Chapter 7: Primary Metals Industry

M All tables and figures in Chapter 7 are from the 1997 Matched Data Set

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Figures

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Tables

Key Findings

- The primary metals industry was the largest contributor of releases and transfers in Canada and the second largest in the United States in 1997, as identified in **Chapter 5**. This industry accounted for 36 percent of NPRI releases and transfers (see **Table 5–25**) and 27 percent of TRI releases and transfers (see **Table 5–26**).
- As noted in **Chapter 4**, this industry accounted for 78 percent of the increase in transfers from 1995 to 1997 reported to NPRI (see **Table 4–52**) and 67 percent of that reported to TRI (see **Table 4–53**).
- More than 72 percent of the total releases and transfers reported by the primary metals industry in both Canada and the United States were on-site releases to land or off-site transfers of metals, both of which result largely in land disposal of the wastes. In Canada, the percentage is even higher. Metal-containing wastes cannot be treated to destroy the metal. The alternative to disposal is recycling.
- Primary metals industry reporting is dominated by steel mills in both Canada and the United States. Manufacturers of basic steel products comprised one-quarter of NPRI primary metals facilities and generated almost two-thirds of NPRI total releases and transfers. In TRI, basic steel producers accounted for one-fifth of the primary metals facilities and almost one-half of the total releases and transfers.
- The primary metals industry reported increases of more than 25 percent in total releases and transfers from 1995 to 1997 in both NPRI and TRI. The industry's off-site transfers of metals rose substantially.
- For both Canada and the United States, the primary nonferrous metal facilities (aluminum, copper, zinc, nickel and lead refiners) accounted for the second-largest amounts of total releases and transfers—21 percent of the NPRI total and 27 percent of that in TRI.
- After a period of slow growth and restructuring, the North American steel industry is expanding, even in the face of domestic and world competition. Economic and regulatory challenges to the industry have, in many cases, led to new or refurbished equipment with cleaner, more efficient technologies and greater efforts to recycle or reuse materials on-site. However, increased production may also increase releases and transfers of pollutants. In addition, waste disposal has increased in years when the economics of disposal compared to recycling are more favorable or when on-site storage limits are reached.
- Several primary metals facilities also upgraded pollution control equipment during the 1995–1997 period. In Canada, several industry initiatives have set specific reduction targets for facilities to try to achieve through changes in production processes and pollution control technologies. US facilities generally attributed changes in pollution control equipment to regular maintenance.

7.1 Introduction

This chapter investigates in more detail primary metals industry reporting to NPRI and TRI. This sector was chosen for special analysis because of the following:

- Primary metals manufacturing is one of the most significant economic sectors in North America, serving as the foundation for virtually all other industrial and commercial sectors, including vehicle manufacturing, construction, packaging, energy transmission, durable appliances, and transportation.
- The primary metals industry is the largest contributor of releases and transfers in Canada and the second largest in the United States (see **Chapter 5, Tables 5–25** and **5–26**). This industrial sector also reported increases of more than 25 percent from 1995 to 1997 in both Canada and the United States, especially in off-site transfers (see **Table 7–4**, later in this chapter).
- Almost half of the 50 facilities in North America with the largest total releases and transfers in 1997 were primary metals facilities, and those facilities accounted for one-sixth of the total North American releases and transfers (see **Table 5–3** in **Chapter 5**).

This chapter examines the context for PRTR reporting by the primary metals industry—the different types of facilities that make up the industry, their industrial processes and products, sources of the pollutants reported and opportunities for pollution reduction.

7.1.1 The Primary Metals Industry and PRTR Reporting

The primary metals industry (US SIC code 33) is composed of facilities that smelt or refine ferrous and nonferrous metal from ore or scrap. Ferrous metals are iron, steel and other iron-containing alloys. Nonferrous metals include aluminum, copper, lead, nickel and zinc. Primary smelting produces metals directly from ore, while secondary refining produces metals from scrap and process waste. Scrap consists of metal pieces (parts, bars, sheets, or wire) that did not meet product specifications in their manufacture, as well as used metallic material that can be recycled. This industry also produces alloys, castings, and formed or drawn metal products.

Economically, steel and aluminum are the most significant subsectors of the primary metals industry. Also, the blast furnace and basic steel products sector (US SIC code 331) facilities report the largest releases and transfers, while the primary refiners of nonferrous metals (US SIC code 333) report the second largest in both Canada and the United States (**Table 7–1**). Therefore, this chapter focuses on steelmaking as well as primary refining of nonferrous metals, particularly aluminum.

The facilities included in the primary metals industry cover a wide range of facility sizes, processes, raw materials and products. While data about the amount of pollutants released and transferred are available, other important information, such as the specific processes and raw materials employed, and the products and size of production, is not available from the PRTR database. Thus, the overall combination of facilities making up the sectors and subsectors of the primary metals industry in North America and in each country will differ, depending on the specific facilities reporting. This needs to be kept in mind when reviewing the pollutant data.

In addition, data analyzed in this chapter are contained in the matched data set for chemicals that must be reported in both countries, as explained in **Chapter 2**. The analysis covers only those substances of concern reported to both NPRI and TRI. Many other voluntary industry initiatives and governmental regulations affect the primary metals industry, but any detailed treatment of them is beyond the scope of this report.

When reporting to national PRTRs, facilities report the amount of metals and metal compounds in waste. A metal cannot be treated because it cannot be destroyed, regardless of whether the wastestream containing the metal is sent for treatment. Therefore, metals can be recycled, released to air or water, or be disposed of, most often in landfills on- or off-site. These landfills are permitted and regulated by government authorities. Reporting of metals recycled either on- or off-site is not required by NPRI and, therefore, is not included in the matched data set or in this analysis. In this report, since more than 72 percent of the amounts reported by the primary metals industry is disposed of in landfills (either on- or off-site—see **Table 7–4**), the analysis is based on the aggregate of releases (which includes on-site landfills) and transfers (which includes off-site landfills).

7.1.2 Guide to the Chapter

This chapter presents information about the economics and structure of the primary metals industry in the three North American countries. Given the relative importance of steelmaking and nonferrous refining, more detailed information is provided for these subsectors, including information on the processes used as well as economic and technological data. The chapter also addresses how those processes and technologies may be sources of pollutants and where opportunities for pollution prevention and reduction may occur. The second part of the chapter (from **Section 7.6**) presents the PRTR data as reported on the pollutants by US and Canadian facilities for 1997 and any changes noted from 1995 to 1997. Particular attention is paid to the two subsectors with the largest reported releases and transfers—manufacturers of basic steel products and primary refineries of nonferrous metals. The latter part of the chapter also discusses the reasons for change that were provided by the NPRI and TRI primary metals facilities reporting the largest decreases or increases of total releases and transfers from 1995 to 1997.

Table 7-1

M 1997

Summary of Releases and Transfers for the Primary Metals Industry (US SIC Code 33) by Subsector, 1997

US SIC Code	Industry	Number of Facilities	Total Releases (kg)	Total Transfers (kg)	Total Releases and Transfers (kg)	% of Total Releases and Transfers
NPRI Facilities						
331	Blast Furnace and Basic Steel Products	43	6,891,149	24,107,050	30,998,199	23.9
332	Iron and Steel Foundries	25	2,751,438	1,019,279	3,770,717	2.9
333	Primary Nonferrous Metals	30	8,722,657	1,125,165	9,847,822	7.6
334	Secondary Nonferrous Metals	8	16,028	480,895	496,923	0.4
335	Nonferrous Rolling and Drawing	36	171,920	65,248	237,168	0.2
336	Nonferrous Foundries	17	48,150	16,158	64,308	0.0
339	Miscellaneous Primary Metal Products	10	423,694	1,105,972	1,529,666	1.2
Total for NPRI Facilities within US SIC 33		**169**	**19,025,036**	**27,919,767**	**46,944,803**	**36.1**
Total for All NPRI Facilities in Matched Data Set		**1,430**	**80,448,924**	**49,508,261**	**129,957,185**	**100.0**
TRI Facilities						
331	Blast Furnace and Basic Steel Products	365	52,386,709	96,605,229	148,991,938	12.8
332	Iron and Steel Foundries	342	11,516,130	10,303,077	21,819,207	1.9
333	Primary Nonferrous Metals	54	82,111,466	3,955,533	86,066,999	7.4
334	Secondary Nonferrous Metals	159	1,644,545	8,410,648	10,055,193	0.9
335	Nonferrous Rolling and Drawing	347	3,553,917	5,409,999	8,963,916	0.8
336	Nonferrous Foundries	320	729,819	2,026,874	2,756,693	0.2
339	Miscellaneous Primary Metal Products	146	682,695	1,788,171	2,470,866	0.2
	SIC code not valid within SIC 33	1	243	117	360	0.0
Subtotal for Single SIC Codes within SIC 33		**1,734**	**152,625,524**	**128,499,648**	**281,125,172**	**24.2**
Subtotal for Multiple SIC Codes within SIC 33*		**104**	**18,382,257**	**19,219,019**	**37,601,276**	**3.2**
Total for TRI Facilities within US SIC 33		**1,838**	**171,007,781**	**147,718,667**	**318,726,448**	**27.4**
Total for All TRI Facilities in Matched Data Set		**19,125**	**767,302,191**	**394,039,756**	**1,161,341,947**	**100.0**

* TRI facilities may report more than one SIC code to define their operations.

7.2 Primary Metals Industry in Canada, Mexico and the United States

The primary metals industry in Canada is about equally divided between basic iron and steel manufacturers and nonferrous metal manufacturers. For Mexico, there are twice as many iron and steel manufacturers as nonferrous metal foundries. For the United States, on the other hand, there are over 3.5 times as many nonferrous metal foundries as there are iron and steel manufacturers. For all three countries, the iron and steel manufacturers employ the majority of the primary metals industry workforce and the value of shipments is larger than that for the nonferrous metal industry, despite its greater number of facilities in Canada and the United States (**Table 7–2**). Because the three countries have different SIC code classification systems, this analysis can distinguish only three subsectors of the primary metals industry: iron and steel manufacturing, aluminum foundries and other nonferrous foundries. Each of the three sectors includes refining as well as casting and drawing of shaped products, such as steel tubes, aluminum pipes and copper wire.

About one-third of primary metals facilities in both Canada and the US report to the respective PRTRs (for NPRI, 169 out of 452, or 37 percent, and for TRI, 1,838 out of 5,330, or 34 percent). Not all facilities must report to the PRTR databases. Only those with more than 10 employee equivalents or who use or manufacture the chemical substance in amounts greater than the thresholds must report. Also, for the purposes of this analysis, only the data for matched substances are included.

While PRTR data for Mexico are not available, there are about one-third as many primary metals industry facilities in Mexico as in Canada, and about three percent of the number in the United States.

7.3 The North American Steel Industry

Steel, an alloy of iron usually containing less than one percent carbon, is the backbone of many other industries, including motor vehicle manufacturing, construction, energy transmission, and the production of household appliances. Steelmaking is an energy-intensive operation, involving a series of manufacturing processes that transform raw materials into iron and steel products.

This section describes the steelmaking process, the companies that make steel in North America, and major economic and technological trends in the industry, and provides a brief explanation of how these trends affect the generation of pollutants and the opportunities for pollution prevention and reduction.

Section 7.9.1, below, will present the PRTR data reported by the manufacturers of basic steel products. The remainder of **Section 7.3** will serve as a short introduction to the many different types of facilities making up the basic steel products subsector of the primary metals industry and will highlight the different sources of the pollutant releases and transfers that will be presented in **Section 7.9.1**. This diversity of facility types and sources of releases and transfers should be kept in mind when reviewing the PRTR data.

7.3.1 Steelmaking Process

Steel manufacturing operations are broadly categorized as integrated or non-integrated. There are two steelmaking processes, using basic oxygen furnaces and electric arc furnaces. The basic oxygen furnaces are used in integrated mills, while electric arc furnaces are usually used in non-integrated mills (mini-mills and specialty steel mills). A third technique, the Midland-Ross (Midrex) Process that produces direct-reduced iron (DRI), is a proprietary process used in one steel mill in Canada, Sidbec-Dosco (owned by Ispat International in Contrecoeur, Quebec) and several in Mexico (Ispat Mexicana and Hylsamex).

An integrated mill begins with raw materials (coal and iron ore), as well as scrap metals and, through a series of steps, extracts carbon and iron, processing them into high tonnage carbon steels. The integrated process begins with cokemaking, where coal is reduced in coke ovens to make a fuel to melt iron ore with limestone in a blast furnace, producing iron. Molten iron from the blast furnace is then combined with flux (an additive such as lime and/or fluorspar) and scrap steel, and high-purity oxygen is injected in a basic oxygen furnace, producing steel. The integrated mills produce a diversity of products, including bars, rods, rails, structural shapes, sheets, tubes and wire rods. These mills are typically large establishments, and their need for coal and iron ore requires their location near rail or water transportation.

The non-integrated facilities, or mini-mills, use a simplified process that begins with scrap metals, thus avoiding the extracting and processing of raw materials. They can also use direct-reduced iron from the proprietary Midrex Process as the raw material. Mini-mills melt and refine scrap metal by passing an electric current through the scrap in electric arc furnaces. They generally produce carbon steels, low-tonnage alloys, and specialty steels—that is, more specialized types and grades of steel than the larger, integrated steel mills. Steel scrap often has a metallic coating of zinc, tin, nickel, lead and/or chromium. Mini-mills must treat the scrap to remove this coating before the scrap enters the furnace. These substances, then, may end up in waste. Mini-mills are generally smaller than integrated steel mills and are sited near sources of electricity and scrap steel and require a local market for their product.

The distinction between the two processes is an important one. Integrated mills are more capital and resource intensive, and their operations typically result in more releases to the environment. In comparison, mini-mill operations are less resource and capital intensive and result in fewer releases to the environment, as the coke and ironmaking steps are bypassed. However, because mini-mills rely exclusively on scrap metals from a variety of sources, they cannot completely

Table 7-2

M 1997

Facilities and Value of Shipments for the Primary Metals Industry in Canada, Mexico and the United States

	Primary Metals Industry					
			Nonferrous Metals Industry			
	Total	Basic Iron and Steel Industry	Total Nonferrous Metals Industry	Aluminum Foundries	Other Nonferrous Foundries	Both Iron/Steel and Nonferrous
Canada						
Number of Facilities	452	201	251	91	160	
Value of Shipments (US$ millions)	17,429	9,217	8,213	4,707	3,506	
Number of Employees	76,723	44,008	32,715	16,425	16,290	
NPRI Number of Facilities	169	75	94	45	49	
NPRI Total Releases and Transfers (kg)	46,944,803	36,298,580	10,646,223	2,460,950	8,185,273	
Mexico						
Number of Facilities	155	100	55	24	31	
Value of Shipments (US$ millions)	10,501	7,403	3,098	481	2,617	
Number of Employees	54,634	35,669	18,965	6,665	12,300	
RETC Number of Facilities	data not available					
RETC Total Releases and Transfers (kg)	data not available					
United States						
Number of Facilities	5,330	1,143	4,187	1,273	2,914	
Value of Shipments (US$ millions)	178,298	90,490	87,808	32,406	55,403	
Number of Employees	687,300	349,200	338,100	137,600	200,500	
TRI Number of Facilities	1,838	707	947	212	735	184
TRI Total Releases and Transfers (kg)	318,726,448	170,811,145	108,918,572	4,167,224	104,751,348	38,996,731
Including Multiple SIC Code Facilities*						
TRI Number of Facilities	1,838	757	1,128	322	899	
TRI Total Releases and Transfers (kg)	318,726,448	177,645,608	146,819,208	7,688,358	141,562,635	

➤ NPRI and TRI data for industry subsectors based on Canadian SIC code as reported by NPRI facilities and US SIC code as reported by TRI facilities.
Sources: Canada from *Manufacturing Industries of Canada: National and Provincial Areas, 1996. Statistics Canada, Catalogue n. 31-203-XPB.* **Mexico** from *Monthly Industrial Survey, Mexican National Institute of Statistics, Geography and Computing, 1997 Annual Survey* ; **United States** Employees and Value of Shipments from "Table 2. Statistics for Industry Groups and Industries: 1996," *1996 Annual Survey of Manufacturers, Bureau of Census, M96(AS)-1,* February 1998, and Number of Facilities from *1996 County Business Patterns*, Bureau of Census.

* See **Section 7.8.2**.

control the quality of the materials fed into their process. This can result in significant variations in their environmental releases.

Both types of mills produce molten steel that is formed into ingots or slabs that are then rolled into finished products. Such rolling operations may require reheating, cleaning, and coating the steel. Finishing operations may also include acid pickling (cleaning the steel by the chemical removal of oil, grease and iron compounds) and coating.

7.3.2 Industry Structure

The United States produced 97.5 million tonnes of crude steel in 1997, the third largest production in the world (behind China and Japan). Canada produced 15.6 million tonnes, ranking 14th in the world, and Mexico produced 14.3 million tonnes, ranking 15th in the world.

The steel sectors of North America are highly interlinked. Steel producers in the three countries engage in cross-border shipments of steel and purchase materials from the same suppliers. Their largest customers are also the same—the automotive and auto parts manufacturers that span the border. With the elimination in 1998, under the North American Free Trade Agreement, of the tariff on steel products shipped over the border, these close linkages will only increase. The United States was the 14th largest exporter of steel in 1997, exporting 5.6 million tonnes. Mexico was the 16th, exporting 5.5 million tonnes and Canada was the 18th, exporting 4.8 million. The United States imported 28.5 million tonnes, the largest amount of any country in the world. Canada and Mexico imported 6.7 million and 1.4 million, respectively, according to the International Iron and Steel Institute.

The Canadian steelmaking sector comprises twelve companies: Algoma Steel, Atlas Steels, Co-Steel Lasco, Dofasco, Gerdau Canada, IPSCO, Ispat Sidbec, Ivaco, QIT-Fer et Titane, Slater Steels, Stelco, and Sydney Steel Corp. These companies operate 17 plants that melt and pour steel in Alberta, Manitoba, Nova Scotia, Ontario, Quebec, and Saskatchewan. Operations in Ontario account for 70 percent of Canadian capacity, including four integrated mills. In 1997, the industry employed 33,400 employees, with sales in excess of C$11 billion (US$7 billion), of which C$3.6 billion (US$2.4 billion) were exports. The IPSCO facility in Regina, Saskatchewan, is not included in this report, since there are no reports from this facility in the public NPRI database.

The US steel industry is considerably larger. In 1997, the US iron and steel industry consisted of an estimated 197 companies operating 279 iron and steel mills, employing 147,000 employees, with shipments valued at US$57 billion. The largest companies include the USX Corporation, Bethlehem Steel Corp., LTV Corp., National Steel Corp., Inland Steel Industries, Armco, Weirton Steel Corp., and Wheeling-Pittsburgh Steel. Approximately 80 percent of US integrated steelmaking capacity is located in the Great Lakes states because, historically, mill sites were selected for their proximity to water (for cooling and processing as well as transportation) and the sources of their raw materials. The remainder are found in the southern and western regions; these are primarily mini-mills, built where abundant electricity and scrap are available. Some of the largest non-integrated steel companies are Nucor Steel, Northwestern Steel and Wire, Trico Steel and the Timken Company.

