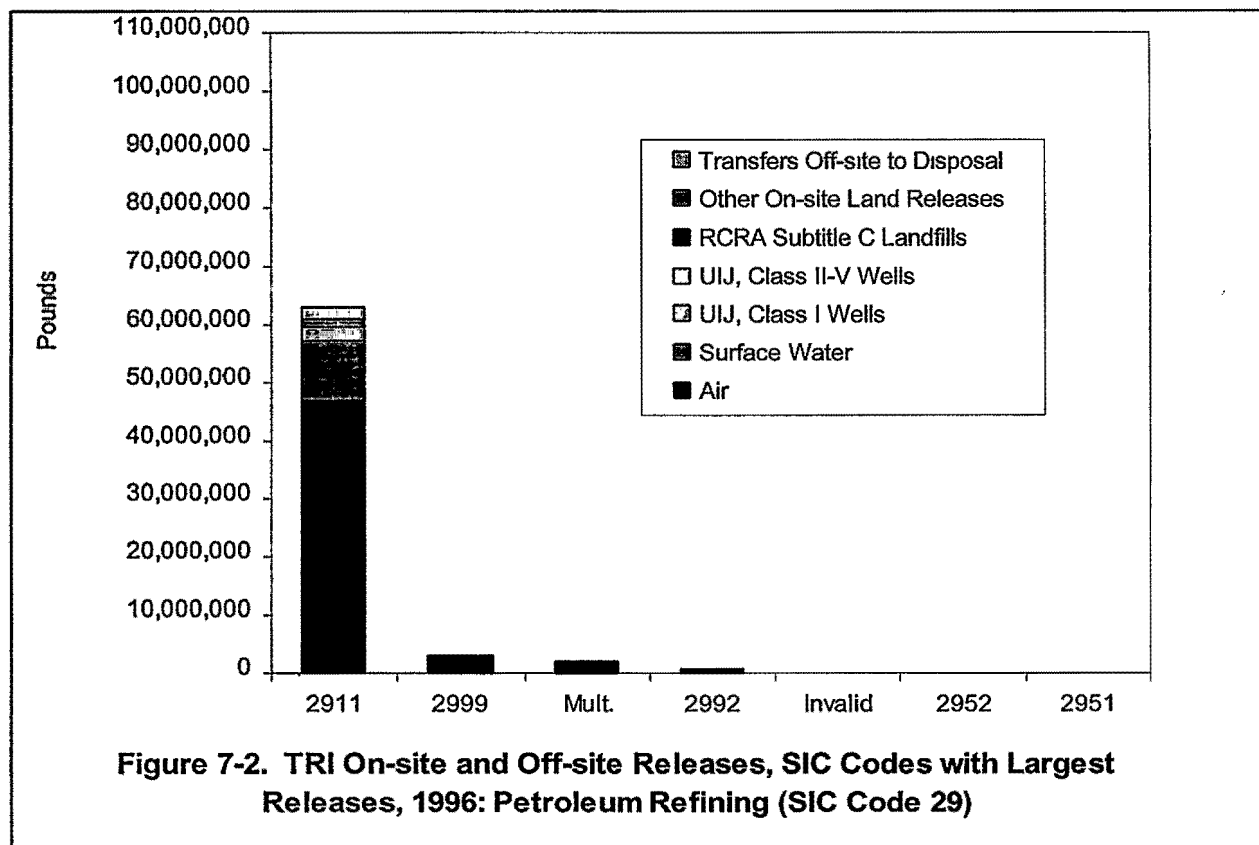
## Other On-site Waste Management

Table 7-4 and Figure 7-3 summarize other on-site waste management. Treatment was the largest category, with 1.31 billion pounds, 63.3% of the total. Refineries (SIC code 2911) reported 99.2% of total on-site waste management (2.05 billion pounds). On-site waste management has by far the largest role in this sector's handling of TRI chemicals.

Figure 7-4 illustrates on-site waste management reporting for petroleum industries.



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



Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category. UIJ = underground injection. Invalid SIC codes are codes beginning "29" that do not exist in the current Standard Industrial Classification code system.

Table 7-4. TRI Other On-site Waste Management, 1996: Petroleum Refining, SIC Code 29 (in Rank Order)

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
2911	Petroleum Refining	148,364,971	603,132,858	1,294,372,631	2,045,870,460
	Multiple within SIC 29	645,727	0	8,511,398	9,157,125
2992	Lubricating Oils & Greases	4,178,041	103,934	632,604	4,914,579
2999	Petroleum & Coal Products, nec*	4,600	364,600	2,015,128	2,384,328
2952	Asphalt Felts & Coatings	151,088	0	0	151,088
	Invalid SIC Code within SIC 29	56,000	0	0	56,000
2951	Asphalt Paving Mixtures & Blocks	109	0	1,765	1,874
	Total for SIC Code 29	153,400,536	603,601,392	1,305,533,526	2,062,535,454

Note: Other On-site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category. Invalid SIC codes are codes beginning "29" that do not exist in the current Standard Industrial Classification code system.

\*nec: not elsewhere classified.

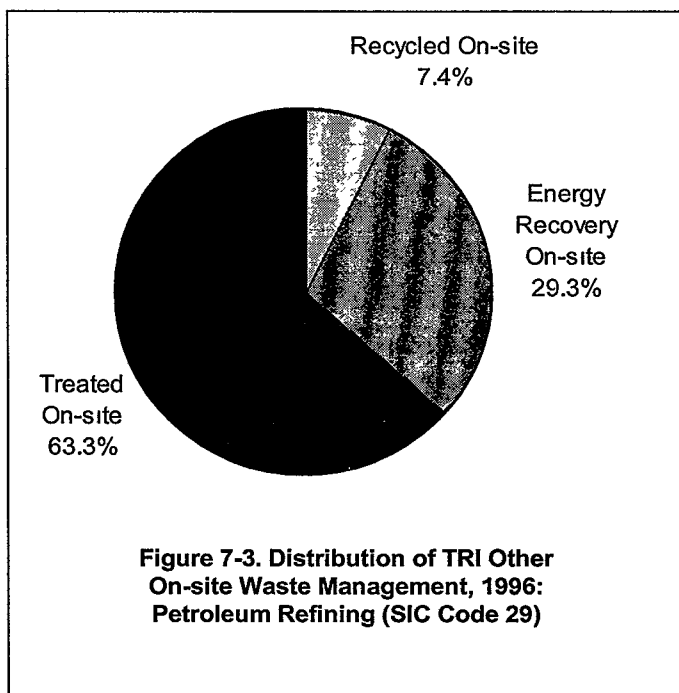


## Transfers Off-site for Further Waste Management

Lubricating oils and greases (SIC code 2992) reported the largest transfers off-site for further waste management, 15.3 million pounds, as shown in Table 7-5. Refineries (SIC code 2911) were second with 10.6 million. The two industries together accounted for 98.8% of the total.

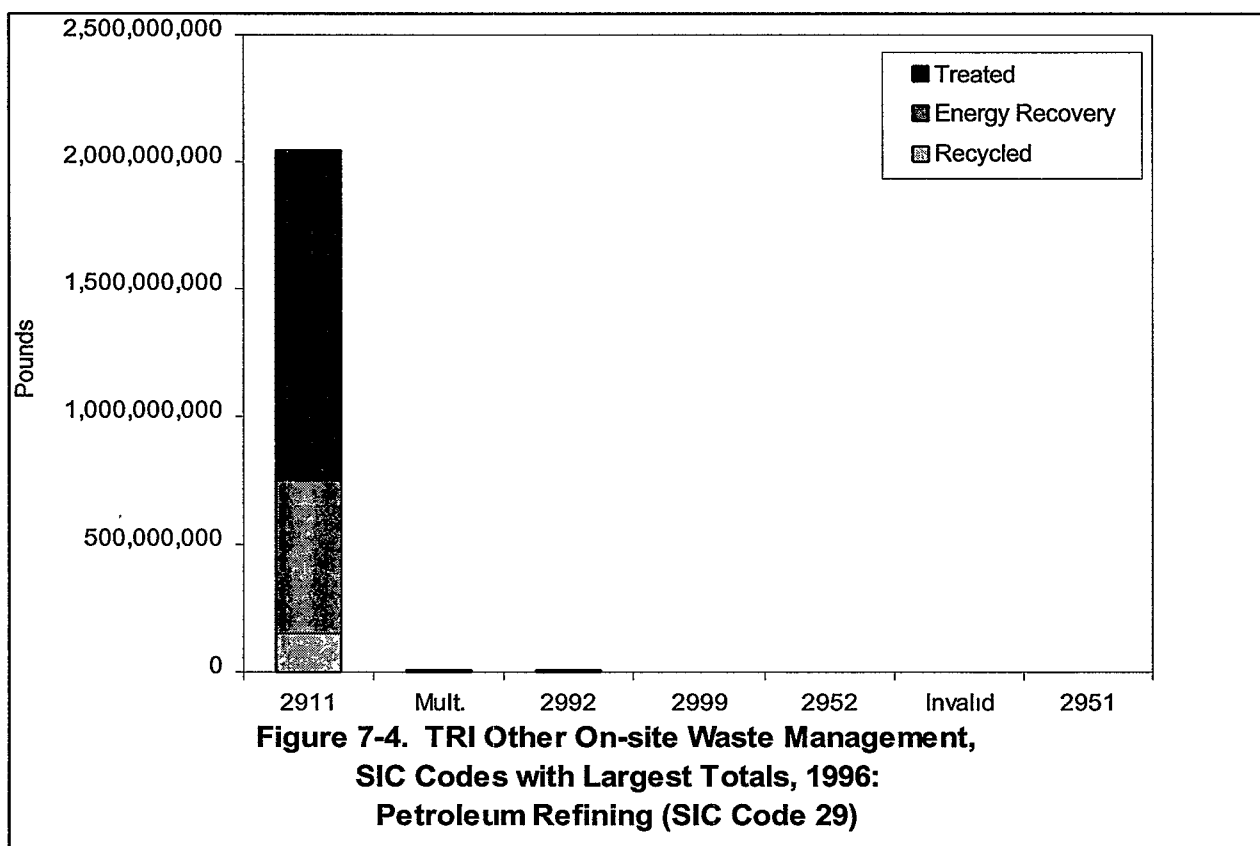
Figure 7-5 shows transfers off-site for further waste management by category of waste-management method. Recycling was the largest category with 18.6 million pounds reported, 71.0% of the total.

Figure 7-6 shows the off-site transfer data by four-digit SIC code.



**Figure 7-3. Distribution of TRI Other On-site Waste Management, 1996: Petroleum Refining (SIC Code 29)**

Note: Data from Section 8 of Form R.



**Figure 7-4. TRI Other On-site Waste Management, SIC Codes with Largest Totals, 1996: Petroleum Refining (SIC Code 29)**

Note: Other On-site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC Code 29 are assigned to the "multiple" category. Invalid SIC codes are codes beginning "29" that do not exist in the current Standard Industrial Classification code system.





**Table 7-5. TRI Transfers Off-site for Further Waste Management, 1996: Petroleum Refining, SIC Code 29**  
(In Rank Order)

SIC Code	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Transfers for Further Waste Management Pounds
2992	Lubricating Oils & Greases	14,184,602	415,767	57,587	602,154	0	15,260,110
2911	Petroleum Refining	4,212,448	239,672	1,958,367	4,176,916	1	10,587,404
	Multiple within SIC 29	112,180	39	53,737	1,109	0	167,065
2999	Petroleum & Coal Products, nec*	35,902	1,593	72,250	0	0	109,745
2952	Asphalt Felts & Coatings	8,195	0	0	7,955	0	16,150
	Invalid SIC Code within SIC 29	0	0	8,310	0	0	8,310
2951	Asphalt Paving Mixtures & Blocks	0	0	0	0	0	0
	<b>Total for SIC Code 29</b>	<b>18,553,327</b>	<b>657,071</b>	<b>2,150,251</b>	<b>4,788,134</b>	<b>1</b>	<b>26,148,784</b>

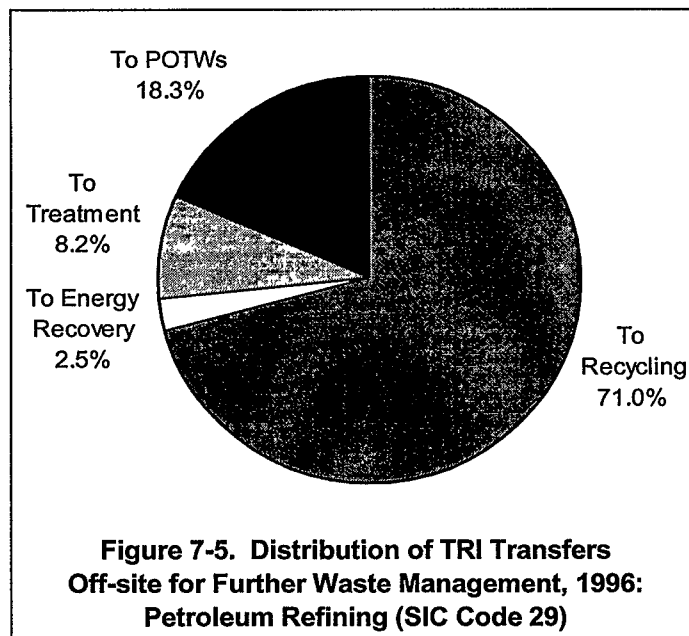
Note: Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers reported without valid waste management code. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

## 1996 TRI Data by State for Petroleum Refining

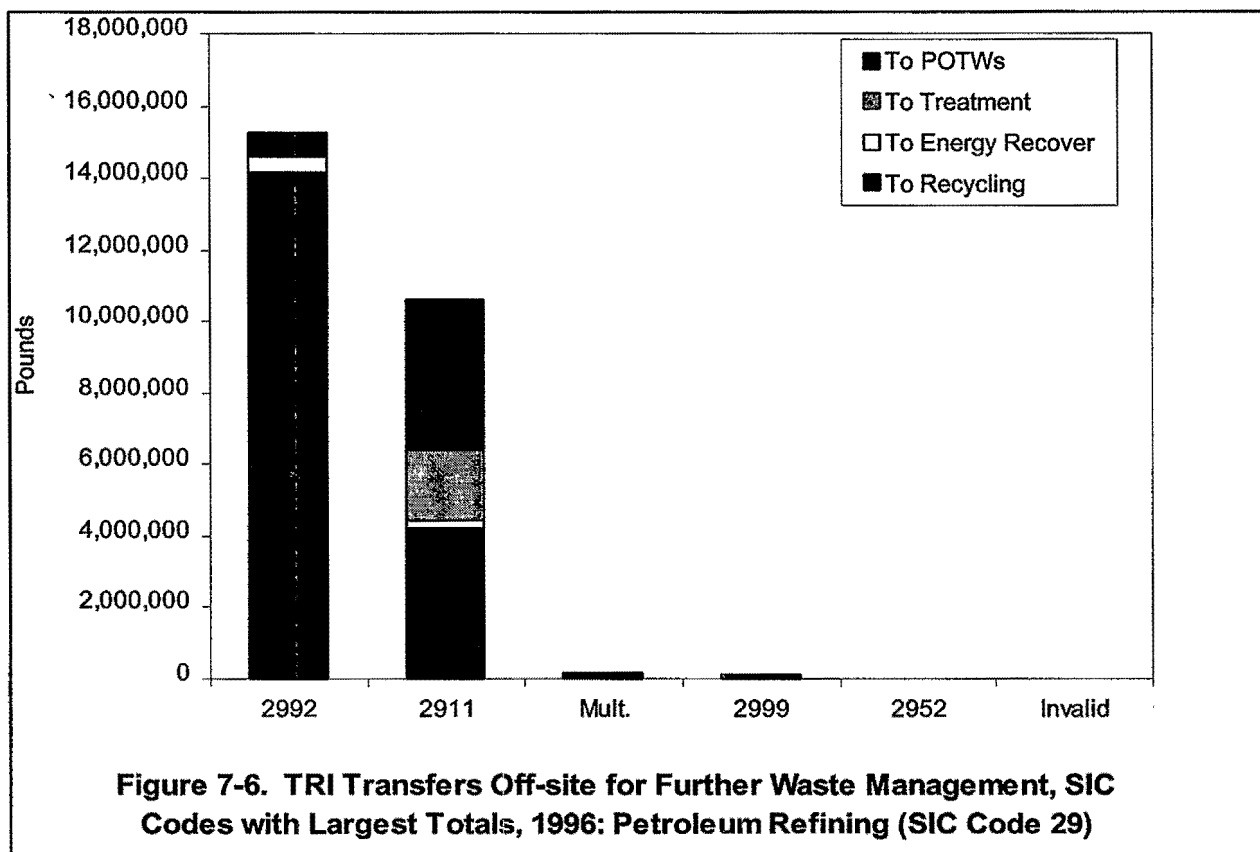
Petroleum refining industries are primarily located near sources of crude oil (either oil and gas fields or onshore petroleum terminals) or near consumers of petroleum products (heavily industrialized areas). Three states, Texas, Louisiana, and California, were home to 42% of U.S. refineries and were also responsible for 53% of the crude distillation capacity in 1994. These three states accounted for 28.9% of the facilities reporting to TRI and 40.9% of the TRI forms submitted in SIC code 29 in 1996.

Texas reported the largest total on- and off-site releases (21.4 million pounds) and California had the second largest total (11.8 million pounds). These states also ranked first and second for both on-site releases and off-site releases (transfers to disposal). California reported the largest quantities



Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R.

of other on-site waste management, with 1.03 billion pounds, and total production-related waste,



**Note:** Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category. Invalid SIC codes are codes beginning "29" that do not exist in the current Standard Industrial Classification code system.

with 1.04 billion pounds. New Jersey was second in both categories, with 331.9 million pounds in other on-site waste management and 333.8 million pounds in total production-related waste. Indiana reported the largest transfers off-site for further waste management with 12.7 million pounds, followed by California with 4.7 million pounds.

Table 7-6 presents 1996 TRI data for the petroleum sector in all states and territories. Map 7-1 illustrates the geographic distribution of on- and off-site releases reported in this sector.

## 1996 TRI Data by Chemical for Petroleum Refining

Nitrate compounds (9.3 million pounds) and ammonia (9.0 million pounds) were the two chemicals with the largest on- and off-site releases for petroleum refining. These were followed by toluene, methanol, and n-hexane with 7.7 million, 5.4 million, and 5.1 million pounds, respectively (see Table 7-7).

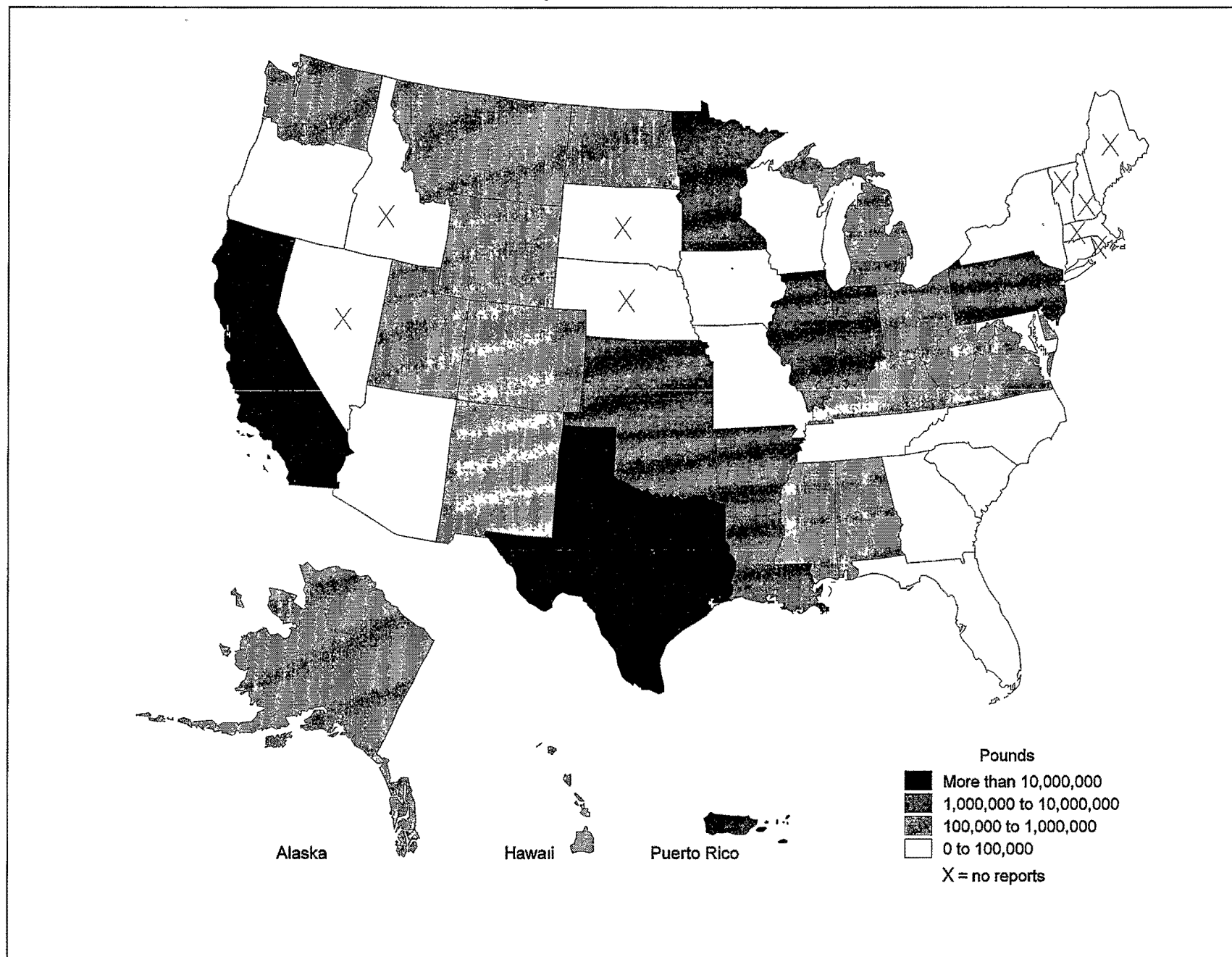


Table 7-6. Summary of TRI Information by State, 1996: Petroleum Refining, SIC Code 29

State	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total On-site Waste Management Pounds	Total Other Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
Alabama	10	41	2	461,060	45	461,105	33,621	508,463	1,008,212	0
Alaska	4	22	3	313,501	0	313,501	147,120	22,240	475,429	6,257
Arizona	5	15	1	10,340	206	10,546	2,933	0	13,480	0
Arkansas	5	31	1	1,328,776	190	1,328,966	1,025,540	92,965	2,448,730	0
California	48	459	38	11,402,869	441,261	11,844,130	1,028,481,664	4,745,047	1,044,581,141	222,820
Colorado	5	39	1	216,155	211,832	427,987	10,383,840	3,792	10,853,473	0
Connecticut	1	1	0	250	0	250	0	1,295	1,794	0
Delaware	2	21	5	162,642	0	162,642	279,600	12,134	428,375	26,000
Florida	10	20	4	4,119	285	4,404	60,252	55,800	64,671	0
Georgia	9	27	7	29,507	1,094	30,601	101,127	8,000	140,195	0
Hawaii	2	30	3	312,207	1,774	313,981	3,527,837	4,554	3,837,689	20
Illinois	29	184	16	2,867,425	125,326	2,992,751	46,227,495	456,035	49,669,653	2,162
Indiana	13	81	11	1,017,661	255,251	1,272,912	8,943,010	12,651,801	22,840,039	10,069
Iowa	4	10	2	1,255	0	1,255	0	0	706	0
Kansas	11	81	9	3,386,540	584	3,387,124	35,710,390	167,722	39,216,245	352
Kentucky	2	44	5	533,772	126,408	660,180	13,672,504	17,066	14,346,645	28,806
Louisiana	24	249	7	6,435,946	286,833	6,722,779	73,801,504	669,201	81,059,845	45,089
Maryland	4	6	2	100	750	850	5,600	250	6,040	0
Massachusetts	2	3	2	0	0	0	0	0	0	0
Michigan	12	62	18	225,621	1,437	227,058	51,150,941	315,487	51,709,072	0
Minnesota	5	57	1	1,118,882	54,220	1,173,102	2,414,518	301,838	3,882,433	0
Mississippi	5	10	4	433,250	0	433,250	33,300	0	421,810	300
Missouri	7	25	4	31,825	4,191	36,016	1,465	11,597	46,171	3
Montana	4	69	1	549,506	15,068	564,574	4,649,688	25,708	5,226,784	10,438
New Jersey	16	126	6	2,751,607	57,469	2,809,076	331,915,837	238,431	333,819,747	90,516
New Mexico	4	51	0	925,060	9,500	934,560	35,993,442	8,374	36,932,410	0
New York	5	14	1	416	175	591	2,498	500,300	502,893	0
North Carolina	6	8	4	1,000	4,501	5,501	106	14,197	15,234	0
North Dakota	1	19	0	345,861	408	346,269	1,275,107	925	1,628,787	0
Ohio	21	111	14	653,842	142,741	796,583	28,082,916	279,947	29,156,543	90
Oklahoma	8	101	8	1,335,910	29,692	1,365,602	56,875,229	193,760	58,413,984	0
Oregon	4	14	1	66,184	1	66,185	2,452	1,621	70,026	0
Pennsylvania	24	155	18	3,298,360	148,555	3,446,915	8,522,028	647,299	12,600,769	10,877
Puerto Rico	8	47	0	1,122,606	14,629	1,137,235	700,211	11,021	1,617,169	3,250
South Carolina	5	13	4	808	226	1,034	3,202	719	4,949	0
Tennessee	2	23	2	49,585	1,555	51,140	28,292,915	166,693	28,508,998	0
Texas	44	614	20	20,751,077	672,007	21,423,084	154,090,426	3,133,283	178,610,982	1,323,213
Utah	5	74	3	289,269	20,980	310,249	100,974,221	151,247	101,445,137	306
Virgin Islands	1	24	0	1,506,131	8	1,506,139	10,959,652	479,203	12,944,993	0
Virginia	2	26	2	330,713	47	330,760	3,007,030	1,680	3,339,189	30
Washington	8	104	5	930,421	0	930,421	15,895,630	246,843	17,067,241	2,875
West Virginia	2	12	3	181,785	0	181,785	619,930	500	803,244	0
Wisconsin	5	23	3	82,676	0	82,676	0	1,531	84,225	0
Wyoming	7	85	0	763,307	28,182	791,489	4,668,673	215	5,456,207	2,984
Total for SIC Code 29	401	3,231	241	66,229,827	2,657,431	68,887,258	2,062,535,454	26,148,784	2,155,301,359	1,786,457

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except. Non-production-related Waste (remedial/catastrophic incidents).

Map 7-1. Total On- and Off-site Releases, 1996: Petroleum Refining, SIC Code 29



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



Table 7-7. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1996: Petroleum Refining, SIC Code 29 (In Rank Order)

CAS Number	Industry	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases	Total On- & 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	
7664-41-7	Nitrate compounds	0	9,257,747	0	0	0	22,298	9,280,045	0	9,280,045
108-88-3	Ammonia	6,775,446	697,412	1,323,520	4,154	0	7,953	8,808,485	203,062	9,011,547
67-56-1	Toluene	7,092,393	37,706	171,612	500	250	351,233	7,653,694	86,341	7,740,035
110-54-3	Methanol	5,205,244	42,317	144,430	0	0	150	5,392,141	81	5,392,222
115-07-1	n-Hexane	4,885,511	153,256	7,208	0	250	9,444	5,055,669	16,831	5,072,500
78-93-3	Propylene	4,302,329	7,050	0	0	0	1,338	4,310,717	387	4,311,104
1330-20-7	Methyl ethyl ketone	4,270,000	6,192	19,000	0	0	5	4,295,197	1,145	4,296,342
71-43-2	Xylene (mixed isomers)	3,864,532	18,700	32,551	500	0	23,300	3,939,583	127,345	4,066,928
1634-04-4	Benzene	2,730,100	21,155	179,403	500	5	42,452	2,973,615	43,769	3,017,384
74-85-1	Methyl tert-butyl ether	2,323,386	101,444	161,550	750	0	26,566	2,613,696	63	2,613,759
7647-01-0	Ethylene	1,944,681	2,927	0	0	0	280	1,947,888	92	1,947,980
110-82-7	Hydrochloric acid	1,433,392	0	0	0	0	0	1,433,392	0	1,433,392
100-41-4	Cyclohexane	1,241,794	7,961	4,862	0	5	5,423	1,260,045	5,796	1,265,841
95-63-6	Ethylbenzene	932,247	3,797	4,299	250	5	56,505	997,103	27,665	1,024,768
	1,2,4-Trimethylbenzene	659,083	2,966	1,270	0	5	9,261	672,585	47,663	720,248
	Subtotal	47,660,138	10,360,630	2,049,705	6,654	520	556,208	60,633,855	560,240	61,194,095
	Total for SIC Code 29	52,101,079	10,567,225	2,310,233	8,664	5,685	1,236,941	66,229,827	2,657,431	68,887,258

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

Reporting of discharges to surface water was dominated by nitrate compounds (87.6% of the sector's total in this category). Ammonia, toluene, and methanol totaled over 5 million pounds each in emissions to air, the medium with the largest releases, and they accounted for 36.6% of total air emissions in this sector. Underground injection was 1.3 million pounds for ammonia, nearly all of it in Class I wells.

## OSHA Carcinogens

Petroleum refining releases of chemicals designated as OSHA carcinogens totaled 4.2 million pounds in 1996, as shown in Table 7-8. (OSHA Carcinogens and the bases for their designation appear in Box 2-4 in Chapter 2). The large majority (3.2 million pounds) was released to air.

One of the top 15 chemicals for total on- and off-site releases, benzene, is an OSHA carcinogen. It accounted for 3.0 million pounds of on- and off-site releases, including 2.7 million pounds of air emissions. No other OSHA carcinogen was reported in such a large amount in this sector.

The next largest total release of an OSHA carcinogen in the petroleum refining sector was nickel compounds with 327,000 pounds, followed by asbestos with 291,000 pounds.

Refineries (SIC code 2911) reported 97.9% of the air emissions of OSHA carcinogens reported in this sector. Figure 7-7 shows the on- and off-site releases of OSHA carcinogens for the four-digit SIC codes in the petroleum sector.

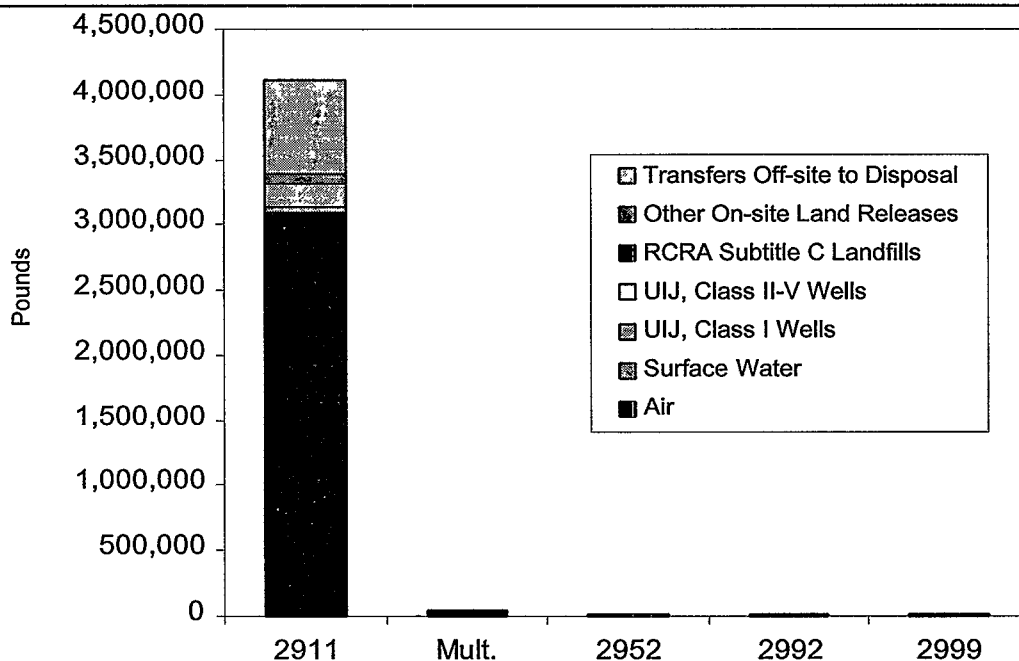


**Table 7-8. TRI On-site and Off-site Releases of OSHA Carcinogens by 4-digit SIC Code, 1996: Petroleum Refining, SIC Code 29 (in Rank Order)**

SIC Code	Industry	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases Transfers Off-site to Disposal Pounds	Total On- & Off-site Releases Pounds
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
2911	Petroleum Refining	3,100,498	30,811	179,403	750	3,605	70,966	3,386,033	729,822	4,115,855
	Multiple within SIC 29	40,034	654	0	0	0	167	40,855	732	41,587
2952	Asphalt Felts & Coatings	5,424	0	0	0	0	0	5,424	4,156	9,580
2992	Lubricating Oils & Greases	8,427	0	0	0	0	0	8,427	245	8,672
2999	Petroleum & Coal Products, nec*	5,504	0	0	0	0	0	5,504	2,500	8,004
	Invalid SIC Code within SIC 29	6,300	0	0	0	0	0	6,300	0	6,300
	<b>Subtotal</b>	<b>3,166,187</b>	<b>31,465</b>	<b>179,403</b>	<b>750</b>	<b>3,605</b>	<b>71,133</b>	<b>3,452,543</b>	<b>737,455</b>	<b>4,189,998</b>
	<b>Total for SIC Code 29</b>	<b>52,101,079</b>	<b>10,567,225</b>	<b>2,310,233</b>	<b>8,664</b>	<b>5,685</b>	<b>1,236,941</b>	<b>66,229,827</b>	<b>2,657,431</b>	<b>68,887,258</b>

**Note:** On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



**Figure 7-7. TRI On-site and Off-site Releases of OSHA Carcinogens, SIC Codes with Largest Totals, 1996: Petroleum Refining (SIC Code 29)**

**Note:** On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category. UIJ = underground injection



**Table 7-9. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1996: Petroleum Refining, SIC Code 29 (in Rank Order)**

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Recycled Off-site Pounds	Energy Recovery Off-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
2911	Petroleum Refining	148,364,971	603,132,858	1,294,372,631	4,179,325	245,436	5,982,505	61,078,881	2,117,356,607	1,786,042
2992	Lubricating Oils & Greases	4,178,041	103,934	632,604	14,167,093	412,381	688,754	721,911	20,904,718	256
	Multiple within SIC 29	645,727	0	8,511,398	112,208	39	55,311	1,963,435	11,288,118	0
2999	Petroleum & Coal Products, nec*	4,600	364,600	2,015,128	35,900	2,393	72,245	2,862,657	5,357,523	159
2952	Asphalt Felts & Coatings	151,088	0	0	8,441	0	7,306	73,240	240,075	0
	Invalid SIC Code within SIC 29	56,000	0	0	0	0	8,310	83,300	147,610	0
2951	Asphalt Paving Mixtures & Blocks	109	0	1,765	0	0	19	4,815	6,708	0
	<b>Total for SIC Code 29</b>	<b>153,400,536</b>	<b>603,601,392</b>	<b>1,305,533,526</b>	<b>18,502,967</b>	<b>660,249</b>	<b>6,814,450</b>	<b>66,788,239</b>	<b>2,155,301,359</b>	<b>1,786,457</b>

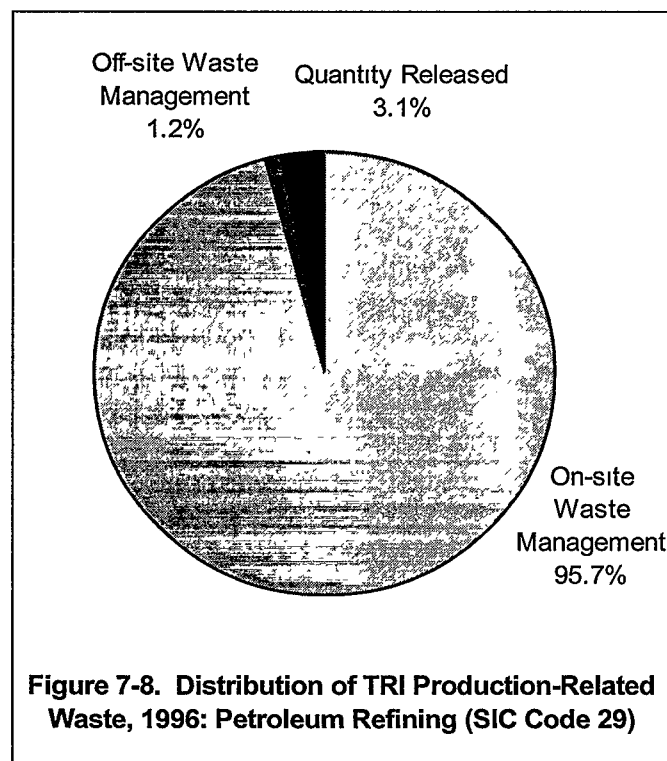
Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category  
\*nec: not elsewhere classified.

## 1996 TRI Chemicals in Waste for Petroleum Refining

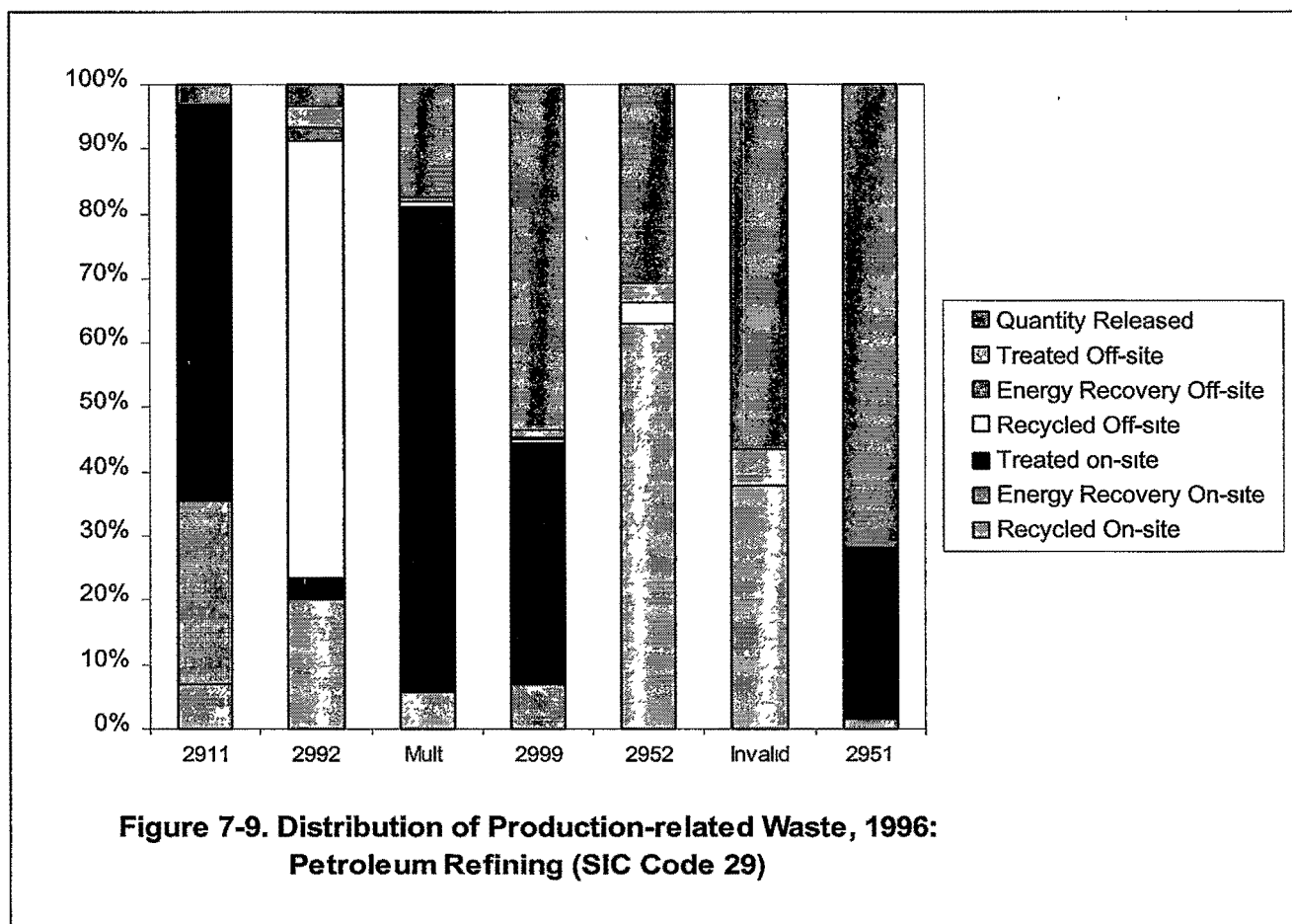
The petroleum refining sector reported a total of 2.16 billion pounds of TRI chemicals in production-related waste for 1996, as shown in Table 7-9 and Figure 7-8. On-site treatment amounted to 1.31 billion pounds, or 60.6% of total production-related waste. On-site energy recovery was next with 603.6 million pounds, or 28.0%.

Refineries (SIC code 2911) topped the list in all production-related waste categories except one, off-site recycling. In that category, lubricating oils and greases (SIC code 2992) reported the largest quantity, 14.2 million pounds. Refineries (SIC code 2911) reported 148.4 million pounds in on-site recycling, 603.1 million pounds in on-site energy recovery, 1.29 billion pounds in on-site treatment, 4.2 million pounds in off-site recycling, 245,000 pounds in off-site energy recovery, 6.0 million pounds in off-site treatment, and 61.1 million pounds in quantities released on- and off-site.

Refineries accounted for 98.2% of all SIC code 29 chemicals reported in waste. Distribution of production-related waste for SIC code 29 industries appear in Figure 7-9.



Note: Data from Section 8 of Form R



Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category. Invalid SIC codes are codes beginning "29" that do not exist in the current Standard Industrial Classification code system.

## Projected Quantities of TRI Chemicals in Waste

Table 7-10 and Figure 7-10 summarize the petroleum refining sector's projections for on- and off-site waste management through 1998. (As explained in Chapter 2, facilities not only report current data but project waste management quantities for the next two years in their TRI submissions.) Total production-related waste is not projected to change by much—a small decrease for 1996 to 1997 and a small increase for 1997 to 1998—because its largest component (on-site treatment) is projected to decrease by just 1.3% and

its second largest component (on-site energy recovery) is projected to increase by 3.5%.

Two categories of off-site waste management are projected to decrease significantly: energy recovery by 15.5% and treatment by 32.2%. In both cases, the greatest change is projected for the first year, 1996-1997. The quantity released on- and off-site is expected to decrease by 4.9% between 1996 and 1998.

Overall, between 1996 and 1998, the projected change in production-related waste is quite small, less than 0.01%. On-site treatment is expected to remain the prevalent waste management method in this sector, representing 60.6% of total production-



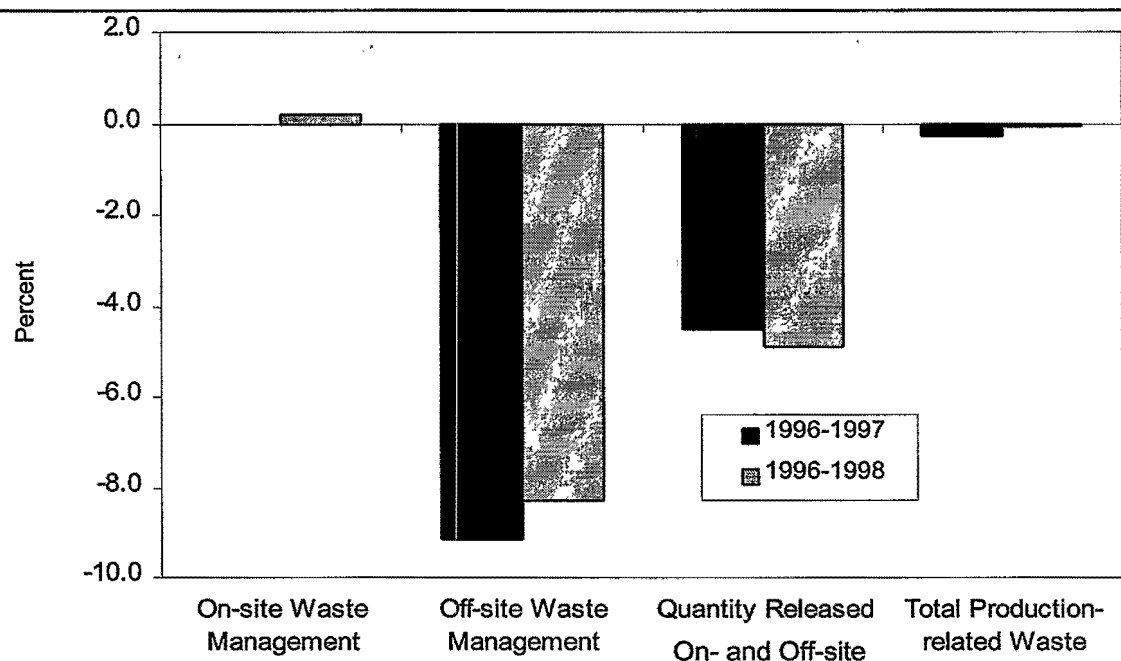


Table 7-10. Current Year and Projected Quantities of TRI Chemicals in Waste, 1996-1998: Petroleum Refining, SIC Code 29

Waste Management Activity	<u>Current Year 1996</u>		<u>Projected 1997</u>		<u>Projected 1998</u>	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
<u>On-site Waste Management</u>						
Recycled On-site	153,400,536	7.1	152,902,846	7.1	153,044,029	7.1
Energy Recovery On-site	603,601,392	28.0	619,232,516	28.8	624,678,006	29.0
Treated On-site	1,305,533,526	60.6	1,289,721,204	60.0	1,289,190,556	59.8
<u>Off-site Waste Management</u>						
Recycled Off-site	18,502,967	0.9	18,371,699	0.9	18,647,223	0.9
Energy Recovery Off-site	660,249	0.0	543,337	0.0	557,708	0.0
Treated Off-site	6,814,450	0.3	4,684,602	0.2	4,622,140	0.2
Quantity Released On- and Off-site	66,788,239	3.1	63,800,506	3.0	63,516,964	2.9
Total Production-related Waste for SIC Code 29	2,155,301,359	100.0	2,149,256,710	100.0	2,154,256,626	100.0

Waste Management Activity	<u>Projected Change</u>	<u>Projected Change</u>	<u>Projected Change</u>
	1996 - 1997 Percent	1997 - 1998 Percent	1996 - 1998 Percent
<u>On-site Waste Management</u>			
Recycled On-site	-0.3	0.1	-0.2
Energy Recovery On-site	2.6	0.9	3.5
Treated On-site	-1.2	-0.0	-1.3
<u>Off-site Waste Management</u>			
Recycled Off-site	-0.7	1.5	0.8
Energy Recovery Off-site	-17.7	2.6	-15.5
Treated Off-site	-31.3	-1.3	-32.2
Quantity Released On- and Off-site	-4.5	-0.4	-4.9
Total Production-related Waste for SIC Code 29	-0.3	0.2	-0.0

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996.



**Figure 7-10. Projected Percentage Changes in Quantities of TRI Chemicals in Waste, 1996-1998: Petroleum Refining (SIC Code 29)**

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996

**Table 7-11. Number of Forms Reporting Source Reduction Activity, 1996: Petroleum Refining. SIC Code 29**

SIC Code	Industry	Category of Source Reduction Activity										
		Forms Reporting Source Reduction Activities			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
		Total Forms Number	Form As Number	Percent of All Forms Percent								
2911	Petroleum Refining	2,582	530	20.5	150	10	339	4	170	4	-	1
2951	Asphalt Paving Mixtures & Blocks	16	1	6.3	1	-	1	-	-	-	-	-
2952	Asphalt Felts & Coatings	94	54	57.4	12	1	-	27	3	1	-	12
2992	Lubricating Oils & Greases	362	58	16.0	23	12	21	7	15	3	-	2
2999	Petroleum & Coal Products, nec*	80	5	6.3	2	-	2	1	2	1	-	-
	Multiple within SIC 29	93	18	19.4	2	-	17	1	-	-	-	-
	Invalid SIC Code within SIC 29	4	-	0.0	-	-	-	-	-	-	-	-
	Total for SIC Code 29	3,231	666	20.6	190	23	380	40	190	9	-	15

Note: Forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category

\*nec: not elsewhere classified.



related waste in 1996 and a projected 59.8% in 1998.

## Source Reduction Activity

One-fifth (20.6%) of the TRI reporting forms submitted in this sector indicated at least one source reduction activity during 1996. Table 7-11 shows that refineries (SIC code 2911) submitted 530 of these (also one-fifth, 20.5%, of the forms in that four-digit SIC code). In the asphalt felts and coatings industry (SIC code 2952), 57.4% of the forms submitted reported source reduction activities in 1996.

Spill and leak prevention was the most commonly reported source reduction activity for the petroleum refining sector overall (SIC code 29) and for refineries (SIC code 2911). Few if any other sectors show this emphasis, which reflects the petroleum sector's dependence on moving and storing enormous quantities of crude oil and other petroleum products. Improvements in operating practices (the most common source reduction activity in most other sectors) was the next highest reported activity in this sector.

## Year-to-Year Comparisons for Petroleum Refining

### 1995-1996 TRI Data for Petroleum Refining

#### On- and Off-site Releases

From 1995 to 1996, the number of TRI forms submitted with petroleum refining codes decreased by 1.0%, as shown in Table 7-12. The number of Form A certification statements, certifying that a chemical's annual reportable amount was less than

500 pounds for the year and that the facility did not manufacture, process, or otherwise use more than 1 million pounds, rose 11.1%. (The Form A certification statement is explained in Chapter 1.) This may reflect growing awareness of the Form A certification statement, which was introduced in reporting year 1995.

On- and off-site releases reported in the petroleum refining sector totaled 7.4% more (a 4.7-million-pound increase) in 1996 than in 1995. Several areas of on-site releases showed significant increases including a 242.5% increase in on-site land releases (from 363,000 pounds to 1.2 million pounds) and an 86.1% increase in surface water discharges (from 5.7 million pounds to 10.6 million pounds). Transfers off-site to disposal decreased by 484,000 pounds (15.4%). Figure 7-11 displays these changes.

#### Other On-site Waste Management

Reporting by petroleum refining facilities of other on-site waste management, which also appears in Table 7-12, rose 97.3%, from 1.05 billion pounds in 1995 to 2.06 billion pounds in 1996. Every area of other on-site waste management increased with on-site treatment topping the list with a 268.4% rise (a 1.00-billion-pound increase). Almost all of the increase in on-site treatment is accounted for by a single facility, Chevron Products in Richmond, California, which reported 2.4 million pounds in 1995 and 942.6 million pounds in 1996, a 940.3-million-pound increase. This facility attributes much of its increase to improved estimation techniques, as described in the section on **Facilities with Large Increases and Decreases in Waste Management, 1991-1996**, later in this chapter.

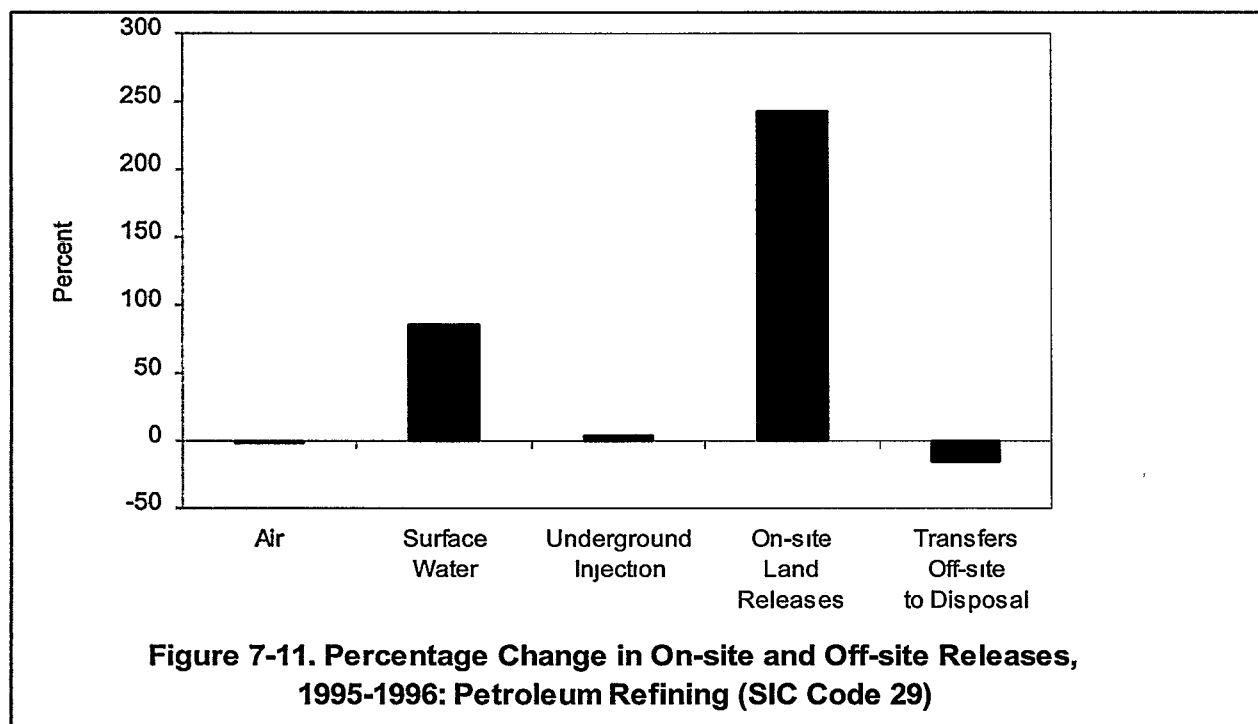
On-site recycling increased 24.1%, from 123.6 million pounds to 153.4 million pounds, and on-site energy recovery rose 6.4%, from 567.3 million pounds to 603.6 million pounds.



**Table 7-12. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1995-1996: Petroleum Refining, SIC Code 29**

	1995 Number	1996 Number	Change 1995 to 1996 Percent
Total Facilities	401	401	0.0
Total Forms	3,262	3,231	-1.0
Form Rs	3,045	2,990	-1.8
Form As	217	241	11.1
	Pounds	Pounds	Percent
<u>On-site Releases</u>			
Total Air Emissions	52,742,051	52,101,079	-1.2
Fugitive Air	30,378,054	27,968,469	-7.9
Point Source Air	22,363,997	24,132,610	7.9
Surface Water Discharges	5,677,398	10,567,225	86.1
Underground Injection	2,217,653	2,318,897	4.6
On-site Land Releases	362,828	1,242,626	242.5
Total On-site Releases	60,999,930	66,229,827	8.6
<u>Off-site Releases</u>			
Transfers Off-site to Disposal	3,140,985	2,657,431	-15.4
Total On- and Off-site Releases	64,140,915	68,887,258	7.4
<u>Other On-site Waste Management</u>			
Recycled On-site	123,620,333	153,400,536	24.1
Energy Recovery On-site	567,256,295	603,601,392	6.4
Treated On-site	354,362,794	1,305,533,526	268.4
Total Other On-site Waste Management	1,045,239,422	2,062,535,454	97.3
<u>Transfers Off-site for Further Waste Management</u>			
Transfers to Recycling	22,993,456	18,553,327	-19.3
Transfers to Energy Recovery	552,946	657,071	18.8
Transfers to Treatment	1,067,905	2,150,251	101.4
Transfers to POTWs	4,926,872	4,788,134	-2.8
Other Off-site Transfers	0	1	—
Total Transfers Off-site for Further Waste Management	29,541,179	26,148,784	-11.5

**Note:** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required in 1995. Other Off-site Transfers are transfers reported without a valid waste management code



Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required in 1995

### Transfers Off-site for Further Waste Management

Transfers to treatment doubled in the petroleum refining sector from 1995 to 1996 (a 101.4% increase, or 1.1 million pounds). Transfers to energy recovery increased 18.8% (104,000 pounds). Transfers to recycling and transfers to POTWs both decreased, 19.3% (4.4 million pounds) and 2.8% (139,000 pounds), respectively. Overall, transfers off-site for further waste management decreased 11.5%, due to the large decreases in recycling. These data are also shown in Table 7-12.

### **1988-1996 TRI Data for Petroleum Refining**

As explained in Chapter 3, comparisons from the 1988 TRI baseline year to the current year rely on the list of “core” TRI chemicals that were reportable, with the same reporting definition, in all

years. These multi-year comparisons also review only the data elements that were collected in all years, which excludes from this section any analysis that distinguishes RCRA subtitle C landfills from other land releases as well as analysis based on the types of underground injection wells. On-site waste management data and transfers off-site to recycling and to energy recovery have been collected only since 1991; these data are included, but cannot be compared across the full 1988-1996 period.

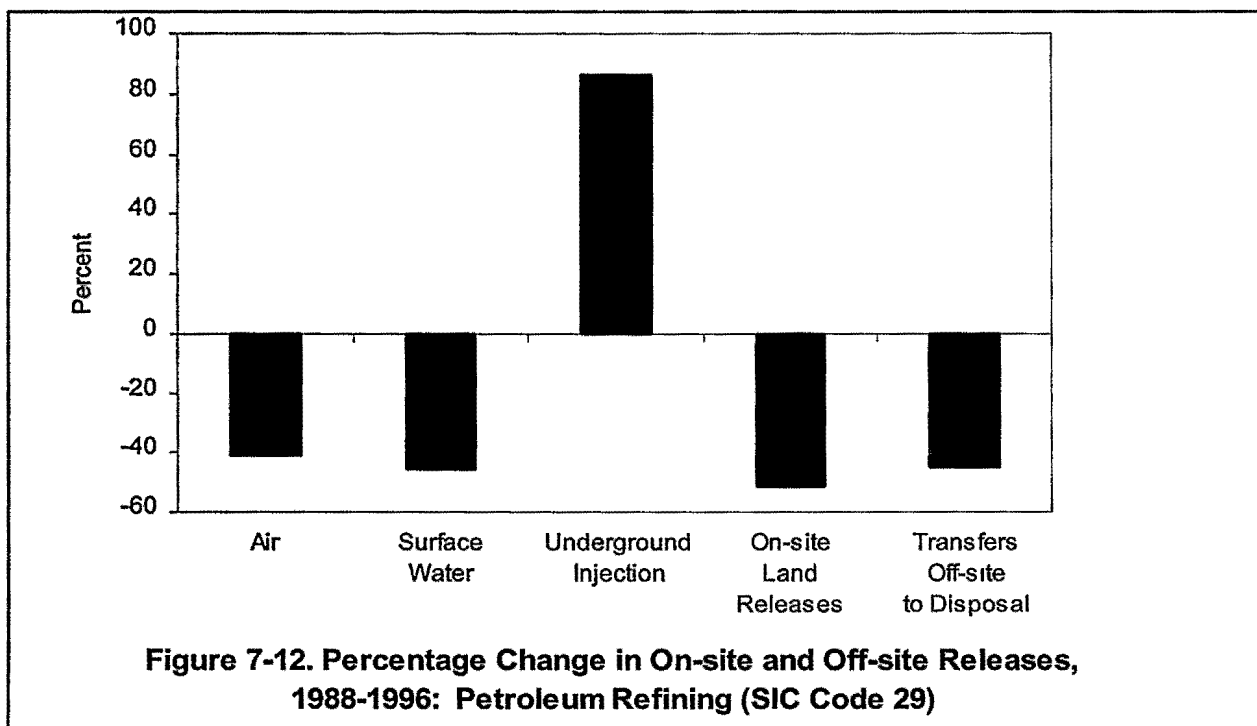
The number of forms reporting petroleum refining SIC codes dropped 2.3% from 1988 to 1996, as presented in Table 7-13. On- and off-site releases decreased by 40.8%, or 29.7 million pounds, and decreases occurred in all release media except underground injection, as shown in Figure 7-12. Underground injection increased 86.1%, from 528,000 pounds in 1988 to 982,000 pounds in 1996.



**Table 7-13. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1988 and 1994-1996: Petroleum Refining, SIC Code 29**

	1988 Number	1994 Number	1995 Number	1996 Number	Change 1988 to 1996 Percent
Total Facilities	376	392	378	373	-0.8
Total Forms	2,814	2,853	2,790	2,748	-2.3
Form Rs	2,814	2,853	2,600	2,550	-9.4
Form As	NA	NA	190	198	NA
	Pounds	Pounds	Pounds	Pounds	Percent
<u>On-site Releases</u>					
Total Air Emissions	64,717,279	41,582,376	37,966,347	38,116,344	-41.1
Fugitive Air	47,881,163	29,028,190	25,525,376	23,418,914	-51.1
Point Source Air	16,836,116	12,554,186	12,440,971	14,697,430	-12.7
Surface Water Discharges	753,428	468,608	514,411	410,016	-45.6
Underground Injection	527,819	704,981	856,378	982,255	86.1
On-site Land Releases	2,455,013	648,650	189,625	1,181,829	-51.9
Total On-site Land Releases	68,453,539	43,404,615	39,526,761	40,690,444	-40.6
<u>Off-site Releases</u>					
Transfers Off-site to Disposal	4,327,282	3,472,485	3,066,557	2,386,208	-44.9
Total On- and Off-site Releases	72,780,821	46,877,100	42,593,318	43,076,652	-40.8
<u>Other On-site Waste Management</u>					
Recycled On-site	NA	112,965,582	115,528,019	84,154,943	NA
Energy Recovery On-site	NA	918,442,566	562,955,277	596,112,342	NA
Treated On-site	NA	167,926,607	257,045,269	1,064,485,499	NA
Other On-site Waste Management	NA	1,199,334,755	935,528,565	1,744,752,784	NA
<u>Transfers Off-site for Further Waste Management</u>					
Transfers to Recycling	NA	20,293,057	22,844,000	18,466,459	NA
Transfers to Energy Recovery	NA	1,392,657	542,664	633,417	NA
Transfers to Treatment	2,538,235	1,253,753	945,589	1,986,839	-21.7
Transfers to POTWs	6,087,311	3,356,885	3,976,605	4,312,823	-29.2
Other Off-site Transfers	906,249	0	0	1	-100.0
Total Transfers Off-site for Further Waste Management	NA	26,296,352	28,308,858	25,399,539	NA

**Note:** Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. **On-site Releases** from Section 5 of Form R and **Off-site Releases** from Section 6 (transfers off-site to disposal) of Form R. **Other On-site Waste Management** from Section 8 of Form R. **Transfers Off-site for Further Waste Management** from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required before 1996. For 1994-1996, Other Off-site Transfers are transfers reported without a valid waste management code. For 1988, Other Off-site Transfers are transfers reported without a valid waste management code or codes not required to be reported in 1988. NA: not required to be reported in that year.



Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required before 1996

Fugitive air emissions made up the majority of the decreases, dropping from 47.9 million pounds to 23.4 million pounds, a 51.1% reduction. Point source air emissions decreased 2.1 million pounds between 1988 and 1996, a 12.7% reduction, and surface water discharges decreased by 343,000 pounds, a 45.6% decrease. On-site land releases in 1996 were half that of 1988, decreasing from 2.5 million pounds in 1988 to 1.2 million pounds in 1996 (a 51.9% reduction).

Transfers off-site to disposal decreased 44.9%, a reduction of 1.9 million pounds.

Other on-site waste management and off-site transfers to recycling and energy recovery generally showed decreases from 1994, except for on-site treatment. On-site treatment increased from 167.9 million pounds in 1994 to 1.06 billion pounds in

1996, a 533.9% increase. (These data were not collected in 1988.)

For the 1988-1996 period, transfers to treatment decreased 21.7%, or 551,000 pounds, and transfers to POTWs decreased 29.2%, or 1.8 million pounds.

Production in the petroleum refining sector increased throughout this period, although employment declined. TRI facilities report absolute amounts of waste managed and environmental releases, not amounts adjusted for changes in production levels. As production in the petroleum refining sector has increased, however, the sector's releases have decreased, led by decreases in fugitive air emissions. Several facilities that have accomplished large decreases in air emissions have done so by implementing process changes, as well as improving their operating practices, as described below.



Table 7-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Petroleum Refining, SIC Code 29

SIC Code	Industry	Year	On-site Releases				Total On-site Releases	Off-site Releases	Total On- and Off-site Releases
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds		Transfers Off-site to Disposal Pounds	
2911	Petroleum Refining	96	34,837,049	379,487	982,255	1,147,695	37,346,486	2,157,061	39,503,547
		95	33,681,768	489,453	854,178	149,756	35,175,155	2,796,594	37,971,749
		94	37,250,761	449,194	702,581	556,682	38,959,218	3,208,739	42,167,957
		88	56,407,891	692,938	503,202	2,251,419	59,855,450	3,799,001	63,654,451
2951	Asphalt Paving Mixtures & Blocks	96	4,816	0	0	0	4,816	0	4,816
		95	1,515	0	0	0	1,515	500	2,015
		94	1,667	0	0	146	1,813	1,146	2,959
		88	25,503	2,000	0	250	27,753	2,440	30,193
2952	Asphalt Felts & Coatings	96	27,210	314	0	25,000	52,524	10,751	63,275
		95	23,022	32	0	9,205	32,259	32,124	64,383
		94	28,389	28	0	0	28,417	69,806	98,223
		88	40,206	280	0	0	40,486	187,722	228,208
2992	Lubricating Oils & Greases	96	449,787	680	0	7,773	458,240	52,096	510,336
		95	274,537	705	0	15,109	290,351	15,773	306,124
		94	269,528	915	0	55,324	325,767	87,321	413,088
		88	827,756	3,918	0	5,219	836,893	67,814	904,707
2999	Petroleum & Coal Products, nec*	96	1,566,370	13,449	0	0	1,579,819	0	1,579,819
		95	2,171,009	12,563	2,200	78	2,185,850	0	2,185,850
		94	2,279,509	13,110	2,400	0	2,295,019	0	2,295,019
		88	2,960,467	12,250	23,000	97,000	3,092,717	250	3,092,967
	Multiple within SIC Code 29	96	1,224,062	16,086	0	1,361	1,241,509	90,300	1,331,809
		95	1,727,469	11,658	0	15,477	1,754,604	136,566	1,891,170
		94	1,727,722	5,111	0	36,498	1,769,331	28,073	1,797,404
		88	4,137,449	42,042	0	79,335	4,258,826	209,542	4,468,368
	Invalid SIC Code within SIC 29	96	7,050	0	0	0	7,050	76,000	83,050
		95	87,027	0	0	0	87,027	85,000	172,027
		94	24,800	250	0	0	25,050	77,400	102,450
		88	318,007	0	1,617	21,790	341,414	60,513	401,927
	Total for SIC Code 29	96	38,116,344	410,016	982,255	1,181,829	40,690,444	2,386,208	43,076,652
		95	37,966,347	514,411	856,378	189,625	39,526,761	3,066,557	42,593,318
		94	41,582,376	468,608	704,981	648,650	43,404,615	3,472,485	46,877,100
		88	64,717,279	753,428	527,819	2,455,013	68,453,539	4,327,282	72,780,821

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

### 1988-1996 Data for Four-Digit Industries in Petroleum Refining

Tables 7-14 through 7-16 summarize, respectively, on- and off-site releases, other on-site waste management, and transfers off-site for further waste management. They present data for 1988 and 1994-1996 for industries at the four-digit SIC code level within SIC code 29.

As made evident in the preceding sections of this chapter, refineries (SIC code 2911) represent the vast majority of facilities and forms for the petroleum refining sector. Only two categories of reporting, for all reporting years presented in the tables, are led by an industry other than SIC code 2911. Lubricating oils and greases (SIC code 2992) reported more transfers to recycling and energy





Table 7-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Petroleum Refining, SIC Code 29

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
2911	Petroleum Refining	96	79,132,470	595,705,592	1,057,877,820	1,732,715,882
		95	78,987,422	561,020,619	248,808,273	888,816,314
		94	67,287,193	915,552,746	162,212,091	1,145,052,030
		88	NA	NA	NA	NA
2951	Asphalt Paving Mixtures & Blocks	96	109	0	1,765	1,874
		95	0	0	950	950
		94	0	0	885	885
		88	NA	NA	NA	NA
2952	Asphalt Felts & Coatings	96	151,088	0	0	151,088
		95	52,545	0	0	52,545
		94	72,940	0	0	72,940
		88	NA	NA	NA	NA
2992	Lubricating Oils & Greases	96	4,178,041	55,250	590,903	4,824,194
		95	5,369,064	0	634,009	6,003,073
		94	12,894,749	0	352,813	13,247,562
		88	NA	NA	NA	NA
2999	Petroleum & Coal Products, nec*	96	0	351,500	983,243	1,334,743
		95	30,336,000	1,934,658	2,586,503	34,857,161
		94	32,640,000	2,889,820	1,358,598	36,888,418
		88	NA	NA	NA	NA
	Multiple within SIC Code 29	96	637,235	0	5,031,768	5,669,003
		95	726,988	0	5,015,534	5,742,522
		94	14,700	0	3,997,550	4,012,250
		88	NA	NA	NA	NA
	Invalid SIC Code within SIC 29	96	56,000	0	0	56,000
		95	56,000	0	0	56,000
		94	56,000	0	4,670	60,670
		88	NA	NA	NA	NA
	Total for SIC Code 29	96	84,154,943	596,112,342	1,064,485,499	1,744,752,784
		95	115,528,019	562,955,277	257,045,269	935,528,565
		94	112,965,582	918,442,566	167,926,607	1,199,334,755
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

recovery in each year covered here (1994-1996), except for transfers to energy recovery in 1995.

### On- and Off-site Releases

As shown in Table 7-14, refineries (SIC code 2911) saw the biggest reported reductions (in total air emissions) (21.6-million-pound reduction) from 1988 to 1996. This contributed to an overall 24.2-million-pound decrease for all release media, a 37.9% reduction.

Multiple-code reporting decreased from 4.5 million pounds to 1.3 million pounds (a 3.1-million-pound decrease, or 70.2%). Reporting in the miscellaneous petroleum and coal product industry (SIC code 2999) decreased from 3.1 million pounds in 1988 to 1.6 million pounds in 1996 (1.5 million pounds, or a 48.9% decrease). These data are also presented in Table 7-14.

Table 7-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Petroleum Refining, SIC Code 29

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
2911	Petroleum Refining	96	4,161,812	216,181	1,818,554	3,709,662	1	9,906,210
		95	4,822,314	304,161	708,706	3,465,291	0	9,300,472
		94	4,746,251	260,453	992,820	2,817,042	0	8,816,566
		88	NA	NA	2,321,128	5,462,836	903,672	NA
2951	Asphalt Paving Mixtures & Blocks	96	0	0	0	0	0	0
		95	0	0	0	0	0	0
		94	0	0	0	0	0	0
		88	NA	NA	0	1,250	0	NA
2952	Asphalt Felts & Coatings	96	8,195	0	0	7,955	0	16,150
		95	1,016	3,750	175	7,551	0	12,492
		94	4	3,285	334	8,450	0	12,073
		88	NA	NA	0	266	0	NA
2992	Lubricating Oils & Greases	96	14,184,342	415,604	40,637	594,575	0	15,235,158
		95	17,910,494	231,493	140,309	503,273	0	18,785,569
		94	15,497,147	1,127,019	149,333	530,157	0	17,303,656
		88	NA	NA	100,837	458,318	2,077	NA
2999	Petroleum & Coal Products, nec*	96	2	1,593	72,250	0	0	73,845
		95	0	3,260	70,250	0	0	73,510
		94	0	1,900	70,250	0	0	72,150
		88	NA	NA	9,750	0	0	NA
	Multiple within SIC Code 29	96	112,108	39	47,088	631	0	159,866
		95	110,176	0	18,929	490	0	129,595
		94	49,655	0	35,466	1,236	0	86,357
		88	NA	NA	1,350	52,550	500	NA
	Invalid SIC Code within SIC 29	96	0	0	8,310	0	0	8,310
		95	0	0	7,220	0	0	7,220
		94	0	0	5,550	0	0	5,550
		88	NA	NA	105,170	112,091	0	NA
	Total for SIC Code 29	96	18,466,459	633,417	1,986,839	4,312,823	1	25,399,539
		95	22,844,000	542,664	945,589	3,976,605	0	28,308,858
		94	20,293,057	1,392,657	1,253,753	3,356,885	0	26,296,352
		88	NA	NA	2,538,235	6,087,311	906,249	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 29 are assigned to the "multiple" category.

\*nec: not elsewhere classified

Figure 7-12 shows percentages changes by media for 1988 to 1996.

### Other On-site Waste Management

Table 7-15 presents on-site waste management data for the sector. (These data have been collected since 1991.)

Refineries reported a large increase in the amount of TRI chemicals treated on-site between 1994 and 1996 (from 162.2 million pounds to 1.06 billion pounds). The amount reported as energy recovery dropped from 915.6 million pounds to 595.7 million pounds over the three-year period, while on-site recycling increased from 67.3 million pounds to 79.1 million pounds. Although the net change for on-site waste management in SIC code



2911 reporting was an increase of almost 600 million pounds over the three years, the total dropped substantially in 1995.

Reported amounts by all other SIC code 29 industries do not approach those of SIC code 2911 for on-site waste management, except for the amount recycled on-site by miscellaneous petroleum and coal products (SIC code 2999). This industry reported 32.6 million pounds in 1994 and zero in 1996 for on-site recycling (see Table 7-15).

### **Transfers Off-site for Further Waste Management**

From 1994 to 1996, refineries had an increase in reporting of transfers off-site for further waste management of 1.1 million pounds, a 12.4% increase. (Data for some types of off-site transfers were not collected in 1988.) This increase was primarily due to an 826,000-pound increase, since 1994, in the amount reported as transfers to treatment. The largest amounts reported in transfers off-site for further waste management were in transfers to recycling and to energy recovery by lubricating oils and greases (SIC code 2992). This industry reported a 1.3-million-pound decrease in transfers to recycling between 1994 and 1996, an 8.5% decrease, and a 711,000-pound reduction in transfers to energy recovery, 63.1% less than the 1994 amount (see Table 7-16).

### **Facilities with Large Increases and Decreases in Releases, 1988-1996**

All facilities discussed in this section reported in SIC code 2911, petroleum refining.

Amoco Petroleum Products, in Texas City, Texas, was the top facility for increases with an overall increase of 2.7 million pounds in on- and off-site releases from 1988 to 1996. This was largely due to reporting of methanol in point source air emissions in 1996 (zero pounds reported in 1988 and 2.2 million pounds in 1996). In 1996, several California refineries researching Maximum Available Control

Technologies (MACT) under the Clean Air Act discovered methanol to be a by-product of a hydrogen production process that employs a low-temperature Schiff-reaction catalyst. The Amoco facility attributes its ranking as the top petroleum refining facility for increases of on- and off-site releases to the fact that other facilities engaged in similar processes have not yet modified their reporting to reflect these findings. No other facility in this sector reported a comparable increase in total on- and off-site releases.

Four of the top five facilities for decreases in total on- and off-site releases reported significant decreases in fugitive air emissions of methyl ethyl ketone (MEK). The top facility for decreases, Sun Company, Inc., in Tulsa, Oklahoma, credits pollution prevention projects, including a study to better assess fugitive losses, for the decrease. The Sun Company facility also replaced open systems with closed, "hard-pipe" systems, improved the quality of gaskets in piping, and brought chillers on-line to lower the vapor pressure of some volatile chemicals. Methyl ethyl ketone reporting in fugitive air emissions decreased between 1988 and 1996 from 1.8 million to 93,000 pounds at this facility, part of its overall reduction of 2.8 million pounds in releases.

BP Oil Company in Belle Chasse, Louisiana, reported large reductions in fugitive air emissions for four chemicals: xylene (mixed isomers), benzene, toluene, and hydrogen fluoride between 1988 and 1996. The BP facility, ranked second in decreases with a reduction of 2.3 million pounds, treated wastewater containing aromatic compounds (xylene, benzene, and toluene) in open ponds prior to 1989. Evaporation of the volatile aromatic compounds from the open ponds resulted in significant fugitive air emissions. Establishment of National Emission Standards for Hazardous Air Pollutants (NESHAPs) for petroleum refineries in August 1995, under the Clean Air Act, is one regulatory development cited as influencing decisions by many refineries, including the BP Oil



facility, to switch from open pond/open ditch wastewater treatment to closed systems. Another regulation cited by BP Oil as encouraging this change is the primary sludge rule (under the Resource Conservation and Recovery Act), which classifies sludge contaminated by petroleum wastewater as hazardous waste.

The Belle Chasse BP facility also reduced hydrogen fluoride point source air emissions by 550,000 pounds between 1988 and 1996. Acid-soluble oil containing free hydrogen fluoride had been used as a fuel in process heaters before passage of RCRA's Boilers or Industrial Furnaces (BIF) rule (February 1991). Burning the acid-soluble oil in heaters contributed to point source air emissions of hydrogen fluoride. BP decided not to apply for a BIF permit and instead employed a new system for treating hydrogen fluoride that neutralizes hydrofluoric acid.

Two of the top five facilities for decreases in fugitive air emissions of both MEK and toluene attributed their reductions to changes in their solvent dewaxing systems. The MEK dewaxing process involves use of a solvent mixture of MEK and toluene to remove wax from lube oil feedstock. The Mobil Oil Beaumont Refinery in Beaumont, Texas, ranked third for decreases in total on- and off-site releases, with an overall reduction of 2.0 million pounds. The facility's 1.4-million-pound decrease in fugitive air emissions of MEK from 1988 to 1996 was largely the result of upgrades made to the solvent dewaxing system. Farmland Industries, Inc., in Coffeyville, Kansas, was fourth for decreases (1.8 million pounds overall). The facility reduced MEK and toluene fugitive air emissions by 828,000 pounds, combined, by eliminating the solvent dewaxing process altogether. Farmland also replaced fixed-roof toluene storage tanks with floating-roof tanks, which contain vapors more efficiently. Ethylene and propylene emissions from point air sources were also significantly reduced at the Farmland facility. Ethylene and propylene are produced as by-

products of catalytic cracking in crude oil refining. The refinery stream containing these chemicals is often used as a fuel gas. Farmland reduced point source air emissions of these chemicals by recovering the fuel gas to sell as product and by improving its refining system so that more of the chemicals are consumed in process.

