Chapter 9

Toxics Release Inventory Data for Electrical Equipment (SIC Code 36)

A Look at Electronic and Other Electrical Equipment and Components, Except Computer Equipment (SIC Code 36)

The electrical equipment sector, Standard Inudstrial 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
361 Electric Transmission and Distribution Equipment	
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 similiar switchboard apparatus and supplies.
362 Electrical Industrial Apparatus	
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.
363 Household Appliances	
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.
364 Electric Lighting and Wiring Equipment	
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
365 Household Audio and Video Equipment, and Audio Recordings	
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.
366 Communications Equipment	
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 pover 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.
367 Electronic Components and Accessories	
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.
369 Miscellaneous Electrical Machinery, Equipment, and Supplies	
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 mediafor 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.

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: Class I Wells Pounds	Underground Injection: Class II-V Wells Pounds	On-site Land Releases: RCRA Subtitle C Landfills Pounds	On-site Land Releases: Other On-site Land Releases Pounds	Total On-site Releases Pounds	Off-site Releases: 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

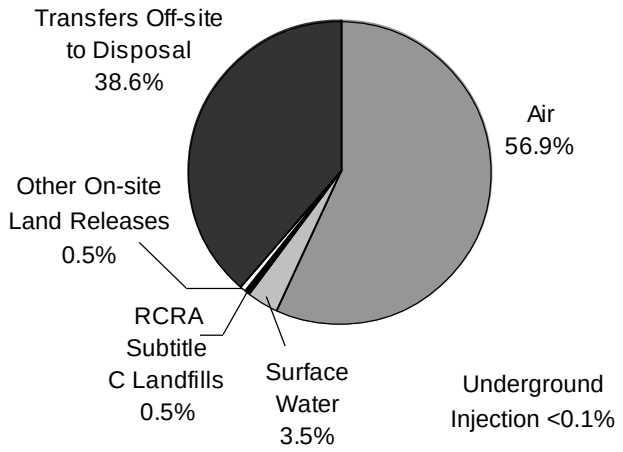


Figure 9-1. Distribution of TRI On-site and Off-site Releases, 1996: Electrical Equipment (SIC Code 36)

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.

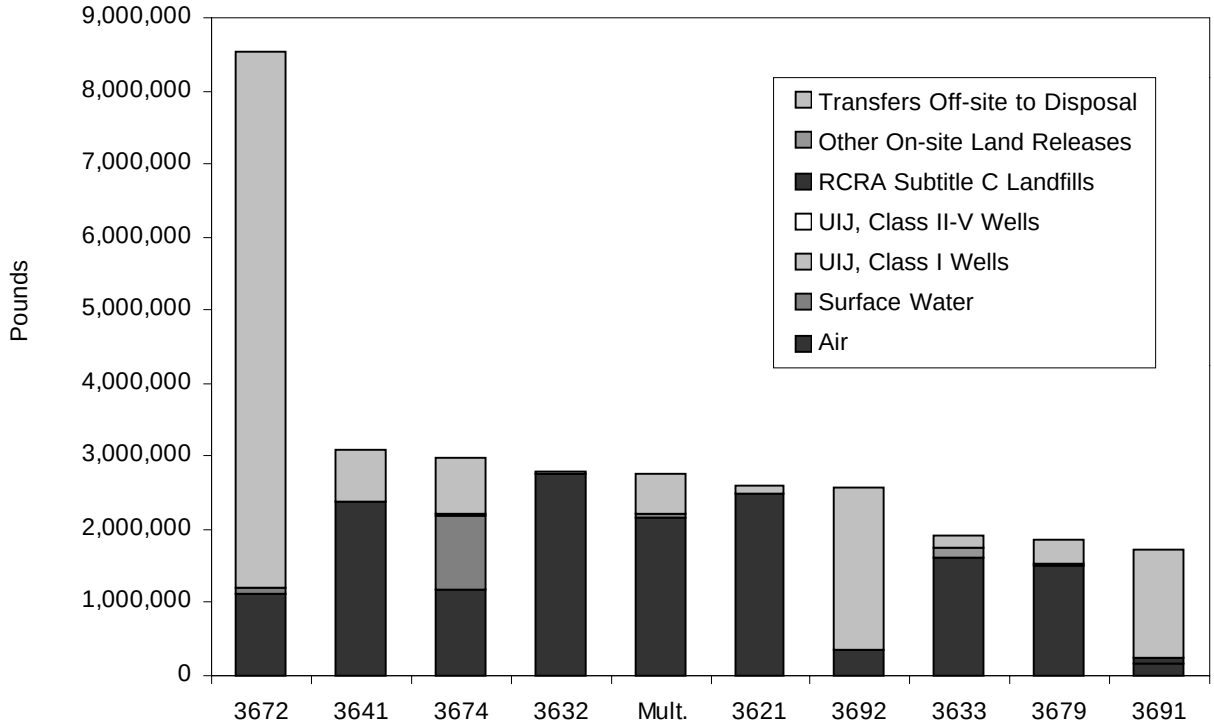


Figure 9-2. TRI On-site and Off-site Releases, SIC Codes with Largest Releases, 1996: Electrical Equipment (SIC Code 36)

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.