Mexico has several large steel companies. Altos Hornos de México has two facilities and is the largest steelwork in Mexico. The TAMSA facility is part of a global alliance of steel companies in Mexico, Argentina and Italy (The DSL Group) and is the sole Mexican producer of seamless steel pipe used in oil and gas production and transportation. Hyslamex, a subsidiary of Alfa Steel, is allied with AK Steel—both companies operating in Canada and the United States. Ispat Mexicana is Mexico's largest steel exporter and is part of Ispat International, which owns steel companies in the US and Canada as well as other countries.

7.3.3 Major Economic Trends

After a long period of slow growth and restructuring, the North American steel industry is enjoying a resurgence due to expanding markets and technical innovation. Throughout the 1980s, the North American steel industry saw slow growth in demand for its products, mainly due to market loss to other materials like plastics, increased imports, lower demand due to weakness elsewhere in the North American manufacturing sector, and inefficiency of older manufacturing plants. This has led to plant closures and massive layoffs, but also to increased automation and investment in new technologies.

During the same period, however, non-integrated mini-mills more than doubled their capacity, benefiting from low-cost scrap metal and lower start-up costs. While the mini-mills could initially manufacture only low-quality steel products, technological improvements have allowed them to expand into new markets such as flat-rolled products. Rising prices for scrap metal and the scarcity of high-quality scrap may now constrain their growth. This is prompting mini-mills to seek alternate iron sources, such as iron carbide. Because mini-mills tend to be smaller and have fewer employees, overall employment in the steel industry has decreased in the last 20 years.

Since 1993, demand for steel has once again picked up, due in large part to growth in the automotive and construction sectors. Recent and rapid changes in automotive design and manufacturing, the largest end use of North American steel, have had a direct impact on steel producers, bringing about much of the steel industry's technological improvements. Government pressure to create more fuel-efficient vehicles, particularly through the Corporate Average Fuel Economy (CAFE) standards in the United States, has driven innovation to develop and produce strong, light autobody steel.

At the same time that the North American steel industry has shown its ability to respond to changing and growing domestic demand, it is being challenged by Russian and European steelmakers, which are vying for an increased share of the North American market. Both the US and Canadian steel industries have also accused some foreign steel suppliers, such as those from Japan and Brazil, of illegally dumping their steel (selling products at less than the cost of production) in the North American market. The steel industries in these countries have countered that the United States is also guilty of dumping its steel in foreign markets. The steel-dumping war is an indication of the fierce competition that has been characteristic of the global steel industry in the 1990s.

7.3.4 Changing Technology and Pollution Prevention Opportunities

Domestic and world competition has led to cleaner, more efficient technologies and environmental management systems. The North American iron and steel industries began major investments in air, water and solid waste control technology and management in the first half of the 1990s, which are continuing today. Recent innovations include the move toward continuous process production, making the whole steelmaking process a continuous flow. This reduces waste, production time, energy consumption and costs. Continuous casting, for example, is now the normal industrial process because of its energy efficiency compared to traditional batch-casting operations.

Overall, production in both countries is cleaner and more efficient than it was 10 or 15 years ago. According to a 1995 EPA review, the US iron and steel industry has generally become more efficient over the past 15 years through improvements in manufacturing techniques, increasing water recycling rates and water conservation, eliminating obsolete processes, introducing pollution prevention, and improving wastewater treatment practices.

Similarly, according to the Canadian Steel Producers' Association, the production of one ton of steel in Canada now results in 80 percent fewer releases to air, water and waste disposal than at the beginning of the decade, and energy consumption has decreased by 19 percent from 1990 to 1997.

Steelmaking is a complex process whose many steps can produce pollutants. Pollution control techniques are necessary but these varied sources of pollutants also provide many opportunities for pollution reduction and prevention. Sources of pollutants and the techniques used to reduce them are described in this section. Efforts in the iron and steel industry have concentrated on reducing cokemaking emissions, dust from electric arc furnaces, and spent acids in finishing.

The production of coke yields many undesirable byproducts, including benzene, phenol, hydrogen cyanide and other cyanide compounds, naphthalene, toluene, and xylene, which are generated from the volatile components in the coal. Captured byproducts are sold commercially. To reduce emissions from cokemaking, some steelmakers are replacing coal with less polluting carbon sources such as pulverized coal injection, natural gas, oil and tar/pitch. Pollutants that escape from doors and lids of coke ovens become fugitive emissions that are released to air as gases and particulates, or they may be found in wastewater from quenching operations or as "scrubber" wastes from air pollution control equipment. Fugitive emissions can be reduced through better door and lid design, seals and cleaning and maintenance.

Improved coke oven design can reduce pollution. Nonrecovery coke ovens use volatile compounds driven from the coal as fuel to heat the oven, eliminating recovery piping systems that may leak or break. EPA considers nonrecovery cokemaking technology to be the "best achievable technology" under the federal Clean Air Act Amendments (CAAA). This option is applicable, however, only in the construction of new coke ovens. Otherwise, the necessity for cokemaking can be reduced or eliminated by making iron directly from iron ore, fuel (coal or natural gas) and lime.

Producing molten iron from iron ore, coke and limestone in a blast furnace generates slag and air particulates. Slag captures impurities in the ore, such as silicon or phosphorus; metals such as cadmium, chromium, lead, manganese, nickel and zinc; or sulfur from the fuel. The amount of slag largely depends on the amount of iron ore processed. For decades, slag has been used by the construction industry as a raw material for aggregate, cement, or light masonry, and new markets are continually being explored. Iron oxide waste in dust and wastewater sludge can be recycled into the ironmaking process itself.

During steelmaking, pollution control devices remove dust and gas that exit the furnace. These devices use either a wet or dry system, producing dust (from the dry system) or sludge (from the wet system). Metals in the emissions come from scrap metals used as raw materials and other metals mixed with the steel to produce steel alloys. Typical of these are zinc, chromium and nickel. Air emissions are proportional to the amount of time the metals spend at high temperatures but techniques are available for reducing this period.

Wastes produced by an electric arc furnace are similar to those from iron- and steelmaking. Electric arc furnace processes avoid cokemaking wastes because they do not require coke. However, mini-mill wastes may have increased concentrations of metals in dust, slag and sludge because of the scrap metal used as input. Steel scrap usually has a metal coating of zinc, tin, nickel, lead and/or chromium; stainless steel scrap is high in nickel and chromium; and galvanized steel's coating is zinc.

The use of electric arc furnaces to produce steel from scrap metal generates electric arc furnace dust, a waste iron oxide contaminated with nonferrous metals, primarily zinc and lead. Individual companies weigh the cost of having off-site facilities recover the metals from the waste against those of disposing of it in off-site landfills. Meanwhile, studies of more economical ways to recycle the metals in the waste continue. Dust from electric arc furnaces can be pelletized and then reused in the furnace. If the concentration of zinc is high enough, it can be recovered. However, not all mills find on-site recovery to be technically or economically competitive. Improvements in technologies have made off-site recycling a cost-effective alternative to land disposal in some cases.

Waste iron oxides are produced during integrated iron and steel manufacturing processes and pose a major pollution prevention challenge for North American producers. Steelmakers and industrial service providers are studying ways to recover iron and nonferrous metals from the waste. On-site recovery processes have yet to be proven, technically or commercially.

Other sources of pollutants and opportunities for pollution reduction occur after the initial steelmaking. Steel that is cast is generally reheated for forming, and then oxides on the surfaces of the cast steel are removed. The oxides become airborne particulates. Cooling water is collected in settling basins along with oil, grease and mill scale generated in the casting process. The scale can be recycled. When the wastewater is treated, sludge is generated. To finish steel, it must be cleaned or "pickled" before a protective coating is applied. Carbon steel is pickled with hydrochloric or sulfuric acid, and stainless steel is pickled with hydrochloric, nitric or hydrofluoric acids. Rinse water from coating processes or grindings from rolling may contain zinc, lead, cadmium or chromium. In forming and finishing, process waters can be recycled and reused or regenerated many times. There are alternatives to the strong acids used in the cleaning process, such as pressurized air or water, abrasives and alkaline agents. Large-scale steel manufacturers commonly recover hydrochloric acid in their finishing operations, but cost-effective recovery techniques for smaller-sized plants are still under development.

7.4 The North American Aluminum and Other Nonferrous Metals Industries

Nonferrous metals include aluminum as well as such metals as copper, nickel, lead and zinc. Primary aluminum is commonly produced by extracting aluminum oxide from bauxite ore, reducing the aluminum oxide to pure molten aluminum. This is then either mixed with other metals to form alloys of specific characteristics or cast into ingots for transportation to fabricating shops. In secondary aluminum production, scrap is usually melted in gas- or oil-fired furnaces, producing ingots of pure aluminum that serve as feedstock for other processes and for producers of other materials. Other nonferrous metals are refined by concentrating the metal from the ore and then leaching or smelting it at high temperatures. Refining wastes may contain impurities such as gold, silver, antimony and other metals that are recovered for their value.

7.4.1 Aluminum Production

Industry Structure

In 1997, almost two-thirds of aluminum production fed three markets: transportation, containers and packaging, and building and construction. The automotive sector is the largest end-user, followed by makers of beverage containers. Electrical applications, consumer durables, and machinery and equipment are the next-largest group. Mexico has only one aluminum smelter, so this section focuses on production of aluminum in the US and Canada.

The Canadian aluminum sector consists of five companies: Alcan Aluminum Limited, Canadian Reynolds Metals Limited, Aluminerie de Bécancour Inc., Alcoa-Aluminerie Lauralco Inc., and Aluminerie Alouette Inc. All but one of the production facilities are located in Quebec, with the exception being in British Columbia. In 1997, the Canadian primary aluminum industry had a total production capacity of about 2.3 million tonnes and an estimated value of C$5.2 billion (US$3.5 billion). Canada is the world's third-largest producer, following the United States and Russia. Almost 81 percent of Canadian aluminum production is exported, of which 75 percent is destined for the United States.

The US primary aluminum sector had a total production capacity of 9.3 million pounds (4.3 million tonnes) in 1997, coming from 23 smelting facilities operated by 13 firms. Four of these firms are integrated producers, including Alcoa Inc., Alumax Inc., Reynolds Metals Company and Kaiser Aluminum & Chemical Corporation. There are an estimated 68 secondary plants. US primary aluminum production is concentrated in the northwest and the Ohio River Valley. Secondary aluminum smelting is located in southern California and the Great Lakes region. In 1997, the industry produced a total of 22 billion pounds (10 million tonnes) of aluminum, of which about 30 percent drew on imported stock and 33 percent on recycled aluminum. US aluminum exports accounted for 13 percent of total production in 1997.

Canada and the United States are each other's largest trading partners in aluminum. In 1997, imports and exports between the two countries totaled three million tons of aluminum, consisting of ingots, scrap and mill products.

Economic and Technological Trends

Aluminum production has remained relatively stable since the late 1980s, when fluctuations in price, supply and demand brought on downsizing and restructuring. World primary aluminum prices fell again in 1993 with increased exports from Russia and Eastern Europe. US aluminum sales increased in 1994 due to increased demand in automotive manufacturing and beverage container stock.

Recent developments in the aluminum industry include new applications for the rehabilitation of transportation infrastructure, such as bridges. The aluminum sector is also expanding by selling product to manufacturers of cruise ships and fast ferries, and attempting to capitalize on the trend toward lighter cars.

Pollutants and Pollution Reduction and Prevention Opportunities

Aluminum refining involves several steps that may produce pollutants and thus require pollution control equipment. These production steps, however, may also provide opportunities for pollution reduction and prevention. The various control and pollution prevention techniques are described here.

Extracting aluminum oxide from bauxite ore involves crushing the ore and mixing it with aqueous sodium hydroxide. This slurry is reacted at high temperatures to remove impurities such as silicon, iron, titanium and calcium oxides. The aluminum oxide is then put in carbon-lined "pots," through which an electric current is passed. The alumina is reduced, liberating oxygen in the form of carbon dioxide and carbon monoxide, and the aluminum collects in the bottom of the pots. The molten aluminum may be treated with chlorine gas or fluoride salts to react with any remaining metallic impurities.

Large amounts of particulates are generated during the extraction process. Typically, this dust is recycled, due to its economic value. Fluoride emissions from the reduction process are captured or recycled. Iron cyanide complexes form in the carbon portion of the pot linings, and these liners eventually crack and must be replaced. Longer-lasting carbon liners have been developed, reducing this waste.

Secondary aluminum processing involves melting aluminum scrap in furnaces to remove magnesium, using chlorine gas or salts. This produces slag that contains magnesium and metallic chlorides. Air emissions typically contain chlorine, metal chlorides of zinc, magnesium and aluminum, and various other metals, depending on the content of the original scrap. Fluorides are emitted both as gases and dust. Baghouse scrubbers are used for emission control.

7.4.2 Production of Other Nonferrous Metals

Economic Statistics

Other nonferrous primary metals producers include copper, zinc, nickel and lead smelters and refineries. More than half of the refined copper consumed annually is used for electrical applications, mostly as wire. While aluminum has largely replaced copper in automobile radiators, an increase in demand for copper is expected due to the increase in the number of electrical circuits in automobiles and residential housing. Copper refineries in Canada produced 560,000 tonnes in 1997. In the United States, 2.4 million tonnes of copper were refined in 1997.

Zinc is used in the automotive and construction industries for the galvanization of steel. New applications for zinc are in the manufacture of zinc-air batteries and galvanized steel studs to replace wood ones in construction. Canada currently produces only a minor amount of secondary zinc. However, processing electric arc furnace dusts or de-zincing galvanized steel scrap could become important sources of refined zinc in the future. Canada produced 745,000 tonnes of zinc metal in 1997 while the United States produced 390,000.

Pollutants and Pollution Reduction and Prevention Opportunities

A variety of processes may be used to recover metals and control impurities during production of such nonferrous metals as zinc, copper, nickel and lead. Oxide ores can be leached with sulfuric acid to produce sulfide ores. Sulfide concentrates are produced from the sulfide ores at the mine site by separating valuable minerals from waste using physical methods. Concentrates may then be smelted at high temperature or treated by pressure leaching to produce metals that meet commercial specifications. The refining process also yields valuable byproducts that may be marketed or further processed by another smelter or refinery. Such byproducts include antimony, arsenic, bismuth, cadmium, copper, lead, nickel, selenium, tellurium, zinc, silver, gold and platinum group metals. Impurities, such as mercury, are usually fixed in a stable form.

Copper oxide ores are processed at the mine site by leaching them with sulfuric acid. The acid is regenerated and reused. The result, copper sulfide concentrates, are then smelted by drying the concentrate and feeding it into a furnace that oxidizes and melts the ore into a mixed copper-iron sulfide. Most zinc sulfide concentrates are roasted and leached, but some can be pressure-leached with sulfuric acid and oxygen at elevated temperature and pressure. In either case, iron is then precipitated out from the solution and the solution is purified, with most of the acid being regenerated and reused. The copper or zinc is recovered by an electrorefining process. In this, an electric current is passed through the solution, coating rods with the metal and precipitating the impurities, which fall to the bottom as slag. Lead concentrates from sulfide or carbonate deposits are smelted prior to purification in an electrolytic or thermal refinery. Nickel sulfide concentrates are smelted to produce intermediate products. Final processing usually entails leaching, solution purification and electrorefining.

Smelters generally have high gas flows that contain particulate matter. They use wet scrubbers, electrostatic precipitators or fabric filters to minimize metal and particulate emissions, and most control acid gas emissions by recovering and marketing sulfuric acid or liquid sulfur dioxide. Some impurities may be bled from the process to control levels of sulfuric acid and/or refined metal, improve workplace quality or reduce releases. Pressurized leaching processes have minimal air emissions and fix sulfur in the elemental form, which can be marketed or stored. Leaching processes and refineries also have minimal air emissions. The acid or other leaching agent is regenerated and reused, with any excess or bleed stream being treated prior to discharge.

Leaching or smelting of ores or concentrates produces solid wastes containing residual minerals or inorganic metal compounds that cannot be economically recovered. Waste must be managed to minimize the potential for such compounds to be dissolved and for dissolved metals or other contaminants to migrate from the impoundment area.

Metals are among the most highly recycled materials in North America. Recyclable materials, including manufacturing scrap from a variety of industries and post-consumer waste, are processed by primary and secondary copper, lead and zinc smelters and refineries and manufacturers of stainless steel and other nickel-based alloys. Metal-containing recyclable materials are important feedstocks for North American metal producers and recyclers, but are tracked as wastes in some jurisdictions to ensure environmentally sound management.

7.5 Legislative and Regulatory Framework for the Primary Metals Industry

7.5.1 Overview of Canadian Legislation and Regulations

General Framework

Under the Canadian environmental protection regime, toxic substances management is generally regulated at the federal level, while ambient and point source air standards, water standards and waste management practices are regulated at the provincial level. Few regulations are aimed exclusively at the steel sector. Rather, the industry's releases are regulated or managed substance by substance.

The federal Canadian Environmental Protection Act (CEPA) is the main enabling legislation for toxic substances management. Under CEPA, substances are evaluated to determine whether they should be designated as "CEPA-toxic," thus requiring special attention to control and reduce their release. Once deemed CEPA-toxic, these substances usually proceed through a Strategic Options Process, to determine the most effective means of control.

The federal Toxic Substances Management Policy (TSMP) provides the broad policy framework for addressing CEPA-toxic substances. Under TSMP, substances that are toxic, persistent, and bioaccumulative are to be virtually eliminated ("Track 1"). Other substances that do not meet these criteria are designated for special lifecycle management to prevent or minimize their release ("Track 2"). The TSMP list includes 16 substances that are relevant to the primary metals industry: PCBs and dioxins and furans are Track 1 substances. Track 2 substances include benzo[a]pyrene, anthracene, other polycyclic aromatic hydrocarbons, arsenic, cadmium, chromium, lead, mercury, nickel, fluorides, dichloromethane, tetrachloroethylene, trichloroethane, and trichloroethylene. None of the Track 1 substances are reportable to NPRI, but all of the Track 2 ones are, with the exception of benzo[a]pyrene and other polycyclic aromatic hydrocarbons.

With regard to waste management, federal legislation deals primarily with the transportation of hazardous waste, under the Transport of Dangerous Goods Act and Regulations, which outline the conditions under which certain types of hazardous waste can be transported, both domestically and internationally. Regulations related to the registration of waste carriers and the licensing of waste sites are covered at the provincial level.

In terms of water discharges, smelters are subject to the federal Fisheries Act, which prohibits the release of effluent that is acutely lethal to fish. At the provincial level, regulatory mechanisms and requirements differ from facility to facility and from province to province. Many controls are stipulated through site-specific requirements, such as site permits, certificates of approval, or licenses. Standards also exist for allowable pH levels and metal concentrations.