The fifth-ranked facility for decreases, Star Enterprises of Port Arthur, Texas, also reduced fugitive air emissions of toluene (by 483,000 pounds) by switching to a closed wastewater treatment system. The Star Enterprises facility had an overall decrease of 1.7 million pounds.

## 1991-1996 Waste Management Data for Petroleum Refining

Table 7-17 summarizes on-and off-site waste management data for the petroleum refining sector for 1991, when TRI began collecting this information, and the three most recent years (1994-1996). Total production-related waste increased from 1.17 billion pounds to 1.81 billion pounds, an increase of 54.7%. The largest increase was reported in on-site treatment, from 107.9 million pounds to 1.06 billion pounds. This amounted to a ten-fold increase, or 956.6 million pounds. Figure 7-13 shows these changes. As noted later, one refinery attributes its large increase in on-site treatment to improved estimating methods rather than to any change in actual quantities of TRI chemicals in waste.

The largest reduction in waste management occurred in on-site recycling, from 294.4 million pounds in 1991 to 84.2 million pounds in 1996, a 71.4% decrease.

### Facilities with Large Increases and Decreases in Waste Management, 1991-1996

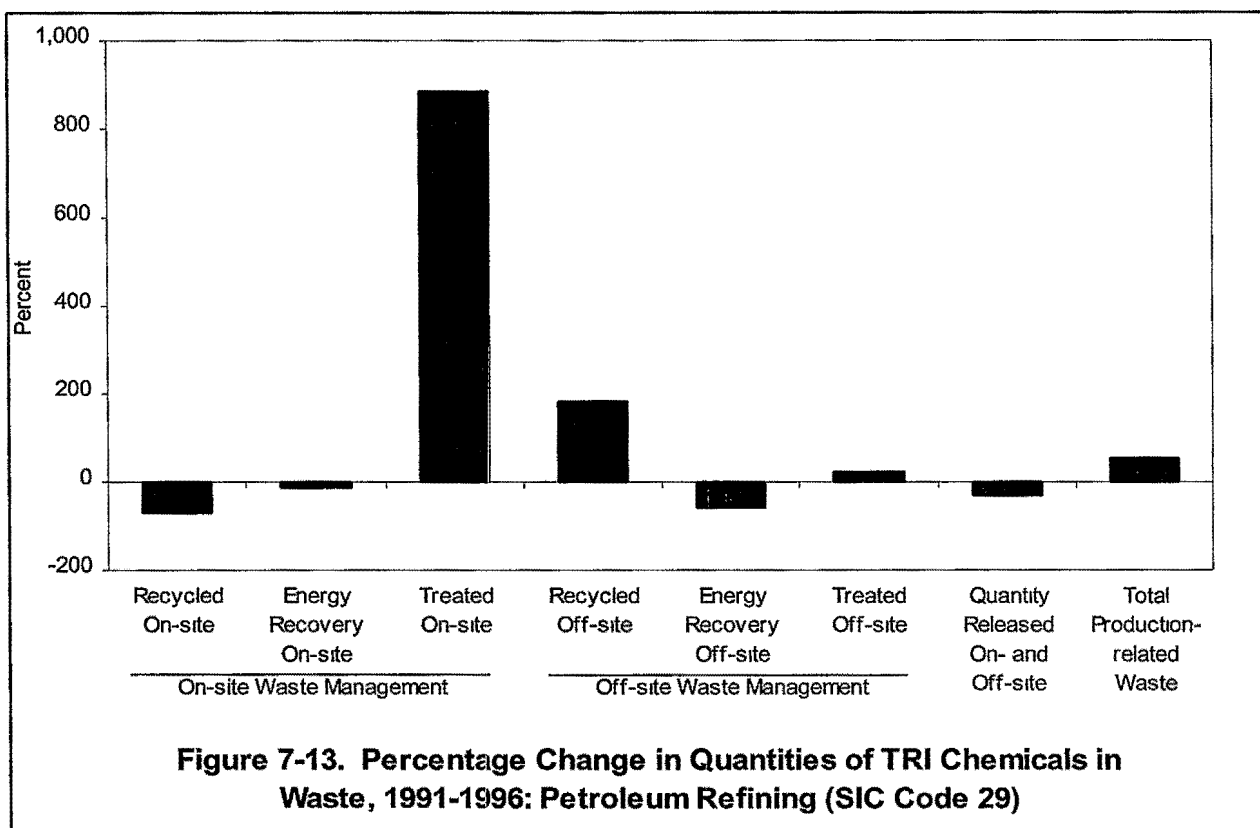
Chevron facilities ranked first and fourth for increases in production-related waste. (All facilities with large changes in production-related waste for



Table 7-17. TRI Waste Management Data, 1991, 1994-1996: Petroleum Refining, SIC Code 29

Waste Management Activity	1991 Pounds	1994 Pounds	1995 Pounds	1996 Pounds
<b><u>On-site Waste Management</u></b>				
Recycled On-site	294,400,808	112,965,582	115,528,019	84,154,943
Energy Recovery On-site	693,949,563	918,442,566	562,955,277	596,112,342
Treated On-site	107,896,271	167,933,107	257,072,989	1,064,502,499
Total On-site Waste Management	1,096,246,642	1,199,341,255	935,556,285	1,744,769,784
<b><u>Off-site Waste Management</u></b>				
Recycled Off-site	6,561,837	20,793,547	22,849,324	18,461,203
Energy Recovery Off-site	1,515,956	1,285,326	517,997	636,870
Treated Off-site	5,028,307	4,516,539	4,952,864	6,234,577
Total Off-site Waste Management	13,106,100	26,595,412	28,320,185	25,332,650
Quantity Released On- and Off-site	62,053,552	46,201,530	42,981,272	42,318,869
Total Production-related Waste	1,171,406,294	1,272,138,197	1,006,857,742	1,812,421,303
Non- Production-related Waste	157,986	400,639	346,033	1,622,512
Waste Management Activity	Change 1994-1995 Percent	Change 1995-1996 Percent	Change 1991-1996 Percent	
<b><u>On-site Waste Management</u></b>				
Recycled On-site	2.3	-27.2	-71.4	
Energy Recovery On-site	-38.7	5.9	-14.1	
Treated On-site	53.1	314.1	886.6	
Total On-site Waste Management	-22.0	86.5	59.2	
<b><u>Off-site Waste Management</u></b>				
Recycled Off-site	9.9	-19.2	181.3	
Energy Recovery Off-site	-59.7	22.9	-58.0	
Treated Off-site	9.7	25.9	24.0	
Total Off-site Waste Management	6.5	-10.5	93.3	
Quantity Released On- and Off-site	-7.0	-1.5	-31.8	
Total Production-related Waste	-20.9	80.0	54.7	
Non- Production-related Waste	-13.6	368.9	927.0	

Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated.



Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated.

1991-1996 reported in SIC code 2911, except the facility discussed at the end of this section). Both Chevron facilities reported large increases in aromatic hydrocarbons treated on-site. Chevron Products in Richmond, California, had the largest increases in on-site treatment for toluene (174.9 million pounds), m-xylene (158.4 million pounds), 1,2,4-trimethylbenzene (125.2 million pounds), and naphthalene (124.2 million pounds). These chemicals comprised 71.8% of the facility's overall 811.6-million-pound increase in total production-related waste. Chevron USA Products in Salt Lake City, Utah, reported increases in on-site treatment of mixed isomers of xylene (24.0 million pounds), toluene (20.0 million pounds), and 1,2,4-trimethylbenzene (14.0 million pounds). This represented 81.3% of the facility's overall increase of 71.4 million pounds. All of these aromatic hydrocarbons are formed in petroleum refining processes. One such process, catalytic reforming, is intended to increase the octane of automobile

gasoline. Catalytic cracking, another process where these aromatic compounds are formed, breaks down ("cracks") large organic molecules into smaller ones.

The Richmond Chevron facility noted that the reported increases of toluene, m-xylene, 1,2,4-trimethylbenzene, and naphthalene in on-site treatment did not represent actual increases in the amounts of these chemicals in the wastewater; rather, the estimation techniques for calculating chemical quantities removed in Chevron's on-site wastewater treatment unit have improved, resulting in significantly different reported amounts.

The facilities with the second, third, and fifth largest increases in total production-related waste all reported significant increases in ethylene and propylene. These two chemicals are formed in the catalytic cracking process and are later partially



consumed in process. Each of the three facilities—Coastal Eagle Point Oil Company, Westville, New Jersey (177.4-million-pound increase), Mobil Oil Paulsboro Refinery, Paulsboro, New Jersey (128.9 million pounds), and Total Petroleum, Inc., Ardmore, Oklahoma (53.9 million pounds)—attribute changes in the reported amounts of ethylene and propylene to a difficulty in applying TRI reporting guidelines to chemicals that are formed in process and partially consumed in process. The facilities also cited a lack of information on how to estimate the amount of these chemicals in refinery streams.

Propylene and ethylene were the chemicals largely responsible for facilities with rankings as the first, third, fourth, and fifth in decreases of production-related waste. The National Cooperative Refinery Association facility in McPherson, Kansas, ranked first with a 303.3-million-pound decrease in production-related waste. This facility reduced the amount of propylene and ethylene burned for energy recovery (sent as constituents of fuels to process heaters) by improving its method of “splitting” (or separating) lighter alkanes from refinery streams so they can be used in product. Energy-recovery quantities of the two chemicals were reduced by a combined 303.5 million pounds. The facility with the third largest decreases, Arco Products Company in Carson, California (124.2 million pounds), stopped reporting individual components of process fuel gases as energy recovery after 1994. The Arco facility reported 123.0 million pounds of propylene and ethylene in energy recovery, combined, in 1991. In 1996 the total for both chemicals was 1.2 million pounds. The fourth-ranked facility, Sinclair Oil Corporation in Sinclair, Wyoming, reported 54 million pounds of propylene and ethylene in energy recovery in 1991 and zero pounds for both in 1996. Its overall reduction for 1991-1996 was 55.8 million pounds.

<sup>1</sup> There are no TRI regulatory definitions of recycling. Facilities may use their own interpretations for purposes of reporting to TRI. Changes in these interpretations do not represent a change in guidance by EPA on how to report recycling.

Quaker State Corporation in Newell, West Virginia (multiple codes 2911 and 2992), reported a 99.8-million-pound decrease for methyl ethyl ketone and a 99.7-million-pound decrease for toluene from 1991 to 1996, both primarily in on-site recycling. The change in reporting was the result of a change in the facility’s interpretation of recycling. The two chemicals, solvents in the facility’s dewaxing system, were previously considered to be recycled each time they were fed back into the dewaxing process. The Quaker State facility no longer reports this “turn-over” as recycling.<sup>1</sup> This facility was second for decreases in production-related waste, with a 199.5-million-pound reduction.

#### **Other Apparent Increases and Decreases in Waste Management, 1991-1996**

In the TRI database, there are other facilities with large apparent increases and decreases, which have been identified as reporting errors or plant closures. Because these are errors or plant closures and not actual changes in the data, these facilities are not discussed in detail here. There is one such facility in petroleum refining:

Seadrift Coke L.P., Seadrift, Texas, decrease of 46.8 million pounds, reporting error.

#### **Facilities Contacted for Explanations (alphabetical by facility):**

Amoco Petroleum Products, Texas City, Texas: L. G. Kuchinski, March 9, 1998 (explanation provided)

Arco Products Company, Carson, California: Josh Miller, March 9, 1998 (explanation provided)

BP Oil Company, Belle Chasse, Louisiana: Randy Borne, March 11, 1998 (explanation provided)

Chevron Products, Richmond, CA: Troy M. Howell, March 9-12, 1998 (explanation provided)

Chevron USA Products, Salt Lake City (no explanation provided)

Coastal Eagle Point Oil Company, Westville, New Jersey: P. Dziubinski, March 9, 1998 (explanation provided)



Farmland Industries, Inc., Coffeyville, Kansas:  
Darrel Stonecipher, March 10, 1998 (explanation  
provided)

Mobil Oil Beaumont Refinery, Beaumont, Texas:  
S.T. Stirling, March 9, 1998 (explanation provided)

Mobil Oil Paulsboro Refinery, Paulsboro, New  
Jersey: Paul Taylor, March 10, 1998 (explanation  
provided)

National Cooperative Refinery Association,  
McPherson, Kansas: Steven Cater, March 9, 1998  
(explanation provided)

Quaker State Corporation, Newell, West Virginia:  
Ronald Ryan, March 9, 1998 (explanation  
provided)

Seadrift Coke L.P., Seadrift, Texas: Emmanuel  
Oladoyin, March 9, 1998 (explanation provided)

Star Enterprises, Port Arthur, Texas: Becky  
Demetre, March 10, 1998 (explanation provided)

Sinclair Oil Corp. Sinclair, Wyoming (could not be  
reached for comment)

Sun Company, Inc., Tulsa, Oklahoma: Sidney  
Cabbiness, March 11, 1998 (explanation provided)

Total Petroleum, Inc., Ardmore, Oklahoma: Darcy  
Jordan, March 11, 1998 (explanation provided)

### Sources

Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual, 1987*.  
Standard Industrial Classification (SIC) codes and industry descriptions.

*U.S. Industry & Trade Outlook '98*, DRI/McGraw Hill, Standard & Poor's, and U.S. Department of Commerce,  
International Trade Administration, 1998: economic analyses, also provides some information on environment and  
industrial processes for selected industries.

U.S. Census Bureau, *1996 Annual Survey of Manufactures. Statistics for Industry Groups and Industries*, M96(AS)-1,  
February 1998 <<http://www.census.gov/prod/www/titles.html#mm>> value of shipments and employment.  
Supplemental data from U.S. Census Bureau <<http://www.census.gov>> for some industries

U.S. Environmental Protection Agency, Office of Enforcement and Compliance Assurance, Office of Compliance, *Profile  
of the Petroleum Refining Industry*, Sector Notebook Project, EPA/310-R-95-013, September 1995 <[http://es.epa.gov/  
oeca/sector/index.html](http://es.epa.gov/oeca/sector/index.html)> industry processes and technologies, pollutant sources, and selected economic data





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## Chapter 8



# ***Toxics Release Inventory Data for Primary Metals (SIC Code 33)***

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## **A Look at the Primary Metal Industries (SIC Code 33)**

The primary metal industries, Standard Industrial Classification (SIC) code 33, smelt and refine ferrous and nonferrous metals from ore, pig (crude iron cast in blocks or “pigs”), or scrap. This sector rolls, draws, and alloys metals, manufactures castings and other basic metal products, and makes nails, spikes, and insulated wire and cable. This group also includes coke production. Box 8-1 lists Standard Industrial Classification codes for the primary metals sector. In TRI, SIC codes are given as reported by the facilities; these may differ from information in economic and other data collections.

In 1996, primary metal industries shipped \$178.30 billion (in current dollars) in products and employed 687,400. Both measures represented a decrease from 1995, when the value of shipments was \$180.31 (in current dollars) billion and employment totaled 685,800. Overall, the sector lost 61% of its employment and 58% of its facilities from 1977 to 1992. From 1989 to 1991, production in primary metals (SIC code 33) fell more sharply (7.8%) than for U.S. manufacturing as a whole (2.8%). (See

Chapter 4, Table 4-10). In the following years, production levels rose in both the primary metal industries and U.S. manufacturing overall, although the primary metals sector has not been able to catch up with the overall improvement. The net increase in production for primary metals from 1989 to 1996 was 11.6%; for U.S. manufacturing as a whole, the increase was 17.6%.

Steel and aluminum are economically the most important products of this sector. Production of these and other metals varies strikingly with changing economic conditions, and also from one metal to another. SIC code designations also organize these industries differently. Steel production encompasses steel works, blast furnaces, and rolling and finishing mills (SIC code 331) and iron and steel foundries (SIC code 332). Steel mills in SIC code 331 may produce steel from iron ore or from iron and steel scrap. Production of nonferrous metals—copper, aluminum, and others such as zinc, lead, titanium, and more—involves primary smelting and refining (SIC code 333), secondary smelting and refining from scrap and waste (SIC code 334), rolling, drawing, and extruding (SIC code 335), and foundries (SIC code 336).

### **Steel**

Steel mills (SIC code 331) shipped \$74.55 billion in products in 1996, employing 221,000. Iron and steel



## Chapter 8 — Toxics Release Inventory Data for Primary Metals

### Box 8-1. SIC Code 33, Primary Metal Industries: Codes and Classifications

SIC Code	Industry Description
<b>331 Steel Works, Blast Furnaces, and Rolling and Finishing Mills</b>	
3312 Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills	Manufacture of hot metal, pig iron, and silvery pig iron from iron ore and iron and steel scrap Conversion of pig iron, scrap iron, and scrap steel into steel Hot rolling of iron and steel into basic shapes, such as plates, sheets, strips, rods, bars and tubing
3313 Electrometallurgical Products, Except Steel	Manufacture of ferro and nonferrous metal additive alloys by electro-metallurgical or metallothermic processes
3315 Steel Wiredrawing and Steel Nails and Spikes	Drawing wire from purchased iron or steel rods, bars, or wire (may include further manufacture of products from wire) Manufacture of steel nails and spikes from purchased materials
3316 Cold-Rolled Steel Sheet, Strip, and Bars	Cold-rolling of steel sheets and strip from purchase of hot-rolled sheets Cold-drawing of steel bars and steel shapes from purchased hot-rolled steel bars. Production of other cold-finished steel
3317 Steel Pipe and Tubes	Production of welded or seamless steel pipe and tubes and heavy riveted steel pipe from purchased materials
<b>332 Iron and Steel Foundries</b>	
3321 Gray and Ductile Iron Foundries	Manufacture of gray and ductile iron castings, including cast iron pressure and soil pipes and fittings
3322 Malleable Iron Foundries	Manufacture of malleable iron castings.
3324 Steel Investment Foundries	Manufacture of steel investment castings
3325 Steel Foundries, nec*	Manufacture of miscellaneous steel castings
<b>333 Primary Smelting, Refining of Nonferrous Metals</b>	
3331 Primary Smelting and Refining of Copper	Smelting copper from ore Refining copper by electrolytic or other processes
3334 Primary Production of Aluminum	Production of aluminum from alumina Refining aluminum by any process
3339 Primary Smelting and Refining of Nonferrous Metals, Except Copper and Aluminum	Smelting and refining nonferrous metals, except copper and aluminum
<b>334 Secondary Smelting, Refining of Nonferrous Metals</b>	
3341 Secondary Smelting and Refining of Nonferrous Metals	Recovery of nonferrous metals and alloys from new and used scrap and dross. Production of alloys from purchased refined materials Includes recovery and alloying of precious metals Includes recovery of tin through secondary smelting and refining, as well
<b>335 Rolling, Drawing, Extruding of Nonferrous Metals</b>	
3351 Rolling, Drawing, and Extruding of Copper	Rolling, drawing, and extruding copper, brass, bronze, and other copper base alloy basic shapes, such as plate, sheet, strip, bar, and tubing
3353 Aluminum Sheet, Plate, and Foil	Flat rolling of aluminum and aluminum-base alloy basic shapes, such as sheet, plate, and foil, including production of welded tube Includes production of similar products by continuous casting
3354 Aluminum Extruded Products	Extruding aluminum and aluminum-base alloy basic shapes, such as rod and bar, pipe and tube, and tube blooms. Includes production of tube by drawing
3355 Aluminum Rolling and Drawing, nec*	Rolling, drawing, and other operations resulting in production of aluminum ingot, including extrusion ingot, and miscellaneous aluminum and aluminum-base alloy basic shapes, such as rolled and continuous cast rod and bar
3356 Rolling, Drawing, and Extruding of Nonferrous Metals, Except Copper and Aluminum	Rolling, drawing, and extruding nonferrous metals other than copper and aluminum
3357 Drawing and Insulating of Nonferrous Wire	Drawing, drawing and insulating, and insulating wire and cable of nonferrous metals from purchased wire bars, rods, or wire Includes manufacture of insulated fiber optic cable

\*nec: not elsewhere classified

**Box 8-1. SIC Code 33, Primary Metal Industries: Codes and Classifications, Continued**

SIC Code	Industry Description
<b>336 Nonferrous Foundries</b>	
3363 Aluminum Die-Castings	Manufacture of die-castings of aluminum (including alloys)
3364 Nonferrous Die-Castings, Except Aluminum	Manufacture of nonferrous metal die-castings, except aluminum
3365 Aluminum Foundries	Manufacture of aluminum (including alloys) castings, except die-castings.
3366 Copper Foundries	Manufacture of copper (including alloys) castings, except die-castings
3369 Nonferrous Foundries, Except Aluminum and Copper	Manufacture of nonferrous metal castings (including alloys), except all die-castings and other castings of aluminum or copper.
<b>339 Miscellaneous Primary Metal Products</b>	
3398 Metal Heat Treating	Heat treating of metal for the trade.
3399 Primary Metal Products, nec*	Manufacture of miscellaneous primary metal products, such as nonferrous nails, spikes, brads, and metal powder, flakes, and paste

Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual, 1987* Standard Industrial Classification (SIC) codes and industry descriptions

\*nec: not elsewhere classified

foundries (SIC code 332) recorded \$15.94 billion in shipments, with employment of 128,200. Steel production thus accounted for half the sector's total in both value of shipments and employment.

Demand for steel is increasing in parts of the developing world, especially Southeast Asia, and in South America, where growing demand is attributed to economic reform. In the developed world, demand for steel is relatively stable, although, as mature economies continue to grow, they tend to consume less steel. In countries of the former Soviet Union, demand for steel in 1996 was only 40% of its 1991 level. In the United States, steel consumption peaked in 1973, plummeted in the 1980s and has partly recovered in the 1990s. By 1996, U.S. steel consumption had reached a level 33% higher than in 1986.

The largest market for steel is motor vehicles, and world trade in that market affects domestic steel production: imported cars are not made with U.S. steel. Lighter materials continue to compete with steel for motor vehicle content, where they help automakers meet fuel efficiency standards and reduce costs, but steel content has in fact been increasing. Construction is the steel industry's second-largest market, and a growing one. According to an American Institute of Steel Construction survey, steel increased from 37% to 58% of commercial building construction in the

United States (measured by the square foot) from 1990 to 1995.

Important technological changes have occurred in the steel industry over the last two decades. The economic decline that hit the industry, shutting down mills and putting steelworkers out of their jobs, largely affected the older, integrated mills—those that produce steel from raw materials (coal, iron ore, as well as scrap steel). Minimills, which produce steel from scrap using electric arc furnaces, expanded during this period.

Recent technological change has focused on the minimills. In 1989, Nucor Corporation brought on line the first thin slab caster/flat rolling mill. This gave minimills the ability to produce low-cost flat-rolled steel, and minimills have since accounted for most of the U.S. added capacity in flat-rolled steel. (Flat-rolled steel represents nearly 60% of U.S. domestic steel shipments.) The minimills' need for quality scrap is expected to exceed supplies. This is one factor driving further technological change in the industry; another is the need to replace antiquated coke ovens, a major pollution source. Thus, further development in the industry now centers on extracting iron from iron ore without use of coke.



Table 8-1. Summary of TRI Information by 4-digit SIC Code, 1996: Primary Metals, SIC Code 33

Total On- and Off-site Releases Rank	Total Production- related Waste Rank	SIC Code	Industry	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds
3	2	3312	Blast Furnaces & Steel Mills	147	1,093	47	55,726,602	59,881,420	115,608,022
7	8	3313	Electrometallurgical Products	13	51	1	22,621,521	141,236	22,762,757
14	16	3315	Steel Wire & Related Products	78	224	24	1,818,968	1,117,464	2,936,432
11	11	3316	Cold Finishing of Steel Shapes	41	146	8	4,445,071	1,788,877	6,233,948
13	12	3317	Steel Pipe & Tubes	67	230	13	2,750,234	796,681	3,546,915
5	10	3321	Gray & Ductile Iron Foundries	193	740	76	22,733,315	11,158,050	33,891,365
24	27	3322	Malleable Iron Foundries	5	22	2	76,132	150,260	226,392
25	24	3324	Steel Investment Foundries	34	96	16	140,150	51,741	191,891
8	13	3325	Steel Foundries, nec*	102	383	39	6,836,197	9,248,779	16,084,976
4	7	3331	Primary Copper	6	48	0	39,081,603	1,418,270	40,499,873
10	9	3334	Primary Aluminum	19	93	14	9,192,498	1,125,887	10,318,385
1	3	3339	Primary Nonferrous Metals, nec*	25	96	6	134,839,282	4,250,840	139,090,122
6	4	3341	Secondary Nonferrous Metals	163	519	44	7,029,167	16,755,093	23,784,260
18	5	3351	Copper Rolling & Drawing	68	150	11	1,184,606	200,096	1,384,702
16	14	3353	Aluminum Sheet, Plate, & Foil	21	97	1	1,946,393	312,365	2,258,758
20	20	3354	Aluminum Extruded Products	59	173	12	1,032,570	79,187	1,111,757
26	28	3355	Aluminum Rolling & Drawing, nec*	2	4	0	69,633	0	69,633
15	19	3356	Nonferrous Rolling & Drawing, nec*	40	126	5	2,105,783	719,723	2,825,506
9	6	3357	Nonferrous Wire Drawing & Insulating	152	519	6	2,836,932	11,032,346	13,869,278
23	15	3363	Aluminum Die-castings	76	158	7	539,478	145,953	685,431
28	26	3364	Nonferrous Die-casting Exc. Aluminum	14	22	4	10,609	8,291	18,900
17	22	3365	Aluminum Foundries	42	98	10	461,684	1,015,373	1,477,057
21	18	3366	Copper Foundries	57	132	10	340,898	753,939	1,094,837
22	21	3369	Nonferrous Foundries, nec*	49	136	6	304,079	689,713	993,792
19	23	3398	Metal Heat Treating	112	161	26	855,677	405,056	1,260,733
12	17	3399	Primary Metal Products, nec*	96	260	21	2,269,788	1,334,337	3,604,125
2	1		Multiple within SIC 33	198	784	55	72,104,755	46,565,361	118,670,116
27	25		Invalid SIC Code within SIC 33	23	42	1	30,576	4,644	35,220
			Total for SIC Code 33	1,902	6,603	465	393,384,201	171,150,982	564,535,183

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents). Facilities/forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category

\*nec: not elsewhere classified.

Traditional steelmaking begins with making coke and making iron. Coke ovens heat coal, in the absence of oxygen, at high temperatures, to produce coke, which will supply fuel and carbon in the next stage. Coke, iron ore, and limestone are heated in a blast furnace, to produce pig iron. Finally, molten iron from the blast furnace is combined with flux and scrap steel in a basic oxygen furnace, where high-purity oxygen is injected. With subsequent forming and finishing operations, this process constitutes fully integrated production. Minimills,

however, melt and refine scrap steel in an electric arc furnace, by passing electric current through the scrap. Both traditional mills and minimills produce molten steel, which is formed into ingots or slabs. These are rolled (with or without reheating, cleaning, and coating) into finished products.



Table 8-1. Summary of TRI Information by 4-digit SIC Code, 1996: Primary Metals, SIC Code 33, Continued

SIC Code	Industry	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-production-related Waste Pounds
3312	Blast Furnaces & Steel Mills	205,965,896	314,485,847	628,035,453	322,543
3313	Electrometallurgical Products	104,044,559	1,608,095	129,275,720	0
3315	Steel Wire & Related Products	13,358,482	13,899,744	29,749,282	36,200
3316	Cold Finishing of Steel Shapes	24,452,828	30,464,657	61,180,242	90,536
3317	Steel Pipe & Tubes	40,928,854	14,379,110	60,001,800	851
3321	Gray & Ductile Iron Foundries	20,842,781	8,021,377	62,253,862	48,057
3322	Malleable Iron Foundries	0	119,741	356,713	0
3324	Steel Investment Foundries	1,287,468	2,771,308	4,635,688	0
3325	Steel Foundries, nec*	24,056,101	5,237,799	46,717,710	21
3331	Primary Copper	63,441,113	51,468,853	154,109,859	704,205
3334	Primary Aluminum	80,086,665	2,733,344	93,154,004	32,371
3339	Primary Nonferrous Metals, nec*	400,129,325	3,133,791	542,169,117	8,729
3341	Secondary Nonferrous Metals	436,069,665	46,367,308	505,109,702	31,532
3351	Copper Rolling & Drawing	326,276,386	38,285,160	378,004,591	27
3353	Aluminum Sheet, Plate, & Foil	40,646,605	3,999,555	46,614,936	25
3354	Aluminum Extruded Products	9,924,938	3,681,182	14,901,594	0
3355	Aluminum Rolling & Drawing, nec*	29,000	24,945	123,618	0
3356	Nonferrous Rolling & Drawing, nec*	9,966,542	4,642,462	15,871,121	3,652
3357	Nonferrous Wiredrawing & Insulating	36,181,666	182,152,735	230,676,573	25,806
3363	Aluminum Die-castings	30,545,599	9,913,790	42,609,575	0
3364	Nonferrous Die-casting Exc. Aluminum	226,487	518,487	763,482	0
3365	Aluminum Foundries	5,831,280	1,838,784	10,053,782	0
3366	Copper Foundries	18,270,757	6,807,397	27,216,087	0
3369	Nonferrous Foundries, nec*	8,253,326	4,779,327	13,523,812	12
3398	Metal Heat Treating	2,739,203	818,364	5,114,086	1,087
3399	Primary Metal Products, nec*	21,871,641	4,028,179	29,729,019	12,764
	Multiple within SIC 33	842,007,107	118,645,496	1,050,163,029	14,070,685
	Invalid SIC Code within SIC 33	663,664	1,171,843	1,977,215	0
	Total for SIC Code 33	2,768,097,938	875,998,680	4,184,091,672	15,389,103

**Note** On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents). Facilities/forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

\*nec not elsewhere classified

## Aluminum, Copper, Lead, Zinc, and Other Nonferrous Metals

Nonferrous rolling and drawing (SIC code 335)—that is, production of basic shapes (plate, sheet, strip, foil, etc.) of copper and aluminum—was the third largest industry group in SIC code 33. This industry group had \$48.82 billion in shipments in 1996 and employment of 162,300. Dissolution of the Soviet Union had an even greater impact on the aluminum industry than on steel, as Russian

demand collapsed but Russian production continued. By 1995, the aluminum industry in Russia and worldwide appeared to have absorbed and adjusted to these changes.

Primary smelting and refining of nonferrous metals (SIC code 333) had \$15.42 billion in value of shipments in 1996, employing 34,900. This SIC code includes copper (SIC code 3331), aluminum (SIC code 3334), and miscellaneous nonferrous metals (SIC code 3339). Miscellaneous primary



nonferrous metals production (SIC code 3339) includes lead and zinc. Although SIC code 333 represents a relatively small segment of the primary metals sector, TRI reporting in this group is significant, as seen in the analyses in this chapter.

Use of aluminum in auto manufacture is rising, and this use overtook containers and packaging in 1994 as aluminum's largest end-use. That was also the year that U.S. production of aluminum cans peaked, at 100 billion units. Virtually all beer and soda cans are now aluminum, and growth in the aluminum container business now depends on growth in beverage consumption. Cool summers were a limiting influence in 1995 and 1996. Copper use is also increasing in automobile manufacture, and it is important in airplane construction, but its primary use is in electrical wiring. The lead market is dominated by one major use: manufacture of lead-acid batteries. Such batteries accounted for 81% of U.S. lead consumption in 1992 and 86% in 1996. The second largest use is ammunition. Galvanizing accounts for more than half of zinc consumption; the automotive and construction industries represent large and growing markets for galvanized steel. Zinc is also used in alloys for die casting and in brass and bronze products.

Processes vary for aluminum, copper, and other metals such as zinc and lead, but metal refining and smelting operations commonly generate slag, sludge, and wastewater that bear pollutants, including metals and metal compounds.

## Other Environmental Issues

Energy costs represent about one fifth of the cost of producing steel, and steelmaking may depend on coal, electricity, natural gas, or oil. Integrated producers (in contrast to minimills) depend on coal for 60% of their energy. Electricity represents one-third of the cost of smelting aluminum—and about half of that electricity comes from coal-fired power plants. Because metal production is energy-intensive, limitations on emissions under consideration in support of the United Nations

Framework Convention for Climate Change could have significant future impact on this sector. Another factor for steelmakers has been the Clean Air Act Amendments of 1990, requiring substantial reductions in coke oven emissions of carcinogens (effective in 1993).

Aluminum and steel are now widely recycled. Recycling accounts for more than one third (34.8%) of the U.S. aluminum supply, according to the Aluminum Association, Inc., and 62.8 billion aluminum cans were recycled in 1996. Steel is the material most recycled in the United States, with an overall recycling rate of 65.2%, according to the Steel Recycling Institute. Not only cans—aluminum and steel—but also steel from automobiles, appliances, and construction products is recycled. Minimills described above depend on such scrap for raw material.

## 1996 TRI Data for Primary Metals

Table 8-1 summarizes TRI data for primary metals production (SIC code 33) by four-digit SIC code, for 1996. The sector submitted 6,603 TRI forms for the year. Seven percent of these were Form A certification statements, certifying that a chemical's annual reportable amount was less than 500 pounds for the year and that the facility did not manufacture, process, or otherwise use more than 1 million pounds. This is a lower percentage of Form A certification statement submissions than in TRI overall (10.1% of all TRI forms). (The Form A certification statement is explained in Chapter 1.) Blast furnaces and steel mills (SIC code 3312) submitted the largest number of forms, 1,093. The second largest number was for forms with more than one SIC code within SIC code 33, the "multiple-codes" category, explained below, with 784. Gray and ductile iron foundries (SIC code 3321) were third with 740.



Table 8-2. Multiple SIC Codes, 1996: Primary Metals, SIC Code 33

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
3312 3316	2	0	208,000	250	208,250	0	0	208,000	0
3312 3317 3325	67	7	1,576,445	10,001	1,586,446	6,615,064	680,305	9,524,603	0
3312 3398	6	1	94	0	94	55,770	22,785	78,881	0
3313 3341	1	0	0	0	0	198,100	0	198,100	0
3315 3398	27	0	7,569,264	4,046,643	11,615,907	9,247,284	10,021,121	30,714,128	1,423,000
3321 3322 3365	4	0	113,108	0	113,108	86,000	480	199,610	0
3321 3365	4	0	44,965	668	45,633	0	41,819	87,603	0
3324 3365 3366	1	0	0	34,500	34,500	9,505	0	44,005	0
3324 3369	84	7	19,006,666	5,405,824	24,412,490	14,975,250	11,920,298	51,230,368	2,020,890
3331 3351	78	5	5,648,284	2,566,775	8,215,059	4,985,475	7,478,086	20,667,029	394,011
3334 3341	76	3	17,365,498	33,153,259	50,518,757	13,700,289	39,830,592	88,486,538	10,202,698
3334 3355	158	14	10,417,316	549,476	10,966,792	239,829,255	40,078,491	277,147,110	27,362
3339 3341	1	0	130	6,700	6,830	0	4,000	10,500	260
3339 3351	3	0	483,358	1,410	484,768	232,200	69,437	734,226	0
3339 3356	195	10	7,863,405	787,643	8,651,048	48,823,168	7,467,265	64,762,389	1,672
3341 3351 3366	5	0	257,031	0	257,031	0	94,633	343,264	0
3341 3351 3398	3	0	194,620	0	194,620	465,400	16,070	672,520	0
3341 3353	1	0	297,000	0	297,000	3,900,014	6,800	4,204,914	0
3341 3355	9	0	424,998	0	424,998	7,480,000	567,475	8,476,124	0
3341 3356 3399	1	0	660	0	660	0	0	660	0
3341 3363 3365 3398	1	0	255	0	255	0	0	27	0
3341 3369	10	1	1,791	746	2,537	41,860	277,040	320,495	0
3341 3398	17	2	328,694	0	328,694	489,186,772	1,402	489,506,136	792
3341 3399	2	1	7,352	0	7,352	5,200	94	12,646	0
3351 3356	3	0	223,079	0	223,079	0	12,580	235,659	0
3351 3357	1	2	0	72,093	0	72,093	2,170,109	45,501	2,285,9320
3365 3366	1	0	392	0	392	392	17	818	0
3365 3369	12	4	257	1,466	1,723	0	9,205	10,744	0
Total for SIC Code 33	784	55	72,104,755	46,565,361	118,670,116	842,007,107	118,645,496	1,050,163,029	14,070,685

**Note:** On-site Releases from Section 5 of Form R On-site Waste Management from Section 8 of Form R Off-site Releases are transfers off-site to disposal from Section 6 of Form R Total Transfers Off-site for Further Waste Management from Section 6 of Form R Total Production-related Waste sums Section 8 of Form R, except Non-production-related Waste (remedial/catastrophic incidents).

Miscellaneous primary nonferrous metals (SIC code 3339) had the largest total on- and off-site releases in SIC code 33, with 139.1 million pounds. It also had the largest on-site releases (134.8 million pounds). This industry smelts and refines nonferrous metals other than copper and aluminum; its products include lead and zinc. Blast furnaces and steel mills (SIC code 3312) had the largest off-site releases (59.9 million pounds) and the largest off-site waste management (314.5 million pounds transferred off-site for further waste management). This industry was second or third in other categories given in Table 8-1.

### Multiple Codes within SIC Code 33

Forms with more than one four-digit SIC code within SIC code 33 represent a significant segment

of primary metals reporting in TRI. Many primary metals facilities conduct related, but distinct, operations, that are classified separately in the Standard Industrial Classification system. For example, steel mills (SIC code 3312) may also manufacture steel pipe (SIC code 3317). Smelters of some nonferrous metals may engage in both primary smelting (producing the metal from ore or other raw materials) and secondary smelting (producing the metal from scrap and dross). These activities have separate SIC codes (for example, SIC code 3334 and SIC code 3341 for aluminum). Refiners and smelters may also further process the metal they produce. A primary lead smelter (SIC code 3339), for example, may also produce lead in basic shapes, such as bars, pipes, plates, rods, sheets, and others (SIC code 3356). Such facilities report on each TRI form all the SIC codes that describe the operations associated with releases and





Table 8-3. TRI On-site and Off-site Releases, 1996: Primary Metals, SIC Code 33 (in Rank Order)

SIC Code	Industry	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases		Total On- & 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		
3339	Primary Nonferrous Metals, nec*	71,751,734	42,739	0	0	0	63,044,809	134,839,282	4,250,840	139,090,122	
	Multiple within SIC 33	16,889,530	5,950,092	0	0	12,550,133	36,715,000	72,104,755	46,565,361	118,670,116	
3312	Blast Furnaces & Steel Mills	12,702,728	20,561,293	613,200	0	8,845,161	13,004,220	55,726,602	59,881,420	115,608,022	
3331	Primary Copper	2,620,634	5,000	251,535	0	0	36,204,434	39,081,603	1,418,270	40,499,873	
3321	Gray & Ductile Iron Foundries	6,034,095	27,971	0	0	75,497	16,595,752	22,733,315	11,158,050	33,891,365	
3341	Secondary Nonferrous Metals	2,574,542	119,311	65,672	0	92,774	4,176,868	7,029,167	16,755,093	23,784,260	
3313	Electrometallurgical Products	5,517,982	1,040,031	0	0	0	16,063,508	22,621,521	141,236	22,762,757	
3325	Steel Foundries, nec*	1,542,091	6,143	0	0	2,652	5,285,311	6,836,197	9,248,779	16,084,976	
3357	Nonferrous Wiredrawing & Insulating	2,811,181	2,680	0	0	0	23,071	2,836,932	11,032,346	13,869,278	
3334	Primary Aluminum	9,172,654	7,379	0	0	9,205	3,260	9,192,498	1,125,887	10,318,385	
3316	Cold Finishing of Steel Shapes	440,045	3,686,484	250	0	305,800	12,492	4,445,071	1,788,877	6,233,948	
3399	Primary Metal Products, nec*	1,786,500	9,962	4	0	3,904	469,418	2,269,788	1,334,337	3,604,125	
3317	Steel Pipe & Tubes	2,566,973	133,602	0	0	6,964	42,695	2,750,234	796,681	3,546,915	
3315	Steel Wire & Related Products	1,695,031	12,478	0	0	83,104	28,355	1,818,968	1,117,464	2,936,432	
3356	Nonferrous Rolling & Drawing, nec*	406,935	48,433	113	0	0	1,650,302	2,105,783	719,723	2,825,506	
3353	Aluminum Sheet, Plate, & Foil	1,900,396	43,497	0	0	0	2,500	1,946,393	312,365	2,258,758	
3365	Aluminum Foundries	436,581	528	0	0	0	24,575	461,684	1,015,373	1,477,057	
3351	Copper Rolling & Drawing	694,187	260,324	0	0	92,762	137,333	1,184,606	200,096	1,384,702	
3398	Metal Heat Treating	855,640	37	0	0	0	0	855,677	405,056	1,260,733	
3354	Aluminum Extruded Products	1,017,031	15,530	5	0	0	4	1,032,570	79,187	1,111,757	
3366	Copper Foundries	197,923	1,797	0	0	122,073	19,105	340,898	753,939	1,094,837	
3369	Nonferrous Foundries, nec*	263,825	292	0	0	2,000	37,962	304,079	689,713	993,792	
3363	Aluminum Die-castings	534,584	61	0	0	0	4,833	539,478	145,953	685,431	
3322	Malleable Iron Foundries	40,240	11,770	0	0	0	24,122	76,132	150,260	226,392	
3324	Steel Investment Foundries	118,499	836	0	0	0	20,815	140,150	51,741	191,891	
3355	Aluminum Rolling & Drawing, nec*	69,633	0	0	0	0	0	69,633	0	69,633	
	Invalid SIC Code within SIC 33	29,151	573	0	0	0	852	30,576	4,644	35,220	
3364	Nonferrous Die-casting Exc. Aluminum	10,519	0	0	0	0	90	10,609	8,291	18,900	
Total for SIC Code 33		144,680,864	31,988,843	930,779	0	22,192,029	193,591,686	393,384,201	171,150,982	564,535,183	

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

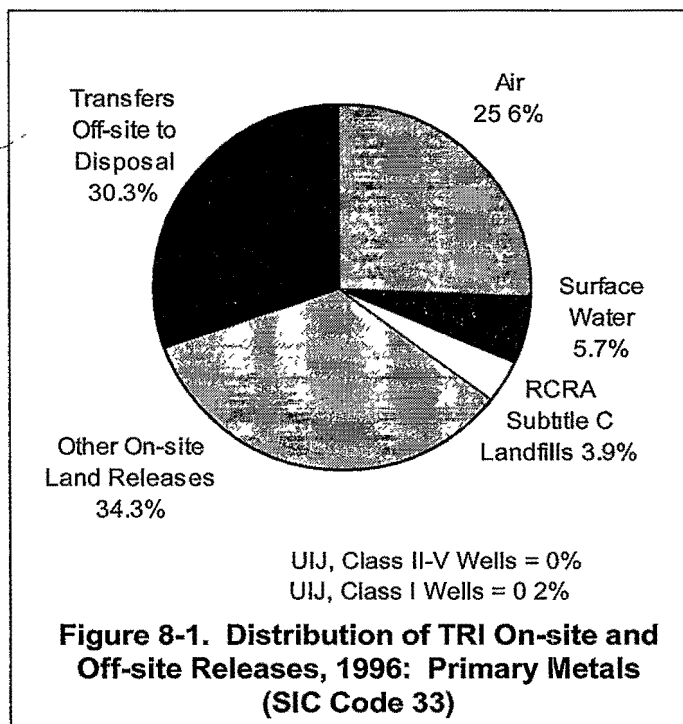
\*nec: not elsewhere classified.

other waste management of the reported chemical. These are the forms in the "multiple codes" category in this report. (Box 4-2 in Chapter 4 further explains reporting of multiple SIC codes and its affect on the analyses presented in the TRI data release.)

Reporting on forms with multiple SIC codes within the sector is further examined in Table 8-2. Secondary smelters and refiners of nonferrous metals (SIC code 3341) appear most often (in 12 of the 28 combinations). Secondary smelting generally recovers metals and alloys from scrap. This activity may combine with primary smelting and refining (SIC code 333), with further processing of the metal (rolling, drawing,

extruding, in SIC code 335), die-casting (SIC code 336), or miscellaneous products (SIC code 339).

Forms with multiple SIC codes had the largest on-site waste management (842.0 million pounds) and the largest total production-related waste (1.05 billion pounds). Forms with multiple SIC codes also had the second or third largest amounts in the other categories (on- and off-site releases and transfers off-site for further waste management). As shown in Table 8-2, the multiple-code combination with the largest total on- and off-site releases was primary production of aluminum (SIC code 3334) with secondary smelting and refining of nonferrous metals (SIC code 3341). This combination had total



Note On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. UIJ = underground injection

on-and-off-site releases of 50.5 million pounds. The combination of secondary nonferrous metal producers (SIC code 3341) and metal heat treating (SIC code 3398) accounted for 489.2 million pounds of other on-site waste management and 489.5 million pounds of total production-related waste.

## On- and Off-site Releases

Table 8-3 shows on- and off-site releases for primary metal industries for 1996, and Figure 8-1 gives the distribution by media of these releases. On-site land releases were the largest category, with 22.2 million pounds released to RCRA subtitle C landfills and 193.6 million pounds in other on-site land releases. Together, they represented 38.2% of all on- and off-site releases in the sector. Off-site releases (transfers off-site to disposal) were the next largest release, with 171.2 million pounds, or 30.3%. Air emissions were 144.7 million pounds, or 25.6%, and surface water discharges were 32.0 million pounds, or 5.7%. Little underground

injection was reported, 931,000 pounds (0.2%), all of it to Class I wells.

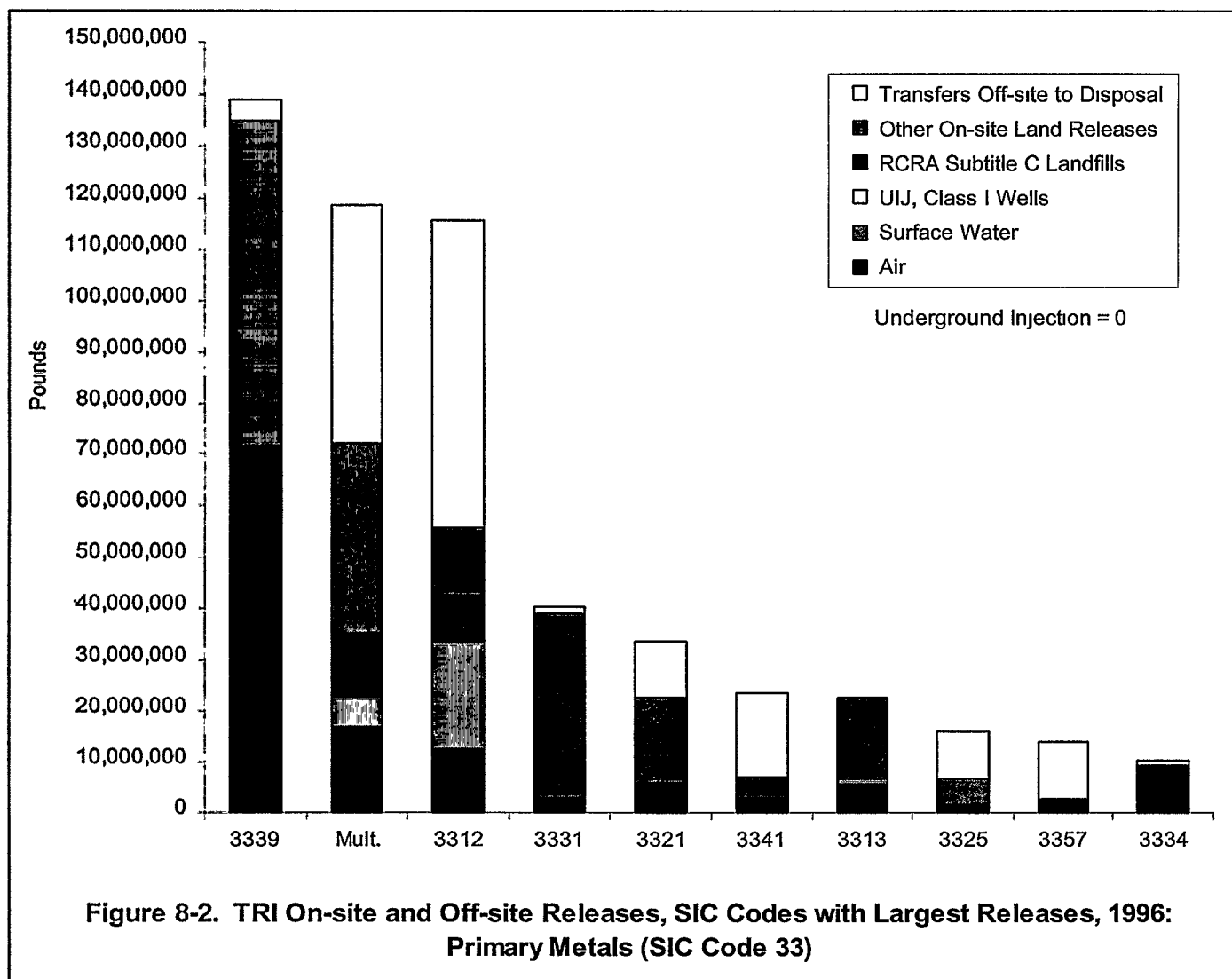
Miscellaneous primary nonferrous metals (SIC code 3339) reported the largest total for on- and off-site releases, 139.1 million pounds. Forms with multiple codes in SIC code 33 reported 118.7 million pounds, followed by blast furnaces and steel mills (SIC code 3312) with 115.6 million pounds. These three groups accounted for two-thirds (66.1%) of the sector's reported releases.

Producers of miscellaneous primary nonferrous metals reported half (49.6%, or 71.8 million pounds) of the sector's air emissions and one third (32.6%, or 63.0 million pounds) of the other on-site land releases. The multiple-codes group reported the largest RCRA landfill releases (12.6 million pounds, or 56.6% of the total). Blast furnaces and steel mills reported the largest amounts in surface water discharges (20.6 million pounds, or 64.3% of that release type), underground injection (613,000 pounds, or 65.9%), and off-site releases (59.9 million pounds, or 35.0%).

Figure 8-2 illustrates the distribution of on- and off-site releases for the primary metal industries with the largest releases.

## Other On-site Waste Management

Recycling was the largest on-site waste management method reported in the primary metals sector, with 2.09 billion pounds recycled out of 2.77 billion pounds managed on-site. Recycling was 75.6% of total on-site waste management. On-site treatment was second with 625.8 million pounds, or 22.6%. Very little energy recovery was reported (49.8 million pounds, or 1.8%), and none of this on-site energy recovery was reported for metals or metal compounds. Metals are not combustible and do not contribute any heat value for energy recovery purposes. Table 8-4 and Figure 8-3 present these data.



Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category. UIJ: underground injection.

Multiple-codes submissions reported the largest total on-site waste management, with 842.0 million pounds, as also shown in Table 8-4. Of this amount, 778.5 million pounds was recycled on-site. Forms with multiple codes in SIC code 33 accounted for 37.2% of on-site recycling and 30.4% of total on-site waste management in the sector. Primary nonferrous metals facilities (SIC code 3339) had the largest on-site treatment, 240.1 million pounds, or 38.4%. Secondary refining of nonferrous metals (SIC code 3341) was second for total on-site waste management, although it did not

lead any category. Its total was 436.1 million pounds, or 15.8% of all on-site waste management.

Figure 8-4 illustrates the on-site waste management of the primary metal industries with the largest totals.

### Transfers Off-site for Further Waste Management

With 277.4 million pounds transferred off-site to recycling, blast furnaces and steel mills reported the



Table 8-4. TRI Other On-site Waste Management, 1996: Primary Metals, SIC Code 33 (in Rank Order)

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds
	Multiple within SIC 33	778,473,601	17,623,145	45,910,361	842,007,107
3341	Secondary Nonferrous Metals	327,093,466	0	108,976,199	436,069,665
3339	Primary Nonferrous Metals, nec*	160,036,537	0	240,092,788	400,129,325
3351	Copper Rolling & Drawing	325,935,091	0	341,295	326,276,386
3312	Blast Furnaces & Steel Mills	83,413,823	3,804,673	118,747,400	205,965,896
3313	Electrometallurgical Products	103,881,994	0	162,565	104,044,559
3334	Primary Aluminum	64,706,648	7,778,770	7,601,247	80,086,665
3331	Primary Copper	63,440,113	0	1,000	63,441,113
3317	Steel Pipe & Tubes	35,725,268	443,607	4,759,979	40,928,854
3353	Aluminum Sheet, Plate, & Foil	6,237,233	15,460,330	18,949,042	40,646,605
3357	Nonferrous Wiredrawing & Insulating	13,392,150	4,657,935	18,131,581	36,181,666
3363	Aluminum Die-castings	30,440,128	0	105,471	30,545,599
3316	Cold Finishing of Steel Shapes	701,000	0	23,751,828	24,452,828
3325	Steel Foundries, nec*	23,976,223	0	79,878	24,056,101
3399	Primary Metal Products, nec*	10,076,103	0	11,795,538	21,871,641
3321	Gray & Ductile Iron Foundries	19,844,260	0	998,521	20,842,781
3366	Copper Foundries	18,270,757	0	0	18,270,757
3315	Steel Wire & Related Products	5,368,115	0	7,990,367	13,358,482
3356	Nonferrous Rolling & Drawing, nec*	2,415,801	0	7,550,741	9,966,542
3354	Aluminum Extruded Products	3,675,762	0	6,249,176	9,924,938
3369	Nonferrous Foundries, nec*	7,779,646	0	473,680	8,253,326
3365	Aluminum Foundries	5,306,555	0	524,725	5,831,280
3398	Metal Heat Treating	143,912	0	2,595,291	2,739,203
3324	Steel Investment Foundries	1,261,033	0	26,435	1,287,468
	Invalid SIC Code within SIC 33	663,664	0	0	663,664
3364	Nonferrous Die-casting Exc. Aluminum	226,469	0	18	226,487
3355	Aluminum Rolling & Drawing, nec*	0	0	29,000	29,000
3322	Malleable Iron Foundries	0	0	0	0
	Total for SIC Code 33	2,092,485,352	49,768,460	625,844,126	2,768,097,938

**Note:** Other On-site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

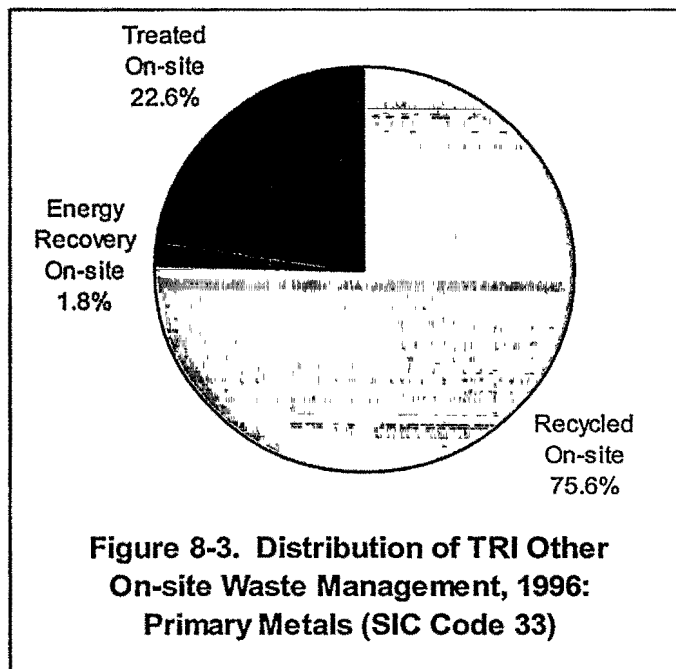
\*nec: not elsewhere classified

largest total transfers off-site for further waste management. This industry's total was 314.5 million pounds, or 35.9% of the sector's total of 876.0 million pounds. Table 8-5 and Figure 8-5 provide data for off-site transfers for further waste management in the primary metals sector.

Transfers to treatment was 66.2 million pounds; two-thirds of this (43.7 million pounds, or 66.1%)

consisted of solidification/stabilization of metals and metal compounds, which prepares them for disposal. Therefore, ultimately, this 43.7 million pounds is released. Zinc compounds accounted for the largest portion of this amount, 24.9 million pounds in solidification/stabilization.

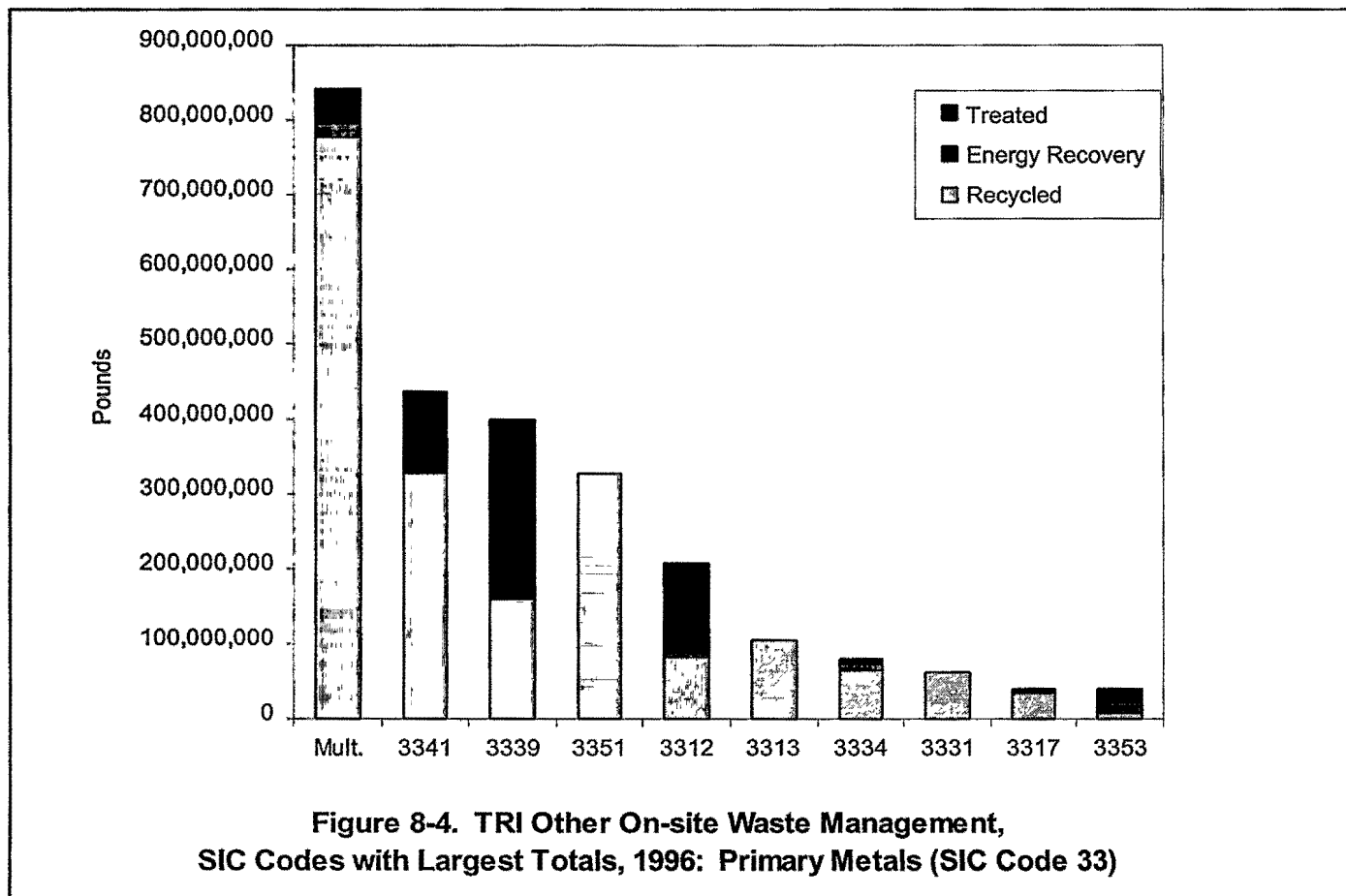
Reporting in other categories of transfers off-site for further waste management was small: transfers



Note: Data from Section 8 of Form R.

to POTWs was 7.9 million pounds, and transfers to energy recovery was 5.6 million pounds. Because metals do not degrade, treatment processes at POTWs and other off-site treatment facilities may remove them from wastes, with other solids, but cannot destroy them. In addition, metals and metal compounds were also 0.2% of the 5.6 million pounds of chemicals reported as transferred off-site to energy recovery; however, these amounts represent misreporting because metals do not burn or contribute heat value to energy recovery.

Figure 8-6 shows off-site transfers for further waste management for the four-digit SIC codes reporting the largest totals in this category in the primary metals sector.



Note: Other On-site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.



Table 8-5. TRI Transfers Off-site for Further Waste Management, 1996: Primary Metals, SIC Code 33 (in Rank Order)

SIC Code	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Transfers for Further Waste Management Pounds
3312	Blast Furnaces & Steel Mills	277,425,228	64,427	35,944,491	791,030	260,671	314,485,847
3357	Nonferrous Wiredrawing & Insulating	179,482,543	2,205,343	418,298	46,301	250	182,152,735
	Multiple within SIC 33	105,199,906	1,245,825	8,925,774	3,273,991	0	118,645,496
3331	Primary Copper	44,592,387	0	6,876,151	315	0	51,468,853
3341	Secondary Nonferrous Metals	43,623,015	8,730	2,706,320	28,743	500	46,367,308
3351	Copper Rolling & Drawing	37,886,932	0	322,111	76,117	0	38,285,160
3316	Cold Finishing of Steel Shapes	25,205,106	0	4,257,351	1,002,200	0	30,464,657
3317	Steel Pipe & Tubes	11,952,200	55,792	2,264,835	106,278	5	14,379,110
3315	Steel Wire & Related Products	10,491,278	1,446	2,232,540	1,174,480	0	13,899,744
3363	Aluminum Die-castings	9,822,808	59,082	9,667	22,233	0	9,913,790
3321	Gray & Ductile Iron Foundries	7,251,847	181,282	465,423	120,801	2,024	8,021,377
3366	Copper Foundries	6,734,132	14,529	57,907	829	0	6,807,397
3325	Steel Foundries, nec*	4,832,058	1,323	403,371	1,047	0	5,237,799
3369	Nonferrous Foundries, nec*	4,643,623	0	127,788	7,916	0	4,779,327
3356	Nonferrous Rolling & Drawing, nec*	3,975,533	4,930	338,881	323,113	5	4,642,462
3399	Primary Metal Products, nec*	3,455,076	5,810	49,182	518,111	0	4,028,179
3353	Aluminum Sheet, Plate, & Foil	3,699,616	241,933	57,686	320	0	3,999,555
3354	Aluminum Extruded Products	2,010,038	1,495,394	162,900	12,850	0	3,681,182
3339	Primary Nonferrous Metals, nec*	3,097,640	0	34,045	1,856	250	3,133,791
3324	Steel Investment Foundries	2,705,889	491	63,670	1,258	0	2,771,308
3334	Primary Aluminum	2,692,028	500	40,816	0	0	2,733,344
3365	Aluminum Foundries	1,828,192	0	255	10,337	0	1,838,784
3313	Electrometallurgical Products	1,290,494	0	316,321	1,280	0	1,608,095
	Invalid SIC Code within SIC 33	1,167,982	3,600	0	261	0	1,171,843
3398	Metal Heat Treating	395,923	28,145	58,211	336,085	0	818,364
3364	Nonferrous Die-casting Exc Aluminum	508,267	0	9,920	300	0	518,487
3322	Malleable Iron Foundries	108,867	57	9,812	1,005	0	119,741
3355	Aluminum Rolling & Drawing, nec*	0	24,945	0	0	0	24,945
	Total for SIC Code 33	796,078,608	5,643,584	66,153,726	7,859,057	263,705	875,998,680

Note: Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

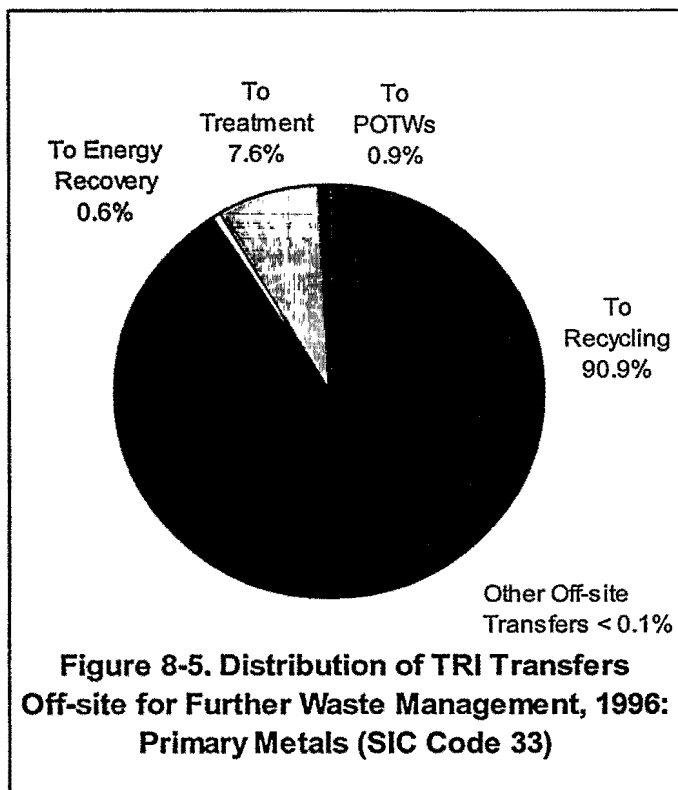
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## 1996 TRI Data by State for Primary Metals

What most influences the location of primary metal production is the location of the metal (in ore or other natural forms). Other factors are power, transportation, and water. Steel mills, for example, congregated along or near the Great Lakes, to obtain iron ore from Michigan while transporting coal (for coke) by rail from Pennsylvania and neighboring states. Primary aluminum production is concentrated in the Pacific Northwest, largely fueled by Bonneville Power Administration

hydropower; production of aluminum sheet, plate, and foil occurs principally in the Midwest. Copper mines in Arizona and other western states (Nevada, Utah) account for the location of primary copper production facilities there as well.

Metal mining and manufacture is more highly concentrated, corporately and geographically, than many other business sectors in the United States. For example, four U.S. companies dominate the U.S. aluminum industry along with one Canadian firm. Lead offers another example: deposits in Alaska, Idaho, Missouri, and Montana account for most U.S. lead mining; there are a total of 18 U.S. mines. Primary lead refineries—there are three—



Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site for disposal) of Form R. Other off-site transfers are transfers reported without a valid waste management code.

are located in Missouri and Montana. Twelve states host 18 secondary smelting and refining facilities. Zinc production shows even more narrow concentration—15 mines produce 95% of the zinc, refined in three facilities (one each in Illinois, Tennessee, and Pennsylvania), with seven secondary smelters recovering zinc from waste and scrap.

This concentration is reflected in TRI reporting, where a single state may account for one-fifth to one-quarter of the sector's national total in any one category. Table 8-6 provides TRI data by state for the primary metal industries.

Utah reported the largest total on- and off-site releases in 1996, 79.5 million pounds, or 14.1% of the U.S. total. Pennsylvania was second with 69.2 million pounds (12.3%). In Utah, most of this total was on-site releases (78.7 million pounds, 20.0% of all on-site releases in the sector), making Utah the state with the largest on-site releases. In

Pennsylvania, most of the releases were off-site (42.4 million pounds in transfers to disposal, or 24.8%), and Pennsylvania was the state with the largest amount in this release type. Map 8-1 illustrates the geographic distribution of total on- and off-site releases in this sector.

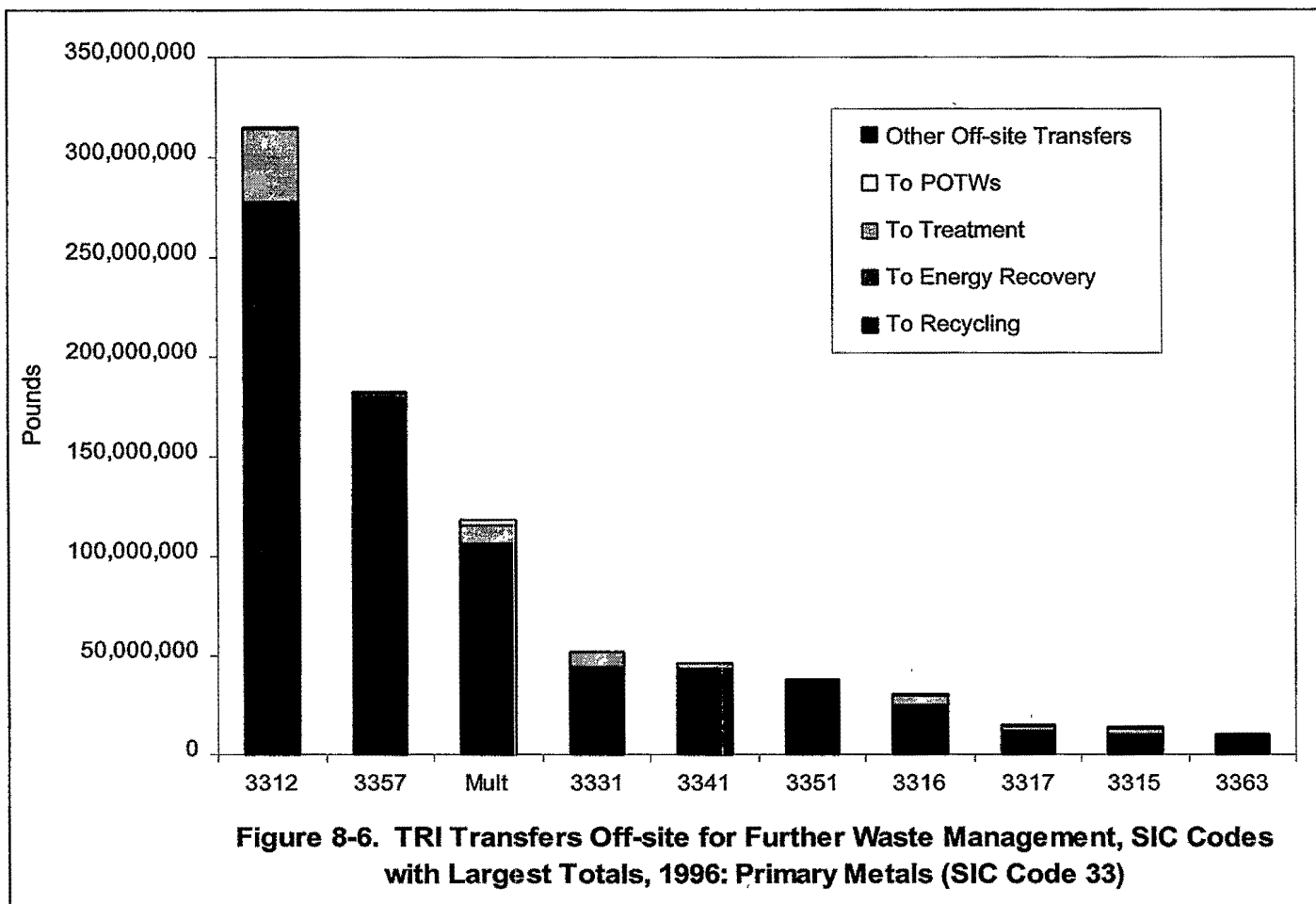
The largest quantities of on-site waste management and of total production-related waste were reported in Arizona. On-site waste management in Arizona was 604.8 million pounds, or 21.8% of that total; the state's production-related waste totaled 716.8 million pounds, or 17.1%. Pennsylvania was second in both categories, with 310.7 million pounds of other on-site waste management (11.2%) and 472.9 million pounds of total production-related waste (11.3%). Indiana led total transfers off-site for further waste management with 104.1 million pounds (11.9%), followed by Texas with 99.1 million pounds (11.3%).

For on-site releases, off-site releases, other on-site waste management, and total production-related waste, amounts reported in the leading state were 43% to 95% higher than in the state that ranked second.

## 1996 TRI Data by Chemical for Primary Metals

As might well be expected, many chemicals that primary metal industries released on- and off-site in the largest amounts in 1996 were metals or metal compounds. (See explanation in Chapter 2 of TRI reporting of the metal component of compounds.) Ten of the top 15 chemicals in the sector, presented in Table 8-7, were metals or their compounds.

Zinc compounds had by far the largest total releases, 174.9 million pounds. Another 9.4 million pounds of releases of the metal zinc were also



Note: Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" code category.

reported, 13th among TRI chemicals reported in this sector (only fume and dust forms of the metal zinc are reportable to TRI.). Together, they represented 32.6% of all releases reported in the primary metals sector. Zinc is most commonly used as a protective coating for other metals. Zinc ammonium chloride and zinc fluoride are both used in galvanizing. Much of the scrap steel processed by secondary smelters is galvanized—a large source of releases of zinc compounds.

Second-ranked chlorine is used to "de-tin" and "de-zinc" iron. It is also a purifying agent in, for example, magnesium processing. Chlorine alone represented 41.3% (59.8 million pounds) of air emissions in the primary metals sector; almost all of this (59.2 million pounds) was reported by one

facility, the Magnesium Corporation of America, in Rowley, Utah. (As described later in this chapter, in the section on **Facilities with Large Increases and Decreases in Releases, 1988-1996.**)

Other chemicals with more than 10 million pounds of air emissions were ammonia (18.1 million pounds, 12.5% of all air emissions) and hydrochloric acid (10.9 million pounds, or 7.5%). Metals and metal compounds represented a smaller portion of air releases, but were still significant, including more than 1 million pounds each of copper (4.7 million pounds), zinc compounds (4.2 million pounds), copper compounds (1.5 million pounds), manganese compounds (1.3 million pounds), and aluminum, fume or dust (1.1 million pounds).