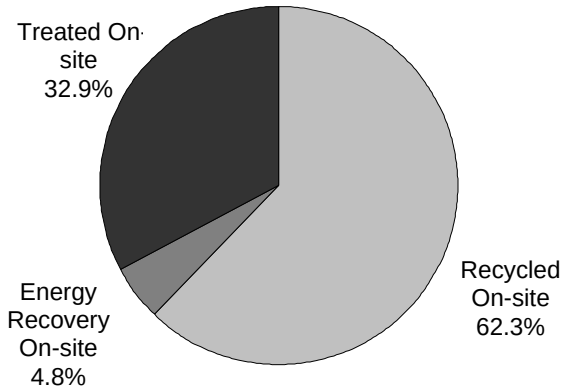


Figure 9-3. Distribution of TRI Other On-site Waste Management, 1996: Electrical Equipment (SIC Code 36)

Note: Data from Section 8 of the Form R.

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

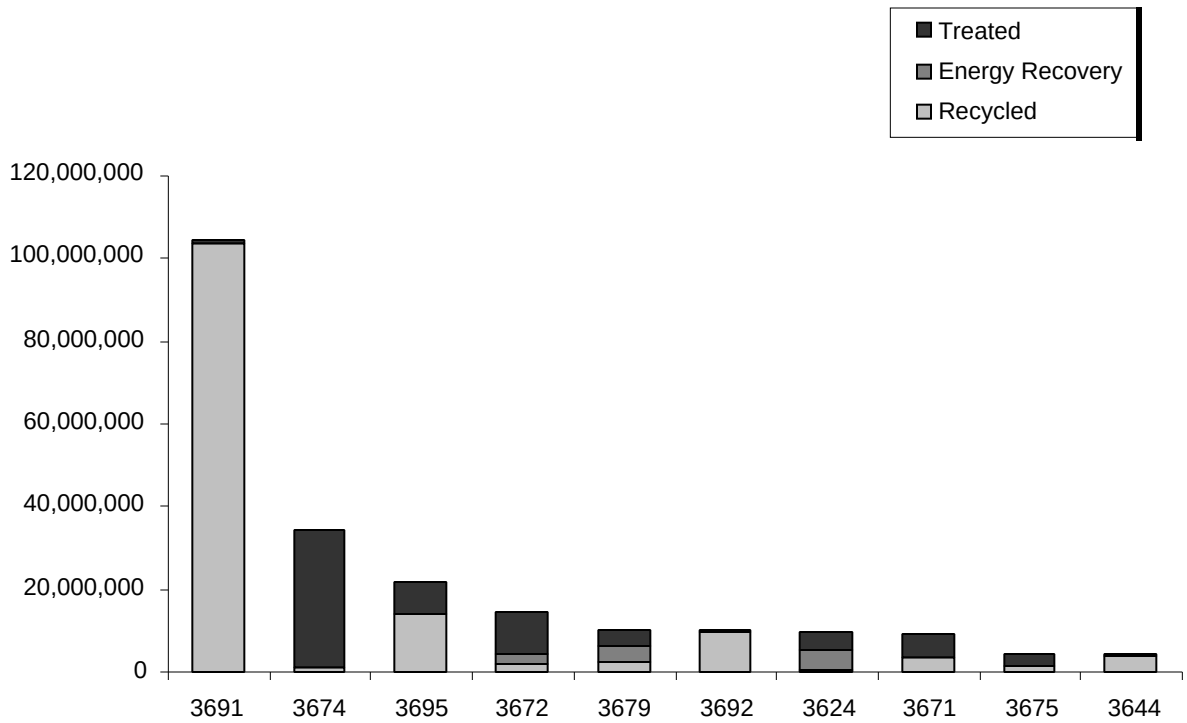


Figure 9-4. TRI Other On-site Waste Management, SIC Codes with Largest Totals, 1996: Electrical Equipment (SIC Code 36)

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 a 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.