All provinces have regulatory requirements to control air emissions. Regulations usually cover common air pollutants and metals, and are often in the form of ambient air quality standards and/or limits on concentrations of emissions at source. Site-specific requirements in permits also include air emission limits, as well as monitoring and reporting requirements.

The 1994 Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA) is also relevant to the primary metals industry, particularly the steel sector. COA is an agreement between the federal government and the Province of Ontario to help meet Canada's obligations under the Canada-US Great Lakes Water Quality Agreement (1978, amended 1987). The COA calls for restoration of degraded areas through the development and implementation of remedial action plans in 17 areas of concern. Steel mills discharge into two such areas, Hamilton Harbour and the St. Marys River. Remedial action plans are in place for both areas. The COA also calls for the prevention and control of pollution with specific targets and schedules for persistent, bioaccumulative, and toxic substances. The COA "Tier 1" substances, which are to be "virtually eliminated" (reduced by 90 percent between 1988 and 2000), include PCBs, dioxins and furans, benzo[a]pyrene and mercury. "Tier 2" substances, to be reduced by over 50 percent between 1988–2000, include anthracene and 17 other polycyclic aromatic hydrocarbons, and cadmium. Mercury, anthracene and cadmium are reportable to NPRI.

Similarly, the St. Lawrence Vision 2000 is a cooperative action plan between the Government of Canada and the Government of Quebec to adopt a joint ecosystem-based approach to protecting the St. Lawrence River. The original agreement calls for a 90-percent reduction of toxic discharges by 50 industrial facilities along the St. Lawrence and Saguenay rivers. Another 56 facilities have been added, and the aim is for the virtual elimination of 11 persistent and bioaccumulative toxic substances.

Sector-specific Regulations and Standards

There is little in the way of sector-specific regulation at the federal level. No federal regulations exist for the steel sector. The only federal regulations specific to a nonferrous metal smelting subsector are the Secondary Lead Smelter Release Regulations, which limit the release of CEPA substances at source. The regulations, under CEPA, establish concentration standards for air emissions of lead in particulate matter and stipulate procedures for sampling, analysis and reporting. The Metal Mining Liquid Effluent Regulations and Guidelines may also be applied to some primary base metal smelters or refineries, under the federal Fisheries Act, if their discharge is combined with the effluent from an active mine.

In the last few years, Environment Canada has launched comprehensive reviews of both the steel sector and the base metal (copper, lead, nickel and zinc) smelting sector. Under the CEPA Strategic Options Process, these multi-stakeholder reviews have assessed management options for toxic substances released by facilities in these sectors.

The Steel Strategic Options Process (SSOP), undertaken in 1996, reviewed the management of benzene, polycyclic aromatic hydrocarbons, arsenic, cadmium, chromium, nickel, lead, mercury, dioxins and furans, and PCBs. It concluded that most substances released by the steel sector were adequately managed through existing programs. However, it was recognized that special action was required to further reduce benzene and polycyclic aromatic hydrocarbon emissions. Through the SSOP, specific objectives were formulated for quantifying and setting reduction targets for these kinds of emissions. It was agreed that these objectives would form the basis of a voluntary Code of Practice for Steelmaking (see Voluntary Measures, below).

The Base Metal Smelting SOP, undertaken in 1997, investigated the management of arsenic, cadmium, nickel, lead, mercury, dioxins and furans. Smelting companies and other stakeholders agreed to voluntary measures to achieve reduction targets for these substances. It was also concluded that ambient air and water quality guidelines for substances released by the base metals smelting facilities would be developed. Progress toward these commitments will be reviewed in the spring of 2001.

The most comprehensive provincial sector-specific regulation for wastewater discharges is found in Ontario. The Ontario Municipal Industrial Strategy for Abatement (MISA) regulations address levels of persistent toxic substances in industrial direct discharges entering Ontario's waterways from nine industrial sectors, including the iron and steel sector. The iron and steel regulation provides standards for total chromium, total lead and total nickel. It covers all four integrated mills in Ontario, as well as three non-integrated mills. It is based on source performance limits derived from analyses of Best Available Technology Economically Achievable (BATEA) and production levels. The regulation took effect in April 1998.

Another sector-specific provincial regulation is Manitoba's Inco Ltd. and Hudson Bay Mining and Smelting Co. Ltd., Smelting Complex Regulation. Introduced in 1988, the regulation requires emission controls at the two facilities for sulfur dioxide and particulate emissions and outlines monitoring requirements related to an acid rain control program.

Voluntary Measures

In recent years, the federal government has placed great emphasis on negotiating voluntary industrial agreements. Environment Canada opted for voluntary action under both the 1996 Steel Strategic Options Process and the Base Metals Smelting Process (see the above section). As agreed under the SSOP, a voluntary Environmental Code of Practice for Steelmaking is being developed, which will include a pledge to reduce CEPA-toxic metals in air emissions and in water effluent and with specific reduction targets for emissions of benzene and polycyclic aromatic hydrocarbons.

The Canadian Steel Producers' Association released its Statement of Commitment and Action in June 1998. In it, the steel industry committed itself to reduce benzene emissions 57 percent per ton of coke produced by 2000, 83 percent by 2005, and 89 percent by 2015. Similarly, the steel industry has committed itself to reduce polycyclic aromatic hydrocarbon emissions 20 percent per ton of coke produced by 2000, 40 percent by 2005, and 50 percent by 2015. Reduction targets are based on 1993 levels and are subject to revision, based on additional information in the future. The Statement of Commitment and Action also outlines sector goals for reductions in other air emissions, reduced energy consumption, and improved water quality and waste management.

To help steel companies meet these reduction targets, the Canadian Steel Producers' Association has developed two environmental Best Practice Manuals on operating methods to reduce polycyclic aromatic hydrocarbon emissions from coke ovens and to reduce benzene emissions from byproduct operations. The draft manuals have been used by companies for a trial period and are expected to be issued in final form by the end of 1999. The Canadian Steel Producers' Association has also committed itself to reviewing and publicly reporting on progress toward the above commitments. Its first Environmental Progress report was released in November 1999.

Another voluntary initiative that has been integrated into the Code of Practice is the Accelerated Reduction/Elimination of Toxics program (ARET). ARET is a national voluntary reporting and reduction program, which calls for the measurement and reduction of 117 substances released to air, to water and as waste (of which 48 are reportable to NPRI). The goal of ARET is to reduce persistent bioaccumulative toxic substances by 90 percent and the other listed substances by 50 percent between 1988 to 2000.

While the program is not specific to the steel sector, 80 percent of Canadian steel manufacturing capacity is covered by the ARET program. Thirteen steel companies have submitted action plans toward meeting the ARET targets. Targeted substances related to the iron and steel sector include most of the 16 CEPA-toxic substances, with the exception of nickel and trichloroethylene. The Aluminum Industry Association and 80 percent of its members also support and participate in ARET. Of ARET substances reported by the aluminum sector, polycyclic aromatic hydrocarbons accounted for 99 percent of emissions (with the exception of anthracene, polycyclic aromatic hydrocarbons are not reportable to NPRI).

The Base Metals Smelting SOP (see Sector-specific Regulations and Standards, above) resulted in a voluntary commitment on the part of the sector to reduce CEPA-toxic metals by 80 percent by 2008 and by 90 percent beyond 2008 (from 1988 levels). Facilities also agreed to develop site-specific environmental management plans, including specific management options for dioxins and furans emissions. Pollution prevention options will also be explored.

7.5.2 Overview of US Legislation and Regulations

General Framework

Legislative authority to regulate releases from the iron and steel sector comes under three federal statutes, the Clean Air Act and its 1990 amendments (CAAA), the Federal Water Pollution Control Act (referred to as the Clean Water Act—CWA—after its 1977 amendments) and the Resource Conservation and Recovery Act (RCRA).

Several general provisions in the CAAA relate to the primary metals industry. Title I of the Clean Air Act addresses requirements to meet the National Ambient Air Quality Standards (NAAQS). Standards for the "criteria pollutants" carbon monoxide, nitrogen dioxide, ozone, lead, sulfur dioxide, and particulate matter most directly affect primary metals producers. Of these, lead and ozone are reportable to TRI. The CAAA's New Source Review (NSR) requirements apply to new facilities, expansions or process modifications. New sources of the "criteria" pollutants regulated under NAAQS, in excess of levels defined by EPA as "major," are subject to the NSR requirements. These can include requirements for Best Available Control Technology (BACT) and continuous on-site monitoring or, in the worst cases, can include Lowest Achievable Emission Rate Standards (LAER) that may be achieved through emissions trading in specified areas.

The CAAA also requires EPA to regulate emissions of 188 hazardous air pollutants from large industrial facilities. Of the 188 substances, all but eight are reportable to TRI. EPA has National Emission Standards for Hazardous Air Pollutants (NESHAPs) as well as a program to issue Maximum Achievable Control Technology (MACT) regulations for new and existing "major sources." "Major sources" are those that emit 10 tons (9 tonnes) per year or more of a listed pollutant or 25 tons (23 tonnes) per year or more of a combination of pollutants.

The Clean Water Act regulates indirect and direct wastewater/effluent discharges. Industry-specific, technology-based standards have been developed that limit the amount of industrial wastewater pollutants being discharged into waterways, either directly to surface water or indirectly to public sewage treatment plants (see below). Surface water discharges are also covered by the Storm Water Rule, which requires the capture and treatment of storm water at primary metals industry facilities.

The Resource Conservation and Recovery Act (RCRA) classifies hazardous wastes and stipulates management and control requirements. These regulations establish a "cradle-to-grave" system governing hazardous waste from the point of generation to disposal. Facilities that generate hazardous waste are subject to waste accumulation, manifesting and record-keeping standards. Facilities that dispose of the waste must obtain a permit from the US EPA or authorized state agency. Most RCRA regulations are not industry specific but apply to any company that transports, treats, stores, or disposes of hazardous wastes. In addition to standards for record keeping and emergency planning, land disposal restrictions apply that prohibit the disposal of hazardous wastes on land without prior treatment (in the case of metals this includes recovery processes, use in glass ceramics, as an ingredient in cement or stabilization).

RCRA-listed wastes can be produced during coke-, iron- and steel-making, forming, and cleaning/descaling operations. Emission control dust and sludge from the smelting and refining processes typically contain zinc, lead, cadmium, nickel and chromium. Spent pickle liquor from finishing may contain iron, chromium and nickel. Wastes containing these metals must be managed in accordance with RCRA regulations.

Sector-specific Regulations and Standards

Under the CAAA and NESHAPs, there are four national emission standards that pertain to the iron and steel industry. Specific standards are set for coke ovens, benzene emissions from coke byproduct recovery plants, halogenated solvent cleaning, and chromium from industrial process cooling towers. In a negotiated rule for coke ovens, the industry agreed to conduct daily monitoring, install flare systems to control upset events, and develop work practice plans to minimize emissions, in return for greater flexibility in meeting the standards.

Under the CAAA's New Source Review requirements, EPA minimum standards for LAER and BACT in iron and steel mills are set out in four new standards of performance: one for electric arc furnaces plus one for electric arc furnaces that are equipped with argon-oxygen decarburization vessels, as well as one each for primary and secondary emissions from basic oxygen furnaces. New performance standards for nonferrous metal smelters include those for primary aluminum, copper and zinc smelters and for secondary lead smelters. These generally address controls on particulates, gases (fluorides or sulfur dioxide), and emissions opacity. All of these standards require specific monitoring and testing procedures.

In addition to national standards for general processes and equipment there are national emission standards under NESHAPs for primary lead smelting that limit emissions of lead, and for secondary lead smelting that limit emissions of lead and total hydrocarbons. Total fluorides and polycyclic organic matter are limited for primary aluminum production facilities under NESHAPs and hydrochloric acid is limited for steel pickling facilities.

The MACT regulations require the application of air pollution reduction measures at all facilities covered by the regulations. Among the primary metals industries, such regulations have been issued for primary and secondary lead smelters, for primary and secondary aluminum smelters and for the steel pickling–hydrochloric acid process. Regulations have been proposed for primary copper smelters and are being developed for integrated iron and steel manufacturers, as well as for iron and steel foundries.

The MACT regulations for the secondary aluminum smelters, for example, establish emission standards for particulate matter (as a surrogate for metals), total hydrocarbons (as a surrogate for organics) and hydrogen chloride (as a surrogate for hydrogen chloride and chlorine). The required emissions reductions can be achieved with pollution controls such as fabric filters or afterburners or through pollution prevention activities. The regulation also allows for "emissions averaging" among various emission sources at a facility in certain situations, to achieve the required emissions reductions in a cost-effective manner. In this way, some emission sources may be reduced further than required while others may be less controlled, as long as all sources at a facility, taken together, achieve the required reduction.

Steel mills' surface water discharges are subject to Effluent Limitations Guidelines and Standards for the Iron and Steel Manufacturing Point Source Category. The standards stipulate limits for total suspended solids, oil and grease, pH, ammonia-N, phenols, total cyanide, total chromium, hexavalent chromium, total lead, total nickel, total zinc, benzene, benzo[a]pyrene, naphthalene, tetrachloroethylene. All of these, except for total suspended solids and oil and grease, are reportable to TRI. EPA completed a preliminary review of the Iron and Steel Manufacturing Point Source Category in 1995 and is currently reviewing the guidelines and standards to determine whether changes should be made in light of advances in manufacturing technologies. Revisions are expected by 2000.

Specific requirements under the CWA for the nonferrous industries include rules for the following Point Source Categories:

- metal molding and casting (40 CFR Part 464), applicable to aluminum, copper, and zinc casting;
- aluminum forming (40 CFR part 467);
- copper forming (40 CFR Part 468); and
- nonferrous metals forming and metal powders (40 CFR part 471). The nonferrous metals specified are lead-tin-bismuth, magnesium, nickel-cobalt, precious metals, refractory metals, titanium, uranium, zinc, and zirconium-hafnium.

Under RCRA, emission control dust and sludge from electric arc furnaces are a listed hazardous waste and are subject to land disposal restrictions. Slag, resulting from the treatment of pollution control dusts produced in scrap metal recycling (electric arc furnace dust), is not classified as hazardous if the toxic metals in the wastes have been reduced to safe levels.

Voluntary Measures

EPA's 33/50 Program, which concluded in 1995, was designed to encourage voluntary commitments from TRI facilities for reductions of 17 targeted chemicals, including cadmium, chromium, lead, mercury and nickel. The program sought a reduction in total releases and transfers of 33 percent from 1988 to 1992 and 50 percent by 1995. More than 1,290 companies pledged reduction goals, including 174 that owned primary metals facilities. Of those, 58 companies owned iron and steel foundries, including all of the major companies mentioned above (in **Section 7.3.2**). TRI primary metals facilities, whose companies made a commitment to the program, achieved a 59-percent reduction in total releases and transfers of the 33/50 Program chemicals from 1988 through 1995. The population of TRI primary metals facilities, as a whole, achieved a reduction of 45 percent, and all TRI facilities together achieved a reduction of 55 percent. In the baseline year (1988), the primary metals industry accounted for 10 percent of all releases and transfers of 33/50 Program chemicals; by 1996, this had increased to nearly 13 percent. While the national program ended with its 1995 goal, similar state and regional programs based on the 33/50 program are ongoing.

In 1995, the EPA and the US aluminum sector entered into a voluntary agreement to reduce perfluorocarbon (PFC) emissions. Under the voluntary Aluminum Industrial Partnership, the industry committed to reducing PFC emissions by 30–60 percent by 2000 from 1990 levels.

Table 7-3

M 1997

Releases and Transfers for the Primary Metals Industry (US SIC Code 33), 1997

	NPRI				TRI			
	Number		Average Forms per Facility		Number		Average Forms per Facility	
Total Facilities	169				1,838			
Total Forms	637		3.8		6,086		3.3	
On-site Releases	**kg**	**%**	**kg/Facility**	**kg/Form**	**kg**	**%**	**kg/Facility**	**kg/Form**
Total Air Emissions	9,744,792	20.8	57,661	15,298	48,370,696	15.2	26,317	7,948
Surface Water Discharges	671,989	1.4	3,976	1,055	21,324,497	6.7	11,602	3,504
Underground Injection	0	0.0	0	0	170,771	0.1	93	28
On-site Land Releases	8,593,216	18.3	50,847	13,490	101,141,817	31.7	55,028	16,619
Matched On-site Releases	**19,025,036**	**40.5**	**112,574**	**29,867**	**171,007,781**	**53.7**	**93,040**	**28,099**
Off-site Transfers								
Treatment (except metals)	55,311	0.1	327	87	13,359,659	4.2	7,269	2,195
Sewage/POTWs (except metals)	106,091	0.2	628	167	4,254,799	1.3	2,315	699
Disposal (except metals)	274,780	0.6	1,626	431	1,361,361	0.4	741	224
Treatment/Sewage/Disposal of Metals	27,483,585	58.5	162,625	43,145	128,742,848	40.4	70,045	21,154
Matched Off-site Transfers	**27,919,767**	**59.5**	**165,206**	**43,830**	**147,718,667**	**46.3**	**80,369**	**24,272**
Total Releases and Transfers	**46,944,803**	**100.0**	**277,780**	**73,697**	**318,726,448**	**100.0**	**173,409**	**52,370**

7.6 Overview of Primary Metals Industry PRTR Reporting

In 1997, primary metals industry facilities reporting to NPRI showed significant differences from those reporting to TRI. Total releases and transfers were significantly higher in TRI, as there are more than 10 times as many primary metals facilities in TRI as in NPRI. Facilities in this industry reported total releases and transfers of 46.9 million kg to NPRI and 318.7 million kg to TRI (**Table 7–3**).

- Metals in on-site releases to land and in off-site transfers are most often disposed of in landfills. Together, on-site land releases of metals and transfers of metals off-site constituted 72 percent of the TRI total releases and transfers from primary metals facilities. Likewise, NPRI primary metals facilities' combined on-site land releases and off-site transfers of metals equaled 77 percent of total releases and transfers. As noted in **Section 7.1.1**, on-site releases to land and off-site transfers of metals generally result in land disposal because metals in wastes cannot be destroyed by treatment. The alternative to disposal is to recover the metals for recycling.
- Air emissions also figured prominently, accounting for 21 percent of NPRI releases and transfers and 15 percent in TRI. Air emissions from NPRI primary metals facilities averaged almost twice those from TRI primary metals facilities (15,298 kg/form for NPRI and 7,948 kg/form for TRI).

NPRI primary metals facilities also reported higher average releases and transfers per form than did TRI primary metals facilities (73,697 kg/form for NPRI and 52,370 kg/form for TRI). The major difference was, again, in transfers of metals off-site, where NPRI primary metals facilities averaged almost twice as much as TRI primary metals facilities (43,145 kg/form for NPRI and 21,154 kg/form for TRI). TRI facilities reported higher average on-site land releases per form (13,490 kg/form for NPRI and 16,619 kg/form for TRI).