Table 8-6. Summary of TRI Information by State, 1996: Primary Metals, SIC Code 33

State	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
Alabama	57	256	21	9,884,138	10,226,857	20,110,995	144,018,429	21,324,410	178,488,243	148
Arizona	20	82	12	42,828,276	59,111	42,887,387	604,763,405	69,121,937	716,810,564	531
Arkansas	34	98	7	2,928,922	99,062	3,027,984	98,346,120	31,692,953	124,623,924	78
California	96	229	14	1,387,773	5,034,316	6,422,089	17,710,853	12,699,264	36,423,673	9,240
Colorado	7	23	0	188,167	49,417	237,584	531,895	6,690,949	7,401,320	0
Connecticut	48	137	13	616,494	219,383	835,877	36,176,182	7,633,359	45,025,052	21
Delaware	3	11	1	39,344	14,943	54,287	13,000,000	3,179,007	16,233,240	5
Florida	15	46	3	126,401	4,110,181	4,236,582	1,585,581	7,081,464	8,933,050	0
Georgia	31	105	2	1,020,579	177,055	1,197,634	2,101,201	9,841,578	13,254,696	20,236
Illinois	136	470	33	28,714,958	3,834,490	32,549,448	66,971,389	42,861,308	140,089,258	154,349
Indiana	136	583	27	20,799,659	29,691,318	50,490,977	180,387,907	104,054,017	336,462,430	10,425
Iowa	26	96	2	5,992,507	877,262	6,869,769	108,625,916	4,703,065	120,173,535	0
Kansas	14	45	1	991,267	989,470	1,980,737	11,277,504	9,320,015	22,485,890	0
Kentucky	47	196	11	4,199,320	158,864	4,358,184	62,161,496	28,586,994	95,505,868	2,500
Louisiana	11	32	2	441,641	3,091	444,732	9,832,957	5,048,847	15,337,492	25,770
Maryland	8	41	5	1,940,627	394,078	2,334,705	10,501,033	1,087,177	13,867,926	0
Massachusetts	43	121	18	144,918	2,601,691	2,746,609	12,910,330	11,521,928	27,157,130	0
Michigan	104	335	18	6,143,903	29,074,648	35,218,551	48,749,663	24,452,047	108,815,289	440
Minnesota	27	67	8	370,618	349,396	720,014	113,987,116	4,952,686	119,580,215	6,069
Mississippi	19	64	2	5,445,573	192,045	5,637,618	3,087,606	5,226,734	14,409,758	10,189
Missouri	43	134	18	18,318,412	2,106,773	20,425,185	109,445,310	17,191,084	147,302,541	17,849
Montana	3	19	0	44,747,042	0	44,747,042	49,712,037	557,931	95,033,608	8,166
Nebraska	7	32	0	89,679	3,006,469	3,096,148	16,278,750	10,103,412	21,800,036	0
Nevada	5	19	6	305,491	0	305,491	1,243,000	242,627	2,031,848	85
New Hampshire	11	40	7	158,886	24,661	183,547	1,823,500	4,428,791	6,644,408	0
New Jersey	51	150	1	926,100	162,716	1,088,816	12,987,795	7,957,577	30,439,899	727,626
New Mexico	5	12	0	17,812,008	250	17,812,258	56,346	10,759	17,879,685	0
New York	67	216	23	2,245,805	1,372,555	3,618,360	119,091,459	23,636,168	148,000,793	7,468
North Carolina	35	105	4	958,585	269,113	1,227,698	9,054,330	10,144,619	23,357,146	0
Ohio	216	740	68	44,392,867	10,927,603	55,320,470	151,010,933	82,433,858	303,114,583	10,057
Oklahoma	30	88	14	351,115	1,989,250	2,340,365	204,748	5,466,527	8,043,238	0
Oregon	22	91	4	4,731,284	124,795	4,856,079	26,795,038	13,410,317	45,088,450	302,547
Pennsylvania	203	748	39	26,856,122	42,360,046	69,216,168	310,719,638	87,785,833	472,876,446	13,056,086
Puerto Rico	3	11	0	42,620	573	43,193	8,900	302,470	354,563	0
Rhode Island	15	43	5	58,937	48,655	107,592	3,417,501	4,271,206	7,774,713	0
South Carolina	27	104	7	1,521,623	3,922,435	5,444,058	1,907,016	34,951,201	41,861,707	202,278
South Dakota	1	7	0	81,160	0	81,160	184,900	95,200	359,520	0
Tennessee	51	180	13	3,881,488	4,158,875	8,040,363	32,597,865	23,057,109	62,634,555	16,388
Texas	73	241	21	4,662,739	1,013,330	5,676,069	41,165,313	99,106,102	116,539,367	9,204
Utah	16	92	9	78,677,680	772,853	79,450,533	247,461,080	6,972,306	334,294,471	704,205
Vermont	1	3	0	0	1,255	1,255	0	0	1,362	0
Virginia	15	57	3	840,381	681,942	1,522,323	19,427,770	6,001,743	26,972,789	0
Washington	25	83	9	4,529,322	1,043,637	5,572,959	38,966,168	7,981,081	51,685,499	15,000
West Virginia	13	71	1	1,970,305	2,236,818	4,207,123	5,024,525	6,217,941	15,387,159	0
Wisconsin	79	274	12	919,445	6,769,700	7,689,145	22,787,433	12,593,079	43,434,705	72,143
Wyoming	3	6	1	100,020	0	100,020	0	0	100,028	0
Total for SIC Code 33	1,902	6,603	465	393,384,201	171,150,982	564,535,183	2,768,097,938	875,998,680	4,184,091,672	15,389,103

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except. Non-production-related Waste (remedial/catastrophic incidents)

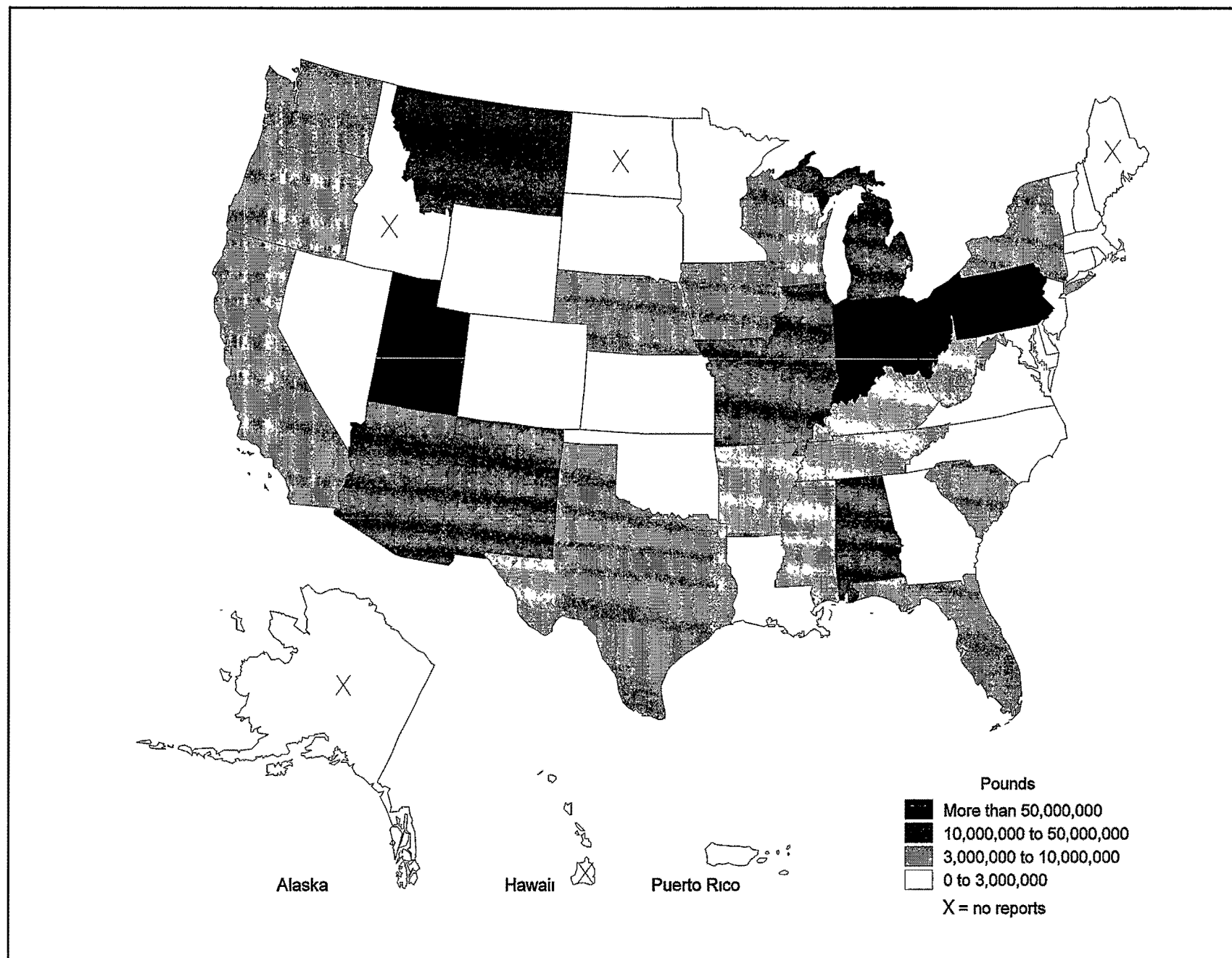
Nitrate compounds (ranked fifth for total on- and off-site releases) accounted for most of the surface water discharges in the sector—27.7 million pounds out of 32.0 million pounds.

The top 15 chemicals in Table 8-7 accounted for 89.2% of all releases reported in this sector.

## OSHA Carcinogens

Chemicals designated as OSHA carcinogens totaled 21.1 million pounds in releases reported by primary metal industries, as shown in Table 8-8. (OSHA carcinogens and the bases for their designation appear in Box 2.4 in Chapter 2.) The majority—7.5

Map 8-1. Total On- and Off-site Releases, 1996: Primary Metals, SIC Code 33



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



**Table 8-7. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1996: Primary Metals, SIC Code 33 (In Rank Order)**

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- & 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	
7782-50-5	— Zinc compounds	4,205,919	164,572	2,605	0	14,127,597	71,737,744	90,238,437	84,624,864	174,863,301
	Chlorine	59,790,515	6,008	0	0	0	5	59,796,528	10	59,796,538
	— Copper compounds	1,527,817	23,036	143,098	0	98,816	46,798,417	48,591,184	4,329,203	52,920,387
	— Manganese compounds	1,275,109	896,367	2,900	0	4,567,109	27,966,965	34,708,450	13,827,724	48,536,174
	— Nitrate compounds	7,936	27,735,809	0	0	0	1,238,031	28,981,776	35,280	29,017,056
—	Lead compounds	946,878	31,735	768	0	1,550,822	9,699,909	12,230,112	10,175,799	22,405,911
7440-50-8	Copper	4,680,442	22,279	17	0	370,828	2,548,009	7,621,575	12,620,192	20,241,767
7664-41-7	Ammonia	18,088,687	734,588	474,179	0	16,000	691,758	20,005,212	186,186	20,191,398
7439-96-5	Manganese	353,452	32,328	1	0	25,609	6,624,150	7,035,540	10,916,446	17,951,986
7429-90-5	Aluminum (fume or dust)	1,080,451	40,775	0	0	52,700	3,798,795	4,972,721	7,140,499	12,113,220
—	Chromium compounds	209,469	48,549	2,900	0	683,464	3,513,186	4,457,568	7,271,419	11,728,987
7647-01-0	Hydrochloric acid	10,900,560	0	0	0	0	0	10,900,560	0	10,900,560
7440-66-6	Zinc (fume or dust)	922,190	7,096	0	0	2,750	6,534,452	7,466,488	1,891,304	9,357,792
463-58-1	Carbonyl sulfide	7,056,628	0	0	0	0	0	7,056,628	0	7,056,628
—	Nickel compounds	134,291	20,704	27,750	0	57,852	3,205,343	3,445,940	2,932,518	6,378,458
	Subtotal	111,180,344	29,763,846	654,218	0	21,553,547	184,356,764	347,508,719	155,951,444	503,460,163
	Total for SIC Code 33	144,680,864	31,988,843	930,779	0	22,192,029	193,591,686	393,384,201	171,150,982	564,535,183

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

million pounds, or 35.4%—were off-site releases (transfers off-site to disposal). Another 6.9 million pounds (32.7%) were reported as other on-site land releases. The third largest category was air emissions, with 6.4 million pounds (30.2%).

The chemical ranked 15th for total on- and off-site releases in this sector, nickel compounds, is an OSHA carcinogen. This chemical had 6.4 million pounds of releases, primarily released on-site to RCRA Subtitle C landfills and off-site (transfers to disposal); as shown in Table 8-7. Other OSHA carcinogens with large releases were lead (5.0 million pounds, also largely on-site to RCRA landfills and off-site to disposal), trichloroethylene (2.4 million pounds, almost entirely in air emissions), nickel (1.5 million pounds, mostly transferred off-site to disposal) and the chemical category of polycyclic aromatic compounds (1.5 million pounds, in transfers off-site to disposal and air emissions).

Reported releases of OSHA carcinogens were highest in the primary nonferrous metals industry (SIC code 3339), 5.8 million pounds. The largest sources of air emissions were the steel pipe and

tubes industry (SIC code 3317) and the forms reporting multiple SIC codes in SIC code 33, with 1.1 million pounds each. Figure 8-7 displays releases of OSHA carcinogens by medium for the primary metal industries with the largest such releases.

## 1996 TRI Chemicals in Waste for Primary Metals

Table 8-9 presents waste management data for the four-digit SIC codes in the primary metals sector. Half (50.0%) of all production-related waste was recycled on-site, 2.09 billion pounds out of 4.18 billion pounds. Off-site recycling accounted for another 781.9 million pounds, or 18.7%. Figure 8-8 shows the distribution of on-site waste management, off-site waste management, and quantities released on- and off-site in this sector.

Forms reporting more than one code in SIC code 33 (multiple codes) accounted for the largest portion

**Table 8-8. TRI On-site and Off-site Releases of OSHA Carcinogens by 4-digit SIC Code, 1996: Primary Metals, SIC Codes 33 (in Rank Order)**

SIC Code	Industry	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases		Total On- & 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 Pounds	Off-site to Disposal Pounds	
3339	Primary Nonferrous Metals, nec*	392,632	722	0	0	0	5,403,890	5,797,244	18,991		5,816,235
	Multiple within SIC 33	1,121,113	10,568	0	0	52,225	952,717	2,136,623	1,864,090		4,000,713
3312	Blast Furnaces & Steel Mills	713,603	22,487	10,650	0	91,728	185,217	1,023,685	1,699,614		2,723,299
3334	Primary Aluminum	449,020	2,065	0	0	9,205	250	460,540	963,721		1,424,261
3341	Secondary Nonferrous Metals	139,364	6,096	82	0	53	12,906	158,501	1,073,580		1,232,081
3321	Gray & Ductile Iron Foundries	688,275	1,404	0	0	75,477	126,789	891,945	299,528		1,191,473
3317	Steel Pipe & Tubes	1,133,620	1,115	0	0	0	0	1,134,735	45,366		1,180,101
3369	Nonferrous Foundries, nec*	17,606	7	0	0	0	33,104	50,717	489,779		540,496
3398	Metal Heat Treating	416,528	0	0	0	0	0	416,528	52,450		468,978
3351	Copper Rolling & Drawing	341,502	557	0	0	762	15,068	357,889	19,680		377,569
3357	Nonferrous Wire Drawing & Insulating	255,589	96	0	0	0	0	255,685	100,073		355,758
3316	Cold Finishing of Steel Shapes	52,337	1,652	0	0	0	3,849	57,838	273,429		331,267
3399	Primary Metal Products, nec*	181,814	536	0	0	120	337	182,807	95,001		277,808
3356	Nonferrous Rolling & Drawing, nec*	150,440	128	95	0	0	13,402	164,065	72,700		236,765
3315	Steel Wire & Related Products	14,912	1,088	0	0	4,622	0	20,622	152,369		172,991
3325	Steel Foundries, nec*	31,834	1,818	0	0	0	6,286	39,938	130,637		170,575
3331	Primary Copper	27,775	250	32,000	0	0	87,251	147,276	12,150		159,426
3313	Electrometallurgical Products	3,451	3,021	0	0	0	61,000	67,472	32,122		99,594
3365	Aluminum Foundries	86,743	22	0	0	0	5	86,770	6,512		93,282
3354	Aluminum Extruded Products	76,068	13	0	0	0	0	76,081	12		76,093
3366	Copper Foundries	11,882	79	0	0	23,565	250	35,776	23,950		59,726
3324	Steel Investment Foundries	12,957	45	0	0	0	7,640	20,642	26,165		46,807
3322	Malleable Iron Foundries	27,740	0	0	0	0	371	28,111	12,317		40,428
3363	Aluminum Die-castings	32,025	10	0	0	0	0	32,035	1,929		33,964
	Invalid SIC Code within SIC 33	3,098	5	0	0	0	0	3,103	2,000		5,103
3364	Nonferrous Die-casting Exc. Aluminum	1,665	0	0	0	0	0	1,665	0		1,665
3353	Aluminum Sheet, Plate, & Foil	187	0	0	0	0	0	187	0		187
	Subtotal	6,383,780	53,784	42,827	0	257,757	6,910,332	13,648,480	7,468,165		21,116,645
	Total for SIC Code 33	144,680,864	31,988,843	930,779	0	22,192,029	193,591,686	393,384,201	171,150,982		564,535,183

**Note:** On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

of production-related waste in the sector. This was 1.05 billion pounds, or one-quarter (25.1%) of the total. As indicated earlier in this chapter, multiple-codes reporting also accounted for the largest portion of on-site recycling, 778.5 million pounds of the 2.09-billion-pound total.

Blast furnaces and steel mills (SIC code 3312) reported the largest quantities in off-site recycling (276.8 million pounds, 35.4% of the 781.9 million pounds in that category) and the largest off-site treatment (31.1 million pounds, out of 73.3 million pounds, or 42.4%). Miscellaneous primary non-ferrous metals (SIC code 3339) accounted for 138.9

million pounds reported as quantities released on- and off-site, one-quarter (25.0%) of the total for this category of 556.2 million pounds.

Although the multiple-codes forms also supplied the largest reporting of on-site energy recovery (17.6 million pounds), aluminum sheet, plate, and foil producers (SIC code 3353) were second with 15.5 million pounds. These two groups accounted for two-thirds (66.5%) of the sector's on-site energy recovery. In off-site energy recovery, producers of aluminum extruded products (SIC code 3354) were first, with 1.5 million pounds, or 32.6% of the total. As mentioned earlier in this

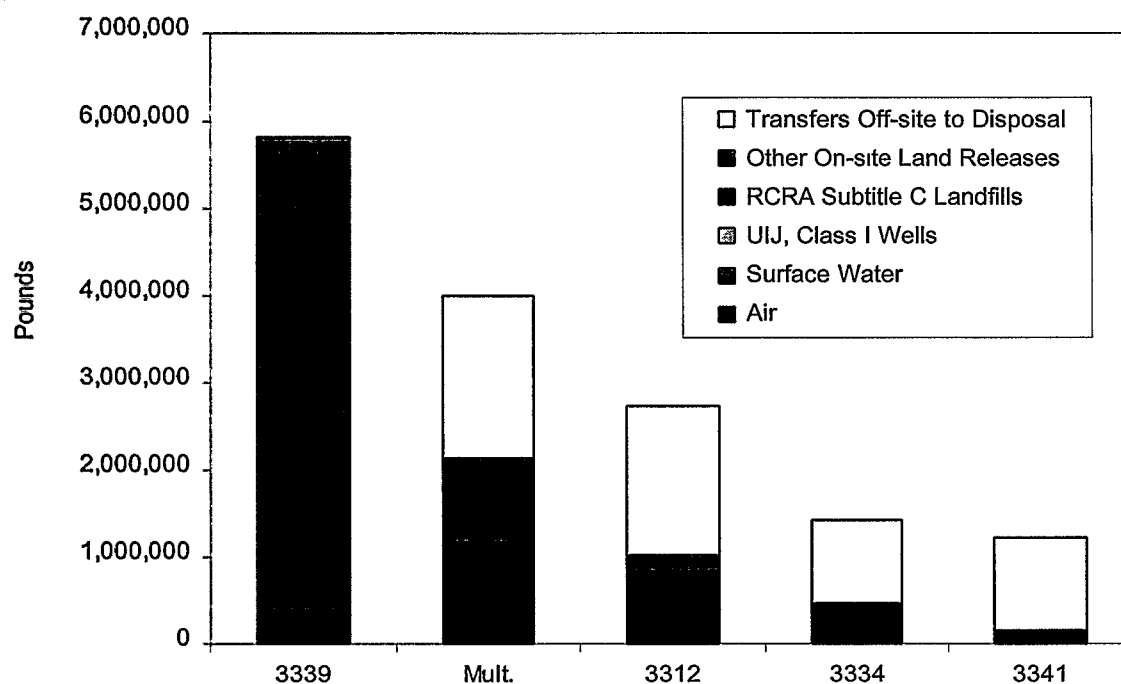


Figure 8-7. TRI On-site and Off-site Releases of OSHA Carcinogens, SIC Codes with Largest Totals, 1996: Primary Metals (SIC Code 33)

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category. UIJ = underground injection

chapter, energy recovery is not an appropriate characterization of the disposition of metals in waste because they are not burned and do not contribute to the combustion. Quantities reported for off-site energy recovery included 0.6% of metals and metal compounds, which represents misreporting because metals do not burn or contribute heat value to energy recovery.

The distribution of production-related waste reported by the primary metal industries with the largest totals appears in Figure 8-9.

## Projected Quantities of TRI Chemicals in Waste

The primary metal industries' projections of waste management data through 1998 appear in Table 8-10. Off-site treatment was projected to increase

10.7% over this period; increases are also expected in on-site energy recovery (4.6%) and on-site treatment (3.8%). Decreases in other categories, however, contributed to an overall projected decrease of 2.0% by 1998. The largest percentage decreases appear in off-site energy recovery (7.3%) and off-site recycling (5.8%). On-site recycling is projected to decrease by 2.9% and quantities released by 2.2%. (As explained in Chapter 2, facilities not only report current data but project waste management quantities for the next two years in their TRI submissions.)

Overall, these projected changes show little difference in the primary metal industries' management of TRI chemicals in waste. On-site recycling would remain at half of the sector's total production-related waste, and quantities released at 13.3%. Thus, little movement up or down the waste

Table 8-9. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1996: Primary Metals, SIC Code 33 (in Rank Order)

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Recycled Off-site Pounds	Energy Recovery Off-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
	Multiple within SIC 33	778,473,601	17,623,145	45,910,361	76,899,218	1,050,685	11,778,314	118,427,705	1,050,163,029	14,070,685
3312	Blast Furnaces & Steel Mills	83,413,823	3,804,673	118,747,400	276,780,609	63,831	31,059,407	114,165,710	628,035,453	322,543
3339	Primary Nonferrous Metals, nec*	160,036,537	0	240,092,788	3,107,600	0	34,698	138,897,494	542,169,117	8,729
3341	Secondary Nonferrous Metals	327,093,466	0	108,976,199	45,257,377	19,727	591,554	23,171,379	505,109,702	31,532
3351	Copper Rolling & Drawing	325,935,091	0	341,295	37,331,984	0	6,769,638	7,626,583	378,004,591	27
3357	Nonferrous Wiredrawing & Insulating	13,392,150	4,657,935	18,131,581	186,226,581	1,352,531	531,226	6,384,569	230,676,573	25,806
3331	Primary Copper	63,440,113	0	1,000	44,592,386	0	6,876,151	39,200,209	154,109,859	704,205
3313	Electrometallurgical Products	103,881,994	0	162,565	2,153,428	0	57,814	23,019,919	129,275,720	0
3334	Primary Aluminum	64,706,648	7,778,770	7,601,247	2,683,143	399	50,445	10,333,352	93,154,004	32,371
3321	Gray & Ductile Iron Foundries	19,844,260	0	998,521	8,160,820	193,395	388,751	32,668,115	62,253,862	48,057
3316	Cold Finishing of Steel Shapes	701,000	0	23,751,828	25,056,126	0	6,010,370	5,660,918	61,180,242	90,536
3317	Steel Pipe & Tubes	35,725,268	443,607	4,759,979	13,362,591	73,141	2,497,902	3,139,312	60,001,800	851
3325	Steel Foundries, nec*	23,976,223	0	79,878	5,297,245	1,123	404,072	16,959,169	46,717,710	21
3353	Aluminum Sheet, Plate, & Foil	6,237,233	15,460,330	18,949,042	3,699,034	241,933	48,602	1,978,762	46,614,936	25
3363	Aluminum Die-castings	30,440,128	0	105,471	11,368,817	6,968	26,275	661,916	42,609,575	0
3315	Steel Wire & Related Products	5,368,115	0	7,990,367	10,168,631	368	3,421,911	2,799,890	29,749,282	36,200
3399	Primary Metal Products, nec*	10,076,103	0	11,795,538	3,770,684	5,810	590,600	3,490,284	29,729,019	12,764
3366	Copper Foundries	18,270,757	0	0	8,208,216	14,600	84,099	638,415	27,216,087	0
3356	Nonferrous Rolling & Drawing, nec*	2,415,801	0	7,550,741	3,675,404	5,754	614,369	1,609,052	15,871,121	3,652
3354	Aluminum Extruded Products	3,675,762	0	6,249,176	2,264,639	1,495,020	146,852	1,070,145	14,901,594	0
3369	Nonferrous Foundries, nec*	7,779,646	0	473,680	4,528,658	0	242,287	499,541	13,523,812	12
3365	Aluminum Foundries	5,306,555	0	524,725	2,079,577	0	325,306	1,817,619	10,053,782	0
3398	Metal Heat Treating	143,912	0	2,595,291	377,684	28,145	627,137	1,341,917	5,114,086	1,087
3324	Steel Investment Foundries	1,261,033	0	26,435	3,007,475	600	64,098	276,047	4,635,688	0
	Invalid SIC Code within SIC 33	663,664	0	0	1,246,529	3,600	21	63,401	1,977,215	0
3364	Nonferrous Die-casting, Exc Aluminum	226,469	0	18	508,185	0	9,905	18,905	763,482	0
3322	Malleable Iron Foundries	0	0	0	108,867	57	53,084	194,705	356,713	0
3355	Aluminum Rolling & Drawing, nec*	0	0	29,000	0	24,945	0	69,673	123,618	0
Total for SIC Code 33		2,092,485,352	49,768,460	625,844,126	781,921,508	4,582,632	73,304,888	556,184,706	4,184,091,672	15,389,103

Note Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category

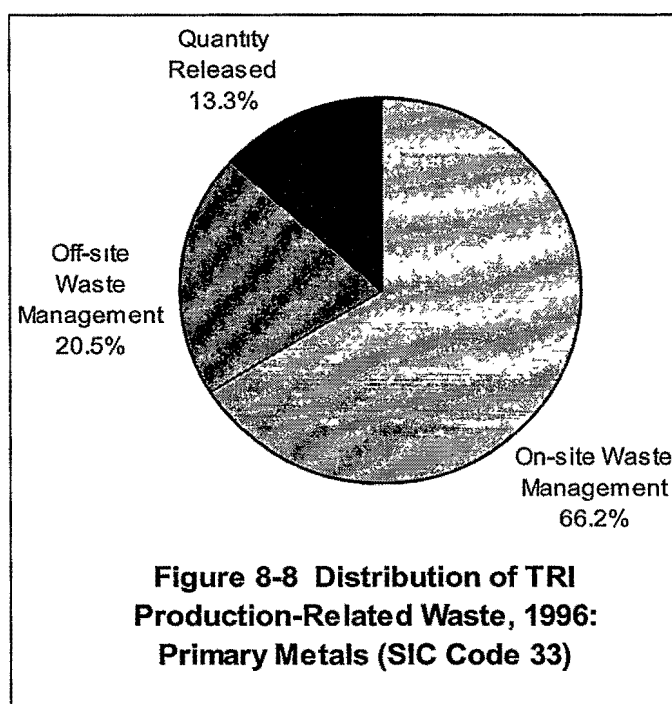
\*nec, not elsewhere classified

management hierarchy, explained in Chapter 2, is expected in this sector.

Figure 8-10 shows the percentage change expected in on-site waste management, off-site waste management, quantities released, and total production-related waste for this sector, as projected for one and two years.

## Source Reduction Activity

Almost 1,000 forms submitted in primary metals production indicated one or more source reduction activity in 1996, representing 14.6% of all forms submitted. The largest number, 172, came from nonferrous wiredrawing and insulating (SIC code 3357), and this was one third (33.1%) of the forms in that industry. Forms with multiple codes within SIC code 33 were second, with 133, or 17.0% of



Note: Data from Section 8 of Form R

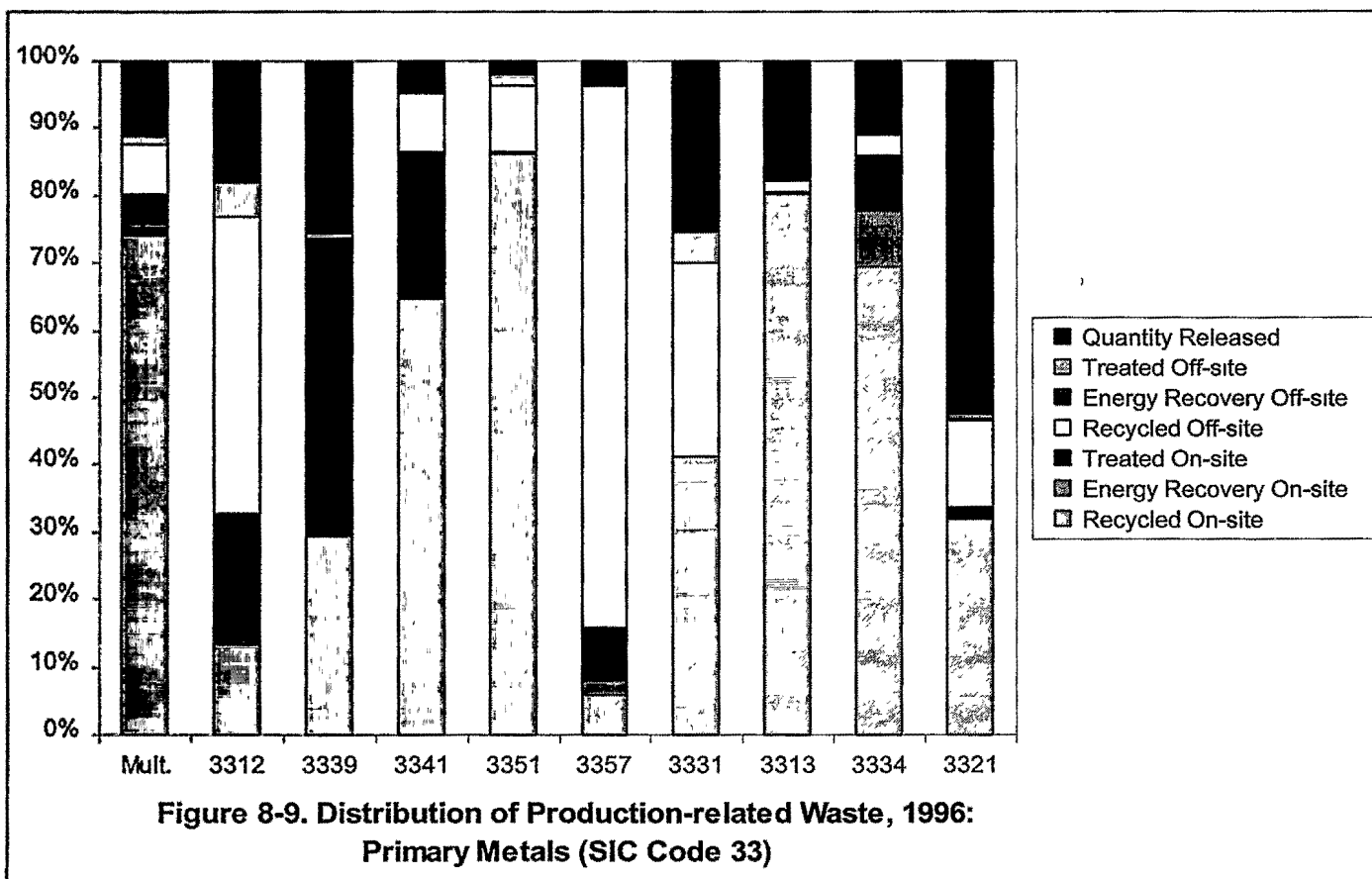


this group's total forms. Steel pipe and tubes production (SIC code 3317) also had a relatively high percentage of forms reporting source reduction activity, compared to other primary metal industries; 20.9% of the 230 forms submitted in SIC code 3317 indicated such activity. Table 8-11 shows the number of forms reporting source reduction activities, by category, for the sector. Good operating practices were the activity most commonly indicated.

## Year-to-Year Comparisons for Primary Metals

### 1995-1996 TRI Data for Primary Metals

From 1995 to 1996, very little change occurred in the total number of TRI forms submitted in the primary metals sector—a 0.3% decrease—but the number of Form A certification statements submitted increased by 22.0% (see Table 8-12). Thus, Form A certification statements represented a small, but increasing, portion of the sector's submissions to TRI. Reporting year 1996 was the second year the Form A certification statement was available, as described in Chapter 1.



Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category

Table 8-10. Current Year and Projected Quantities of TRI Chemicals in Waste, 1996-1998: Primary Metals, SIC Code 33

Waste Management Activity	Current Year 1996		Projected 1997		Projected 1998	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
<u>On-site Waste Management</u>						
Recycled On-site	2,092,485,352	50.0	2,078,788,001	50.0	2,030,876,756	49.5
Energy Recovery On-site	49,768,460	1.2	51,500,077	1.2	52,056,021	1.3
Treated On-site	625,844,126	15.0	637,803,164	15.3	649,500,613	15.8
<u>Off-site Waste Management</u>						
Recycled Off-site	781,921,508	18.7	730,248,561	17.6	736,688,116	18.0
Energy Recovery Off-site	4,582,632	0.1	4,369,808	0.1	4,246,864	0.1
Treated Off-site	73,304,888	1.8	84,694,424	2.0	81,177,694	2.0
Quantity Released On- and Off-site	556,184,706	13.3	570,042,820	13.7	544,224,247	13.3
Total Production-related Waste for SIC Code 33	4,184,091,672	100.0	4,157,446,855	100.0	4,098,770,311	100.0

Waste Management Activity	Projected Change	Projected Change	Projected Change
	1996-1997 Percent	1997-1998 Percent	1996-1998 Percent
<u>On-site Waste Management</u>			
Recycled On-site	-0.7	-2.3	-2.9
Energy Recovery On-site	3.5	1.1	4.6
Treated On-site	1.9	1.8	3.8
<u>Off-site Waste Management</u>			
Recycled Off-site	-6.6	0.9	-5.8
Energy Recovery Off-site	-4.6	-2.8	-7.3
Treated Off-site	15.5	-4.2	10.7
Quantity Released On- and Off-site	2.5	-4.5	-2.2
Total Production-related Waste for SIC Code 33	-0.6	-1.4	-2.0

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996

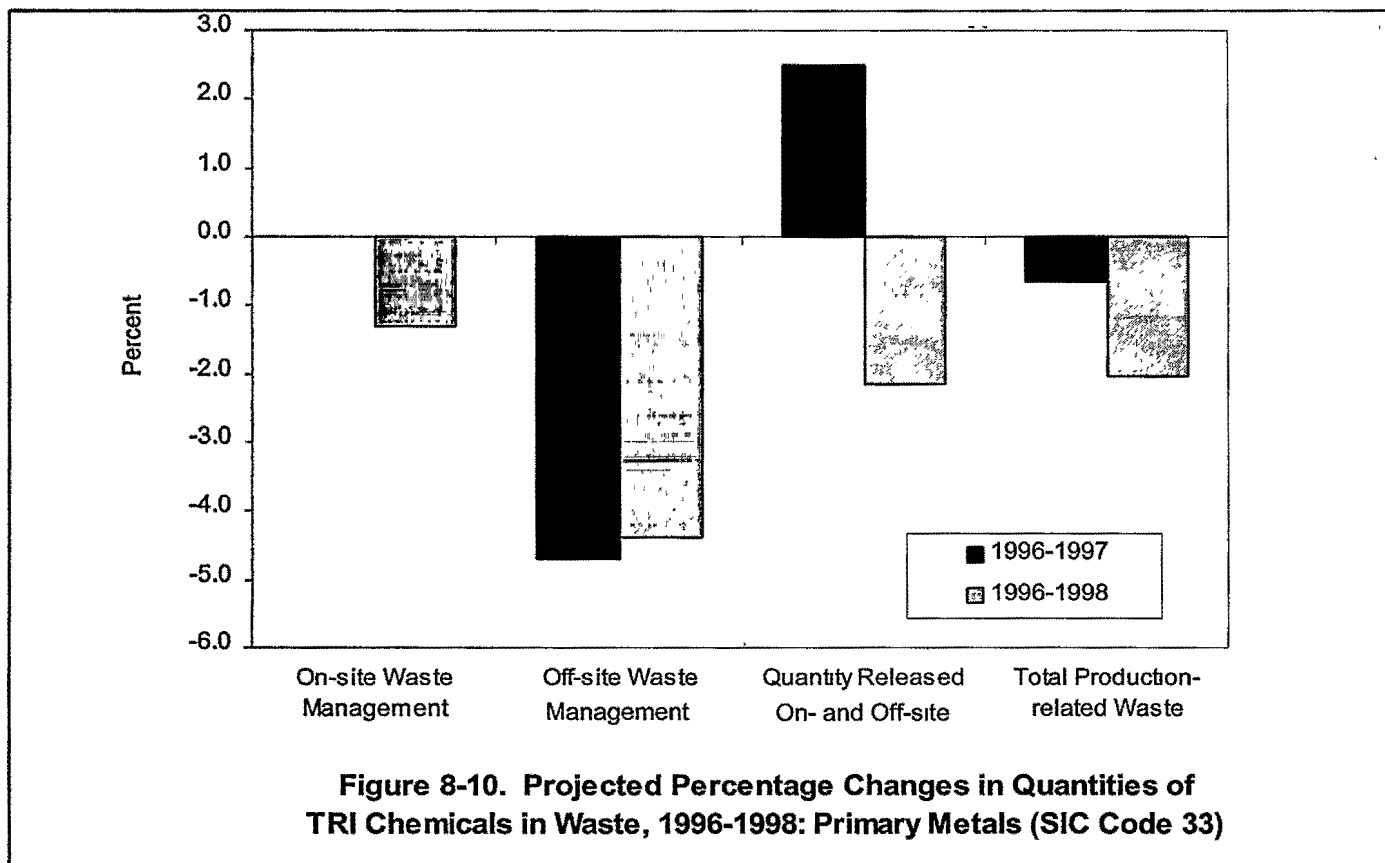
### On- and Off-site Releases

Releases on- and off-site increased by 7.7% from 1995 to 1996 in primary metals, as shown in Table 8-12. This was an increase of 40.5 million pounds. All types of on- and off-site releases were larger in 1996 than in 1995. An increase of 28.9 million pounds (15.5%) in on-site land releases was the largest absolute change (13.8 million pounds of this was reported on forms with multiple SIC codes, including 7.3 million pounds of copper compounds and 5.5 million pounds of zinc compounds).

Fugitive air emissions increased by 15.6%, or 5.2 million pounds (including a 3.7 million pound

increase in copper from forms with multiple SIC codes). Surface water discharges increased by 16.7%, or 4.6 million pounds (including a 2.4-million-pound increase in nitrate compounds and 1.0 million pounds in ethylene glycol). Small percentage changes occurred in point-source air emissions (0.8% or 862,000 pounds) and in off-site transfers to disposal (0.4% or 657,000 pounds). The largest percentage increase—44.7%—was reported in underground injection, but this release type remained a small portion overall of the sector's reporting.





Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996

Figure 8-11 shows the 1995-1996 percentage change in releases by medium for the primary metals sector.

#### Other On-site Waste Management

Table 8-12 also shows the changes from 1995 to 1996 in primary metal industries' on-site waste management. A small net increase (1.0%) in total other on-site waste management represents quite different changes in waste management methods. On-site recycling, the largest on-site method reported, decreased by 1.6%, a reduction of 33.6 million pounds. On-site treatment increased 49.3 million pounds, which was an 8.5% increase.

The smallest on-site method reported, energy recovery, increased by 12.1 million pounds, but this represented a 32.2% increase; this resulted principally from reported increases of 5.1 million pounds of polycyclic aromatic compounds in

primary aluminum production (SIC code 3334) and 3.1 million pounds of methyl ethyl ketone in aluminum sheet, plate, and foil production (SIC code 3353).

#### Transfers Off-site for Further Waste Management

An increase of 33.8 million pounds in off-site transfers for further waste management for the primary metals sector, from 1995 to 1996, represented a 4.0% increase. These data also appear on Table 8-12. Less than 1% change occurred in transfers to recycling (0.7% increase, 5.6 million pounds) and transfers to POTWs (0.9% increase, 73,000 pounds). Large percentage increases were reported in transfers to energy recovery (46.0%, or 1.8 million pounds) and transfers to treatment (74.3%, or 28.2 million pounds). This increase in transfers to treatment was the largest difference, in pounds, from 1995 to 1996.



Table 8-11. Number of Forms Reporting Source Reduction Activity, 1996: Primary Metals, SIC Code 33

SIC Code	Industry	Total Forms Number	Category of Source Reduction Activity									
			Forms Reporting Source Reduction Activities		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
			Number	Percent of All Forms Percent								
3312	Blast Furnaces & Steel Mills	1,093	125	11.4	68	1	22	8	58	0	3	0
3313	Electrometallurgical Products	51	8	15.7	5	1	0	0	2	0	0	0
3315	Steel Wire & Related Products	224	25	11.2	9	0	6	4	5	2	4	2
3316	Cold Finishing of Steel Shapes	146	17	11.6	10	8	2	0	1	1	0	5
3317	Steel Pipe & Tubes	230	48	20.9	22	0	4	4	17	6	2	2
3321	Gray & Ductile Iron Foundries	740	47	6.4	16	2	19	9	12	0	1	2
3322	Malleable Iron Foundries	22	1	4.5	1	0	0	0	0	0	0	0
3324	Steel Investment Foundries	96	14	14.6	9	0	0	1	4	1	2	0
3325	Steel Foundries, nec*	383	52	13.6	18	6	8	7	32	0	3	2
3331	Primary Copper	48	8	16.7	0	0	0	0	8	0	0	0
3334	Primary Aluminum	93	12	12.9	8	0	0	3	3	0	0	0
3339	Primary Nonferrous Metals, nec*	96	17	17.7	15	0	8	0	1	0	0	0
3341	Secondary Nonferrous Metals	519	68	13.1	48	8	22	22	28	1	0	1
3351	Copper Rolling & Drawing	150	20	13.3	14	0	1	2	5	4	0	0
3353	Aluminum Sheet, Plate, & Foil	97	15	15.5	14	0	2	1	0	0	0	1
3354	Aluminum Extruded Products	173	31	17.9	25	1	2	1	6	0	2	0
3355	Aluminum Rolling & Drawing, nec*	4	2	50.0	1	0	0	0	1	0	1	0
3356	Nonferrous Rolling & Drawing, nec*	126	20	15.9	9	0	1	6	5	1	0	2
3357	Nonferrous Wiredrawing & Insulating	519	172	33.1	102	4	3	26	64	4	10	11
3363	Aluminum Die-castings	158	23	14.6	19	6	1	0	5	0	0	2
3364	Nonferrous Die-casting, Exc Aluminum	22	2	9.1	0	0	0	1	0	0	0	1
3365	Aluminum Foundries	98	13	13.3	6	1	6	4	6	2	0	0
3366	Copper Foundries	132	19	14.4	8	0	3	3	10	1	0	1
3369	Nonferrous Foundries, nec*	136	20	14.7	14	0	9	2	12	0	0	1
3398	Metal Heat Treating	161	13	8.1	9	0	3	1	5	1	0	0
3399	Primary Metal Products, nec*	260	40	15.4	29	5	8	2	16	0	0	0
Multiple within SIC 33		784	133	17.0	47	3	41	18	57	5	8	10
Invalid SIC Code within SIC 33		42	1	2.4	0	0	0	1	1	0	0	1
Total for SIC Code 33		6,603	966	14.6	526	46	171	126	364	29	36	44

Note: Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

\*nec. not elsewhere classified

## 1988-1996 TRI Data for Primary Metals

As explained in Chapter 3, comparisons from the 1988 TRI baseline year to the current year rely on the list of "core" TRI chemicals that were reportable, with the same reporting definition, in all years. These multi-year comparisons also review only the data elements that were collected in all years, which excludes from this section any

analysis that distinguishes RCRA subtitle C landfills from other land releases as well as analysis based on the types of underground injection wells. On-site waste management data and transfers off-site to recycling and to energy recovery have been collected only since 1991; these data are included, but cannot be compared across the full 1988-1996 period.

From 1988 to 1996, primary metals reporting of on- and off-site releases of the "core" chemicals

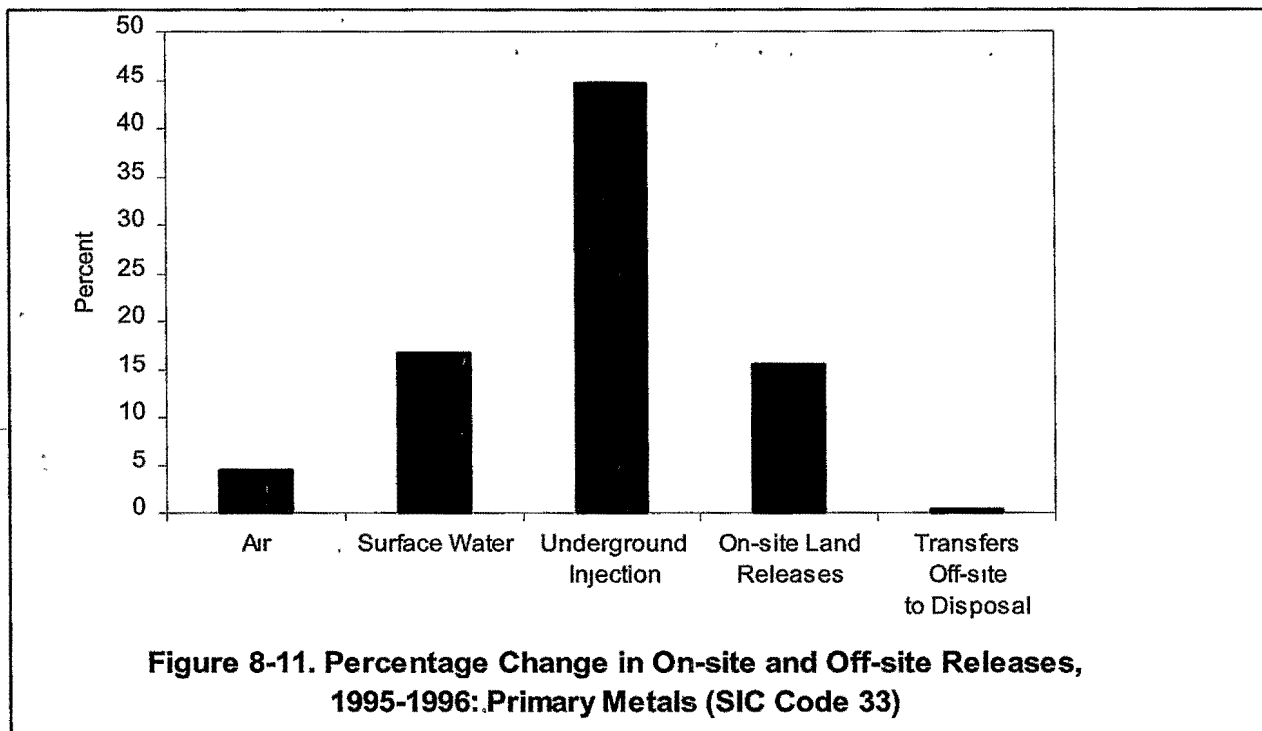


## Chapter 8 — Toxics Release Inventory Data for Primary Metals

**Table 8-12. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1995-1996: Primary Metals, SIC Code 33**

	1995 Number	1996 Number	Change 1995 to 1996 Percent
<b>Total Facilities</b>	1,918	1,902	-0.8
<b>Total Forms</b>	6,625	6,603	-0.3
Form Rs	6,244	6,138	-1.7
Form As	381	465	22.0
	Pounds	Pounds	Percent
<u><b>On-site Releases</b></u>			
Total Air Emissions	138,586,653	144,680,864	4.4
Fugitive Air	33,490,963	38,722,723	15.6
Point Source Air	105,095,690	105,958,141	0.8
Surface Water Discharges	27,413,980	31,988,843	16.7
Underground Injection	643,374	930,779	44.7
On-site Land Release	186,902,139	215,783,715	15.5
<b>Total On-site Releases</b>	353,546,146	393,384,201	11.3
<u><b>Off-site Releases</b></u>			
Transfers Off-site to Disposal	170,494,473	171,150,982	0.4
<b>Total On- and Off-site Releases</b>	524,040,619	564,535,183	7.7
<u><b>Other On-site Waste Management</b></u>			
Recycled On-site	2,126,095,519	2,092,485,352	-1.6
Energy Recovery On-site	37,646,972	49,768,460	32.2
Treated On-site	576,557,298	625,844,126	8.5
<b>Total Other On-site Waste Management</b>	2,740,299,789	2,768,097,938	1.0
<u><b>Transfers Off-site for Further Waste Management</b></u>			
Transfers to Recycling	790,487,124	796,078,608	0.7
Transfers to Energy Recovery	3,864,615	5,643,584	46.0
Transfers to Treatment	37,963,394	66,153,726	74.3
Transfers to POTWs	7,786,083	7,859,057	0.9
Other Off-site Transfer	2,089,432	263,705	-87.4
<b>Total Transfers Off-site for Further Waste Management</b>	842,190,648	875,998,680	4.0

**Note.** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required in 1995. Other Off-site Transfers are transfers reported without a valid waste management code.



Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required in 1995.

decreased by 21.1%, a reduction of 132.7 million pounds, as shown in Table 8-13. The largest decrease, in percentage and pounds, was reported in air emissions, a 94.2-million-pound decrease or 45.8%. This reflected substantial reductions from 1988 to 1996 in fugitive air emissions of 1,1,1-trichloroethane (14.5-million-pound decrease) and in point source air emissions of chlorine (44.0-million-pound decrease). Decreases occurred in all release types except off-site releases (transfers to disposal), which increased 6.6%, or 10.3 million pounds.

The reduction in surface water discharges was 9.0% (or 321,000 pounds), and in underground injection, it was 41.8% (or 328,000 pounds). On-site land releases were reported as 18.4% less in 1996 than in 1988, a reduction of 48.1 million pounds.

As Table 8-13 shows, however, all categories of releases have increased over the last three

years. As noted earlier in this chapter, steel production dropped sharply in the 1980s but has been recovering in this decade. Such changes, in steel and other metal production, are likely influences on the release data. As noted earlier, aged coke ovens are top pollutant sources and concerns about their emissions are heightened because of the emitted chemicals' cancer-causing potential. Alternatives to the use of coke may present more economically feasible alternatives than replacing the outdated facilities. Metals themselves—environmentally recalcitrant—present a different challenge, arguing for more effective use and recovery of the materials themselves. The value of the metals themselves also supports this direction.

On-site waste management data and transfers off-site for recycling or energy recovery were not collected in 1988. For the 1994-1996 period, on-site recycling increased 48.2 million pounds and transfers off-site to recycling decreased 42.1



Table 8-13. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1988 and 1994-1996: Primary Metals, SIC Code 33

	1988 Number	1994 Number	1995 Number	1996 Number	Change 1988 to 1996 Percent
Total Facilities	1,578	1,803	1,793	1,787	13.2
Total Forms	5,402	5,912	5,869	5,895	9.1
Form Rs	5,402	5,912	5,561	5,507	1.9
Form As	NA	NA	308	388	NA
	Pounds	Pounds	Pounds	Pounds	Percent
<u>On-site Releases</u>					
Total Air Emissions	205,709,250	100,413,995	106,640,916	111,481,430	-45.8
Fugitive Air	55,206,075	20,730,230	20,135,598	24,883,097	-54.9
Point Source Air	150,503,175	79,683,765	86,505,318	86,598,333	-42.5
Surface Water Discharges	3,552,854	1,658,054	1,086,730	3,231,569	-9.0
Underground Injection	784,604	292,868	352,624	456,600	-41.8
On-site Land Releases	261,634,596	172,165,293	184,419,842	213,489,081	-18.4
Total On-site Land Releases	471,681,304	274,530,210	292,500,112	328,658,680	-30.3
<u>Off-site Releases</u>					
Transfers Off-site to Disposal	157,672,647	159,355,439	162,529,241	168,003,961	6.6
Total On- and Off-site Releases	629,353,951	433,885,649	455,029,353	496,662,641	-21.1
<u>Other On-site Waste Management</u>					
Recycled On-site	NA	1,513,279,562	1,547,382,144	1,561,479,306	NA
Energy Recovery On-site	NA	28,435,206	30,580,825	37,175,005	NA
Treated On-site	NA	330,031,172	349,525,323	321,821,258	NA
Total Other On-site Waste Management	NA	1,871,745,940	1,927,488,292	1,920,475,569	NA
<u>Transfers Off-site for Further Waste Management</u>					
Transfers to Recycling	NA	823,742,756	763,629,448	781,639,908	NA
Transfers to Energy Recovery	NA	3,593,384	3,718,565	5,492,991	NA
Transfers to Treatment	46,106,054	23,294,952	31,775,498	62,569,458	35.7
Transfers to POTWs	4,993,085	2,952,419	3,260,183	3,395,489	-32.0
Other Off-site Transfers	8,830,043	2,107,539	1,928,899	263,705	-97.0
Total Transfers Off-site for Further Waste Management	NA	855,691,050	804,312,593	853,361,551	NA

Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required before 1996. For 1994-1996, Other Off-site Transfers are transfers reported without a valid waste management code. For 1988, Other Off-site Transfers are transfers reported without a valid waste management code or codes not required to be reported in 1988. NA: not required to be reported in that year.



million pounds, as shown on Table 8-13 . Other categories showed increases, except for on-site treatment.

For categories reported across the full comparison period, transfers off-site to treatment increased 35.7%, or 16.5 million pounds (including a 12.1-million-pound increase in zinc compounds), from 1988 to 1996, while transfers to POTWs decreased 32.0%, or 1.6 million pounds.

### ***1988-1996 Data for Four-Digit Industries in Primary Metals***

Tables 8-14 through 8-16, summarize data for 1988 and 1994-1996 for industries at the four-digit SIC code level within SIC code 33. The tables present, respectively, on- and off-site releases, other on-site waste management, and transfers off-site for further waste management.

#### **On- and Off-site Releases**

Three industries in the primary metals sector recorded decreases of more than 50 million pounds in on- and off-site releases from 1988 to 1996. These were blast furnaces and steel mills (SIC code 3312), with a 58.1-million-pound reduction (39.2% decrease); primary copper refiners and smelters (SIC code 3331), with a 54.7-million-pound reduction (58.0%); and primary smelters and refiners of nonferrous metals other than copper and aluminum (SIC code 3339), with a 52.6-million-pound reduction (29.2%).

Forms with multiple codes in SIC code 33 had the largest increase for 1988 to 1996: 41.9 million pounds, or 60.4%. This was more than three times the next-largest increase, which was reported in electrometallurgical products (SIC code 3313), of 12.8 million pounds. This was a 272.5% increase in this industry, occurring principally in reporting of on-site land releases of manganese compounds. The

multiple-codes forms showed increases in all media except air.

No other industry reported a net change—increase or decrease—of more than 10 million pounds for the 1988-1996 period. As is true in the overall numbers, some industries, especially those reporting relatively large amounts, show increases in the more recent years.

Table 8-14 provides release data for all four-digit SIC codes in the primary metals sector, for 1988-1996. Percentage changes by medium appear in Figure 8-12.

#### **Other On-site Waste Management**

Aluminum extruded products (SIC code 3354) reported the largest net decrease in other on-site waste management since 1994 (on-site waste management data were not collected in 1988): 81.3 million pounds, a 92.8% reduction. This was largely the result of decreased on-site treatment. Primary copper refiners (SIC code 3331) reported a 63.2-million-pound decrease, or 50.0%, predominantly in on-site recycling.

Secondary refiners and smelters of nonferrous metals (SIC code 3341) reported the largest increase for 1994-1996. This was 79.5 million pounds, an increase of 27.9%, and it resulted largely from increases in on-site recycling and to a lesser degree in on-site treatment. Electrometallurgical products (SIC code 3313) reported an increase of 51.6 million pounds, or 98.2%, the result of an increase in on-site recycling.

On-site waste management data for 1994 through 1996 appear in Table 8-15 for primary metal industries.

#### **Transfers Off-site for Further Waste Management**

As shown in Table 8-16 , blast furnaces and steel mills (SIC code 3312) reported the largest



# Chapter 8 — Toxics Release Inventory Data for Primary Metals

Table 8-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33

SIC Code	Industry	Year	On-Site Releases				Total On-site Releases Pounds	Off-site Releases Pounds	Total On- & Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds			
3312	Blast Furnaces & Steel Mills	96	7,655,589	1,118,889	203,200	21,796,481	30,774,159	59,128,809	89,902,968
		95	9,540,762	503,642	174,400	18,784,231	29,003,035	37,573,670	66,576,705
		94	9,921,525	563,544	129,800	10,694,054	21,308,923	31,203,817	52,512,740
		88	28,109,078	2,274,214	644,569	62,183,212	93,211,073	54,774,326	147,985,399
3313	Electrometallurgical Products	96	561,231	748,031	0	16,063,508	17,372,770	141,236	17,514,006
		95	412,557	191,387	0	10,906,401	11,510,345	104,487	11,614,832
		94	872,564	136,292	0	11,117,566	12,126,422	84,731	12,211,153
		88	72,425	48,817	0	2,773,778	2,895,020	1,807,121	4,702,141
3315	Steel Wire & Related Products	96	354,855	11,078	0	111,459	477,392	993,664	1,471,056
		95	562,383	14,682	0	119,476	696,541	1,500,768	2,197,309
		94	520,460	15,046	0	103,046	638,552	1,296,213	1,934,765
		88	1,027,717	5,034	0	87,559	1,120,310	2,867,585	3,987,895
3316	Cold Finishing of Steel Shapes	96	288,738	6,674	250	318,287	613,949	1,325,842	1,939,791
		95	268,810	20,144	250	202,244	491,448	3,590,254	4,081,702
		94	146,310	21,622	250	208,905	377,087	518,653	895,740
		88	650,382	2,229	750	15,690	669,051	974,613	1,643,664
3317	Steel Pipe & Tubes	96	2,497,776	6,561	0	49,659	2,553,996	796,681	3,350,677
		95	2,118,124	4,498	0	43,113	2,165,735	1,432,276	3,598,011
		94	1,730,266	5,027	0	51,031	1,786,324	1,100,789	2,887,113
		88	2,589,817	42,191	0	39,865	2,671,873	545,075	3,216,948
3321	Gray & Ductile Iron Foundries	96	4,518,726	13,310	0	16,326,226	20,858,262	10,530,513	31,388,775
		95	4,420,746	14,369	0	16,499,841	20,934,956	12,017,312	32,952,268
		94	4,734,990	10,717	0	7,960,688	12,706,395	12,554,705	25,261,100
		88	13,820,242	224,123	0	10,954,692	24,999,057	8,301,055	33,300,112
3322	Malleable Iron Foundries	96	38,750	11,770	0	24,122	74,642	150,260	224,902
		95	89,971	2,590	0	43,800	136,361	235,963	372,324
		94	97,430	10,950	0	32,180	140,560	198,171	338,731
		88	28,220	131	0	44,626	72,977	673,415	746,392
3324	Steel Investment Foundries	96	32,357	65	0	20,815	53,237	51,741	104,978
		95	49,531	290	0	1,365	51,186	108,655	159,841
		94	44,619	45	0	1,250	45,914	93,404	139,318
		88	985,980	255	0	31,807	1,018,042	273,640	1,291,682
3325	Steel Foundries, nec*	96	1,470,065	6,138	0	5,287,934	6,764,137	9,232,614	15,996,751
		95	1,549,405	3,761	0	5,143,085	6,696,251	8,529,227	15,225,478
		94	1,259,960	6,560	0	4,581,717	5,848,237	6,306,047	12,154,284
		88	994,995	2,502	1,000	1,690,637	2,689,134	5,280,284	7,969,418
3331	Primary Copper	96	1,880,735	4,500	251,535	36,157,129	38,293,899	1,417,770	39,711,669
		95	1,723,086	3,800	175,855	39,692,372	41,595,113	707,850	42,302,963
		94	1,352,756	4,550	159,865	43,054,411	44,571,582	1,115,860	45,687,442
		88	3,132,810	54,650	0	91,253,754	94,441,214	11,200	94,452,414
3334	Primary Aluminum	96	7,996,237	5,063	0	12,215	8,013,515	143,642	8,157,157
		95	6,368,681	8,325	0	24,125	6,401,131	94,443	6,495,574
		94	5,689,202	3,567	0	24,130	5,716,899	116,188	5,833,087
		88	7,163,220	40,304	0	23,826	7,227,350	215,430	7,442,780
3339	Primary Nonferrous Metals, nec*	96	60,248,846	8,710	0	63,044,804	123,302,360	4,250,840	127,553,200
		95	59,052,870	11,075	0	55,191,159	114,255,104	4,158,956	118,414,060
		94	50,941,093	14,630	0	60,207,483	111,163,206	6,544,693	117,707,899
		88	104,467,111	50,085	39,320	73,365,711	177,922,227	2,253,874	180,176,101

Note. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category

\*nec: not elsewhere classified.

Table 8-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33, Continued

SIC Code	Industry	Year	On-site Releases				Total On-site Releases Pounds	Off-site Releases	Total On- & Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds		Transfers Off-site to Disposal Pounds	
3341	Secondary Nonferrous Metals	96	936,479	43,314	1,493	4,232,442	5,213,728	16,731,093	21,944,821
		95	1,254,728	38,005	1,821	1,733,590	3,028,144	13,126,817	16,154,961
		94	1,991,395	464,473	2,775	1,377,863	3,836,506	23,906,556	27,743,062
		88	1,102,347	28,173	0	1,044,704	2,175,224	20,485,182	22,660,406
3351	Copper Rolling & Drawing	96	694,161	8,728	0	230,095	932,984	200,096	1,133,080
		95	648,593	4,975	0	27,648	681,216	958,228	1,639,444
		94	833,573	5,304	0	5,530	844,407	1,317,405	2,161,812
		88	1,641,183	22,903	0	309,818	1,973,904	1,406,515	3,380,419
3353	Aluminum Sheet, Plate, & Foil	96	1,518,439	397	0	2,500	1,521,336	312,365	1,833,701
		95	1,341,743	447	0	2,700	1,344,890	258,188	1,603,078
		94	1,303,327	1,859	0	2,250	1,307,436	432,497	1,739,933
		88	9,599,231	5,679	0	99,679	9,704,589	201,771	9,906,360
3354	Aluminum Extruded Products	96	1,014,501	2,530	5	4	1,017,040	79,185	1,096,225
		95	1,679,464	37	14	8	1,679,523	42,905	1,722,428
		94	1,913,340	26	11	8	1,913,385	37,564	1,950,949
		88	2,450,700	4,250	0	69,891	2,524,841	1,135,959	3,660,800
3355	Aluminum Rolling & Drawing, nec*	96	69,633	0	0	0	69,633	0	69,633
		95	65,459	0	0	0	65,459	0	65,459
		94	40,182	0	0	0	40,182	0	40,182
		88	228,529	750	0	0	229,279	500	229,779
3356	Nonferrous Rolling & Drawing, nec*	96	392,365	433	113	60,302	453,213	719,723	1,172,936
		95	420,273	1,226	279	56,405	478,183	644,644	1,122,827
		94	615,523	481	162	115,400	731,566	596,606	1,328,172
		88	691,847	1,555	113	44,356	737,871	905,358	1,643,229
3357	Nonferrous Wiredrawing & Insulating	96	2,424,517	2,430	0	20,333	2,447,280	11,019,088	13,466,368
		95	2,553,698	4,955	0	0	2,558,653	9,183,510	11,742,163
		94	3,401,982	4,686	0	3,203	3,409,871	8,077,464	11,487,335
		88	3,775,523	6,145	250	4,051	3,785,969	3,382,377	7,168,346
3363	Aluminum Die-castings	96	513,912	61	0	4,833	518,806	145,203	664,009
		95	364,754	1,278	0	255	366,287	242,159	608,446
		94	307,680	822	0	1,000	309,502	185,093	494,595
		88	161,632	24,089	0	0	185,721	271,575	457,296
3364	Nonferrous Die-casting Exc Aluminum	96	10,519	0	0	90	10,609	8,291	18,900
		95	11,445	0	0	0	11,445	90	11,535
		94	23,784	0	0	0	23,784	191	23,975
		88	60,787	0	0	0	60,787	42,091	102,878
3365	Aluminum Foundries	96	258,481	528	0	24,575	283,584	1,015,186	1,298,770
		95	243,806	536	0	12,150	256,492	1,349,748	1,606,240
		94	299,207	1,010	0	8,950	309,167	1,123,055	1,432,222
		88	146,422	4,754	0	250	151,426	123,076	274,502
3366	Copper Foundries	96	197,923	1,797	0	141,178	340,898	753,939	1,094,837
		95	161,583	2,260	0	215,299	379,142	762,480	1,141,622
		94	300,733	3,024	5	112,049	415,811	682,402	1,098,213
		88	226,040	1,255	0	72,973	300,268	221,679	521,947
3369	Nonferrous Foundries, nec*	96	212,539	292	0	39,962	252,793	689,713	942,506
		95	197,814	80	0	13,280	211,174	1,303,541	1,514,715
		94	200,410	378	0	47,013	247,801	865,505	1,113,306
		88	492,787	750	0	58,983	552,520	328,850	881,370

Note On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category

\*nec: not elsewhere classified



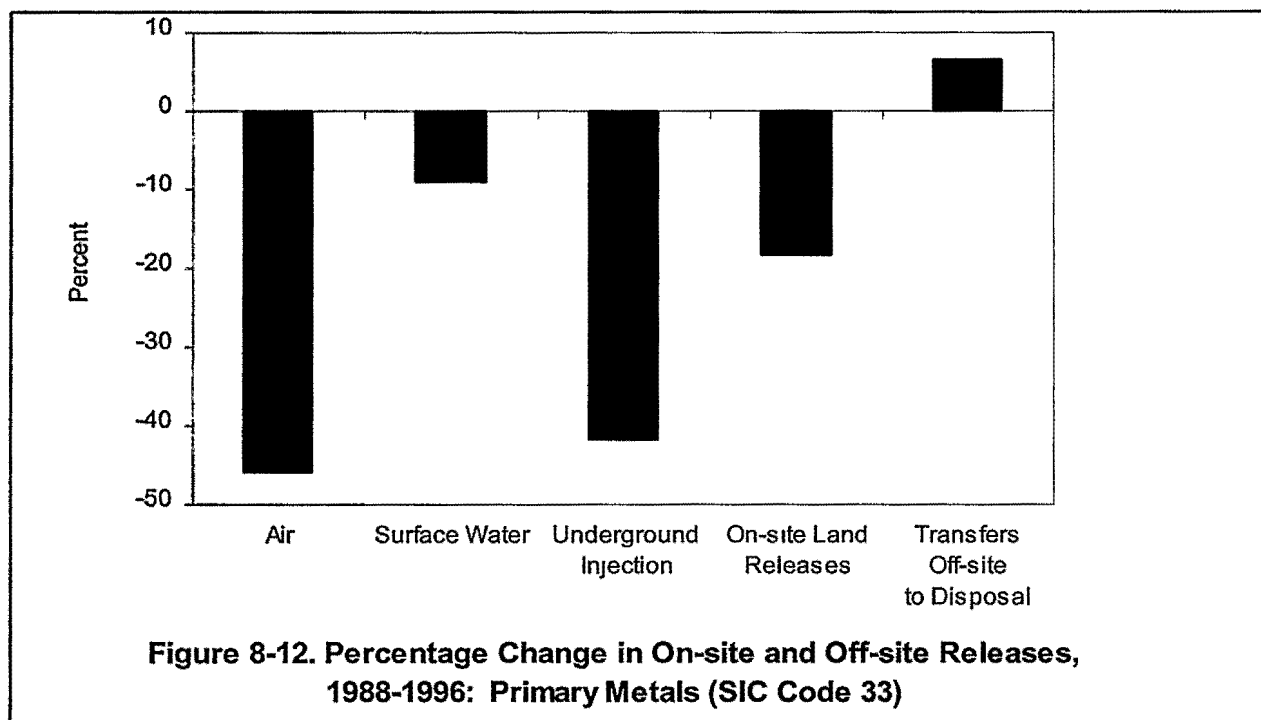


Table 8-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33, Continued

SIC Code	Industry	Year	On-site Releases				Total On-site Releases Pounds	Off-site Releases	Total On- & Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds		Transfers Off-site to Disposal Pounds	
3398	Metal Heat Treating	96	528,961	10	0	0	528,971	278,089	807,060
		95	756,828	0	0	0	756,828	234,142	990,970
		94	825,789	7	0	0	825,796	502,453	1,328,249
		88	883,642	0	50,000	0	933,642	131,488	1,065,130
3399	Primary Metal Products, nec*	96	813,947	9,407	4	254,385	1,077,743	1,334,223	2,411,966
		95	836,724	15,093	5	255,695	1,107,517	1,697,182	2,804,699
		94	891,684	54,455	0	269,313	1,215,452	1,641,560	2,857,012
		88	672,480	11,747	0	81,729	765,956	289,491	1,055,447
	Multiple within SIC Code 33	96	14,321,997	1,220,280	0	49,264,891	64,807,168	46,549,511	111,356,679
		95	9,786,124	237,517	0	35,450,514	45,474,155	62,151,549	107,625,704
		94	9,997,354	328,173	0	32,154,940	42,480,467	58,521,194	101,001,661
		88	16,267,080	387,410	2	12,356,307	29,010,799	40,429,525	69,440,324
	Invalid SIC Code within SIC 33	96	29,151	573	0	852	30,576	4,644	35,220
		95	160,954	1,758	0	1,086	163,798	520,197	683,995
		94	156,857	806	0	31,313	188,976	332,623	521,599
		88	4,267,023	308,859	48,600	5,026,698	9,651,180	10,339,592	19,990,772
	Total for SIC Code 33	96	111,481,430	3,231,569	456,600	213,489,081	328,658,680	168,003,961	496,662,641
		95	106,640,916	1,086,730	352,624	184,419,842	292,500,112	162,529,241	455,029,353
		94	100,413,995	1,658,054	292,868	172,165,293	274,530,210	159,355,439	433,885,649
		88	205,709,250	3,552,854	784,604	261,634,596	471,681,304	157,672,647	629,353,951

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



Note: Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from section 5 of Form R and Off-site Releases from section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required before 1996

Table 8-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
3312	Blast Furnaces & Steel Mills	96	60,869,980	3,737,684	90,270,099	154,877,763
		95	60,271,235	2,872,804	41,092,804	104,236,843
		94	97,361,641	3,887,285	43,027,067	144,275,993
		88	NA	NA	NA	NA
3313	Electrometallurgical Products	96	103,881,994	0	145,565	104,027,559
		95	121,019,260	0	53,681	121,072,941
		94	51,829,119	3,600	643,341	52,476,060
		88	NA	NA	NA	NA
3315	Steel Wire & Related Products	96	13,609	0	1,355,402	1,369,011
		95	69,592	0	1,489,732	1,559,324
		94	109,620	0	1,395,688	1,505,308
		88	NA	NA	NA	NA
3316	Cold Finishing of Steel Shapes	96	0	0	21,354,655	21,354,655
		95	0	0	17,261,196	17,261,196
		94	1,483,300	0	13,240,163	14,723,463
		88	NA	NA	NA	NA
3317	Steel Pipe & Tubes	96	34,673,216	0	2,771,541	37,444,757
		95	34,423,000	0	3,354,673	37,777,673
		94	13,329,000	0	3,054,804	16,383,804
		88	NA	NA	NA	NA
3321	Gray & Ductile Iron Foundries	96	19,844,260	0	450,443	20,294,703
		95	14,922,373	0	787,301	15,709,674
		94	20,392,952	0	400,396	20,793,348
		88	NA	NA	NA	NA
3322	Malleable Iron Foundries	96	0	0	0	0
		95	0	0	9,696	9,696
		94	1,953,000	0	34,992	1,987,992
		88	NA	NA	NA	NA
3324	Steel Investment Foundries	96	1,261,033	0	26,035	1,287,068
		95	3,067,473	0	24,470	3,091,943
		94	789,638	0	47,994	837,632
		88	NA	NA	NA	NA
3325	Steel Foundries, nec*	96	23,976,223	0	50,306	24,026,529
		95	31,514,085	0	12,347	31,526,432
		94	14,272,095	0	1,529	14,273,624
		88	NA	NA	NA	NA
3331	Primary Copper	96	63,190,113	0	0	63,190,113
		95	68,124,204	0	0	68,124,204
		94	126,383,578	0	9,000	126,392,578
		88	NA	NA	NA	NA
3334	Primary Aluminum	96	64,610,698	0	7,279,689	71,890,387
		95	54,194,907	0	6,451,050	60,645,957
		94	39,635,294	0	20,414,126	60,049,420
		88	NA	NA	NA	NA
3339	Primary Nonferrous Metals, nec*	96	158,106,267	0	67,390,754	225,497,021
		95	155,803,566	0	58,828,714	214,632,280
		94	175,881,652	0	43,550,334	219,431,986
		88	NA	NA	NA	NA

Note. Data from Section 8 of Form R. Firms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

\*nec: not elsewhere classified



# Chapter 8 — Toxics Release Inventory Data for Primary Metals

**Table 8-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33, Continued**

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
3341	Secondary Nonferrous Metals	96	318,079,966	0	46,326,753	364,406,719
		95	246,643,664	0	45,354,190	291,997,854
		94	246,643,664	0	45,354,190	291,997,854
		88	NA	NA	NA	NA
3351	Copper Rolling & Drawing	96	325,900,391	0	332,175	326,232,566
		95	281,476,767	0	404,997	281,881,764
		94	312,105,658	0	377,280	312,482,938
		88	NA	NA	NA	NA
3353	Aluminum Sheet, Plate, & Foil	96	6,237,233	15,460,330	16,863,591	38,561,154
		95	13,610,949	11,233,296	13,356,333	38,200,578
		94	12,781,359	10,545,225	10,597,916	33,924,500
		88	NA	NA	NA	NA
3354	Aluminum Extruded Products	96	2,902,706	0	3,369,538	6,272,244
		95	4,054,618	15,017	97,710,335	101,779,970
		94	3,396,562	113,611	84,071,575	87,581,748
		88	NA	NA	NA	NA
3355	Aluminum Rolling & Drawing, nec*	96	0	0	29,000	29,000
		95	0	32,700	56,200	88,900
		94	0	730,000	759,000	1,489,000
		88	NA	NA	NA	NA
3356	Nonferrous Rolling & Drawing, nec*	96	2,415,801	0	7,280,901	9,696,702
		95	13,340,985	0	6,949,037	20,290,022
		94	14,111,016	0	5,279,971	19,390,987
		88	NA	NA	NA	NA
3357	Nonferrous Wiredrawing & Insulating	96	13,392,150	4,524,860	15,870,044	33,787,054
		95	14,100,955	4,744,757	14,847,831	33,693,543
		94	10,142,671	4,484,090	15,082,861	29,709,622
		88	NA	NA	NA	NA
3363	Aluminum Die-castings	96	30,440,128	0	40,971	30,481,099
		95	46,597,930	10,632	773,403	47,381,965
		94	19,560,026	0	848,466	20,408,492
		88	NA	NA	NA	NA
3364	Nonferrous Die-casting Exc. Aluminum	96	226,469	0	18	226,487
		95	113,009	0	100	113,109
		94	1,074,000	0	0	1,074,000
		88	NA	NA	NA	NA
3365	Aluminum Foundries	96	5,306,555	0	192,064	5,498,619
		95	8,255,161	0	124,315	8,379,476
		94	6,761,341	0	152,158	6,913,499
		88	NA	NA	NA	NA
3366	Copper Foundries	96	18,270,757	0	0	18,270,757
		95	17,661,213	0	10,641	17,671,854
		94	18,037,541	0	0	18,037,541
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category

\*nec: not elsewhere classified.



**Table 8-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33, Continued**

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
3369	Nonferrous Foundries, nec*	96	7,779,646	0	473,680	8,253,326
		95	5,923,600	0	342,239	6,265,839
		94	4,562,508	0	233,000	4,795,508
		88	NA	NA	NA	NA
3398	Metal Heat Treating	96	143,912	0	1,178,471	1,322,383
		95	240,236	250	521,371	761,857
		94	3,697,631	0	444,372	4,142,003
		88	NA	NA	NA	NA
3399	Primary Metal Products, nec*	96	9,906,103	0	55,003	9,961,106
		95	18,935,275	0	9,033	18,944,308
		94	18,804,550	0	378,614	19,183,164
		88	NA	NA	NA	NA
	Multiple within SIC Code 33	96	289,386,432	13,452,131	38,714,560	341,553,123
		95	324,223,224	11,671,369	39,699,594	375,594,187
		94	274,244,093	8,671,395	45,753,532	328,669,020
		88	NA	NA	NA	NA
	Invalid SIC Code within SIC 33	96	663,664	0	0	663,664
		95	8,794,863	0	40	8,794,903
		94	24,410,475	0	1,483,080	25,893,555
		88	NA	NA	NA	NA
	Total for SIC Code 33	96	1,561,479,306	37,175,005	321,821,258	1,920,475,569
		95	1,547,382,144	30,580,825	349,525,323	1,927,488,292
		94	1,513,279,562	28,435,206	330,031,172	1,871,745,940
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

\*nec: not elsewhere classified

decreases since 1994 in transfers off-site for further waste management (data for some types of off-site transfers were not collected in 1988). This reduction was 71.9 million pounds, or 19.1%.

Transfers to recycling was the largest component of this reduction. Miscellaneous primary nonferrous metal refiners (SIC code 3339) were second with a 19.4-million-pound decrease, or 86.1%, also chiefly in transfers to recycling.

Multiple-codes forms carried the largest increase in transfers off-site for further waste management: 45.3 million pounds, or 62.6%, and this reflected increases in all transfer types except to POTWs. Second was primary copper refining (SIC code 3331) with 30.4 million pounds or 144.3%. This was from increases in transfers to recycling and to treatment. Secondary nonferrous metal refiners (SIC code 3341) reported 16.2 million pounds more

in off-site transfers in 1996 than in 1994, a 57.6% increase. Transfers to recycling also increased in this industry.

### *Facilities with Large Increases and Decreases in Releases, 1988-1996*

The release of zinc compounds plays a large role in the rankings of all five of the top increasers for total on- and off-site releases from 1988 to 1996. Zinc Corporation of America in Monaca, Pennsylvania (SIC code 3333), ranked first with a total increase of 20.8 million pounds. The zinc smelter reported no transfers off-site for disposal for zinc compounds in 1988 and 16.0 million pounds in 1996. Smelting is not 100% efficient and the slag by-product contains residual zinc. During a clean-up operation that lasted from 1993 to 1996, slag was removed from the facility grounds and



Table 8-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
3312	Blast Furnaces & Steel Mills	96	268,823,209	64,427	34,308,418	723,823	260,671	304,180,548
		95	306,654,969	21,818	10,505,775	597,547	1,852,705	319,632,814
		94	367,666,708	22,159	7,971,086	398,041	0	376,057,994
		88	NA	NA	19,326,580	1,874,273	8,151,206	NA
3313	Electrometallurgical Products	96	1,290,494	0	316,321	1,280	0	1,608,095
		95	698,366	0	452,469	55	0	1,150,890
		94	1,096,811	0	188,499	145	0	1,285,455
		88	NA	NA	118,885	1,434	250	NA
3315	Steel Wire & Related Products	96	7,965,305	1,200	962,334	6,990	0	8,935,829
		95	5,013,717	3,520	1,253,512	35,634	750	6,307,133
		94	4,320,402	10,712	622,860	8,222	9,604	4,971,800
		88	NA	NA	237,682	126,029	4,116	NA
3316	Cold Finishing of Steel Shapes	96	24,522,053	0	4,174,001	2,195	0	28,698,249
		95	12,948,404	0	2,026,954	1,764	0	14,977,122
		94	23,504,968	0	743,847	1,815	1,676,000	25,926,630
		88	NA	NA	174,128	9,979	63,390	NA
3317	Steel Pipe & Tubes	96	11,952,200	55,792	2,133,577	106,278	5	14,247,852
		95	14,241,632	95,334	3,343,428	20,686	5	17,701,085
		94	17,218,027	92,027	401,653	15,960	0	17,727,667
		88	NA	NA	1,144,426	32,019	250	NA
3321	Gray & Ductile Iron Foundries	96	6,858,912	175,229	183,886	105,341	2,024	7,325,392
		95	7,384,362	126,102	358,835	42,510	0	7,911,809
		94	7,561,687	145,926	27,340	30,823	71,810	7,837,586
		88	NA	NA	2,103,747	105,671	29,262	NA
3322	Malleable Iron Foundries	96	108,867	0	9,812	1,005	0	119,684
		95	103,041	0	0	1,390	0	104,431
		94	66,399	0	0	2,980	0	69,379
		88	NA	NA	0	29,577	0	NA
3324	Steel Investment Foundries	96	2,705,889	491	63,670	879	0	2,770,929
		95	2,602,628	0	5,804	5,948	0	2,614,380
		94	3,772,440	171	19,325	4,224	0	3,796,160
		88	NA	NA	39,169	32,268	17,001	NA
3325	Steel Foundries, nec*	96	4,832,058	250	402,954	1,047	0	5,236,309
		95	8,045,934	250	525,052	32,030	250	8,603,516
		94	5,789,173	0	314,006	13,330	0	6,116,509
		88	NA	NA	172,227	58,748	3,250	NA
3331	Primary Copper	96	44,592,387	0	6,876,151	315	0	51,468,853
		95	24,733,569	0	4,822,340	565	0	29,556,474
		94	19,641,455	0	1,423,049	565	0	21,065,069
		88	NA	NA	29,011	10,400	0	NA
3334	Primary Aluminum	96	2,692,028	500	38,499	0	0	2,731,027
		95	1,118,908	0	7,915	0	0	1,126,823
		94	4,381,161	0	55,483	0	0	4,436,644
		88	NA	NA	501,659	0	0	NA
3339	Primary Nonferrous Metals, nec*	96	3,097,640	0	34,045	1,856	250	3,133,791
		95	13,551,556	0	36,371	25,029	5	13,612,961
		94	22,432,554	0	121,462	29,308	0	22,583,324
		88	NA	NA	62,920	6,079	0	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category

\*nec: not elsewhere classified.