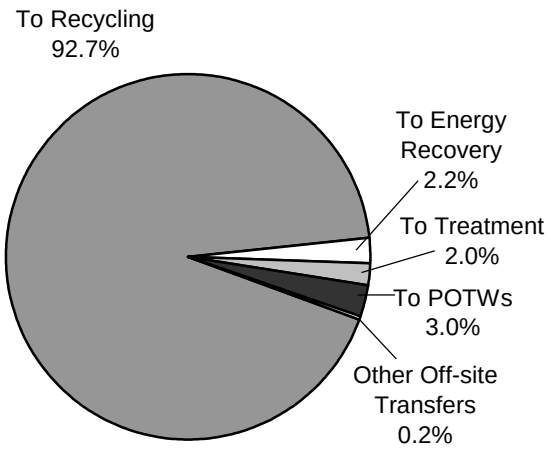


Figure 9-5. Distribution of TRI Transfers Off-site for Further Waste Management, 1996: Electrical Equipment (SIC Code 36)

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.

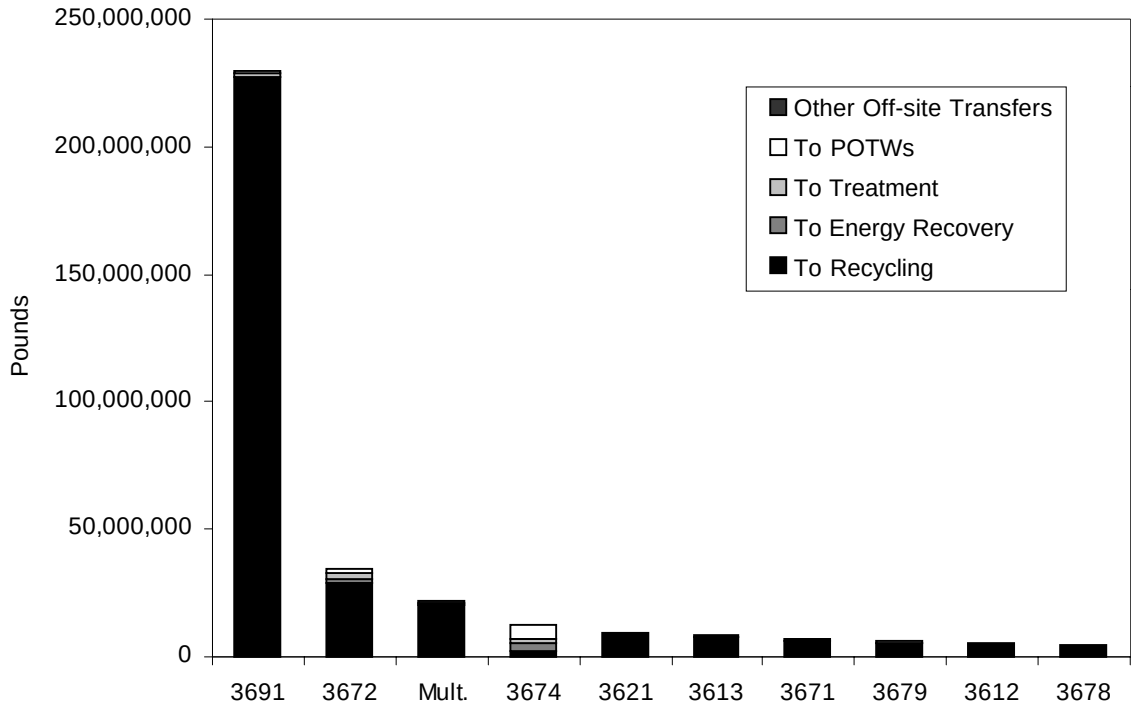


Figure 9-6. TRI Transfers Off-site for Further Waste Management, SIC Codes with Largest Totals, 1996: Electrical Equipment (SIC Code 36)