A recent CEC study investigated differences in NPRI and TRI average releases and transfers per form. The study, cited and discussed at the end of **Section 5.2.2** above, examined methanol and methyl ethyl ketone and also looked at kraft paper mill reporting. The study found that differences in

Table 7-4

M 1997

NPRI and TRI Releases and Transfers for the Primary Metals Industry (US SIC Code 33), 1995–1997

	NPRI					TRI				
	1995	1996	1997	Change 1995–1997		1995	1996	1997	Change 1995–1997	
	Number	Number	Number	Number	%	Number	Number	Number	Number	%
Total Facilities	166	166	169	3	1.8	1,852	1,855	1,838	-14	-0.8
Total Forms	602	590	637	35	5.8	6,030	6,034	6,086	56	0.9
On-site Releases	**kg**	**kg**	**kg**	**kg**	**%**	**kg**	**kg**	**kg**	**kg**	**%**
Total Air Emissions	8,992,889	10,317,729	9,744,792	751,903	8.4	50,296,816	52,219,043	48,370,696	-1,926,120	-3.8
Surface Water Discharges	1,006,268	790,847	671,989	-334,279	-33.2	12,676,668	13,554,209	21,324,497	8,647,829	68.2
Underground Injection	0	0	0	0	—	159,917	207,073	170,771	10,854	—
On-site Land Releases	8,555,020	8,112,326	8,593,216	38,196	0.4	96,278,156	104,209,269	101,141,817	4,863,661	5.1
Matched On-site Releases	**18,575,952**	**19,240,477**	**19,025,036**	**449,084**	**2.4**	**159,411,557**	**170,189,594**	**171,007,781**	**11,596,224**	**7.3**
Off-site Transfers										
Treatment (except metals)	167,176	112,679	55,311	-111,865	-66.9	4,870,995	4,674,076	13,359,659	8,488,664	174.3
Sewage/POTWs (except metals)	91,586	206,648	106,091	14,505	15.8	3,013,388	3,158,929	4,254,799	1,241,411	41.2
Disposal (except metals)	189,691	268,517	274,780	85,089	44.9	3,233,140	1,294,071	1,361,361	-1,871,779	-57.9
Treatment/Sewage/Disposal of Metals	18,313,300	21,101,808	27,483,585	9,170,285	50.1	81,066,969	97,445,849	128,742,848	47,675,879	58.8
Matched Off-site Transfers	**18,761,753**	**21,689,652**	**27,919,767**	**9,158,014**	**48.8**	**92,184,492**	**106,572,925**	**147,718,667**	**55,534,175**	**60.2**
Total Releases and Transfers	**37,337,705**	**40,930,129**	**46,944,803**	**9,607,098**	**25.7**	**251,596,049**	**276,762,519**	**318,726,448**	**67,130,399**	**26.7**

industry structure, particularly facility production capacity, and differences in pollution prevention and control practices between the two countries contributed to differences in the averages. Factors similar to those noted in the study may account for some of the differences between Canadian and US primary metals reporting.

7.7 Change in Total Releases and Transfers, 1995–1997

Between 1995 and 1997, total releases and transfers from primary metals facilities in both countries increased, by 26 percent for NPRI and 27 percent for TRI, while the number of facilities reporting stayed relatively constant. Both NPRI and TRI primary metals facilities reported significant increases in off-site transfers of metals. NPRI on-site releases from primary metals facilities increased by two percent, despite a 33-percent drop in surface water discharges. NPRI air emissions increased eight percent. TRI on-site releases, meanwhile, increased by seven percent, primarily in surface water discharges and on-site land releases. TRI primary metals facilities reported a decrease in air emissions (by four percent—see **Table 7–4**).

Facilities with substantial changes from 1995 to 1997 were contacted and asked to explain the differences, identifying factors that influenced their increases or decreases over this period. (Contact information for facility representatives who supplied explanations is available upon request.)

7.7.1 NPRI Facilities with Significant Changes, 1995–1997

This section describes NPRI primary metals facilities that reported the largest decreases and the largest increases in total releases and transfers from 1995 to 1997. The descriptions of the reasons for the changes were provided by the facilities, either on their NPRI form or in interviews.

As in shown in **Table 5–39**, nine of the 50 NPRI facilities with the largest decreases in total releases and transfers from 1995 to 1997 were primary metals facilities. These nine facilities reported decreases of five million kg. Six of the nine reported the majority of their decreases in off-site transfers or on-site releases to land of metals. Four of the nine facilities reported in the blast furnace and basic steel products industry (US SIC code 331) and two each reported as iron and steel foundries (US SIC code 332) and in the primary nonferrous metal industry (US SIC code 333).

Several facilities with large decreases reported that their efforts were made to meet commitments under various reduction programs, such as the federal Strategic Options Process and associated commitments of the Canadian Steel Producers Association, federal and provincial acid rain reduction programs and the federal ARET program, described earlier in this chapter.

Sixteen of the 50 NPRI facilities with the largest increases in total releases and transfers from 1995 to 1997 were primary metals facilities (see **Table 5–40**). Together these 16 facilities reported increases of 15 million kg. For eight of the 16 facilities, the majority of the increases were on-site releases to land or off-site transfers of zinc and its compounds. Nine of the 16 facilities reported in the blast furnace and basic steel products sector (US SIC code 331).

NPRI Facilities with Large Decreases

Nine primary metals facilities were among the 50 NPRI facilities with the largest decreases in total releases and transfers from 1995 to 1997 (see **Table 5–39**). The reasons cited for the decreases varied. Three facilities reported changes in measurement methods rather than changes in actual amounts released. Two facilities indicated higher than usual transfers of waste in 1995, with levels returning to normal by 1997. Two facilities reported decreased production levels, and two identified increased efforts at recycling and reclamation. One facility reported improvements in process efficiency as well as variable amounts of contaminants in inputs from year to year. Another facility installed pollution control equipment.

The NPRI primary metals facility with the largest reported decrease from 1995 to 1997—and eighth among all NPRI facilities in the matched data set—was Algoma Steel Inc. (US SIC code 331), located in Sault Ste. Marie, Ontario. Algoma reported significant on-site land releases in 1995, an increase in air emissions in 1996, and a reduction in both in 1997. Algoma Steel reported that it has no transfers because it either stores or disposes of materials at its on-site permitted landfill. The reported increase in air emissions for 1996 was due to a misinterpretation of the fate of phosphoric acid in a process, where the acid is consumed rather than released to air. The 1997 NPRI data reflect this correction.

Algoma has introduced measures to reduce its benzene emissions, in response to the ARET challenge and the Canadian Steel Producers Association's commitments. Most reductions to date have been achieved by Algoma through improved maintenance and process controls. Benzene emission controls are being phased in, beginning with the year 2000.

In 1996, Algoma reported increased releases of cyanides and phenols, byproducts of the cokemaking process. Discharges of cyanides to surface waters were attributed to process control equipment upsets. The change in phenols was due to changes in analytical reporting methods. The 1997 report indicates a reduction in both of these releases. Future releases of these substances will be below the NPRI reporting threshold levels, due to the installation of engineering controls and a biological treatment plant, ammonia still upgrades and a fixed ammonia step in the byproducts operations.

Co-Steel Lasco (US SIC code 331) in Whitby, Ontario, ranked ninth among NPRI facilities for decreases in releases and transfers from 1995 to 1997. This mini-mill, built in 1964, produces steel rods and beams used in construction. Co-Steel Lasco recycles half a million cars per year along with other steel scrap. It recovers 99.8 percent of the steel from the cars and other scrap metal. Co-Steel sells aluminum and copper that it recovers from the shredding operation, but its primary product is steel.

The metal is shredded and then melted in an electric arc furnace. Much of the facility's releases come from tiny pieces of wire and other materials which remain after the shredder operation. These materials are disposed of on-site in a permitted landfill. Furnace dust is sent off-site for disposal to a hazardous waste landfill near Sarnia, Ontario. Releases and transfers vary from year to year, due to growth in the business, improved efficiency, and the make-up of the feedstock. Starting in 1999, the mill will be expanded and the company will be sending its furnace dust to a recycling facility in Pennsylvania instead of the landfill site in Ontario. The facility expects to eliminate off-site transfers to disposal.

Dominion Castings Ltd., owned by NACO Inc. (US SIC code 332) and located in Hamilton, Ontario, ranked 10th among NPRI facilities for decreases. The company manufactures steel castings, largely for trains, including diesel locomotive frames and suspension units. In 1996, Dominion began to divert much of its waste away from landfill disposal to recycling in an ongoing effort to reduce and reuse materials as much as possible. Reported decreases also reflected, in part, an overestimation of releases and transfers in 1995.

Titan Steel and Wire (US SIC code 331) is owned by Mitsui and Co., Ltd. and located in Surrey, British Columbia. It reported the 16th-largest reduction in total releases and transfers from 1995 to 1997 among all primary metals facilities. In the mid-1990s, Titan's total transfers and its transfers of zinc and lead increased, and then decreased considerably in 1996 and 1997. Titan explained that this was due to the removal of sludge from its sludge lagoons, which were at capacity. Regular levels of transfers have now resumed.

Titan's levels of phosphoric and nitric acid transfers increased in 1996. This was due to the timing of shipping dates. For example, nitric acid increased considerably because it had been accumulating in waste barrels and was shipped off in a large load in 1996.

QIT-Fer et Titane Inc. (US SIC code 339), the NPRI facility with the 18th-largest decrease from 1995 to 1997, is located in Tracy, Quebec. In 1996, it reduced its total transfers, as well as releases and transfers of zinc, lead, chromium and copper as oxides. However, a significant increase in manganese, again in oxide form, was recorded because of a one-time transfer of accumulated material on site. In 1995, a one-time transfer to disposal of red dust containing zinc had increased zinc transfers for that one year. This transfer was undertaken to create on-site space for a new plant that will upgrade its titanium oxide product for more specialized markets.

To honor commitments under St. Lawrence Vision 2000, QIT-Fer et Titane installed a water treatment plant (for solid fines filtration) on-site, which became operational in 1994. While QIT-Fer et Titane once released significant volumes of mainly solid ore fines (finely crushed or powdered ores) into the river, its reported discharge is now less than 1,500 kg of chromium compounds and about 6,100 kg of zinc compounds. Most notably, water-insoluble mercuric compounds contained in ore fines (no elemental mercury is present in the ore) have been virtually eliminated. Also, acid is regenerated at the new plant for reuse. The new plant is fueled by carbon monoxide, which is recovered and scrubbed from the main plant on-site.

Sydney Steel Corporation (US SIC code 332), located in Sydney, Nova Scotia, ranked 25th in NPRI for decreases in releases and transfers. It is a mini-mill, which refines scrap metal in electric arc furnaces. The facility attributed its reduction in air emissions in the 1995–1997 period to declining levels of production. Sydney Steel reached maximum production levels in 1995 with 340,000 liquid tonnes of steel. Production declined in 1996 to 160,000 liquid tonnes and was further reduced in 1997 to 140,000 liquid tonnes. The facility estimates that for every tonne of production, 16 kg of emissions are produced. This dust is collected in a positive pressure baghouse and is disposed of on-site in a lined landfill. It is not transported off-site, as there are no disposal sites close to Sydney Steel.

In 1994–1995, the company installed clarifiers at effluent discharge points and enhanced its effluent treatment system. It has also replaced ethylene glycol-based hydraulic fluids, which were found to be toxic to fish before biodegrading in surface waters.

The company has responded to a combination of pressures, including regulatory requirements, voluntary commitments, and local community concerns. Sydney Steel has the Canadian Steel Producers Association's commitments made through the federal Strategic Options Process, as well as commitments made under ARET, the Voluntary Climate Change registry, and with the local joint action group on Monk Creek (tar ponds).

The Copper Cliff Nickel Refinery of the Ontario Division of Inco Ltd., located in Copper Cliff, Ontario, recorded an apparent decrease (ranking 39th) in the matched data set. It changed the SIC code it reported under from US SIC code 3339 (Canadian SIC code 2959, Other Nonferrous Smelting and Refining) to US SIC code 1061 (Canadian SIC code 0613, Nickel-Copper Mines). Since it reported as a primary metals facility in 1995, the amounts reported are included in this analysis. However, it reported as a mining facility for 1996 and 1997. Amounts for those years were excluded from the matched data set because the US mining industry was not required to report to TRI in 1997.

The Copper Cliff Nickel Refinery indicated that there have been no substantial reductions in emissions for the 1995 to 1997 period. In 1997, the facility reported an increase in its transfers of chromium. This was reportedly due to a change in NPRI reporting rules that was designed for Ontario Hydro to account for production "vessels" that are consumed during production. In the case of Inco Ltd., this captured the waste from the demolition of its brick furnaces. This waste brick, which contains chromium, is transferred to a permitted landfill. Also, in 1997, Inco introduced a program to reroute effluent that had previously been directly discharged into surface waters to a wastewater treatment system on its smelter complex site.

The Ontario Division of Inco Ltd. has already met its commitments under ARET to reduce metals emissions by 50 percent (from 1988 levels). It is also working toward meeting the industry-wide commitments to reduce by 70 percent (from 1988 levels) releases of lead, arsenic, and nickel as part of an industry-wide commitment agreed to through the federal Strategic Options Process.

The Horne copper smelter of Métallurgie Noranda (US SIC code 333) in Rouyn-Noranda, Quebec, had the 41st-largest decrease in total releases and transfers. It is a custom smelter that processes concentrates and a wide variety of recyclable materials. It has also produced and marketed sulfuric acid since 1990. The facility produces approximately 200,000 tonnes of copper per year and about 400,000 to 500,000 tonnes of sulfuric acid. The resulting copper anodes are refined at another Noranda facility that removes impurities, which include silver, gold and platinum group metals.

From 1995 to 1996, releases from the Horne smelter remained relatively constant. Air emissions of specific metals varied somewhat with changing inputs in concentrates. In 1997, the smelter began to significantly reduce emissions of lead, copper and zinc, which account for 90 percent of the facility's metal emissions. Reductions resulted from the introduction of a new process vessel, the Noranda continuous copper converter, and the installation of a new baghouse to capture secondary ventilation gases from the taphole of the Noranda reactor and for particulate removal from the Noranda continuous copper converter. The facility has little or no transfers from year to year, but is an important destination for transfers of recyclable materials from other sites for the recovery of copper and other metals.

Noranda's corporate policies drive environmental improvements. Sulfur fixation now exceeds 70 percent and a level of 90 percent is targeted. Noranda participates in the ARET program and achieved reductions of over 50 percent in emissions of several metals from 1988 levels in advance of the year 2000. Further emission reductions are anticipated as the Noranda continuous copper converter is progressively commissioned and the remaining batch converters are shut down.

The Ford Motor Company, Essex Aluminum Plant (US SIC code 335) is located in Windsor, Ontario. It manufactures and recycles aluminum and reported the 43rd-largest decrease in releases and transfers among NPRI facilities. Reductions from 1995 to 1997 in total transfers and releases were due both to fluctuations in production levels and also to facility initiatives to increase recycling and internal reclamation. Changes to the process and in the composition of raw materials have been implemented.

Facility improvements are a result of voluntary measures. Ford participates in the Canadian Automotive Manufacturing Pollution Prevention Project. This is a Memorandum of Understanding, signed in 1992 between Environment Canada, the Ontario Ministry of Environment, Chrysler Canada Ltd., Ford Motor Company of Canada Ltd., General Motors of Canada Ltd., and the Canadian Vehicle Manufacturers' Association (CVMA). It focuses on reducing/eliminating releases through pollution prevention measures of Tier 1 and 2 substances under the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (July 1994).

Another important influence since 1997 has been the development of the company's environmental management system. Ford Canada's operations are fully certified under ISO 14000, which strives for continuous improvement, beyond mere compliance. Ford is increasingly adopting a risk management approach to environmental management, such as its initiative to take out its underground storage tanks, to reduce the risk of leaks in the future.

NPRI Facilities with Large Increases

Sixteen of the 50 NPRI facilities with the largest increases in total releases and transfers for the matched substances were primary metals industry facilities (see **Table 5–40**). Of these, eight facilities reported that favorable waste disposal costs prompted them to increase off-site transfers, especially those with limited on-site storage capacity. Six facilities indicated that increases were associated with increased production levels. Three facilities changed their method of measuring or calculating their releases and transfers, which led to apparent increases. Two facilities reported increases due to new equipment start-up that should not occur in future years. (Some stated more than one reason.)

Dofasco Inc. (US SIC code 331) is located in Hamilton, Ontario. It is ranked number one for releases and transfers among NPRI facilities in the matched data set and for increases from 1995 to 1997. It is a combined integrated and mini-mill steel facility and operates Canada's only tinplating operation. From 1996 to 1997, Dofasco's off-site transfers increased due to two changes. First, an arrangement to send basic oxygen furnace sludge for use in a mine reclamation project was discontinued. As a result, the sludge was sent off-site for disposal. Second, Dofasco's new electric arc furnace came on-line, generating dust containing zinc, manganese and lead. This dust was also transferred off-site for disposal in a permitted landfill. The electric arc furnace, which uses 1.2 million tonnes of scrap, has allowed Dofasco to increase production with significantly lower environmental impacts, as compared to integrated operations. The process has also reduced energy consumption by two-thirds.

While Dofasco reported increases in total releases and transfers, it reduced its releases from 1996 to 1997, primarily with the installation of a benzene emission control system for its coke plant byproduct operations. Dofasco pledged to reduce benzene emissions 80 percent by 2000. The commitment formed part of Dofasco's voluntary Environmental Management Agreement, signed with Environment Canada and the Ontario Ministry of Environment and Energy. The Agreement sets targets for key parameters of air quality, waste management, community activities, energy usage and PCB waste destruction. Reduction targets that go beyond compliance are set for polycyclic aromatic hydrocarbons, benzene, and ARET substances.

Dofasco has also reduced its releases to surface waters from 126 tonnes, to 16 tonnes in 1995. This puts it well within water effluent limits set by Ontario's Municipal Industrial Strategy for Abatement (MISA). Following on-site primary and biological treatment of its coke-making effluent, Dofasco sends this effluent to the City of Hamilton sewage treatment plant for tertiary treatment.

The NPRI facility with the third-largest increase in total releases and transfers from 1995 to 1997 was Lake Erie Steel (US SIC code 339), owned by Stelco Co. and located in Nanticoke, Ontario. While total releases and transfers rose 3.4 million kg from 1995 to 1996, they decreased by 2.4 million kg from 1996 to 1997. The increase occurred in transfers off-site (the facility's transfers had been zero in 1995).

Lake Erie Steel explained that fluctuations in total releases and transfers were related to levels of production, special programs to reduce emissions (particularly benzene) and increased efficiency in its wastewater and biological treatment plants. Sludge that was transferred in 1996 was rich in zinc, hence the increase in zinc that year. The increase in manganese was attributed to the slag which was reported as a transfer, but which was actually used as landfill cover and not put in the landfill.