Table 8-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33, Continued

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
3341	Secondary Nonferrous Metals	96	41,515,735	8,730	2,680,431	9,028	500	44,214,424
		95	30,564,906	4,941	2,740,920	12,293	5	33,323,065
		94	25,059,316	5,356	2,767,720	15,616	206,250	28,054,258
		88	NA	NA	2,312,732	28,926	130,157	NA
3351	Copper Rolling & Drawing	96	37,886,932	0	322,111	76,117	0	38,285,160
		95	41,609,193	0	87,467	53,899	75,174	41,825,733
		94	36,257,143	0	83,753	51,083	0	36,391,979
		88	NA	NA	823,027	59,752	0	NA
3353	Aluminum Sheet, Plate, & Foil	96	3,699,616	241,933	57,686	320	0	3,999,555
		95	6,238,488	402,172	84,852	298	0	6,725,810
		94	8,170,589	612,960	200,028	305	0	8,983,882
		88	NA	NA	342,764	1,266	0	NA
3354	Aluminum Extruded Products	96	2,009,788	1,495,394	53,900	2,100	0	3,561,182
		95	2,229,805	1,403,644	57,381	1,623	0	3,692,453
		94	1,950,654	1,437,354	63,392	4,584	0	3,455,984
		88	NA	NA	557,904	957,842	129,660	NA
3355	Aluminum Rolling & Drawing, nec*	96	0	24,945	0	0	0	24,945
		95	24,000	261,129	11,000	5	0	296,134
		94	30,000	48,231	12,505	5	1,010	91,751
		88	NA	NA	18,066	0	0	NA
3356	Nonferrous Rolling & Drawing, nec*	96	3,975,533	4,930	338,881	4,279	5	4,323,628
		95	14,930,862	0	312,945	4,627	0	15,248,434
		94	11,769,884	9,700	386,269	3,847	0	12,169,700
		88	NA	NA	464,363	71,556	0	NA
3357	Nonferrous Wiredrawing & Insulating	96	179,466,898	2,069,048	395,517	28,338	250	181,960,051
		95	175,301,822	928,154	499,046	3,816	0	176,732,838
		94	173,100,805	849,749	456,205	13,614	129,697	174,550,070
		88	NA	NA	1,064,494	27,769	101,776	NA
3363	Aluminum Die-castings	96	9,822,808	56,813	9,667	22,233	0	9,911,521
		95	9,414,442	0	29,519	936	0	9,444,897
		94	9,852,956	1	21,641	1,879	250	9,876,727
		88	NA	NA	574,593	193,485	2,900	NA
3364	Nonferrous Die-casting Exc. Aluminum	96	508,267	0	9,920	300	0	518,487
		95	259,681	0	6,700	55	0	266,436
		94	2,220,189	0	2,150	255	0	2,222,594
		88	NA	NA	0	81,398	0	NA
3365	Aluminum Foundries	96	1,731,046	0	255	10,337	0	1,741,638
		95	1,535,974	0	0	7,466	0	1,543,440
		94	1,647,469	0	5	5,670	0	1,653,144
		88	NA	NA	4,189	1,750	0	NA
3366	Copper Foundries	96	6,734,132	14,529	57,907	829	0	6,807,397
		95	5,916,697	16,428	27,899	308	0	5,961,332
		94	3,995,407	9,055	36,626	555	12,418	4,054,061
		88	NA	NA	78,098	535	0	NA
3369	Nonferrous Foundries, nec*	96	4,643,623	0	125,528	7,916	0	4,777,067
		95	4,128,113	0	42,878	1,565	5	4,172,561
		94	2,241,972	0	71,991	1,591	0	2,315,554
		88	NA	NA	10,040	11,042	500	NA

Note Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category

\*nec: not elsewhere classified



Table 8-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Primary Metals, SIC Code 33, Continued

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
3398	Metal Heat Treating	96	395,923	28,145	58,211	26,420	0	508,699
		95	340,938	12,264	189,654	1,526	0	544,382
		94	211,918	25,135	99,950	36,299	250	373,552
		88	NA	NA	50,559	78,275	19,000	NA
3399	Primary Metal Products, nec*	96	3,455,076	5,810	41,642	28,611	0	3,531,139
		95	3,172,141	7,940	46,287	37,250	0	3,263,618
		94	2,925,849	6,123	58,661	32,787	250	3,023,670
		88	NA	NA	60,590	7,265	41	NA
	Multiple within SIC Code 33	96	105,185,507	1,241,225	8,914,134	2,227,391	0	117,568,257
		95	64,860,247	430,514	4,246,229	2,370,533	0	71,907,523
		94	62,590,031	317,225	7,114,472	2,270,961	0	72,292,689
		88	NA	NA	14,999,967	839,033	19,013	NA
	Invalid SIC Code within SIC 33	96	1,167,982	3,600	0	261	0	1,171,843
		95	6,005,053	4,355	54,266	825	0	6,064,499
		94	4,266,789	1,500	30,974	7,955	0	4,307,218
		88	NA	NA	834,234	346,714	158,271	NA
	Total for SIC Code 33	96	781,639,908	5,492,991	62,569,458	3,395,489	263,705	853,361,551
		95	763,629,448	3,718,565	31,775,498	3,260,183	1,928,899	804,312,593
		94	823,742,756	3,593,384	23,294,952	2,952,419	2,107,539	855,691,050
		88	NA	NA	46,106,054	4,993,085	8,830,043	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 33 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

disposed of in an off-site landfill. This accounted for a majority of the facility's increase in releases. The number two facility for increases was Nucor Steel in Crawfordsville, Indiana (SIC code 3312 reported in 1996). A 15.5-million-pound increase in transfers off-site for disposal of zinc compounds in 1996 made up 91.8% of the facility's 16.9 million-pound overall increase. The Nucor Steel facility was being built in 1988 and did not go into production until mid-1989. The facility began reporting on zinc compounds in 1990. Rouge Steel in Dearborn, Michigan (SIC code 3312), was third in releases with a 13.0-million-pound net increase. Transfers of zinc compounds off-site for disposal increased from 250 pounds in 1988 to 12.0 million pounds in 1996. (This facility also ranked fourth in decreases of production-related waste for 1991 to 1996). Asarco Inc., East Helena, Montana (SIC code 3339), had an 11.5-million-pound total increase in releases, 59.6% of which was due to an increase in the amount of zinc compounds released on-site to land (a 6.9 million-pound increase).

GM Powertrain Defiance in Defiance, Ohio (SIC code 3321), was fifth in increases of releases with a net increase of 11.3 million pounds. This foundry reported an 11.8-million-pound increase in zinc compounds released on-site to land. The facility receives galvanized sheet scrap metal for melting and recasting for automobile production. Zinc, being the primary component of the protective coating on galvanized metals, vaporizes during the melting process and is captured in wet-dust collectors. The aqueous waste from the dust collectors is sent to settling ponds. The GM facility attributes the increase in zinc compound releases to an increase in the amount of galvanized scrap metal received.

The top facility for decreases in releases, Magnesium Corporation of America in Rowley, Utah (SIC code 3339), reported a 43.0-million-pound decrease in total releases. The facility produces elemental magnesium from magnesium chloride. At one point in the process, a magnesium



oxide by-product is treated with chlorine as a purifying agent and excess chlorine is emitted to air. The facility has reduced the amount of chlorine in its air emissions by improving the efficiency of the process involving chlorine and by installing a chlorine reduction burner which controls about 90% of the chlorine leaving the stack. Reduction of chlorine in point source air emissions accounted for all of the facility's decrease.

Zinc compounds were primarily responsible for four of the top five facility decreases in releases. The second-ranked facility, Asarco, Inc., a copper smelter in Hayden, Arizona (SIC code 3331), reported a 15.0 million-pound reduction in releases of zinc compounds, 60.4% of the facility's total releases (24.8 million pounds). The reduction was partly accounted for by a process change in which slag is reprocessed to recover zinc left over from prior smelting of raw material. According to Asarco, a small part of the reduction may be due to a decrease in the amount of zinc compounds present in the raw material. Third in decreases, Doe Run Company in Herculaneum, Missouri (SIC code 3339), a lead smelter, reported a 15.4-million-pound reduction in zinc compounds, 73.2% of the 21.0 million-pound overall decrease. Nearly all of this reduction was in the category of on-site releases to land. The reduction was partly due to a decreased amount of zinc present in the raw material. This facility was a participant in EPA's 33/50 Program, as documented in *EPA's 33/50 Program Success Story: The Doe Run Company, Reducing Land Releases from Lead Production by Improving Concentrate Quality* (EPA 745-K-96-065, December 1996). Doe Run's project to reduce lead in wastes included a change in mining and milling operations that provide the raw material sent to the smelter. The changes included instituting tighter process controls, and conducting training to improve the efficiency of the materials separation process and provide raw materials with fewer impurities.

Phelps Dodge Hidalgo, Inc., in Playas, New Mexico (SIC code 3331 in 1988) ranked fourth for decreases in releases with a 12.7 million-pound

total reduction. Eleven million pounds of zinc compounds were reported in 1988, primarily in on-site releases to land, and no zinc releases were reported in 1996. The copper smelter ceased using a water treatment chemical that contained zinc. Part of the decrease may also be due to a reduction in the amount of zinc present in the concentrate (which results from initial processing of copper ore) that is brought on-site for smelting. Fifth in decreases, Republic Engineered Steels in Canton, Ohio (SIC code 3312), reduced transfers of zinc compounds off-site for disposal by over 6 million pounds between 1988 and 1996. This accounted for 52.8% of the total decrease (11.4 million pounds). The alloy and stainless steel manufacturer uses 100% scrap metal as raw material. A large portion of this is galvanized metal that contains zinc compounds. This minimill melts scrap in an electric arc furnace, which produces zinc-laden dust. The dust is collected and sent off-site for recycling.

The top facility for decreases in releases, Magnesium Corporation of America in Rowley, Utah (SIC code 3339), reported a 43.0-million-pound decrease in total releases. The facility produces elemental magnesium from magnesium chloride. At one point in the process, a magnesium oxide by-product is treated with chlorine as a purifying agent and excess chlorine is emitted to air. The facility has reduced the amount of chlorine in its air emissions by improving the efficiency of the process involving chlorine and by installing a chlorine reduction burner which controls about 90% of the chlorine leaving the stack.

## 1991-1996 Waste Management Data for Primary Metals

Table 8-17 summarizes on- and off-site waste management data for the primary metals sector for 1991, when TRI began collecting this information, and the three most recent years (1994-1996). Total production-related waste increased from 2.31 billion pounds to 3.25 billion pounds from 1991 to 1996, an increase of 40.8%. All categories increased except off-site energy recovery, which





decreased 52.1%, from 9.2 million pounds to 4.4 million pounds. (As noted earlier, energy recovery represents a small portion of overall waste management in primary metals production.)

The largest component of the overall increase was on-site recycling, which increased 666.8 million pounds, followed by off-site recycling, with a 134.0-million-pound increase. The increase in on-site energy recovery was 4.7 million pounds. On-site treatment increased by 69.2 million pounds and off-site treatment by 24.5 million pounds.

Quantities released on- and off-site increased 47.2 million pounds from 1991 to 1996.

Figure 8-13 shows the percentage changes for on- and off-site waste management types.

TRI facilities report absolute amounts of waste managed and of environmental releases, not adjusted for changes in production levels. Increases in production in this sector since 1991 may account for some of the increases in waste management quantities reported to TRI. As noted in the descriptions below, the facility with the largest increase in waste management for 1991-1996 came on line during this period. Some facilities, however, attribute their large increases to changes in what they consider recycling rather than to changes in production or in actual quantities of TRI chemicals in waste managed.<sup>1</sup>

### Facilities with Large Increases and Decreases in Waste Management, 1991-1996

Four of the top five facilities for increases in production-related waste reported increases in on-site recycling of copper compounds. The number-one facility was PMX Industries, Inc., in Cedar Rapids, Iowa (multiple codes 3341, 3351, and 3398). The copper alloy production facility came on-line in 1991 and did not achieve full production capacity until 1996, which accounts for its 99.0-million-pound increase in the amount of copper recycled on-site (95.1% of the 104.1 million-pound

overall increase). The recycling activity consists of returning waste copper from casting and rolling processes to furnaces for re-melting. Other facilities with large increases in on-site recycling of copper compounds cited changes in interpretation and procedures regarding this reporting. The third facility for overall increases was Revere Copper Products, Inc., Rome, New York (SIC code 3351), with 99.0 million pounds. The facility, whose primary business is recycling copper for sale to other business entities, changed its interpretation of on-site recycling<sup>2</sup> between the comparison years, resulting in an increase of 90.2 million pounds. This was also the case for the fourth-ranked increaser, Halstead Metal Products, Inc., Wynne, Arkansas (SIC code 3351). Halstead's reported 68.6-million-pound increase in on-site recycling of copper was also attributed to a change in the facility's interpretation of the reporting requirements for on-site recycling. The facility had a total net increase of 62.7 million pounds. The fifth-ranked facility, BHP Copper Metals Company, San Manuel, Arizona (multiple SIC codes 3331 and 3351), reported a 64.5-million-pound increase in on-site recycling of copper and a total net increase of 57.9 million pounds. The increase was due to a change in reporting procedure regarding how recycling applies to slag.

The second-ranked facility for increases reported an overall increase of 102.2 million pounds, the majority due to a 101.7-million-pound increase in the amount of manganese compounds recycled on-site. Elkem Metals Company in Marietta, Ohio (SIC code 3313), described the increase as attributable to increased accuracy about how to report under TRI.

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<sup>1</sup> There are no TRI regulatory definitions of recycling. Facilities may use their own interpretations for purposes of reporting to TRI. Changes in these interpretations do not represent a change in guidance by EPA on how to report recycling.

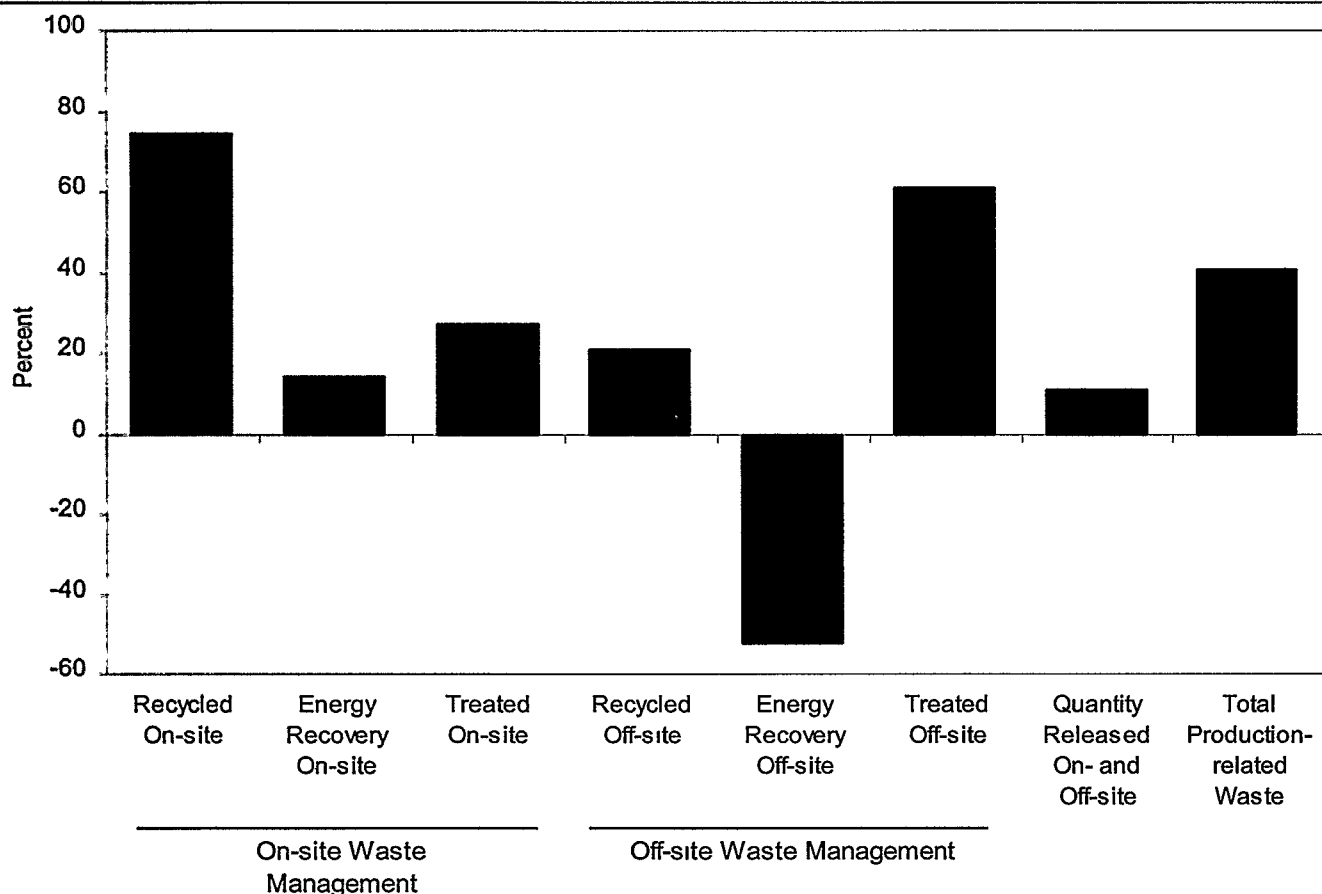
<sup>2</sup> There are no TRI regulatory definitions of recycling. Facilities may use their own interpretations for purposes of reporting to TRI. Changes in these interpretations do not represent a change in guidance by EPA on how to report recycling.



Table 8-17. TRI Waste Management Data, 1991, 1994-1996: Primary Metals, SIC Code 33

Waste Management Activity	1991 Pounds	1994 Pounds	1995 Pounds	1996 Pounds
<u>On-site Waste Management</u>				
Recycled On-site	894,659,655	1,513,279,562	1,547,386,744	1,561,479,306
Energy Recovery On-site	32,481,224	28,435,206	30,580,825	37,175,005
Treated On-site	252,659,916	330,031,172	349,525,323	321,825,158
Total On-site Waste Management	1,179,800,795	1,871,745,940	1,927,492,892	1,920,479,469
<u>Off-site Waste Management</u>				
Recycled Off-site	633,148,871	814,388,973	798,464,174	767,099,207
Energy Recovery Off-site	9,248,040	3,641,774	3,752,971	4,434,404
Treated Off-site	40,257,219	30,142,438	51,264,638	64,763,111
Total Off-site Waste Management	682,654,130	848,173,185	853,481,783	836,296,722
Quantity Released On- and Off-site	443,834,329	405,236,340	420,674,033	491,005,091
Total Production-related Waste	2,306,289,254	3,125,155,465	3,201,648,708	3,247,781,282
Non- Production-related Waste	473,183	23,922,491	17,995,211	15,226,628
Waste Management Activity	Change 1994-1995 Percent	Change 1995-1996 Percent	Change 1991-1996 Percent	
<u>On-site Waste Management</u>				
Recycled On-site	2.3	0.9	74.5	
Energy Recovery On-site	7.5	21.6	14.5	
Treated On-site	5.9	-7.9	27.4	
Total On-site Waste Management	3.0	-0.4	62.8	
<u>Off-site Waste Management</u>				
Recycled Off-site	-2.0	-3.9	21.2	
Energy Recovery Off-site	3.1	18.2	-52.1	
Treated Off-site	70.1	26.3	60.9	
Total Off-site Waste Management	0.6	-2.0	22.5	
Quantity Released On- and Off-site	3.8	16.7	10.6	
Total Production-related Waste	2.4	1.4	40.8	
Non- Production-related Waste	-24.8	-15.4	3,117.9	

**Note** Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid  
Data from Section 8 of Form R (Current Year, Column B) of year indicated



**Figure 8-13. Percentage Change in Quantities of TRI Chemicals in Waste, 1991-1996: Primary Metals (SIC Code 33)**

Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated.

Doe Run Company in Boss, Missouri (multiple SIC codes 3339 and 3341 reported in 1991 and SIC code 3341 in 1996), was first for decreases in production-related waste. This lead smelter had a total decrease of 48.5 million pounds, over 99% attributable to a decrease in on-site recycling of lead compounds. In 1994, the facility was given approval by EPA to utilize slag as a feedstock substitute at its Herculanum sister facility (see the number two facility for decreases in on- and off-site releases, above). The Boss smelter initiated an in-line process whereby a sulfide reagent is combined with slag as it is generated, rendering some of the constituent metal compounds, including lead, unleachable. The treated slag is, therefore, no

longer a hazardous waste by RCRA standards, and the facility no longer reports the lead compounds to TRI.

GNB Technologies, Inc., in Vernon, California was second for decreases with 47.6 million pounds. This facility, a secondary lead smelter (SIC 3341), reported 47.0 million pounds in on-site recycling of lead compounds in 1991 and no on-site recycling of lead compounds in 1996. The third-ranked facility for decreases in production-related waste, Wolverine Tube, Inc. in Decatur, Alabama (multiple codes 3351, 3354, 3365, and 3366 in 1991 and multiple codes 3351, 3355, and 3366 in 1996), accounts for its 43.0-million-pound decrease



in on-site recycling of copper by a change in how they reported. Copper tubing that did not meet specification at the copper and copper alloy tubing manufacturing facility is remelted and recast. This was historically reported as on-site recycling but is no longer designated by the facility as on-site recycling<sup>3</sup>. The facility had a 44.5 million-pound total decrease.

The fourth-ranked facility, Rouge Steel Company in Dearborn, Michigan (SIC code 3312), had a total decrease in production-related waste of 43.3 million pounds. About three-fourths of the reduction was due to a drop in the amount of aluminum (fume or dust) reported to off-site recycling. Rouge Steel used to report the constituents of its slag to TRI and no longer does. The slag contains large amounts of aluminum and was interpreted by the facility to be in the form of fume or dust in the 1988 report.

#### **Facilities Contacted for Explanations (alphabetical by facility):**

Asarco Inc., East Helena, Montana (no explanation provided)

Asarco, Inc., Hayden, Arizona: Ed Riege, March 20, 1998 (explanation provided)

BHP Copper Metals Company, San Manuel, Arizona: Brent Fletcher, March 20, 1998 (explanation provided)

Doe Run Company, Boss, Missouri: Doug Bice, April 9, 1998 (explanation provided)

Doe Run Company, Herculaneum, Missouri: Gary Walker, March 20, 1998 (explanation provided)

Elkem Metals Company, Marietta, Ohio: Rod Dement, March 20, 1998 (explanation provided)

GM Powertrain Defiance, Defiance, Ohio: Gary Nobler, March 20, 1998 (explanation provided)

GNB Technologies, Vernon, California (no explanation provided)

Halstead Metal Products, Inc., Wynne, Arkansas: Charles Blanton, March 20, 1998 (explanation provided)

Magnesium Corporation of America, Rowley, Utah: Chris Menefee, March 19, 1998 (explanation provided)

Nucor Steel, Crawfordsville, Indiana: Dave Sulc, April 6, 1998 (explanation provided)

Phelps Dodge Hidalgo, Inc., Playas, New Mexico: Gerry Roose, March 25, 1998 (explanation provided)

PMX Industries, Inc., Cedar Rapids, Iowa: Jim Howes, March 20, 1998 (explanation provided)

Republic Engineered Steels, Canton, Ohio: Eric Howland, March 24, 1998 (explanation provided)

Revere Copper Products, Inc., Rome, New York: Doug Bailey, March 24, 1998 (explanation provided)

Rouge Steel Company, Dearborn, Michigan: Charles B. Johnson, April 6, 1998 (explanation provided)

Wolverine Tube, Inc., Decatur, Alabama: Ralph Campbell, March 20, 1998 (explanation provided)

Zinc Corporation of America, Monaca, Pennsylvania: Joe Uriah, March 19, 1998 (explanation provided)

<sup>3</sup> There are no TRI regulatory definitions of recycling. Facilities may use their own interpretations for purposes of reporting to TRI. Changes in these interpretations do not represent a change in guidance by EPA on how to report recycling.



### Sources

Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987: Standard Industrial Classification (SIC) codes and industry descriptions.

U.S. *Industry & Trade Outlook '98*, DRI/McGraw Hill, Standard & Poor's, and U.S. Department of Commerce, International Trade Administration, 1998: economic analyses, also provides some information on environment and industrial processes for selected industries.

U.S. Census Bureau, *1996 Annual Survey of Manufactures: Statistics for Industry Groups and Industries*, M96(AS)-1, February 1998 <<http://www.census.gov/prod/www/titles.html#mm>>: value of shipments and employment. Supplemental data from U.S. Census Bureau <<http://www.census.gov>> for some industries.

U.S. Environmental Protection Agency, Office of Enforcement and Compliance Assurance, Office of Compliance, *Profile of the Iron and Steel Industry*, Sector Notebook Project, EPA/310-R-95-005, September 1995; *Profile of the Nonferrous Metals Industry*, EPA/310-R-95-010, September 1995 <<http://es.epa.gov/oeca/sector/index.html>>: industry processes and technologies, pollutant sources, and selected economic data.

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## Chapter 9



# ***Toxics Release Inventory Data for Electrical Equipment (SIC Code 36)***

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## **A Look at Electronic and Other Electrical Equipment and Components, Except Computer Equipment (SIC Code 36)**

The electrical equipment sector, Standard Industrial Classification (SIC) code 36, manufactures several major types of electrical equipment and components. Major industry groups in this sector produce equipment for transmission and distribution of electricity, electrical motors and related products for industry, household appliances, and electric lighting and wiring equipment. Other major industry groups in this sector manufacture communications equipment (including telephone and telegraph equipment, as well as radio and television broadcasting equipment) and electronic components (including circuit boards and semiconductors). Because early computers were large machines with many moving parts, computers are not classified as electrical equipment (SIC code 36), but as industrial machinery (SIC code 35).

Components of computer manufacturing, however—circuit boards and semiconductors—are important products in SIC code 36. Box 9-1 lists Standard Industrial Classification (SIC) codes and their designations for this sector. In TRI, SIC codes are given as reported by the facilities; these may differ from information in data collections that focus more on economic activity.

In 1996, production of electronic and electrical equipment and components resulted in shipments valued at \$320.61 billion, up from \$301.45 billion in 1995 (in current dollars). Employment in the sector was 1.6 million in 1996. Electrical equipment manufacture has grown much more rapidly than U.S. manufacturing as a whole. From 1989 to 1996, production in the electrical equipment sector rose 90.3%, compared to 17.6% for all manufacturing (see Chapter 4, Table 4-10.) The diversity of product categories in this sector lends a certain confusion to any overview of its performance. Analysis of this sector in *U.S. Industry & Trade Outlook '98* (DRI/McGraw-Hill, Standard & Poor's, and U.S. Department of Commerce, International Trade Administration, 1998), is spread among at least seven chapters that address industries on the basis of common economic activity rather than classification in the SIC system. Factors that influence the production of equipment for generating and transmitting



**Box 9-1. SIC Code 36, Electronic and Other Electrical Equipment and Components, Except Computer Equipment: Codes and Classifications**

SIC Code	Industry Description
<b>361 Electric Transmission and Distribution Equipment</b>	
3612 Power, Distribution, and Specialty Transformers.	Manufacture of power, distribution, instrument, and specialty transformers.
3613 Switchgear and Switchboard Apparatus	Manufacture of switchgear and switchboard apparatus, including power switches, circuit breakers, power switching equipment, and similar switchgear for general industrial applications; switchboards and cubicles, control and metering panels, fuses and fuse mountings, and similar switchboard apparatus and supplies
<b>362 Electrical Industrial Apparatus</b>	
3621 Motors and Generators	Manufacture of electric motors and power generators, motor generator sets, railway motors and control equipment, and motors, generators, and control equipment for gasoline, electric, and oil-electric buses and trucks.
3624 Carbon and Graphite Products	Manufacture of carbon, graphite, and metal-graphite brushes and brush stock; carbon or graphite electrodes for thermal and electrolytic uses; carbon and graphite fibers; and other carbon, graphite, and metal-graphite products.
3625 Relays and Industrial Controls	Manufacture of relays, motor starters and controllers, and other industrial controls and accessories.
3629 Electrical Industrial Apparatus, nec*	Manufacture of miscellaneous industrial and commercial electric apparatus and equipment, such as variable capacitors and rectifiers for industrial applications
<b>363 Household Appliances</b>	
3631 Household Cooking Equipment	Manufacture of household electric and nonelectric cooking equipment, such as stoves, ranges, and ovens, except portable electric appliances. Includes microwave and convention ovens (including portable)
3632 Household Refrigerators and Home and Farm Freezers	Manufacture of household refrigerators and home and farm freezers.
3633 Household Laundry Equipment	Manufacture of laundry equipment, such as washing machines, dryers, and ironers, for household use, including coin-operated.
3634 Electric Housewares and Fans	Manufacture of electric housewares for heating, cooking, and other purposes. Manufacture of electric household fans, except attic fans. Includes household-type ventilation and exhaust fans, portable household cooking appliances (except convection and microwave ovens), electric space heaters, and portable humidifiers and dehumidifiers.
3635 Household Vacuum Cleaners	Manufacture of vacuum cleaners for household use.
3639 Household Appliances, nec*	Manufacture of miscellaneous household appliances, such as water heaters, dishwashers, food waste disposal units, and household sewing machines.
<b>364 Electric Lighting and Wiring Equipment</b>	
3641 Electric Lamp Bulbs and Tubes	Manufacture of electric bulbs, tubes, and related light sources. Includes incandescent filament lamps, vapor and fluorescent lamps, photoflash and photoflood lamps, and electrotherapeutic lamp units for ultraviolet and infrared radiation.
3643 Current-Carrying Wiring Devices	Manufacture of current-carrying wiring devices.
3644 Noncurrent-carrying Wiring Devices	Manufacture of noncurrent-carrying wiring devices. Includes conduits and fittings; electrical insulators (except porcelain, other ceramic, and glass insulators), outlet, switch, and fuse boxes, pole line hardware
3645 Residential Electric Lighting Fixtures	Manufacture of residential electric lighting fixtures and equipment, fixed or portable.
3646 Commercial, Industrial, and Institutional Electric Lighting Fixtures	Manufacture of commercial, industrial, and institutional electric lighting fixtures
3647 Vehicular Lighting Equipment	Manufacture of vehicular lighting equipment
3648 Lighting Equipment, nec*	Manufacture of miscellaneous lighting fixtures and equipment, electric and nonelectric, including flashlights, searchlights, ultraviolet lamp fixtures, and infrared lamp fixtures

\*nec: not elsewhere classified.


**Box 9-1. SIC Code 36, Electronic and Other Electrical Equipment and Components, Except Computer Equipment: Codes and Classifications, Continued**

SIC Code	Industry Description
<b>365 Household Audio and Video Equipment, and Audio Recordings</b>	
3651 Household Audio and Video Equipment	Manufacture of electronic audio and video equipment for home entertainment (including automotive), such as television sets, radio broadcast receivers, tape players, phonographs, and video records and players. Manufacture of public address systems and music distribution apparatus
3652 Phonograph Records and Prerecorded Audio Tapes and Disks	Manufacture of phonograph records and prerecorded audio tapes and disks.
<b>366 Communications Equipment</b>	
3661 Telephone and Telegraph Apparatus	Manufacture of wire telephone and telegraph equipment. Includes modems and other telephone and telegraph communications interface equipment
3663 Radio and Television Broadcasting and Communications Equipment	Manufacture of radio and television broadcasting and communications equipment. Includes closed-circuit and cable television equipment, studio equipment, light communications equipment; transmitters, transceivers, and receivers (except household and automotive); cellular radio telephones, communication antennas, receivers; RF power amplifiers, and fixed and mobile radio systems
3669 Communications Equipment, nec*	Manufacture of miscellaneous communications and related equipment. Includes intercommunication equipment, traffic signaling equipment, and fire and burglar alarm apparatus
<b>367 Electronic Components and Accessories</b>	
3671 Electron Tubes	Manufacture of electron tubes and tube parts.
3672 Printed Circuit Boards	Manufacture of printed circuit boards
3674 Semiconductors and Related Devices	Manufacture of semiconductors and related solid-state devices. Includes semiconductor diodes and stacks, including rectifiers, integrated microcircuits (semiconductor networks), transistors, solar cells, and light sensing and emitting semiconductor (solid state devices).
3675 Electronic Capacitors	Manufacture of electronic capacitors
3676 Electronic Resistors	Manufacture of electronic resistors.
3677 Electronic Coils, Transformers, and Other Inductors	Manufacture of electronic coils, transformers, and inductors.
3678 Electronic Connectors	Manufacture of electronic connectors
3679 Electronic Components, nec*	Manufacture of miscellaneous electronic components, such as receiving antennas, switches, and waveguides.
<b>369 Miscellaneous Electrical Machinery, Equipment, and Supplies</b>	
3691 Storage Batteries	Manufacture of storage batteries.
3692 Primary Batteries, Dry and Wet	Manufacture of primary batteries, dry or wet.
3694 Electrical Equipment for Internal Combustion Engines	Manufacture of electrical equipment for internal combustion engines. Includes armatures, starting motors, alternators, and generators for automobiles and aircraft. Includes ignition apparatus for internal combustion engines, including spark plugs, magnetos, coils, and distributors
3695 Magnetic and Optical Recording Media	Manufacture of blank tape, disk, or cassette magnetic or optical recording media for use in recording audio, video, and other signals
3699 Electrical Machinery, Equipment, and Supplies, nec*	Manufacture of miscellaneous electrical machinery, equipment, and supplies, including high energy particle acceleration systems and equipment, electronic simulators, appliance and extension cords, bells and chimes, and insect traps.

Source: Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987. Standard Industrial Classification (SIC) codes and industry descriptions

\*nec: not elsewhere classified





## Chapter 9 – TRI Data for Electrical Equipment

Table 9-1. Summary of TRI Information by 4-digit SIC Code, 1996: Electrical Equipment, SIC Code 36

Total On- and Off-site Releases Rank	Total Production-related Waste Rank	SIC Code	Industry	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds
13	13	3612	Transformers, Except Electronic	38	90	2	1,041,920	246,650	1,288,570
26	12	3613	Switchgear & Switchboard Apparatus	42	84	3	123,558	41,590	165,148
6	9	3621	Motors & Generators	79	191	8	2,487,700	99,028	2,586,728
19	10	3624	Carbon & Graphite Products	26	40	0	347,258	53,653	400,911
34	27	3625	Relays & Industrial Controls	14	26	1	81,551	4,588	86,139
28	25	3629	Electrical Industrial Apparatus, nec*	16	25	1	93,917	62,649	156,566
29	34	3631	Household Cooking Equipment	9	26	0	81,098	69,869	150,967
4	18	3632	Household Refrigerators & Freezers	13	64	1	2,751,418	47,550	2,798,968
8	20	3633	Household Laundry Equipment	10	60	0	1,745,257	161,947	1,907,204
16	28	3634	Electric Housewares & Fans	16	28	2	556,491	1,250	557,741
37	39	3635	Household Vacuum Cleaners	2	3	0	17,255	500	17,755
14	24	3639	Household Appliances, nec*	12	45	1	932,151	208,891	1,141,042
2	15	3641	Electric Lamps	26	65	0	2,373,160	728,039	3,101,199
18	16	3643	Current-carrying Wiring Devices	47	80	6	170,107	237,174	407,281
21	17	3644	Noncurrent-carrying Wiring Devices	18	42	2	299,293	7,734	307,027
27	26	3645	Residential Lighting Fixtures	10	15	5	153,711	5,900	159,611
22	32	3646	Commercial Lighting Fixtures	12	19	1	227,393	250	227,643
33	35	3647	Vehicular Lighting Equipment	6	16	0	70,206	16,754	86,960
32	19	3648	Lighting Equipment, nec*	8	18	1	33,888	59,300	93,188
17	29	3651	Household Audio & Video Equipment	13	21	0	443,864	2,604	446,468
39	37	3652	Prerecorded Records & Tapes	4	5	0	5,489	5,081	10,570
31	31	3661	Telephone & Telegraph Apparatus	12	15	3	122,377	4,006	126,383
38	36	3663	Radio & TV Communications Equipment	8	27	0	10,835	5	10,840
36	23	3669	Communications Equipment, nec*	11	13	0	40,346	7,248	47,594
15	7	3671	Electron Tubes	14	70	0	632,671	339,378	972,049
1	2	3672	Printed Circuit Boards	214	582	11	1,197,800	7,347,373	8,545,173
3	3	3674	Semiconductors & Related Devices	131	499	6	2,227,646	741,476	2,969,122
11	11	3675	Electronic Capacitors	27	63	0	917,038	641,297	1,558,335
25	30	3676	Electronic Resistors	7	12	0	100,371	78,797	179,168
30	33	3677	Electronic Coils & Transformers	16	23	0	133,084	1,750	134,834
24	14	3678	Electronic Connectors	24	60	1	166,456	26,446	192,902
9	6	3679	Electronic Components, nec*	106	194	21	1,536,616	332,553	1,869,169
10	1	3691	Storage Batteries	77	181	1	242,993	1,480,262	1,723,255
7	8	3692	Primary Batteries, Dry & Wet	22	55	0	367,994	2,210,035	2,578,029
20	22	3694	Engine Electrical Equipment	20	42	0	244,322	105,717	350,039
12	5	3695	Magnetic & Optical Recording Media	17	39	0	1,264,005	139,443	1,403,448
23	21	3699	Electrical Equipment & Supplies, nec*	23	61	10	141,107	51,952	193,059
5	4		Multiple within SIC 36	75	212	2	2,220,202	543,769	2,763,971
35	38		Invalid SIC Code within SIC 36	8	10	1	49,571	750	50,321
Total for SIC Code 36				1,233	3,121	90	25,652,119	16,113,258	41,765,377

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents). Facilities/forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category

\*nec: not elsewhere classified.

electricity may differ markedly from those that drive the manufacture of washing machines, printed circuit boards, or lead-acid batteries.

Manufacture of electronic components (SIC code 367, which includes circuit boards and semiconductors) represents the largest economic activity within SIC code 36. The value of this

industry's shipments in 1996 was \$128 billion and employment was 587,900, about two-fifths of the sector's total in both measures. The second largest industry group was production of communications equipment (SIC code 366), which had \$66.23 billion in shipments and employed 258,400, roughly one-fifth of the sector's totals.



Table 9-1. Summary of TRI Information by 4-digit SIC Code, 1996: Electrical Equipment, SIC Code 36, Continued

SIC Code	Industry	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
3612	Transformers, Except Electronic	360,608	5,832,457	8,272,263	108
3613	Switchgear & Switchboard Apparatus	587,653	8,382,165	9,279,624	17,370
3621	Motors & Generators	636,199	9,549,206	12,380,217	1,408
3624	Carbon & Graphite Products	9,560,688	233,848	10,232,251	130
3625	Relays & Industrial Controls	24,624	1,237,141	1,349,794	0
3629	Electrical Industrial Apparatus, nec*	2,482	1,363,697	1,602,541	1,156
3631	Household Cooking Equipment	4,042	252,446	411,317	0
3632	Household Refrigerators & Freezers	138,190	1,489,300	4,476,760	5,200
3633	Household Laundry Equipment	855,473	971,627	3,671,164	0
3634	Electric Housewares & Fans	71,400	491,937	1,123,011	0
3635	Household Vacuum Cleaners	206	48,355	66,044	0
3639	Household Appliances, nec*	279,422	502,213	1,942,083	0
3641	Electric Lamps	1,566,403	1,638,112	6,450,360	60
3643	Current-carrying Wiring Devices	2,817,437	2,973,124	6,254,196	0
3644	Noncurrent-carrying Wiring Devices	4,120,598	1,160,346	5,577,483	0
3645	Residential Lighting Fixtures	1,472,725	12,978	1,593,530	0
3646	Commercial Lighting Fixtures	168,917	33,472	425,192	0
3647	Vehicular Lighting Equipment	79,000	89,712	267,603	0
3648	Lighting Equipment, nec*	76,000	4,186,539	4,342,672	0
3651	Household Audio & Video Equipment	63,458	479,132	991,893	0
3652	Prerecorded Records & Tapes	527	93,103	103,423	0
3661	Telephone & Telegraph Apparatus	970	300,740	428,086	0
3663	Radio & TV Communications Equipment	116,171	17,963	140,024	0
3669	Communications Equipment, nec*	31,598	2,711,065	2,802,973	0
3671	Electron Tubes	9,141,793	7,314,087	17,659,163	0
3672	Printed Circuit Boards	14,524,539	34,473,455	58,951,340	103
3674	Semiconductors & Related Devices	34,547,619	12,254,762	49,332,568	17,220
3675	Electronic Capacitors	4,289,484	3,876,009	9,829,376	2
3676	Electronic Resistors	183,297	186,223	498,284	0
3677	Electronic Coils & Transformers	8,624	264,659	423,469	0
3678	Electronic Connectors	1,594,310	4,877,714	6,869,077	0
3679	Electronic Components, nec*	10,150,879	6,356,214	18,349,206	3,075
3691	Storage Batteries	104,469,548	229,399,495	358,730,306	3,536
3692	Primary Batteries, Dry & Wet	10,029,861	2,075,512	14,742,152	0
3694	Engine Electrical Equipment	466,862	1,404,347	3,004,650	0
3695	Magnetic & Optical Recording Media	21,578,346	1,730,414	24,834,037	1,601
3699	Electrical Equipment & Supplies, nec*	781,870	2,385,434	3,501,883	0
	Multiple within SIC 36	3,227,519	22,014,716	28,404,703	304
	Invalid SIC Code within SIC 36	7,735	29,131	87,521	99
Total for SIC Code 36		238,037,077	372,692,850	679,402,239	51,372

**Note:** On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except. Non-production-related Waste (remedial/catastrophic incidents) Facilities/forms with more than one 4-digit SIC code within SIC code 20 are assigned to the "multiple" category

\*nec: not elsewhere classified

Two segments of the electronic component industry have been associated with high levels of wastes managed by industries in SIC code 36, as is evident in the analyses presented in this chapter: semiconductors and related devices (SIC code 3674) and printed circuit boards (SIC code 3672).

Although computers are the primary end use of semiconductors (half of the market in 1995), all

electronic products depend on semiconductors, including consumer electronics (televisions, radios, VCRs, etc.), telecommunications, industrial machinery, and equipment for both transportation and military uses.

The process of building a semiconductor from silicon ingots to computer chips bearing hundreds



of integrated circuits involves repeated coating, etching, and cleaning processes, using solvents and acids. Some parts of the processes that build printed circuit boards are somewhat similar, although laminating, drilling, coating, and soldering operations generate additional forms of waste, including particulates.

The Semiconductor Industry Association uses TRI data “to document individual company and industry-wide pollution-prevention and waste-management practices.” The association cites a decrease in hazardous air pollutants (HAPs) by 1994 to less than one fourth their 1987 level. Semiconductor manufacture previously generated air emissions of two ozone-depleting chemicals—1,1,1-trichloroethane (methyl chloroform) and Freon 113—that have been practically eliminated in industry processes since 1993, as noted by the Semiconductor Industry Association. Use of trichloroethylene has also been reduced.

Lead-acid batteries are classified among miscellaneous electrical equipment and supplies (SIC code 369). Eighty-three percent of the lead-acid battery market consists of starting, lighting, and ignition batteries, with common applications in vehicles from motorcycles and passenger cars to marine aircraft and military vehicles. The remaining 17% of this market is in industrial uses. Once a major concern in landfills, lead-acid batteries were recycled at an average rate of 94.9% per year from 1990 to 1995, according to the Battery Council International. Manufacture of these storage batteries, however, continues to generate large quantities of TRI chemicals in waste. Battery production is also the driving factor in the U.S. and global lead industry.

## 1996 TRI Data for Electrical Equipment

Table 9-1 summarizes TRI reporting by the electrical equipment sector for 1996. More than 3,100 TRI reporting forms were submitted for 1996. Just 2.9% were Form A certification statements, certifying that a chemical’s annual reportable amount was less than 500 pounds for the year and that the facility did not manufacture, process, or otherwise use more than 1 million pounds. This is considerably lower than the 10.1% national average for all sectors. (The Form A certification statement is explained in Chapter 1.) Of the 3,121 total forms submitted, 582 (18.6%) reported in printed circuit board manufacture (SIC code 3672) and 499 (16.0%) in production of semiconductors and related devices (SIC code 3674).

As shown in Table 9-1, printed circuit board manufacture accounted for the largest on- and off-site releases, 8.5 million pounds or one fifth (20.5%) of the sector’s total releases. This consisted primarily of off-site releases (transfers off-site to disposal), which were 7.3 million pounds for this industry or 45.6% of the sector’s total off-site releases. The largest on-site releases were reported in the manufacture of household refrigerators and freezers (SIC code 3632), which was 2.8 million pounds or 10.7% of the on-site releases in this sector. The storage battery industry (SIC code 3691) reported by far the largest portion of other on-site waste management (104.5 million pounds or 43.9% of that total), transfers off-site for further waste management (229.4 million pounds, or 61.6%), and total production-related waste (358.7 million pounds, or 52.8%).

Some facilities in this sector manufacture products in similar but distinct categories, as designated in the Standard Industrial Classification (SIC) scheme. For example, facilities may manufacture both electrical transformers (SIC code 3612) and electric motors (SIC code 3621). Others may produce more than one kind of household equipment: cooking



Table 9-2. Multiple SIC Codes, 1996: Electrical Equipment, SIC Code 36

SIC Codes	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
3612 3621 3699	39	0	3,412	38,364	41,776	9,284	7,444,526	7,813,645	0
3613 3629	2	0	216,790	0	216,790	0	4,279	220,719	0
3621 3624	1	0	255	0	255	0	500	425	0
3621 3694	2	0	50	3,187	3,237	0	465	3,422	0
3625 3643	8	0	91,515	2,600	94,115	58,714	56,694	209,192	150
3625 3651 3661 3663 3669 3699	5	1	28	0	28	0	86,439	86,578	0
3625 3676	4	0	181,282	0	181,282	26,818	306,053	515,553	0
3631 3632	8	0	21,732	30,114	51,846	74,674	6,495	132,702	0
3631 3632 3633 3639	8	0	150,130	0	150,130	0	419,400	569,265	0
3632 3639	20	1	1,095,109	15,766	1,110,875	494,929	201,832	1,808,144	154
3643 3644	2	0	1	10,485	10,486	1,700	19,018	31,152	0
3643 3644 3646	5	0	602	0	602	0	114,999	113,239	0
3645 3646	1	0	4,964	0	4,964	0	17,372	22,336	0
3651 3671 3672 3679 3694	4	0	2,857	0	2,857	34,030	85,530	121,417	0
3651 3672	2	0	260	0	260	47,769	250	47,814	0
3662 3679	10	0	626	12,470	13,096	34,372	1,305,786	1,083,483	0
3663 3671	1	0	0	0	0	0	38,192	38,192	0
3663 3671 3679	21	0	15,720	223,965	239,685	242,458	1,528,530	2,011,877	0
3663 3678 3679	2	0	150	4,257	4,407	39,109	70	43,657	0
3672 3674	4	0	14,686	0	14,686	0	77,111	90,677	0
3672 3678	10	0	303,981	2,050	306,031	30,010	78,881	420,396	0
3672 3699	9	0	2,137	80,054	82,191	74,380	9,918,265	10,073,946	0
3674 3679	28	0	16,475	0	16,475	1,934,381	69,629	2,016,198	0
3675 3677	1	0	90,819	0	90,819	20,383	17,946	129,148	0
3691 3692	13	0	5,861	207	6,068	95,508	216,449	672,026	0
3694 3699	2	0	760	120,250	121,010	9,000	5	129,500	0
Total for SIC Code 36	212	2	2,220,202	543,769	2,763,971	3,227,519	22,014,716	28,404,703	304

**Note:** On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases are transfers off-site to disposal from Section 6 of Form R. Total Transfers Off-site for Further Waste Management from Section 6 of Form R. Total Production-related Waste sums Section 8 of Form R, except Non-production-related Waste (remedial/catastrophic incidents).

ranges (SIC code 3631), refrigerators (SIC code 3632), and dishwashers (SIC code 3639). These facilities will report multiple SIC codes on their TRI forms. (Box 4-2 in Chapter 4 further explains reporting of multiple SIC codes and its affect on the analyses presented in the TRI data release.)

Table 9-2 examines TRI reporting from the 212 forms submitted with more than one code within SIC code 36. Two industries appear in five combinations each: printed circuit boards (SIC code 3672) and miscellaneous electronic components (SIC code 3679). Forms reporting multiple SIC codes are a smaller factor in the electrical equipment manufacture than in many other sectors. This indicates more of a concentration in this sector on single or closely related product lines.

## On- and Off-site Releases

Of the 41.8 million pounds of on- and off-site releases reported in the electrical equipment sector, 23.8 million pounds were air emissions, or 56.9% of the total releases. Table 9-3 and Figure 9-1 present release data for electrical equipment manufacturing.

Off-site releases (transfers to disposal) were the second largest release category, with 16.1 million pounds (38.6%). Discharges to surface water totaled 1.5 million pounds (3.5%). On-site land releases were 436,000 pounds (1.0%), about equally divided between RCRA subtitle C landfills and other on-site land releases. Only 27 pounds of underground injection was reported in this sector.

Four industries reported more than 2 million pounds each of air emissions. These were



Table 9-3. TRI On-site and Off-site Releases, 1996: Electrical Equipment, SIC Code 36 (in Rank Order)

SIC Code	Industry	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site 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	Total On- and Off-site Releases Pounds
3672	Printed Circuit Boards	1,125,321	67,982	5	5	1,619	2,868	1,197,800	7,347,373	8,545,173
3641	Electric Lamps	2,373,158	2	0	0	0	0	2,373,160	728,039	3,101,199
3674	Semiconductors & Related Devices	1,163,923	1,035,005	12	0	0	28,706	2,227,646	741,476	2,969,122
3632	Household Refrigerators & Freezers	2,751,418	0	0	0	0	0	2,751,418	47,550	2,798,968
	Multiple within SIC 36	2,153,400	66,292	0	0	0	510	2,220,202	543,769	2,763,971
3621	Motors & Generators	2,484,120	113	5	0	1,600	1,862	2,487,700	99,028	2,586,728
3692	Primary Batteries, Dry & Wet	367,770	224	0	0	0	0	367,994	2,210,035	2,578,029
3633	Household Laundry Equipment	1,626,148	411	0	0	0	118,698	1,745,257	161,947	1,907,204
3679	Electronic Components, nec*	1,518,106	275	0	0	15,986	2,249	1,536,616	332,553	1,869,169
3691	Storage Batteries	172,066	3,441	0	0	62,380	5,106	242,993	1,480,262	1,723,255
3675	Electronic Capacitors	876,970	1,270	0	0	37,350	1,448	917,038	641,297	1,558,335
3695	Magnetic & Optical Recording Media	1,236,187	1,000	0	0	26,818	0	1,264,005	139,443	1,403,448
3612	Transformers, Except Electronic	1,032,444	19	0	0	0	9,457	1,041,920	246,650	1,288,570
3639	Household Appliances, nec*	931,843	308	0	0	0	0	932,151	208,891	1,141,042
3671	Electron Tubes	355,841	276,825	0	0	5	0	632,671	339,378	972,049
3634	Electric Housewares & Fans	555,621	110	0	0	0	760	556,491	1,250	557,741
3651	Household Audio & Video Equipment	443,614	250	0	0	0	0	443,864	2,604	446,468
3643	Current-carrying Wiring Devices	169,241	505	0	0	0	361	170,107	237,174	407,281
3624	Carbon & Graphite Products	342,874	274	0	0	0	4,110	347,258	53,653	400,911
3694	Engine Electrical Equipment	175,629	0	0	0	22,849	45,844	244,322	105,717	350,039
3644	Noncurrent-carrying Wiring Devices	298,675	18	0	0	0	600	299,293	7,734	307,027
3646	Commercial Lighting Fixtures	227,393	0	0	0	0	0	227,393	250	227,643
3699	Electrical Equipment & Supplies, nec*	138,515	582	0	0	1,500	510	141,107	51,952	193,059
3678	Electronic Connectors	164,356	75	0	0	0	2,025	166,456	26,446	192,902
3676	Electronic Resistors	60,053	0	0	0	40,318	0	100,371	78,797	179,168
3613	Switchgear & Switchboard Apparatus	118,157	4,895	0	0	0	506	123,558	41,590	165,148
3645	Residential Lighting Fixtures	153,711	0	0	0	0	0	153,711	5,900	159,611
3629	Electrical Industrial Apparatus, nec*	93,486	421	0	0	0	10	93,917	62,649	156,566
3631	Household Cooking Equipment	80,830	268	0	0	0	0	81,098	69,869	150,967
3677	Electronic Coils & Transformers	133,079	5	0	0	0	0	133,084	1,750	134,834
3661	Telephone & Telegraph Apparatus	122,372	5	0	0	0	0	122,377	4,006	126,383
3648	Lighting Equipment, nec*	31,858	2,030	0	0	0	0	33,888	59,300	93,188
3647	Vehicular Lighting Equipment	70,206	0	0	0	0	0	70,206	16,754	86,960
3625	Relays & Industrial Controls	81,541	10	0	0	0	0	81,551	4,588	86,139
	Invalid SIC Code within SIC 36	49,571	0	0	0	0	0	49,571	750	50,321
3669	Communications Equipment, nec*	40,346	0	0	0	0	0	40,346	7,248	47,594
3635	Household Vacuum Cleaners	17,255	0	0	0	0	0	17,255	500	17,755
3663	Radio & TV Communications Equipment	10,580	0	0	0	0	255	10,835	5	10,840
3652	Prerecorded Records & Tapes	5,479	0	0	0	5	5	5,489	5,081	10,570
Total for SIC Code 36		23,753,157	1,462,615	22	5	210,430	225,890	25,652,119	16,113,258	41,765,377

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

household refrigerators and freezers (2.8 million pounds; SIC code 3632), motors and generators (2.5 million pounds, SIC code 3621), electric lamps (2.4 million pounds, SIC code 3641), and the forms reporting multiple codes in SIC code 36 (2.2 million pounds). As noted, printed circuit board manufacture accounted for the largest total releases and the largest off-site releases (transfers to disposal). Figure 9-2 shows releases by medium for the electrical equipment industries with the largest on- and off-site releases.

## Other On-site Waste Management

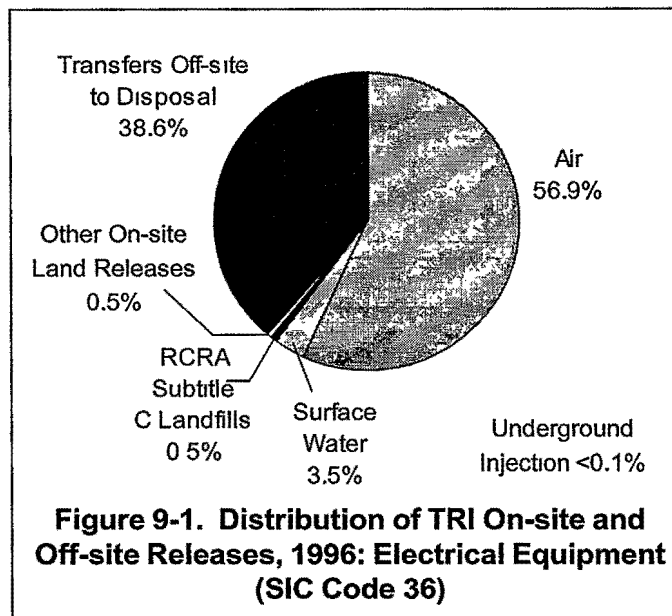
Recycling was the largest category in other on-site waste management, with 148.3 million pounds out of the total of 238.0 million pounds (62.3%), as shown in Table 9-4 and Figure 9-3. Production of storage batteries accounted for the largest amount of on-site recycling, 103.8 million pounds. This was more than seven times as much as the industry with the second-largest quantities of on-site recycling: magnetic and optical recording media

(SIC code 3695), which had 14.1 million pounds. Semiconductor production (SIC code 3674) accounted for 33.5 million pounds of on-site treatment, the largest reporting in that category. Carbon and graphite products (SIC code 3624), in the industrial apparatus group, reported the largest on-site energy recovery, 4.8 million pounds.

Figure 9-4 illustrates the distribution of on-site waste management reporting for the top 10 industries in the electrical equipment sector.

### Transfers Off-site for Further Waste Management

Almost two-thirds (61.6%) of the transfers off-site for further waste management in this sector were reported in storage battery manufacturing. This was 229.4 million pounds, of the 372.7-million-pound total. The bulk of this reporting—both by the



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

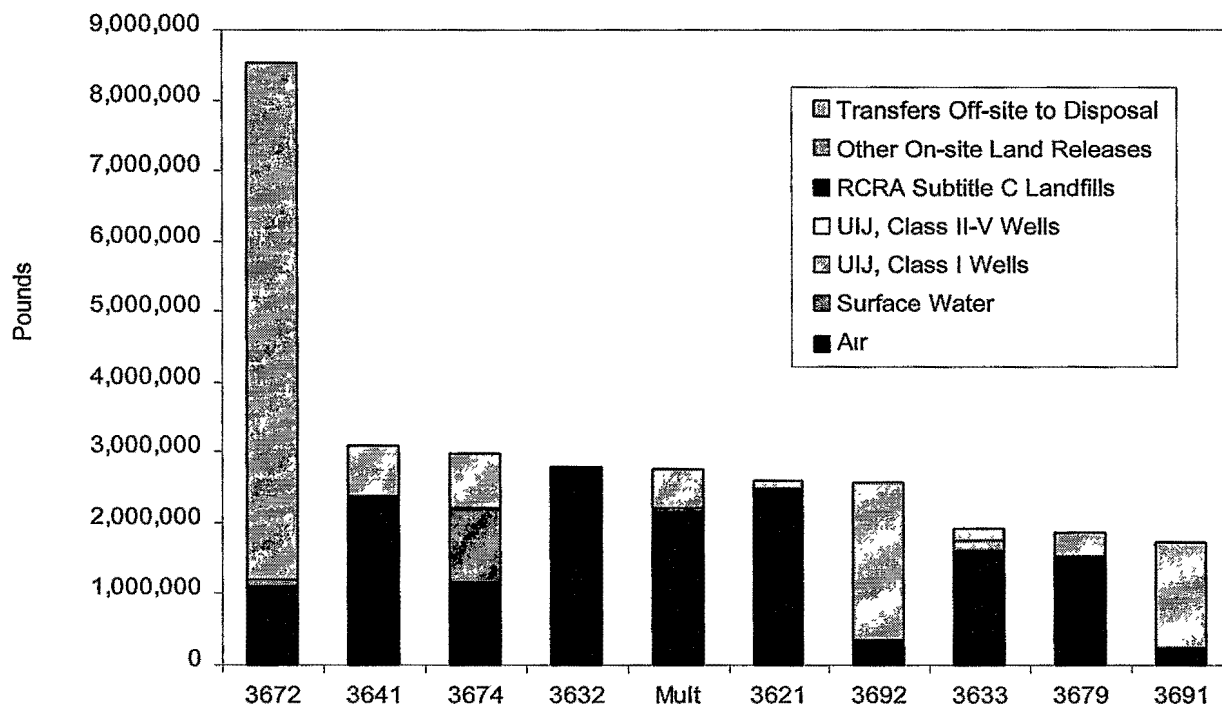


Figure 9-2. TRI On-site and Off-site Releases, SIC Codes with Largest Releases, 1996: Electrical Equipment (SIC Code 36)

Note. On-site Releases from Section 5 of Form R Off-site Releases from Section 6 (off-site transfers to disposal) of Form R UIJ = underground injection Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.



Table 9-4. TRI Other On-site Waste Management, 1996: Electrical Equipment, SIC Code 36 (in Rank Order)

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
3691	Storage Batteries	103,789,022	0	680,526	104,469,548
3674	Semiconductors & Related Devices	933,850	81,600	33,532,169	34,547,619
3695	Magnetic & Optical Recording Media	14,062,691	0	7,515,655	21,578,346
3672	Printed Circuit Boards	2,000,164	2,354,650	10,169,725	14,524,539
3679	Electronic Components, nec*	2,272,825	4,059,106	3,818,948	10,150,879
3692	Primary Batteries, Dry & Wet	9,567,891	0	461,970	10,029,861
3624	Carbon & Graphite Products	353,874	4,848,730	4,358,084	9,560,688
3671	Electron Tubes	3,505,895	0	5,635,898	9,141,793
3675	Electronic Capacitors	1,634,437	0	2,655,047	4,289,484
3644	Noncurrent-carrying Wiring Devices	3,655,994	37,895	426,709	4,120,598
	Multiple within SIC 36	954,565	0	2,272,954	3,227,519
3643	Current-carrying Wiring Devices	2,481,048	0	336,389	2,817,437
3678	Electronic Connectors	101,608	0	1,492,702	1,594,310
3641	Electric Lamps	371,942	0	1,194,461	1,566,403
3645	Residential Lighting Fixtures	1,472,695	0	30	1,472,725
3633	Household Laundry Equipment	140,253	0	715,220	855,473
3699	Electrical Equipment & Supplies, nec*	13,063	0	768,807	781,870
3621	Motors & Generators	168,540	0	467,659	636,199
3613	Switchgear & Switchboard Apparatus	0	0	587,653	587,653
3694	Engine Electrical Equipment	242,400	0	224,462	466,862
3612	Transformers, Except Electronic	63,568	0	297,040	360,608
3639	Household Appliances, nec*	119,741	42,000	117,681	279,422
3676	Electronic Resistors	151,297	0	32,000	183,297
3646	Commercial Lighting Fixtures	0	0	168,917	168,917
3632	Household Refrigerators & Freezers	16,000	0	122,190	138,190
3663	Radio & TV Communications Equipment	116,171	0	0	116,171
3647	Vehicular Lighting Equipment	0	0	79,000	79,000
3648	Lighting Equipment, nec*	0	0	76,000	76,000
3634	Electric Housewares & Fans	0	0	71,400	71,400
3651	Household Audio & Video Equipment	63,458	0	0	63,458
3669	Communications Equipment, nec*	31,288	0	310	31,598
3625	Relays & Industrial Controls	0	0	24,624	24,624
3677	Electronic Coils & Transformers	8,624	0	0	8,624
	Invalid SIC Code within SIC 36	0	0	7,735	7,735
3631	Household Cooking Equipment	4,040	0	2	4,042
3629	Electrical Industrial Apparatus, nec*	1,816	666	0	2,482
3661	Telephone & Telegraph Apparatus	0	0	970	970
3652	Prerecorded Records & Tapes	0	0	527	527
3635	Household Vacuum Cleaners	206	0	0	206
	Total for SIC Code 36	148,298,966	11,424,647	78,313,464	238,037,077

Note: Other On-site Waste Management from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

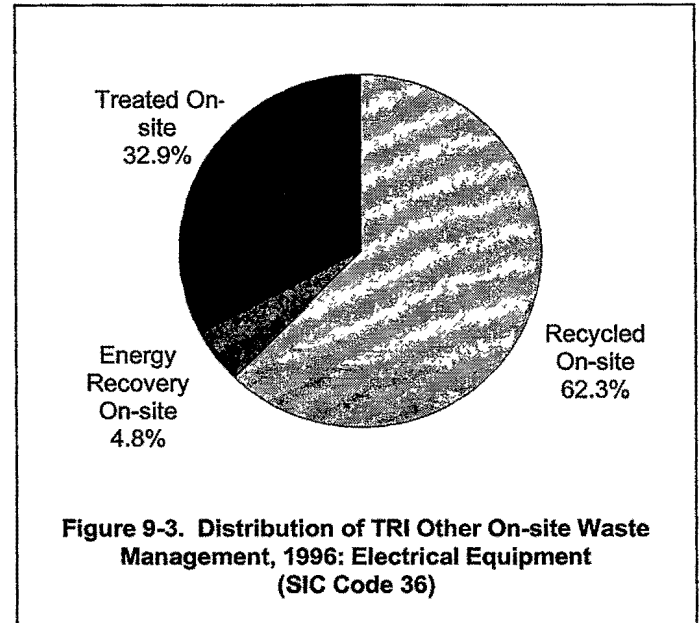
storage battery industry and for the sector as a whole—occurred in transfers to recycling. Overall, recycling represented 92.7% of the sector's transfers for further waste management. Table 9-5 presents these data for four-digit SIC codes in electrical equipment manufacturing. Figure 9-5 illustrates the distribution of these transfers.

Recycling was also the largest off-site transfer type reported by other industries in SIC code 36 with relatively high totals for off-site transfers, but somewhat less exclusively, as shown in Table 9-5. Also, although semiconductors and related devices ranked fourth overall, this industry reported the largest amounts in transfers to energy recovery (3.2

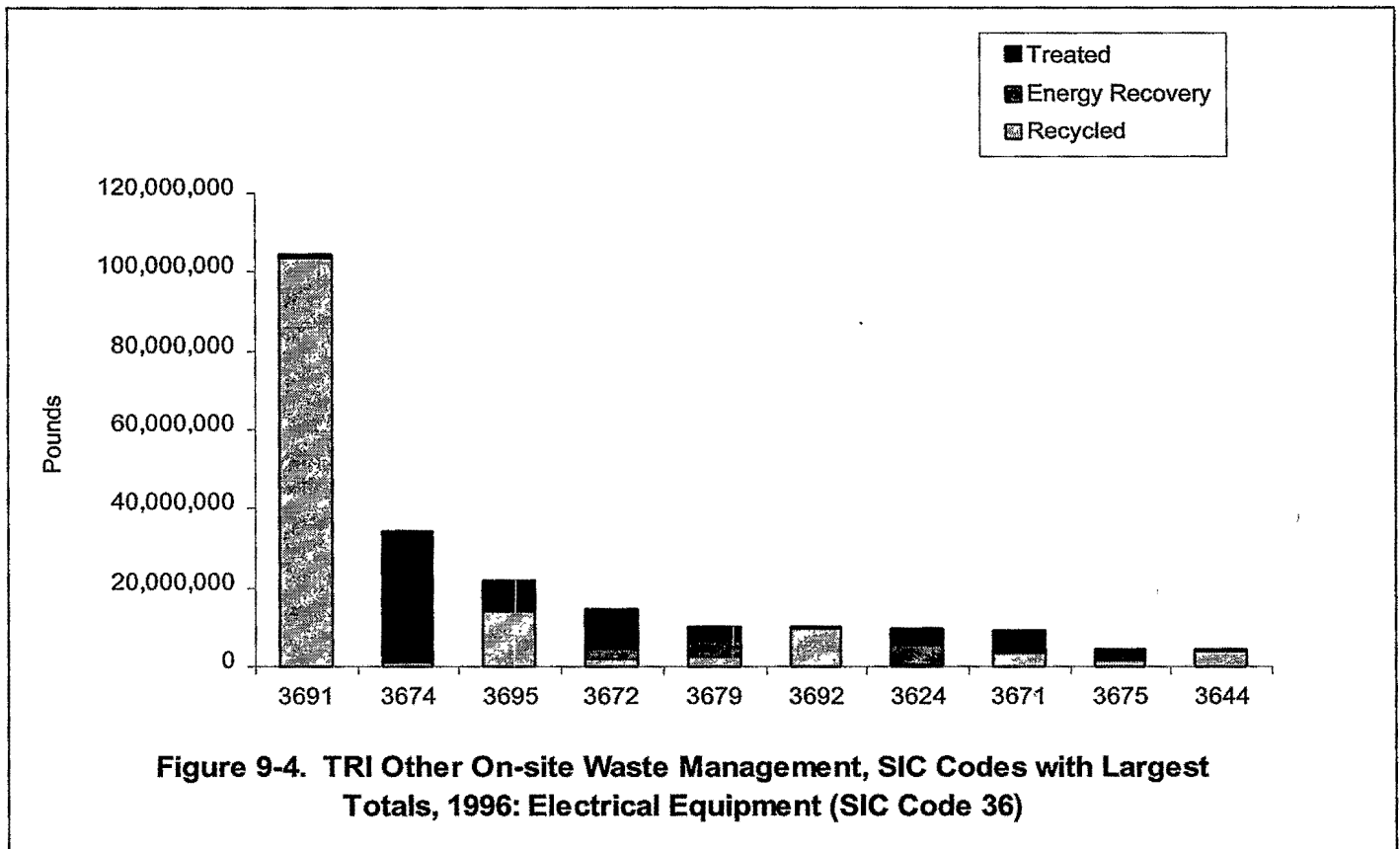
million pounds) and transfers to POTWs (5.1 million pounds), and the second largest in transfers to treatment (1.8 million pounds). Printed circuit boards ranked first (with 2.0 million pounds) in transfers to treatment. Figure 9-6 illustrates reporting of off-site transfers for further waste management for the industries with the largest totals.

## 1996 TRI Data by State for Electrical Equipment

California had the largest number of forms in electrical equipment manufacture, as shown in Table 9-6, with 377 or 12.1% of the total. No other state had as many as 200. California did not rank



Note. Data from Section 8 of the Form R



Note: Other On-site Waste Management from Section 8 of Form R.





Table 9-5. TRI Transfers Off-site for Further Waste Management, 1996: Electrical Equipment, SIC Code 36 (in Rank Order)

SIC Code	Industry	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Transfers for Further Waste Management Pounds
3691	Storage Batteries	227,556,700	20,344	1,060,430	762,021	0	229,399,495
3672	Printed Circuit Boards	29,117,449	1,636,044	1,956,470	1,606,958	156,534	34,473,455
	Multiple within SIC 36	20,283,719	292,774	273,570	626,647	538,006	22,014,716
3674	Semiconductors & Related Devices	2,223,075	3,191,701	1,785,498	5,054,488	0	12,254,762
3621	Motors & Generators	9,263,970	225,377	44,373	15,486	0	9,549,206
3613	Switchgear & Switchboard Apparatus	8,139,717	2,323	44,943	195,182	0	8,382,165
3671	Electron Tubes	6,419,546	277,142	359,820	257,579	0	7,314,087
3679	Electronic Components, nec*	5,617,060	286,857	134,678	317,369	250	6,356,214
3612	Transformers, Except Electronic	5,721,472	104,576	5,538	871	0	5,832,457
3678	Electronic Connectors	4,758,385	18,727	15,867	84,735	0	4,877,714
3648	Lighting Equipment, nec*	4,183,734	0	2,055	750	0	4,186,539
3675	Electronic Capacitors	2,316,659	271,600	967,195	320,555	0	3,876,009
3643	Current-carrying Wiring Devices	2,926,192	0	33,882	13,046	4	2,973,124
3669	Communications Equipment, nec*	2,691,945	9,985	7,875	1,260	0	2,711,065
3699	Electrical Equipment & Supplies, nec*	1,749,593	250	4,083	631,508	0	2,385,434
3692	Primary Batteries, Dry & Wet	1,915,651	41,280	110,493	8,088	0	2,075,512
3695	Magnetic & Optical Recording Media	277,653	952,735	127,440	372,586	0	1,730,414
3641	Electric Lamps	1,125,452	56,515	204,838	251,307	0	1,638,112
3632	Household Refrigerators & Freezers	1,133,408	273,347	14,059	68,486	0	1,489,300
3694	Engine Electrical Equipment	1,371,989	18,998	11,270	2,090	0	1,404,347
3629	Electrical Industrial Apparatus, nec*	1,243,891	100,907	6,553	12,346	0	1,363,697
3625	Relays & Industrial Controls	1,211,263	1,384	23,244	1,250	0	1,237,141
3644	Noncurrent-carrying Wiring Devices	1,039,784	65,840	5,061	49,661	0	1,160,346
3633	Household Laundry Equipment	647,221	49,992	2,037	272,377	0	971,627
3639	Household Appliances, nec*	390,588	50,400	2,970	58,255	0	502,213
3634	Electric Housewares & Fans	486,293	2,444	0	3,200	0	491,937
3651	Household Audio & Video Equipment	419,171	40,995	17,469	1,497	0	479,132
3661	Telephone & Telegraph Apparatus	294,672	5,800	251	17	0	300,740
3677	Electronic Coils & Transformers	253,478	1,400	9,781	0	0	264,659
3631	Household Cooking Equipment	246,086	750	2,000	3,610	0	252,446
3624	Carbon & Graphite Products	201,050	29,202	2,990	606	0	233,848
3676	Electronic Resistors	134,786	8,327	41,110	2,000	0	186,223
3652	Prerecorded Records & Tapes	88,397	3,707	715	284	0	93,103
3647	Vehicular Lighting Equipment	51,597	29,215	7,900	1,000	0	89,712
3635	Household Vacuum Cleaners	48,100	0	250	5	0	48,355
3646	Commercial Lighting Fixtures	19,677	10,515	2,530	750	0	33,472
	Invalid SIC Code within SIC 36	29,121	0	0	10	0	29,131
3663	Radio & TV Communications Equipment	17,463	0	500	0	0	17,963
3645	Residential Lighting Fixtures	5,338	2,590	4,800	250	0	12,978
Total for SIC Code 36		345,621,345	8,084,043	7,294,538	10,998,130	694,794	372,692,850

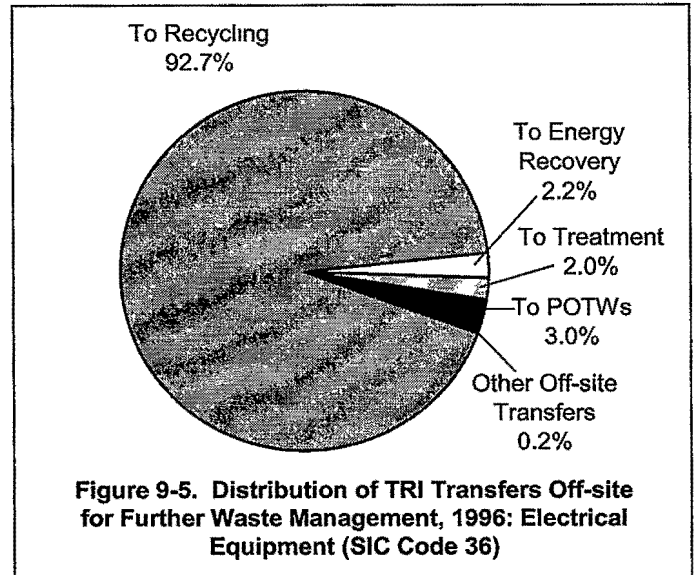
Note: Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without valid waste management code. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category. \*nec: not elsewhere classified.

highest, however, in any reporting category shown in Table 9-6. The state with the largest on- and off-site releases was Pennsylvania, with 7.9 million pounds; this is largely the effect of a facility reporting error in off-site releases (transfers for disposal). Three states reported more than 2 million pounds each in on- and off-site releases: Kentucky (3.0 million pounds), Ohio (2.8 million pounds), and Indiana (2.6 million pounds).

Four states reported more than 20 million pounds in other on-site waste management. Indiana led this list with 25.3 million pounds, followed by Kansas with 24.6 million pounds, Tennessee with 23.2 million pounds, and Alabama with 21.2 million pounds. Kansas was first for transfers off-site for further waste management (36.1 million pounds) and for total production-related waste (61.0 million pounds). Second in the category of

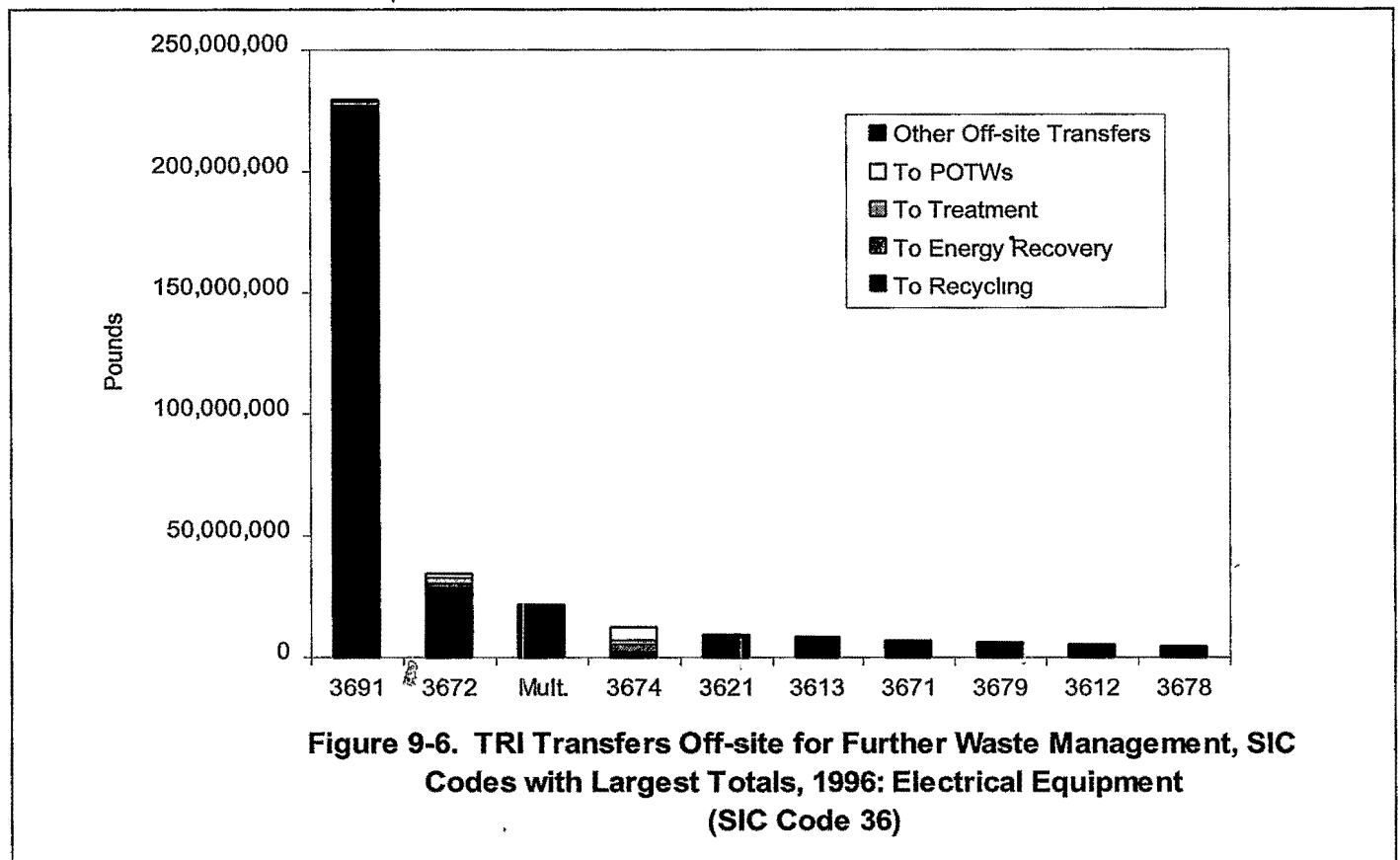
off-site transfers was Texas, with 33.8 million pounds, and California was third with 29.0 million pounds. For total production-related waste, California was second with 51.7 million pounds, and Indiana was third with 49.4 million pounds.