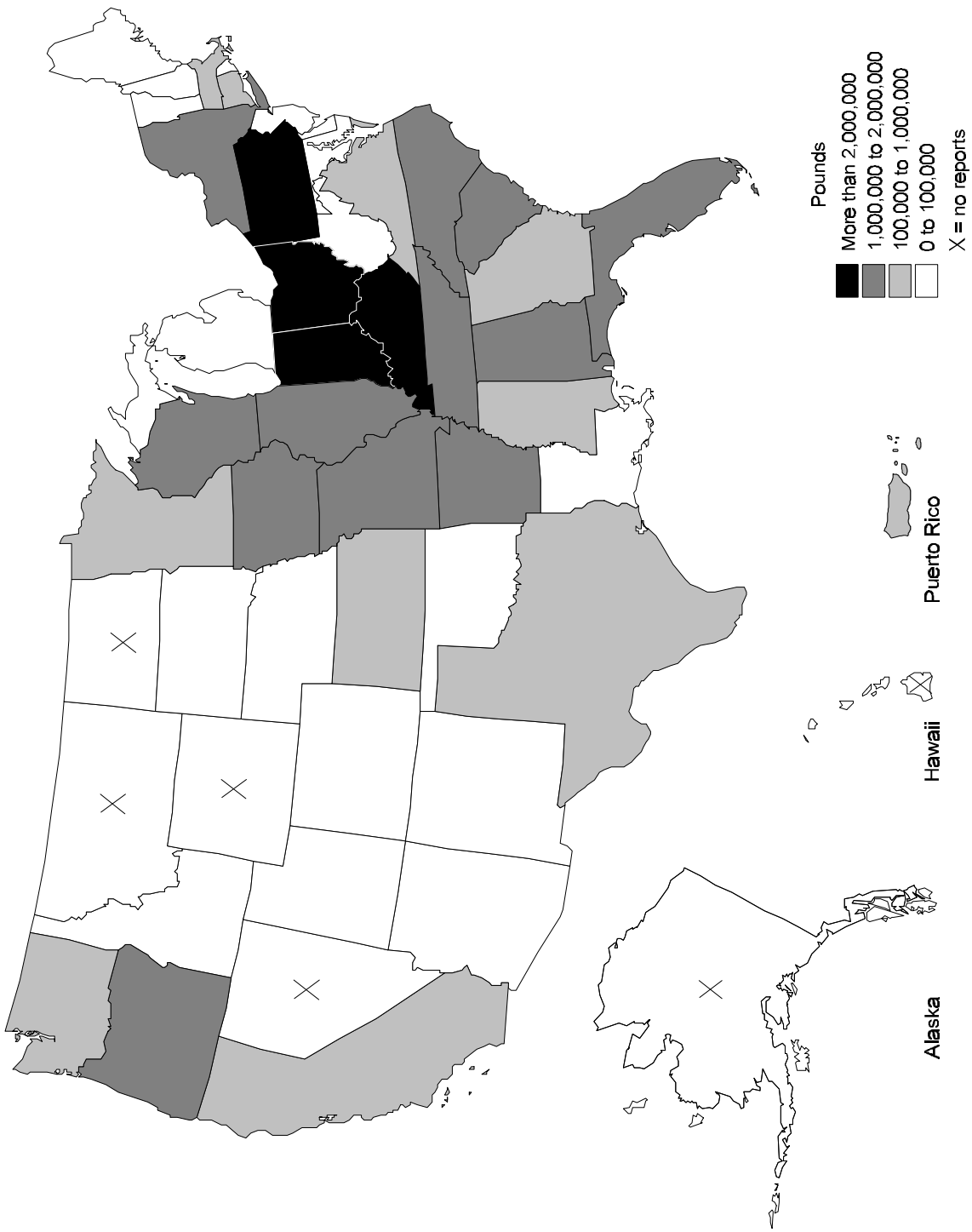
Note: Off-site Transfers for Further Waste Management from Section 6 (excluding off-site transfers to disposal) of Form R. Other Off-site Transfers are transfers reported without a valid waste management code. Forms with more than on 4-digit SIC code within SIC code 36 are assigned to the "multiple" category.

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: Class I Wells Pounds	Underground Injection: Class II-V Wells Pounds	On-site Land Releases: RCRA Subtitle C Landfills Pounds	On-site Land Releases: Other On-site Land Releases Pounds	Total On-site Releases Pounds	Off-site Releases: 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: Class I Wells Pounds	Underground Injection: Class II-V Wells Pounds	On-site Land Releases: RCRA Subtitle C Landfills Pounds	On-site Land Releases: Other On-site Land Releases Pounds	Total On-site Releases Pounds	Off-site Releases: 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.