Lake Erie Steel's most significant environmental program is the Benzene Reduction Program. This was started in 1994, in advance of the Canadian Steel Producers Association's commitment to reduce benzene emissions across the industry. Lake Erie anticipates that it will reduce its benzene emissions by 90 percent by 2000, at a cost of approximately C$1 million (US$670,000). Other benefits include reductions in anthracene, xylene and naphthalene releases. Lake Erie has also introduced a C$10 million (US$6.7 million) program to reduce emissions from its coke oven battery, by recycling exhaust back into the coke oven gas stream to be used as fuel rather than release it into the air.

Other initiatives include an enhanced spill control program in all mills, which puts emphasis on better equipment and maintenance and has led to reduction in ethylene glycol releases, use of waste oxides in the blast furnace, and screening slag for recycling back into the blast furnace. Lake Erie attributes recent improvements in its environmental performance to voluntary action in response to Canadian Steel Producers' Association commitments and internal policies.

The Inco Ltd. Copper Cliff Smelter Complex of the Ontario Division (US SIC code 333) is also located in Copper Cliff, Ontario, and reported NPRI's fourth-largest increase in releases and transfers from 1995 to 1997. From 1995 to 1996, air emissions containing sulfur compounds from the smelting operations increased, while air emissions of metals decreased, as production stayed constant. The increase in air emissions was attributable to the commissioning of the C$600 million (US$400 million) rebuilt smelter. The system was installed primarily to meet commitments under the Ontario Countdown Acid Rain program. Other targets include a 70 percent reduction (from 1988 levels) for lead, arsenic, and nickel, which is part of an industry-wide commitment agreed to through the federal Strategic Options Process. Inco Ltd. continues to examine the feasibility of further reductions in sulfur and metal emissions.

The NPRI facility with the fifth-largest increase in releases and transfers was Gerdau MRM (US SIC code 331) located in Selkirk, Manitoba. It operates an electric arc furnace with scrap feed, which produces approximately 300,000 tonnes of steel per year. Gerdau reported an increase in on-site releases, particularly releases to land, from 1995 to 1996. Baghouse dust is disposed of on-site. The increase came in part from increased production, but was largely due to a change in the facility's reporting protocol. The methodology used in 1996 led to an overestimate in releases, but also to improved analytical data in some cases.

Gerdau MRM's improved environmental performance is due to parent company policy. Gerdau Groupe of Brazil instills a culture of continuous improvement at the facility. Gerdau has also made commitments under ARET, which it expects to meet with the installation of a new baghouse system in 1999. Gerdau MRM is also a member of Canadian Steel Producers' Association's environmental committee.

Sorevco, Ispat Sidbec (US SIC code 331) is located in Coteau-du-Lac, Quebec, and reported the eighth-largest increase in total releases and transfers. In 1997, it produced approximately 135,000 tonnes of galvanized steel. Since it began operations in 1991, Sorevco has been steadily increasing its production. Its most significant environmental issue is the zinc dross that is a byproduct of the galvanizing process. The zinc dross is stored on-site in small quantities and regularly transferred off-site.

By 1997, with increased production, the company began to introduce operational changes to reduce the amount of zinc dross produced. Because zinc is expensive, the company sought ways of using it more efficiently in the production process. Changes included improvements in laboratory control and more frequent testing of the zinc bath. Sorevco also plans to install a C$1 million (US$670,000) coding gauge machine, which will accurately measure the optimal amount of zinc, aluminum, and antimony necessary for the galvanizing process. This is expected to result in the most efficient use of these inputs and a reduction in zinc dross per unit output.

The Hudson Bay Mining and Smelting Company's Metallurgical Complex (US SIC code 333) is located in Flin Flon, Manitoba, on the border with Saskatchewan. The site consists of two local mines, a milling facility, and copper and zinc refineries. Its Metallurgic Complex reported the 12th-largest increase in releases and transfers. Air emissions in 1995 were the lowest on record. This followed a substantial upgrade in an off-gas baghouse, which in turn followed conversion of the zinc process to a hydrometallurgical leaching system. Emissions climbed in 1996 and 1997, but have continued to decrease relative to 1988 levels. Air emissions follow a three- to four-year cycle, beginning with the year that the smelter's off-gas baghouse is overhauled. Hudson Bay Mining will be replacing the aging baghouse system by 2000, at a cost of C$25 million (US$17 million). This will result in reductions in air emissions.

One impetus for replacing the aging baghouses is the commitments the company has made under the voluntary ARET program. Hudson Bay Mining has committed itself to reducing its cadmium emissions by 90 percent, and other base metals by 50 percent, by 2000 (from 1988 levels). The company expects to meet all commitments. In 1997, only those for cadmium and copper had not already been met. Cadmium has been reduced by about 75 percent so far, although copper emissions have been reduced by only 10 percent. Hudson Bay Mining noted that it is also committed to reducing gaseous air emissions to address local community concerns.

The Brunswick Smelting Division lead smelter (US SIC code 333) of Noranda Mining and Exploration Inc., in Belledune, New Brunswick, reported the 13th-largest increase in releases and transfers. The facility is one of two primary lead smelting operations in Canada and includes a sinter plant, blast furnace and refinery, as well as a battery breaker and two short rotary furnaces. The facility produces approximately 110,000 tonnes per year of refined lead and lead alloys and a variety of co-products containing antimony, bismuth, copper, silver and other metals. Eighty percent of its feed is from concentrates and 20 percent is from secondary materials, including used batteries and other recyclable materials. The increase in transfers from 1996 to 1997 resulted from off-site disposal of a quantity of accumulated dust. Most of this material was returned to the process, but some dust containing higher concentrations of cadmium and other impurities was stabilized and sent for disposal to maintain workplace quality and avoid excess on-site releases to air and water.

The facility attributes environmental performance to corporate policy and internal practices and has made community relations a priority. In 1995, the company began to introduce environmental management systems modeled on the ISO 14000 standard. The facility has improved its pollution control systems and general maintenance and invested C$1 million (US $670,000) in engineering and control improvements to its wastewater effluent treatment system from 1995 to 1996. In 1996, it conducted environmental awareness training for all employees.

Metalex Products Ltd. (US SIC code 333) is located in Richmond, British Columbia, and reported the 14th-largest increase in releases and transfers. It is a secondary lead refinery, which produced 4,500 tons (US) of lead oxide and lead antimony alloys in 1997. Most of its secondary lead feed is from used car batteries. Metalex showed an increase in total transfers from 1995 to 1996, and again in 1997. This was due to the transfer to a landfill of furnace slag, containing 1.5 percent lead, that was being stored on-site. .

Metalex reported strong provincial and municipal regulatory pressure to improve its environmental performance. The Greater Vancouver Regional District (GVRD) is responsible for air and water regulations. Metalex has made considerable investments in its environmental control technology in recent years. In 1997, it invested C$200,000 (US$135,000) to build a new water treatment plant on site and C$400,000 (US$270,00) to replace two baghouses. It has also upgraded its battery breaking equipment, which improves overall efficiency.

Stelco McMaster Ltée (US SIC code 331) is located in Contrecoeur, Quebec. This facility ranked 16th among NPRI facilities for increases in releases and transfers. It is one of the largest scrap steel recyclers and secondary refineries in Canada, producing 600,000–700,000 tonnes of steel per year.

From 1995 to 1996, transfers off-site increased significantly, as Stelco McMaster cleared its stockpiled waste byproducts, which contained zinc and manganese. These were sent to a disposal site, as there are no recycling processes for such materials in Canada. Air emissions also increased in this period, due to an increase in production.

Stelco McMaster is working toward meeting voluntary commitments under ARET. It is working toward zero discharge and an increase in recycling and reuse of materials. New technology has been put in place to increase overall efficiency and reduce process byproducts.

Among other NPRI primary metals facilities with the largest increases in total releases and transfers, three attributed increases to increased production, some in conjunction with increased transfers of stored waste:

Zalev Brothers Ltd. (US SIC code 339), Windsor, Ontario (30th for increased releases and transfers in NPRI; increased production)

AltaSteel, Stelco Inc. (US SIC code 331), Edmonton, Alberta (38th; increased production and transfer of stored waste to disposal)

Stelco Inc., Hilton Works (US SIC code 331), Hamilton, Ontario (40th; increased production and one-time removal of asbestos)

Two facilities reported changes in estimating methods that led to apparent increases:

Falconbridge Ltd., Kidd Metallurgical Division, (US SIC code 333), Cochrane, Ontario (33rd)

Atlas Specialty Steels (US SIC code 331), Welland, Ontario (37th)

7.7.2 TRI Facilities with Significant Changes, 1995–1997

This section describes TRI primary metals facilities that reported the largest decreases and the largest increases in total releases and transfers from 1995 to 1997. The descriptions of the reasons for the changes were provided by the facilities in interviews.

As was seen in **Table 5–41**, 11 of the 50 TRI facilities with the largest decreases of total releases and transfers from 1995 to 1997 were primary metals facilities. These 11 facilities reported decreases of 25 million kg. Ten of the 11 reported the majority of their decreases in off-site transfers or on-site releases to land of metals. Four of the 11 facilities reported in the blast furnace and basic steel products industry (US SIC code 331), and four reported in the primary nonferrous metals industry (US SIC code 333).

Twenty-eight of the 50 TRI facilities with the largest increases in total releases and transfers from 1995 to 1997 were primary metals facilities (see **Table 5–42**). Together these 28 facilities reported increases of 83 million kg from 1995 to 1997. For 22 of them, the majority of the increases were on-site releases to land or off-site transfers of zinc and its compounds. Twenty-three of the 28 facilities reported in the blast furnace and basic steel products sector (US SIC code 331).

TRI Facilities with Large Decreases

Eleven of the 50 TRI facilities with the largest decreases in total releases and transfers (see **Table 5–41**) were primary metals industry facilities. Seven were able to provide explanations for the decreases. Three reported efforts at pollution control or reduction through on-site recycling. Two cited changes in feed stock composition, and two reported decreased production. Another reported changes in methods used to estimate releases as the reason for the change.

The ASARCO Inc. Ray Complex copper smelter (US SIC code 333) in Hayden, Arizona, reported the largest decrease in total releases and transfers of all TRI facilities. This facility reported decreases in on-site releases to land of copper compounds, zinc compounds and lead compounds and attributed them in part to more aggressive on-site recycling activities. Zinc is recycled from slag left from prior smelting of raw material.

Recycling also played a major role for National Steel Corp.'s Great Lakes Division (US SIC code 331) in Ecorse, Michigan. The facility reported decreases in transfers for off-site disposal of zinc compounds due to the installation of an on-site recycling briquette facility at the end of 1996. It ranked 10th among TRI facilities for reductions in releases and transfers from 1995 to 1997.

The Phelps Dodge Hidalgo Inc. facility of Playas, New Mexico (SIC code 333), had the 13th-largest reduction in releases and transfers among TRI facilities. Phelps Dodge Hidalgo indicated that about two-thirds of its decreases in on-site releases were due to changes in the composition of the feed stock and one-third to decreases in production.

Zinc Corp. of America, Horsehead Industries, Inc., (SIC codes 333 and 334) of Monaca, Pennsylvania, which ranked 15th, also attributed its decreases in releases to changes in the composition of feedstock.

Electralloy Corporation, G.O. Carlson Inc., (US SIC code 331) in Oil City, Pennsylvania, had apparent decreases from 1995 to 1997, ranking 24th for decreases among TRI facilities. However, this facility changed from reporting the entire metal compound in its slag to reporting just the amount of the base metal chromium, under EPA's direction. Actual releases and transfers have not changed appreciably during this time. This facility is a producer of specialty stainless steel products, using an electric arc furnace and argon-oxygen decarburization vessels to produce many grades of steel. Throughout this process, scrap steel and a variety of other raw materials are employed—either to contribute to the content of other metals (chromium, copper, etc.) in the resulting steel alloy or as an aid in the production (such as lime). Combined in a high temperature environment, the lime rises to the top of the molten metal and is removed as slag. Other wastestreams come from slag and metal vapors that are captured in a wet scrubber or baghouse. All contain some amount of the materials used as inputs to the process.

Magnesium Corporation of America (US SIC code 333) in Rowley, Utah, ranked 32nd for decreases among TRI facilities. This facility, owned by Renco Group Inc., is a manufacturer of elemental magnesium from magnesium chloride. Magnesium is used commercially as an alloying agent to strengthen aluminum, in the die-casting of automotive parts, and in the chemical industry. Chlorine gas is a major byproduct at the plant; at one point in the process, a magnesium oxide byproduct is treated with chlorine as a purifying agent and excess chlorine is emitted to the air. As chlorine gas is difficult to scrub, it is converted to hydrochloric acid. Between 1995 and 1997, the facility upgraded its scrubbers and hydrochloric acid emissions decreased.

Ranking 41st for decreases, Avesta Sheffield Plate (US SIC code 331) in New Castle, Indiana, manufactures stainless steel plate that is used to make such products as large storage tanks and machine parts. Chromium is a constituent of stainless steel. According to the company, 1995 was a high production year. Transfers decreased substantially in 1996.

Olin Brass (US SIC code 335) in Indianapolis, Indiana, makes copper and brass sheet, rod, tubing, and wire. Its products are used by the automotive, electrical, and plumbing industries. End products include condenser coil for home and automotive air conditioners, door knobs and lock sets. Copper, chromium, and zinc transfers are mostly in the form of scrap metal. According to the facility, the apparent decrease from 1995 to 1997 is the result of improved EPA guidance on TRI reporting which led to more accurate data. Olin Brass had TRI's 49th-largest reduction in releases and transfers.

TRI Facilities with Large Increases

Twenty-eight of the 50 TRI facilities with the largest increases in total releases and transfers were primary metals industry facilities (see **Table 5–42**). Eight of these facilities cited increased production as the reason for the increases in releases and transfers. Seven explained that they had switched from transfers to recycling to transfers to disposal for economic reasons. Other reasons included changes due to single events, such as equipment failure and on-site clean-up, and better estimates.

The USS Clairton Works (US SIC code 331) in Clairton, Pennsylvania, reported the largest increase in total releases and transfers among all TRI facilities. It is a coke plant owned by the USX Corporation. The facility produces coke for use in blast furnaces at steel manufacturing facilities. Approximately 20 percent of the coke made at Clairton Works is used by USX facilities. The rest is sold to outside steel manufacturers. Ethylene is produced as a byproduct in coke manufacture. Clairton Works transfers the ethylene byproduct off-site to a sister facility, Irvin Works, via pipeline. This is reported as a transfer to treatment or to energy recovery. Irvin Works, a steel finishing plant, burns the ethylene as fuel in a blast furnace and flares off the excess. In 1997, a blast furnace outage at Irvin resulted in the flaring off of a significant amount of additional ethylene. Consequently, the amount reported as transfers to treatment went up.

Kennecott Utah Copper in Magna, Utah, a primary copper refinery (US SIC code 333), reported TRI's second-largest increase in total releases and transfers. Releases of copper compounds to land accounted for about 40 percent of the increase, and releases of arsenic compounds, lead compounds, and zinc compounds each accounted for about 20 percent of the total. The facility reported that the smelting process was changed in June 1995 to reduce sulfur dioxide emissions. The production rate has increased since that time. As a result of increased production, there was about a twofold increase in the generation of slag tailings from 1996 to 1997. This accounted for approximately two-thirds of the increase. The remaining increase was due to clean-up activity that began in 1996. This involves the removal of sediment from old sludge ponds, and then drying and relocating it to a lined repository on-site that meets RCRA specifications. The clean-up process is expected to continue for a couple of years.

The TRI facility with the third-largest increase, Nucor-Yamato Steel Co. (US SIC code 331) in Blytheville, Arkansas, is a mini-mill that makes scrap metal into new steel for "structural long products" such as beams for buildings. The majority of its reporting is for zinc that is transferred off-site. In the process, the zinc, from galvanized scrap steel, is vaporized and collected in baghouses. Zinc concentrations can vary as much as 10 percent, depending on the scrap steel received. From 1996 to 1997, production at this facility increased 10 percent, causing the increase in zinc off-site transfers.

Armco Steel (US SIC code 331) in Butler, Pennsylvania, reported the fourth-largest increases in releases and transfers. This steel mill uses a nitric acid pickling process in the production of specialty steels. Increased releases of nitrate compounds were directly related to increased production.

The sixth-ranked TRI facility for increases was Steel Dynamics Inc. (US SIC code 331) of Butler, Indiana, which reported increases in transfers to off-site disposal of zinc compounds and manganese compounds. The facility began operation in January 1996 and has increased production since that time. Only minimal releases were reported in 1995, associated with equipment tests.

USS Gary Works (US SIC code 331) in Gary, Indiana, reported the seventh-largest increase in total releases and transfers of any TRI facility. The Gary Works facility, owned by the USX Corporation, is primarily a sheet steel producer. Products include galvanized steel for the automotive industry, tin for the canned food industry and other grades for the appliance industry. The facility reported that zinc is a minor impurity in its raw material, but greater concentrations are found in the steel scrap that is recycled.

Releases of zinc to land are mainly found in sludge that is produced from cleaning scrubbers and from the galvanizing process. The sludge is landfilled on-site. In 1994, the EPA conducted a facility inspection as part of an enforcement action. The agency was investigating why the plant was not reporting releases of some TRI chemicals that similar steel facilities were reporting. EPA maintained that exceeding "use thresholds" necessitated reporting of certain chemicals while USS Gary Works had assumed that reporting was triggered when releases exceeded thresholds. In part to address EPA's concerns and in part to develop a more structured environmental management system at the plant, the facility initiated a program where wastestreams were sampled and analyzed for chemical identity and content. Wastestream sampling and analysis has subsequently led to a better understanding of the types and quantities of the chemicals present. This was primarily responsible for the increase in zinc reporting. The decision to test wastestreams was also intended to evaluate new technologies and methods for improving waste minimization and pollution prevention programs at the plant level.