Map 9-1 shows the geographic distribution of total on- and off-site releases in the electrical equipment sector.



**Figure 9-5. Distribution of TRI Transfers Off-site for Further Waste Management, 1996: Electrical Equipment (SIC Code 36)**

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code.



**Figure 9-6. TRI Transfers Off-site for Further Waste Management, SIC Codes with Largest Totals, 1996: Electrical Equipment (SIC Code 36)**

Note: Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.



## Chapter 9 – TRI Data for Electrical Equipment

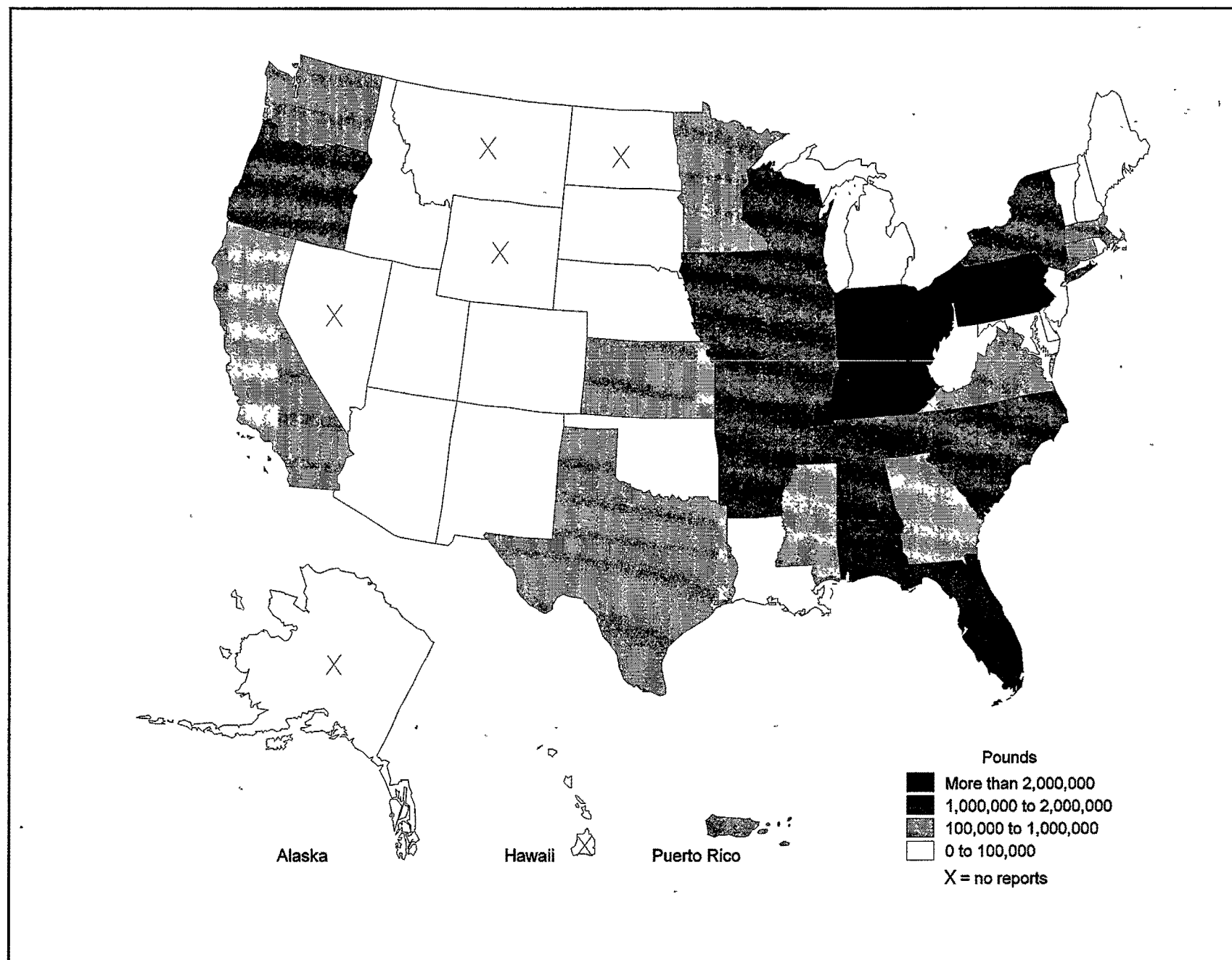
Table 9-6. Summary of TRI Information by State, 1996: Electrical Equipment, SIC Code 36

State	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production- related Waste Pounds	Non- Production- related Waste Pounds
Alabama	12	33	1	1,960,575	18,667	1,979,242	21,182,260	2,512,368	25,784,586	1,601
Arizona	28	91	0	172,108	20,380	192,488	5,289,170	4,574,626	9,725,187	1
Arkansas	17	62	0	1,462,988	164,510	1,627,498	2,024,807	860,418	6,765,539	0
California	160	377	2	643,092	296,311	939,403	16,633,328	29,016,309	51,701,428	0
Colorado	16	44	1	60,392	4,587	64,979	5,105,124	1,092,289	6,339,452	0
Connecticut	25	47	2	363,618	2,021	365,639	552,087	3,714,434	4,622,167	0
Delaware	1	2	0	210	0	210	0	4,966,134	4,966,364	0
Florida	26	63	1	106,885	1,234,545	1,341,430	1,637,861	8,186,619	11,732,348	120
Georgia	26	61	0	361,825	216,504	578,329	6,347,504	18,754,544	26,055,775	156
Idaho	4	12	1	45,810	19,429	65,239	196,964	116,059	328,400	0
Illinois	77	174	13	1,036,696	165,222	1,201,918	1,631,833	17,138,164	20,912,736	1,255
Indiana	57	149	9	2,243,441	344,645	2,588,086	25,317,676	21,145,315	49,414,408	0
Iowa	19	67	0	1,175,622	178,369	1,353,991	14,004,493	12,510,946	27,958,664	1,408
Kansas	12	29	0	163,962	264,305	428,267	24,632,371	36,145,448	61,025,104	0
Kentucky	22	62	0	2,879,379	71,762	2,951,141	530,058	9,221,072	12,821,186	10
Louisiana	7	19	1	73,940	67,600	141,540	170,631	12,613,759	12,880,508	0
Maine	8	21	0	57,869	115,690	173,559	1,029,983	282,821	1,479,599	0
Maryland	7	11	3	65,165	1,000	66,165	30,862	98,880	194,405	0
Massachusetts	46	116	8	509,715	133,435	643,150	1,289,248	3,234,513	5,744,353	210
Michigan	19	26	1	162,771	1,916	164,687	16,302	2,710,893	2,796,438	5,123
Minnesota	31	65	2	214,083	25,616	239,699	1,623,403	6,057,883	7,920,977	0
Mississippi	12	36	0	676,952	2,235	679,187	5,160,898	969,870	9,484,151	814
Missouri	39	104	0	898,646	464,939	1,363,585	17,032,797	21,087,131	39,413,821	0
Nebraska	7	20	0	83,128	43,022	126,150	46,440	4,998,443	5,174,686	0
Nevada	2	2	0	0	0	0	0	250	1,271	0
New Hampshire	17	49	0	135,402	63,223	198,625	2,096,282	2,627,629	4,896,613	0
New Jersey	19	25	2	49,967	14,396	64,363	332,611	11,398,499	11,795,129	1
New Mexico	2	16	0	61,645	27,992	89,637	505,490	729,967	1,324,832	0
New York	52	176	9	1,120,909	454,222	1,575,131	10,708,429	15,410,994	29,316,567	12,600
North Carolina	54	117	3	563,055	591,363	1,154,418	1,166,280	11,777,689	22,707,150	442
Ohio	64	167	4	1,530,546	1,281,901	2,812,447	10,372,594	18,522,376	32,369,313	0
Oklahoma	12	23	2	67,944	30	67,974	20,260	571,107	657,298	0
Oregon	19	71	0	1,091,055	2,948	1,094,003	4,952,476	7,379,840	13,329,531	0
Pennsylvania*	60	130	5	683,686	7,262,262	7,945,948	12,189,874	10,520,890	30,689,543	2,150
Puerto Rico	19	38	4	31,305	289,584	320,889	344,952	2,669,672	3,601,193	0
Rhode Island	6	11	0	39,381	45,560	84,941	241,006	929,355	1,253,319	0
South Carolina	31	100	1	912,959	950,218	1,863,177	10,220,736	12,835,533	25,496,737	5,032
South Dakota	4	5	0	30,243	32	30,275	33,902	51,400	130,045	0
Tennessee	43	116	2	1,523,077	459,646	1,982,723	23,153,160	4,185,542	31,855,365	17,370
Texas	55	169	4	467,314	156,759	624,073	5,881,309	33,780,776	40,831,174	14
Utah	8	26	0	32,655	968	33,623	360,616	1,427,190	1,551,086	0
Vermont	7	18	0	131,975	3,325	135,300	706,507	382,160	1,224,072	5
Virginia	21	51	1	767,826	119,582	887,408	571,732	4,778,205	6,266,457	0
Washington	11	24	1	194,027	78,063	272,090	1,222,718	920,162	2,303,886	0
West Virginia	3	4	0	1,745	18,489	20,234	1,974	27,977	47,630	0
Wisconsin	46	92	7	796,531	435,985	1,232,516	1,468,069	9,756,699	12,511,746	3,060
Total for SIC Code 36	1,233	3,121	90	25,652,119	16,113,258	41,765,377	238,037,077	372,692,850	679,402,239	51,372

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents)

\* One Pennsylvania facility reported 6,792,500 pounds of off-site releases (transfers off-site to disposal) in error.

Map 9-1. Total On- and Off-site Releases, 1996: Electrical Equipment, SIC Code 36



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

Table 9-7. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1996: Electrical Equipment, SIC Code 36 (in Rank Order)

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	
				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	Total On- & Off-site Releases Pounds
—	Lead compounds	67,278	3,494	0	0	62,380	5,452	138,604	7,655,823	7,794,427
1330-20-7	Xylene (mixed isomers)	5,364,033	250	0	0	0	13,647	5,377,930	20,764	5,398,694
—	Nitrate compounds	8,065	1,395,444	0	0	0	0	1,403,509	1,113,948	2,517,457
—	Glycol ethers	2,415,624	12,508	0	0	0	750	2,428,882	66,380	2,495,262
1717-00-6	1,1-Dichloro-1-fluoroethane (HCFC-141b)	2,387,085	0	0	0	0	0	2,387,085	50,838	2,437,923
—	Manganese compounds	107,793	647	0	0	0	5	108,445	2,072,948	2,181,393
108-88-3	Toluene	2,094,414	385	0	0	0	7,002	2,101,801	32,506	2,134,307
—	Zinc compounds	47,540	3,335	0	0	19,634	58,163	128,672	1,924,162	2,052,834
79-01-6	Trichloroethylene	2,037,091	7	0	0	0	0	2,037,098	2,855	2,039,953
78-93-3	Methyl ethyl ketone	1,149,824	770	0	0	0	0	1,150,594	251	1,150,845
75-09-2	Dichloromethane	1,123,964	0	0	0	0	1,810	1,125,774	23,667	1,149,441
7664-41-7	Ammonia	835,814	16,950	0	0	5	0	852,769	73,276	926,045
127-18-4	Tetrachloroethylene	800,348	1	0	0	0	0	800,349	8,216	808,565
68-12-2	N,N-Dimethylformamide	784,201	0	0	0	1,350	0	785,551	2,810	788,361
—	Barium compounds	7,790	1,572	0	0	0	756	10,118	764,898	775,016
	Subtotal	19,230,864	1,435,363	0	0	83,369	87,585	20,837,181	13,813,342	34,650,523
	Total for SIC Code 36	23,753,157	1,462,615	22	5	210,430	225,890	25,652,119	16,113,258	41,765,377

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

## 1996 TRI Data by Chemical for Electrical Equipment

The top 15 chemicals for total on- and off-site releases in electrical equipment manufacture appear in Table 9-7. Lead compounds led this list (7.8 million pounds) and accounted for the largest portion of off-site releases (7.7 million pounds in transfers off-site to disposal). The major source of this reporting of lead compounds was printed circuit board manufacturing (SIC code 3672), with 6.8 million pounds of lead compounds in transfers to disposal.

Xylene, a solvent and cleaning agent, ranked second among all TRI chemicals for on- and off-site releases in electrical equipment reporting. Almost all of the 5.4 million pounds reported as releases was emitted to air. Two industries accounted for the majority of the xylene releases—

electric lamp bulbs and tubes (SIC code 3641), with 1.8 million pounds, and motors and generators (SIC code 3621), with 1.1 million pounds.

The top 15 chemicals accounted for 34.7 million pounds (83.0%) of the 41.8 million pounds of total releases in this sector in 1996.

## OSHA Carcinogens

On- and off-site releases in this sector of chemicals designated as OSHA carcinogens totaled 6.1 million pounds in 1996, as shown in Table 9-8. (OSHA carcinogens and the bases for their designation appear in Box 2-4 in Chapter 2.) The majority (5.3 million pounds, 87.2%) was released to air; 722,000 pounds was released off-site (transferred to disposal).

Of the top 15 chemicals for on- and off-site releases in the electrical equipment sector (see Table 9-7), four are OSHA carcinogens: trichloroethylene, dichloromethane, tetrachloroethylene, and N,N-dimethylformamide. Releases of these four

Table 9-8. TRI On-site and Off-site Releases of OSHA Carcinogens by 4-digit SIC Code, 1996: Electrical Equipment, SIC Code 36 (in Rank Order)

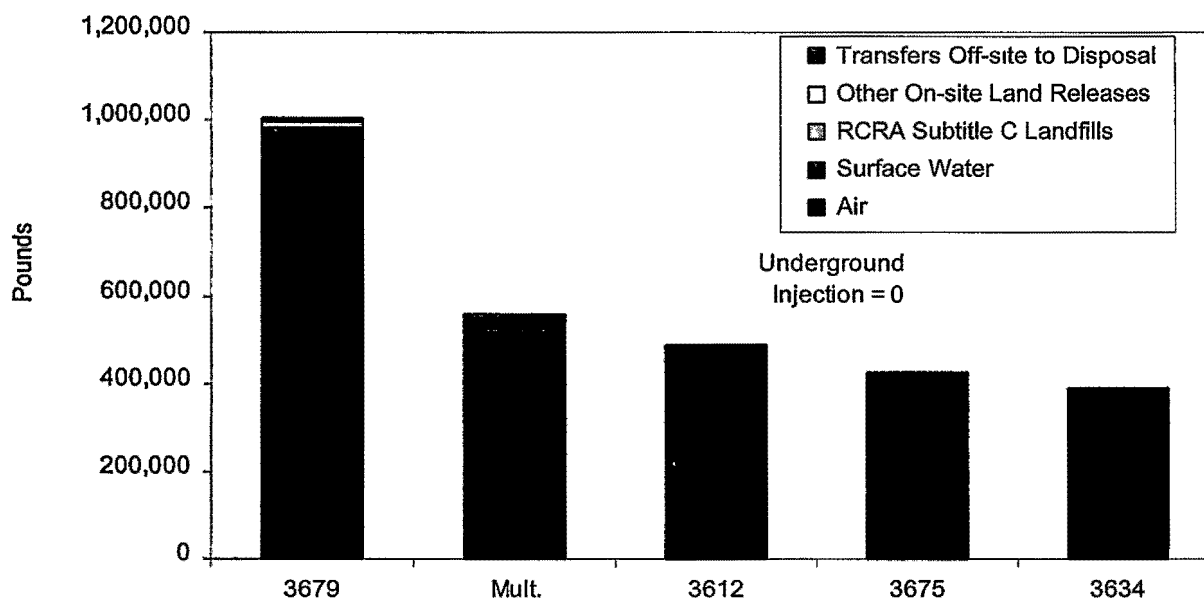
SIC Code	Industry	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases	
				Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds		Transfers Off-site to Disposal Pounds	Total On- & Off-site Releases Pounds
3679	Electronic Components, nec*	982,128	4	0	0	15,981	0	998,113	4,843	1,002,956
	Multiple within SIC 36	518,643	691	0	0	0	0	519,334	37,427	556,761
3612	Transformers, Except Electronic	484,976	5	0	0	0	1,808	486,789	2,000	488,789
3675	Electronic Capacitors	422,147	0	0	0	1,350	2	423,499	2,811	426,310
3634	Electric Housewares & Fans	390,638	110	0	0	0	0	390,748	250	390,998
3621	Motors & Generators	317,034	5	0	0	0	5	317,044	8,677	325,721
3624	Carbon & Graphite Products	220,580	19	0	0	0	4,105	224,704	40,813	265,517
3674	Semiconductors & Related Devices	206,373	7	0	0	0	0	206,380	20,304	226,684
3651	Household Audio & Video Equipment	223,370	0	0	0	0	0	223,370	2,603	225,973
3691	Storage Batteries	20,236	557	0	0	0	0	20,793	195,312	216,105
3641	Electric Lamps	15,139	0	0	0	0	0	15,139	142,408	157,547
3672	Printed Circuit Boards	154,617	276	0	0	0	0	154,893	750	155,643
3694	Engine Electrical Equipment	66,112	0	0	0	15	39,617	105,744	45,782	151,526
3692	Primary Batteries, Dry & Wet	149,618	0	0	0	0	0	149,618	0	149,618
3671	Electron Tubes	132,778	45	0	0	0	0	132,823	48	132,871
3678	Electronic Connectors	126,851	49	0	0	0	0	126,900	5,281	132,181
3645	Residential Lighting Fixtures	129,989	0	0	0	0	0	129,989	0	129,989
3695	Magnetic & Optical Recording Media	10,464	0	0	0	0	0	10,464	108,485	118,949
3661	Telephone & Telegraph Apparatus	117,171	0	0	0	0	0	117,171	6	117,177
3639	Household Appliances, nec*	102,358	84	0	0	0	0	102,442	4,630	107,072
3677	Electronic Coils & Transformers	87,107	0	0	0	0	0	87,107	750	87,857
3644	Noncurrent-carrying Wiring Devices	87,112	0	0	0	0	0	87,112	250	87,362
3643	Current-carrying Wiring Devices	52,328	0	0	0	0	10	52,338	25,506	77,844
3629	Electrical Industrial Apparatus, nec*	74,387	12	0	0	0	5	74,404	2,649	77,053
3613	Switchgear & Switchboard Apparatus	50,599	0	0	0	0	0	50,599	510	51,109
3646	Commercial Lighting Fixtures	47,486	0	0	0	0	0	47,486	0	47,486
3699	Electrical Equipment & Supplies, nec*	37,594	293	0	0	250	0	38,137	355	38,492
3625	Relays & Industrial Controls	35,365	0	0	0	0	0	35,365	2,300	37,665
3647	Vehicular Lighting Equipment	13,056	0	0	0	0	0	13,056	16,754	29,810
3631	Household Cooking Equipment	1,029	258	0	0	0	0	1,287	23,189	24,476
3669	Communications Equipment, nec*	20,236	0	0	0	0	0	20,236	0	20,236
3633	Household Laundry Equipment	325	194	0	0	0	0	519	19,575	20,094
3635	Household Vacuum Cleaners	17,255	0	0	0	0	0	17,255	500	17,755
3676	Electronic Resistors	11,967	0	0	0	0	0	11,967	0	11,967
3652	Prerecorded Records & Tapes	5,479	0	0	0	5	5	5,489	5,081	10,570
3663	Radio & TV Communications Equipment	4,413	0	0	0	0	250	4,663	0	4,663
3632	Household Refrigerators & Freezers	3,973	0	0	0	0	0	3,973	0	3,973
	Invalid SIC Code within SIC 36	3,355	0	0	0	0	0	3,355	0	3,355
3648	Lighting Equipment, nec*	15	130	0	0	0	0	145	1,800	1,945
	Subtotal	5,344,303	2,739	0	0	17,601	45,807	5,410,450	721,649	6,132,099
	Total for SIC Code 36	23,753,157	1,462,615	22	5	210,430	225,890	25,652,119	16,113,258	41,765,377

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

chemicals totaled 4.8 million pounds (78.1%) of the 6.1-million-pound total. The OSHA carcinogen with the fifth highest releases was styrene, with 523,000 pounds. The OSHA carcinogen with the largest off-site releases (transfers to disposal) was nickel compounds with 275,000 pounds.

Miscellaneous electronic components (SIC code 3679) reported the largest amount, 1.0 million pounds (16.4%), almost all of which was in air emissions. Figure 9-7 shows the on- and off-site releases of the four-digit SIC codes with the largest OSHA carcinogen releases.



**Figure 9-7. TRI On-site and Off-site Releases of OSHA Carcinogens, SIC Codes with Largest Totals, 1996: Electrical Equipment (SIC Code 36)**

Note: On-site Releases from Section 5 of Form R. Off-site Releases from Section 6 (off-site transfers to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category

## 1996 TRI Chemicals in Waste for Electrical Equipment

The electrical equipment sector reported a total of 679.4 million pounds of TRI chemicals in production-related waste for 1996, as shown in Table 9-9. Off-site recycling amounted to 381.2 million pounds, or 56.1% of total production-related waste. On-site recycling was the next largest category, with 148.3 million pounds, or 21.8%.

With 251.8 million pounds recycled off-site and 103.8 million pounds recycled on-site, storage battery manufacturing (SIC code 3691) accounted for the majority of this reporting. These two amounts represented 52.3% of the total reporting of

TRI chemicals in production-related waste in this sector. The second-largest total production-related waste was that of printed circuit board manufacture (SIC code 3672, 59.0 million pounds) and third was semiconductor production (SIC code 3674, 49.3 million pounds).

After on- and off-site recycling, on-site treatment was the next largest waste management option for the electrical equipment sector, with 78.3 million pounds. Quantities released totaled 35.5 million pounds. Treatment off-site and energy recovery on- and off-site were reported in smaller quantities, each less than 2.5% of total production-related waste.

Figure 9-8 shows the distribution of on-site waste management, off-site waste management, and quantities released on- and off-site in this sector for

Table 9-9. Quantities of TRI Chemicals in Waste by 4-digit SIC Code, 1996: Electrical Equipment, SIC Code 36 (in Rank Order)

SIC Code	Industry	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Recycled Off-site Pounds	Energy Recovery Off-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
3691	Storage Batteries	103,789,022	0	680,526	251,752,730	20,220	411,404	2,076,404	358,730,306	3,536
3672	Printed Circuit Boards	2,000,164	2,354,650	10,169,725	36,764,610	1,635,374	3,813,057	2,213,760	58,951,340	103
3674	Semiconductors & Related Devices	933,850	81,600	33,532,169	2,242,554	3,370,499	6,252,279	2,919,617	49,332,568	17,220
	Multiple within SIC 36	954,565	0	2,272,954	21,214,184	292,764	947,760	2,722,476	28,404,703	304
3695	Magnetic & Optical Recording Media	14,062,691	0	7,515,655	441,425	920,884	280,946	1,612,436	24,834,037	1,601
3679	Electronic Components, nec*	2,272,825	4,059,106	3,818,948	5,616,869	288,112	382,236	1,911,110	18,349,206	3,075
3671	Electron Tubes	3,505,895	0	5,635,898	6,632,579	277,142	359,291	1,248,358	17,659,163	0
3692	Primary Batteries, Dry & Wet	9,567,891	0	461,970	1,311,009	40,700	790,510	1,950,072	14,742,152	0
3621	Motors & Generators	168,540	0	467,659	8,986,433	224,185	49,125	2,484,275	12,380,217	1,408
3624	Carbon & Graphite Products	353,874	4,848,730	4,358,084	202,335	29,202	2,211	437,815	10,232,251	130
3675	Electronic Capacitors	1,634,437	0	2,655,047	2,577,974	229,600	1,085,693	1,646,625	9,829,376	2
3613	Switchgear & Switchboard Apparatus	0	0	587,653	8,240,982	2,323	251,723	196,943	9,279,624	17,370
3612	Transformers, Except Electronic	63,568	0	297,040	6,525,846	104,581	5,448	1,275,780	8,272,263	108
3678	Electronic Connectors	101,608	0	1,492,702	4,870,608	29,608	145,821	228,730	6,869,077	0
3641	Electric Lamps	371,942	0	1,194,461	1,230,298	74,215	463,687	3,115,757	6,450,360	60
3643	Current-carrying Wiring Devices	2,481,048	0	336,389	2,948,681	0	48,985	439,093	6,254,196	0
3644	Noncurrent-carrying Wiring Devices	3,655,994	37,895	426,709	1,043,577	56,532	55,755	301,021	5,577,483	0
3632	Household Refrigerators & Freezers	16,000	0	122,190	1,249,348	273,347	82,545	2,733,330	4,476,760	5,200
3648	Lighting Equipment, nec*	0	0	76,000	4,172,321	0	2,000	92,351	4,342,672	0
3633	Household Laundry Equipment	140,253	0	715,220	656,909	50,098	198,523	1,910,161	3,671,164	0
3699	Electrical Equipment & Supplies, nec*	13,063	0	768,807	1,903,192	485	640,896	175,440	3,501,883	0
3694	Engine Electrical Equipment	242,400	0	224,462	2,223,320	18,848	20,302	275,318	3,004,650	0
3669	Communications Equipment, nec*	31,288	0	310	2,705,995	9,985	7,875	47,520	2,802,973	0
3639	Household Appliances, nec*	119,741	42,000	117,681	389,038	50,895	59,374	1,163,354	1,942,083	0
3629	Electrical Industrial Apparatus, nec*	1,816	666	0	1,317,704	105,551	15,854	160,950	1,602,541	1,156
3645	Residential Lighting Fixtures	1,472,695	0	30	5,338	2,590	10,700	102,177	1,593,530	0
3625	Relays & Industrial Controls	0	0	24,624	1,216,200	1,384	9,842	97,744	1,349,794	0
3634	Electric Housewares & Fans	0	0	71,400	491,842	2,444	3,000	554,325	1,123,011	0
3651	Household Audio & Video Equipment	63,458	0	0	419,171	40,746	22,333	446,185	991,893	0
3676	Electronic Resistors	151,297	0	32,000	175,748	8,327	40,839	90,073	498,284	0
3661	Telephone & Telegraph Apparatus	0	0	970	295,091	5,800	97	126,128	428,086	0
3646	Commercial Lighting Fixtures	0	0	168,917	17,901	13,279	2,309	222,786	425,192	0
3677	Electronic Coils & Transformers	8,624	0	0	259,474	1,400	10,038	143,933	423,469	0
3631	Household Cooking Equipment	4,040	0	2	252,085	765	4,739	149,686	411,317	0
3647	Vehicular Lighting Equipment	0	0	79,000	51,197	31,315	6,400	99,691	267,603	0
3663	Radio & TV Communications Equipment	116,171	0	0	17,430	0	296	6,127	140,024	0
3652	Prerecorded Records & Tapes	0	0	527	88,397	3,708	219	10,572	103,423	0
	Invalid SIC Code within SIC 36	0	0	7,735	31,385	0	0	48,401	87,521	99
3635	Household Vacuum Cleaners	206	0	0	48,100	0	0	17,738	66,044	0
Total for SIC Code 36		148,298,966	11,424,647	78,313,464	381,209,880	8,216,908	16,484,112	35,454,262	679,402,239	51,372

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified

1996. Distribution of production-related waste for the top industries in the sector appears in Figure 9-9.

## Projected Quantities of TRI Chemicals in Waste

Table 9-10 summarizes the electrical equipment sector's projections for on- and off-site waste management through 1998. (As explained in

Chapter 2, facilities not only report current data but project waste management quantities for the next two years in their TRI submissions.) Total production-related waste is projected to increase by 4.4% (30.1 million pounds). Projected changes include a 12.0% decrease in quantities released on- and off-site through 1998, from 35.5 million pounds to 31.2 million pounds. The largest percentage change is projected in on-site energy recovery, a 27.2% decrease, but this method represents a small portion overall of the sector's

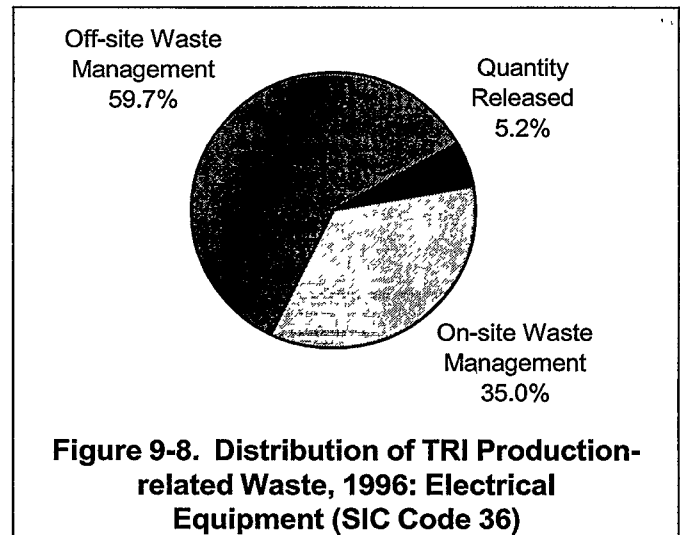




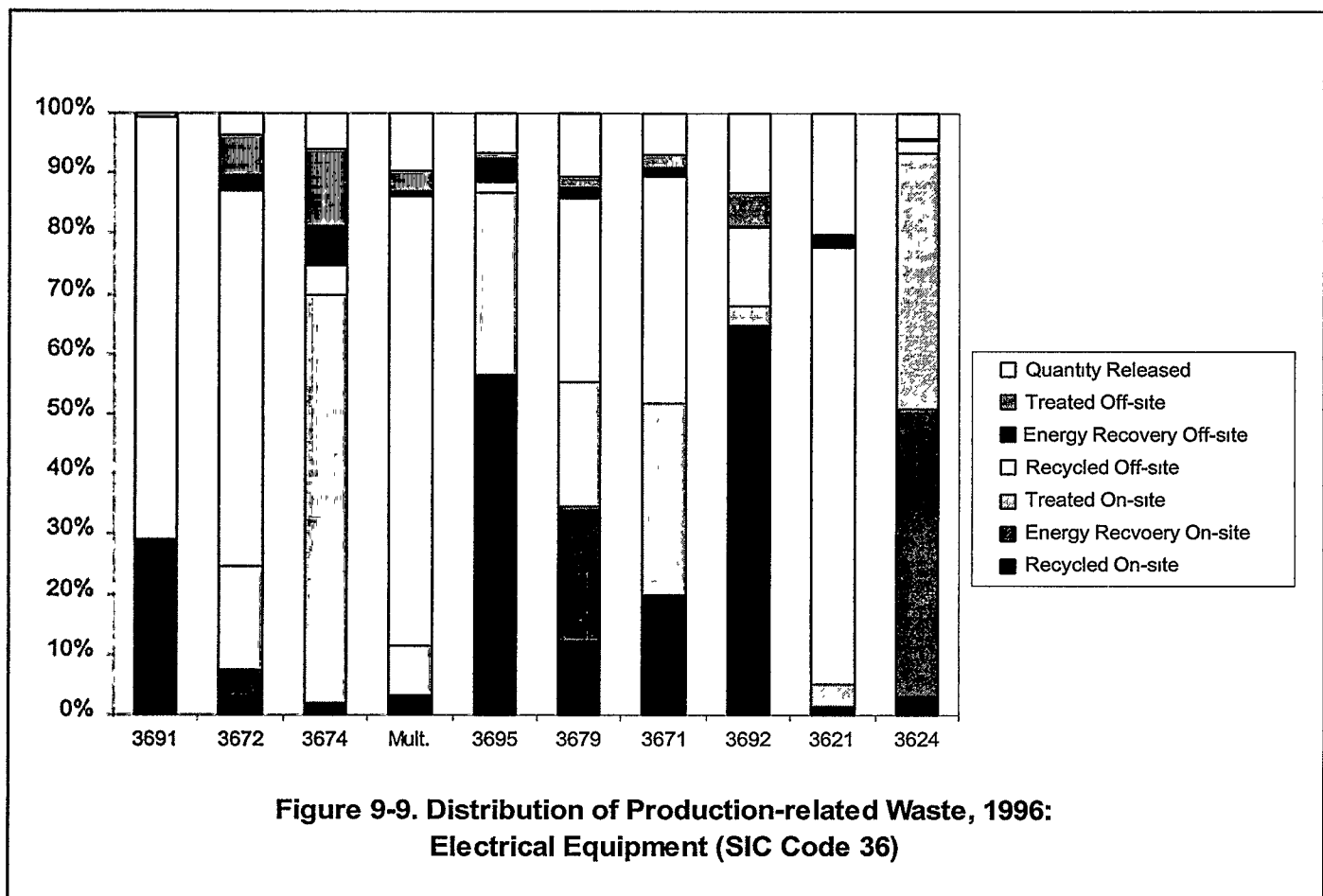
management of TRI chemicals in waste (1.7% of production-related waste in 1996). The largest reduction in pounds is projected in off-site recycling, a 5.6-million-pound decrease.

Increases are projected in on-site recycling and treatment. For on-site recycling, the projected change is a 17.8% increase, or 26.4 million pounds. For on-site treatment, the expected increase is 19.7%, or 15.4 million pounds. These increases, along with smaller quantities and percentages in off-site energy recovery and treatment, contributed to the overall projected increase of 4.4% in total production-related waste by 1998.

Figure 9-10 displays the projected percentage changes in on-site waste management, off-site



Note: Data from Section 8 of Form R



Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category



**Table 9-10. Current Year and Projected Quantities of TRI Chemicals in Waste, 1996-1998: Electrical Equipment, SIC Code 36**

Waste Management Activity	Current Year 1996		Projected 1997		Projected 1998	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
<u>On-site Waste Management</u>						
Recycled On-site	148,298,966	21.8	160,052,084	23.2	174,658,980	24.6
Energy Recovery On-site	11,424,647	1.7	8,115,845	1.2	8,312,982	1.2
Treated On-site	78,313,464	11.5	87,241,082	12.7	93,756,654	13.2
<u>Off-site Waste Management</u>						
Recycled Off-site	381,209,880	56.1	375,729,870	54.6	375,611,989	52.9
Energy Recovery Off-site	8,216,908	1.2	8,413,913	1.2	8,465,817	1.2
Treated Off-site	16,484,112	2.4	16,860,308	2.4	17,499,728	2.5
Quantity Released On- and Off-site	35,454,262	5.2	32,094,402	4.7	31,197,319	4.4
Total Production-related Waste for SIC Code 36	679,402,239	100.0	688,507,504	100.0	709,503,469	100.0

Waste Management Activity	Projected Change	Projected Change	Projected Change
	1996-1997 Percent	1997-1998 Percent	1996-1998 Percent
<u>On-site Waste Management</u>			
Recycled On-site	7.9	9.1	17.8
Energy Recovery On-site	-29.0	2.4	-27.2
Treated On-site	11.4	7.5	19.7
<u>Off-site Waste Management</u>			
Recycled Off-site	-1.4	0.0	-1.5
Energy Recovery Off-site	2.4	0.6	3.0
Treated Off-site	2.3	3.8	6.2
Quantity Released On- and Off-site	-9.5	-2.8	-12.0
Total Production-related Waste for SIC Code 36	1.3	3.0	4.4

Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996.

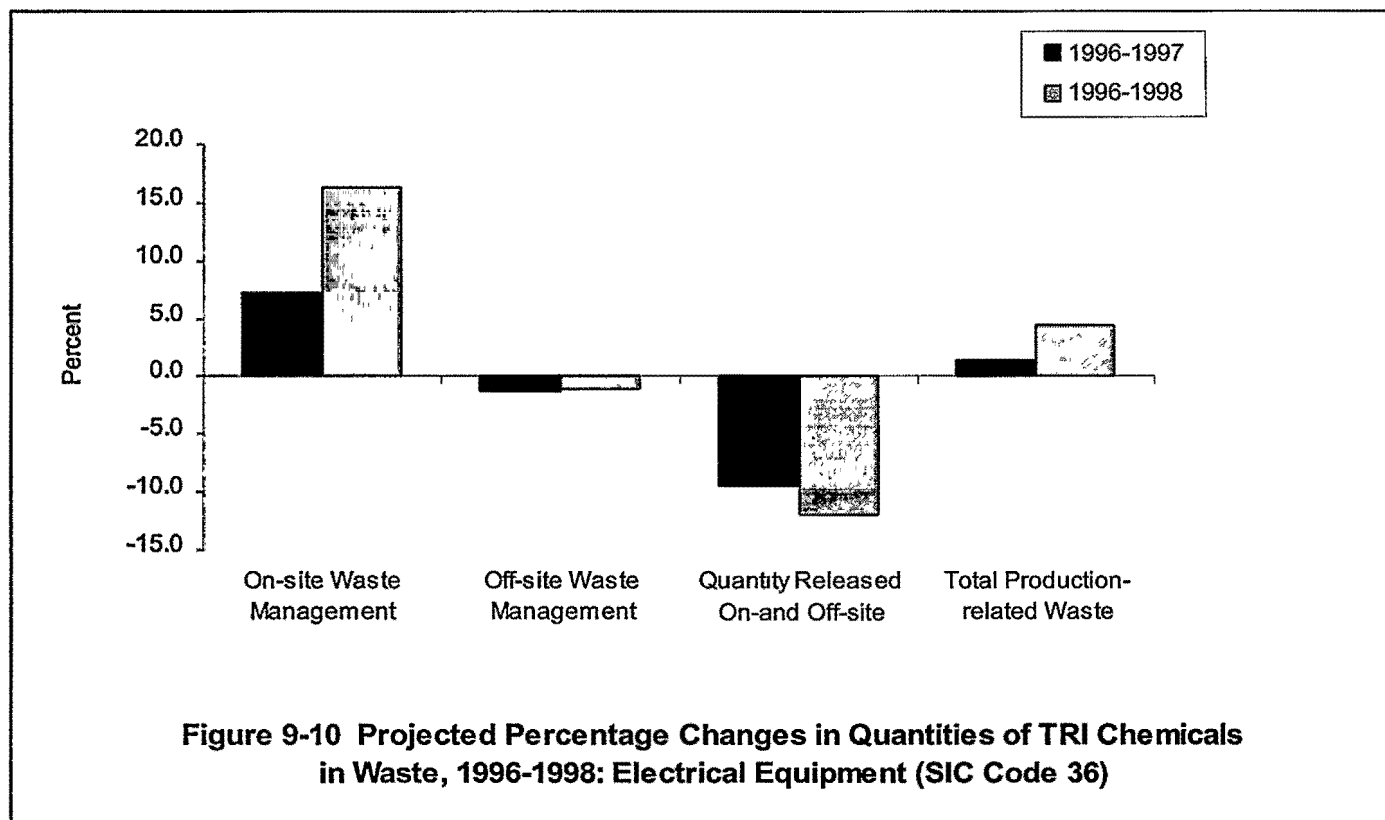
waste management, quantities released on- and off-site, and total production-related waste.

The projected changes also indicate some difference over time in where electrical equipment manufacturers expect to manage TRI chemicals in waste, but not necessarily in how they expect to do so. On-site recycling is projected to increase from 21.8% of production-related waste in 1996 to 24.6% in 1998, while off-site recycling is projected to decrease from 56.1% to 52.9%. These are, and would remain, the largest waste management

activities in electrical equipment manufacturing. These distributions, which also appear in Table 9-10, thus suggest relatively little movement up the waste management hierarchy, explained in Chapter 2, although the projected decreasing role of releases indicates some progress.

### Source Reduction Activity

Table 9-11 shows that 21.9% of forms submitted in electrical equipment manufacturing indicated one or more source reduction activities in 1996. Printed



Note: Current year and projected year amounts are all taken from Section 8 of Form R for 1996

circuit boards (SIC code 3672) and semiconductors (SIC code 3674) were the two industries with the largest numbers of such forms (122 and 118, respectively); these were also the industries with the largest total submissions in 1996. More than one third (34.8%) of the forms submitted in storage battery manufacturing (SIC code 3691) indicated source reduction activity. Improved operating practices were cited most often on forms in SIC code 36 (335 forms); the second largest category was process modifications (244 forms).

## Year-to-Year Comparisons for Electrical Equipment

### 1995-1996 TRI Data for Electrical Equipment

From 1995 to 1996, the number of forms submitted with electrical equipment SIC codes decreased 6.3%. The number of Form A certification statements in these submissions also decreased (by 10.9%); unlike most TRI sectors where the number of Form A certification statements increased in 1996. Table 9-12 provides TRI data for the electrical equipment sector for the two years.



Table 9-11. Number of Forms Reporting Source Reduction Activity, 1996: Electrical Equipment, SIC Code 36

SIC Code	Industry	Total Forms Number	Forms Reporting Source Reduction Activities		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
3612	Transformers, Except Electronic	90	12	13.3	7	0	0	1	2	2	4	1
3613	Switchgear & Switchboard Apparatus	84	9	10.7	3	1	2	2	1	2	0	0
3621	Motors & Generators	191	53	27.7	24	3	8	11	5	3	8	3
3624	Carbon & Graphite Products	40	7	17.5	2	2	1	2	1	0	0	0
3625	Relays & Industrial Controls	26	4	15.4	1	0	0	1	1	1	0	0
3629	Electrical Industrial Apparatus, nec*	25	7	28.0	2	0	0	3	4	0	0	0
3631	Household Cooking Equipment	26	7	26.9	1	0	0	1	4	0	1	1
3632	Household Refrigerators & Freezers	64	6	9.4	0	0	0	6	0	0	3	0
3633	Household Laundry Equipment	60	11	18.3	4	0	0	1	0	0	4	3
3634	Electric Housewares & Fans	28	5	17.9	1	0	2	0	2	0	0	0
3635	Household Vacuum Cleaners	3	1	33.3	0	0	0	0	0	0	1	0
3639	Household Appliances, nec*	45	9	20.0	3	0	0	1	5	1	1	0
3641	Electric Lamps	65	9	13.8	4	0	1	3	2	2	1	2
3643	Current-carrying Wiring Devices	80	17	21.3	10	4	1	3	2	2	0	2
3644	Noncurrent-carrying Wiring Devices	42	7	16.7	5	0	2	1	0	2	1	0
3645	Residential Lighting Fixtures	15	3	20.0	0	0	0	0	0	1	2	2
3646	Commercial Lighting Fixtures	19	3	15.8	3	0	1	0	3	0	0	0
3647	Vehicular Lighting Equipment	16	1	6.3	0	0	0	1	0	1	0	0
3648	Lighting Equipment, nec*	18	1	5.6	0	0	0	0	0	0	0	1
3651	Household Audio & Video Equipment	21	7	33.3	0	1	0	1	1	0	3	1
3652	Prerecorded Records & Tapes	5	3	60.0	3	0	0	1	1	1	0	0
3661	Telephone & Telegraph Apparatus	15	1	6.7	0	0	0	0	0	1	0	0
3663	Radio & TV Communications Equipment	27	2	7.4	0	0	0	0	1	0	1	0
3669	Communications Equipment, nec*	13	4	30.8	2	1	0	4	3	0	0	2
3671	Electron Tubes	70	14	20.0	8	0	1	0	3	3	0	2
3672	Printed Circuit Boards	582	122	21.0	56	12	14	24	63	14	5	9
3674	Semiconductors & Related Devices	499	118	23.6	60	23	14	25	47	3	3	1
3675	Electronic Capacitors	63	23	36.5	5	0	1	6	12	2	0	2
3676	Electronic Resistors	12	6	50.0	4	0	0	2	4	2	0	0
3677	Electronic Coils & Transformers	23	2	8.7	2	0	0	0	0	0	0	0
3678	Electronic Connectors	60	10	16.7	5	1	0	0	3	1	0	0
3679	Electronic Components, nec*	194	50	25.8	27	3	2	12	20	11	1	3
3691	Storage Batteries	181	63	34.8	49	6	20	1	17	1	0	5
3692	Primary Batteries, Dry & Wet	55	21	38.2	12	1	5	2	14	1	2	0
3694	Engine Electrical Equipment	42	7	16.7	4	2	0	1	1	1	0	0
3695	Magnetic & Optical Recording Media	39	13	33.3	9	0	1	3	6	0	0	0
3699	Electrical Equipment & Supplies, nec*	61	5	8.2	2	2	0	0	1	0	0	0
Multiple within SIC 36		212	39	18.4	16	6	3	12	14	2	0	8
Invalid SIC Code within SIC 36		10	2	20.0	1	0	0	0	1	0	0	0
Total for SIC Code 36		3,121	684	21.9	335	68	79	131	244	60	41	48

Note. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category

\*nec not elsewhere classified

### On- and Off-site Releases

From 1995 to 1996, on- and off-site releases increased by 3.2%, a net increase of 1.3 million pounds. This resulted primarily from a 60.1% increase in off-site releases (transfers to disposal) of 6.0 million pounds. The increase reported in transfers to disposal of lead compounds in the printed circuit board industry (SIC code 3672) was 6.4 million pounds (partly offset by decreases in other chemicals and SIC codes).

Air emissions decreased by 19.6%, or 5.8 million pounds; reductions occurred in both fugitive and point-source emissions. The large percentage increase in surface water discharges—189.0%, or 957,000 pounds—reflects an increase in discharges of nitrate compounds (902,000 pounds) reported in semiconductor manufacturing (SIC code 3674).

Table 9-12 and Figure 9-11 summarize on- and off-site release data for electrical equipment manufacturing for 1995 and 1996.



Table 9-12. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1995-1996: Electrical Equipment, SIC Code 36

	1995 Number	1996 Number	Change 1995 to 1996 Percent
Total Facilities	1,271	1,233	-3.0
Total Forms	3,332	3,121	-6.3
Form Rs	3,231	3,031	-6.2
Form As	101	90	-10.9
	Pounds	Pounds	Percent
<u>On-site Releases</u>			
Total Air Emissions	29,526,026	23,753,157	-19.6
Fugitive Air	7,617,276	6,351,489	-16.6
Point Source Air	21,908,750	17,401,668	-20.6
Surface Water Discharges	506,027	1,462,615	189.0
Underground Injection	5	27	440.0
On-site Land Releases	360,363	436,320	21.1
Total On-site Releases	30,392,421	25,652,119	-15.6
<u>Off-site Releases</u>			
Transfers Off-site to Disposal	10,063,276	16,113,258	60.1
Total On- and Off-site Releases	40,455,697	41,765,377	3.2
<u>Other On-site Waste Management</u>			
Recycled On-site	99,843,391	148,298,966	48.5
Energy Recovery On-site	10,495,234	11,424,647	8.9
Treated On-site	101,176,929	78,313,464	-22.6
Total Other On-site Waste Management	211,515,554	238,037,077	12.5
<u>Transfers Off-site for Further Waste Management</u>			
Transfers to Recycling	380,005,358	345,621,345	-9.0
Transfers to Energy Recovery	10,500,554	8,084,043	-23.0
Transfers to Treatment	9,026,805	7,294,538	-19.2
Transfers to POTWs	11,589,298	10,998,130	-5.1
Other Off-site Transfers	10,758	694,794	6,358.4
Total Transfers Off-site for Further Waste Management	411,132,773	372,692,850	-9.3

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required in 1995. Other Off-site Transfers are transfers reported without a valid waste management code.



### Other On-site Waste Management

Table 9-12 also gives 1995-1996 data for on-site waste management. On-site recycling increased by 48.5 million pounds, which was 48.5%, more than twice the decrease in on-site treatment of 22.9 million pounds, or 22.6%. The increase in on-site recycling arose largely from an increase of 46.1 million pounds of lead compounds, reported in storage battery manufacturing (SIC code 3691).

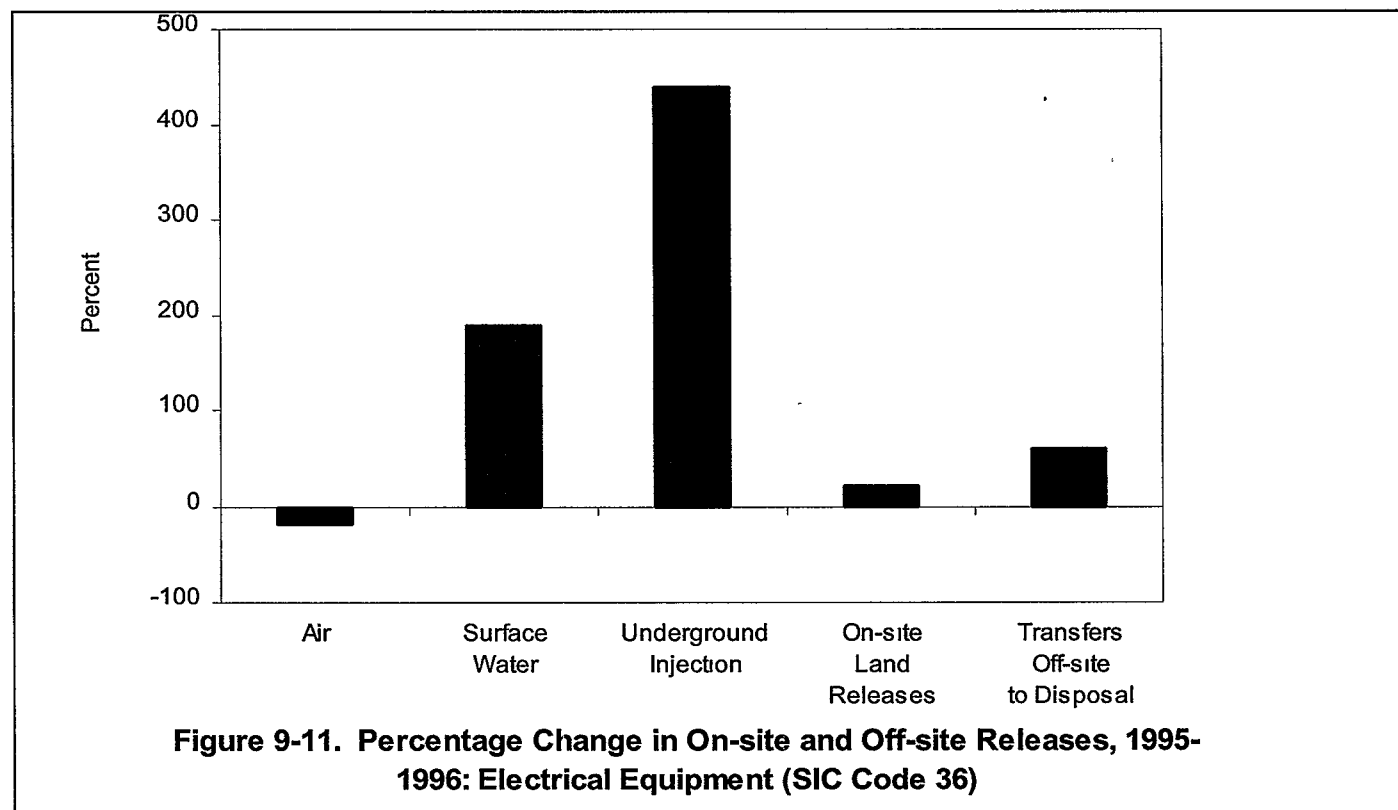
Energy recovery, the smallest waste management option in reporting in the electrical equipment sector, increased 929,000 pounds, or 8.9%. Overall, on-site waste management in this sector showed a 26.5-million-pound increase, or 12.5%.

### Transfers Off-site for Further Waste Management

All types of transfers off-site for further waste management (except those with invalid codes)

decreased from 1995 to 1996 in the electrical equipment sector. These data also appear on Table 9-12. The largest reduction in pounds occurred in reported transfers to recycling—34.4 million pounds. This was a 9.0% reduction. The largest reduction in off-site transfers to recycling was in reporting of lead in the storage battery industry (SIC code 3691). As seen in the descriptions of facilities with large increases and decreases, later in this chapter, these were not the same facilities as reported increases in on-site recycling of lead compounds, mentioned above.

Transfers to energy recovery decreased by 2.4 million pounds (23.0%) and transfers to treatment by 1.7 million pounds (19.2%). The smallest decrease was reported in transfers to POTWs, 591,000 pounds or 5.1%. The overall reduction in transfers off-site for further waste management was 38.4 million pounds, or 9.3%.



**Note** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required in 1995



## 1988-1996 TRI Data for Electrical Equipment

As explained in Chapter 3, comparisons from the 1988 TRI baseline year to the current year rely on the list of “core” TRI chemicals that were reportable, with the same reporting definition, in all years. These multi-year comparisons also review only the data elements that were collected in all years, which excludes from this section any analysis that distinguishes RCRA subtitle C landfills from other land releases as well as analysis based on the types of underground injection wells. On-site waste management data and transfers off-site to recycling and to energy recovery have been collected only since 1991; these data are included, but cannot be compared across the full 1988-1996 period.

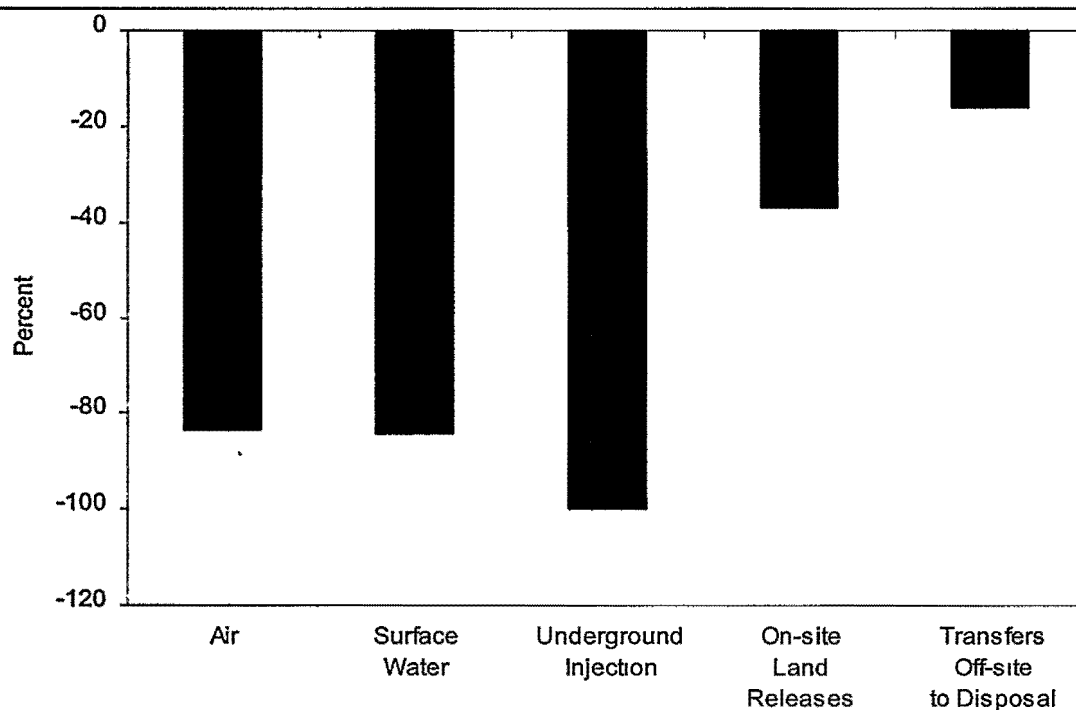
The number of forms reporting electrical equipment SIC codes dropped 37.6% from 1988 to 1996, as

presented in Table 9-13. On- and off-site releases of the 1988-1996 “core” chemicals decreased by 74.6%, or 99.0 million pounds, and decreases occurred in all release media, as shown in Figure 9-12. Reductions were 16.2% in off-site releases (transfers to disposal) and 37.0% in on-site land releases. In all other release types, the percentage decrease was more than 80%.

Other on-site waste management activities show increases and off-site transfers to recycling and energy recovery show decreases from 1994 to 1996. These data were not collected in 1988.

For the full comparison period, 1988 to 1996, transfers to treatment decreased two thirds (66.7%, or 11.3 million pounds), and transfers to POTWs by half (48.1%, or 2.5 million pounds).

As noted earlier in this chapter, production in this sector nearly doubled from 1988 to 1996, rising



**Figure 9-12. Percentage Change in On-site and Off-site Releases, 1988-1996: Electrical Equipment (SIC Code 36)**

**Note:** Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from section 5 of Form R and Off-site Releases from section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required before 1996.

**Table 9-13. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1988 and 1994-1996: Electrical Equipment, SIC Code 36**

	1988 Number	1994 Number	1995 Number	1996 Number	Change 1988 to 1996 Percent
Total Facilities	1,634	1,213	1,157	1,147	-29.8
Total Forms	4,047	2,688	2,586	2,524	-37.6
Form Rs	4,047	2,688	2,511	2,465	-39.1
Form As	NA	NA	75	59	NA
	Pounds	Pounds	Pounds	Pounds	Percent
<u>On-site Releases</u>					
Total Air Emissions	114,527,670	28,729,995	23,256,608	18,866,942	-83.5
Fugitive Air	34,327,953	6,067,827	5,265,968	4,501,128	-86.9
Point Source Air	80,199,717	22,662,168	17,990,640	14,365,814	-82.1
Surface Water Discharges	309,962	54,944	47,383	48,491	-84.4
Underground Injection	36,999	0	5	27	-99.9
On-site Land Releases	587,728	153,909	333,628	370,532	-37.0
Total On-site Land Releases	115,462,359	28,938,848	23,637,624	19,285,992	-83.3
<u>Off-site Releases</u>					
Transfers Off-site to Disposal	17,256,677	7,732,906	7,819,505	14,467,045	-16.2
Total On- and Off-site Releases	132,719,036	36,671,754	31,457,129	33,753,037	-74.6
<u>Other On-site Waste Management</u>					
Recycled On-site	NA	96,159,323	97,970,855	145,834,353	NA
Energy Recovery On-site	NA	2,073,744	2,191,839	2,026,264	NA
Treated On-site	NA	47,183,395	51,213,177	51,682,275	NA
Other On-site Waste Management	NA	145,416,462	151,375,871	199,542,892	NA
<u>Transfers Off-site for Further Waste Management</u>					
Transfers to Recycling	NA	346,513,941	369,640,348	335,785,441	NA
Transfers to Energy Recovery	NA	9,301,907	9,342,647	7,046,203	NA
Transfers to Treatment	16,894,091	7,156,203	6,379,829	5,617,617	-66.7
Transfers to POTWs	5,297,962	2,523,844	2,713,929	2,750,887	-48.1
Other Off-site Transfers	1,314,257	13,837	10,758	586,488	-55.4
Total Transfers Off-site for Further Waste Management	NA	365,509,732	388,087,511	351,786,636	NA

**Note:** Does not include delisted chemicals, chemicals added in 1990, 1991, 1994, and 1995, and aluminum oxide, ammonia, hydrochloric acid, and sulfuric acid. **On-site Releases** from Section 5 of Form R and **Off-site Releases** from Section 6 (transfers off-site to disposal) of Form R. **Other On-site Waste Management** from Section 8 of Form R. **Transfers Off-site for Further Waste Management** from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required before 1996. For 1994-1996, Other Off-site Transfers are transfers reported without a valid waste management code. For 1988, Other Off-site Transfers are transfers reported without a valid waste management code or codes not required to be reported in 1988. NA: not required to be reported in that year.

90.3% in that period; employment, declining in the late 1980s, has also grown. TRI facilities report absolute amounts of waste managed and of environmental releases, not adjusted for changes in production levels. Even with rapid growth in production in this sector, however, all categories of

releases have been decreasing. One factor is the decrease in ozone-depleting chemicals, as the United States moved to ban their production in accordance with the Montreal Protocol. Production of 1,1,1-trichloroethane, for example, was banned effective January 1, 1996. As described below, one





facility with large decreases in releases since 1988 stopped using this chemical in 1992. Other facilities with large decreases also made process and equipment changes to eliminate or reduce use of TRI chemicals.

### ***1988-1996 Data for Four-Digit Industries in Electrical Equipment***

Tables 9-14 through 9-16, summarize on- and off-site releases, other on-site waste management, and transfers off-site for further waste management for 1988 and 1994-1996 for industries at the four-digit SIC code level within SIC code 36.

#### **On- and Off-site Releases**

The largest reduction in on- and off-site releases for 1988-1996 was reported in the miscellaneous electronic components industry (SIC code 3679). This was a decrease of 31.8 million pounds or 97.3%. Air emissions in this industry totaled 31.3 million pounds in 1988 and 517,000 pounds in 1996; at the same time, off-site releases (transfers to disposal) decreased from 1.4 million pounds to 332,000 pounds. The second largest reduction occurred in forms reporting multiple codes in SIC code 36. This was a reduction of 12.3 million pounds, or 85.5%. Most of the change for multiple codes occurred in air emissions (from 12.3 million pounds to 1.7 million pounds), followed by off-site transfers (1.7 million pounds to 408,000 pounds).

The miscellaneous electronic components industry (SIC code 3679) reported reductions in releases of 12.0 million pounds of methyl ethyl ketone, 5.3 million pounds of toluene, and 3.8 million pounds of dichloromethane. In this same industry, reductions of two ozone-depleting chemicals were 3.5 million pounds of Freon 113 and 2.5 million pounds of 1,1,1-trichloroethane. The only larger reported decrease of an ozone-depleting chemical was that of the forms reporting multiple SIC codes in the electrical equipment sector: 3.2 million pounds of 1,1,1-trichloroethane.

Although the sector overall showed large decreases, three industries recorded increases from 1988 to 1996. The largest was reported in manufacturing of printed circuit boards (SIC code 3672), 2.5 million pounds or 47.5%. Smaller increases were reported in manufacture of primary batteries, dry and wet (484,000 pounds, or 23.5%; SIC code 3692) and magnetic and optical recording media (214,000 pounds, or 17.9%; SIC code 3695). All other industries had net decreases.

Table 9-14 supplies on- and off-site release data for all four-digit SIC codes in the electrical equipment sector.

#### **Other On-site Waste Management**

Three electrical equipment industries reported decreases of more than 1 million pounds in other on-site waste management from 1994 to 1996. (These data were not collected in 1988.) They were electronic capacitors (SIC code 3675), with a 2.6-million-pound reduction, or 38.3%; residential lighting fixtures (SIC code 3645), with 1.4 million pounds, or 49.6%; and miscellaneous electronic components (SIC code 3679), with 1.0 million pounds, or 20.7%. These were decreases in on-site recycling and/or on-site treatment.

By far the largest increase was reported in manufacturing of storage batteries (SIC code 3691). This was an increase of 38.1 million pounds or 58.0%. This increase occurred in on-site recycling. The next largest increase was 5.1 million pounds for manufacture of primary batteries, dry and wet (SIC code 3692), an increase of 107.3%, which reflected increases in on-site recycling and on-site treatment.

On-site waste management data for industries in SIC code 36 appear in Table 9-15.

#### **Transfers Off-site for Further Waste Management**

Table 9-16 presents data on transfers off-site for further waste management, for the 1988-1996 period, for four-digit SIC codes in SIC code 36.

Table 9-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36

SIC Code	Industry	Year	On-site Releases				Off-site Releases		Total On- and Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
3612	Transformers, Except Electronic	96	1,032,444	19	0	9,457	1,041,920	246,650	1,288,570
		95	1,092,601	31	0	6,005	1,098,637	118,098	1,216,735
		94	974,330	226	0	6,071	980,627	294,244	1,274,871
		88	2,540,195	3	0	250	2,540,448	469,894	3,010,342
3613	Switchgear & Switchboard Apparatus	96	116,583	4,895	0	506	121,984	40,840	162,824
		95	165,447	2,848	0	10	168,305	38,215	206,520
		94	268,662	3,696	0	1,255	273,613	13,948	287,561
		88	1,103,264	10,076	0	0	1,113,340	297,104	1,410,444
3621	Motors & Generators	96	2,408,579	113	5	3,462	2,412,159	98,778	2,510,937
		95	2,580,307	143	0	49,835	2,630,285	112,559	2,742,844
		94	3,154,781	139	0	2,169	3,157,089	77,208	3,234,297
		88	5,900,349	1,020	0	1,563	5,902,932	567,069	6,470,001
3624	Carbon & Graphite Products	96	328,576	258	0	5	328,839	11,225	340,064
		95	215,309	256	0	715	216,280	6,807	223,087
		94	90,182	256	0	21,208	111,646	29,928	141,574
		88	603,714	1,038	0	750	605,502	134,344	739,846
3625	Relays & Industrial Controls	96	50,368	10	0	0	50,378	4,588	54,966
		95	53,328	20	0	0	53,348	2,775	56,123
		94	90,177	270	0	0	90,447	3,169	93,616
		88	619,180	510	0	684	620,374	47,932	668,306
3629	Electrical Industrial Apparatus, nec*	96	93,486	421	0	10	93,917	62,649	156,566
		95	47,947	194	0	0	48,141	61,645	109,786
		94	109,079	297	0	0	109,376	17,397	126,773
		88	642,290	314	0	0	642,604	208,795	851,399
3631	Household Cooking Equipment	96	80,830	268	0	0	81,098	69,869	150,967
		95	228,518	254	0	0	228,772	47,369	276,141
		94	1,017,589	5	0	0	1,017,594	80,081	1,097,675
		88	1,062,677	500	0	0	1,063,177	97,831	1,161,008
3632	Household Refrigerators & Freezers	96	1,084,455	0	0	0	1,084,455	4,900	1,089,355
		95	1,989,246	0	0	0	1,989,246	7,140	1,996,386
		94	2,136,246	0	0	0	2,136,246	5,273	2,141,519
		88	5,044,610	790	0	500	5,045,900	37,518	5,083,418
3633	Household Laundry Equipment	96	1,626,116	411	0	98,688	1,725,215	161,947	1,887,162
		95	2,011,979	505	0	85,321	2,097,805	115,690	2,213,495
		94	1,941,740	198	0	0	1,941,938	121,759	2,063,697
		88	2,375,306	1,236	0	948	2,377,490	990,450	3,367,940
3634	Electric Housewares & Fans	96	555,621	110	0	760	556,491	1,250	557,741
		95	568,829	60	0	10	568,899	6,735	575,634
		94	542,669	120	0	0	542,789	11,888	554,677
		88	945,962	167	0	0	946,129	219,916	1,166,045
3635	Household Vacuum Cleaners	96	17,255	0	0	0	17,255	500	17,755
		95	31,200	0	0	0	31,200	750	31,950
		94	70,719	0	0	0	70,719	1,250	71,969
		88	122,350	0	0	0	122,350	0	122,350
3639	Household Appliances, nec*	96	604,044	259	0	0	604,303	205,107	809,410
		95	529,684	5	0	0	529,689	59,295	588,984
		94	827,029	5	0	0	827,034	49,500	876,534
		88	1,420,752	0	0	0	1,420,752	98,900	1,519,652

Note On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category

\*nec: not elsewhere classified



# Chapter 9 – TRI Data for Electrical Equipment

**Table 9-14 . TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued**

SIC Code	Industry	Year	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 Pounds	Releases to Land Pounds		Transfers Off-site to Disposal Pounds	
3641	Electric Lamps	96	2,362,734	2	0	0	2,362,736	607,775	2,970,511
		95	2,768,629	1	0	0	2,768,630	712,037	3,480,667
		94	2,607,271	4	0	0	2,607,275	542,353	3,149,628
		88	2,586,244	252	0	0	2,586,496	987,998	3,574,494
3643	Current-carrying Wiring Devices	96	143,164	505	0	361	144,030	233,140	377,170
		95	336,882	250	0	1,420	338,552	317,699	656,251
		94	374,038	5	0	520	374,563	220,595	595,158
		88	1,236,848	4	0	57,948	1,294,800	221,824	1,516,624
3644	Noncurrent-carrying Wiring Devices	96	298,675	18	0	600	299,293	7,100	306,393
		95	369,291	16	0	1,200	370,507	69,894	440,401
		94	447,411	5	0	2,000	449,416	163,250	612,666
		88	1,822,413	1,500	0	340	1,824,253	209,363	2,033,616
3645	Residential Lighting Fixtures	96	153,711	0	0	0	153,711	5,900	159,611
		95	193,305	0	0	0	193,305	9,900	203,205
		94	299,153	0	0	0	299,153	11,150	310,303
		88	526,165	69	0	0	526,234	12,787	539,021
3646	Commercial Lighting Fixtures	96	227,393	0	0	0	227,393	250	227,643
		95	326,421	0	0	0	326,421	500	326,921
		94	439,603	0	0	0	439,603	0	439,603
		88	605,259	0	0	0	605,259	46,062	651,321
3647	Vehicular Lighting Equipment	96	65,519	0	0	0	65,519	16,754	82,273
		95	197,214	15	0	0	197,229	18,724	215,953
		94	413,238	15	0	0	413,253	18,576	431,829
		88	511,911	22	0	0	511,933	108,087	620,020
3648	Lighting Equipment, nec*	96	31,858	2,030	0	0	33,888	59,300	93,188
		95	26,890	500	0	0	27,390	52,867	80,257
		94	56,248	505	0	5	56,758	64,734	121,492
		88	213,393	0	0	0	213,393	250	213,643
3651	Household Audio & Video Equipment	96	320,881	250	0	0	321,131	2,604	323,735
		95	276,023	250	0	0	276,273	3,574	279,847
		94	681,368	250	0	0	681,618	2,866	684,484
		88	1,127,888	500	0	0	1,128,388	179,630	1,308,018
3652	Prerecorded Records & Tapes	96	5,479	0	0	10	5,489	5,081	10,570
		95	11,837	0	0	0	11,837	11	11,848
		94	94,489	0	0	0	94,489	11	94,500
		88	105,446	0	0	0	105,446	6,983	112,429
3661	Telephone & Telegraph Apparatus	96	122,372	5	0	0	122,377	4,006	126,383
		95	125,422	1	0	0	125,423	616	126,039
		94	158,195	1	0	0	158,196	463	158,659
		88	5,179,394	4,186	0	0	5,183,580	160,892	5,344,472
3663	Radio & TV Communications Equipment	96	10,580	0	0	255	10,835	5	10,840
		95	29,465	0	0	5	29,470	0	29,470
		94	82,757	0	0	5	82,762	3,900	86,662
		88	687,045	1	0	250	687,296	19,631	706,927
3669	Communications Equipment, nec*	96	28,676	0	0	0	28,676	7,248	35,924
		95	88,642	0	0	0	88,642	3,832	92,474
		94	172,329	2	0	0	172,331	5,047	177,378
		88	1,055,561	0	0	0	1,055,561	48,931	1,104,492

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category

\*nec: not elsewhere classified.



**Table 9-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued**

SIC Code	Industry	Year	On-site Releases				Off-site Releases		Total On- and Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
3671	Electron Tubes	96	342,577	4,636	0	5	347,218	331,828	679,046
		95	887,629	3,529	0	0	891,158	870,176	1,761,334
		94	1,670,238	6,418	0	0	1,676,656	1,376,579	3,053,235
		88	1,235,312	4,850	0	0	1,240,162	619,788	1,859,950
3672	Printed Circuit Boards	96	498,264	14,909	10	4,487	517,670	7,133,555	7,651,225
		95	454,263	9,678	0	15,571	479,512	636,779	1,116,291
		94	637,708	8,528	0	48,251	694,487	503,891	1,198,378
		88	3,033,962	1,475	0	0	3,035,437	2,151,232	5,186,669
3674	Semiconductors & Related Devices	96	809,320	7,708	12	28,706	845,746	613,912	1,459,658
		95	829,321	9,707	5	12,010	851,043	471,308	1,322,351
		94	1,119,864	14,896	0	15,250	1,150,010	713,761	1,863,771
		88	6,097,631	30,025	36,749	500	6,164,905	1,099,248	7,264,153
3675	Electronic Capacitors	96	873,970	1,270	0	37,448	912,688	638,487	1,551,175
		95	1,484,227	1,682	0	2,266	1,488,175	653,543	2,141,718
		94	1,765,353	2,080	0	10,820	1,778,253	578,618	2,356,871
		88	4,013,553	165,166	0	66,590	4,245,309	1,077,784	5,323,093
3676	Electronic Resistors	96	41,453	0	0	0	41,453	38,479	79,932
		95	159,982	0	0	0	159,982	18,499	178,481
		94	264,378	0	0	0	264,378	8,544	272,922
		88	1,452,771	0	0	250	1,453,021	16,388	1,469,409
3677	Electronic Coils & Transformers	96	120,729	5	0	0	120,734	1,750	122,484
		95	138,843	1	0	250	139,094	1,500	140,594
		94	97,088	1	0	251	97,340	10,575	107,915
		88	267,968	0	0	0	267,968	6,320	274,288
3678	Electronic Connectors	96	153,904	75	0	2,025	156,004	26,446	182,450
		95	278,037	88	0	4,640	282,765	34,150	316,915
		94	337,142	338	0	8,650	346,130	42,471	388,601
		88	2,179,847	850	0	250	2,180,947	110,048	2,290,995
3679	Electronic Components, nec*	96	516,758	275	0	18,230	535,263	332,226	867,489
		95	815,653	108	0	115	815,876	248,913	1,064,789
		94	993,152	227	0	2,306	995,685	291,483	1,287,168
		88	31,276,241	16,139	0	11,020	31,303,400	1,372,209	32,675,609
3691	Storage Batteries	96	143,291	3,191	0	67,486	213,968	577,262	791,230
		95	129,859	2,518	0	126,374	258,751	823,725	1,082,476
		94	129,856	3,781	0	260	133,897	250,450	384,347
		88	684,391	5,713	0	19,590	709,694	1,059,371	1,769,065
3692	Primary Batteries, Dry & Wet	96	333,129	224	0	0	333,353	2,210,035	2,543,388
		95	401,190	175	0	45	401,410	1,467,033	1,868,443
		94	384,430	185	0	35	384,650	1,467,952	1,852,602
		88	1,122,297	87	0	0	1,122,384	936,965	2,059,349
3694	Engine Electrical Equipment	96	175,118	0	0	68,693	243,811	105,717	349,528
		95	246,065	0	0	167	246,232	90,341	336,573
		94	248,699	0	0	158	248,857	107,292	356,149
		88	2,159,811	1	0	7,737	2,167,549	570,180	2,737,729
3695	Magnetic & Optical Recording Media	96	1,236,187	1,000	0	26,818	1,264,005	139,443	1,403,448
		95	1,417,216	3,905	0	24,649	1,445,770	202,482	1,648,252
		94	1,675,427	255	0	33,100	1,708,782	192,902	1,901,684
		88	1,114,752	750	0	0	1,115,502	74,435	1,189,937

Note On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



Table 9-14. TRI On-site and Off-site Releases by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued

SIC Code	Industry	Year	On-site Releases				Off-site Releases		Total On- and Off-site Releases Pounds
			Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	Releases to Land Pounds	Total On-site Releases Pounds	Transfers Off-site to Disposal Pounds	
3699	Electrical Equipment & Supplies, nec*	96	138,250	582	0	2,010	140,842	51,675	192,517
		95	171,487	550	0	3,010	175,047	58,327	233,374
		94	292,497	795	0	1,260	294,552	64,200	358,752
		88	1,732,072	13,595	0	250	1,745,917	245,564	1,991,481
	Multiple within SIC Code 36	96	1,666,709	5,042	0	510	1,672,261	408,014	2,080,275
		95	1,464,316	10,076	0	10	1,474,402	473,668	1,948,070
		94	1,940,660	11,167	0	265	1,952,092	376,956	2,329,048
		88	12,276,889	8,411	0	418,058	12,703,358	1,677,000	14,380,358
	Invalid SIC Code within SIC 36	96	47,884	0	0	0	47,884	750	48,634
		95	114,104	17	0	0	114,121	2,329	116,450
		94	124,200	274	0	70	124,544	8,642	133,186
		88	7,841,957	40,712	250	250	7,883,169	1,067,954	8,951,123
	Total for SIC Code 36	96	18,866,942	48,491	27	370,532	19,285,992	14,467,045	33,753,037
		95	23,256,608	47,383	5	333,628	23,637,624	7,819,505	31,457,129
		94	28,729,995	54,944	0	153,909	28,938,848	7,732,906	36,671,754
		88	114,527,670	309,962	36,999	587,728	115,462,359	17,256,677	132,719,036

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

(Some transfer types were not collected prior to 1991.) The largest decrease from 1994-1996 appeared in manufacture of storage batteries (SIC code 3691), a 13.9-million-pound reduction (5.7%). This was primarily a reduction in off-site recycling. The telephone and telegraph apparatus industry (SIC code 3661) had a decrease of 3.3 million pounds or 91.6%. On-site recycling also accounted for the largest portion of this reduction. Three other industries had decreases of more than 1 million pounds: miscellaneous electronic components (SIC code 3679), 1.8 million pounds or 23.3%; engine electrical equipment (SIC code 3694), 1.7 million pounds or 54.4%; semiconductors (SIC code 3674), 1.4 million pounds or 20.8%

The largest increase in transfers off-site for further waste management was reported in the printed circuit board industry (SIC code 3672), and this was 2.8 million pounds, or 12.6%. An increase in this industry in off-site recycling more than offset smaller reductions other off-site transfer types. Five industries reported increases of 1.5 million to 2.0

million pounds: electron tubes (SIC code 3671), 2.0 million pounds; miscellaneous communications equipment (SIC code 3669), 1.8 million pounds; miscellaneous lighting equipment (SIC code 3648), 1.8 million pounds; the multiple-SIC-code category, 1.8 million pounds; and electronic connectors (SIC code 3678), 1.5 million pounds.

#### Facilities with Large Increases and Decreases in Releases, 1988-1996

The facility with the largest increases in on- and off-site releases for 1988 to 1996, Duracell USA in Lancaster, South Carolina (SIC code 3692), reported an increase of zinc compounds and manganese compounds totaling 587,000 pounds. The Duracell plant manufactures AA and AAA alkaline batteries. Zinc and manganese are the primary electrolytic components of alkaline batteries. Duracell attributes the increases to significant increases in production. The net increase for the facility between 1991 and 1996 was 559,000 pounds.