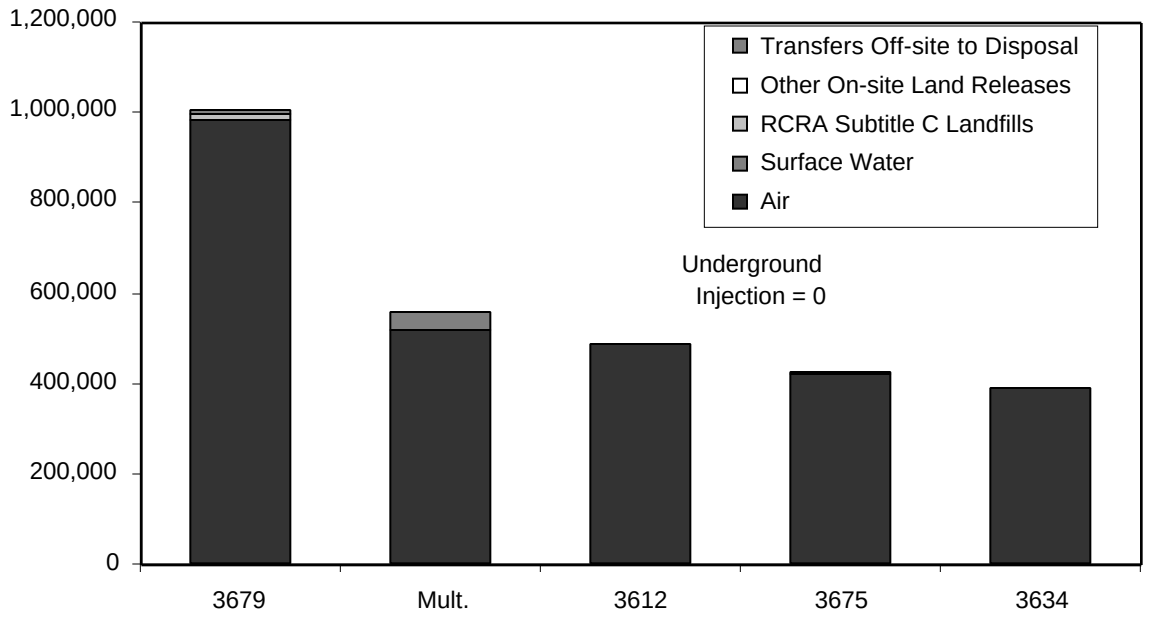


Figure 9-7. TRI On-site and Off-site Releases of OSHA Carcinogens, SIC Codes with Largest Totals, 1996: Electrical Equipment (SIC Code 36)

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	1,931,009	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

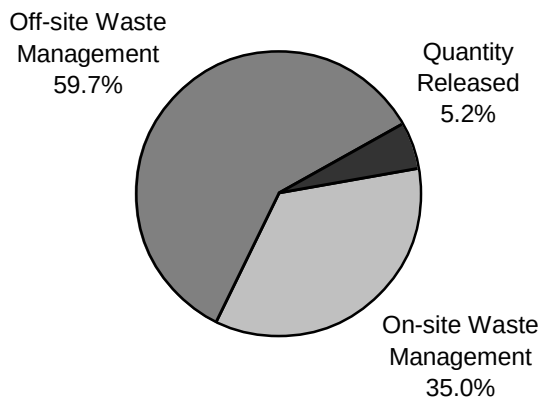


Figure 9-8. Distribution of TRI Production-related Waste, 1996: Electrical Equipment (SIC Code 36)

Note: Data from Section 8 of Form R.