Other TRI primary metals facilities with the largest increases in total releases and transfers attributed their increases to increased production:

- Nucor Steel (US SIC code 331), Plymouth, Utah (10th for increased releases and transfers in TRI)
- Nucor Steel Arkansas Plant (US SIC code 331), Blytheville, Arkansas (15th; also due to increased galvanizing in scrap metal received)
- BHP Copper Metals (US SIC codes 333 and 335), San Manuel, Arizona (16th; also due to increased sampling and monitoring)
- Bar Techs Inc. (US SIC code 331), Johnstown, Pennsylvania (24th)

Other facilities attributed increases to a change in operating practice—redirecting waste from recycling to stabilization and landfill. The choice between waste management methods depends largely on their relative costs. For example, from 1995 to 1997, the major US recycler for steel mills, Horsehead Industries, raised its prices. In the same period, Envirosafe Co., with several disposal sites for metals in the United States, lowered its prices. The relative cost therefore favored disposal over recycling. Most facilities expect to switch back to recycling if costs are reduced. Facilities (all of which are US SIC code 331) citing this reason for increases include:

- Birmingham Southeast LLC, Birmingham Steel Corp., Inc., Cartersville, Georgia (18th)
- Birmingham Steel Corp., Kankakee Illinois Steel Division, Bourbonnais, Illinois (19th)
- Ameristeel Corp., Jacksonville Mill Division, Baldwin, Florida (20th)
- Birmingham Steel Corp., Washington Steel Division, Seattle, Washington (26th)
- Ameristeel Corp., Charlotte, North Carolina (28th)
- Koppel Steel Corp., NS Group Inc., Koppel, Pennsylvania (40th)
- Auburn Steel Co., Auburn, New York (46th)

7.8 Industry Mix within the North American Primary Metals Sector

The primary metals industries in the two countries also differ in the types of facilities making up the industrial sector as a whole, which influences the types and amounts of releases and transfers reported. Any analysis of NPRI and TRI must take into account both the different subsectors within the primary metals industry and the different number of facilities within each subsector. The primary metals sector consists of a diverse set of industries, and the releases and transfers that pertain to a facility in one subsector can differ quite substantially from those found in another.

7.8.1 Industrial Subsectors

This section analyzes releases and transfers from facilities that reported under subsectors of US SIC code 33 or the Canadian SIC code 29 (**Table 7–5**). The US SIC code 33 covers seven subsectors:

- Blast Furnace and Basic Steel Products—US SIC Code 331. These mills manufacture hot metal and pig iron; plates, sheets, strips, rods or tubing; metallic additive alloys; steel nails and spikes; and cold-finished steel, including steel sheets, bars and steel pipe.
- Iron and Steel Foundries—US SIC Code 332. These facilities manufacture iron and steel castings.
- Primary Nonferrous Metals—US SIC Code 333. These facilities refine nonferrous metals from ore or alumina or refine nonferrous metals by electrolytic or other processes. This subsector includes aluminum, copper and other nonferrous smelters.
- Secondary Nonferrous Metals—US SIC Code 334. These facilities recover nonferrous metals and alloys from new and used scrap, including production of alloys from purchased refined materials, recovery of precious metals and recovery of tin through secondary smelting and refining.
- Nonferrous Rolling and Drawing—US SIC Code 335. These facilities produce basic shapes, such as nonferrous metal plates, sheets, strips, bars, tubing, pipes, rods and wire. Processes and materials employed include rolling, drawing, and extruding of copper, brass, bronze, and other copper alloys,

aluminum and aluminum-based alloys, and other nonferrous metals.

Nonferrous Foundries—US SIC Code 336. These facilities manufacture die-castings and other castings of nonferrous metals such as aluminum and copper.

Miscellaneous Primary Metals Products—US SIC Code 339. These facilities manufacture miscellaneous primary metals products, such as nonferrous nails, spikes, brads, and metal powder, flakes and paste.

The Canadian primary metals industry facilities generally report under Canadian SIC code 29, although the subsectors do differ. The Canadian primary metals industry subsectors are:

Ferro-alloys Industries and Steel Foundries (US SIC codes 331 and 332)

Steel Pipe and Tube Industries (US SIC code 331)

Iron Foundries (US SIC code 332)

Primary Production of Aluminum (US SIC code 333)

Other Nonferrous Smelting and Refining (US SIC code 333)

Aluminum Rolling, Casting and Extruding (US SIC codes 335, 336 and 339)

Copper Rolling, Casting and Extruding (US SIC codes 335, 336 and 339)

Other Metal Rolling, Casting and Extruding (US SIC codes 334, 335, 336 and 339)

In addition, this analysis includes 29 Canadian facilities that reported Canadian SIC codes 30 (Fabricated Metals) or 33 (Electrical/Electronic Products), because they reported a US SIC code within 33. Their 68 forms totaled 342,292 kg of releases and transfers.

The US SIC code system must be used because only the Canadian facilities report both.

7.8.2 Multiple SIC Codes

One challenge in comparing NPRI and TRI data is that each NPRI facility reports only one (US) SIC code that best describes the facility's operations, while a TRI facility must report all relevant SIC codes. For a TRI facility reporting multiple SIC codes, it is not possible to break down the reported releases and transfers of a pollutant into individual SIC codes. For example, a US facility that chooses SIC codes 333 and 335 to describe its operations may report 110,000 kg of aluminum off-site transfers. It is not possible to determine what proportion of the 110,000 kg is transferred due to operations within SIC code 333 and what proportion within SIC code 335.

Data for US facilities that report multiple SIC codes are thus not easily comparable to those for facilities reporting a single three-digit SIC code. Facilities reporting multiple SIC codes represent eight percent of the forms and 12 percent of the total releases and transfers from primary metals industry facilities in TRI (**Table 7–5**).

To investigate the effect of facilities reporting multiple SIC codes, TRI data at the three-digit subsector level are presented in two ways. First, only facilities reporting a single three-digit SIC code are listed, and second, to the single-SIC code group are added all facilities that reported the same three-digit SIC code among their multiple codes. Thus, except for **Tables 7–10** and **7–16**, further tables in this chapter provide a range of estimates for TRI, with the single three-digit estimates being a lower bound and the single-plus-multiple group an upper one.

7.9 Industrial Subsectors—Detailed PRTR Data

For both NPRI and TRI, the blast furnace and basic steel products sector (US SIC code 331) submitted the most forms and reported the largest total releases and transfers in 1997. Large off-site transfers from this subsector gave it the largest total releases and transfers in the primary metals industry. The primary nonferrous metals sector (US SIC code 333) reported the largest on-site releases and the second-largest total releases and transfers for both NPRI and TRI. Together, these two subsectors represented 87 percent of total releases and transfers from NPRI primary metals facilities and 74 percent from those in TRI. Therefore, the following sections provide the PRTR data for these two subsectors that dominate PRTR reporting in the primary metals industry.

7.9.1 Blast Furnace and Basic Steel Products (US SIC Code 331)

Manufacturers of basic steel products represented 25 percent of the NPRI primary metals facilities and reported almost two-thirds of their total releases and transfers. For the TRI primary metals industry, these manufacturers represented over 20 percent of the facilities and reported almost half of the total releases and transfers. While NPRI and TRI facilities in this subsector submitted about the same number of forms per facility, average releases and transfers per form were 1.8 times higher for NPRI facilities than for TRI. This was primarily due to higher average off-site transfers (more than twice as high), since on-site releases were comparable (**Table 7–6**).

Table 7-5

M 1997

Releases and Transfers for the Primary Metals Industry (US SIC Code 33), by Subsector, 1997

US SIC Code	Industry	Number of Facilities	Number of Forms	Total Air Emissions (kg)	Surface Water Discharges (kg)	Underground Injection (kg)	On-site Land Releases (kg)	Total Releases (kg)
NPRI Facilities								
331	Blast Furnace and Basic Steel Products	43	205	1,500,475	597,703	0	4,785,227	6,891,149
332	Iron and Steel Foundries	25	93	86,282	5,607	0	2,658,404	2,751,438
333	Primary Nonferrous Metals	30	157	7,908,169	67,329	0	744,535	8,722,657
334	Secondary Nonferrous Metals	8	21	15,076	50	0	0	16,028
335	Nonferrous Rolling and Drawing	36	85	166,368	1,131	0	2,100	171,920
336	Nonferrous Foundries	17	39	47,849	0	0	0	48,150
339	Miscellaneous Primary Metal Products	10	37	20,573	169	0	402,950	423,694
	Total for NPRI Facilities	**169**	**637**	**9,744,792**	**671,989**	**0**	**8,593,216**	**19,025,036**
TRI Facilities								
331	Blast Furnace and Basic Steel Products	365	1,755	5,842,909	18,060,754	87,958	28,395,088	52,386,709
332	Iron and Steel Foundries	342	1,139	2,070,301	26,610	0	9,419,219	11,516,130
333	Primary Nonferrous Metals	54	235	30,879,726	456,488	81,949	50,693,303	82,111,466
334	Secondary Nonferrous Metals	159	495	642,560	13,348	807	987,830	1,644,545
335	Nonferrous Rolling and Drawing	347	999	2,826,202	197,709	57	529,949	3,553,917
336	Nonferrous Foundries	320	651	565,759	2,670	0	161,390	729,819
339	Miscellaneous Primary Metal Products	146	309	595,894	1,689	0	85,112	682,695
	SIC code not valid within SIC 33	1	3	237	6	0	0	243
	Subtotal for Single SIC Codes	**1,734**	**5,586**	**43,423,588**	**18,759,274**	**170,771**	**90,271,891**	**152,625,524**
331/332		2	31	87,750	545,021	0	462,562	1,095,333
331/332/336		1	2	5,896	0	0	0	5,896
331/334		3	18	2,593	6	0	0	2,599
331/335		6	24	137,729	15	0	0	137,744
331/335/339		2	8	2,942	0	0	0	2,942
331/339		12	80	66,434	1,516,710	0	73,681	1,656,825
332/333		1	2	0	0	0	0	0
332/334		1	3	5,501	0	0	0	5,501
332/336		21	76	95,015	22	0	565,462	660,499
332/336/339		1	1	0	0	0	0	0
333/334		3	15	275,027	424	0	0	275,451
333/335		3	92	3,719,560	501,119	0	9,500,759	13,721,438
334/335		20	54	83,933	757	0	0	84,690
334/335/336		2	8	205,296	0	0	0	205,296
334/335/339		4	28	170,861	730	0	2,943	174,534
334/336		1	3	15	6	0	0	21
334/336/339		1	3	1,395	4	0	0	1,399
334/339		5	11	16,754	1	0	264,353	281,108
335/336		8	24	30,625	387	0	166	31,178
335/339		5	11	24,047	18	0	0	24,065
336/339		2	6	15,735	3	0	0	15,738
	Subtotal for Multiple SIC Codes	**104**	**500**	**4,947,108**	**2,565,223**	**0**	**10,869,926**	**18,382,257**
	Total for TRI Facilities	**1,838**	**6,086**	**48,370,696**	**21,324,497**	**170,771**	**101,141,817**	**171,007,781**

US SIC Code	Industry	Treatment (except metals) (kg)	Sewage/POTWs (except metals) (kg)	Disposal (except metals) (kg)	Treatment/ Sewage/Disposal of Metals (kg)	Total Transfers (kg)	Total Releases and Transfers (kg)	% of Total Releases and Transfers
NPRI Facilities								
331	Blast Furnace and Basic Steel Products	49,315	103,520	247,396	23,706,819	24,107,050	30,998,199	66.0
332	Iron and Steel Foundries	0	2,571	24,553	992,155	1,019,279	3,770,717	8.0
333	Primary Nonferrous Metals	0	0	0	1,125,165	1,125,165	9,847,822	21.0
334	Secondary Nonferrous Metals	0	0	0	480,895	480,895	496,923	1.1
335	Nonferrous Rolling and Drawing	5,016	0	2,830	57,402	65,248	237,168	0.5
336	Nonferrous Foundries	60	0	0	16,098	16,158	64,308	0.1
339	Miscellaneous Primary Metal Products	920	0	1	1,105,051	1,105,972	1,529,666	3.3
	Total for NPRI Facilities	**55,311**	**106,091**	**274,780**	**27,483,585**	**27,919,767**	**46,944,803**	**100.0**
TRI Facilities								
331	Blast Furnace and Basic Steel Products	12,430,168	1,033,327	644,198	82,497,536	96,605,229	148,991,938	46.7
332	Iron and Steel Foundries	52,447	15,196	466,338	9,769,096	10,303,077	21,819,207	6.8
333	Primary Nonferrous Metals	34,552	0	0	3,920,981	3,955,533	86,066,999	27.0
334	Secondary Nonferrous Metals	0	5,692	6,618	8,398,338	8,410,648	10,055,193	3.2
335	Nonferrous Rolling and Drawing	393,451	500,620	94,871	4,421,057	5,409,999	8,963,916	2.8
336	Nonferrous Foundries	52,898	19	63,163	1,910,794	2,026,874	2,756,693	0.9
339	Miscellaneous Primary Metal Products	24,358	321,967	55,709	1,386,137	1,788,171	2,470,866	0.8
	SIC code not valid within SIC 33	0	0	0	117	117	360	0.0
	Subtotal for Single SIC Codes	**12,987,874**	**1,876,821**	**1,330,897**	**112,304,056**	**128,499,648**	**281,125,172**	**88.2**
331/332		60	0	0	342	402	1,095,735	0.3
331/332/336		0	0	0	0	0	5,896	0.0
331/334		0	0	0	486,683	486,683	489,282	0.2
331/335		22,239	0	0	5,618	27,857	165,601	0.1
331/335/339		28,178	0	0	0	28,178	31,120	0.0
331/339		263,881	616,462	3,271	1,371,024	2,254,638	3,911,463	1.2
332/333		0	0	0	0	0	0	0.0
332/334		2,795	0	0	0	2,795	8,296	0.0
332/336		5,274	340,318	23,930	96,709	466,231	1,126,730	0.4
332/336/339		0	0	0	340	340	340	0.0
333/334		0	0	0	13,855,648	13,855,648	14,131,099	4.4
333/335		49,358	0	2,905	215,552	267,815	13,989,253	4.4
334/335		0	0	0	21,890	21,890	106,580	0.0
334/335/336		0	54	0	59,486	59,540	264,836	0.1
334/335/339		0	1,421,144	18	298,082	1,719,244	1,893,778	0.6
334/336		0	0	0	6	6	27	0.0
334/336/339		0	0	0	0	0	1,399	0.0
334/339		0	0	0	189	189	281,297	0.1
335/336		0	0	0	25,492	25,492	56,670	0.0
335/339		0	0	340	1,731	2,071	26,136	0.0
336/339		0	0	0	0	0	15,738	0.0
	Subtotal for Multiple SIC Codes	**371,785**	**2,377,978**	**30,464**	**16,438,792**	**19,219,019**	**37,601,276**	**11.8**
	Total for TRI Facilities	**13,359,659**	**4,254,799**	**1,361,361**	**128,742,848**	**147,718,667**	**318,726,448**	**100.0**

Table 7-6

M 1997

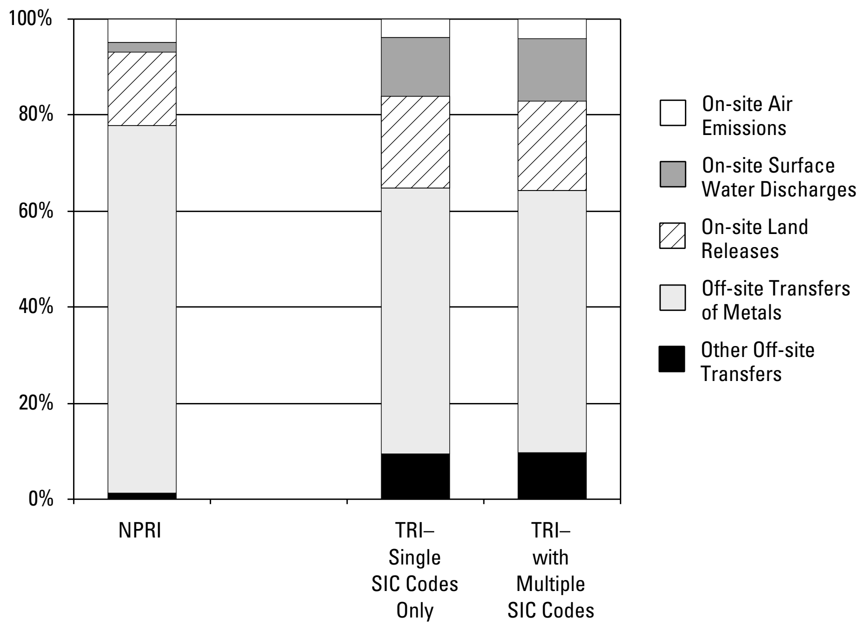
NPRI and TRI Releases and Transfers for Blast Furnace and Basic Steel Products (US SIC Code 331), 1997

	NPRI		TRI Single SIC Codes		TRI Total Including Multiple SIC Code Forms	
	Number		Number		Number	
Facilities	43		365		391	
Forms	205		1,755		1,918	
	kg	% of Total	kg	% of Total	kg	% of Total
Total Air Emissions	1,500,475	4.8	5,842,909	3.9	6,146,253	4.0
Surface Water Discharges	597,703	1.9	18,060,754	12.1	20,122,506	13.0
Underground Injection	0	0.0	87,958	0.1	87,958	0.1
On-site Land Releases	4,785,227	15.4	28,395,088	19.1	28,931,331	18.7
Matched On-site Releases	**6,891,149**	**22.2**	**52,386,709**	**35.2**	**55,288,048**	**35.7**
Treatment (except metals)	49,315	0.2	12,430,168	8.3	12,744,526	8.2
Sewage/POTWs (except metals)	103,520	0.3	1,033,327	0.7	1,649,789	1.1
Disposal (except metals)	247,396	0.8	644,198	0.4	647,469	0.4
Treatment/Sewage/Disposal of Metals	23,706,819	76.5	82,497,536	55.4	84,361,203	54.5
Matched Off-site Transfers	**24,107,050**	**77.8**	**96,605,229**	**64.8**	**99,402,987**	**64.3**
Matched Releases and Transfers	**30,998,199**	**100.0**	**148,991,938**	**100.0**	**154,691,035**	**100.0**
	Number		Number		Number	
Average Forms/Facility	4.8		4.8		4.9	
	kg		kg		kg	
Average Releases						
per Facility	160,259		143,525		141,402	
per Form	33,615		29,850		28,826	
Average Transfers						
per Facility	560,629		264,672		254,228	
per Form	117,595		55,046		51,826	
Average Releases and Transfers						
per Facility	720,888		408,197		395,629	
per Form	151,211		84,896		80,652	

Figure 7-1

M 1997

NPRI and TRI Releases and Transfers, Blast Furnace and Basic Steel Products (US SIC Code 331), 1997



➤ Underground injection zero for NPRI and less than 1 percent for TRI.

Releases and Transfers from the Blast Furnace and Basic Steel Products Subsector

NPRI facilities' releases and transfers were almost all transfers off-site of metals or on-site land disposal. For NPRI facilities, 92 percent of total releases and transfers consisted of off-site transfers of metals and on-site land disposal, while for TRI the percentage was 75 percent. TRI facilities reported much greater surface water discharges than did NPRI facilities (**Figure 7–1**). As described above, one TRI facility in this subsector reported a large increase in surface water discharges of nitric acid (Armco Steel in Butler, Pennsylvania, 12 million kg in 1997) due to increased production. TRI facilities also reported transferring nonmetals to treatment in greater proportion than NPRI facilities.