**Table 9-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36**

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
3612	Transformers, Except Electronic	96	63,568	0	276,040	339,608
		95	63,518	0	138,421	201,939
		94	40,810	0	195,563	236,373
		88	NA	NA	NA	NA
3613	Switchgear & Switchboard Apparatus	96	0	0	259,795	259,795
		95	0	0	406,774	406,774
		94	11,900	0	397,486	409,386
		88	NA	NA	NA	NA
3621	Motors & Generators	96	168,540	0	467,659	636,199
		95	176,079	0	257,677	433,756
		94	191,108	0	327,835	518,943
		88	NA	NA	NA	NA
3624	Carbon & Graphite Products	96	7,550	0	1,962,834	1,970,384
		95	6,700	0	1,009,100	1,015,800
		94	5,600	0	1,438,000	1,443,600
		88	NA	NA	NA	NA
3625	Relays & Industrial Controls	96	0	0	24,624	24,624
		95	1,000	0	13,075	14,075
		94	1,500	0	45,745	47,245
		88	NA	NA	NA	NA
3629	Electrical Industrial Apparatus, nec*	96	1,816	666	0	2,482
		95	0	0	2,492	2,492
		94	23,530	0	12,180	35,710
		88	NA	NA	NA	NA
3631	Household Cooking Equipment	96	4,040	0	2	4,042
		95	9,500	0	2	9,502
		94	7,300	0	0	7,300
		88	NA	NA	NA	NA
3632	Household Refrigerators & Freezers	96	16,000	0	122,190	138,190
		95	539,580	0	127,143	666,723
		94	465,000	0	0	465,000
		88	NA	NA	NA	NA
3633	Household Laundry Equipment	96	140,253	0	425,633	565,886
		95	227,108	0	480,821	707,929
		94	230,212	0	448,620	678,832
		88	NA	NA	NA	NA
3634	Electric Housewares & Fans	96	0	0	70,000	70,000
		95	0	0	48,000	48,000
		94	0	0	102,440	102,440
		88	NA	NA	NA	NA
3635	Household Vacuum Cleaners	96	206	0	0	206
		95	838	0	0	838
		94	5,062	0	0	5,062
		88	NA	NA	NA	NA
3639	Household Appliances, nec*	96	112,750	42,000	105,600	260,350
		95	121,931	0	0	121,931
		94	119,500	0	1,600	121,100
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified



Table 9-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
3641	Electric Lamps	96	371,942	0	799,381	1,171,323
		95	104,048	0	490,066	594,114
		94	201,611	0	595,228	796,839
		88	NA	NA	NA	NA
3643	Current-carrying Wiring Devices	96	2,481,048	0	203,841	2,684,889
		95	1,487,977	0	60,854	1,548,831
		94	1,045,082	0	228,541	1,273,623
		88	NA	NA	NA	NA
3644	Noncurrent-carrying Wiring Devices	96	3,655,373	37,895	426,709	4,119,977
		95	3,343,886	31,066	392,319	3,767,271
		94	81,573	16,423	330,734	428,730
		88	NA	NA	NA	NA
3645	Residential Lighting Fixtures	96	1,472,680	0	0	1,472,680
		95	2,337,476	0	0	2,337,476
		94	2,922,282	0	0	2,922,282
		88	NA	NA	NA	NA
3646	Commercial Lighting Fixtures	96	0	0	168,917	168,917
		95	0	0	184,506	184,506
		94	7,958	0	110,437	118,395
		88	NA	NA	NA	NA
3647	Vehicular Lighting Equipment	96	0	0	46,000	46,000
		95	18,197	0	46,000	64,197
		94	33,737	0	37,485	71,222
		88	NA	NA	NA	NA
3648	Lighting Equipment, nec*	96	0	0	76,000	76,000
		95	0	0	58,000	58,000
		94	0	0	0	0
		88	NA	NA	NA	NA
3651	Household Audio & Video Equipment	96	63,458	0	0	63,458
		95	125,771	0	36,000	161,771
		94	93,980	0	70,800	164,780
		88	NA	NA	NA	NA
3652	Prerecorded Records & Tapes	96	0	0	527	527
		95	0	0	639	639
		94	0	0	10,784	10,784
		88	NA	NA	NA	NA
3661	Telephone & Telegraph Apparatus	96	0	0	0	0
		95	495	0	0	495
		94	32,234	0	0	32,234
		88	NA	NA	NA	NA
3663	Radio & TV Communications Equipment	96	116,171	0	0	116,171
		95	56,976	0	0	56,976
		94	71,437	0	0	71,437
		88	NA	NA	NA	NA
3669	Communications Equipment, nec*	96	28,388	0	310	28,698
		95	40,796	0	260	41,056
		94	199,478	0	15,007	214,485
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



**Table 9-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued**

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
3671	Electron Tubes	96	3,264,095	0	4,636,398	7,900,493
		95	5,316,048	0	3,163,795	8,479,843
		94	2,139,252	0	1,864,807	4,004,059
		88	NA	NA	NA	NA
3672	Printed Circuit Boards	96	1,889,041	614,656	4,018,166	6,521,863
		95	112,494	438,057	3,081,769	3,632,320
		94	953,082	297,084	5,495,759	6,745,925
		88	NA	NA	NA	NA
3674	Semiconductors & Related Devices	96	448,850	81,600	21,448,053	21,978,503
		95	398,600	598,000	20,207,926	21,204,526
		94	291,563	431,804	16,551,542	17,274,909
		88	NA	NA	NA	NA
3675	Electronic Capacitors	96	1,634,437	0	2,535,839	4,170,276
		95	1,155,140	0	5,717,687	6,872,827
		94	1,260,555	0	5,499,504	6,760,059
		88	NA	NA	NA	NA
3676	Electronic Resistors	96	43,797	0	32,000	75,797
		95	160,360	0	0	160,360
		94	170,840	0	0	170,840
		88	NA	NA	NA	NA
3677	Electronic Coils & Transformers	96	8,624	0	0	8,624
		95	8,000	0	0	8,000
		94	3,000	0	0	3,000
		88	NA	NA	NA	NA
3678	Electronic Connectors	96	101,608	0	1,017,609	1,119,217
		95	112,759	0	976,721	1,089,480
		94	103,820	0	872,028	975,848
		88	NA	NA	NA	NA
3679	Electronic Components, nec*	96	1,116,486	1,249,447	1,633,781	3,999,714
		95	1,370,828	1,083,416	1,450,610	3,904,854
		94	1,567,718	1,289,703	2,186,473	5,043,894
		88	NA	NA	NA	NA
3691	Storage Batteries	96	103,783,022	0	165,873	103,948,895
		95	57,163,908	0	1,630,740	58,794,648
		94	65,108,048	0	700,224	65,808,272
		88	NA	NA	NA	NA
3692	Primary Batteries, Dry & Wet	96	9,567,891	0	329,452	9,897,343
		95	8,187,830	0	80,000	8,267,830
		94	4,772,958	0	810	4,773,768
		88	NA	NA	NA	NA
3694	Engine Electrical Equipment	96	242,400	0	17,829	260,229
		95	810,544	0	25,464	836,008
		94	981,882	0	8,725	990,607
		88	NA	NA	NA	NA

**Note:** Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category

\*nec: not elsewhere classified.





Table 9-15. TRI Other On-site Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued

SIC Code	Industry	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
3695	Magnetic & Optical Recording Media	96	14,062,691	0	7,515,655	21,578,346
		95	12,665,555	0	8,298,602	20,964,157
		94	12,285,166	0	7,694,313	19,979,479
		88	NA	NA	NA	NA
3699	Electrical Equipment & Supplies, nec*	96	13,063	0	757,807	770,870
		95	17,675	0	619,664	637,339
		94	70,580	0	577,600	648,180
		88	NA	NA	NA	NA
	Multiple within SIC Code 36	96	954,565	0	2,130,016	3,084,581
		95	1,829,238	41,300	2,197,288	4,067,826
		94	659,965	38,730	1,351,125	2,049,820
		88	NA	NA	NA	NA
	Invalid SIC Code within SIC 36	96	0	0	7,735	7,735
		95	0	0	10,762	10,762
		94	0	0	12,000	12,000
		88	NA	NA	NA	NA
	Total for SIC Code 36	96	145,834,353	2,026,264	51,682,275	199,542,892
		95	97,970,855	2,191,839	51,213,177	151,375,871
		94	96,159,323	2,073,744	47,183,395	145,416,462
		88	NA	NA	NA	NA

Note: Data from Section 8 of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

Increases in releases by SIC code 36 facilities are relatively small, compared to the other industry sectors presented in this *1996 TRI Public Data Release*. The second, third, and fourth facilities for increased releases in the electrical equipment sector reported an average increase of about 446,000 pounds.

3M in Hutchinson, Minnesota (SIC code 3679), ranked first in decreases of releases (14.2 million pounds) due in large part to reductions in the amount of methyl ethyl ketone (MEK) in point source air emissions. This facility manufactures sticky and magnetic tape. MEK is used as a solvent in the magnetic tape coating process. The reduction was achieved by installing carbon-bed type solvent recovery units that allow for the recovery and reuse of MEK, as well as the utilization of thermal oxidation.

Hadco Corporation in Derry, New Hampshire (SIC code 3679 in 1988), ranked second in decreases of releases with a net reduction of 2.3 million pounds. Hadco, a producer of printed wiring boards, reported a reduction of 1.9 million pounds (combined fugitive and point source air emissions) in dichloromethane (methylene chloride). The chemical was used as a cleaning agent in the manufacturing process. The facility reduced methylene chloride releases by installing activated carbon vapor recovery units and then wholly eliminated its use by substituting an aqueous cleaning solution. Hadco was a participant in EPA's Excellence in Leadership program, or Project XL. The project's goal is to "allow the EPA, state environmental agencies and regulated sources to develop and implement alternative strategies that replace or modify regulatory requirements, produce superior environmental performance, and promote



**Table 9-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36**

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
3612	Transformers, Except Electronic	96	5,721,472	104,576	3,588	871	0	5,830,507
		95	6,519,476	101,036	1,530	4,405	0	6,626,447
		94	6,066,543	101,976	13,516	1,794	0	6,183,829
		88	NA	NA	127,135	4,502	18,911	NA
3613	Switchgear & Switchboard Apparatus	96	8,139,717	2,323	40,723	64,932	0	8,247,695
		95	8,809,254	3,000	22,632	104,250	0	8,939,136
		94	8,594,021	3,499	59,824	150,630	0	8,807,974
		88	NA	NA	129,594	30,622	0	NA
3621	Motors & Generators	96	9,260,470	225,377	43,705	15,486	0	9,545,038
		95	9,089,006	229,205	40,644	70,310	0	9,429,165
		94	9,618,271	232,286	44,362	1,390	0	9,896,309
		88	NA	NA	344,488	6,066	287,389	NA
3624	Carbon & Graphite Products	96	201,050	13,280	2,990	601	0	217,921
		95	115,029	33,900	3,197	1,086	0	153,212
		94	220,187	25,260	2,964	1,114	0	249,525
		88	NA	NA	15,982	1,000	13,973	NA
3625	Relays & Industrial Controls	96	1,186,663	1,384	15,504	50	0	1,203,601
		95	890,447	0	13,950	274	0	904,671
		94	665,599	5,650	22,166	4,210	0	697,625
		88	NA	NA	44,348	7,666	0	NA
3629	Electrical Industrial Apparatus, nec*	96	1,243,891	100,907	6,553	12,346	0	1,363,697
		95	1,452,418	88,760	7,096	15	0	1,548,289
		94	1,355,252	77,043	1,228	10	0	1,433,533
		88	NA	NA	235,577	311	0	NA
3631	Household Cooking Equipment	96	246,086	750	2,000	2,860	0	251,696
		95	333,450	16,813	3,010	9,420	0	362,693
		94	235,960	114,761	8,900	8,019	0	367,640
		88	NA	NA	24,697	1,000	23,130	NA
3632	Household Refrigerators & Freezers	96	1,005,926	272,447	530	14,889	0	1,293,792
		95	862,751	298,413	4,778	1,419	0	1,167,361
		94	737,408	220,800	1,841	12,503	0	972,552
		88	NA	NA	801,758	125,023	1,210	NA
3633	Household Laundry Equipment	96	647,221	49,991	2,025	192,288	0	891,525
		95	786,494	100,432	2,899	131,500	0	1,021,325
		94	702,909	132,409	3,370	85,962	0	924,650
		88	NA	NA	476,033	83,363	250	NA
3634	Electric Housewares & Fans	96	486,293	2,444	0	3,200	0	491,937
		95	277,630	8,344	0	21,005	0	306,979
		94	280,100	8,439	0	32,090	0	320,629
		88	NA	NA	50,929	15,661	9,784	NA
3635	Household Vacuum Cleaners	96	48,100	0	250	5	0	48,355
		95	49,466	0	0	11	0	49,477
		94	46,000	0	14,880	15	0	60,895
		88	NA	NA	15,500	3,400	0	NA
3639	Household Appliances, nec*	96	389,451	47,750	2,970	1,755	0	441,926
		95	485,997	15,055	1,770	1,000	0	503,822
		94	490,828	7,522	2,129	755	0	501,234
		88	NA	NA	53,907	87,398	0	NA

**Note** Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified



## Chapter 9 – TRI Data for Electrical Equipment

**Table 9-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued**

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
3641	Electric Lamps	96	1,125,452	56,515	191,633	4,211	0	1,377,811
		95	1,352,351	70,145	243,992	2,347	0	1,668,835
		94	1,215,699	72,615	140,690	454	0	1,429,458
		88	NA	NA	153,212	26,809	145,860	NA
3643	Current-carrying Wiring Devices	96	2,895,782	0	33,316	11,296	4	2,940,398
		95	4,173,187	0	39,138	63,680	0	4,276,005
		94	3,770,883	0	35,710	79,547	0	3,886,140
		88	NA	NA	177,619	44,031	93,669	NA
3644	Noncurrent-carrying Wiring Devices	96	1,039,784	54,362	4,261	49,350	0	1,147,757
		95	985,199	66,249	3,153	829	0	1,055,430
		94	591,395	77,197	1,504	7,961	0	678,057
		88	NA	NA	166,735	8,142	94	NA
3645	Residential Lighting Fixtures	96	5,338	2,590	4,800	250	0	12,978
		95	5,110	750	4,800	505	0	11,165
		94	11,500	9,650	3,750	1,005	0	25,905
		88	NA	NA	39,589	1,000	0	NA
3646	Commercial Lighting Fixtures	96	19,677	10,515	2,530	750	0	33,472
		95	11,881	11,240	4,150	0	0	27,271
		94	1,100	4,269	1,650	0	0	7,019
		88	NA	NA	65,916	0	352	NA
3647	Vehicular Lighting Equipment	96	51,597	29,215	7,150	1,000	0	88,962
		95	68,302	24,450	10,070	1,265	0	104,087
		94	91,647	37,167	13,210	265	0	142,289
		88	NA	NA	53,314	77,476	750	NA
3648	Lighting Equipment, nec*	96	4,183,734	0	2,055	750	0	4,186,539
		95	3,567,875	0	1,250	250	0	3,569,375
		94	2,369,875	0	250	15	0	2,370,140
		88	NA	NA	50,000	817	0	NA
3651	Household Audio & Video Equipment	96	419,171	40,995	17,469	1,497	0	479,132
		95	740,290	37,302	17,065	17,363	0	812,020
		94	681,148	29,278	22,130	20,765	0	753,321
		88	NA	NA	160,610	182,700	8,000	NA
3652	Prerecorded Records & Tapes	96	88,397	3,707	715	284	0	93,103
		95	59,161	480	862	276	0	60,779
		94	69,833	445	1,512	285	0	72,075
		88	NA	NA	3,777	755	0	NA
3661	Telephone & Telegraph Apparatus	96	294,672	5,800	1	17	0	300,490
		95	2,991,074	591	6	83	0	2,991,754
		94	3,577,617	0	2,365	15,748	0	3,595,730
		88	NA	NA	219,059	210,319	0	NA
3663	Radio & TV Communications Equipment	96	17,463	0	500	0	0	17,963
		95	9,686	0	4,032	5	0	13,723
		94	167,775	250	6,387	305	0	174,717
		88	NA	NA	11,250	18	0	NA
3669	Communications Equipment, nec*	96	2,691,945	9,985	7,875	1,260	0	2,711,065
		95	1,845,751	10,413	39,562	1,755	0	1,897,481
		94	758,153	15,863	101,209	15,005	0	890,230
		88	NA	NA	132,064	27,591	0	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.



**Table 9-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued**

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
3671	Electron Tubes	96	6,419,546	277,142	357,620	138,779	0	7,193,087
		95	4,890,466	223,267	528,922	106,771	0	5,749,426
		94	3,985,905	97,110	967,716	172,033	0	5,222,764
		88	NA	NA	230,454	171,358	0	NA
3672	Printed Circuit Boards	96	21,313,781	1,558,887	1,180,153	648,451	48,228	24,749,500
		95	19,930,674	78,901	860,448	557,342	10,008	21,437,373
		94	17,553,901	2,548,298	1,446,880	436,657	0	21,985,736
		88	NA	NA	1,862,200	1,054,009	16,680	NA
3674	Semiconductors & Related Devices	96	895,619	2,449,368	1,031,589	1,055,726	0	5,432,302
		95	1,007,532	3,175,066	1,402,859	1,076,161	0	6,661,618
		94	1,188,983	3,207,714	1,485,020	966,940	13,832	6,862,489
		88	NA	NA	3,442,518	699,728	317,503	NA
3675	Electronic Capacitors	96	2,315,804	271,400	967,190	320,293	0	3,874,687
		95	2,603,302	363,785	1,403,824	320,041	0	4,690,952
		94	2,270,813	105,825	1,083,874	182,100	0	3,642,612
		88	NA	NA	899,073	351,141	125,924	NA
3676	Electronic Resistors	96	122,488	4,543	41,110	0	0	168,141
		95	216,881	17,300	14,224	0	0	248,405
		94	213,622	22,469	34,635	3	0	270,729
		88	NA	NA	237,733	3	84,646	NA
3677	Electronic Coils & Transformers	96	252,178	1,400	9,781	0	0	263,359
		95	571,950	10,224	11,901	0	0	594,075
		94	126,155	3,832	7,665	0	0	137,652
		88	NA	NA	32,027	0	71,799	NA
3678	Electronic Connectors	96	4,758,385	18,727	15,617	8,635	0	4,801,364
		95	5,364,519	49,790	4,717	6,538	0	5,425,564
		94	3,157,635	80,078	41,844	11,642	0	3,291,199
		88	NA	NA	304,723	94,662	750	NA
3679	Electronic Components, nec*	96	5,488,055	172,384	104,568	28,509	250	5,793,766
		95	6,475,888	163,773	99,557	72,560	750	6,812,528
		94	7,171,275	103,950	113,960	162,210	0	7,551,395
		88	NA	NA	2,421,331	827,062	35,015	NA
3691	Storage Batteries	96	227,476,604	20,344	1,051,662	2,580	0	228,551,190
		95	254,486,447	33,679	28,619	1,401	0	254,550,146
		94	242,362,170	21,126	61,117	1,825	0	242,446,238
		88	NA	NA	587,702	21,482	250	NA
3692	Primary Batteries, Dry & Wet	96	1,901,008	12,680	77,493	1,125	0	1,992,306
		95	3,698,528	5,895	138,514	502	0	3,843,439
		94	1,654,045	83,869	286,249	258	0	2,024,421
		88	NA	NA	235,855	440	0	NA
3694	Engine Electrical Equipment	96	1,371,739	18,689	11,270	2,090	0	1,403,788
		95	3,195,127	205,498	5,748	2,321	0	3,408,694
		94	3,045,622	12,853	18,329	939	0	3,077,743
		88	NA	NA	166,940	6,764	900	NA
3695	Magnetic & Optical Recording Media	96	277,653	952,735	127,440	3,327	0	1,361,155
		95	391,963	964,890	31,839	23,276	0	1,411,968
		94	503,432	1,500,145	31,498	93,037	0	2,128,112
		88	NA	NA	365,807	71,227	0	NA

Note Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified



Table 9-16. TRI Transfers Off-site for Further Waste Management by 4-digit SIC Code, 1988 and 1994-1996: Electrical Equipment, SIC Code 36, Continued

SIC Code	Industry	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
3699	Electrical Equipment & Supplies, nec*	96	1,749,593	250	4,083	1,508	0	1,755,434
		95	2,254,592	545	9,430	151	0	2,264,718
		94	2,514,616	3,070	13,140	277	0	2,531,103
		88	NA	NA	144,655	93,649	1,300	NA
	Multiple within SIC Code 36	96	20,004,515	252,741	244,898	159,906	538,006	21,200,066
		95	18,884,686	2,933,456	1,369,641	113,802	0	23,301,585
		94	18,009,035	335,189	1,010,779	56,037	5	19,411,045
		88	NA	NA	1,295,495	862,817	10,384	NA
	Invalid SIC Code within SIC 36	96	29,121	0	0	10	0	29,131
		95	186,508	0	0	10	0	186,518
		94	437,029	0	47,950	39	0	485,018
		88	NA	NA	1,114,485	97,950	45,734	NA
	Total for SIC Code 36	96	335,785,441	7,046,203	5,617,617	2,750,887	586,488	351,786,636
		95	369,640,348	9,342,647	6,379,829	2,713,929	10,758	388,087,511
		94	346,513,941	9,301,907	7,156,203	2,523,844	13,837	365,509,732
		88	NA	NA	16,894,091	5,297,962	1,314,257	NA

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Forms with more than one 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

\*nec: not elsewhere classified.

greater accountability to stakeholders. Under [Project XL], the EPA [allowed] Hadco to demonstrate that its metal-rich sludge can be safely reclaimed without all of the strict regulatory controls imposed by law and that the experiment will yield substantial economic and environmental benefits." (EPA Web site, <http://www.epa.gov/region01/pr/files/pr092997d.html>) Hadco attributes much of its reduction in releases to participation in Project XL.

The third facility for decreased releases was Lucent Technologies, Inc., in North Andover, Massachusetts (SIC code 3661 in 1988). A corporate mandate to eliminate ozone depleters and chlorinated solvents led to the facility's release reduction and eventual elimination of 1,1,1-trichloroethane by 1992. The chemical was used as a developer in a photo-lithography process to manufacture hybrid integrated circuits for telecommunications equipment. The facility had an overall reduction in releases of 1.7 million pounds between 1988 and 1996.

The Bureau of Engraving, Inc., in Minneapolis, Minnesota, was the fourth largest decreaser in releases (1.38 million pounds). In 1988, the facility reported exactly the same amounts of chloromethane (SIC code 3679 in 1988 and no code reported in 1996) and dichloromethane (SIC code 3675 in 1988 and no code reported in 1996). The facility said that the 1988 reporting for chloromethane was an error and may represent double-counting of reported amounts for dichloromethane. This facility manufactures printed circuit boards and stopped using dichloromethane (methylene chloride) in 1992. The chemical, used as a cleaning agent, was replaced with a pumice cleaning rinse.

Fifth for decreases was Whirlpool Corporation in Fort Smith, Arkansas (SIC code 3632) with a net reduction of 1.36 million pounds. The Whirlpool facility, which manufactures refrigerators, painted the steel refrigerator cabinets on site, resulting in large air emissions of toluene (used as a paint-thinning agent). Between 1988 and 1989, this



process was taken off-line and only pre-painted cabinets were received, resulting in a 764,000-pound decrease in air emissions of toluene from this facility.

### **Other Apparent Increases and Decreases in Releases, 1988-1996**

In the TRI database, there are other facilities with large apparent increases and decreases, which have been identified as reporting errors or plant closures. Because these are errors or plant closures and not actual changes in the data, these facilities are not discussed in detail here. There is one such facility in the electrical equipment sector:

Thomson Consumer Electronics, Dunmore, Pennsylvania, increase of 6.7 million pounds, reporting error.

### **1991-1996 Waste Management Data for Electrical Equipment**

Table 9-17 summarizes on- and off-site waste management data for the electrical equipment sector for 1991, when TRI began collecting this information, and the three most recent years (1994-1996). Total production-related waste decreased from 663.9 million pounds to 612.2 million pounds from 1991 to 1996, a decrease of 7.8%. During this period, on-site waste management decreased from 280.8 million pounds to 199.5 million pounds, or 28.9%. At the same time, off-site waste management increased from 312.6 million pounds to 386.2 million pounds (23.5%). In both cases, change in the quantities recycled was the largest factor. Reporting of quantities released decreased by two thirds (62.5%) over this period, from 70.5 million pounds to 26.4 million pounds.

Figure 9-13 shows the percentage changes for on- and off-site waste management types.

As production-related waste has increased in the electrical equipment sector's reporting to TRI in the more recent years, recycling on-site and off-site have also increased, while off-site treatment and

quantities released have continued to decline. These developments suggest some progress in improved waste management options, as called for in the waste management hierarchy (explained in Chapter 2). Several facilities attribute their large reported increases to production increases and to new production as operations came on-line, as described below. This is consistent with the remarkable level of growth in this sector, compared to U.S. manufacturing overall, as noted at the beginning of this chapter. At the same time, however, production decreases have also been cited to explain reductions in reported quantities.

### ***Facilities with Large Increases and Decreases in Waste Management, 1991-1996***

All five facilities for increases in production-related waste from 1991 to 1996 were lead storage battery manufacturers (SIC code 3691). Exide Corporation facilities ranked as the first (Salina, Kansas, 24.5 million pounds); third (Bristol, Tennessee, 15.2 million pounds); and fourth (Manchester, Iowa, 13.7 million pounds). The Salina facility increased on-site recycling of lead compounds by 22.0 million pounds. The increase is due to the installation of a "re-melt pot" used to recycled lead chips that are left over from the battery manufacturing process. The increase at the Bristol facility consisted of 15.1 million pounds of lead compounds. This facility, a new plant, did not go into production until 1994, and thus there were no data for the facility in comparison year 1991. The Manchester facility had an increase of 10.8 million pounds in on-site recycling and a 2.6-million-pound increase in off-site recycling. The increase is attributed to a substantial increase in production. An increase in the amount of lead sent to an off-site smelter for recycling also contributed to the reported increase in off-site recycling.

Johnson Controls Battery facilities are ranked second and fifth for increases in production-related waste. The number two facility is actually a warehouse (San Antonio, Texas, 19.6 million pounds) and was not operational until the summer of 1995. This warehouse stores used lead-acid

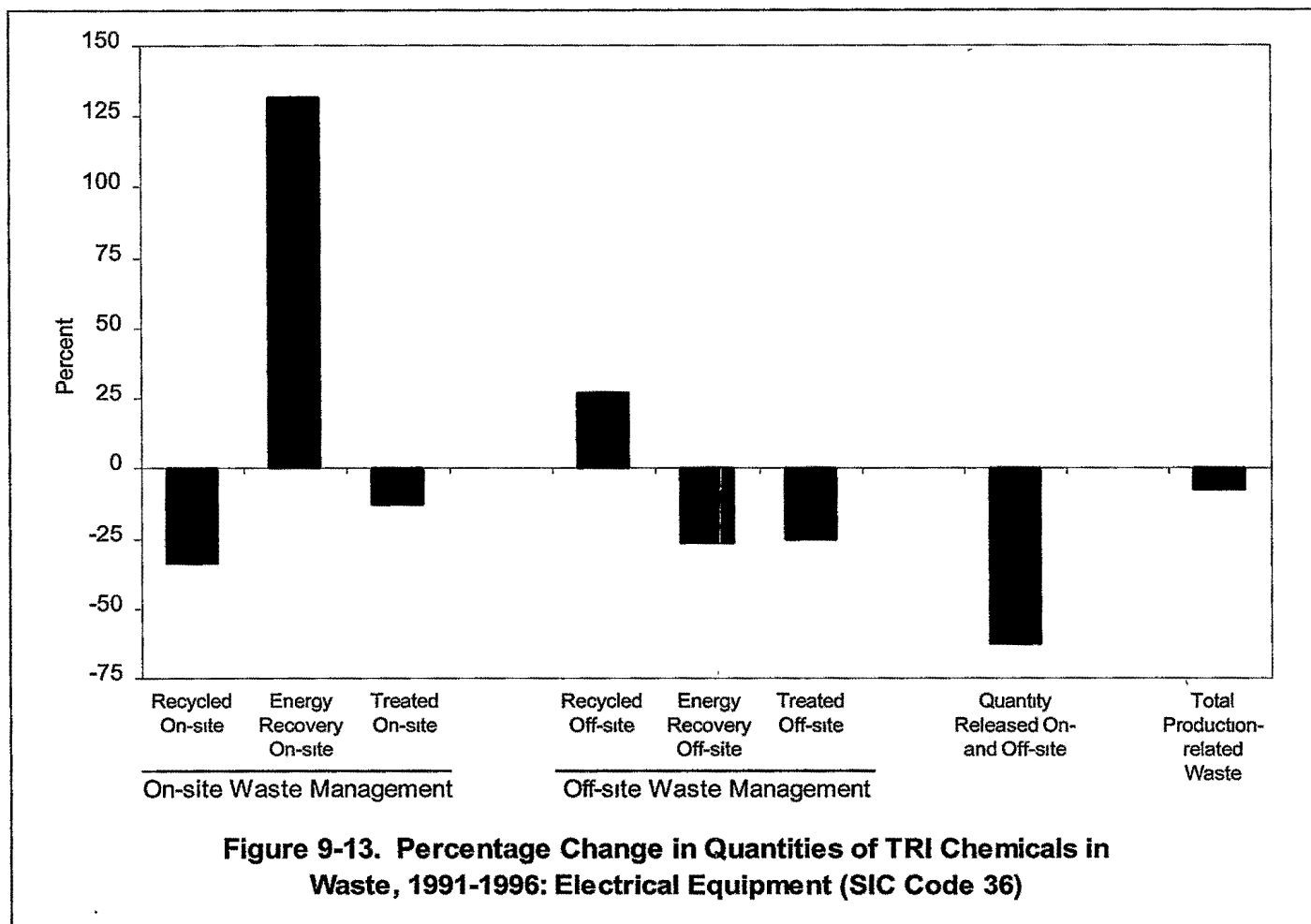


## Chapter 9 – TRI Data for Electrical Equipment

Table 9-17. TRI Waste Management Data, 1991, 1994-1996: Electrical Equipment, SIC Code 36

Waste Management Activity	1991 Pounds	1994 Pounds	1995 Pounds	1996 Pounds
<b><u>On-site Waste Management</u></b>				
Recycled On-site	220,655,709	96,198,523	97,975,655	145,834,353
Energy Recovery On-site	874,367	2,073,744	2,191,839	2,026,264
Treated On-site	59,297,721	47,183,395	51,213,177	51,682,275
Total On-site Waste Management	280,827,797	145,455,662	151,380,671	199,542,892
<b><u>Off-site Waste Management</u></b>				
Recycled Off-site	292,457,523	341,856,348	391,101,969	371,277,615
Energy Recovery Off-site	9,542,531	9,807,798	9,326,881	6,987,062
Treated Off-site	10,582,423	9,539,582	9,409,191	7,928,674
Total Off-site Waste Management	312,582,477	361,203,728	409,838,041	386,193,351
Quantity Released On- and Off-site	70,508,528	40,412,712	30,824,661	26,418,498
Total Production-related Waste	663,918,802	547,072,102	592,043,373	612,154,741
Non- Production-related Waste	710,695	59,944	169,133	30,797
Waste Management Activity	Change 1994-1995 Percent	Change 1995-1996 Percent	Change 1991-1996 Percent	
<b><u>On-site Waste Management</u></b>				
Recycled On-site	1.8	48.8	-33.9	
Energy Recovery On-site	5.7	-7.6	131.7	
Treated On-site	8.5	0.9	-12.8	
Total On-site Waste Management	4.1	31.8	-28.9	
<b><u>Off-site Waste Management</u></b>				
Recycled Off-site	14.4	-5.1	27.0	
Energy Recovery Off-site	-4.9	-25.1	-26.8	
Treated Off-site	-1.4	-15.7	-25.1	
Total Off-site Waste Management	13.5	-5.8	23.5	
Quantity Released On- and Off-site	-23.7	-14.3	-62.5	
Total Production-related Waste	8.2	3.4	-7.8	
Non- Production-related Waste	182.2	-81.8	-95.7	

Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated.



Note: Does not include delisted chemicals, chemicals added in 1994 and 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated.

battery cores and ships them to smelters for recycling; 19.4 million pounds of lead compounds were reported as recycled off-site in 1996. Because the facility was not in operation until 1995, there were no data for comparison year 1991. The number five facility (St. Joseph, Missouri) reported an 11.4-million-pound increase in off-site recycling of lead compounds (99.5% of the overall increase). This battery manufacturing plant noted that several regulations, all passed since 1991, have essentially put many such facilities out of the business of recycling lead on-site. The cost of obtaining permits and monitoring under several environmental regulations made it impractical for many lead storage battery manufacturers to operate secondary smelters for recycling lead compounds, according to this facility. Regulations cited

included the Boiler Industrial Furnace rule of RCRA, Owner/Operator of a Hazardous Waste Treatment, Storage, or Disposal Facility provisions, and the Point Source Discharge (PSD) rule under the Clean Air Act.

The top facility in decreases of production-related waste was IBM in Endicott, New York (SIC code 3672). The facility reported a total decrease of 49.9 million pounds, more than 35 million of which were reported as reductions in 1,1,1-trichloromethane and dichloromethane. There were no reported amounts of either chemical in any category of production-related waste in 1996.

The second and third facilities for decreases are lead storage battery manufacturers (SIC code





3691). Johnson Controls Battery in Geneva, Illinois (ranked second) reduced reporting of production-related waste by 34.7 million pounds. The facility had large decreases in both on-site recycling (10 million pounds) and off-site recycling (24.7 million pounds) of lead compounds. Douglas Battery Manufacturing Company in Winston-Salem, North Carolina (ranked third), reported a total decrease of 30.6 million pounds, 30.3 million pounds of which were due to a drop in the amount of lead compounds recycled off-site. In addition to declining production levels between 1991 and 1996, the Douglas facility attributed part of the change to an improvement in a process involving the use of a lead oxide paste. As a result, smaller amounts of lead compounds are left over and sent off-site for recycling.

The fourth facility, Dover Electronics Company in Conklin, New York (SIC code 3679), reported a reduction of 26.1 million pounds. All of this decrease was due to a drop in the amount of tetrachloroethylene used as a degreaser in the production of multi-layered ceramic substrates used in circuit board construction. The facility no longer manufactures the ceramic substrates and no longer uses tetrachloroethylene. No amount of the chemical was reported in 1996.

#### **Other Apparent Increases and Decreases in Production-Related Waste, 1991-1996**

In the TRI database, there are other facilities with large apparent increases and decreases, which have been identified as reporting errors or plant closures. Because these are errors or plant closures and not actual changes in the data, these facilities are not discussed in detail here. There is one such facility in the electrical equipment sector:

Johnson Controls Battery, Louisville, Kentucky, decrease of 19.3 million pounds, plant closure.

#### **Facilities Contacted for Explanations (alphabetical by facility):**

3M, Hutchinson, Minnesota: Mike Bennett, March 23, 1998 (explanation provided)

Bureau of Engraving, Inc., Minneapolis, Minnesota: Bill Curry, March 23, 1998 (explanation provided)

Douglas Battery Manufacturing Company, Winston-Salem, North Carolina: Al Csontos, March 24, 1998 (explanation provided)

Dover Electronics Company, Conklin, New York: James O'Brien, March 23, 1998 (explanation provided)

Duracell USA, Lancaster, South Carolina: Jeff Johnston, March 24, 1998 (explanation provided)

Exide Corporation, Bristol, Tennessee: Norman Enix, March 23, 1998 (explanation provided)

Exide Corporation, Manchester, Iowa: Gary Drees, March 23, 1998 (explanation provided)

Exide Corporation, Salina, Kansas: Tina Ziegelmeier, March 23, 1998 (explanation provided)

Hadco Corporation, Derry, New Hampshire: Ron Blanchette, March 23, 1998 (explanation provided)

IBM, Endicott, New York (no explanation provided)

Johnson Controls Battery, Geneva, Illinois (no explanation provided)

Johnson Controls Battery, Louisville, Kentucky: Debbie Hastings, March 23, 1998 (explanation provided)

Johnson Controls Battery, San Antonio, Texas: Iris Williams, March 23, 1998 (explanation provided)

Johnson Controls Battery, St. Joseph, Missouri: Cary Mans, March 23, 1998 (explanation provided)

Lucent Technologies, Inc., North Andover, Massachusetts: Anne Reynolds, March 23, 1998 (explanation provided)

Thomson Consumer Electronics, Dunmore, Pennsylvania: Bob Murray, April 20, 1998 (explanation provided)

Whirlpool Corporation, Fort Smith, Arkansas: Scott Horton, March 24, 1998 (explanation provided)



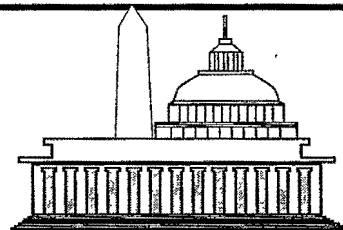
## Sources

- Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual*, 1987: Standard Industrial Classification (SIC) codes and industry descriptions.
- U.S. *Industry & Trade Outlook '98*, DRI/McGraw Hill, Standard & Poor's, and U.S. Department of Commerce, International Trade Administration, 1998: economic analyses, also provides some information on environment and industrial processes for selected industries.
- U.S. Census Bureau, *1996 Annual Survey of Manufactures: Statistics for Industry Groups and Industries*, M96(AS)-1, February 1998 <<http://www.census.gov/prod/www/titles.html#mm>>: value of shipments and employment. Supplemental data from U.S. Census Bureau <<http://www.census.gov>> for some industries.
- U.S. Environmental Protection Agency, Office of Enforcement and Compliance Assurance, Office of Compliance, *Profile of the Electronics and Computer Industry*, Sector Notebook Project, EPA/310-R-95-002, September 1995 <<http://es.epa.gov/oeca/sector/index.html>>: industry processes and technologies, pollutant sources, and selected economic data.



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## **Chapter 10**



# ***Toxics Release Inventory Data for Federal Facilities***

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## **A Look at the Federal Facilities Reporting to TRI**

Facilities owned and operated by Federal agencies are required to report to TRI, regardless of Standard Industrial Classification (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 an agency-wide reduction of 50% in on-site releases and off-site transfers to treatment and disposal by 1999, based on their 1994 TRI reporting. It encourages Federal facilities to use source reduction wherever practicable to achieve their reductions.

Box 10-1 lists the Federal agencies that have facilities reporting to TRI. Because the Department of Defense has the most facilities and dominates the TRI reporting by Federal facilities, this chapter considers the facilities reporting in each defense agency as a separate entity.

While most Federal facilities began reporting to TRI for the 1994 reporting year, the Department of Energy (DOE) instructed its facilities to begin filing TRI reports for 1993, a year earlier than mandated by the Executive Order. In addition, since 1987 (the first TRI reporting year), facilities owned by the Federal government but operated by private contractors have had to report to TRI if they met the reporting thresholds. These contractors are still required to report, even after 1994. The reports from the Federal government agencies are entered into the TRI database, but the reports for these facilities from the private contractors are not, in order to avoid duplication.

## **1996 TRI Data for Federal Facilities**

For the 1996 reporting year, 133 Federal facilities from 13 Federal agencies submitted 378 reports to TRI. Table 10-1 summarizes TRI data for these Federal agencies. Of the forms submitted by Federal facilities, 7.4% (28) were Form A certification statements, certifying that a facility's



**Box 10-1. Federal Agencies Reporting to TRI**

**Federal Agencies Reporting to TRI**

Department of Defense (DOD)  
 Air Force  
 Army  
 Defense Logistics Agency (DLA)  
 Marines  
 Navy  
 Army Corps of Engineers (Corp)  
 Department of Agriculture (Agriculture)  
 Department of Energy (DOE)  
 Department of Health and Human Services (HHS)  
 Department of Interior (Interior)  
 Department of Justice (DOJ)  
 Department of Transportation (DOT)  
 Department of Treasury (Treasury)  
 Department of Veterans Affairs (VA)  
 Environmental Protection Agency (EPA)  
 National Aeronautics and Space Administration (NASA)  
 Tennessee Valley Authority (TVA)  
 U.S. Enrichment Corporation (USEC)

total annual reportable amount of a TRI chemical was less than 500 pounds for the year and that the facility did not manufacture, process, or otherwise use more than 1 million pounds. (The Form A certification statement is explained in Chapter 1.)

The Department of Defense (DOD) had the largest number of facilities reporting, 74 or 55.6% of the total. DOD facilities accounted for 65.3% of the Federal facility forms, with 247. The Department of Energy had the next largest number of facilities with 19 facilities (14.3%) and 52 forms (13.8%). Within DOD, the Army had the most facilities with 31 (41.9% of all DOD facilities).

As shown in Table 10-1, Air Force facilities ranked first for total on- and off-site releases but third for total production-related waste. Total releases from Air Force facilities were 2.1 million pounds (31.7% of the Federal facilities' total), and total production-related waste was 2.7 million pounds (5.7% of the Federal facilities' total). Army facilities

**Table 10-1. Summary of TRI Information by Agency, 1996: Federal Facilities**

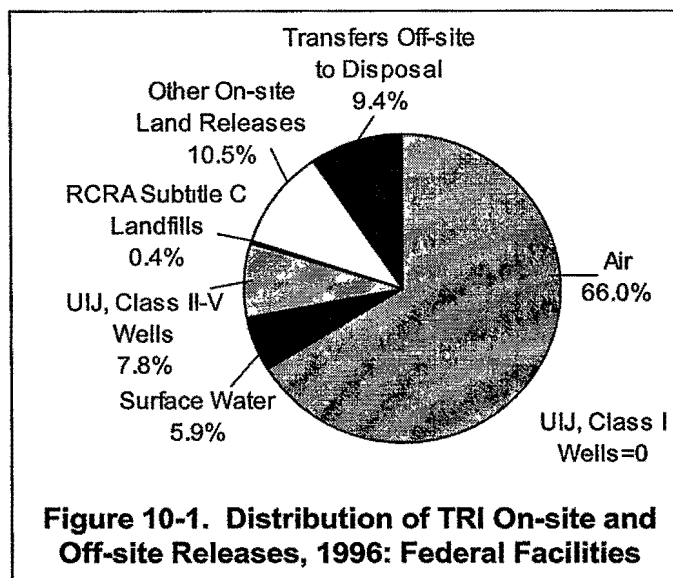
Total On- and Off-site Releases Rank	Total Production-related Waste Rank	Agency	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
1	3	Dept. of Defense	74	247	18	3,428,786	599,877	4,028,663	20,389,006	5,486,838	29,756,235	96,155
2	1	Air Force	19	64	7	1,983,113	80,029	2,063,142	294,100	381,249	2,689,218	60,311
14	6	Army	31	105	9	665,507	208,526	874,033	18,709,920	4,220,984	23,757,167	35,804
8	10	Defense Logistics Agency	1	5	0	4,854	0	4,854	1,184,803	0	1,189,657	0
3	4	Marines	7	22	0	165,652	90,541	256,193	0	288,236	526,279	40
		Navy	16	51	2	609,660	220,781	830,441	200,183	596,369	1,593,914	0
13	16	Army Corps of Engineers	2	3	0	9,210	0	9,210	1,575	180	10,955	0
6	9	Dept. of Agriculture	8	11	0	605,480	0	605,480	57,600	250	663,530	68
4	5	Dept. of Energy	19	52	2	740,637	1,174	741,811	732,432	31,011	1,534,559	8,289
16	12	Dept. of Health and Human Services	1	1	0	0	750	750	43,000	0	43,900	450
15	15	Dept. of Interior	4	5	2	4,772	0	4,772	0	0	16,173	0
11	13	Dept. of Justice	2	2	0	11,605	0	11,605	0	0	23,305	0
10	14	Dept. of Transportation	1	2	0	19,600	1,096	20,696	0	0	19,600	0
9	2	Dept. of Treasury	8	15	1	57,287	9,350	66,637	120	13,743,208	13,848,646	0
17	17	Environmental Protection Agency	1	2	0	17	0	17	0	0	17	0
7	8	National Aeronautics and Space Admin.	7	24	3	327,182	320	327,502	429,188	246,121	794,021	2,801
12	11	Tennessee Valley Authority	4	6	1	10,071	0	10,071	52,500	12,226	74,797	0
5	7	U.S. Enrichment Corporation	2	8	1	675,204	230	675,434	122,400	0	806,080	0
Total for Federal Facilities			133	378	28	5,889,851	612,797	6,502,648	21,827,821	19,519,834	47,591,818	107,763

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial catastrophic incidents)



reported much larger amounts of other on-site waste management and, therefore, much larger amounts of total production-related waste, ranking first in both these categories. Army facilities reported 18.7 million pounds of chemicals managed on-site (85.7% of the total managed on-site by Federal facilities) and 23.8 million pounds of total production-related waste (49.9% of the total).

Facilities belonging to the Navy accounted for the largest amounts of off-site releases (transfers off-site to disposal), with 221,000 pounds (36.0% of the total). Facilities reporting from the Department of Treasury accounted for 70.4% (13.7 million pounds) of the total transfers off-site for further waste management.



**Figure 10-1. Distribution of TRI On-site and Off-site Releases, 1996: Federal Facilities**

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

## On- and Off-site Releases

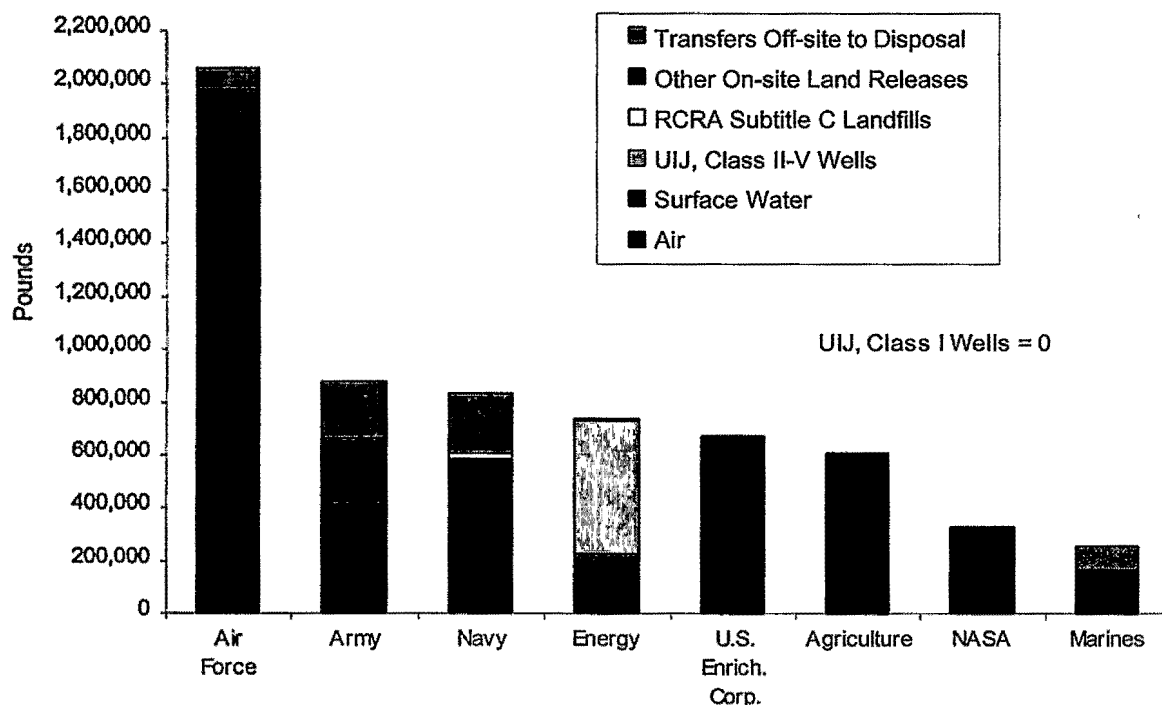
Two-thirds (66.0%) of all on- and off-site releases reported by Federal facilities were air emissions, 4.3 million pounds out of 6.5 million pounds of total releases (see Table 10-2 and Figure 10-1). Air Force facilities reported the largest air emissions, 1.9 million pounds, which was 44.1% of total air

emissions from Federal facilities. (See Figure 10-2) This is not surprising since a number of the Air Force installations are large facilities engaged in aircraft repair and maintenance, using volatile chemicals to clean parts and strip paint.

**Table 10-2. TRI On-site and Off-site Releases, 1996: Federal Facilities**

Agency	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site Releases Transfers Off-site to Disposal Pounds	Total On- & Off-site Releases Pounds
			Class I Wells Pounds	Class II-V Wells Pounds	RCRA Subtitle C Landfills Pounds	Other On-site Land Releases Pounds			
Dept. of Defense	3,060,551	341,430	0	0	23,516	3,289	3,428,786	599,877	4,028,663
Air Force	1,895,706	87,366	0	0	0	41	1,983,113	80,029	2,063,142
Army	413,931	248,587	0	0	0	2,989	665,507	208,526	874,033
Defense Logistics Agency	4,854	0	0	0	0	0	4,854	0	4,854
Marines	165,625	27	0	0	0	0	165,652	90,541	256,193
Navy	580,435	5,450	0	0	23,516	259	609,660	220,781	830,441
Army Corps of Engineers	3,910	300	0	0	0	5,000	9,210	0	9,210
Dept. of Agriculture	10	0	0	0	0	605,470	605,480	0	605,480
Dept. of Energy	196,948	27,461	0	505,541	0	10,687	740,637	1,174	741,811
Dept. of Health and Human Services	0	0	0	0	0	0	0	750	750
Dept. of Interior	750	4,017	0	0	0	5	4,772	0	4,772
Dept. of Justice	10,305	1,300	0	0	0	0	11,605	0	11,605
Dept. of Transportation	19,600	0	0	0	0	0	19,600	1,096	20,696
Dept. of Treasury	280	107	0	0	0	56,900	57,287	9,350	66,637
Environmental Protection Agency	17	0	0	0	0	0	17	0	17
National Aeronautics and Space Admin	327,182	0	0	0	0	0	327,182	320	327,502
Tennessee Valley Authority	335	9,736	0	0	0	0	10,071	0	10,071
U S Enrichment Corporation	674,953	251	0	0	0	0	675,204	230	675,434

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



**Figure 10-2. TRI On-site and Off-site Releases, 1996:  
Federal Facilities (Agencies with Largest Totals)**

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

All other categories of releases were less than 700,000 pounds total. Nearly all releases from U.S. Department of Agriculture facilities were on-site releases to land, which were 605,000 pounds (accounting for 85.9% of total land releases). Of the more than 600,000 pounds of off-site releases (transfers off-site to disposal), Department of Defense facilities accounted for 97.9%, with Navy and Army facilities each representing one-third of that total. Department of Energy facilities reported all of the releases to underground wells (503,000 pounds). Surface water discharges were a total of 385,000 pounds with Army facilities accounting for 64.6% of the total.

## Other On-site Waste Management

Recycling was the largest on-site waste management method used by Federal facilities, with 12.2 million pounds (55.8%), followed by treatment with 9.7 million pounds (44.2%). Very little (7,700 pounds) on-site energy recovery was reported. On-site waste management data appear in Table 10-3, and their distribution is illustrated in Figure 10-3.

For all types of on-site waste management—recycling, energy recovery, and treatment—Army facilities reported the largest quantities (see Table 10-3 and Figure 10-4). Army facilities reported a total of 18.7 million pounds of on-site waste management, which was 85.7% of the total for Federal facilities. This was 10.1 million pounds



Table 10-3. TRI Other On-site Waste Management, 1996: Federal Facilities

Agency	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
Dept of Defense	11,378,222	7,700	9,003,084	20,389,006
Air Force	61,738	0	232,362	294,100
Army	10,109,100	7,700	8,593,120	18,709,920
Defense Logistics Agency	1,184,803	0	0	1,184,803
Marines	0	0	0	0
Navy	22,581	0	177,602	200,183
Army Corps of Engineers	0	0	1,575	1,575
Dept. of Agriculture	0	0	57,600	57,600
Dept. of Energy	362,585	0	369,847	732,432
Dept. of Health and Human Services	0	0	43,000	43,000
Dept. of Interior	0	0	0	0
Dept. of Justice	0	0	0	0
Dept. of Transportation	0	0	0	0
Dept. of Treasury	0	0	120	120
Environmental Protection Agency	0	0	0	0
National Aeronautics and Space Admin	429,110	0	78	429,188
Tennessee Valley Authority	0	0	52,500	52,500
U S Enrichment Corporation	0	0	122,400	122,400
Total for Federal Facilities	12,169,917	7,700	9,650,204	21,827,821

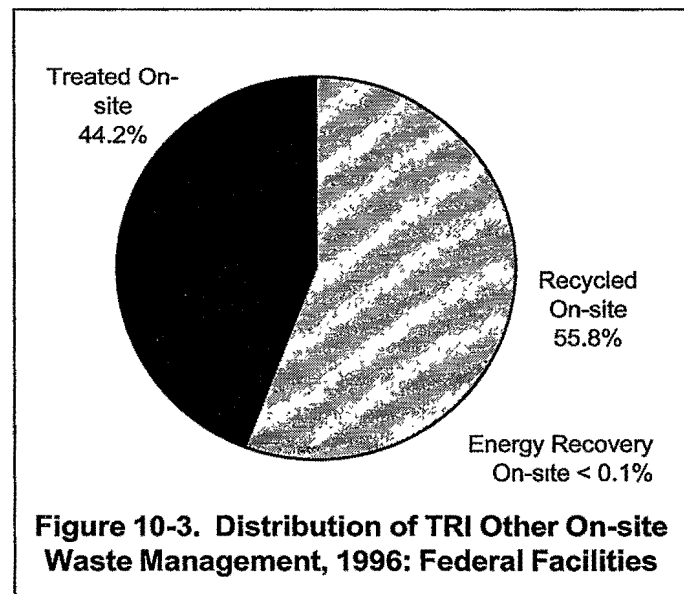
Note: Other On-site Waste Management from Section 8 of Form R

recycled on-site and 8.6 million pounds treated on-site. Only facilities from one other agency reported more than 1 million pounds of on-site waste management. The Defense Logistics Agency facility reported 1.2 million pounds of chemicals recycled on-site.

## Transfers Off-site for Further Waste Management

Transfers to recycling were the largest off-site transfer type reported by Federal facilities, with 18.6 million pounds (95.0% of the total), as shown in Table 10-4 and illustrated in Figure 10-5. Other types of transfers totaled less than 600,000 pounds.

Department of Treasury facilities accounted for 74.1% of all transfers to recycling (13.7 million pounds) and 70.4% of all transfers off-site for further waste management (also 13.7 million pounds). Department of Defense facilities accounted for 28.1% of all such transfers (5.5 million pounds) with Army facilities reporting 4.2



Note: Data from Section 8 of Form R





Table 10-4. TRI Transfers Off-site for Further Waste Management, 1996: Federal Facilities

Agency	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Off-site Transfers for Further Waste Management Pounds
Dept. of Defense	4,566,374	295,346	566,657	58,461	0	5,486,838
Air Force	152,142	70,479	129,132	29,496	0	381,249
Army	3,855,274	65,314	293,964	6,432	0	4,220,984
Defense Logistics Agency	0	0	0	0	0	0
Marines	95,622	105,415	86,184	1,015	0	288,236
Navy	463,336	54,138	57,377	21,518	0	596,369
Army Corps of Engineers	0	0	0	180	0	180
Dept. of Agriculture	0	0	0	250	0	250
Dept. of Energy	28,771	0	2,240	0	0	31,011
Dept. of Health and Human Services	0	0	0	0	0	0
Dept. of Interior	0	0	0	0	0	0
Dept. of Justice	0	0	0	0	0	0
Dept. of Transportation	0	0	0	0	0	0
Dept. of Treasury	13,742,428	0	5	775	0	13,743,208
Environmental Protection Agency	0	0	0	0	0	0
National Aeronautics and Space Admin.	215,930	8,755	21,435	1	0	246,121
Tennessee Valley Authority	0	0	0	12,226	0	12,226
U.S. Enrichment Corporation	0	0	0	0	0	0
<b>Total for Federal Facilities</b>	<b>18,553,503</b>	<b>304,101</b>	<b>590,337</b>	<b>71,893</b>	<b>0</b>	<b>19,519,834</b>

Note: Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code

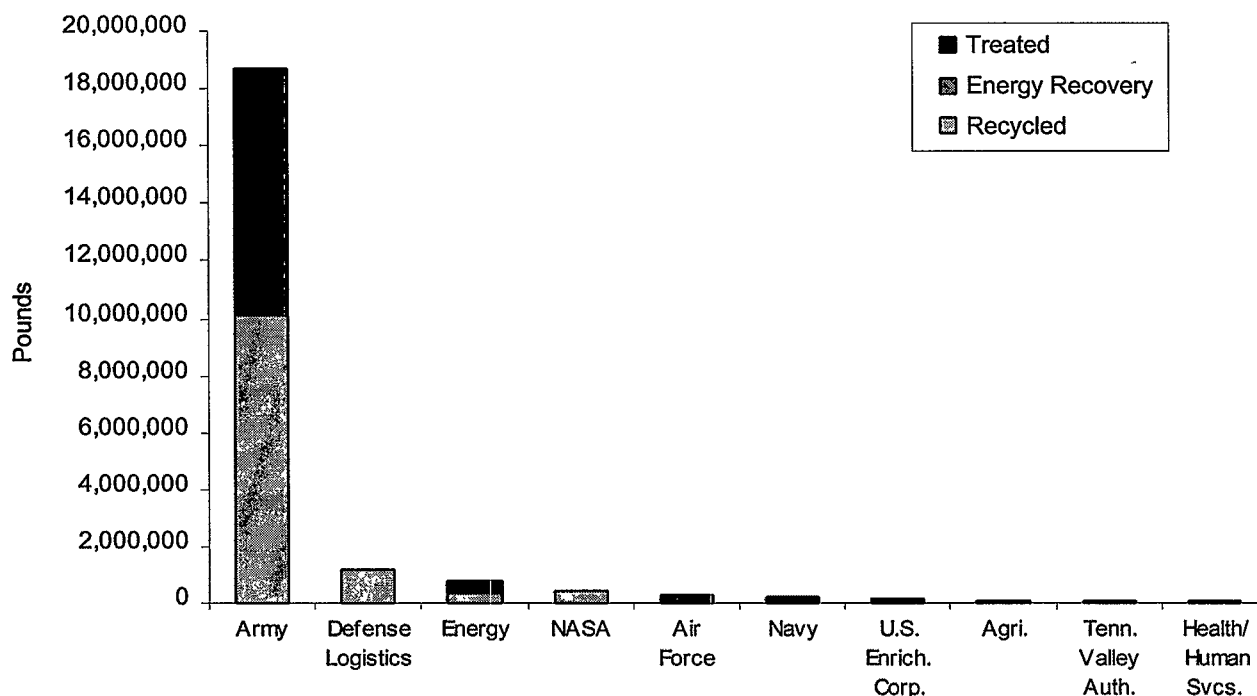
million pounds, almost all as transfers to recycling.  
(See Table 10-4 and Figure 10-6)

## 1996 TRI Data by State for Federal Facilities

Federal facilities reporting to TRI in 1996 were located in 36 states and the territory of Guam. California had 17 facilities, and Texas 11. Federal facilities located in California led the other states in both on-site and off-site releases, as shown in Table 10-5. Federal facilities in California reported 1.1 million pounds of on- and off-site releases (16.6% of the total of 6.5 million pounds). Oklahoma was second with 756,000 pounds, or 11.6%, and Georgia was third with 743,000 pounds, or 11.4%. Map 10-1 shows the distribution of total on- and off-site releases by state for Federal facilities.

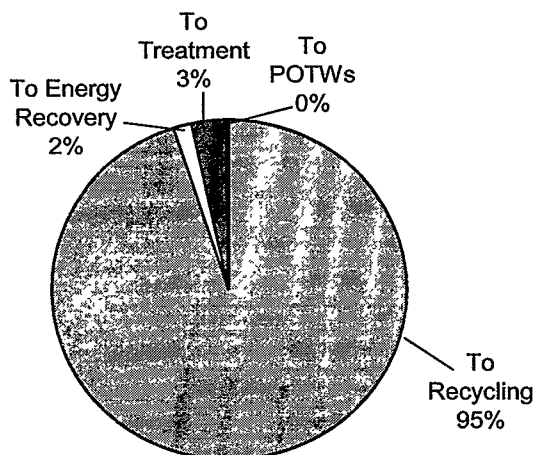
For other on-site waste management, Virginia reported 19.5 million pounds, or 89.3% of the total. Federal facilities located in Colorado reported 9.0 million pounds transferred off-site for further waste management, 45.9% of the total of such transfers. Pennsylvania reported 4.8 million pounds (24.8%), and the state with the third largest amount was Missouri with 2.5 million pounds (12.6%).

Production-related waste totaled 19.8 million pounds in Virginia, or 41.6% of all production-related waste reported by Federal facilities, followed by Colorado, with 9.1 million pounds, or 19.0%. Pennsylvania was third with 4.9 million pounds, or 10.3%. Finally, non-production related waste (from one-time events such as catastrophic events or clean-up actions) was 108,000 pounds in 1996, with Federal facilities in Missouri and in Tennessee reporting over 34,000 pounds (about 32% each).



**Figure 10-4. TRI Other On-site Waste Management, 1996: Federal Facilities (Agencies with Largest Totals)**

Note: Other On-site Waste Management from Section 8 of Form R.



**Figure 10-5. Distribution of TRI Transfers Off-site for Further Waste Management, 1996: Federal Facilities**

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R.

## 1996 TRI Data by Chemical for Federal Facilities

In 1996, the chemical with the largest on- and off-site releases reported by Federal facilities was dichloromethane, with 857,000 pounds, the overwhelming majority of which was air emissions, as shown in Table 10-6. This chemical accounted for 13.2% of total on- and off-site releases reported by Federal facilities. The top 15 chemicals dominated the reporting picture for Federal facilities. These chemicals comprised 85.0% of total on- and off-site releases, with a majority of the reported releases in all on-site release types. Only for off-site releases (transfers to disposal), with 31.2% (191,000 pounds out of the total 613,000



Table 10-5. Summary of TRI Information by State, 1996: Federal Facilities

State	Total Facilities Number	Total Forms Number	Form As Number	Total On-site Releases Pounds	Total Off-site Releases Pounds	Total On- and Off-site Releases Pounds	Total Other On-site Waste Management Pounds	Total Transfers Off-site for Further Waste Management Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
Alabama	4	18	0	246,428	44,053	290,481	8,780	82,411	385,081	2,810
Arizona	4	7	0	30,167	10,700	40,867	42,500	31,420	114,131	15,700
Arkansas	1	3	0	113	0	113	0	46,898	47,011	0
California	17	39	0	913,607	167,125	1,080,732	51,601	665,745	1,818,956	431
Colorado	4	5	0	10,467	8,600	19,067	26,154	8,965,914	9,061,884	200
Connecticut	1	4	0	20,006	0	20,006	7,700	483,700	511,401	0
District of Columbia	3	4	0	9,210	250	9,460	1,695	12,336	23,171	0
Florida	4	19	3	375,460	16,290	391,750	266,913	60,910	715,634	0
Georgia	5	23	2	698,283	45,064	743,347	23,570	223,627	974,791	12,576
Guam	1	1	0	3,000	0	3,000	0	15,000	0	0
Hawaii	2	4	0	54,765	2,150	56,915	0	11,525	67,730	0
Idaho	1	1	0	8,212	0	8,212	141,700	302	150,200	0
Illinois	3	6	0	7,324	0	7,324	400	8,020	9,987	5,800
Iowa	1	1	0	13,799	0	13,799	0	3,620	17,419	0
Kansas	1	1	0	0	140	140	14,623	20,999	35,762	0
Kentucky	7	10	1	370,078	0	370,078	78,700	72,369	465,246	100
Louisiana	2	4	0	5,429	0	5,429	0	0	5,429	0
Maine	2	3	2	15,362	0	15,362	0	1,311	16,673	0
Maryland	5	8	0	98,217	1,846	100,063	74,586	73,077	246,780	450
Michigan	1	2	0	17	0	17	0	0	17	0
Missouri	2	16	0	23,794	50,420	74,214	71,566	2,452,969	2,564,081	34,673
Nebraska	1	1	0	526,720	0	526,720	0	0	526,720	0
New Jersey	2	4	0	63,646	0	63,646	0	19,674	62,886	0
New Mexico	5	8	0	43,230	0	43,230	1,633	313	45,997	0
New York	3	12	0	1,817	61,500	63,317	127,603	161,638	352,416	0
North Carolina	3	13	0	121,458	21,695	143,153	0	118,505	262,201	50
Ohio	4	9	1	335,311	230	335,541	186,600	4,360	531,604	30
Oklahoma	4	20	4	745,872	10,160	756,032	191,168	279,559	1,227,882	131
Oregon	3	11	9	500	0	500	0	0	57	5
Pennsylvania	4	14	1	37,183	2,748	39,931	23,111	4,837,528	4,900,092	0
South Carolina	1	7	0	24,031	0	24,031	182,820	597	206,730	31
Tennessee	7	23	2	393,995	9,059	403,054	506,752	283	875,100	34,334
Texas	11	26	1	245,784	21,781	267,565	124,724	310,138	761,246	442
Utah	2	6	0	84,000	42,310	126,310	134,900	250	261,169	0
Virginia	7	25	0	191,428	220	191,648	19,496,244	283,594	19,776,151	0
Washington	3	13	0	68,111	96,456	164,567	22,578	271,242	448,916	0
Wyoming	2	7	2	103,027	0	103,027	19,200	0	121,267	0
<b>Total for Federal Facilities</b>	<b>133</b>	<b>378</b>	<b>28</b>	<b>5,889,851</b>	<b>612,797</b>	<b>6,502,648</b>	<b>21,827,821</b>	<b>19,519,834</b>	<b>47,591,818</b>	<b>107,763</b>

Note: On-site Releases from Section 5 of Form R. On-site Waste Management from Section 8 of Form R. Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Total Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Total Production-related Waste sums Section 8 (Current Year, Column B) of Form R, except Non-production-related Waste (remedial/catastrophic incidents)

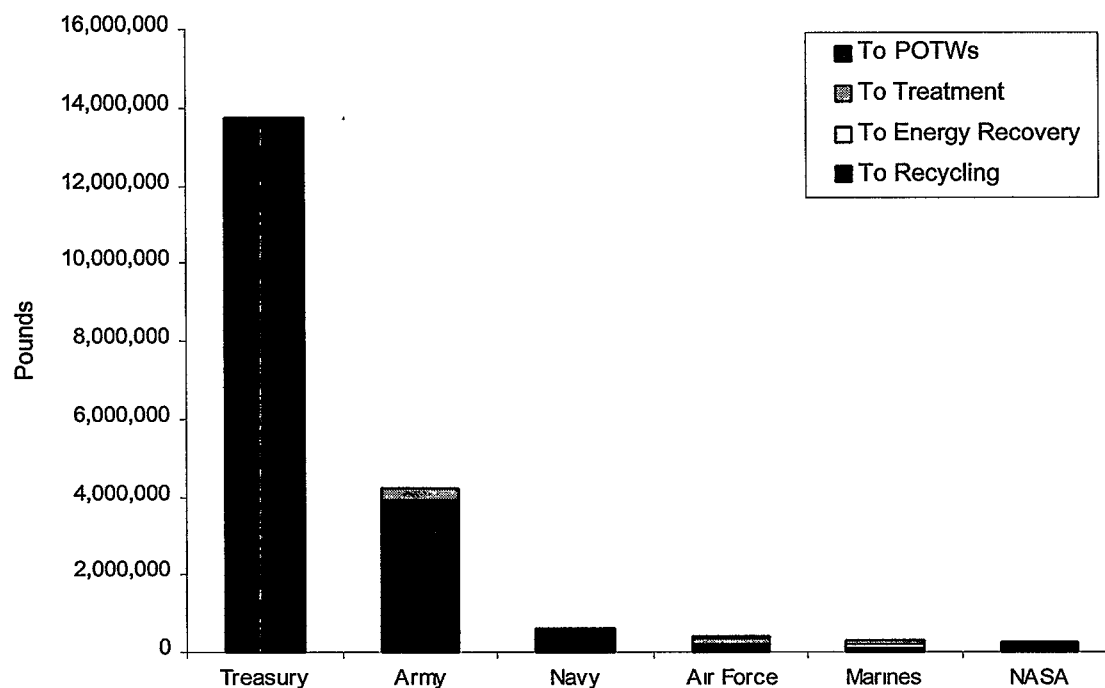
pounds), did the top 15 chemicals not constitute the majority.

The 3.8 million pounds of air emissions of the top 15 were 89.4% of all air emissions reported by Federal facilities for 1996. Air emissions were the largest type of on- or off-site release reported by Federal facilities and the largest release for 11 of the top 15 chemicals in Federal facility reporting. For surface water discharges, the top 15 constituted 93.7% of the amount reported by Federal facilities. Two-thirds (65.8%) of all surface water discharges were nitrate compounds (253,000 pounds out of

385,000 pounds). Methanol accounted for 98.8% of all on-site underground injection (499,000 pounds out of 506,000 pounds). Similarly, one chemical, ammonia, accounted for 80.0% of all on-site land releases (545,000 pounds out of 681,000 pounds).

## OSHA Carcinogens

On- and off-site releases of chemicals designated as OSHA carcinogens totaled 1.7 million pounds, or 26.2% of all releases reported by Federal facilities in 1996, as shown on Table 10-7. (OSHA carcinogens and the bases for their designation



**Figure 10-6. TRI Transfers Off-site for Further Waste Management, 1996: Federal Facilities (Agencies with Largest Totals)**

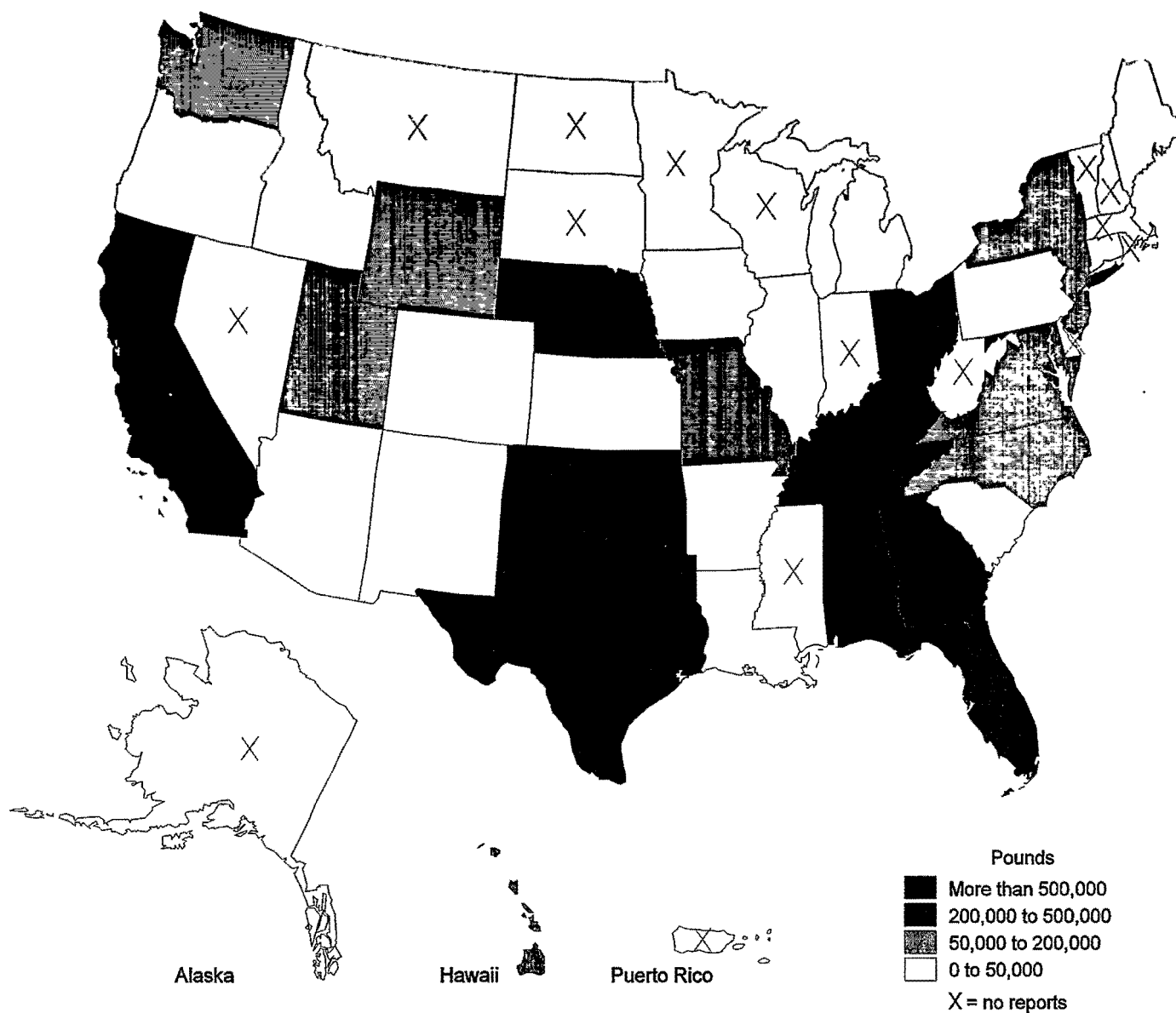
**Note:** Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R

**Table 10-6. The 15 Chemicals with the Largest Total On-site and Off-site Releases, 1996: Federal Facilities (in Rank Order)**

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	
				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	Total On- and Off-site Releases Pounds
75-09-2	Dichloromethane	839,656	10	0	0	0	280	839,946	17,453	857,399
78-93-3	Methyl ethyl ketone	663,435	6,551	0	0	0	0	669,986	20,882	690,868
76-14-2	Dichlorotetrafluoroethane (CFC-114)	633,009	0	0	0	0	0	633,009	0	633,009
7664-41-7	Ammonia	43,275	7,640	0	0	0	545,025	595,940	0	595,940
67-56-1	Methanol	35,956	4,600	0	499,383	0	1,631	541,570	0	541,570
79-01-6	Trichloroethylene	352,838	11	0	0	5,000	0	357,849	0	357,849
—	Nitrate compounds	12	253,000	0	0	0	60,450	313,462	230	313,692
127-18-4	Tetrachloroethylene	292,384	251	0	0	0	0	292,635	4,739	297,374
107-21-1	Ethylene glycol	47,127	87,836	0	913	18,516	2,708	157,100	119,459	276,559
76-13-1	Freon 113	214,805	0	0	0	0	0	214,805	1,145	215,950
108-88-3	Toluene	173,491	250	0	250	0	1,351	175,342	16,977	192,319
1330-20-7	Xylene (mixed isomers)	166,355	250	0	2,120	0	1,850	170,575	4,980	175,555
7647-01-0	Hydrochloric acid	143,785	0	0	0	0	0	143,785	0	143,785
71-36-3	n-Butyl alcohol	134,768	0	0	0	0	0	134,768	1,900	136,668
71-55-6	1,1,1-Trichloroethane	97,113	6	0	0	0	0	97,119	3,349	100,468
Subtotal		3,838,009	360,405	0	502,666	23,516	613,295	5,337,891	191,114	5,529,005
Total for Federal Facilities		4,294,841	384,602	0	505,541	23,516	681,351	5,889,851	612,797	6,502,648

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

Map 10-1. Total On- and Off-site Releases, 1996: Federal Facilities



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



Table 10-7. TRI On-site and Off-site Releases of OSHA Carcinogens, 1996: Federal Facilities (in Rank Order)

Agency	Total Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection		On-site Land Releases		Total On-site Releases Pounds	Off-site 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			
Air Force	1,125,408	273	0	0	0	0	1,125,681	11,418	1,137,099
Navy	154,390	1,000	0	0	5,000	0	160,390	81,246	241,636
Army	103,218	30	0	0	0	280	103,528	17,376	120,904
National Aeronautics and Space Admin	99,550	0	0	0	0	0	99,550	0	99,550
Dept. of Treasury	10	88	0	0	0	48,500	48,598	2,100	50,698
Dept. of Energy	21,027	653	0	250	0	5,343	27,273	1,174	28,447
Marines	13,726	0	0	0	0	0	13,726	1,265	14,991
Dept. of Justice	10,305	0	0	0	0	0	10,305	0	10,305
Subtotal	1,527,634	2,044	0	250	5,000	54,123	1,589,051	114,579	1,703,630
Total for Federal Facilities	4,294,841	384,602	0	505,541	23,516	681,351	5,889,851	612,797	6,502,648

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

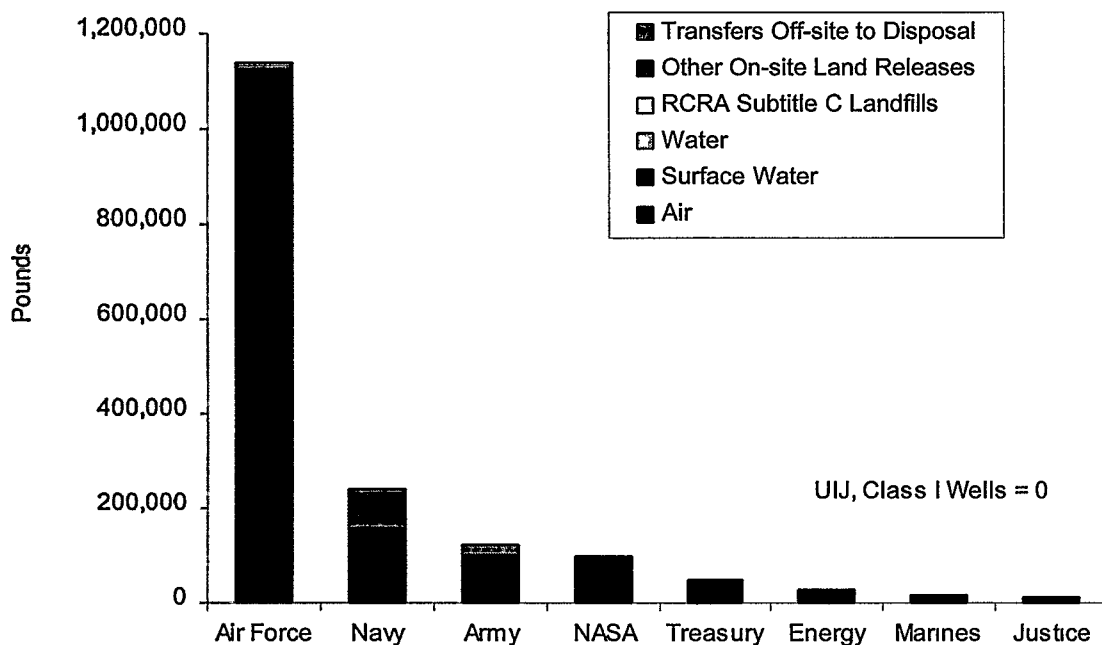
appear in Box 2-4 in Chapter 2.) Three of the 15 chemicals with the largest total releases are OSHA carcinogens: dichloromethane (ranked number one), trichloroethylene (sixth ranked), and tetrachloroethylene (eighth ranked). (See Table 10-6.) These three chemicals' releases totaled 1.5 million pounds, or 88.8% of the total for OSHA carcinogen releases by Federal facilities.