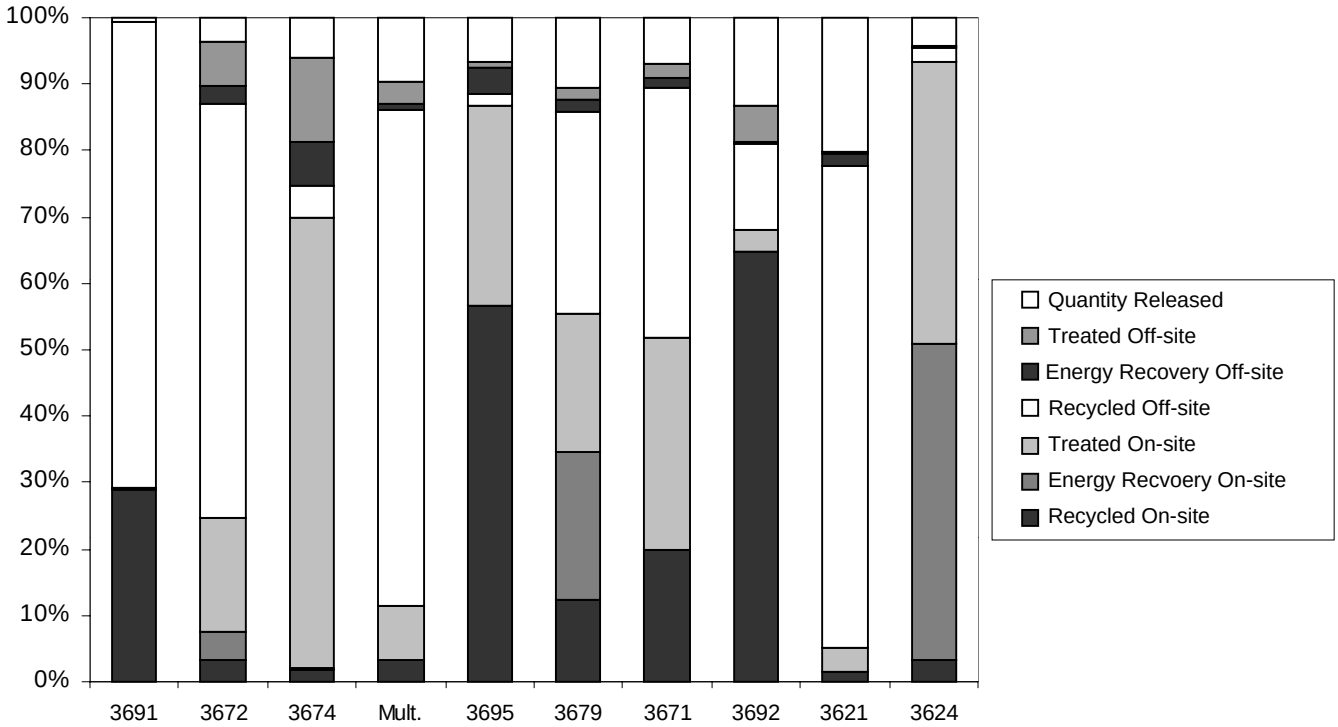


Figure 9-9. Distribution of Production-related Waste, 1996: Electrical Equipment (SIC Code 36)

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 Total Pounds	Current Year 1996 Percent of Total	Projected 1997 Total Pounds	Projected 1997 Percent of Total	Projected 1998 Total Pounds	Projected 1998 Percent of Total
On-site Waste Management						
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
Off-site Waste Management						
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 1996-1997 Percent	Projected Change 1997-1998 Percent	Projected Change 1996-1998 Percent
On-siteWaste Management			
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
Off-site Waste Management			
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

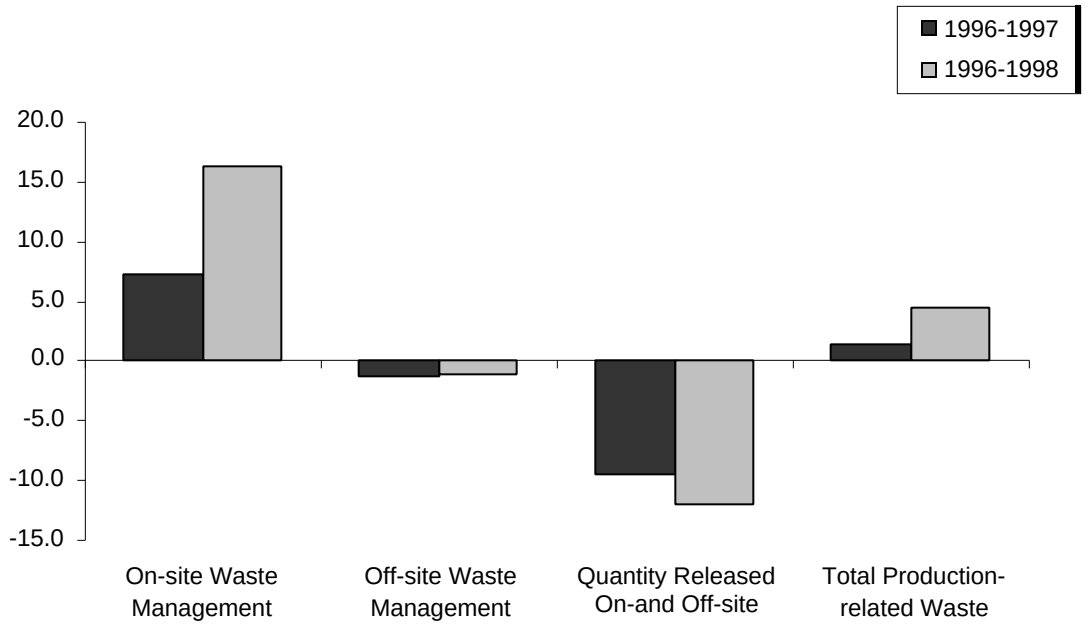


Figure 9-10 Projected Percentage Changes in Quantities of TRI Chemicals in Waste, 1996-1998: Electrical Equipment (SIC Code 36)

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: Number	Forms Reporting Source Reduction Activities: Percent of All Forms Percent	Category of Source Reduction Activity: Good Operating Practices Number	Inventory Control Number	Spill and Leak Prevention Number	Raw Material Modifi-cations Number	Process Modifi-cations Number	Cleaning and Degreasing Number	Surface Preparation and Finishing Number	Product Modifi-cations 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	1996	Change 1995 to 1996
	Number	Number	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
On-site Releases			
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
Off-site Releases			
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
Other On-site Waste Management			
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
Transfers Off-site for Further Waste Management			
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%.