Chemicals from the Blast Furnace and Basic Steel Products Subsector

Zinc and its compounds was the substance with the greatest total releases and transfers for both NPRI and TRI facilities in this subsector. The NPRI facilities reported 21 million kg of zinc and its compounds. This represented 66 percent of total releases and transfers for NPRI facilities in this subsector (**Table 7–7**). TRI facilities reported 79 million kg of zinc and its compounds, accounting for 53 percent of the total releases and transfers (**Tables 7–8** and **7–9**).

As described in **Section 7.3.4** above, zinc may be present in scrap metal, as it is used to coat steel to protect it from rust (called galvanizing), or it may be an impurity in raw materials. Scrap steel is degalvanized (zinc is removed through chemical treatment), and this zinc may be found in dust from the electric arc furnace. In the case of impurities in iron ore, zinc is found in waste (slag) and in gases from the blast furnace. Zinc in dust from steelmaking can be recycled if the concentration is sufficiently high and if the economics of recycling versus land disposal either on- or off-site are favorable. Zinc that is recycled is not included in the total releases and transfers presented here.

Table 7-7

M 1997

NPRI Releases and Transfers for Blast Furnace and Basic Steel Products (US SIC Code 331), by Chemical, 1997

CAS Number	Chemical	Number of Forms	Total Air Emissions (kg)	Surface Water Discharges (kg)	Underground Injection (kg)	On-site Land Releases (kg)	Total Releases (kg)
—	Zinc (and its compounds)	21	93,916	14,098	0	2,656,941	2,765,055
—	Manganese (and its compounds)	23	31,051	4,771	0	1,037,333	1,074,191
—	Lead (and its compounds)	15	7,392	2,666	0	320,324	332,656
—	Chromium (and its compounds)	17	3,723	357	0	20,813	25,843
—	Copper (and its compounds)	17	2,308	415	0	94,941	97,991
—	Nickel (and its compounds)	14	858	3,430	0	4,777	9,182
—	Cadmium (and its compounds)	2	0	0	0	0	100
—	Arsenic (and its compounds)	1	0	0	0	0	100
7440-62-2	Vanadium (fume or dust)	2	1	0	0	0	1
—	Antimony (and its compounds)	1	0	0	0	0	0
7429-90-5	Aluminum (fume or dust)	7	2,537	334	0	460,000	463,122
	Subtotal for Metals	**120**	**141,786**	**26,071**	**0**	**4,595,129**	**4,768,241**
—	Nitric acid and nitrate compounds	6	22	551,890	0	0	552,512
7647-01-0	Hydrochloric acid	9	42,733	0	0	0	42,733
7664-93-9	Sulfuric acid	5	10,360	0	0	0	10,360
—	Cyanides	1	0	3,980	0	0	3,980
7664-39-3	Hydrogen fluoride	1	585	0	0	0	585
7664-38-2	Phosphoric acid	5	0	0	0	0	549
	Subtotal for Acids/Bases	**27**	**53,700**	**555,870**	**0**	**0**	**610,719**
	All Other Chemicals	**58**	**1,304,989**	**15,762**	**0**	**190,098**	**1,512,189**
	Total	**205**	**1,500,475**	**597,703**	**0**	**4,785,227**	**6,891,149**

CAS Number	Chemical	Treatment (except metals) (kg)	Sewage/POTWs (except metals) (kg)	Disposal (except metals) (kg)	Treatment/ Sewage/Disposal of Metals (kg)	Total Transfers (kg)	Total Releases and Transfers (kg)	Average Total Releases and Transfers per Form kg/form
—	Zinc (and its compounds)	0	0	0	17,816,386	17,816,386	20,581,441	980,069
—	Manganese (and its compounds)	0	0	0	3,299,349	3,299,349	4,373,540	190,154
—	Lead (and its compounds)	0	0	0	1,367,297	1,367,297	1,699,953	113,330
—	Chromium (and its compounds)	0	0	0	599,300	599,300	625,143	36,773
—	Copper (and its compounds)	0	0	0	367,889	367,889	465,880	27,405
—	Nickel (and its compounds)	0	0	0	176,647	176,647	185,829	13,274
—	Cadmium (and its compounds)	0	0	0	929	929	1,029	515
—	Arsenic (and its compounds)	0	0	0	486	486	586	586
7440-62-2	Vanadium (fume or dust)	0	0	0	0	0	1	1
—	Antimony (and its compounds)	0	0	0	0	0	0	0
7429-90-5	Aluminum (fume or dust)	0	0	0	78,536	78,536	541,658	77,380
	Subtotal for Metals	**0**	**0**	**0**	**23,706,819**	**23,706,819**	**28,475,060**	**237,292**
—	Nitric acid and nitrate compounds	0	16,001	0	0	16,001	568,513	94,752
7647-01-0	Hydrochloric acid	0	0	0	0	0	42,733	4,748
7664-93-9	Sulfuric acid	0	0	0	0	0	10,360	2,072
—	Cyanides	0	0	0	0	0	3,980	3,980
7664-39-3	Hydrogen fluoride	0	0	0	0	0	585	585
7664-38-2	Phosphoric acid	0	1	0	0	1	550	110
	Subtotal for Acids/Bases	**0**	**16,002**	**0**	**0**	**16,002**	**626,721**	**23,212**
	All Other Chemicals	**49,315**	**87,518**	**247,396**	**0**	**384,229**	**1,896,418**	**32,697**
	Total	**49,315**	**103,520**	**247,396**	**23,706,819**	**24,107,050**	**30,998,199**	**151,211**

Table 7-8

M 1997

TRI Releases and Transfers for Blast Furnace and Basic Steel Products (US SIC Code 331), by Chemical, 1997 (Single SIC Codes Only)

CAS Number	Chemical	Number of Forms	Total Air Emissions (kg)	Surface Water Discharges (kg)	Underground Injection (kg)	On-site Land Releases (kg)	Total Releases (kg)
—	Zinc (and its compounds)	155	953,908	68,828	340	14,006,214	15,029,290
—	Manganese (and its compounds)	228	385,262	276,191	952	12,387,899	13,050,304
—	Lead (and its compounds)	139	100,927	9,425	0	645,678	756,030
—	Chromium (and its compounds)	223	80,982	19,939	952	1,052,863	1,154,736
—	Nickel (and its compounds)	197	25,721	9,799	340	67,659	103,519
—	Copper (and its compounds)	97	15,460	7,046	340	63,238	86,084
—	Antimony (and its compounds)	14	1,481	5,889	0	23,561	30,931
—	Cadmium (and its compounds)	14	1,104	9	0	517	1,630
—	Cobalt (and its compounds)	19	1,013	201	0	5,610	6,824
—	Arsenic (and its compounds)	5	234	0	0	3,040	3,274
7440-62-2	Vanadium (fume or dust)	4	597	208	0	454	1,259
—	Silver (and its compounds)	2	0	0	0	265	265
—	Selenium (and its compounds)	2	0	0	0	263	263
—	Mercury (and its compounds)	3	2	0	0	150	152
7429-90-5	Aluminum (fume or dust)	16	18,158	14,276	0	0	32,434
	Subtotal for Metals	**1,118**	**1,584,849**	**411,811**	**2,924**	**28,257,411**	**30,256,995**
—	Nitric acid and nitrate compounds	80	215,544	17,574,866	0	40,796	17,831,206
7647-01-0	Hydrochloric acid	53	775,621	0	0	0	775,621
7664-39-3	Hydrogen fluoride	31	117,283	30	0	5,306	122,619
7664-38-2	Phosphoric acid	65	19,654	2	0	59,466	79,122
—	Cyanides	22	114,377	26,282	21,769	7,434	169,862
7664-93-9	Sulfuric acid	15	45,107	0	0	0	45,107
74-90-8	Hydrogen cyanide	3	446	0	0	0	446
	Subtotal for Acids/Bases	**269**	**1,288,032**	**17,601,180**	**21,769**	**113,002**	**19,023,983**
	All Other Chemicals	**368**	**2,970,028**	**47,763**	**63,265**	**24,675**	**3,105,731**
	Total	**1,755**	**5,842,909**	**18,060,754**	**87,958**	**28,395,088**	**52,386,709**

CAS Number	Chemical	Treatment (except metals) (kg)	Sewage/POTWs (except metals) (kg)	Disposal (except metals) (kg)	Treatment/ Sewage/Disposal of Metals (kg)	Total Transfers (kg)	Total Releases and Transfers (kg)	Average Total Releases and Transfers per Form kg/form
—	Zinc (and its compounds)	0	0	0	64,098,068	64,098,068	79,127,358	510,499
—	Manganese (and its compounds)	0	0	0	9,910,924	9,910,924	22,961,228	100,707
—	Lead (and its compounds)	0	0	0	4,636,742	4,636,742	5,392,772	38,797
—	Chromium (and its compounds)	0	0	0	1,914,130	1,914,130	3,068,866	13,762
—	Nickel (and its compounds)	0	0	0	930,285	930,285	1,033,804	5,248
—	Copper (and its compounds)	0	0	0	765,569	765,569	851,653	8,780
—	Antimony (and its compounds)	0	0	0	9,631	9,631	40,562	2,897
—	Cadmium (and its compounds)	0	0	0	26,807	26,807	28,437	2,031
—	Cobalt (and its compounds)	0	0	0	4,451	4,451	11,275	593
—	Arsenic (and its compounds)	0	0	0	546	546	3,820	764
7440-62-2	Vanadium (fume or dust)	0	0	0	572	572	1,831	458
—	Silver (and its compounds)	0	0	0	347	347	612	306
—	Selenium (and its compounds)	0	0	0	345	345	608	304
—	Mercury (and its compounds)	0	0	0	263	263	415	138
7429-90-5	Aluminum (fume or dust)	0	0	0	198,856	198,856	231,290	14,456
	Subtotal for Metals	**0**	**0**	**0**	**82,497,536**	**82,497,536**	**112,754,531**	**100,854**
—	Nitric acid and nitrate compounds	1,922,530	717,517	368,497	0	3,008,544	20,839,750	260,497
7647-01-0	Hydrochloric acid	0	0	0	0	0	775,621	14,634
7664-39-3	Hydrogen fluoride	382,860	16,162	46,232	0	445,254	567,873	18,318
7664-38-2	Phosphoric acid	30,221	2	167,281	0	197,504	276,626	4,256
—	Cyanides	724	35,279	1,122	0	37,125	206,987	9,409
7664-93-9	Sulfuric acid	0	0	0	0	0	45,107	3,007
74-90-8	Hydrogen cyanide	0	0	0	0	0	446	149
	Subtotal for Acids/Bases	**2,336,335**	**768,960**	**583,132**	**0**	**3,688,427**	**22,712,410**	**84,433**
	All Other Chemicals	**10,093,833**	**264,367**	**61,066**	**0**	**10,419,266**	**13,524,997**	**36,753**
	Total	**12,430,168**	**1,033,327**	**644,198**	**82,497,536**	**96,605,229**	**148,991,938**	**84,896**

Table 7-9

M 1997

TRI Releases and Transfers for Blast Furnace and Basic Steel Products (US SIC Code 331), by Chemical, 1997 (Single and Multiple SIC Codes)

CAS Number	Chemical	Number of Forms	Total Air Emissions (kg)	Surface Water Discharges (kg)	Underground Injection (kg)	On-site Land Releases (kg)	Total Releases (kg)
—	Zinc (and its compounds)	160	986,323	69,684	340	14,120,273	15,176,620
—	Manganese (and its compounds)	248	394,909	282,223	952	12,687,012	13,365,096
—	Lead (and its compounds)	145	104,023	10,362	0	670,707	785,092
—	Chromium (and its compounds)	246	87,395	21,081	952	1,108,519	1,217,947
—	Nickel (and its compounds)	219	30,652	11,208	340	100,780	142,980
—	Copper (and its compounds)	110	15,976	8,072	340	72,309	96,697
—	Antimony (and its compounds)	14	1,481	5,889	0	23,561	30,931
—	Cadmium (and its compounds)	15	1,105	9	0	707	1,821
—	Cobalt (and its compounds)	24	1,704	541	0	5,614	7,859
—	Arsenic (and its compounds)	5	234	0	0	3,040	3,274
7440-62-2	Vanadium (fume or dust)	5	597	208	0	454	1,259
—	Silver (and its compounds)	2	0	0	0	265	265
—	Selenium (and its compounds)	2	0	0	0	263	263
—	Mercury (and its compounds)	3	2	0	0	150	152
7429-90-5	Aluminum (fume or dust)	20	18,938	14,276	0	0	33,214
	Subtotal for Metals	**1,218**	**1,643,339**	**423,553**	**2,924**	**28,793,654**	**30,863,470**
—	Nitric acid and nitrate compounds	97	224,809	19,624,836	0	40,796	19,890,441
7647-01-0	Hydrochloric acid	54	776,342	0	0	0	776,342
7664-39-3	Hydrogen fluoride	41	122,026	38	0	5,306	127,370
7664-38-2	Phosphoric acid	71	20,111	2	0	59,466	79,579
—	Cyanides	22	114,377	26,282	21,769	7,434	169,862
7664-93-9	Sulfuric acid	17	48,829	0	0	0	48,829
74-90-8	Hydrogen cyanide	4	586	0	0	0	586
	Subtotal for Acids/Bases	**306**	**1,307,080**	**19,651,158**	**21,769**	**113,002**	**21,093,009**
	All Other Chemicals	**394**	**3,195,834**	**47,795**	**63,265**	**24,675**	**3,331,569**
	Total	**1,918**	**6,146,253**	**20,122,506**	**87,958**	**28,931,331**	**55,288,048**

CAS Number	Chemical	Treatment (except metals) (kg)	Sewage/POTWs (except metals) (kg)	Disposal (except metals) (kg)	Treatment/ Sewage/Disposal of Metals (kg)	Total Transfers (kg)	Average Total Releases and Total Releases and Transfers (kg)	Transfers per Form kg/form
—	Zinc (and its compounds)	0	0	0	64,400,508	64,400,508	79,577,128	497,357
—	Manganese (and its compounds)	0	0	0	10,182,613	10,182,613	23,547,709	94,950
—	Lead (and its compounds)	0	0	0	4,650,937	4,650,937	5,436,029	37,490
—	Chromium (and its compounds)	0	0	0	2,811,959	2,811,959	4,029,906	16,382
—	Nickel (and its compounds)	0	0	0	1,291,384	1,291,384	1,434,364	6,550
—	Copper (and its compounds)	0	0	0	777,105	777,105	873,802	7,944
—	Antimony (and its compounds)	0	0	0	9,631	9,631	40,562	2,897
—	Cadmium (and its compounds)	0	0	0	26,807	26,807	28,628	1,909
—	Cobalt (and its compounds)	0	0	0	4,796	4,796	12,655	527
—	Arsenic (and its compounds)	0	0	0	546	546	3,820	764
7440-62-2	Vanadium (fume or dust)	0	0	0	572	572	1,831	366
—	Silver (and its compounds)	0	0	0	347	347	612	306
—	Selenium (and its compounds)	0	0	0	345	345	608	304
—	Mercury (and its compounds)	0	0	0	263	263	415	138
7429-90-5	Aluminum (fume or dust)	0	0	0	203,390	203,390	236,604	11,830
	Subtotal for Metals	**0**	**0**	**0**	**84,361,203**	**84,361,203**	**115,224,673**	**94,602**
—	Nitric acid and nitrate compounds	2,197,855	1,333,637	368,522	0	3,900,014	23,790,455	245,262
7647-01-0	Hydrochloric acid	0	0	0	0	0	776,342	14,377
7664-39-3	Hydrogen fluoride	398,007	16,164	46,232	0	460,403	587,773	14,336
7664-38-2	Phosphoric acid	53,589	2	170,527	0	224,118	303,697	4,277
—	Cyanides	724	35,279	1,122	0	37,125	206,987	9,409
7664-93-9	Sulfuric acid	0	0	0	0	0	48,829	2,872
74-90-8	Hydrogen cyanide	0	0	0	0	0	586	147
	Subtotal for Acids/Bases	**2,650,175**	**1,385,082**	**586,403**	**0**	**4,621,660**	**25,714,669**	**84,035**
	All Other Chemicals	**10,094,351**	**264,707**	**61,066**	**0**	**10,420,124**	**13,751,693**	**34,903**
	Total	**12,744,526**	**1,649,789**	**647,469**	**84,361,203**	**99,402,987**	**154,691,035**	**80,652**

NPRI average releases and transfers of zinc and its compounds were twice those for TRI facilities in this subsector. This was primarily due to higher average off-site transfers, but on-site releases were also one and one-half times as large on average, due to larger average on-site land disposal. This was also true for the metals as a group (**Figure 7–2**).

Metals are present in the ores and scrap metals that are used as inputs to the basic steelmaking processes and acids and bases are used to clean feedstock and products. Metals comprise the majority of releases and transfers from both NPRI and TRI facilities in this subsector (**Figure 7–3**).

The average releases and transfers of metals per form reported by NPRI facilities were more than twice those for TRI facilities. TRI facilities report, on average, higher releases and transfers of acids and bases than do NPRI facilities in this subsector (**Figure 7–2**). TRI facilities reported 3.6 times the average per form of NPRI facilities. If the one large form for nitrate compounds is not included, the TRI average per form is still 1.7 times that for NPRI. Releases and transfers of other substances average about the same per form.