Air Force facilities reported two-thirds of OSHA carcinogen releases—1.1 million pounds, or 66.7%. Navy facilities were the group with the second largest amount, accounting for 242,000 pounds, or 14.2%. The type of release that was reported in the largest amounts for most OSHA carcinogens was air emissions. All but one of the Federal agencies reported the majority of their OSHA carcinogen releases as air emissions. For the Department of Treasury facilities, on-site releases to land were largest. (See Table 10-7 and Figure 10-7.)

## 1996 TRI Chemicals in Waste for Federal Facilities

Table 10-8 and Figure 10-8 present 1996 waste management data for all Federal facilities. Production-related waste totaled 47.6 million pounds in 1996. Off-site recycling was the largest waste management activity reported, with 18.5 million pounds, or 38.8% of total production-related waste. On-site recycling followed with 12.2 million pounds, or 25.6%.

Army facilities led all waste management categories in 1996, except off-site recycling and quantities released on- and off-site. Army facilities' total production-related waste was 23.8 million pounds, 49.9% of the total for Federal facilities. (See Table 10-8.) The agency reporting the second largest amount of total production-related waste was the Department of the Treasury, due to reports of 13.8 million pounds in off-site recycling. Third ranked were Air Force facilities, with 2.7 million pounds, of which 2.0 million pounds were released on- and off-site.



**Figure 10-7. TRI On-site and Off-site Releases of OSHA Carcinogens, 1996: Federal Facilities (Agencies with Largest Totals)**

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

**Table 10-8. Quantities of TRI Chemicals in Waste, 1996: Federal Facilities**

Agency	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Recycled Off-site Pounds	Energy Recovery Off-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site Pounds	Total Production-related Waste Pounds	Non-Production-related Waste Pounds
Dept. of Defense	11,378,222	7,700	9,003,084	4,623,737	338,304	595,649	3,809,539	29,756,235	96,155
Air Force	61,738	0	232,362	151,932	69,562	161,785	2,011,839	2,689,218	60,311
Army	10,109,100	7,700	8,593,120	3,855,829	108,514	243,270	839,634	23,757,167	35,804
Defense Logistics Agency	1,184,803	0	0	0	0	0	4,854	1,189,657	0
Marines	0	0	0	152,612	106,000	87,034	180,633	526,279	40
Navy	22,581	0	177,602	463,364	54,228	103,560	772,579	1,593,914	0
Army Corps of Engineers	0	0	1,575	0	0	180	9,200	10,955	0
Dept. of Agriculture	0	0	57,600	0	0	59	605,871	663,530	68
Dept. of Energy	362,585	0	369,847	68,509	0	2,242	731,376	1,534,559	8,289
Dept. of Health and Human Services	0	0	43,000	0	0	900	0	43,900	450
Dept. of Interior	0	0	0	0	0	0	16,173	16,173	0
Dept. of Justice	0	0	0	0	0	0	23,305	23,305	0
Dept. of Transportation	0	0	0	0	0	0	19,600	19,600	0
Dept. of Treasury	0	0	120	13,782,277	0	1	66,248	13,848,646	0
Environmental Protection Agency	0	0	0	0	0	0	17	17	0
National Aeronautics and Space Admin	429,110	0	78	8,790	7,270	19,098	329,675	794,021	2,801
Tennessee Valley Authority	0	0	52,500	0	0	12,226	10,071	74,797	0
U.S. Enrichment Corporation	0	0	122,400	0	0	0	683,680	806,080	0
<b>Total for Federal Facilities</b>	<b>12,169,917</b>	<b>7,700</b>	<b>9,650,204</b>	<b>18,483,313</b>	<b>345,574</b>	<b>630,355</b>	<b>6,304,755</b>	<b>47,591,818</b>	<b>107,763</b>

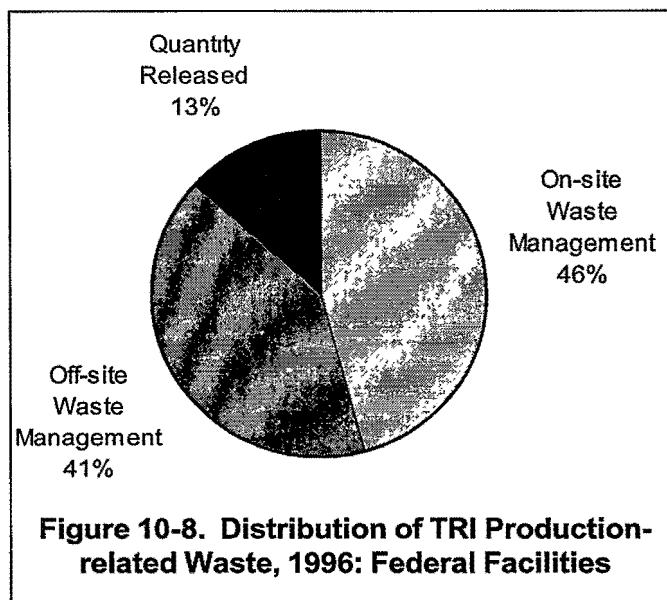
Note: Data from Section 8 of Form R.



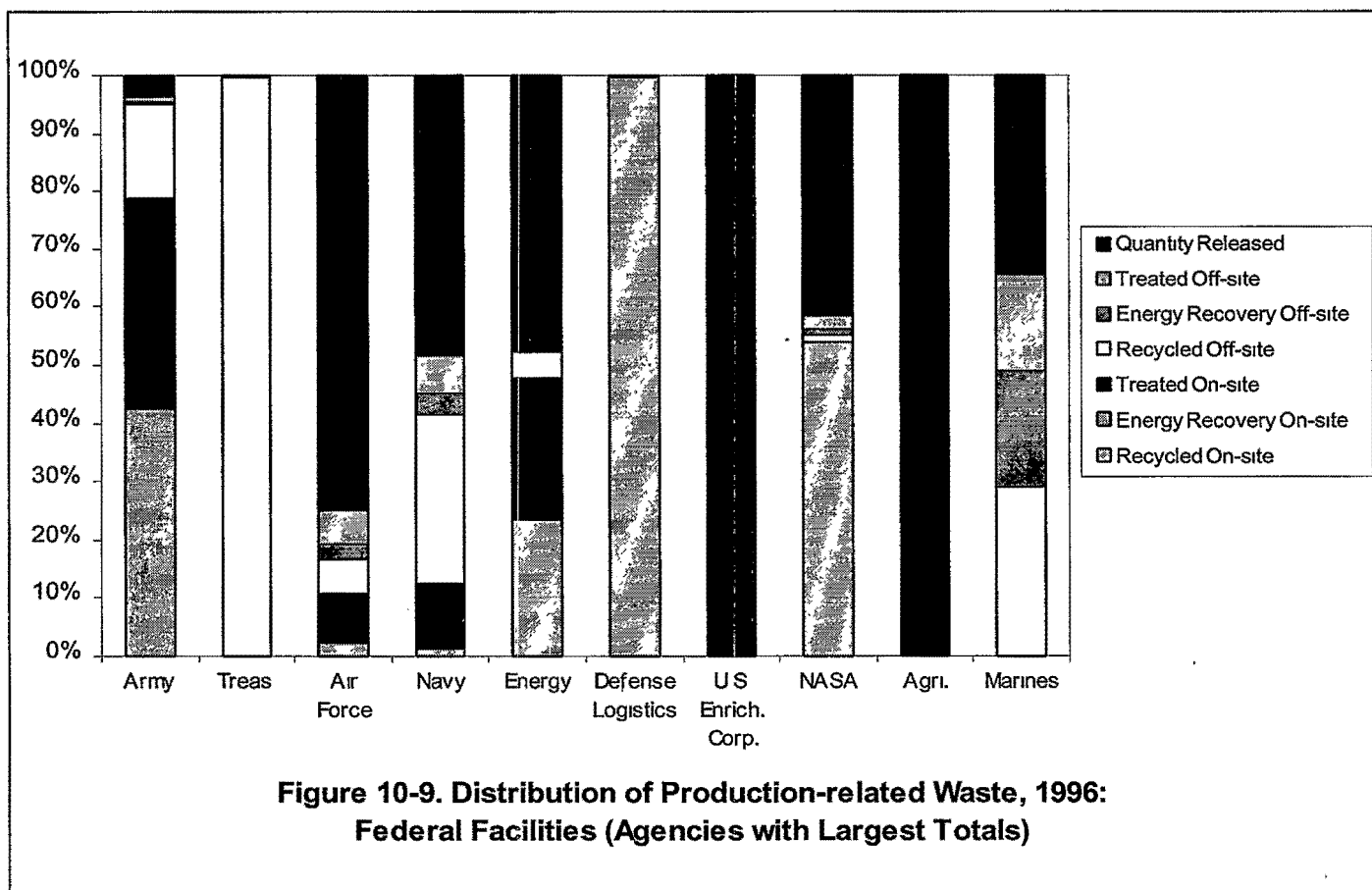
Distribution of production-related waste for the top Federal agencies appears in Figure 10-9.

## Projected Quantities of TRI Chemicals in Waste

Projections by Federal facilities are presented in Table 10-9. The table shows large increases for on-site recycling and on-site treatment for reporting year 1998. This is a result of a very large increase projected by one facility. The U.S. Army Ammunition Plant in Radford, Virginia, projected increases of nitric acid in on-site recycling from 9.2 million pounds to 92.0 million pounds and on-site treatment from 4.1 million



Note: Data from Section 8 of the Form R



Note: Data from Section 8 of Form R





Table 10-9. Current Year and Projected Quantities of TRI Chemicals in Waste, 1996-1998: Federal Facilities

Waste Management Activity	Current Year 1996		Projected 1997		Projected 1998	
	Total Pounds	Percent of Total	Total Pounds	Percent of Total	Total Pounds	Percent of Total
<u>On-site Waste Management</u>						
Recycled On-site	12,169,917	25.6	15,987,048	36.7	94,151,989	60.5
Energy Recovery On-site	7,700	0.0	700	0.0	0	0.0
Treated On-site	9,650,204	20.3	7,420,741	17.0	42,365,388	27.2
<u>Off-site Waste Management</u>						
Recycled Off-site	18,483,313	38.8	14,024,602	32.2	13,539,209	8.7
Energy Recovery Off-site	345,574	0.7	326,682	0.7	305,222	0.2
Treated Off-site	630,355	1.3	511,082	1.2	471,457	0.3
Quantity Released On- and Off-site	6,304,755	13.2	5,346,094	12.3	4,911,237	3.2
Total Production-related Waste for Federal Facilities	47,591,818	100.0	43,616,949	100.0	155,744,502	100.0
Waste Management Activity	Projected Change 1996-1997		Projected Change 1997-1998		Projected Change 1996-1998	
	Percent		Percent		Percent	
<u>On-site Waste Management</u>						
Recycled On-site	31.4		488.9		673.6	
Energy Recovery On-site	-90.9		-100.0		-100.0	
Treated On-site	-23.1		470.9		339.0	
<u>Off-site Waste Management</u>						
Recycled Off-site	-24.1		-3.5		-26.7	
Energy Recovery Off-site	-5.5		-6.6		-11.7	
Treated Off-site	-18.9		-7.8		-25.2	
Quantity Released On- and Off-site	-15.2		-8.1		-22.1	
Total Production-related Waste for Federal Facilities	-8.4		257.1		227.3	

Note: Current year and projected year amounts are taken from Section 8 of Form R for 1996.

pounds to 41.0 million pounds from 1996 to 1998. The facility expected to install a new system to make dinitrotoluene. Since then, however, the facility has decided not to install the new system so projections should be lower in subsequent years.

Federal facilities projected an overall increase of over 200% in production-related waste from 1996 to 1998. Without the one form for nitric acid mentioned above, however, this would have been a projected decrease of 24.3%. On-site recycling and treatment are projected to increase, also because of the one form for nitric acid. Off-site recycling is projected to decrease by 26.7% from 1996 to 1998 and off-site treatment by 25.2%. Quantities released on- and off-site are also expected to decrease, by 22.1%. (As explained in Chapter 2, facilities not only report current data but project waste management quantities for the next two years in their TRI submissions.)

## Source Reduction Activity

Among the 378 forms from Federal facilities, 155 or 41.0% indicated at least one source reduction activity underway in 1996, as shown in Table 10-10. As stated earlier, Executive Order 12856 establishes release and transfer goals for Federal facilities. The Executive Order encourages Federal facilities to use the waste management hierarchy, which gives priority to source reduction, as the means to achieve these goals. Several agencies seem to be accomplishing this source reduction objective. Two agencies that have one reporting facility each, the Department of Health and Human Services and the Department of Transportation, indicated source reduction activities for each chemical reported. Agencies with large percentages of forms that reported source reduction activities were the National Aeronautics and Space Administration (75.0% of forms submitted) and the Air Force (67.2%).



The most prevalent type of source reduction activity undertaken was good operating practices, with 71 forms, or 45.8% of all forms reporting source reduction activity. National Aeronautics and Space Administration facilities, however, reported good operating practices and process modifications in equal numbers, and Air Force facilities reported more forms with cleaning and degreasing and surface preparation and finishing. (See Table 10-10.)

## Year-to-Year Comparisons for Federal Facilities

### 1995-1996 TRI Data for Federal Facilities

#### On- and Off-site Releases

From 1995 to 1996, on- and off-site releases reported by Federal facilities decreased by 24.9%, from 8.7 million pounds to 6.5 million pounds. The

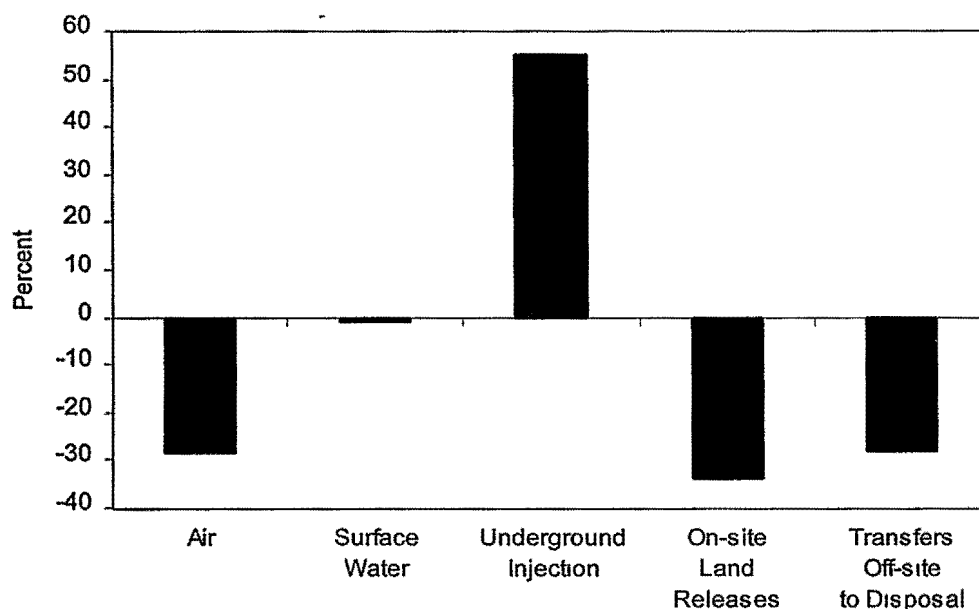
largest reduction, in pounds, occurred in reported air emissions, which decreased 1.7 million pounds, or 28.7%. The largest percentage decrease was in on-site land releases, which were reduced by 33.7% (358,000 pounds). Off-site releases (transfers off-site to disposal) decreased by 28.2%, or 241,000 pounds. Very little change was reported in surface water discharges (a 1.0% decrease). Underground injection increased by 180,000 pounds, or 55.2%. Table 10-11 presents 1995 and 1996 reporting by Federal facilities, and Figure 10-10 illustrates the changes by release type.

Also indicated on Table 10-11 is a 16.6% decrease from 1995 to 1996 in the number of forms submitted by Federal facilities. At the same time, Form A certification statements from Federal facilities increased 40.0%. (The Form A certification statement is explained in Chapter 1.) This may reflect greater awareness of the Form A certification statement in its second year.

Table 10-12 shows changes in on-and off-site releases from 1995 to 1996 for each Federal agency. Air Force facilities reported the largest decreases with a reduction of 1.6 million pounds, or

**Table 10-10. Number of Forms Reporting Source Reduction Activity, 1996: Federal Facilities**

Agency	Forms Reporting Source Reduction Activities			Category of Source Reduction Activity							
	Total Forms Number	Percent of All Forms		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
		Number	Percent								
Dept of Defense	247	118	47.8	54	36	12	15	19	33	44	2
Air Force	64	43	67.2	16	9	4	10	11	27	22	2
Army	105	38	36.2	23	15	5	5	5	2	3	0
Defense Logistics Agency	5	0	0.0	0	0	0	0	0	0	0	0
Mannes	22	11	50.0	1	0	0	0	0	0	14	0
Navy	51	26	51.0	14	12	3	0	3	4	5	0
Army Corps of Engineers	3	0	0.0	0	0	0	0	0	0	0	0
Dept. of Agriculture	11	4	36.4	0	0	4	0	0	0	0	0
Dept of Energy	52	6	11.5	4	0	1	2	1	2	0	0
Dept of Health and Human Services	1	1	100.0	0	0	1	0	0	0	0	0
Dept of Interior	5	1	20.0	1	0	1	0	0	1	0	0
Dept of Justice	2	0	0.0	0	0	0	0	0	0	0	0
Dept. of Transportation	2	2	100.0	0	2	0	0	0	0	0	0
Dept of Treasury	15	4	26.7	1	0	0	3	0	0	0	0
Environmental Protection Agency	2	0	0.0	0	0	0	0	0	0	0	0
National Aeronautics and Space Ad	24	18	75.0	11	0	2	1	11	5	3	2
Tennessee Valley Authority	6	0	0.0	0	0	0	0	0	0	0	0
U S Enrichment Corp	8	1	12.5	0	0	0	0	1	0	0	0
Total for Federal Facilities	378	155	41.0	71	38	21	21	32	41	47	4



**Figure 10-10. Percentage Change in On-site and Off-site Releases, 1995-1996: Federal Facilities**

**Note:** On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required in 1995.

44.4%. This was achieved primarily by reductions in air emissions, of 1.0 million pounds, or 34.7%. Army and Marine facilities reported the second and third largest decreases, with reductions of 286,000 pounds (24.7%) and 271,000 pounds (51.4%), respectively. All other agencies reported reductions from 1995 to 1996 except for Department of Agriculture and Department of Energy facilities, which reported increases, of 124,000 (25.8%) and 157,000 pounds (26.9%), respectively. Also, the Department of Health and Human Services facility and the Environmental Protection Agency facility showed small increases.

### Other On-site Waste Management

Reporting of on-site waste management by Federal facilities also appears in Table 10-11. This table indicates a reduction in other on-site waste management for 1995 to 1996. However, these data include one form with an error in 1995 reporting. The

U.S. Army facility in Radford, Virginia, reported 34.0 million pounds of nitric acid recycled on-site for 1995 in error. The correct amount is 3.4 million pounds. Box 10-2 presents the corrected data for Table 10-11. As Box 10-2 indicates, this corrected information also applies to several other sections later in this chapter. The following discussion is based on the information shown in Box 10-2.

In 1995, on-site waste management by Federal facilities totaled 18.1 million pounds, and in 1996, 21.8 million pounds. This constituted a 20.4% increase, which was from an increase in on-site recycling of 7.1 million pounds. On-site treatment decreased by 3.4 million pounds, or 26.2%. Very little on-site energy recovery is reported by Federal facilities.

Table 10-13 shows changes in on-site waste management from 1995 to 1996 for each Federal agency. Box 10-2 gives the corrected data for this



**Table 10-11. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers Off-site for Further Waste Management, 1995-1996: Federal Facilities**

	1995 Number	1996 Number	Change 1995 to 1996 Percent
Total Facilities	148	133	-10.1
Total Forms	453	378	-16.6
Form Rs	433	350	-19.2
Form As	20	28	40.0
	Pounds	Pounds	Percent
<u>On-site Releases</u>			
Total Air Emissions	6,025,046	4,294,841	-28.7
Fugitive Air	2,898,152	2,463,277	-15.0
Point Source Air	3,126,894	1,831,564	-41.4
Surface Water Discharges	388,541	384,602	-1.0
Underground Injection	325,751	505,541	55.2
On-site Land Releases	1,062,633	704,867	-33.7
Total On-site Releases	7,801,971	5,889,851	-24.5
<u>Off-site Releases</u>			
Transfers Off-site to Disposal	853,704	612,797	-28.2
Total On- and Off-site Releases	8,655,675	6,502,648	-24.9
<u>Other On-site Waste Management</u>			
Recycled On-site	35,643,116	12,169,917	-65.9
Energy Recovery On-site	13,084	7,700	-41.1
Treated On-site	13,067,406	9,650,204	-26.2
Total Other On-site Waste Management	48,723,606	21,827,821	-55.2
<u>Transfers Off-site for Further Waste Management</u>			
Transfers to Recycling	20,692,884	18,553,503	-10.3
Transfers to Energy Recovery	422,412	304,101	-28.0
Transfers to Treatment	896,623	590,337	-34.2
Transfers to POTWs	115,132	71,893	-37.6
Other Off-site Transfers	0	0	—
Total Transfers Off-site for Further Waste Management	22,127,051	19,519,834	-11.8

Note: On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required in 1995. Other Off-site Transfers are transfers reported without a valid waste management code. See corrected on-site waste management data in Box 10-2.

table, taking into account the effect of the error by one Army facility. Army facilities reported the largest amounts of on-site waste management in both years. In both 1995 and 1996, they accounted for 85.7%. The increase was 3.2 million pounds, or 20.5%. Five other agencies also showed increases: Defense Logistics Agency, Army Corps of Engineers, Departments of Agriculture and Energy, and the U.S. Enrichment Corporation. Seven agencies reported reductions from 1995 to 1996: Air Force, Marines, Navy, Departments of Health and Human Services and Treasury, National Aeronautics and Space Administration, and the

Tennessee Valley Authority. The other five Federal agencies (Departments of Interior, Justice, Transportation, and Veterans Affairs, and the Environmental Protection Agency) reported no amounts for on-site waste management in either year.

#### Transfers Off-site for Further Waste Management

Federal facilities reported decreases in transfers off-site for further waste management of 11.8%, from 22.1 million pounds to 19.5 million pounds. These



Box 10-2. Correction to TRI Other On-site Waste Management Data, 1995-1996: Federal Facilities

**Correction to TRI Other On-site Waste Management Data, 1995-1996: Federal Facilities**

One Army facility submitted a 1996 form with on-site recycling data in the prior year column (1995) that differed from 1995 reporting by a factor of 10. Correcting for this error would result in the following data for federal facilities' reporting of on-site waste management:

**Corrected Data for Table 10-11 and Table 10-15**

Waste Management Activity	1995	1996	Change from 1995-1996	
	Pounds	Pounds	Pounds	Percent
<b>On-site Waste Management</b>				
Recycled On-site	5,043,116	12,169,917	7,126,801	141.3
Energy Recovery On-site	13,084	7,700	-5,384	-41.1
Treated On-site	13,067,406	9,650,204	-3,417,202	-26.2
Total On-site Waste Management	18,123,606	21,827,821	3,704,215	20.4
Total Production-related Waste	47,483,831.00	47,591,818.00	107,987.00	0.2

**Corrected Data for Table 10-13**

Corrected Data for Table 10-10					
Agency	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total On-site Waste Management Pounds
Army	96	10,109,100	7,700	8,593,120	18,709,920
	95	3,497,968	13,000	12,013,462	15,524,430

Note: One form from Army facility: change from 34,000,000 to 3,400,000, recycled on-site 1995

data also appear in Table 10-11. The net decrease for off-site waste management was 2.6 million pounds. Transfers off-site to recycling constitute the largest portion of transfers off-site for further waste management and were reduced by 10.3%, or 2.1 million pounds from 1995 to 1996. All other such transfer categories also recorded decreases, of about 30%.

Table 10-14 shows changes in transfers off-site for further waste management from 1995 to 1996 for each Federal agency. Navy facilities reported the largest decrease in transfers off-site for further waste management, of 1.4 million pounds (69.7% reduction). The largest increase was reported by the National Aeronautics and Space Administration. Its

facilities reported an increase of 183,000 pounds, which was three times the amount reported by this agency in 1995.

**Facilities with Large Increases and Decreases in Releases, 1995-1996**

Two Federal facilities reported increases of greater than 100,000 pounds from 1995 to 1996. The U.S. Department of Energy Naval Petroleum Reserves of California in Tupman, California, reported an increase in on-site underground injection of methanol of 184,000 pounds, from 315,000 pounds in 1995 to 499,000 pounds in 1996. Methanol is used at this facility for freeze protection in pipelines. The amount used year to year depends on



Table 10-12. TRI On-site and Off-site Releases, 1995-1996: Federal Facilities

Agency	Year	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 Pounds	Releases to Land Pounds			
Dept of Defense	96	3,060,551	341,430	0	26,805	3,428,786	599,877	4,028,663
	95	4,612,697	359,098	0	489,891	5,461,686	797,675	6,259,361
Air Force	96	1,895,706	87,366	0	41	1,983,113	80,029	2,063,142
	95	2,903,603	34,748	0	486,507	3,424,858	287,560	3,712,418
Army	96	413,931	248,587	0	2,989	665,507	208,526	874,033
	95	649,851	312,766	0	2,874	965,491	194,482	1,159,973
Defense Logistics Agency	96	4,854	0	0	0	4,854	0	4,854
	95	5,101	0	0	250	5,351	505	5,856
Marines	96	165,625	27	0	0	165,652	90,541	256,193
	95	362,188	47	0	3	362,238	164,849	527,087
Navy	96	580,435	5,450	0	23,775	609,660	220,781	830,441
	95	691,954	11,537	0	257	703,748	150,279	854,027
Army Corps of Engineers	96	3,910	300	0	5,000	9,210	0	9,210
	95	3,120	255	0	19,000	22,375	0	22,375
Dept of Agriculture	96	10	0	0	605,470	605,480	0	605,480
	95	0	0	0	481,120	481,120	0	481,120
Dept of Energy	96	196,948	27,461	505,541	10,687	740,637	1,174	741,811
	95	203,097	10,782	325,751	42,277	581,907	2,501	584,408
Dept of Health and Human Services	96	0	0	0	0	0	750	750
	95	0	0	0	0	0	0	0
Dept of Interior	96	750	4,017	0	5	4,772	0	4,772
	95	750	4,086	0	0	4,836	0	4,836
Dept of Justice	96	10,305	1,300	0	0	11,605	0	11,605
	95	19,510	13,000	0	0	32,510	0	32,510
Dept. of Transportation	96	19,600	0	0	0	19,600	1,096	20,696
	95	16,499	0	0	0	16,499	4,544	21,043
Dept of Treasury	96	280	107	0	56,900	57,287	9,350	66,637
	95	7,670	0	0	30,000	37,670	34,050	71,720
Dept. of Veterans Affairs	96	No reports received						
	95	0	0	0	0	0	0	0
Environmental Protection Agency	96	17	0	0	0	17	0	17
	95	11	0	0	0	11	0	11
National Aeronautics and Space Admin	96	327,182	0	0	0	327,182	320	327,502
	95	473,974	0	0	5	473,979	14,934	488,913
Tennessee Valley Authority	96	335	9,736	0	0	10,071	0	10,071
	95	13,620	0	0	0	13,620	0	13,620
U S Enrichment Corporation	96	674,953	251	0	0	675,204	230	675,434
	95	674,098	1,320	0	340	675,758	0	675,758
Total for Federal Facilities	96	4,294,841	384,602	505,541	704,867	5,889,851	612,797	6,502,648
	95	6,025,046	388,541	325,751	1,062,633	7,801,971	853,704	8,655,675

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



Table 10-13. TRI Other On-site Waste Management, 1995-1996: Federal Facilities

Agency	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
Dept. of Defense	96	11,378,222	7,700	9,003,084	20,389,006
	95	34,709,104	13,084	12,489,922	47,212,110
Air Force	96	61,738	0	232,362	294,100
	95	117,680	84	255,475	373,239
Army	96	10,109,100	7,700	8,593,120	18,709,920
	95	34,097,968	13,000	12,013,462	46,124,430
Defense Logistics Agency	96	1,184,803	0	0	1,184,803
	95	436,000	0	0	436,000
Marines	96	0	0	0	0
	95	9,224	0	406	9,630
Navy	96	22,581	0	177,602	200,183
	95	48,232	0	220,579	268,811
Army Corps of Engineers	96	0	0	1,575	1,575
	95	0	0	350	350
Dept. of Agriculture	96	0	0	57,600	57,600
	95	0	0	46,300	46,300
Dept. of Energy	96	362,585	0	369,847	732,432
	95	307,661	0	383,490	691,151
Dept. of Health and Human Services	96	0	0	43,000	43,000
	95	0	0	44,668	44,668
Dept. of Interior	96	0	0	0	0
	95	0	0	0	0
Dept. of Justice	96	0	0	0	0
	95	0	0	0	0
Dept. of Transportation	96	0	0	0	0
	95	0	0	0	0
Dept. of Treasury	96	0	0	120	120
	95	0	0	2,330	2,330
Dept. of Veterans Affairs	96	No reports received			
	95	0	0	0	0
Environmental Protection Agency	96	0	0	0	0
	95	0	0	0	0
National Aeronautics and Space Admin.	96	429,110	0	78	429,188
	95	626,351	0	70	626,421
Tennessee Valley Authority	96	0	0	52,500	52,500
	95	0	0	62,576	62,576
U.S. Enrichment Corporation	96	0	0	122,400	122,400
	95	0	0	37,700	37,700
Total for Federal Facilities	96	12,169,917	7,700	9,650,204	21,827,821
	95	35,643,116	13,084	13,067,406	48,723,606

Note: Data from Section 8 of Form R. See corrected data in Box 10-2.



Table 10-14. TRI Transfers Off-site for Further Waste Management, 1995-1996: Federal Facilities

Agency	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTW's Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
Dept of Defense	96	4,566,374	295,346	566,657	58,461	0	5,486,838
	95	5,888,229	401,482	871,491	23,267	0	7,184,469
Air Force	96	152,142	70,479	129,132	29,496	0	381,249
	95	503,454	125,177	147,464	1,311	0	777,406
Army	96	3,855,274	65,314	293,964	6,432	0	4,220,984
	95	3,376,650	103,874	560,458	3,581	0	4,044,563
Defense Logistics Agency	96	0	0	0	0	0	0
	95	0	0	2,287	0	0	2,287
Marines	96	95,622	105,415	86,184	1,015	0	288,236
	95	276,165	36,800	75,251	1,275	0	389,491
Navy	96	463,336	54,138	57,377	21,518	0	596,369
	95	1,731,960	135,631	86,031	17,100	0	1,970,722
Army Corps of Engineers	96	0	0	0	180	0	180
	95	0	0	0	325	0	325
Dept of Agriculture	96	0	0	0	250	0	250
	95	0	0	0	0	0	0
Dept of Energy	96	28,771	0	2,240	0	0	31,011
	95	93,535	0	7,320	0	0	100,855
Dept of Health and Human Services	96	0	0	0	0	0	0
	95	54,509	0	603	0	0	55,112
Dept of Interior	96	0	0	0	0	0	0
	95	20,979	0	4,852	0	0	25,831
Dept of Justice	96	0	0	0	0	0	0
	95	0	0	0	0	0	0
Dept of Transportation	96	0	0	0	0	0	0
	95	0	1,517	282	0	0	1,799
Dept of Treasury	96	13,742,428	0	5	775	0	13,743,208
	95	14,603,963	0	0	540	0	14,604,503
Dept. of Veterans Affairs	96	No reports received					
	95	0	0	0	91,000	0	91,000
Environmental Protection Agency	96	0	0	0	0	0	0
	95	0	0	0	0	0	0
National Aeronautics and Space Admin	96	215,930	8,755	21,435	1	0	246,121
	95	31,669	19,413	12,075	0	0	63,157
Tennessee Valley Authority	96	0	0	0	12,226	0	12,226
	95	0	0	0	0	0	0
U S Enrichment Corporation	96	0	0	0	0	0	0
	95	0	0	0	0	0	0
Total for Federal Facilities	96	18,553,503	304,101	590,337	71,893	0	19,519,834
	95	20,692,884	422,412	896,623	115,132	0	22,127,051

Note: Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R





the winter weather. The colder the winter, the more that is used and subsequently injected underground.

The Department of Agriculture (USDA) Research Service in Clay Center, Nebraska, reported an increase in on-site land releases of ammonia of 124,000 pounds, from 403,000 in 1995 to 527,000 pounds in 1996. The reporting by this USDA facility highlights the effects of Executive Order 12856. Almost all of the reported releases arise from application of anhydrous ammonia as a fertilizer for corn. These releases make the Clay Center facility one of the top facilities in Nebraska for total on- and off-site releases. Department of Agriculture facilities, like many other Federal facilities, do not operate in the manufacturing sectors (SIC codes 20 to 39) that are subject to TRI reporting. If these facilities were in the private sector, their releases would not be reported to TRI because agricultural facilities generally are not covered under TRI. To provide the public with some information on non-reportable sources of TRI chemical releases, such as the application of fertilizers, EPA has included a discussion of diffuse sources in Chapter 2.

Three U.S. Air Force Bases reported the largest decreases in total on- and off-site releases among Federal facilities. Elmendorf Air Force Base in Alaska reported 481,000 pounds of ethylene glycol released on-site to land in 1995. It did not report for 1996 because it now uses propylene glycol instead. Tinker Air Force Base in Oklahoma reported the second largest decrease, of 173,000 pounds of air emissions of dichloromethane. This facility reported 546,000 pounds in 1995 and 373,000 pounds in 1996. A third Air Force base, Robins Air Force Base in Georgia also reported decreases of air emissions of dichloromethane, from 254,000 pounds in 1995 to 134,000 pounds in 1996, a decrease of 120,000. Robins Air Force Base and Tinker Air Force Base achieved these reductions through source reduction programs. Tinker Air Force Base is in the process of implementing a detailed pollution prevention plan that targets TRI chemicals for significant reductions through the application of process changes and new technology.

The chemical dichloromethane is used primarily in paint stripping of aircraft and aircraft parts, but also in degreasing and the cleaning of bearings. The installation of the Aircraft Component Stripping high pressure water jet system has significantly reduced chemicals used for paint stripping, and dichloromethane has been eliminated for bearing-cleaning operations through the use of an aqueous cleaning process. Additional reductions have been achieved since 1996 through the use of Environmentally Acceptable Strippers for aircraft paint stripping operations. Robins Air Force Base uses a baking soda high pressure water system to limit its use of chemical paint strippers.

## 1995-1996 Waste Management Data for Federal Facilities

Table 10-15 summarizes on- and off-site waste management data for Federal facilities for 1995 and 1996. As before, Box 10-2, presented above, provides corrected data for this table, taking into account the effect of one facility's error in reporting of on-site waste management. The following discussion reflects the data in Box 10-2.

Total production-related waste remained about the same from 1995 to 1996 for Federal facilities. However, all types of waste management activity showed decreases except on-site recycling. Off-site waste management decreased a total of 2.6 million pounds, or 12.0%. Quantities released on- and off-site also had reductions of 2.3 million pounds, or 26.7%.

### Facilities with Large Increases and Decreases in Waste Management, 1995-1996

The U.S. Defense Logistics Agency in Richmond, Virginia, reported increases for four CFCs and Halons in on-site recycling. On-site recycling for the four was 436,000 pounds in 1995 and 1.2 million pounds in 1996, an increase of 749,000 pounds. This facility is the Federal reserve for ozone-depleting substances for all Department of Defense facilities. The facility receives the substances, recycles them, and returns them for



reuse. The facility's mission is to increase the amount of ozone-depleting substances received and recycled. Increases in on-site recycling are anticipated over the next few years until such substances are completely phased out. This program was initiated in late 1994. The second largest reported increase was from the U.S. Army's Lake City Ammunition plant in Independence, Missouri, which reported off-site recycling of copper of 1.3 million pounds in 1995 and 1.6 million pounds in 1996, an increase of 337,000 pounds. The facility with the third largest increase was the U.S. Mint in Philadelphia, Pennsylvania, which reported 3.5 million pounds of copper recycled off-site in 1995 and 3.8 million pounds in 1996, an increase of 300,000 pounds.

The Philadelphia Naval Shipyard in Philadelphia, Pennsylvania, reported the largest decrease with an overall reduction of 1.5 million pounds from 1995 to 1996. In 1995, this facility, which consisted of both a shipyard and a foundry, reported 1.5 million pounds of copper recycled off-site. In 1996, the shipyard closed, but the foundry remains in operation. The amount of copper reported as recycled off-site in 1996 was 150,000 pounds.

The facility with the largest decrease in waste management was the U.S. Mint in Denver, Colorado. This Department of the Treasury facility reported 8.7 million pounds of copper recycled off-site in 1995 and 7.7 million pounds in 1996, a reduction of 1.0 million pounds. The Denver Mint attributes this reduction to a decrease in production of nickels, which are made with a copper core.

### **Other Apparent Increases and Decreases in Waste Management, 1995-1996**

In the TRI database, there are other facilities with large apparent increases and decreases, which have been identified as reporting errors or changes. There is one such Federal facility:

U.S. Army Ammunition Plant, Radford, Virginia, decrease of 27.1 million pounds, reporting error (see Box 10-3).

## **1994-1996 TRI Data for Federal Facilities**

Federal facilities have been required to report to TRI since the 1994 reporting year. (While some facilities, most notably in the Department of Energy, began reporting in 1993, some facilities did not submit reports until 1995.) Industry-specific chapters in this public data release analyze TRI reporting from 1988, TRI's baseline year, to 1996. They also review waste management data since 1991, the year that TRI began collecting this information, through 1996. Because Federal-facility reporting does not cover these longer periods, this section compares data from 1994 to 1996 only.

Multi-year comparisons of TRI data rely on the list of "core" TRI chemicals that were reportable, with the same reporting definition, in all years. For the years 1994 through 1996, in addition to delisted chemicals, this set of chemicals excludes the chemicals added in 1995 and also ammonia, hydrochloric acid, and sulfuric acid because of changes in their reporting definitions. These analyses also cover only the data elements that were collected in all years, which excludes from this section any analysis that distinguishes RCRA subtitle C landfills from other land releases as well as analysis based on the types of underground injection wells.

### **On- and Off-site Releases**

From 1994 to 1996, the number of Federal facilities reporting to TRI decreased from 172 to 122, a 29.1% decrease, as shown in Table 10-16. The number of forms submitted dropped from 611 to 341, a 44.2% decrease. More than three-quarters of this decrease (233 forms out of 270 forms) was due to Department of Defense facilities. The Department of Defense credits much of this decrease to reductions in the use of TRI chemicals achieved through its agency-wide policy of source reduction. In addition, three major Navy facilities closed and three private contractor-operated



Table 10-15. TRI Waste Management Data, 1995-1996: Federal Facilities

Waste Management Activity	1995	1996	Change from 1995-1996	
	Pounds	Pounds	Pounds	Percent
<u>On-site Waste Management</u>				
Recycled On-site	35,643,116	12,169,917	-23,473,199	-65.9
Energy Recovery On-site	13,084	7,700	-5,384	-41.1
Treated On-site	13,067,406	9,650,204	-3,417,202	-26.2
Total On-site Waste Management	48,723,606	21,827,821	-26,895,785	-55.2
<u>Off-site Waste Management</u>				
Recycled Off-site	20,642,592	18,483,313	-2,159,279	-10.5
Energy Recovery Off-site	474,708	345,574	-129,134	-27.2
Treated Off-site	990,294	630,355	-359,939	-36.3
Total Off-site Waste Management	22,107,594	19,459,242	-2,648,352	-12.0
Quantity Released On- and Off-site	8,602,631	6,304,755	-2,297,876	-26.7
Total Production-related Waste	79,433,831	47,591,818	-31,842,013	-40.1
Non- Production-related Waste	178,390	107,763	-70,627	-39.6

Note: Data from Section 8 of Form R (Current Year, Column B) of year indicated. See corrected on-site waste management data in Box 10-2.

facilities closed or were mothballed between 1994 and 1996.

Total on- and off-site releases reported by Federal facilities, also presented in Table 10-16, decreased by half (50.4%) during this period, from 11.0 million pounds to 5.4 million pounds. Air emissions, which were the largest release type in all three years, also decreased by half (50.7%), from 8.3 million pounds to 4.1 million pounds. In 1994, releases to air reported by Federal facilities were divided about equally between fugitive and point source emissions. By 1996, however, this had changed. From 1994 to 1996, fugitive air emissions decreased 44.3% and point source air emissions decreased 57.3%, compared to 1994 reporting. As a result, fugitive air emissions of 2.4 million pounds in 1996 represented a larger proportion (57.5%) of the Federal facilities' air releases.

Other types of on-site releases reported by Federal facilities increased from 1994 to 1996, although the amounts remained well below 1 million pounds in

each category. These were a 12.7% increase in surface water discharges, 58.8% increase in underground injection, and 39.7% increase in on-site land releases. Off-site releases (transfers to disposal), however, decreased by 71.7% from 2.2 million pounds to 613,000 pounds. These data also appear in Table 10-16 and they are illustrated in Figure 10-11.

Table 10-17 provides 1994-1996 data for on- and off-site releases for each Federal agency. The largest reductions were reported by the Air Force (2.9 million pounds, a decrease of 59.7%) and the Army (1.3 million pounds, a decrease of 66.9%). For the Air Force, most of the overall decrease was in air emissions (2.6 million pounds). For the Army, the largest reduction was in off-site releases (740,000 pounds transferred to disposal), followed by air emissions (518,000 pounds). The largest increase was 120,000 pounds (21.4%) by Department of Energy facilities, principally in underground injection.



**Table 10-16. Comparison of TRI On-site and Off-site Releases, Other On-site Waste Management, and Transfers for Further Waste Management, 1994-1996: Federal Facilities**

	1994 Number	1995 Number	1996 Number	Change 1994 to 1996 Percent
Total Facilities	172	139	122	-29.1
Total Forms	611	419	341	-44.2
Form Rs	611	399	314	-48.6
Form As	NA	20	27	—
	Pounds	Pounds	Pounds	Percent
<u>On-site Releases</u>				
Total Air Emissions	8,315,612	5,715,738	4,098,880	-50.7
Fugitive Air	4,237,122	2,685,945	2,358,622	-44.3
Point Source Air	4,078,490	3,029,793	1,740,258	-57.3
Surface Water	109,999	79,721	123,962	12.7
Underground Injection	318,318	325,751	505,541	58.8
On-site Land Releases	71,129	581,513	99,383	39.7
Total On-site Releases	8,815,058	6,702,723	4,827,766	-45.2
<u>Off-site Releases</u>				
Transfers Off-site to Disposal	2,163,898	849,290	612,567	-71.7
Total On- and Off-site Releases	10,978,956	7,552,013	5,440,333	-50.4
<u>Other On-site Waste Management</u>				
Recycled On-site	1,995,164	35,643,116	12,167,717	509.9
Energy Recovery On-site	633,190	13,084	7,700	-98.8
Treated On-site	2,504,525	12,566,460	9,312,954	271.8
Total Other On-site Waste Management	5,132,879	48,222,660	21,488,371	318.6
<u>Transfers Off-site for Further Waste Management</u>				
Transfers to Recycling	18,296,314	20,635,425	18,524,539	1.2
Transfers to Energy Recovery	597,731	419,412	304,101	-49.1
Transfers to Treatment	1,769,843	891,471	589,916	-66.7
Transfers to POTWs	232,151	112,422	37,528	-83.8
Other Off-site Transfers	1,700	0	0	-100.0
Total Transfers Off-site for Further Waste Management	20,897,739	22,058,730	19,456,084	-6.9

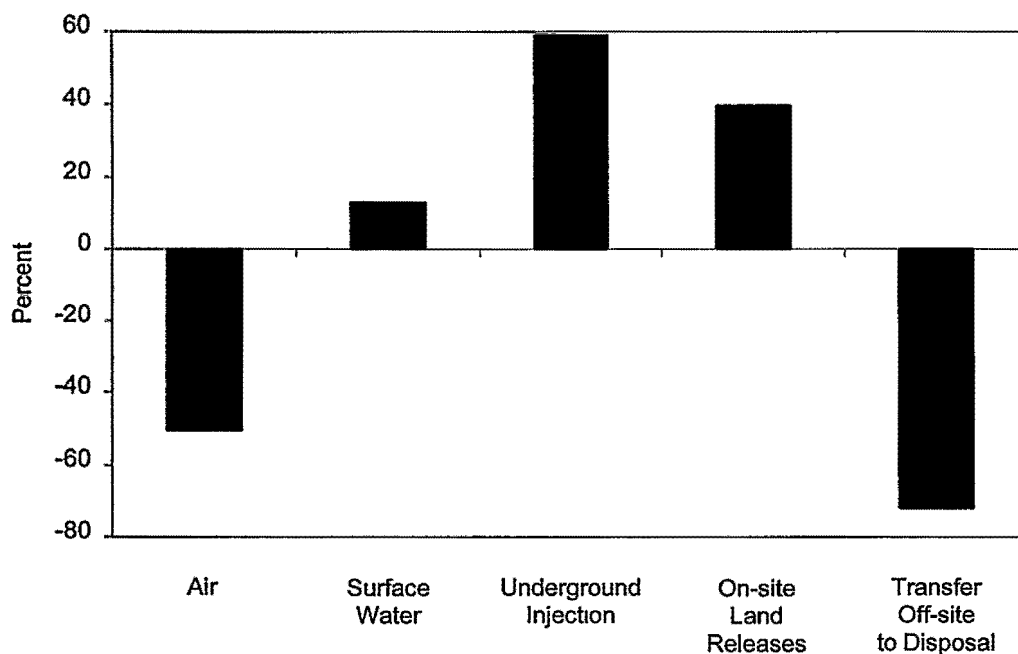
Note. Does not include delisted chemicals, chemicals added in 1995, and ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Other On-site Waste Management from Section 8 of Form R. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Breakdown of Underground Injection and On-site Land Releases not required before 1996. Other Off-site Transfers are transfers reported without a valid waste management code. NA: not required to be reported in that year. See corrected data in Box 10-3.

### Other On-site Waste Management

Table 10-16 also provides data on Federal facilities' reporting of other on-site waste management from 1994 to 1996. Box 10-3 supplies corrected data for this table, taking into account the effect of an error in reporting for on-site recycling in 1994 and 1995 and for on-site treatment in 1994. The following discussion is based on the information shown in Box 10-3. The overall change was a decrease from 34.3 million pounds in 1994 to 21.5 million pounds

in 1996. This was a decrease of 37.4%. This was the result of a decrease of 12.8 million pounds (51.3% decrease) in on-site recycling. On-site treatment showed an increase of 7.0%, from 8.7 million pounds in 1994 to 9.3 million pounds in 1996.

Other on-site waste management data for the individual agencies, for the 1994-1996 period, appear in Table 10-18. Box 10-3 supplies corrected



**Figure 10-11. Percentage Change in On-site and Off-site Releases, 1994-1996: Federal Facilities**

Note: Does not include delisted chemicals, chemicals added in 1995, and ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R. Breakdown of On-site Land Releases and Underground Injection not required before 1996

data for this table, taking into account the effect of an error in reporting by one Army facility. The largest decrease was reported by the Army, a reduction of 11.5 million pounds (or 38.3%), from 1994 to 1996. Most of this reduction was reported in on-site recycling. The largest reported increase was that of the Defense Logistics Agency, an increase of 606,000 pounds (or 104.6%), resulting from an increase in on-site recycling.

#### Transfers Off-site for Further Waste Management

From 1994 to 1996, Federal facilities' reporting of transfers off-site for further waste management decreased 6.9%, from 20.9 million pounds to 19.5 million pounds. The large majority of this reporting was in transfers to recycling, which increased slightly (1.2%), from 18.3 million pounds to 18.5

million pounds. All other types of off-site transfers decreased. These data also appear in Table 10-16.

Table 10-19 provides data for the Federal agencies on transfers off-site for further waste management. Army facilities reported the largest reduction, a decrease of 1.8 million pounds, or 30.1%, from 1994 to 1996. Facilities of the Department of the Treasury reported the largest increase, 1.0 million pounds, or 8.2%.

#### Facilities with Large Increases and Decreases in Releases, 1994-1996

The Federal facility with the largest increase in total on- and off-site releases was U.S. Department of Energy Naval Petroleum Reserves of California



Table 10-17. TRI On-site and Off-site Releases, by Agency, 1994-1996: Federal Facilities

Agency	Year	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 Pounds	Releases to Land Pounds		Transfers Off-site to Disposal Pounds	
Dept of Defense	96	2,943,461	102,485	0	26,805	3,072,751	599,877	3,672,628
	95	4,391,417	57,555	0	489,891	4,938,863	795,321	5,734,184
	94	6,682,870	64,910	1	41,186	6,788,967	2,046,943	8,835,910
Air Force	96	1,809,856	87,366	0	41	1,897,263	80,029	1,977,292
	95	2,731,753	34,748	0	486,507	3,253,008	285,256	3,538,264
	94	4,380,750	15,337	0	20,677	4,416,764	487,215	4,903,979
Army	96	408,091	9,642	0	2,989	420,722	208,526	629,248
	95	640,421	11,223	0	2,874	654,518	194,432	848,950
	94	926,237	12,513	1	14,829	953,580	948,858	1,902,438
Defense Logistics Agency	96	4,854	0	0	0	4,854	0	4,854
	95	5,101	0	0	250	5,351	505	5,856
	94	31,707	0	0	0	31,707	0	31,707
Marines	96	140,225	27	0	0	140,252	90,541	230,793
	95	322,188	47	0	3	322,238	164,849	487,087
	94	450,845	1,027	0	3,880	455,752	460,134	915,886
Navy	96	580,435	5,450	0	23,775	609,660	220,781	830,441
	95	691,954	11,537	0	257	703,748	150,279	854,027
	94	893,331	36,033	0	1,800	931,164	150,736	1,081,900
Army Corps of Engineers	96	3,910	300	0	5,000	9,210	0	9,210
	95	3,110	255	0	19,000	22,365	0	22,365
	94	3,410	1,600	0	17,300	22,310	0	22,310
Dept of Agriculture	96	0	0	0	0	0	0	0
	95	0	0	0	0	0	0	0
	94	No reports received						
Dept of Energy	96	155,452	5,803	505,541	10,678	677,474	1,174	678,648
	95	140,969	3,542	325,751	42,277	512,539	2,501	515,040
	94	220,764	3,766	318,317	12,273	555,120	3,848	558,968
Dept of Health and Human Services	96	0	0	0	0	0	750	750
	95	0	0	0	0	0	0	0
	94	500	0	0	0	500	60,622	61,122
Dept of Interior	96	750	4,017	0	0	4,767	0	4,767
	95	750	4,086	0	0	4,836	0	4,836
	94	1,161	0	0	0	1,161	0	1,161
Dept of Justice	96	10,305	1,300	0	0	11,605	0	11,605
	95	19,510	13,000	0	0	32,510	0	32,510
	94	79,360	13,000	0	0	92,360	0	92,360
Dept of Transportation	96	19,600	0	0	0	19,600	1,096	20,696
	95	16,499	0	0	0	16,499	4,544	21,043
	94	23,566	0	0	250	23,816	1,541	25,357
Dept of Treasury	96	30	107	0	56,900	57,037	9,350	66,387
	95	7,410	0	0	30,000	37,410	34,050	71,460
	94	6,310	0	0	20	6,330	37,000	43,330
Dept of Veterans Affairs	96	No reports received						
	95	0	0	0	0	0	0	0
	94	No reports received						
Environmental Protection Agency	96	17	0	0	0	17	0	17
	95	11	0	0	0	11	0	11
	94	20	0	0	0	20	0	20

**Note:** Does not include delisted chemicals, chemicals added in 1995, and ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R



Table 10-17. TRI On-site and Off-site Releases, by Agency, 1994-1996: Federal Facilities, Continued

Agency	Year	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 Pounds	Releases to Land Pounds			
National Aeronautics and Space Admin.	96	327,172	0	0	0	327,172	320	327,492
	95	473,964	0	0	5	473,969	12,874	486,843
	94	546,899	2,236	0	18	549,153	13,944	557,397
National Security Agency	96	No reports received						
	95	No reports received						
	94	0	0	0	0	0	0	0
Tennessee Valley Authority	96	0	9,736	0	0	9,736	0	9,736
	95	0	0	0	0	0	0	0
	94	0	23,704	0	21	23,725	0	23,725
U.S. Enrichment Corporation	96	638,183	214	0	0	638,397	0	638,397
	95	662,098	1,283	0	340	663,721	0	663,721
	94	750,752	783	0	61	751,596	0	751,596
Total for Federal Facilities	96	4,098,880	123,962	505,541	99,383	4,827,766	612,567	5,440,333
	95	5,715,738	79,721	325,751	581,513	6,702,723	849,290	7,552,013
	94	8,315,612	109,999	318,318	71,129	8,815,058	2,163,898	10,978,956

Note: Does not include delisted chemicals, chemicals added in 1995, and ammonia, hydrochloric acid, and sulfuric acid. On-site Releases from Section 5 of Form R and Off-site Releases from Section 6 (transfers off-site to disposal) of Form R.

in Tupman, California. Reporting of methanol has varied, with 308,000 pounds injected underground in 1994, 184,000 pounds in 1995, and 499,000 pounds in 1996. As described above for 1995-to-1996 increases, methanol is used at this facility as an antifreeze so that the amount used and subsequently injected underground varies depending on winter temperatures. The facility with the second largest increase was the U.S. Navy facility in San Diego, California, with 98,000 pounds of aluminum oxide (fibrous forms) transferred off-site to disposal in 1996 and no reports for this chemical in 1994. Aluminum oxide is used as a grit for paint removal and is collected and disposed of along with paint chips.

The Tinker Air Force Base in Oklahoma reported the largest decrease of total releases from 1994 to 1996. This facility reported air emissions of dichloromethane of 857,000 pounds in 1994, 546,000 pounds in 1995, and 373,000 pounds in 1996. As described above for 1995-to-1996 decreases, this was achieved through its source reduction program. The U.S. Army Arsenal in Pine Bluff, Arkansas, reported the second largest decrease, with 348,000 pounds of transfers to disposal of both hexachloroethane and zinc

compounds in 1994, and no reports for these chemicals in 1996. A second U.S. Air Force Base, in Marietta, Georgia, reported a decrease of 187,000 pounds of methyl ethyl ketone, from 192,000 pounds to 5,000 pounds, in air emissions. It also reported 136,000 pounds in transfers to disposal of manganese compounds in 1994 and no report for this chemical in 1996. Methyl ethyl ketone (MEK) had been used by many at this facility as a paint gun cleaner and general cleaning solvent on aircraft. Strict controls on the distribution of MEK were created, resulting in a reduction in use and the consequent reduction in reported air emissions. During a reclamation project at the base, soils containing naturally occurring manganese compounds were dug up and removed. The manganese compounds in the soil were reported to TRI. This project was completed before the 1996 reporting year.

## 1994-1996 Waste Management Data for Federal Facilities

Table 10-20 summarizes on- and off-site waste management data for Federal facilities from 1994 to 1996. Box 10-3 supplies corrected data for this

**Box 10-3. Corrected On-site Waste Management Quantities, 1994-1996: Federal Facilities**

One federal Army facility did not submit a report for 1994. The form from this facility for nitric acid for 1995 indicates large amounts of this chemical were recycled on-site and treated on-site in 1994 (under the prior year reporting column). In addition, the facility reported a number 10 times smaller for the recycled on-site amount for 1995 on the 1996 form (under the prior year reporting column) than it did on the 1995 form. Correcting for these errors would result in the following data.

**Corrected Data for Table 10-16 and Table 10-20**

Waste Management Activity	1994 Pounds	1995 Pounds	1996 Pounds	Change 1994 to 1996 Percent
<u>Other On-site Waste Management</u>				
Recycled On-site	24,995,164	5,043,116	12,167,717	-51.3
Energy Recovery On-site	633,190	13,084	7,700	-98.8
Treated On-site	8,704,525	12,566,460	9,312,954	7.0
Total Other On-site Waste Management	34,332,879	17,622,660	21,488,371	-37.4
Total Production-related Waste	65,492,432	47,134,174	46,112,296	
Waste Management Activity	Change 1994-1995 Percent	Change 1995-1996 Percent	Change 1994-1996 Percent	
<u>Other On-site Waste Management</u>				
Recycled On-site	-79.8	141.3	-51.3	
Energy Recovery On-site	-97.9	-41.1	-98.8	
Treated On-site	44.4	-25.9	7.0	
Total Other On-site Waste Management	-48.7	21.9	-37.4	
Total Production-related Waste	-28.0	-2.2	-29.6	

**Corrected Data for Table 10-18**

Agency	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Total Treated On-site Pounds	Total On-site Waste Management Pounds
Dept. of Defense	96	11,376,022	7,700	8,891,254	20,274,976
	95	4,109,104	13,084	11,714,032	15,836,220
	94	24,182,837	633,190	6,872,812	31,688,839
Army	96	10,106,900	7,700	8,483,690	18,598,290
	95	3,497,968	13,000	11,714,032	15,225,000
	94	23,230,686	17,000	6,872,812	30,120,498

**Note:** Data from Section 8 of Form R. One form added for 1994 (23,000,000 pounds recycled on-site and 6,200,000 pounds treated on-site). One form corrected for 1995 (from 34,000,000 pounds to 3,400,000 pounds recycled on-site).





Table 10-18. TRI Other On-site Waste Management by Agency, 1994-1996: Federal Facilities

Agency	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
Dept. of Defense	96	11,376,022	7,700	8,891,254	20,274,976
	95	34,709,104	13,084	12,175,092	46,897,280
	94	1,182,837	633,190	2,071,494	3,887,521
Air Force	96	61,738	0	229,962	291,700
	95	117,680	84	240,075	357,839
	94	281,873	0	933,958	1,215,831
Army	96	10,106,900	7,700	8,483,690	18,598,290
	95	34,097,968	13,000	11,714,032	45,825,000
	94	230,686	17,000	672,812	920,498
Defense Logistics Agency	96	1,184,803	0	0	1,184,803
	95	436,000	0	0	436,000
	94	532,560	0	46,563	579,123
Marines	96	0	0	0	0
	95	9,224	0	406	9,630
	94	85,538	128,100	8,527	222,165
Navy	96	22,581	0	177,602	200,183
	95	48,232	0	220,579	268,811
	94	52,180	488,090	409,634	949,904
Army Corps of Engineers	96	0	0	1,575	1,575
	95	0	0	350	350
	94	0	0	1,450	1,450
Dept. of Agriculture	96	0	0	57,600	57,600
	95	0	0	46,300	46,300
	94	No reports received			
Dept. of Energy	96	362,585	0	208,427	571,012
	95	307,661	0	226,374	534,035
	94	104,137	0	302,934	407,071
Dept. of Health and Human Services	96	0	0	43,000	43,000
	95	0	0	44,668	44,668
	94	0	0	11,000	11,000
Dept. of Interior	96	0	0	0	0
	95	0	0	0	0
	94	0	0	4,430	4,430
Dept. of Justice	96	0	0	0	0
	95	0	0	0	0
	94	0	0	0	0
Dept. of Transportation	96	0	0	0	0
	95	0	0	0	0
	94	0	0	0	0
Dept. of Treasury	96	0	0	120	120
	95	0	0	2,330	2,330
	94	0	0	2,205	2,205
Dept. of Veterans Affairs	96	No reports received			
	95	0	0	0	0
	94	No reports received			

Note: Does not include delisted chemicals, chemicals added in 1995, and ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R. See corrected data in Box 10-3.



Table 10-18. TRI Other On-site Waste Management by Agency, 1994-1996: Federal Facilities, Continued

Agency	Year	Recycled On-site Pounds	Energy Recovery On-site Pounds	Treated On-site Pounds	Total Other On-site Waste Management Pounds
Environmental Protection Agency	96	0	0	0	0
	95	0	0	0	0
	94	0	0	0	0
National Aeronautics and Space Admin	96	429,110	0	78	429,188
	95	626,351	0	70	626,421
	94	707,690	0	712	708,402
National Security Agency	96	No reports received			
	96	No reports received			
	94	0	0	12,500	12,500
Tennessee Valley Authority	96	0	0	52,500	52,500
	95	0	0	62,576	62,576
	94	0	0	35,000	35,000
U S Enrichment Corporation	96	0	0	58,400	58,400
	95	0	0	8,700	8,700
	94	0	0	62,800	62,800
Total for Federal Facilities	96	12,167,717	7,700	9,312,954	21,488,371
	95	35,643,116	13,084	12,566,460	48,222,660
	94	1,995,164	633,190	2,504,525	5,132,879

Note: Does not include delisted chemicals, chemicals added in 1995, and ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R. See corrected data in Box 10-3.

table, taking into account the effect of an error in reporting for quantities recycled on-site in 1994 and 1995 and treated on-site in 1994. The following discussion is based on the information shown in Box 10-3. Total production-related waste decreased from 65.5 million pounds to 46.1 million pounds in this period, a decrease of 29.6%. As noted above, on-site waste management showed a decrease, from 34.3 million pounds to 21.5 million pounds, or 37.4%. Federal facilities' reporting of off-site waste management decreased from 20.7 million pounds to 19.4 million pounds, or 6.4%. Quantities released on- and off-site decreased by half (50.0%), from 10.4 million pounds to 5.2 million pounds.

#### Facilities with Large Increases and Decreases in Waste Management, 1994-1996

The U.S. Defense Logistics Agency in Richmond, Virginia, reported increases for four CFCs and Halons in on-site recycling as part of its on-going operations as the Federal reserve for ozone-

depleting substances, described above for the 1995-to-1996 increases. On-site recycling for the four was 533,000 pounds in 1994, 436,000 pounds in 1995, and 1.2 million pounds in 1996, an increase of 652,000 pounds from 1994 to 1996. The facility with the second largest increase was the U.S. Mint in Denver, Colorado, with increases in off-site recycling of copper from 7.3 million pounds in 1994 to 7.7 million pounds in 1996. However, as described above, this is a decrease from the 1995 amount of 8.7 million pounds. The facility with the third largest increase was the U.S. Mint in Philadelphia, Pennsylvania, which reported 3.5 million pounds of copper recycled off-site in both 1994 and 1995 and 3.8 million pounds in 1996, an increase of 300,000 pounds, also described above.

The facility with the largest decrease in waste from 1994 to 1995 was the Tinker Air Force Base in Oklahoma, with decreases in dichloromethane of quantities released on- and off-site of 485,000 pounds, from 863,000 pounds in 1994 to 378,000 pounds in 1996. This facility accounts for the



Table 10-19. TRI Transfers Off-site for Further Waste Management, by Agency, 1994-1996: Federal Facilities

Agency	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
Dept of Defense	96	4,558,899	295,346	566,407	24,346	0	5,444,998
	95	5,885,549	401,482	871,491	20,557	0	7,179,079
	94	5,493,409	582,593	1,681,620	185,996	1,450	7,945,068
Air Force	96	144,667	70,479	129,132	596	0	344,874
	95	500,774	125,177	147,464	1,311	0	774,726
	94	285,896	225,789	265,695	116,267	1,450	895,097
Army	96	3,855,274	65,314	293,964	1,967	0	4,216,519
	95	3,376,650	103,874	560,458	1,621	0	4,042,603
	94	4,847,318	177,510	1,002,843	2,123	0	6,029,794
Defense Logistics Agency	96	0	0	0	0	0	0
	95	0	0	2,287	0	0	2,287
	94	0	7,100	8,630	0	0	15,730
Marines	96	95,622	105,415	85,934	265	0	287,236
	95	276,165	36,800	75,251	525	0	388,741
	94	62,073	98,500	99,881	61,534	0	321,988
Navy	96	463,336	54,138	57,377	21,518	0	596,369
	95	1,731,960	135,631	86,031	17,100	0	1,970,722
	94	298,122	73,694	304,571	6,072	0	682,459
Army Corps of Engineers	96	0	0	0	180	0	180
	95	0	0	0	325	0	325
	94	0	0	0	0	0	0
Dept. of Agriculture	96	0	0	0	0	0	0
	95	0	0	0	0	0	0
	94	No reports received					0
Dept of Energy	96	7,282	0	2,069	0	0	9,351
	95	59,735	0	7,020	0	0	66,755
	94	25,700	0	26,853	10	0	52,563
Dept. of Health and Human Services	96	0	0	0	0	0	0
	95	54,509	0	603	0	0	55,112
	94	25,401	0	19,460	34,415	0	79,276
Dept. of Interior	96	0	0	0	0	0	0
	95	0	0	0	0	0	0
	94	0	0	0	4,500	0	4,500
Dept. of Justice	96	0	0	0	0	0	0
	95	0	0	0	0	0	0
	94	0	0	0	0	0	0
Dept. of Transportation	96	0	0	0	0	0	0
	95	0	1,517	282	0	0	1,799
	94	0	3,554	998	0	250	4,802
Dept. of Treasury	96	13,742,428	0	5	775	0	13,743,208
	95	14,603,963	0	0	540	0	14,604,503
	94	12,693,820	0	0	6,980	0	12,700,800
Dept. of Veterans Affairs	96	No reports received					0
	95	0	0	0	91,000	0	91,000
	94	No reports received					0
Environmental Protection Agency	96	0	0	0	0	0	0
	95	0	0	0	0	0	0
	94	0	0	0	0	0	0

Note: Does not include delisted chemicals, chemicals added in 1995, and ammonia, hydrochloric acid, and sulfuric acid. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code.



Table 10-19. TRI Transfers Off-site for Further Waste Management, by Agency, 1994-1996: Federal Facilities

Agency	Year	Transfers to Recycling Pounds	Transfers to Energy Recovery Pounds	Transfers to Treatment Pounds	Transfers to POTWs Pounds	Other Off-site Transfers Pounds	Total Transfers Off-site for Further Waste Management Pounds
National Aeronautics and Space Admin	96	215,930	8,755	21,435	1	0	246,121
	95	31,669	16,413	12,075	0	0	60,157
	94	57,984	11,584	13,808	250	0	83,626
National Security Agency	96	No reports received					
	95	No reports received					
	94	0	0	38	0	0	38
Tennessee Valley Authority	96	0	0	0	12,226	0	12,226
	95	0	0	0	0	0	0
	94	0	0	27,066	0	0	27,066
U S Enrichment Corporation	96	0	0	0	0	0	0
	95	0	0	0	0	0	0
	94	0	0	0	0	0	0
Total for Federal Facilities	96	18,524,539	304,101	589,916	37,528	0	19,456,084
	95	20,635,425	419,412	891,471	112,422	0	22,058,730
	94	18,296,314	597,731	1,769,843	232,151	1,700	20,897,739

Note: Does not include delisted chemicals, chemicals added in 1995, and ammonia, hydrochloric acid, and sulfuric acid. Transfers Off-site for Further Waste Management from Section 6 (excluding transfers off-site to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code

Table 10-20. TRI Waste Management Data, 1994-1996: Federal Facilities

Waste Management Activity	1994 Pounds	1995 Pounds	1996 Pounds
<u>On-site Waste Management</u>			
Recycled On-site	1,995,164	35,643,116	12,167,717
Energy Recovery On-site	633,190	13,084	7,700
Treated On-site	2,504,525	12,566,460	9,312,954
Total On-site Waste Management	5,132,879	48,222,660	21,488,371
<u>Off-site Waste Management</u>			
Recycled Off-site	18,051,026	20,580,092	18,454,324
Energy Recovery Off-site	558,744	471,708	345,574
Treated Off-site	2,102,577	961,194	595,560
Total Off-site Waste Management	20,712,347	22,012,994	19,395,458
Quantity Released On- and Off-site	10,447,206	7,498,520	5,228,467
Total Production-related Waste	36,292,432	77,734,174	46,112,296
Non- Production-related Waste	307,616	174,295	107,685
Waste Management Activity	Change 1994-1995 Percent	Change 1995-1996 Percent	Change 1994-1996 Percent
<u>On-site Waste Management</u>			
Recycled On-site	1,686.5	-65.9	509.9
Energy Recovery On-site	-97.9	-41.1	-98.8
Treated On-site	401.8	-25.9	271.8
Total On-site Waste Management	839.5	-55.4	318.6
<u>Off-site Waste Management</u>			
Recycled Off-site	14.0	-10.3	2.2
Energy Recovery Off-site	-15.6	-26.7	-38.2
Treated Off-site	-54.3	-38.0	-71.7
Total Off-site Waste Management	6.3	-11.9	-6.4
Quantity Released On- and Off-site	-28.2	-30.3	-50.0
Total Production-related Waste	114.2	-40.7	27.1
Non- Production-related Waste	-43.3	-38.2	-65.0

Note: Does not include delisted chemicals, chemicals added in 1995, ammonia, hydrochloric acid, and sulfuric acid. Data from Section 8 of Form R (Current Year, Column B) of year indicated. See corrected data in Box 10-3.



largest decreases in total releases for both 1994 to 1996 and 1995 to 1996, as described above. The facility attributes the reductions to process and equipment changes implemented as a result of its source reduction program. The U.S. Army Lake City Ammunition Plant in Independence, Missouri, reported the second largest decreases, with 2.3 million pounds of copper recycled off-site in 1994 and 1.6 million pounds in 1996, a decrease of 620,000 pounds. The facility reporting the third largest decreases in waste was the U.S. Army Arsenal in Pine Bluff, Arkansas, with 351,000 pounds of both hexachloroethane and zinc compounds released on and off-site in 1994 and 50 pounds of each in 1996. This decrease occurred from 1995 to 1996, as described above.

**Facilities Contacted For Explanations  
(alphabetical by facility):**

U.S. Air Force, Elmendorf Air Force Base, Alaska:  
Cheryl Paige, March 23, 1998 (explanation provided)

U.S. Air Force Plant, Marietta, Georgia: Rochelle  
Routman, April 16, 1998 (explanation provided)

U.S. Air Force, Robins Air Force Base, Georgia:  
Andrew Porth (Department of Defense), April 16,  
1998 (explanation provided)

U.S. Air Force, Tinker Air Force Base, Oklahoma:  
Anne Schaefer, March 25, 1998 (explanation  
provided)

U.S. Army Arsenal, Pine Bluff, Arkansas (could not  
be reached for comment)

U.S. Army Ammunition Plant, Radford, Virginia:  
Shelley Barker, April 15, 1998 (explanation provided)

U.S. Army, Lake City Ammunition Plant,  
Independence, Missouri (could not be reached for  
comment)

U.S. Defense Logistics Agency, Richmond, Virginia:  
Adrianne Moore and Ron Sibley, April 15, 1998  
(explanation provided)

U.S. Department of Agriculture, Agricultural  
Research Service, Clay Center, Nebraska: Glen  
Becker, March 24, 1998 (explanation provided)

U.S. Department of Energy Naval Petroleum Reserves  
of California, Tupman, California: Gary Walker, April  
15, 1998 (explanation provided)

U.S. Mint, Denver, Colorado: Gail Fallon, April 20,  
1998 (explanation provided)

U.S. Mint, Philadelphia, Pennsylvania (could not be  
reached for comment)

U.S. Navy, Philadelphia Naval Shipyard,  
Philadelphia, Pennsylvania: Mark Donato, April 20,  
1998

U.S. Navy, San Diego Naval Station, San Diego,  
California (no explanation provided)

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# **APPENDIX A**

## **EPA REGIONAL OFFICE AND STATE TRI CONTACTS**

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### **EPA REGIONAL SECTION 313 COORDINATORS**

#### **USEPA Region I**

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**Appendix A — EPA Regional Office and State TRI Contacts**

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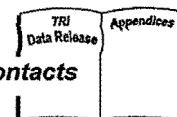
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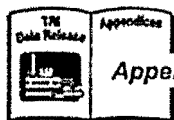
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**Hawaii**

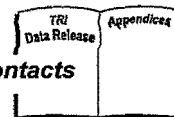
Marsha Graf, TRI Coordinator  
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## **Maine**

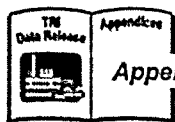
Rayna Leibowitz  
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**Appendix A — EPA Regional Office and State TRI Contacts**

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**Navajo Nation**

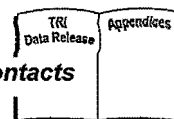
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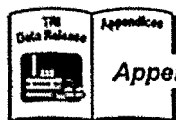
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**Appendix A — EPA Regional Office and State TRI Contacts**

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**Rhode Island**

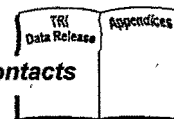
Karen Slattery  
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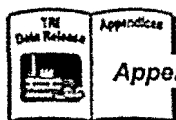
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*Appendix A — EPA Regional Office and State TRI Contacts*

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Wyoming Emergency Response Commission  
5500 Bishop Blvd.  
Cheyenne, WY 82009-3320  
(307) 777-4900  
Fax (307) 635-6017  
Email: [hellerj@wy-iso.army.mil](mailto:hellerj@wy-iso.army.mil)

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## APPENDIX B

# PUBLIC ACCESS TO THE TOXICS RELEASE INVENTORY AND RELATED INFORMATION

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According to many, the TRI program is one of the most effective environmental programs ever legislated by Congress and administered by EPA. Its success is due, in large part, to the right-to-know provisions contained in the legislation itself. By requiring that the resulting data be made publicly available by electronic and other means, Congress ensures that citizens, the media, environmental advocates, researchers, the business community, and others can influence and evaluate industry's efforts to reduce toxics emissions.

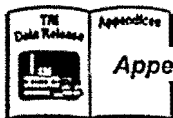
Every year, EPA enhances its databases to make the received data easier to search and expands its outreach activities to include new potential users of the data. To do this, the EPA identifies and engages the assistance of organizations to help promote TRI awareness, provide access, and increase data usage. Journalists, national and local public interest and environmental groups, and state governments continue to be key outreach participants. Libraries in communities all across the U.S., in particular, members of the Federal Depository Library Program, are committed to providing public access to TRI data in a variety of formats. Because the value of TRI increases as more people use it, EPA encourages these organizations to acquaint new users with TRI, help people who already know about TRI to better use and understand the data, and, whenever

possible, to provide feedback on how to improve TRI products and services.

Many different options are available for accessing TRI, and more are added every year. EPA offers the data in a variety of common computer and hard copy formats to ensure that everyone can easily use the information. TRI is available on diskette, CD-ROM, and computer bulletin boards. It is also available through several on-line national computer databases, and more and more TRI information is being added to the Internet. TRI reports are available from state government offices as well as from EPA. You can contact your state EPCRA Coordinator or you can call your EPA Regional TRI Coordinator for assistance. (See listing of Regional coordinators and state EPCRA contacts in Appendix A.) Many other avenues for accessing TRI are described in the following pages.

TRI has proven to be a rich source of data for a broad public audience. For instance, educators are using the data to conduct studies and courses on the environment; labor unions are using the TRI data to improve conditions for workers; and businesses are using the data in many ways - as a basis for reducing large stocks of toxic chemicals, to cut costs, to improve operations, to reduce the use of toxic chemicals, and for a variety of other reasons. Concerned citizens are a growing user





## **Appendix B—Public Access to the Toxics Release Inventory and Related Information**

group. These individuals, on their own and through organized groups, are using TRI to raise and answer questions about chemical releases in their communities. States use the national data to compare releases within industries.

Avenues of public access to TRI will continue to grow, and TRI will continue to be an important first step for discovering which chemicals are being manufactured, released, or transferred in communities across the country. The diversity of the groups across the country who use TRI will also increase as will the varied uses of the data. TRI will increasingly become the data source used to positively influence the views of companies, legislators, and the public regarding the overall conditions of the nation's environment.

### **ACCESSING TOXICS RELEASE INVENTORY (TRI) PRODUCTS AND SERVICES**

Accessing TRI data is easy. It is available in a wide variety of computer and hardcopy formats to meet most user's needs. Through outreach activities, EPA identifies organizations in the toxics community to help promote awareness of TRI and use of its data products. TRI data is available online, for purchase from the Government Printing Office (GPO) or the National Technical Information Service (NTIS), for use in Federal Depository Libraries across the U.S., or from the National Center for Environmental Publications (NCEPI). In addition, state officials also receive TRI reports from facilities in their jurisdiction, and many states publish reports highlighting state and local trends.

#### **Products**

##### **TRI CD-ROM**

This two-disc set contains the complete national TRI, starting with the first inventory in 1987. It also contains Chemical Fact Sheets that provide reference material on the health and environmental effects of TRI chemicals.

User-friendly software provides the capability to search TRI data by facility, location, chemical, SIC code, and other data fields. Other features allow flexibility in printing standard and custom reports, data downloading, and calculating releases for search sets (for example, to calculate average air releases for all pulp and paper manufacturers). Complete documentation outlining the history of TRI, how it is used, and how to operate the software is included.

The NCEPI offers the TRI CD-ROM free of charge to all government organizations, educators, students, non-profit organizations, and citizen groups. Businesses may purchase the discs from the GPO or NTIS for about \$40.