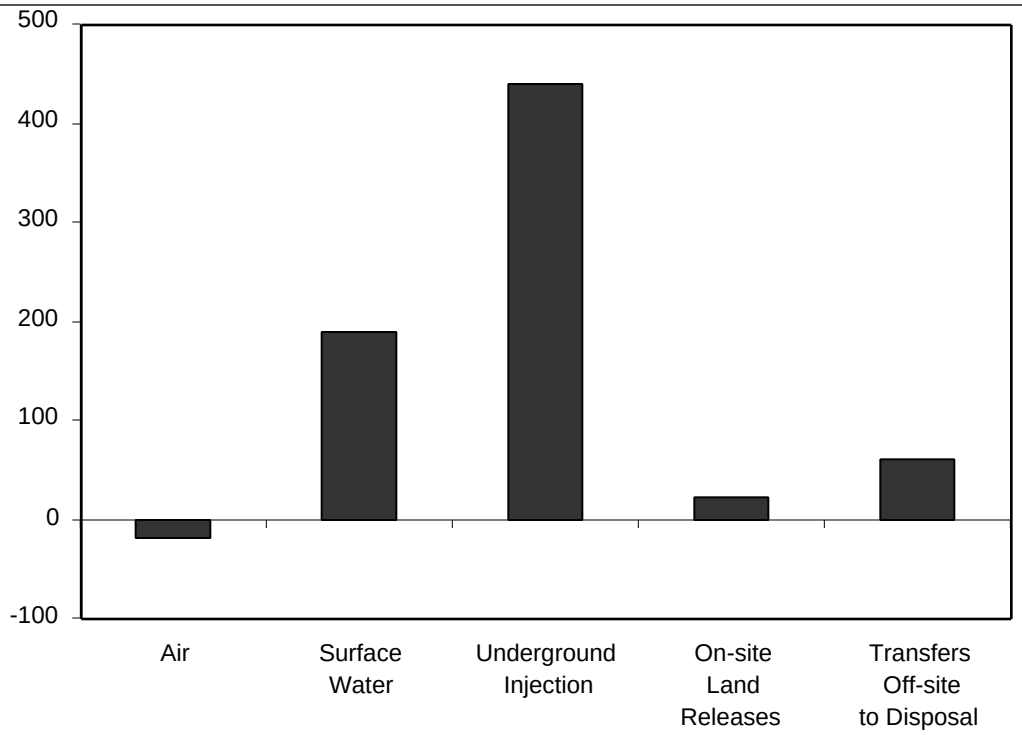


Figure 9-11. Percentage Change in On-site and Off-site Releases, 1995-1996: Electrical Equipment (SIC Code 36)

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. 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

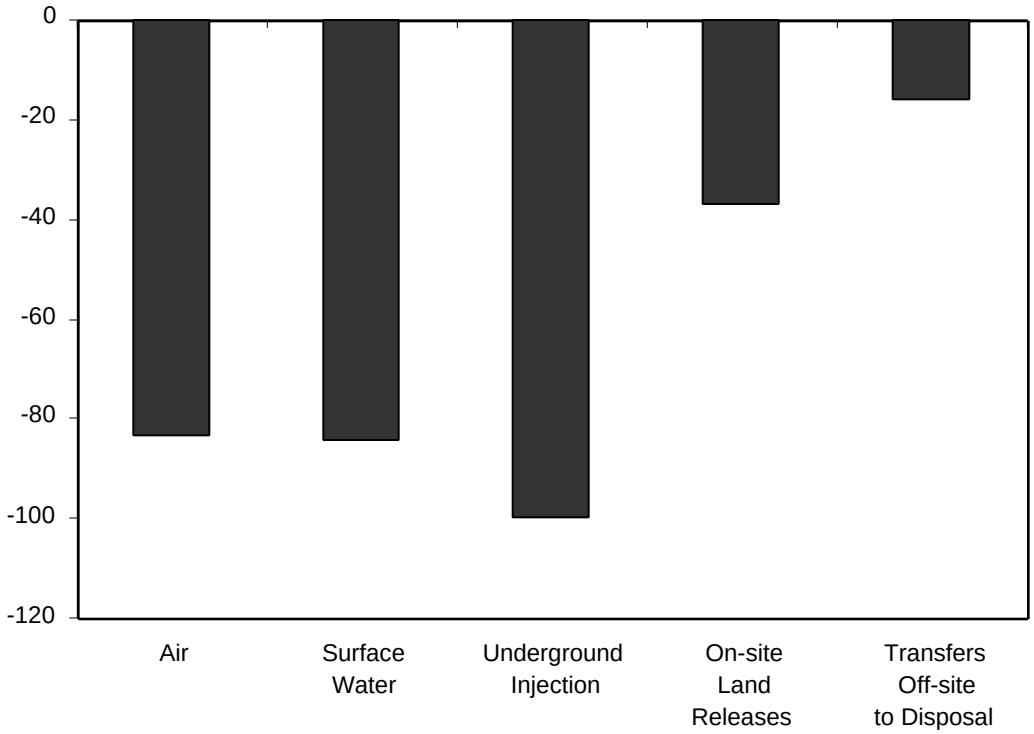


Figure 9-12. Percentage Change in On-site and Off-site Releases, 1988-1996: Electrical Equipment (SIC Code 36)

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
On-site Releases					
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
Off-site Releases					
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
Other On-site Waste Management					
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
Transfers Off-site for Further Waste Management					
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

			On-site Releases					Off-site Releases	
SIC Code	**Industry**	**Year**	**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	**Total On- and Off-site Releases** 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.