For more information, contact:

#### **National Center for Environmental Publications and Information (NCEPI)**

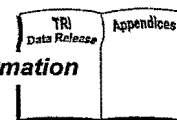
P.O. Box 42419  
Cincinnati, OH 45242-2419  
Call: (800) 490-9198  
Fax: (513) 489-8695  
Hours: 7:00a.m. - 5:30 p.m. (Eastern Time)  
Publication Number: EPA 749-C-97-003

#### **U.S. Government Printing Office (GPO)**

Superintendent of Documents  
P.O. Box 371954  
Pittsburgh, PA 15250-7954  
Call: (202) 512-1800  
Fax: (202) 512-2250  
Hours: 8:30 a.m. - 4:00 p.m. (Eastern Time)  
Stock Number: 055-000-00582-6

#### **National Technical Information Service (NTIS)**

U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, VA 22161  
Call: (800) 553 6847  
(703) 487-4650  
Fax: (703) 321-8547  
Email: [info@ntis.fedworld.gov](mailto:info@ntis.fedworld.gov)  
Hours: 8:30 a.m. - 5:00 p.m. (Eastern Time)  
Publication Number: PB97-502-587



### TRI State Data Files

Selected information from TRI reports submitted to EPA is available on diskettes or the Internet in dBASE (.dbf) format. For each state, one or more diskettes contain the most frequently used TRI data, such as the names, locations, and contacts for reporting facilities; chemical names and CAS numbers; aggregate releases in pounds of chemicals released to air, land, water, and underground injection wells; and total chemical transfers to off-site locations and publicly-owned treatment works. Diskettes for 1991 and later years also contain selected pollution prevention data. A diskette containing federal facilities nationwide is also available for reporting year 1995. Diskettes are accompanied by user instructions. The cost of diskettes for a single state varies, depending on the number of disks in the set. The same information may be downloaded off the Internet for free at <http://www.epa.gov/opptintr/tri/disks.htm>.

To obtain diskettes, contact:

**U.S. Government Printing Office (GPO)**  
Superintendent of Documents  
P.O. Box 37082  
Washington, DC 20013-7082  
Call: (888) 293-6498 (toll-free)  
(202) 512-1530  
Fax: (202) 512-1262  
Hours: 7:00 a.m. - 5:00 p.m. (Eastern Time)

### TRI Information Kit

The TRI Information Kit is designed to acquaint a broad and disparate audience with the TRI. The information kit is appropriate for those familiar or unfamiliar with TRI. It contains a brochure, bookmark, poster, and other explanatory materials. It is designed to answer the “who, what, when, why, where, and how” questions of TRI in clear, non-jargon language. The kit provides a broad explanation of TRI, as well as examples of how various groups have used TRI, where it can be accessed or obtained, and organizations that

are sources for further information about TRI and the chemicals reported. Copies are free.

To request copies, contact:

**National Center for Environmental Publications and Information (NCEPI)**  
P.O. Box 42419  
Cincinnati, OH 45242-2419  
Call: (800) 490-9198  
(513) 489-8190  
Fax: (513) 489-8695  
Document Number: EPA-749-K-98-001

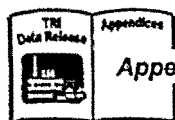
**TRI User Support Service (TRI-US)**  
U.S. EPA  
401 M Street, SW. (MC-7407)  
Washington, DC 20460  
Call: (202) 260-1531  
Fax: (202) 401-2347  
Email: [tri.us@epamail.epa.gov](mailto:tri.us@epamail.epa.gov)  
Hours: 8:00 a.m. - 4:30 p.m. (Eastern Time)

### Chemicals in the Environment

Issue number 6 of *Chemicals in the Environment* (CIE), published in the Fall of 1997, is devoted entirely to TRI. This 22 page publication contains 19 articles ranging from the history of TRI to the future of new TRI products. Articles include perspectives from the community, State, Federal, and International level. The publication also provides valuable information on training and contacts within the EPA. CIE is available free over the Internet (<http://www.epa.gov/opptintr/cie>) or from NCEPI.

To request copies, contact:

**National Center for Environmental Publications and Information (NCEPI)**  
P.O. Box 42419  
Cincinnati, OH 45242-2419  
Call: (800) 490-9198  
(513) 489-8190  
Fax: (513) 489-8695  
Document Number: EPA749-R-97-001b



## Appendix B —Public Access to the Toxics Release Inventory and Related Information

### Public Data Release Reports

EPA assembles several detailed annual reports providing summaries, analyses, and comparison of TRI data by year. The reports summarize data on total releases and transfers of TRI chemicals; geographic distribution of TRI releases and transfers; industrial patterns of releases and transfers; the interstate and intrastate transport of wastes and other kinds of analyses. A limited number of copies are free while supplies last.

- 1996 Toxics Release Inventory: Public Data Release
- 1996 Toxics Release Inventory: Public Data Release State Fact Sheets

To request copies, contact:

#### **EPCRA Hotline**

Call: (800) 424-9346

(703) 412-9810 (Washington Metropolitan area)

TDD: (800) 553-7672

Fax: (703) 412-3333 (To request documents only)

Hours: 8:30 a.m. - 7:30 p.m. (Eastern Time)

#### **TRI User Support Service (TRI-US)**

U.S. EPA

401 M Street, SW. (MC-7407)

Washington, DC 20460

Call: (202) 260-1531

Fax: (202) 401-2347

Email: [tri.us@epamail.epa.gov](mailto:tri.us@epamail.epa.gov)

Hours: 8:00 a.m. - 4:30 p.m. (Eastern Time)

### *Act Locally: Preventing Pollution at the Community Level with Resources that Control Pesticide and Toxic Chemical Use*

This is a catalogue which describes tools, resources, and programs of the Office of Prevention, Pesticides and Toxic Substances (OPPTS). It lists information about OPPTS' extensive base of information on the characteristics and effects of pesticides and industrial chemicals. These "tools" include

databases; computer programs for chemical screening; funding resources; access to information hotlines; and descriptions of programs and initiatives that may be useful in protecting local environments.

*Act Locally* describes activities developed by OPPTS that are compatible with the Agency's community-based environmental protection (CBEP) goals and initiatives. In addition, it describes some of the products that OPPTS developed that are useful tools for supporting CBEP activities in large and small communities. These tools can help communities learn about potential chemical risks, and can be used to develop strategies to mitigate those risks and help improve the local environment.

The catalogue is available as a resource on the Internet at (<http://www.epa.gov/opptintr/actlocal>) and can be viewed, printed, or downloaded. The online site also has hyperlinks to other OPPTS and related resources. A published version of *Act Locally* is expected by late summer 1998.

For more information, contact:

#### **Office of Prevention, Pesticides and Toxic Substances**

##### **Office of Pollution Prevention and Toxics**

Environmental Assistance Division (MC-7408)

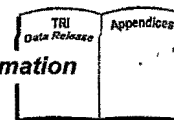
Community-Based Programs Branch

Joseph Schechter, Senior Environmental Protection Specialist

Call: (202) 260-1540

### *Risk Screening Guide*

The "Toxic Chemical Release Inventory Risk Screening Guide" describes a method for evaluating TRI data for environmental managers and provides a structured way for citizens to look at TRI data from a human health perspective. (Vol. 1 - The Process and Vol. 2 Appendices, July 1989. EPA Document Number: 560/2-89-002.)



To order, contact:

**National Technical Information Service (NTIS)**

U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, VA 22161  
Call: (800) 553-6847  
(703) 487-4650  
Fax: (703) 321-8547  
Email: [info@ntis.fedworld.gov](mailto:info@ntis.fedworld.gov)  
Hours: 8:30 a.m. - 5:00 p.m. (Eastern Time)  
Publication Number: PB90-122-128  
Cost: \$61.50

**Chemical Fact Sheets**

OPPT is continuing to develop Chemical Fact Sheets as part of its effort to provide the public with information on chemicals. The goal is to provide information summaries that supplement environmental release information for TRI chemicals. Two types of summaries are available for each chemical. One is a two-page document providing a non-technical summary of chemical information. The other is a longer, referenced presentation of information that provides the basis for statements included in the shorter summary.

Both summaries provide the following information for each chemical:

- its identity and properties
- how it is used
- how exposure to it might occur
- what happens to it in the environment
- how it affects human health and the environment
- what EPA offices and other groups can be contacted for more information

Chemical Fact Sheets are now available for 40 high-production volume TRI chemicals. Another 60 are in various stages of OPPT review. Among the chemicals for which Fact Sheets are available are: methylene chloride (dichloromethane), toluene, acrylonitrile, perchloroethylene, methyl t-butyl ether, and styrene.

The Chemical Fact Sheets, their accompanying support documents, and a list of completed fact sheets can be found on the Internet at: (<http://www.epa.gov/chemfact>).

For more information, contact:

**TSCA Assistance Information Services Hotline**

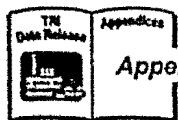
C/O: Garcia Consulting  
401 M St. S.W. (MC-7408)  
Washington, DC 20460  
Call: (202) 554-1404  
TDD: (202) 554-0551  
Fax: (202) 554-5603

**Assistance Services**

**TRI User Support Service (TRI-US)**

U.S. EPA  
401 M Street, SW. (MC-7407)  
Washington, DC 20460  
Call: (202) 260-1531  
Fax: (202) 401-2347  
Email: [tri.us@epamail.epa.gov](mailto:tri.us@epamail.epa.gov)  
<http://www.epa.gov/opptintr/tri>  
Hours: 8:00 a.m.- 4:30 p.m. (Eastern Time)

The TRI-US Service provides general information about the TRI and support for access to any of the data formats. TRI specialists can help determine the data product best suited for an individual user's needs. The service provides a comprehensive search assistance for the TRI on-line and CD-ROM applications. TRI-US provides both National Library of Medicine/TOXNET and CD-ROM training through individual sessions and workshops. Documentation for all TRI products is available from TRI-US. Copies of TRI reports are distributed as well. This support service provides referrals to EPA Regional and state TRI contacts and to the libraries where TRI is available. Referrals to TRI resources in other localities are also available. For more information about accessing TRI or obtaining TRI data products, visit us at the TRI Web site: (<http://www.epa.gov/opptintr/tri/disks.htm>).



## Appendix B—Public Access to the Toxics Release Inventory and Related Information

### EPCRA Hotline

Call: (800) 424-9346

(703) 412-9810 (Washington Metropolitan area)

Fax: (703) 412-3333 (To request documents only)

TDD: (800) 553-7672

<http://www.epa.gov/epaoswer/hotline>

Hours: 9:00 a.m. - 6:00 p.m. (Eastern Time)

The Emergency Planning and Community Right-to-Know (EPCRA) Hotline provides regulatory, policy, and technical assistance to the regulated community, federal agencies, local and state governments, the public, and other interested parties in response to questions related to EPCRA. The Hotline provides information on the availability of documents related to EPCRA and copies of selected EPCRA documents on a limited basis. For more information about the EPCRA Hotline, visit their Internet Web site at: (<http://www.epa.gov/epaoswer/hotline>).

### Federal Depository Libraries

TRI products are distributed through the Federal Depository Library Program, a network of 1,400 public and academic libraries located in communities all across the U.S. While librarians in these organizations are not specialists in TRI information, they are often quite knowledgeable about obtaining and using information resources in general. Over 700 depository libraries receive the TRI on CD-ROM. Librarians in these institutions can assist you in searching the database and using other features of the discs, such as printing reports and downloading data from the CD-ROM. More and more depository libraries are allowing patrons to access the Internet using public workstations located in the library.

For more information or to identify the Federal Depository Library nearest you, contact your local library. TRI User Support Service can also refer you to the closest Federal Depository Library that can provide access to TRI.

### Online Services

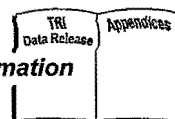
#### EPA Internet Public Server

For TRI, like many other EPA programs, the Internet is fast becoming one of the best resources for identifying information that is available to the public. EPA manages a full service Internet site, offering access via the World Wide Web. The World Wide Web server (<http://www.epa.gov>) is a graphical user interface allowing access not only to text but to images as well. Using a WWW program (or “browser,” such as Netscape or Explorer), users can access the Web site. Consult your system administrator for specific access procedures. There is no cost for accessing the EPA public server or using any of the information that you find there.

The TRI home page (<http://www.epa.gov/opptintr/tri>) offers information useful to both novice and experienced users of the toxics community. It provides, in lay terms, a description of what TRI is, how it can be used, a discussion of TRI and health issues, and much more. You can find out about TRI products, view or download the 1996 TRI data release reports, and identify who to contact for more information in EPA regions and states programs across the country. From the TRI home page, you can “link” to other EPA and non-EPA sites that allow you to search the TRI data base online.

#### National Library of Medicine (NLM) TOXNET System

The National Library of Medicine (NLM) TOXNET System makes TRI accessible to concerned citizens and to businesses and organizations interested in environmental or public health issues. TOXNET offers state-of-the-art, user-friendly, on-line searching. The system features a variety of on-line user assistance features, a flexible command language, and “free text” search capability. Users can print



specific portions of the records either on-line or off-line, and there are a wide variety of customized text options built into the system. The menu-driven search package allows individuals with limited computer skills to use the TRI on-line database efficiently and effectively. The chemical fact sheets can also be accessed via the TOXNET system. On-line costs range from \$18-\$20 per hour. An NLM password is necessary to use the file. The system contains the complete national TRI data for all reporting years.

TOXNET is available on the Internet. The address for the file is [toxnet@tox.nlm.nih.gov](mailto:toxnet@tox.nlm.nih.gov) or visit NLM's Web site at: <http://www.nlm.nih.gov/pubs/factsheets/trifs.html> for more information about accessing TRI on TOXNET.

For more information, contact:

**National Library of Medicine  
Specialized Information Services**

TRI Representative

8600 Rockville Pike

Bethesda, MD 20894

Call: (301) 496-6531

E-mail: [toxmail@tox.nlm.nih.gov](mailto:toxmail@tox.nlm.nih.gov)

Hours: 7 days/week; 24 hours/day

For more information on the EPA's Internet server, contact the Internet support group at the E-mail address:

[internet\\_support@unixmail.rtpnc.epa.gov](mailto:internet_support@unixmail.rtpnc.epa.gov).

**Envirofacts**

Another EPA Web site, the Envirofacts Warehouse (<http://www.epa.gov/enviro>) provides free access to five of EPA's largest databases with Superfund data, Safe Drinking Water information, Hazardous Waste data, Water Discharge permits, Air Releases, and TRI information. TRI is specifically addressed through National Library of Medicine (NLM) TOXNET System.

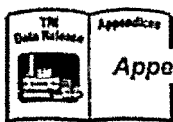
**Envirofact's TRI page:**

The user at [http://www.epa.gov/enviro/html/tris/tris\\_overview.html](http://www.epa.gov/enviro/html/tris/tris_overview.html) can read about EPA's databases, generate reports, and produce maps showing the location of TRI and other facilities. Envirofacts allows the user to search the TRI database by facility name, geographic location, SIC Code, or chemical name and to produce reports on the facilities and map their locations. A variety of user specified parameters let users point and click to customize their searches. The maps include facility locations as well as user defined demographic information, schools, hospitals, roads, bodies of water, and more. Maps can be printed out or saved in various formats including GIF, JPG, TIF, PDF, EPS, ARC/INFO and more.

**Right-to-Know Computer Network (RTK NET)**

The Right-to-Know Computer Network (RTK NET) offers free access to TRI data from 1987 through the current reporting year, along with health facts for each TRI chemical, searchable through the World Wide Web, Telnet, and dial-up. RTK NET, operated jointly by the Unison Institute and OMB Watch, is an on-line telecommunications link to environmental and other databases. This service promotes pollution prevention by putting TRI data together with other prevention strategies. It provides communication among individuals concerned about toxics use reduction and seeks to increase use and analysis of TRI and related data. RTK NET links TRI with other environmental data, civil cases brought by the U.S. EPA, a portion of the 1990 Census data, and a mapping program called Landview.

The TRI data can be accessed through the World Wide Web (<http://www.rtk.net>), Telnet (<rtk.net>), and by modem. (To access by modem, dial 202-234-8570, set computer parameters to 8,N,1, and type "public" (no quotes) in lower case and register for a free account.) Participants can communicate with one another through computer-generated mail, in addition to exchanging and reviewing documents electronically.



## Appendix B—Public Access to the Toxics Release Inventory and Related Information

In addition to the TRI data, the following databases on RTK NET may be of interest to TRI users:

- **ARIP** - EPA Accidental Release Information Program.
- **BRS** - EPA RCRA Biennial Reporting System.
- **NPRI** - Canada's TRI-like system, called the National Pollutant Release Inventory
- **Census Data by Zip Code** - Linking 1990 U.S. Summary with TRI, FINDS, and BRS.
- **CERCLIS** - CERCLA "Superfund" Information System.
- **CUS** - EPA TSCA Inventory of chemical production database.
- **DOCKET** - EPA civil litigation and administrative actions
- **ERNS** - EPA Emergency Response Notification System.
- **FINDS** - Identifying information and location of all facilities regulated by EPA
- **NPL** - EPA Superfund National Priorities List of Sites
- **PCS** - EPA Water Permit Compliance System contains files on facilities, pipes, and pollutant limits
- **ROADMAPS** - Regulatory levels and health effects of TRI chemicals
- **RODs** - EPA Records of Decision
- **SETS** - EPA Superfund Site Enforcement Tracking System
- **USGS** - Water Use Database

Training is available from the computer service on using telecommunications, using RTK NET, and searching the database.

For more information, contact:

### **RTK NET**

c/o The Unison Institute  
1742 Connecticut Avenue, N.W.  
Washington, DC 20009-1171  
Call: (202) 797-7200  
Fax: (202) 234-8584  
Email: [info@rtk.net](mailto:info@rtk.net)

### *Integrated Risk Information System (IRIS)*

The Integrated Risk Information System (IRIS) contains summaries of health risks and EPA regulatory information on over 500 specific chemicals. It is a key source for descriptive and quantitative hazard/risk information, such as oral reference dose and inhalation reference concentrations for chronic, noncarcinogenic health effects; oral slope factors and unit risk for chronic exposure to carcinogens; EPA drinking water health advisories; and summaries of EPA regulatory actions. The system is useful in the risk assessment process.

For online access, contact:

### **National Library of Medicine**

TRI Representative  
8600 Rockville Pike  
Bethesda, MD 20894  
Call: (301) 496-6531  
Hours: 7 days/week; 24 hours/day

For diskettes, contact:

### **National Technical Information Service (NTIS)**

U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, VA 22161  
Call: (800) 553-6847  
(703) 487-4650  
Fax: (703) 321-8547  
Email: [info@ntis.fedworld.gov](mailto:info@ntis.fedworld.gov)  
Hours: 8:30 a.m. - 5:00 p.m. (Eastern Time)

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# APPENDIX C

## ADDITIONAL INFORMATION FOR ASSESSING THE IMPACTS OF TRI CHEMICALS

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### HAZARD DATA AVAILABILITY ON HIGH PRODUCTION VOLUME (HPV) TRI CHEMICALS

According to data aggregated from industry reports submitted under the Toxic Substances Control Act (TSCA) 1990 Inventory Update Rule, the U.S. produces and/or imports 2,863 chemicals (excluding polymers and inorganic chemicals) in annual volumes over 1 million pounds. Among these U.S. high production volume (HPV) chemicals, 203 are on the TRI list (see Table A). EPA has reviewed the publicly available data on each of these HPV chemicals and has determined that many may not have been tested to determine the extent of their toxicity to humans or the environment. (A number of these chemicals are also pesticides, but this analysis did not consider information developed under FIFRA).

International authorities agree that testing in six basic endpoint areas comprise a minimally acceptable data set to provide a basic understanding of a chemical's toxicity and allow a preliminary assessment of potential hazard/risk. These basic tests address: acute toxicity; chronic toxicity; developmental and reproductive toxicity; mutagenicity; ecotoxicity; and environmental fate and comprise the "Screening Information Data Set" (SIDS) test

battery established by the Organization for Economic Cooperation and Development (OECD) which is used by EPA and 29 OECD member countries around the world as a basic indicator of potential hazard for input to initial assessment of chemical risk.

EPA used the OECD SIDS test battery as the yardstick for determining whether SIDS-type basic toxicity information was available on each HPV chemical, and searched over 20 publicly accessible databases to identify which of the six tests had been performed on which chemicals. EPA's search found that a full set of basic toxicity information is available for only 7% of the HPV chemicals and that no information on basic toxicity, i.e., either human health or environmental toxicity, is publicly available for 43% of the 2,863 HPV chemicals produced (and/or imported) in the U.S.

The subset of 203 HPV chemicals in the 1995 TRI list yielded better results than for HPV chemicals as a whole, but even the TRI chemicals showed some significant gaps in the basic data set. Although the full six-test SIDS battery was available for only ~ 54% of the chemicals, all of the TRI HPV chemicals had at least some data available. About 20% of the TRI HPV chemicals,



Appendix C—Additional Information for Assessing the Impacts of TRI Chemicals

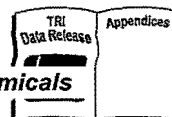
Table A. Hazard Data Availability of U.S. High Production Volume TRI Chemicals<sup>1</sup>

CAS Number	Chemical Name	Acute	Chronic	Teratogenicity/ Reproductive Toxicity <sup>2</sup>	Mutagenicity <sup>2</sup>	Ecotoxicity <sup>2</sup>	Environmental Fate <sup>2</sup>	Total On- and Off-site Releases > 1 Million Pounds <sup>3</sup>
75-07-0	Acetaldehyde	X	X	X	X	X	X	X
75-05-8	Acetonitrile	X		X	X	X	X	X
98-86-2	Acetophenone	X			X	X	X	X
107-02-8	Acrolein	X	X	X	X	X	X	
79-06-1	Acrylamide	X	X	X	X	X	X	X
79-10-7	Acrylic acid	X	X	X	X	X	X	X
107-13-1	Acrylonitrile	X	X	X	X	X	X	X
107-18-6	Allyl alcohol	X		X	X	X	X	X
107-05-1	Allyl chloride	X	X	X	X	X	X	
62-53-3	Aniline	X	X	X	X	X	X	X
90-04-0	o-Anisidine	X			X		X	
1912-24-9	Atrazine	X	X	X	X	X	X	
98-87-3	Benzal chloride	X			X		X	
71-43-2	Benzene	X	X	X	X	X	X	X
98-07-7	Benzoic trichloride	X	X		X	X	X	
98-88-4	Benzoyl chloride	X	X		X	X	X	
94-36-0	Benzoyl peroxide	X	X		X	X	X	
100-44-7	Benzyl chloride	X	X	X	X	X	X	
92-52-4	Biphenyl	X	X	X	X	X	X	X
111-91-1	Bis(2-chloroethoxy)methane	X				X	X	
111-44-4	Bis(2-chloroethyl) ether	X			X	X	X	
56-35-9	Bis(tributyltin) oxide	X	X	X	X	X	X	
353-59-3	Bromochlorodifluoromethane (Halon 1211)	X	X	X	X		X	
74-83-9	Bromomethane	X	X	X	X	X	X	X
75-63-8	Bromotrifluoromethane (Halon 1301)	X		X	X		X	
106-99-0	1,3-Butadiene	X	X	X	X		X	X
141-32-2	Butyl acrylate	X	X	X	X	X	X	X
71-36-3	n-Butyl alcohol	X		X	X	X	X	X
78-92-2	sec-Butyl alcohol	X		X	X	X	X	X
75-65-0	tert-Butyl alcohol	X	X	X	X	X	X	X
106-88-7	1,2-Butylene oxide	X	X	X	X		X	
123-72-8	Butyraldehyde	X			X	X	X	
1563-66-2	Carbofuran	X		X	X	X	X	
75-15-0	Carbon disulfide	X	X	X	X	X	X	X
56-23-5	Carbon tetrachloride	X		X	X	X	X	X
120-80-9	Catechol	X	X	X	X	X	X	
115-28-6	Chloroacetic acid	X	X		X	X	X	
75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	X	X	X	X	X	X	X
563-47-3	3-Chloro-2-methyl-1-propene	X	X	X	X	X	X	
79-11-8	Chloroacetic acid	X			X	X	X	
4080-31-3	1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride	X		X	X			
106-47-8	p-Chloroaniline	X			X	X	X	
108-90-7	Chlorobenzene	X	X	X	X	X	X	X
75-45-6	Chlorodifluoromethane (HCFC-22)	X	X	X	X	X	X	X
75-00-3	Chloroethane	X	X	X	X	X	X	X
67-66-3	Chloroform	X	X	X	X	X	X	X
74-87-3	Chloromethane	X	X	X	X	X	X	X
107-30-2	Chloromethyl methyl ether	X			X		X	
126-99-8	Chloroprene	X	X	X	X	X	X	X
8001-58-9	Creosote	X	X	X	X	X	X	X
120-71-8	p-Cresidine	X			X		X	
95-48-7	o-Cresol	X	X	X	X	X	X	
106-44-5	p-Cresol	X	X	X	X	X	X	X
108-39-4	m-Cresol	X	X	X	X	X	X	X
1319-77-3	Cresol (mixed isomers)	X	X	X	X	X	X	X
4170-30-3	Crotonaldehyde	X			X	X	X	
98-82-8	Cumene	X	X	X	X	X	X	X
80-15-9	Cumene hydroperoxide	X			X	X	X	
110-82-7	Cyclohexane	X	X	X	X	X	X	X
108-93-0	Cyclohexanol	X		X	X	X	X	X
94-75-7	2,4-D (acetic acid)	X	X	X	X	X	X	
2702-72-9	2,4-D sodium salt	X		X	X	X		
533-74-4	Dazomet	X			X	X		
1163-19-5	Decabromodiphenyl oxide	X	X	X	X	X	X	X
117-81-7	Di-(2-ethylhexyl) phthalate	X	X	X	X	X	X	X

<sup>1</sup> Based on 203 U.S. HPV TRI chemicals from 1990 IUR Update and 1995 TRI reporting

<sup>2</sup> For (teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate, test data were considered available if any studies relevant to the endpoint were located; completing the SIDS set for these endpoints requires multiple studies.

<sup>3</sup> Total on-site and off-site releases equals total of on-site releases and transfers to disposal


Table A. Hazard Data Availability of U.S. High Production Volume TRI Chemicals<sup>1</sup>, Continued

CAS Number	Chemical Name	Acute	Chronic	Teratogenicity/ Reproductive Toxicity <sup>2</sup>	Mutagenicity <sup>2</sup>	Ecotoxicity <sup>2</sup>	Environmental Fate <sup>2</sup>	Total On- and Off-site Releases > 1 Million Pounds <sup>3</sup>
101-80-4	4,4'-Diaminodiphenyl ether	X	X	X	X	X	X	
95-80-7	2,4-Diaminotoluene	X	X	X	X	X	X	
25376-45-8	Diaminotoluene (mixed isomers)	X	X	X	X	X	X	X
106-93-4	1,2-Dibromoethane	X	X	X	X	X	X	
84-74-2	Dibutyl phthalate	X	X	X	X	X	X	
99-30-9	Dichloran	X		X	X	X	X	
306-83-2	2,2-Dichloro-1,1,1-trifluoroethane (HCFC-123)	X	X	X	X	X	X	
764-41-0	1,4-Dichloro-2-butene	X	X	X	X	X	X	
110-57-6	trans-1,4-Dichloro-2-butene	X		X	X	X	X	
95-50-1	1,2-Dichlorobenzene	X	X	X	X	X	X	X
106-46-7	1,4-Dichlorobenzene	X	X	X	X	X	X	
541-73-1	1,3-Dichlorobenzene	X		X	X	X	X	
612-83-9	3,3'-Dichlorobenzidine dihydrochloride	X			X	X	X	
75-71-8	Dichlorodifluoromethane (CFC-12)	X	X	X	X	X	X	X
107-06-2	1,2-Dichloroethane	X	X	X	X	X	X	X
75-09-2	Dichloromethane	X	X	X	X	X	X	X
120-83-2	2,4-Dichlorophenol	X		X	X	X	X	
78-87-5	1,2-Dichloropropane	X	X	X	X	X	X	
542-75-6	1,3-Dichloropropylene	X	X	X	X	X	X	
76-14-2	Dichlorotetrafluoroethane (CFC-114)	X				X	X	X
77-73-6	Dicyclopentadiene	X			X	X	X	X
111-42-2	Diethanolamine	X	X	X	X	X	X	X
64-67-5	Diethyl sulfate	X	X	X	X	X	X	X
2524-03-0	Dimethyl chlorophosphate	X	X	X	X		X	
131-11-3	Dimethyl phthalate	X	X	X	X	X	X	
77-78-1	Dimethyl sulfate	X	X	X	X	X	X	
124-40-3	Dimethylamine	X	X	X	X	X	X	
121-69-7	N,N-Dimethylaniline	X	X	X	X	X	X	
68-12-2	N,N-Dimethylformamide	X	X	X	X	X	X	X
105-67-9	2,4-Dimethylphenol	X	X		X	X	X	
576-26-1	2,6-Dimethylphenol	X	X		X	X	X	
528-29-0	o-Dinitrobenzene	X			X	X	X	
88-85-7	Dinitrobutyl phenol	X		X	X	X	X	
51-28-5	2,4-Dinitrophenol	X		X	X	X	X	
121-14-2	2,4-Dinitrotoluene	X	X	X	X	X	X	
606-20-2	2,6-Dinitrotoluene	X	X	X	X	X	X	
25321-14-6	Dinitrotoluene (mixed isomers)	X	X	X	X	X	X	
123-91-1	1,4-Dioxane	X		X	X	X	X	X
122-39-4	Diphenylamine	X		X	X	X	X	X
330-54-1	Diuron	X		X	X	X	X	
106-89-8	Epichlorohydrin	X	X		X	X	X	X
110-80-5	2-Ethoxyethanol	X		X	X	X	X	
140-88-5	Ethyl acrylate	X	X	X	X	X	X	X
541-41-3	Ethyl chloroformate	X				X	X	
100-41-4	Ethylbenzene	X	X	X	X	X	X	X
74-85-1	Ethylene	X			X	X	X	X
107-21-1	Ethylene glycol	X	X	X	X	X	X	X
75-21-8	Ethylene oxide	X	X	X	X	X	X	X
75-34-3	Ethylidene dichloride	X	X	X	X	X	X	
50-00-0	Formaldehyde	X	X	X	X	X	X	X
64-18-6	Formic acid	X		X	X	X	X	X
76-13-1	Freon 113	X	X	X	X	X	X	X
77-47-4	Hexachlorocyclopentadiene	X	X	X	X	X	X	
67-72-1	Hexachloroethane	X	X	X	X	X	X	
110-54-3	n-Hexane	X	X	X	X	X	X	X
123-31-9	Hydroquinone	X	X	X	X	X	X	
55406-53-6	3-Iodo-2-propynyl butylcarbamate	X						
13463-40-6	Iron pentacarbonyl	X			X	X		
78-84-2	Isobutyraldehyde	X			X	X	X	
67-63-0	Isopropyl alcohol (manufacturing)	X	X	X	X	X	X	X
80-05-7	4,4'-Isopropylidenediphenol	X		X	X	X	X	X
108-31-6	Maleic anhydride	X	X	X	X	X	X	X
149-30-4	2-Mercaptobenzothiazole	X	X	X	X	X	X	X
150-50-5	Merphos	X				X		
67-56-1	Methanol	X		X	X	X	X	X

<sup>1</sup> Based on 203 U.S. HPV TRI chemicals from 1990 IUR Update and 1995 TRI reporting

<sup>2</sup> For teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate, test data were considered available if any studies relevant to the endpoint were located, completing the SIDS set for these endpoints requires multiple studies

<sup>3</sup> Total on-site and off-site releases equals total of on-site releases and transfers to disposal

# Appendix C — Additional Information for Assessing the Impacts of TRI Chemicals

Table A. Hazard Data Availability of U.S. High Production Volume TRI Chemicals<sup>1</sup>, Continued

CAS Number	Chemical Name	Acute	Chronic	Teratogenicity/ Reproductive Toxicity <sup>2</sup>	Mutagenicity <sup>2</sup>	Ecotoxicity <sup>2</sup>	Environmental Fate <sup>2</sup>	Total On- and Off-site Releases > 1 Million Pounds <sup>3</sup>
94-74-6	Methoxone	X		X	X	X	X	
109-86-4	2-Methoxyethanol	X		X	X	X	X	X
96-33-3	Methyl acrylate	X	X	X	X	X	X	
79-22-1	Methyl chlorocarbonate	X					X	
78-93-3	Methyl ethyl ketone	X	X	X	X	X	X	X
108-10-1	Methyl isobutyl ketone	X	X	X	X	X	X	X
624-83-9	Methyl isocyanate	X		X	X		X	
556-61-6	Methyl isothiocyanate	X		X		X	X	
80-62-6	Methyl methacrylate	X	X	X	X	X	X	X
1634-04-4	Methyl tert-butyl ether	X	X	X	X	X	X	X
872-50-4	N-Methyl-2-pyrrolidone	X	X	X	X	X	X	X
74-95-3	Methylene bromide	X	X		X	X	X	
101-14-4	4,4'-Methylenedibis(2-chloroaniline)	X			X		X	
101-77-9	4,4'-Methylenedianiline	X	X	X	X	X	X	
75-86-5	2-Methylacetonitrile	X		X	X	X	X	
924-42-5	N-Methylolacrylamide	X		X	X			
109-06-8	2-Methylpyridine	X	X		X	X	X	
76-15-3	Monochloropentafluoroethane (CFC-115)	X					X	
91-20-3	Naphthalene	X	X	X	X	X	X	X
1929-82-4	Nitrapyrin	X		X	X	X	X	
100-01-6	p-Nitroaniline	X	X	X	X	X	X	
98-95-3	Nitrobenzene	X	X	X	X	X	X	X
55-63-0	Nitroglycerin	X		X	X	X	X	
100-02-7	4-Nitrophenol	X		X	X	X	X	
79-46-9	2-Nitropropane	X	X	X	X	X	X	
79-21-0	Peracetic acid	X			X		X	
594-42-3	Perchloromethyl mercaptan	X			X		X	
108-95-2	Phenol	X	X	X	X	X	X	X
95-54-5	1,2-Phenylenediamine	X		X	X	X	X	
106-50-3	p-Phenylenediamine	X	X	X	X	X	X	
108-45-2	1,3-Phenylenediamine	X	X	X	X	X	X	
90-43-7	2-Phenylphenol	X	X	X	X	X	X	
75-44-5	Phosgene	X					X	
85-44-9	Phthalic anhydride	X		X	X	X	X	X
1918-02-1	Picloram	X	X	X	X	X	X	
107-19-7	Propargyl alcohol	X			X	X	X	
123-38-6	Propionaldehyde	X		X	X	X	X	
115-07-1	Propylene	X	X		X		X	X
75-56-9	Propylene oxide	X	X	X	X	X	X	X
110-86-1	Pyridine	X		X	X	X	X	X
81-07-2	Saccharin (manufacturing)	X			X	X	X	
122-34-9	Simazine	X	X	X	X	X	X	
1982-69-0	Sodium dicamba	X						
128-04-1	Sodium dimethyldithiocarbamate	X			X	X	X	
132-27-4	Sodium o-phenylphenoxide	X		X	X	X		
100-42-5	Styrene	X	X	X	X	X	X	X
96-09-3	Styrene oxide	X		X	X	X	X	
79-34-5	1,1,2,2-Tetrachloroethane	X	X	X	X	X	X	X
630-20-6	1,1,1,2-Tetrachloroethane	X	X		X	X	X	
127-18-4	Tetrachloroethylene	X	X	X	X	X	X	X
62-56-6	Thiourea	X		X	X	X	X	
137-26-8	Thiram	X	X	X	X	X	X	
108-88-3	Toluene	X		X	X	X	X	X
584-54-9	Toluene-2,4-diisocyanate	X	X		X	X	X	
91-08-7	Toluene-2,6-diisocyanate	X	X		X		X	
26471-62-5	Toluenedisocyanate (mixed isomers)	X	X		X	X	X	
95-53-4	o-Toluidine	X		X	X	X	X	
120-82-1	1,2,4-Trichlorobenzene	X	X	X	X	X	X	
71-55-6	1,1,1-Trichloroethane	X		X			X	X
79-00-5	1,1,2-Trichloroethane	X	X		X	X	X	X
79-01-6	Trichloroethylene	X	X	X	X	X	X	X
75-69-4	Trichlorofluoromethane (CFC-11)	X	X		X	X	X	X
96-18-4	1,2,3-Trichloropropane	X	X	X	X	X	X	X
121-44-8	Triethylamine	X	X	X	X	X	X	X
95-63-6	1,2,4-Trimethylbenzene	X		X	X	X	X	X
76-87-9	Triphenyltin hydroxide	X	X		X	X		
108-05-4	Vinyl acetate	X	X	X	X	X	X	X

<sup>1</sup>Based on 203 U.S. HPV TRI chemicals from 1990 IUR Update and 1995 TRI reporting

<sup>2</sup>For teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate, test data were considered available if any studies relevant to the endpoint were located, completing the SIDS set for these endpoints requires multiple studies.

<sup>3</sup>Total on-site and off-site releases equals total of on-site releases and transfers to disposal

Table A. Hazard Data Availability of U.S. High Production Volume TRI Chemicals<sup>1</sup>, Continued

CAS Number	Chemical Name	Teratogenicity/ Reproductive Toxicity <sup>2</sup>			Mutagenicity <sup>2</sup>	Ecotoxicity <sup>2</sup>	Environmental Fate <sup>2</sup>	Total On- and Off-site Releases > 1 Million Pounds <sup>3</sup>
		Acute	Chronic					
75-01-4	Vinyl chloride	X	X	X	X	X	X	X
75-35-4	Vinylidene chloride	X	X	X	X	X	X	
95-47-6	o-Xylene	X	X	X	X	X	X	X
106-42-3	p-Xylene	X	X	X	X	X	X	X
108-38-3	m-Xylene	X	X	X	X	X	X	X
1330-20-7	Xylene (mixed isomers)	X	X	X	X	X	X	X

<sup>1</sup> Based on 203 U.S. HPV TRI chemicals from 1990 IUR Update and 1995 TRI reporting

<sup>2</sup> For teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate, test data were considered available if any studies relevant to the endpoint were located, completing the SIDS set for these endpoints requires multiple studies

<sup>3</sup> Total on-site and off-site releases equals total of on-site releases and transfers to disposal.

Table B. Hazard Data Availability for U.S. High Production Volume (HPV) TRI Chemicals

Number of SIDS Tests Performed <sup>1</sup>	TRI Chemical	
	Yes	No
0	0 (0.0%)	1216 (45.7%)
1	2 (1.0%)	393 (14.8%)
2	5 (2.5%)	291 (10.9%)
3	15 (7.4%)	251 (9.4%)
4	21 (10.3%)	236 (8.9%)
5	51 (25.1%)	180 (6.8%)
6	109 (53.7%)	93 (3.5%)
TOTAL	203	2660

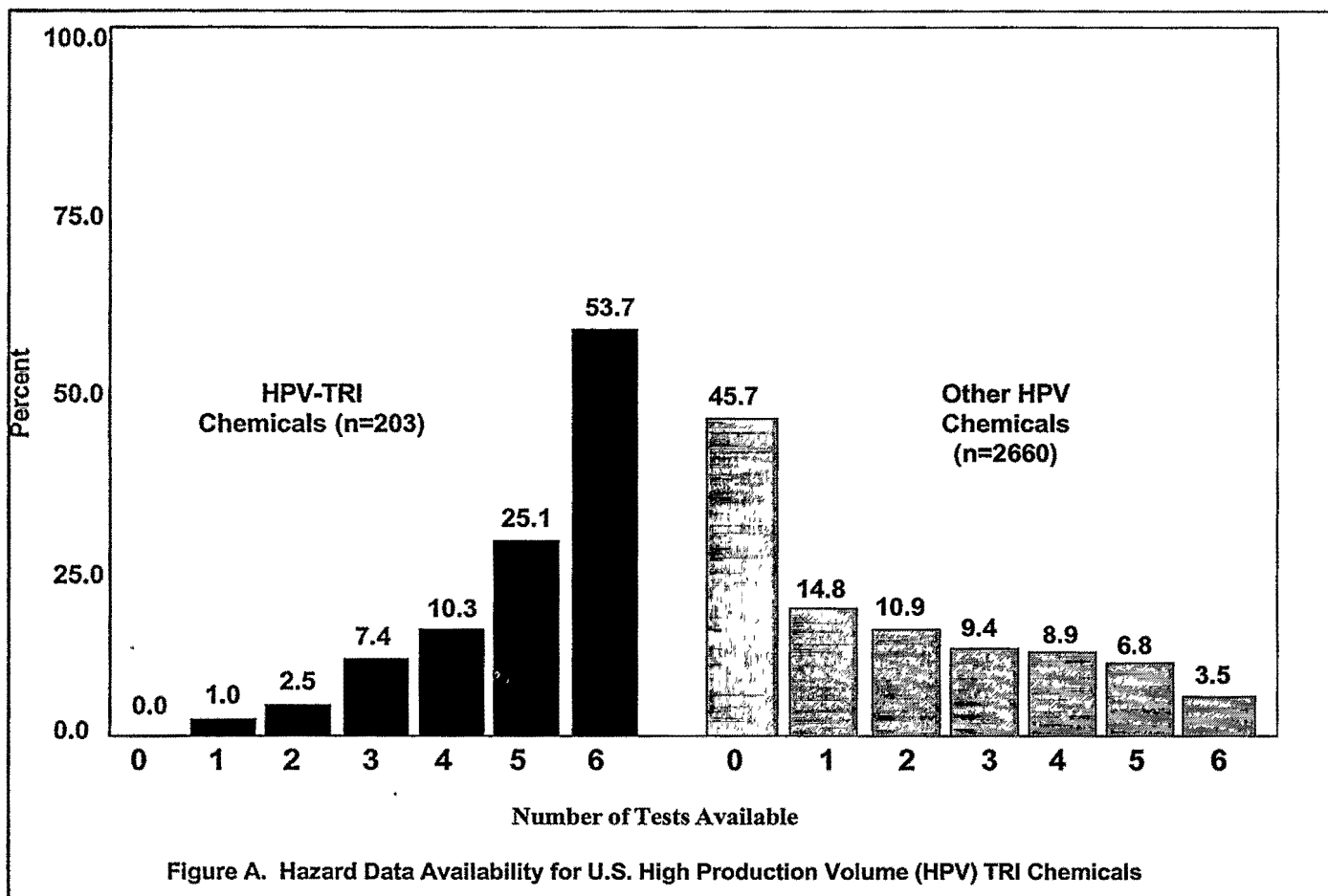
<sup>1</sup> SIDS tests data include acute toxicity, chronic toxicity, teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate. For teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate, test data were considered available if any studies relevant to the endpoint were located, completing the SIDS set for these endpoints requires multiple studies

Data Source: EPA information on 2,863 U.S. HPV Chemicals from 1990 IUR Update and 1995 TRI Reporting

however, had four or fewer of the tests completed and publicly available (see Table B and Figure A).

EPA also examined the HPV TRI chemicals with higher exposure potential and identified 91 (out of the 203) HPV TRI chemicals with reported total (on-site and off-site) releases at levels greater than 1 million pounds (for the 1995 reporting year). Of these 91 high release HPV TRI chemicals, 74% have information available on all six basic SIDS tests, an additional 20% had five of the SIDS tests available, and all of the high release HPV TRI chemicals have data available from at least three of the SIDS tests (see Table C and Figure B).

The EPA data availability survey reveals that the majority of HPV chemicals *which are not listed on TRI* may not have been tested for the basic information that would allow determination as to whether they *should* be listed on TRI (see Figure A). The lack of availability of basic toxicity information on most HPV chemicals is a serious issue for several reasons. For EPA, the availability of hazard information on individual chemicals is fundamental to many of the Agency's approaches to accomplishing its mission of environmental protection including risk assessment, safeguarding children's health, expanding the public's right-to-know, and



Note: The six SIDS tests considered are acute toxicity, chronic toxicity, teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate. For teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate, test data were considered available if any studies relevant to the endpoint were located; completing the SIDS set for these endpoints requires multiple studies.

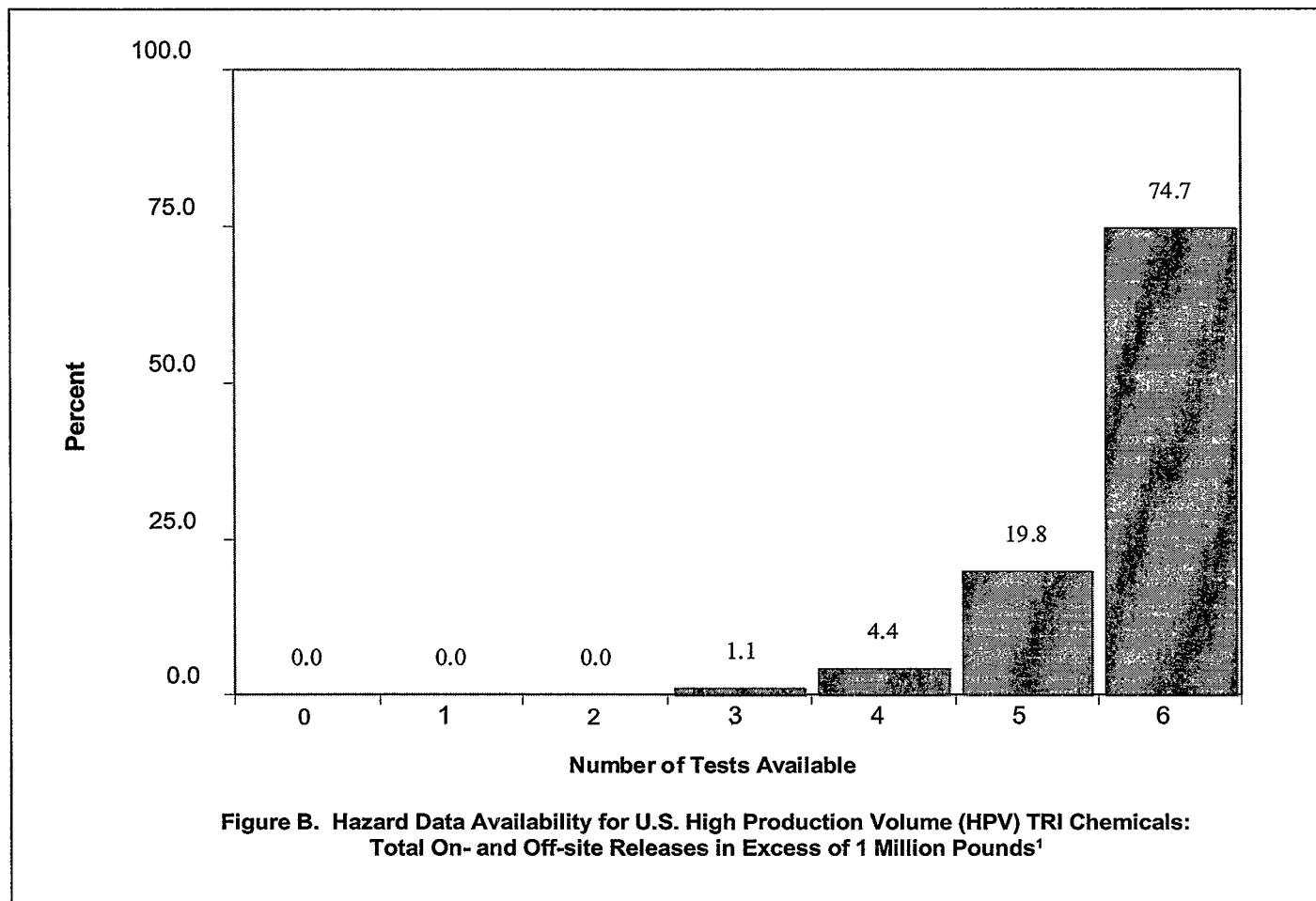
**Table C. Hazard Data Availability for U.S. High Production Volume (HPV) TRI Chemicals: Total On- and Off-site Releases in Excess of 1 Million Pounds<sup>1</sup>**

Number of SIDS Tests Performed <sup>2</sup>	TRI Chemical Released or Transferred > 1,000,000 lbs	
	Yes	No
0	0 (0.0%)	1,216 (43.9%)
1	0 (0.0%)	395 (14.2%)
2	0 (0.0%)	296 (10.7%)
3	1 (1.1%)	265 (9.6%)
4	4 (4.4%)	253 (9.1%)
5	18 (19.8%)	213 (7.7%)
6	68 (74.7%)	134 (4.8%)
<b>TOTAL</b>	<b>91</b>	<b>2,772</b>

<sup>1</sup>Total on- and off-site releases equals total of on-site releases and transfers to disposal, 1995 TRI Reporting

<sup>2</sup>SIDS tests data include acute toxicity, chronic toxicity, teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate. For teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate, test data were considered available if any studies relevant to the endpoint were located, completing the SIDS set for these endpoints requires multiple studies

Data Source: EPA information on 2,863 U.S. HPV Chemicals from 1990 IUR Update and 1995 TRI Reporting



<sup>1</sup> Total On- and off-site releases equals total of on-site releases and transfers to disposal, 1995 TRI Reporting

Note: The six SIDS tests considered are acute toxicity, chronic toxicity, teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate. For teratogenicity/reproductive toxicity, mutagenicity, ecotoxicity, and environmental fate, test data were considered available if any studies relevant to the endpoint were located, completing the SIDS set for these endpoints requires multiple studies.

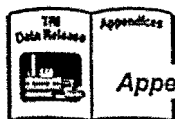
Data Source: EPA information on 2,863 U.S. HPV Chemicals from 1990 IUR Update and 1995 TRI Reporting

promoting pollution prevention. Congress acknowledged and established the need for data in identifying, controlling and preventing the possible hazardous effects of chemicals on health and the environment when it passed TSCA. TSCA states that it is the policy of the U.S. that manufacturers are responsible for testing chemicals, and the Act provides EPA the authority to require chemical testing and impose controls as necessary. In practice, implementation has been difficult for a variety of reasons and the pace of testing — some of which is progressing voluntarily under international agreements to share the economic burden of testing across many countries — has been too slow.

To obtain more information relating to EPA's work with the SIDS or HPV chemicals, contact the Toxic Substances Control Act (TSCA) Hotline at 202 554-1404 or by email at: [tsca-hotline@epamail.epa.gov](mailto:tsca-hotline@epamail.epa.gov). Additional information can also be obtained on the OPPT SIDS website at: <http://www.epa.gov/opptintr/sids/overview.htm>.

## SCREENING INFORMATION SYSTEM/LAN (SIS/L)

The SIS/L (Screening Information System/LAN) will enable the public to track chemicals across



## Appendix C — Additional Information for Assessing the Impacts of TRI Chemicals

major OPPT, EPA and federal government databases, information systems and document collections that contain information on production and use; release, exposure and monitoring; toxicity and hazard; and risk. Users will be able to search for chemicals by both CAS number and chemical name. Acting as a platform for multiple data sources, SIS/L will provide access to chemical information lists and databases regardless of their origin (see Table D). EPA is currently working to make SIS/L available on EPA's public access home page as a valuable information source for EPA, other federal agencies, state and local governments, public interest groups, research organizations, non-government organizations, industry, and the public. Table D lists the top 25 TRI chemicals and the related information sources that are listed on SIS/L.

### SIS/L Information Lists

#### **Chemicals On Reporting Rules database (CORR)**

Chemicals On Reporting Rules database tracks all proposed and final chemical rules promulgated by US EPA/OPPT.

#### **Toxic Substances Control Act Test Submissions (TSCATS)**

**8(d):** Section 8(d) health and safety reporting requirements; chemicals not officially under Section 8(d) reporting requirements, but which had information concurrently submitted along with chemicals under Section 8(d) are also tracked as 8(d) chemicals.

**SECT4:** Section 4 Chemical Testing Program (CTP); chemicals not officially under the CTP, but which had information concurrently submitted along with chemicals under the CTP, are also tracked as Section 4 chemicals.

**8(e):** Section 8(e) Notice of Substantial Risk requires manufacturers, processors or distributors of chemicals to submit to EPA any new data on

one of their chemicals that reasonably supports a conclusion that the chemical presents a substantial risk of injury to health or the environment; besides data on health and environmental effects, submitters often make known uses of the chemical, workplace practices and other Exposure and market information.

**FYI:** For Your Information (FYIs) are similar in content to the TSCA Section 8(e) Notices but do not meet the statutory requirements for submission under the Toxic Substances Control Act; besides data on health and environmental effects, submitters often make known uses of the chemical, workplace practices and other exposure and market information.

#### **Chemical Hazard Information Profile (CHIPs)**

Chemical Hazard Information Profiles summarize readily available information on health effects, environmental effects and exposure relating to a specific chemical. CHIPs were prepared by the US EPA, OPPT from about 1978 to 1990; they have since been superseded by other screening reviews in OPPT's current Existing Chemical Program.

#### **Substitute Hazard Profile (Sub)**

Every chemical referenced in a Substitute Hazard Profile; these profiles are similar in content to CHIPs but generally summarize readily available information on only health and environmental effects; these reviews were prepared in the US EPA, OPPT from about 1985 to 1990; they have since been superseded by reviews in OPPT's current Existing Chemical Program.

#### **Health Effects Assessment Summary Table (HEAST)**

Every chemical in the Health Effects Assessment Summary Tables developed by US EPA, ORD, OHEA; these tables include draft (or unverified) RfD's, RfC's, and cancer potency estimates (both final and draft or unverified) and comments and references.

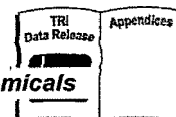


Table D. Screening Information System/LAN

CAS Number	Chemical Name	CORR	8(d)	SECT4	8(e)	FYI	CHIP	Sub	HEAST	CURE	IRIS	PEPS
67-56-1	*METHANOL	X	X	X	X	X	X	X	X	X	X	X
74-85-1	*ETHENE	X	X	X	X	X	X					
75-09-2	*METHANE, DICHLORO-	X	X	X	X	X	X	X	X	X	X	
75-15-0	*CARBON DISULFIDE	X	X	X	X	X	X		X	X	X	
78-93-3	*2-BUTANONE	X	X	X	X	X	X		X	X	X	X
100-42-5	*BENZENE, ETHENYL	X	X	X	X	X	X		X	X	X	
108-88-3	*BENZENE, METHYL	X	X	X	X	X	X		X	X	X	
110-49-6	*ETHANOL, 2 METHOXY-, ACETATE		X	X	X	X	X		X	X		X
110-54-3	*HEXANE	X	X	X	X	X			X	X	X	
110-80-5	*ETHANOL, 2 ETHOXY-	X	X	X	X	X	X		X	X	X	X
111-15-9	*ETHANOL, 2 ETHOXY-, ACETATE		X		X	X			X	X	X	X
1314-13-2	*ZINC OXIDE, (ZNO)		X	X	X					X		
1330-20-7	*BENZENE, DIMETHYL	X	X	X	X	X	X		X	X	X	
7439-92-1	*LEAD	X	X	X	X	X	X	X	X	X	X	
7439-96-5	*MANGANESE	X	X		X	X	X		X	X	X	
7440-47-3	*CHROMIUM	X	X	X	X	X	X			X		
7440-50-8	*COPPER	X	X	X	X	X	X	X	X	X	X	
7440-66-6	*ZINC	X	X	X	X	X	X	X	X	X	X	
7647-01-0	*HYDROCHLORIC ACID	X	X	X	X	X	X			X	X	
7664-38-2	*PHOSPHORIC ACID	X	X	X	X		X				X	
7664-41-7	*AMMONIA	X	X	X	X	X	X	X	X	X	X	
7782-50-5	*CHLORINE	X	X	X	X	X	X			X	X	
14797-55-8	*NITRATE	X	X	X						X	X	
16065-83-1	*CHROMIUM III		X						X	X	X	
18540-29-9	*CHROMIUM (HEXAVALENT)		X		X				X	X	X	

Table D. Screening Information System/LAN, Continued

CAS Number	Chemical Name	RM(x)	MEGA	SIDS	RoL	WQCD	DWHA	FIFRA	INERT	OSHA	NIOSH	ACGIH
67-56-1	*METHANOL	X			X			X	X	X	X	X
74-85-1	*ETHENE	X		X	X			X			X	
75-09-2	*METHANE, DICHLORO-	X	X		X	X	X		X	X	X	X
75-15-0	*CARBON DISULFIDE	X	X		X					X	X	X
78-93-3	*2-BUTANONE	X	X	X	X		X		X	X	X	X
100-42-5	*BENZENE, ETHENYL	X		X	X	X	X			X	X	X
108-88-3	*BENZENE, METHYL	X			X	X	X		X	X	X	X
110-49-6	*ETHANOL, 2 METHOXY-, ACETATE	X		X	X					X	X	X
110-54-3	*HEXANE	X			X		X		X	X	X	X
110-80-5	*ETHANOL, 2 ETHOXY-	X	X		X				X	X	X	X
111-15-9	*ETHANOL, 2 ETHOXY-, ACETATE	X			X				X	X	X	X
1314-13-2	*ZINC OXIDE, (ZNO)	X			X			X	X	X	X	X
1330-20-7	*BENZENE, DIMETHYL	X			X		X	X	X	X	X	X
7439-92-1	*LEAD	X			X	X	X			X	X	X
7439-96-5	*MANGANESE	X			X	X				X	X	X
7440-47-3	*CHROMIUM	X			X		X			X	X	X
7440-50-8	*COPPER	X			X	X		X		X	X	X
7440-66-6	*ZINC	X			X	X		X	X		X	
7647-01-0	*HYDROCHLORIC ACID	X	X		X			X	X	X	X	X
7664-38-2	*PHOSPHORIC ACID	X			X			X	X	X	X	X
7664-41-7	*AMMONIA	X			X	X				X	X	X
7782-50-5	*CHLORINE		X		X	X		X		X	X	X
14797-55-8	*NITRATE				X	X						
16065-83-1	*CHROMIUM III										X	X
18540-29-9	*CHROMIUM (HEXAVALENT)				X						X	X





### **Chemical Unit Record Estimate (CURE)**

Every chemical in the Chemical Unit Record Estimate; an index and summary of all health and environmental effects and risk reviews published by US EPA, ORD.

### **Integrated Risk Information System (IRIS)**

Every chemical referenced in the US EPA, ORD Integrated Risk Information System, which summarizes official EPA-wide chemical hazard and risk evaluations.

### **Production/Exposure Profile (PEPs)**

Every chemical referenced in a Production/Exposure Profile; PEPs were prepared in the US EPA, OPPT from about 1978 to 1986.

### **Risk Management Tracking System (RMx)**

Every chemical tracked in the Risk Management tracking system for the previous version of the US EPA, OPPT Existing Chemical Program.

### **TSCA Section 4 Testing Program (MEGA)**

Every chemical within the TSCA Section 4 Testing Program including those chemicals with tests in proposal or negotiation stage, those awaiting submission of test results and those awaiting verification of compliance with the test rule or consent order, as well as historical information on chemicals that have completed Section 4 testing.

### **Screening Information Data Set Program (SIDS)**

Every chemical being evaluated under the Screening Information Data Set program; SIDS is an international voluntary information sharing and testing program developed under the aegis of the Organization for Economic Cooperation and Development (OECD); the program is intended to fill basic data gaps on high volume chemicals with little safety information.

### **Register of Lists (RoL)**

Every chemical referenced in the proprietary database Register of Lists (RoL); RoL listed the statutory authority for all chemicals regulated by the US EPA; RoL is no longer supported by the US EPA.

### **Water Quality Criteria Document (WQCD)**

Every chemical which has a Water Quality Criteria Document from within the US EPA, Office of Water.

### **Drinking Water Health Advisory (DWHA)**

Every chemical which has a Drinking Water Health Advisory as developed by the US EPA, Office of Water.

### **Federal Insecticide & Rodenticide Act (FIFRA)**

Every chemical subject to regulation by the US EPA, Office of Pesticide Programs under Federal Insecticide & Rodenticide Act as a registered Active Ingredient.

### **Inerts**

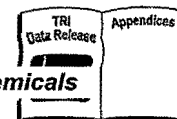
Every chemical the US EPA, Office of Pesticide Programs has determined to be potentially toxic but are not claimed by pesticide manufacturers to have any pesticidal activity in their registered products.

### **Occupational Safety and Health Administration (OSHA)**

Every chemical for which a PEL (Permissible Exposure Limits) and other workplace standards have been promulgated by the Occupational Safety and Health Administration (US DOL).

### **National Institute for Occupational Safety and Health (NIOSH)**

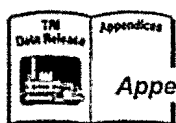
Every chemical in the NIOSH (National Institute for Occupational Safety and Health/NIH/US DHHS) Occupational Exposure Survey of around



1980; NOES lists number of workers and number of facilities by SIC codes (Standard Industrial Classification).

**American Conference of Governmental Industrial Hygienists (ACGIH)**

Every chemical for which workplace standards have been recommended by the American Conference of Governmental Industrial Hygienists.



***Appendix C — Additional Information for Assessing the Impacts of TRI Chemicals***

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## APPENDIX D

### TRI FORM R AND FORM A FOR 1996

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Facilities reporting to the Toxics Release Inventory submit their information on TRI's Form R. If a facility's total annual reportable amount of a chemical does not exceed 500 pounds, and the facility does not manufacture, process, or otherwise use more than 1 million pounds of the chemical, it may submit a Form A certification statement. (Form A certification statement reporting is further explained in Chapter 1.) This appendix supplies copies of the Form R and Form A certification statement for the 1996 reporting year.

#### FORM R

The 1996 Form R is divided into two parts:

Part I, Facility Identification Information, contains information on such matters as name, address, parent company information, and contact names and phone numbers for the facility.

Part II, Chemical-Specific Information, contains information such as chemical identity, facility activities and uses of the chemical, amounts of on- and off-site releases and transfers off-site for further waste management, on-site waste treatment methods and efficiencies, on- and off-site waste management

quantities, and information on source reduction and recycling activities.

#### FORM A CERTIFICATION STATEMENT

The 1996 Form A certification statement consists of facility identification information and chemical identification, as in Form R. Facilities do not report on the Form A certification statement amounts or other information about their use, releases, or waste management of the chemical.

Readers who are interested in a more in-depth understanding of who is required to report to TRI and how to fill out the forms, should refer to the EPCRA Information Hotline at 1-800-424-9346. Reporting software, forms, and instructions for the current reporting year are available from EPA's Web site at: <http://www.epa.gov/opptintr/tri/report.htm>.

United States  
Environmental Protection  
Agency**FORM R**Section 313 of the Emergency Planning and Community  
Right-to-Know Act of 1986, also known as Title III of the Superfund  
Amendments and Reauthorization ActTOXIC CHEMICAL RELEASE  
INVENTORY REPORTING FORM

WHERE TO SEND COMPLETED FORMS: 1 EPCRA Reporting Center  
P.O. Box 3348  
Merrifield, VA 22116-3348  
ATTN: TOXIC CHEMICAL RELEASE INVENTORY

2 APPROPRIATE STATE OFFICE  
(See instructions in Appendix F)

Enter "X" here if this  
is a revision

For EPA use only

**IMPORTANT:** See instructions to determine when "Not Applicable (NA)" boxes should be checked.**PART I. FACILITY IDENTIFICATION INFORMATION****SECTION 1. REPORTING YEAR** 19 \_\_\_\_**SECTION 2. TRADE SECRET INFORMATION**

2.1 Are you claiming the toxic chemical identified on page 2 trade secret?  
☐ Yes (Answer question 2.2; Attach substantiation forms) ☐ No Do not answer 2.2; go to Section 3

2.2 Is this copy ☐ Sanitized ☐ Unsanitized  
(Answer only If "YES" in 2.1)

**SECTION 3. CERTIFICATION (Important: Read and sign after completing all form sections.)**

I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data available to the preparers of this report.

Name and official title of owner/operator or senior management official:

Signature:

Date signed:

**SECTION 4. FACILITY IDENTIFICATION**

TRI Facility ID Number

4.1

Facility or Establishment Name

Facility or Establishment Name or Mailing Address (if different from street address)

Street

Mailing Address

City/County/State/Zip Code

City/County/State/Zip Code

4.2

This report contains information for:  
(Important: check a or b; check c if applicable)

a.

☐ An entire facility

b.

☐ Part of a facility

c.

☐ A Federal facility

4.3

Technical Contact Name

Telephone Number (include area code)

4.4

Public Contact Name

Telephone Number (include area code)

4.5

SIC Code(s) (4 digits)

a.

b.

c.

d.

e.

f.

4.6

Latitude

Degrees

Minutes

Seconds

Longitude

Degrees

Minutes

Seconds

4.7

Dun & Bradstreet  
Number(s) (9 digits)

4.8

EPA Identification Number(s)  
(RCRA I.D. No.) (12 characters)

4.9

Facility NPDES Permit  
Number(s) (9 characters)

4.10

Underground Injection Well Code  
(UIC) I.D. Number(s) (12 digits)

a.

a.

a.

a.

b.

b.

b.

b.

**SECTION 5. PARENT COMPANY INFORMATION**

5.1

Name of Parent Company

☐

NA

5.2

Parent Company's Dun &amp; Bradstreet Number

☐

NA

(9 digits)

**EPA FORM R**  
**PART II. CHEMICAL - SPECIFIC INFORMATION**

TRI FACILITY ID NUMBER

Toxic Chemical, Category, or Generic Name

**SECTION 1. TOXIC CHEMICAL IDENTITY**

(Important: DO NOT complete this section if you completed Section 2 below.)

**1.1** **CAS NUMBER** (IMPORTANT Enter only one number exactly as it appears on the Section 313 list Enter category code if reporting a chemical category)

**1.2** Toxic Chemical or Chemical Category Name (Important Enter only one name exactly as it appears on the Section 313 list)

**1.3** Generic Chemical Name (Important Complete only if Part I, Section 2.1 is checked "yes" Generic name must be structurally descriptive)

**SECTION 2. MIXTURE COMPONENT IDENTITY**

(Important: DO NOT complete this section if you complete Section 1 above.)

**2.1** Generic Chemical Name Provided by Supplier (Important Maximum of 70 characters, including numbers, letters, spaces, and punctuation)

**SECTION 3. ACTIVITIES AND USES OF THE TOXIC CHEMICAL AT THE FACILITY** (Important: Check all that apply.)**3.1** Manufacture the toxic chemical:a. ☐ Produce b. ☐ Import

If produce or import

c. ☐ For on-site use/processingd. ☐ For sale/distributione. ☐ As a byproductf. ☐ As an impurity**3.2** Process the toxic chemical:a. ☐ As a reactantb. ☐ As a formulation componentc. ☐ As an article componentd. ☐ Repackaging**3.3** Otherwise use the toxic chemical:a. ☐ As a chemical processing aidb. ☐ As a manufacturing aidc. ☐ Ancillary or other use**SECTION 4. MAXIMUM AMOUNT OF THE TOXIC CHEMICAL ON-SITE AT ANY TIME DURING THE CALENDAR YEAR**

**4.1**  (Enter two-digit code from instruction package.)

**SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM**

		A. Total Release (pounds/year)(enter range from instructions or estimate)	B. Basis of estimate (enter code)	C. % From Stormwater
<b>5.1</b>	Fugitive or non-point air emissions	NA <input type="checkbox"/>		
<b>5.2</b>	Stack or point air emissions	NA <input type="checkbox"/>		
<b>5.3</b>	Discharges to receiving streams or water bodies (enter one name per box)			
Stream or Water Body Name				
<b>5.3.1</b>				
<b>5.3.2</b>				
<b>5.3.3</b>				
<b>5.4.1</b>	Underground Injection on-site to Class I Wells	NA <input type="checkbox"/>		
<b>5.4.2</b>	Underground Injection on-site to Class II-V Wells	NA <input type="checkbox"/>		

If additional pages of Part II, Section 5.3 are attached, indicate the total number of pages in this box  and indicate which Part II, Section 5.3 page this is, here  (example: 1,2,3, etc.)

<b>EPA FORM R</b> <b>PART II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)</b>						TRI FACILITY ID NUMBER	
						Toxic Chemical, Category, or Generic Name	
<b>SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM</b>							
			NA	A. Total Release (pounds/year) (enter range code from instructions or estimate)	B. Basis of Estimate (enter code)		
5.5	Disposal to land on-site						
5.5.1A	RCRA Subtitle C landfills	<input type="checkbox"/>					
5.5.1B	Other landfills	<input type="checkbox"/>					
5.5.2	Land treatment/application farming	<input type="checkbox"/>					
5.5.3	Surface impoundment	<input type="checkbox"/>					
5.5.4	Other disposal	<input type="checkbox"/>					
<b>SECTION 6. TRANSFERS OF THE TOXIC CHEMICAL IN WASTES TO OFF-SITE LOCATIONS</b>							
<b>6.1 DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS (POTWs)</b>							
<b>6.1.A. Total Quantity Transferred to POTWs and Basis of Estimate</b>							
6.1.A.1. Total Transfers (pounds/year) (enter range code or estimate)				6.1.A.2 Basis of Estimate (enter code)			
6.1.B. <input type="checkbox"/>		POTW Name					
POTW Address							
City		State		County		Zip	
6.1.B. <input type="checkbox"/>		POTW Name					
POTW Address.							
City		State		County		Zip	
If additional pages of Part II, Section 6.1 are attached, indicate the total number of pages in this box <input type="text"/> and indicate which Part II, Section 6.1 page this is here <input type="text"/> (example: 1,2,3, etc.)							
<b>SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS</b>							
6.2 <input type="checkbox"/> OFF-SITE EPA IDENTIFICATION NUMBER (RCRA ID NO.)							
Off-Site Location Name							
Off-Site Address							
City		State		County		Zip	
Is location under control of reporting facility or parent company?						<input type="checkbox"/> Yes	<input type="checkbox"/> No

**EPA FORM R**  
**PART II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)**

TRI FACILITY ID NUMBER

Toxic Chemical, Category, or Generic Name

**SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS (continued)**

A. Total Transfers (pounds/year) (enter range code or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.M
2.	2.	2.M
3.	3	3.M
4.	4	4.M

6.2 OFF-SITE EPA IDENTIFICATION NUMBER (RCRA ID NO.)

Off-Site Location Name					
Off-Site Address					
City		State		County	
				Zip	

Is location under control of reporting facility or parent company? ☐ Yes ☐ No

A. Total Transfers (pound/year) (enter range code or estimate)	B. Basis of Estimate (enter code)	C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery (enter code)
1.	1.	1.M
2.	2.	2.M
3.	3.	3.M
4.	4.	4.M

**SECTION 7A. ON-SITE WASTE TREATMENT METHODS AND EFFICIENCY**
☐ Not Applicable (NA) - Check here if no on-site waste treatment is applied to any waste stream containing the toxic chemical or chemical category.

a. General Waste Stream (enter code)	b. Waste Treatment Method(s) Sequence (enter 3-character code(s))	c. Range of Influent Concentration	d. Waste Treatment Efficiency Estimate	e. Based on Operating Data?
7A.1a	7A.1b	7A.1c	7A.1d	7A.1e
	1 <input type="text"/> 2 <input type="text"/>			
	3 <input type="text"/> 4 <input type="text"/> 5 <input type="text"/>		%	Yes <input type="checkbox"/> No <input type="checkbox"/>
	6 <input type="text"/> 7 <input type="text"/> 8 <input type="text"/>			
7A.2a	7A.2b	7A.2c	7A.2d	7A.2e
	1 <input type="text"/> 2 <input type="text"/>			
	3 <input type="text"/> 4 <input type="text"/> 5 <input type="text"/>		%	Yes <input type="checkbox"/> No <input type="checkbox"/>
	6 <input type="text"/> 7 <input type="text"/> 8 <input type="text"/>			
7A.3a	7A.3b	7A.3c	7A.3d	7A.3e
	1 <input type="text"/> 2 <input type="text"/>			
	3 <input type="text"/> 4 <input type="text"/> 5 <input type="text"/>		%	Yes <input type="checkbox"/> No <input type="checkbox"/>
	6 <input type="text"/> 7 <input type="text"/> 8 <input type="text"/>			
7A.4a	7A.4b	7A.4c	7A.4d	7A.4e
	1 <input type="text"/> 2 <input type="text"/>			
	3 <input type="text"/> 4 <input type="text"/> 5 <input type="text"/>		%	Yes <input type="checkbox"/> No <input type="checkbox"/>
	6 <input type="text"/> 7 <input type="text"/> 8 <input type="text"/>			
7A.5a	7A.5b	7A.5c	7A.5d	7A.5e
	1 <input type="text"/> 2 <input type="text"/>			
	3 <input type="text"/> 4 <input type="text"/> 5 <input type="text"/>		%	Yes <input type="checkbox"/> No <input type="checkbox"/>
	6 <input type="text"/> 7 <input type="text"/> 8 <input type="text"/>			

If additional pages of Part II, Sections 6.2/7A are attached, indicate the total number of pages in this box  and indicate which Part II, Sections 6.2/7A page this is, here.  (example: 1.2.3. etc.)



**EPA FORM R**  
**PART II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)**

TRI FACILITY ID NUMBER

Toxic Chemical, Category, or Generic Name

**SECTION 7B. ON-SITE ENERGY RECOVERY PROCESSES**

☐ **Not Applicable (NA) - Check here if no on-site energy recovery is applied to any waste stream containing the toxic chemical or chemical category.**

Energy Recovery Methods [enter 3-character code (s)]

1  2  3  4

**SECTION 7C. ON-SITE RECYCLING PROCESSES**

☐ **Not applicable (NA) - Check here if no on-site recycling is applied to any waste stream containing the toxic chemical or chemical category.**

Recycling Methods [enter 3-character code(s)]

1  2  3  4  5   
 6  7  8  9  10

**SECTION 8. SOURCE REDUCTION AND RECYCLING ACTIVITIES**

<i>All quantity estimates can be reported using up to two significant figures.</i>		Column A Prior Year (pounds/year)	Column B Current Reporting Year (pounds/year)	Column C Following Year (pounds/year)	Column D Second Following Year (pounds/year)
8.1	Quantity released*				
8.2	Quantity used for energy recovery on-site				
8.3	Quantity used for energy recovery off-site				
8.4	Quantity recycled on-site				
8.5	Quantity recycled off-site				
8.6	Quantity treated on-site				
8.7	Quantity treated off-site				
8.8	Quantity released to the environment as a result of remedial actions, catastrophic events, or one-time events not associated with production processes (pounds/year)				
8.9	Production ratio or activity index				
8.10	Did your facility engage in any source reduction activities for this chemical during the reporting year? If not, enter "NA" in Section 8.10.1 and answer Section 8.11.				
	Source Reduction Activities [enter code(s)]	Methods to Identify Activity (enter codes)			
8.10.1		a.	b.	c.	
8.10.2		a.	b.	c.	
8.10.3		a.	b.	c.	
8.10.4		a.	b.	c.	
8.11	Is additional optional information on source reduction, recycling, or pollution control activities included with this report? (Check one box)			YES <input type="checkbox"/>	NO <input type="checkbox"/>

\* Report releases pursuant to EPCRA Section 329(8) including "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment." Do not include any quantity treated on-site or off-site.


 United States  
Environmental Protection Agency

**TOXIC CHEMICAL RELEASE INVENTORY  
FORM A**
**WHERE TO SEND  
THIS STATEMENT:**

 1 EPCRA Reporting Center  
P.O. Box 3348  
Merrifield, VA 22116-3348  
ATTN: TOXIC CHEMICAL RELEASE INVENTORY

 2 APPROPRIATE STATE OFFICE  
(See instructions in Appendix F)

 Enter "X" here if  
this is a revision

**PART I. FACILITY IDENTIFICATION INFORMATION**
**SECTION 1.**
**REPORTING  
YEAR**

19 \_\_\_\_

**SECTION 2. TRADE SECRET INFORMATION**
**2.1**

Are you claiming the toxic chemical identified on page 2 trade secret?

☐

 Yes: Answer question 2.2 and  
attach substantiation forms

☐

 No: Do not answer 2.2, continue  
with Section 3.

**2.2**

If you answered yes in 2.1, is this copy.

☐

Sanitized

☐

Unsanitized

**SECTION 3. CERTIFICATION (Important: Please read and sign after completing the statement.)**

I hereby certify that to the best of my knowledge and belief, for the toxic chemical listed in this statement, the annual reportable amount, as defined in 40 CFR 372.27(a), did not exceed 500 pounds for this reporting year and that the chemical was manufactured, processed, or otherwise used in an amount not exceeding 1 million pounds during this reporting year.

Name and official title of owner/operator or senior management official

Signature

Date Signed

**SECTION 4. FACILITY IDENTIFICATION**
**4.1**

Facility or Establishment Name

TRI Facility ID Number

Mailing Address (if different from street address)

City

State

Zip Code

Street Address

City

County

State

Zip Code

**4.2**
**This report contains information for:**

(Important: check c if applicable, a and b have been intentionally left blank)


 c. ☐

 A Federal  
facility

**4.3**
**Technical Contact**

Name

Telephone Number (include area code)

	United States Environmental Protection Agency	<b>TOXIC CHEMICAL RELEASE INVENTORY FORM A</b>
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**SECTION 4. FACILITY IDENTIFICATION (Continued)**

<b>4.4</b>	<b>Intentionally left blank</b>						
<b>4.5</b>	<b>SIC Code (4-digit)</b>	a.	b.	c.	d.	e.	f.
<b>4.6</b>	<b>Latitude and Longitude</b>	Latitude			Longitude		
		Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
<b>4.7</b>	<b>Dun &amp; Bradstreet Number(s) (9 digits)</b>					a.	
						b.	
<b>4.8</b>	<b>EPA Identification Number(s) (RCRA I.D. No.) (12 characters)</b>					a.	
						b.	
<b>4.9</b>	<b>Facility NPDES Permit Number(s) (9 characters)</b>					a.	
						b.	
<b>4.10</b>	<b>Underground Injection Well Code (UIC) I.D. Number(s) (12 digits)</b>					a.	
						b.	

**SECTION 5. PARENT COMPANY INFORMATION**

<b>5.1</b>	Name of Parent Company		
	<input type="checkbox"/> NA		
<b>5.2</b>	Parent Company's Dun & Bradstreet Number		
	<input type="checkbox"/> NA	(9 digits)	

**PART II. CHEMICAL IDENTIFICATION****SECTION 1. TOXIC CHEMICAL IDENTITY**

<b>1.1</b>	CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.)
<b>1.2</b>	Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.)
<b>1.3</b>	Generic Chemical Name (Important: Complete <b>only</b> if Part I, Section 2 1 is checked "yes" Generic Name must be structurally descriptive.)

**SECTION 2. MIXTURE COMPONENT IDENTITY**

(Important: DO NOT complete this section if you complete Section 1 above.)

<b>2.1</b>	Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.)