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

			On-site Releases					Off-site Releases	
SIC Code	Industry	Year	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	Total On- and Off-site Releases 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

			On-site Releases					Off-site Releases	
SIC Code	**Industry**	**Year**	**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	**Total On- and Off-site Releases** 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

			On-site Releases					Off-site Releases	
SIC Code	Industry	Year	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	Total On- and Off-site Releases 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.

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

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
On-site Waste Management				
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
Off-site Waste Management				
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
On-site Waste Management			
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
Off-site Waste Management			
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.

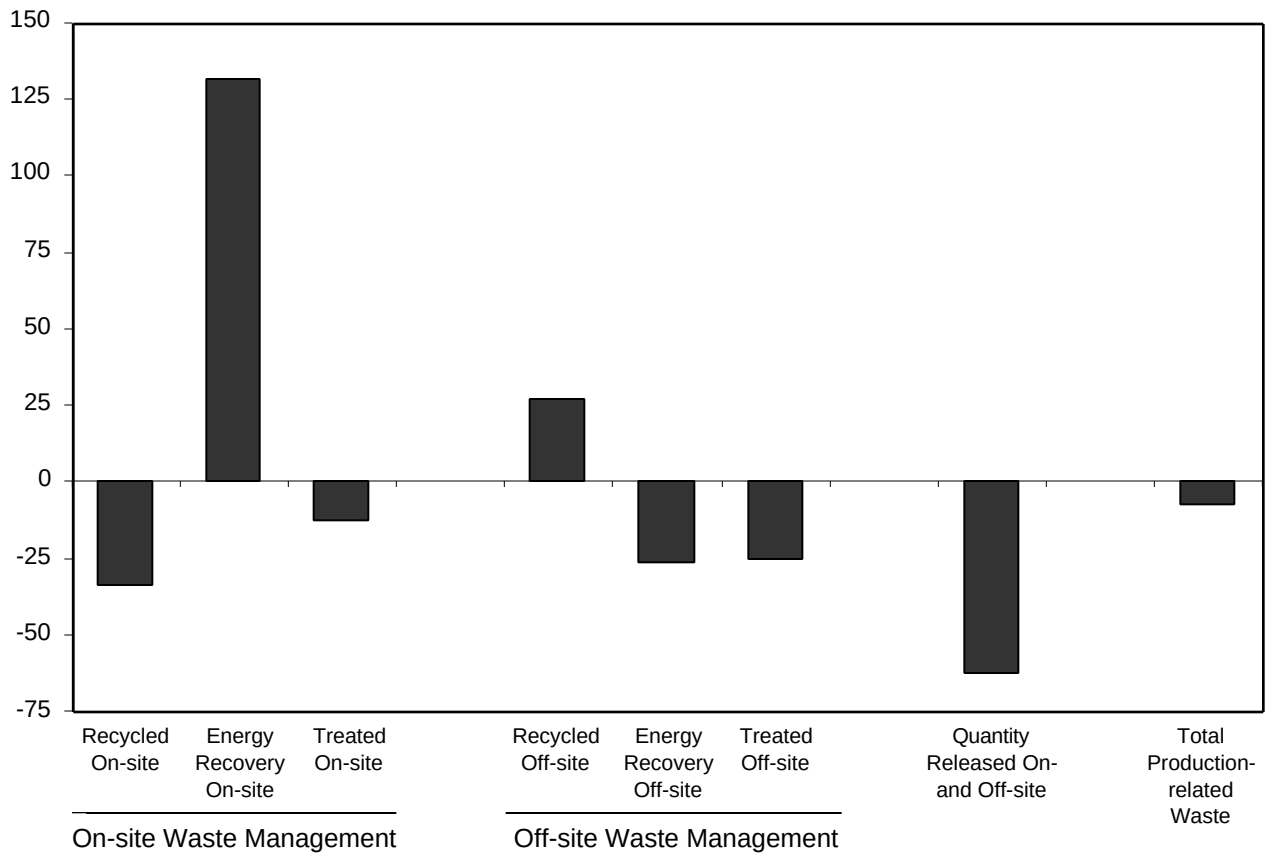


Figure 9-13. Percentage Change in Quantities of TRI Chemicals ir Waste, 1991-1996: Electrical Equipment (SIC Code 36)

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 & Poorís, 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.