Figure 7–2 M 1997

NPRI and TRI Average Releases and Transfers per Form for Blast Furnace and Basic Steel Products (US SIC Code 331), by Chemical Group, 1997 (Single and Multiple SIC Codes)

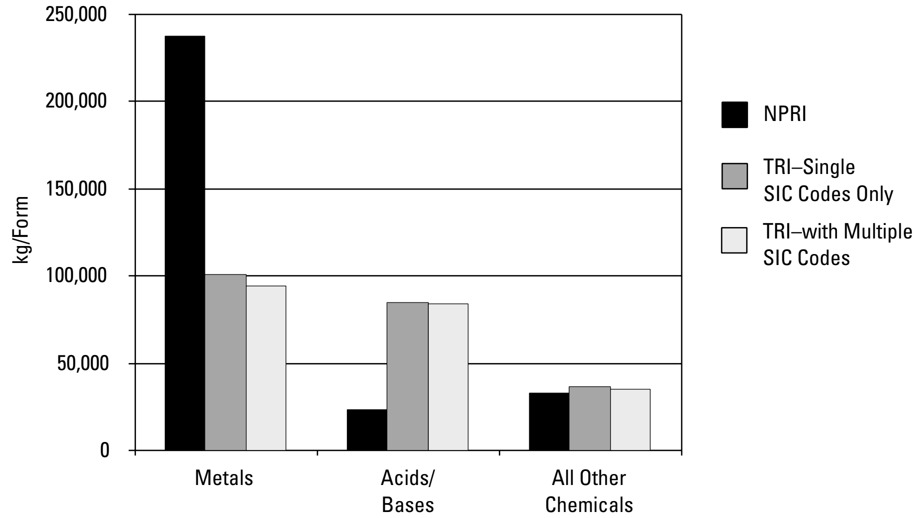


Figure 7–3 M 1997

Distribution of NPRI and TRI Total Releases and Transfers, Blast Furnace and Basic Steel Products (US SIC Code 331), by Chemical Group, 1997

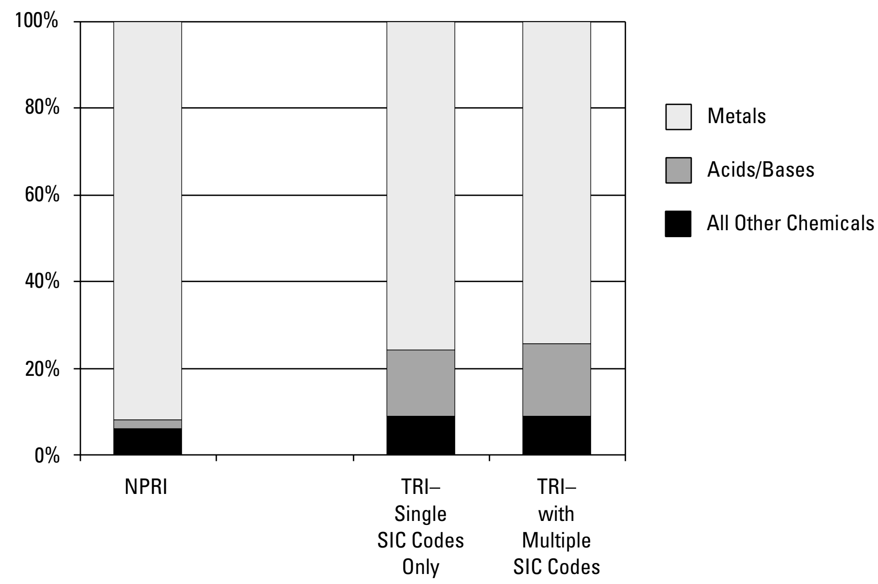


Table 7-10

M 1997

NPRI and TRI Releases and Transfers for Blast Furnace and Basic Steel Products (US SIC Code 331), 1995–1997

	NPRI				TRI*			
	1995	1997	Change 1995–1997		1995	1997	Change 1995–1997	
	Number	Number	Number	%	Number	Number	Number	%
Total Facilities	43	43	0	0.0	363	365	2	0.6
Total Forms	201	205	4	2.0	1,655	1,755	100	6.0
On-site Releases	**kg**	**%**	**kg**	**%**				
Total Air Emissions	1,641,019	1,500,475	-140,544	-8.6	6,924,451	5,842,909	-1,081,542	-15.6
Surface Water Discharges	858,780	597,703	-261,077	-30.4	9,747,350	18,060,754	8,313,404	85.3
Underground Injection	0	0	0	—	79,206	87,958	8,752	—
On-site Land Releases	6,472,122	4,785,227	-1,686,895	-26.1	22,290,285	28,395,088	6,104,803	27.4
Matched On-site Releases	**8,978,485**	**6,891,149**	**-2,087,336**	**-23.2**	**39,041,292**	**52,386,709**	**13,345,417**	**34.2**
Off-site Transfers								
Treatment (except metals)	151,376	49,315	-102,061	-67.4	3,283,073	12,430,168	9,147,095	278.6
Sewage/POTWs (except metals)	20,596	103,520	82,924	402.6	726,015	1,033,327	307,312	42.3
Disposal (except metals)	155,411	247,396	91,985	59.2	2,391,296	644,198	-1,747,098	-73.1
Treatment/Sewage/Disposal of Metals	13,355,792	23,706,819	10,351,027	77.5	32,864,109	82,497,536	49,633,427	151.0
Matched Off-site Transfers	**13,683,175**	**24,107,050**	**10,423,875**	**76.2**	**39,264,493**	**96,605,229**	**57,340,736**	**146.0**
Total Releases and Transfers	**22,661,660**	**30,998,199**	**8,336,539**	**36.8**	**78,305,785**	**148,991,938**	**70,686,153**	**90.3**

* TRI data for single SIC codes only.

Changes in Releases and Transfers for the Blast Furnace and Basic Steel Products Subsector, 1995–1997, and Projected Changes, 1997–1999

From 1995 to 1997, the blast furnace and basic steel products subsector reported substantial increases in total releases and transfers from essentially the same number of facilities. NPRI facilities reported a 37 percent increase due to a 78 percent increase in off-site transfers of metals. NPRI facilities reported decreases in on-site releases (nine percent reduction to air, 30 percent to water and 26 percent to on-site landfills). TRI facilities in this subsector, on the other hand, reported increases of 90 percent in total releases and transfers, including increases of more than 150 percent in off-site transfers of metals, 27 percent in on-site land disposal, and 85 percent in on-site releases to water. TRI facilities reported decreases in on-site air emissions (16 percent) and off-site transfers to disposal of nonmetals (73 percent—see **Table 7–10**).

Neither NPRI nor TRI facilities project increases of this magnitude to continue. Particularly, total releases and transfers of the substances that TRI facilities reported in this subsector for 1997 showed an increase of more than 40 percent in total releases and transfers from 1995 to 1997, with a projected increase of less than five percent from 1997 to 1999. Similarly, total releases and transfers of substances that NPRI facilities reported in this subsector for 1997 showed an increase of 33 percent, with a projected increase of six percent from 1997 to 1999 (**Figure 7–4** and **Table 7–11**).

Twenty-three facilities in the blast furnace and basic steel products subsector were among the 50 TRI facilities with the largest increases in total releases and transfers from 1995 to 1997. (**Table 5–42** lists the 50 facilities.) These 23 facilities reported increases of 67 million kg, which was 95 percent of the net increase reported by all TRI facilities in this subsector. As described above, these increases resulted primarily from larger production or from sending wastes to off-site land disposal that would previously have been sent to be recycled. The small projected increases may reflect the expectation of several of these facilities to switch back to off-site transfers to recycling in the future.

Nine facilities in the blast furnace and basic steel products subsector were among the 50 NPRI facilities with the largest increases in total releases and

Figure 7–4 M 1997

Percent Change in Total Releases and Transfers for Blast Furnace and Basic Steel Products (US SIC Code 331), NPRI and TRI, 1995–1997 and Projected 1997–1999

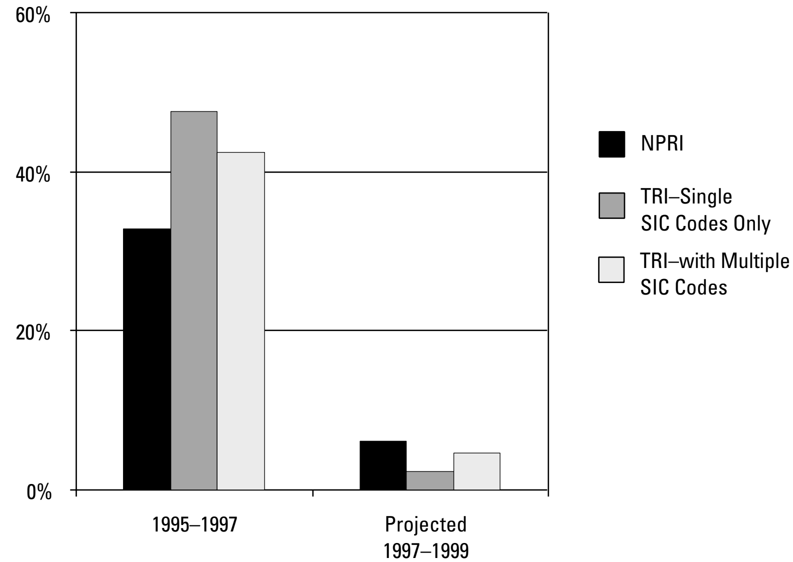


Table 7-11 M 1997

Change in Total Releases and Transfers for Blast Furnace and Basic Steel Products (US SIC Code 331), NPRI and TRI, 1995–1997 and Projected 1997–1999

	Total Releases and Transfers				
	1995* (kg)	1997 (kg)	1999 Projected (kg)	% Change 1995–1997	Projected % Change 1997–1999
NPRI	23,339,605	30,998,199	32,875,945	32.8	6.1
TRI—Single SIC Codes Only**	92,714,253	136,746,680	140,039,132	47.5	2.4
TRI—Single and Multiple SIC Codes**	99,905,438	142,249,273	148,832,874	42.4	4.6

* Data for same facility and chemical as reported for 1997.
** Data from Section 8 of TRI Form R.

transfers from 1995 to 1997. (**Table 5–40** lists the 50 facilities.) These nine facilities reported increases of 9.2 million kg in total releases and transfers from 1995 to 1997, or more than the net increase of 8.3 million kg from all NPRI facilities in this subsector. As described above, these increases resulted from new equipment start-up and favorable waste disposal costs. The small projected increases may reflect expectations that equipment problems have been resolved.

7.9.2 Primary Nonferrous Metals (US SIC Code 333)

Primary smelters and refiners of nonferrous metals represented 18 percent of NPRI primary metals facilities and just three percent of those in TRI. This subsector reported the second-largest total releases and transfers of all subsectors in the primary metals industry: 21 percent for NPRI and 27 percent for TRI (see **Table 7–5**). While NPRI and TRI facilities in this subsector submitted about the same number of forms (an average of five per facility), average releases and transfers per form were substantially higher for TRI facilities, unlike basic steel products manufacturers and all industries as a whole. TRI manufacturers of primary nonferrous metals reported more than five times the average per form for releases and for total releases and transfers and more than seven times the average per form for transfers (**Table 7–12**).

Table 7-12

M 1997

NPRI and TRI Releases and Transfers for Primary Nonferrous Metals (US SIC Code 333), 1997

	NPRI		TRI Single SIC Codes		TRI Total Including Multiple SIC Code Forms	
	Number		Number		Number	
Facilities	30		54		61	
Forms	157		235		344	
	kg	% of Total	kg	% of Total	kg	% of Total
Total Air Emissions	7,908,169	80.3	30,879,726	35.9	34,874,313	30.5
Surface Water Discharges	67,329	0.7	456,488	0.5	958,031	0.8
Underground Injection	0	0.0	81,949	0.1	81,949	0.1
On-site Land Releases	744,535	7.6	50,693,303	58.9	60,194,062	52.7
Matched On-site Releases	**8,722,657**	**88.6**	**82,111,466**	**95.4**	**96,108,355**	**84.2**
Treatment (except metals)	0	0.0	34,552	0.0	83,910	0.1
Sewage/POTWs (except metals)	0	0.0	0	0.0	0	0.0
Disposal (except metals)	0	0.0	0	0.0	2,905	0.0
Treatment/Sewage/Disposal of Metals	1,125,165	11.4	3,920,981	4.6	17,992,181	15.8
Matched Off-site Transfers	**1,125,165**	**11.4**	**3,955,533**	**4.6**	**18,078,996**	**15.8**
Matched Releases and Transfers	**9,847,822**	**100.0**	**86,066,999**	**100.0**	**114,187,351**	**100.0**
	Number		Number		Number	
Average Forms/Facility	5.2		4.4		5.6	
	kg		kg		kg	
Average Releases						
per Facility	290,755		1,520,583		1,575,547	
per Form	55,558		349,410		279,385	
Average Transfers						
per Facility	37,506		73,251		296,377	
per Form	7,167		16,832		52,555	
Average Releases and Transfers						
per Facility	328,261		1,593,833		1,871,924	
per Form	62,725		366,243		331,940	

Releases and Transfers from the Primary Nonferrous Metals Subsector

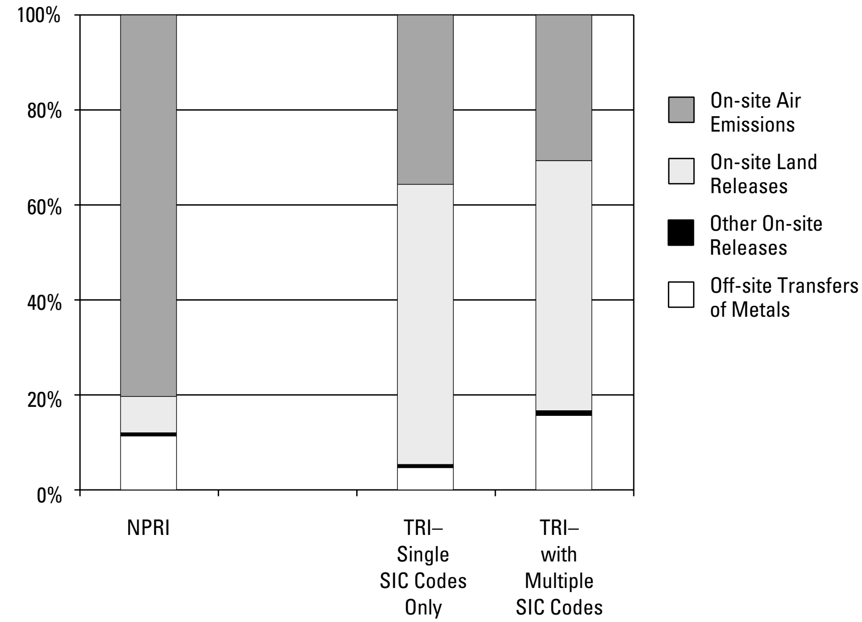
In contrast to the basic steel products manufacturers, the majority of the total in the nonferrous subsector consisted of on-site releases. Releases for NPRI nonferrous smelters and refiners represented 89 percent of their total releases and transfers; releases for the equivalent TRI group represented 95 percent. For NPRI facilities, air emissions accounted for the proportionately large on-site releases, amounting to 80 percent of total releases and transfers (**Figure 7–5** and **Table 7–12**). For TRI facilities, on-site releases to land were the largest category, accounting for over 50 percent of total releases and transfers. When on-site releases to land and off-site transfers of metals are considered together (i.e., as a form of disposal, whether on- or off-site), total disposal for this subsector was 19 percent for NPRI facilities and 64 percent for TRI facilities.

Chemicals from the Primary Nonferrous Metals Subsector

Sulfuric acid was the subject of the largest total releases and transfers by NPRI facilities in this subsector. For TRI facilities, zinc and its compounds accounted for the largest percentage of total releases and transfers. More than 5.9 million kg of total releases and transfers of acids and bases were report-

Figure 7–5 M 1997

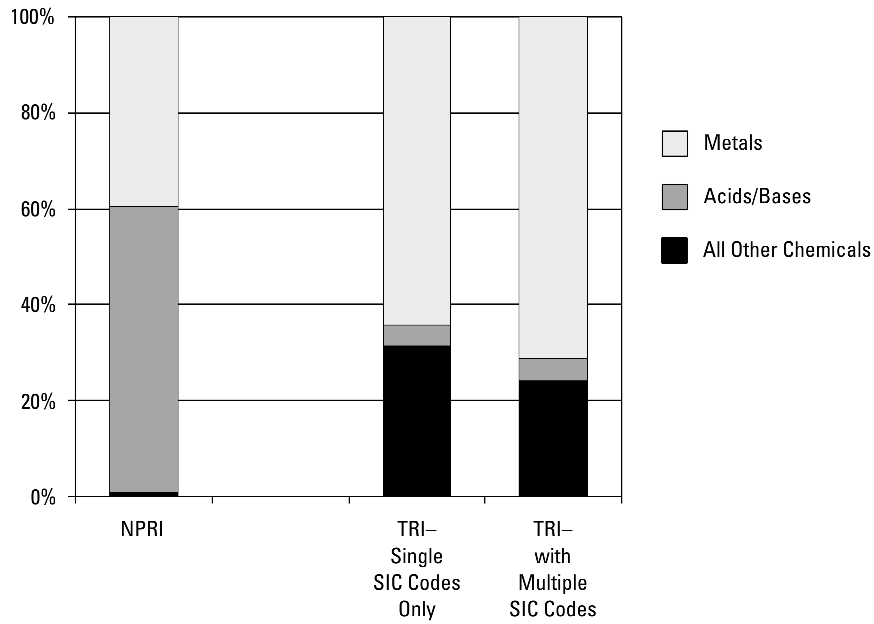
NPRI and TRI Releases and Transfers, Primary Nonferrous Metals (US SIC Code 333), 1997



➤ Other Off-site Transfers less than one percent for NPRI and TRI.

Figure 7–6 M 1997

NPRI and TRI Total Releases and Transfers, Primary Nonferrous Metals (US SIC Code 333), by Chemical Group, 1997



ed to NPRI, representing 60 percent of the total (**Figure 7–6** and **Table 7–13**). One NPRI facility (the Copper Cliff Smelter Complex of Inco Ltd.) reported 3.9 million kg of sulfuric acid releases to air, accounting for 95 percent of the subsector's total releases and transfers of this chemical. This facility also reported an increase of 1.1 million kg from 1995 to 1996 due to equipment start-up (see **Section 7.7.1**), but small increases in 1997.

On the other hand, TRI facilities reported about five million kg of acids and bases, but total releases and transfers of metals represented two-thirds (64 percent for single SIC codes and 71 percent including multiple SIC codes) of the TRI total releases and transfers for this subsector (**Tables 7–14** and **7–15** and **Figure 7–6**).

As mentioned above, overall TRI facilities reported much higher average releases and transfers per form than did NPRI facilities in this subsector. This was true for metals, where TRI facilities reported an average of total releases and transfers per form that was 10 times that of NPRI facilities. The difference was even greater for chemicals other than metals, acids and bases. However, for acids and bases, the NPRI facilities' per form average was about two and one-half times higher than that of TRI facilities because of high air emissions of sulfuric acid (**Figure 7–7** and **Tables 7–13** through **7–15**).

Table 7-13

M 1 9 9 7

NPRI Releases and Transfers for Primary Nonferrous Metals (US SIC Code 333), 1997

CAS Number	Chemical	Number of Forms	Total Air Emissions (kg)	Surface Water Discharges (kg)	Underground Injection (kg)	On-site Land Releases (kg)	Total Releases (kg)
—	Lead (and its compounds)	11	530,533	1,534	0	409	533,081
—	Zinc (and its compounds)	13	610,331	26,139	0	320	636,799
—	Chromium (and its compounds)	10	6,169	719	0	649,004	655,934
—	Copper (and its compounds)	19	389,611	4,541	0	19,483	413,635
—	Nickel (and its compounds)	10	221,325	19,885	0	24,700	265,952
—	Arsenic (and its compounds)	10	146,593	1,535	0	0	148,843
—	Cadmium (and its compounds)	6	39,714	828	0	0	40,542
—	Manganese (and its compounds)	16	385	6,194	0	40,001	46,622
—	Selenium (and its compounds)	4	4,629	3,989	0	0	9,280
—	Cobalt (and its compounds)	4	3,135	1,030	0	10,565	14,730
—	Antimony (and its compounds)	4	5,578	600	0	0	6,178
—	Mercury (and its compounds)	1	0	0	0	0	6
—	Silver (and its compounds)	5	1,239	172	0	52	1,463
7440-62-2	Vanadium (fume or dust)	1	87	163	0	1	251
	Subtotal for Metals	**114**	**1,959,329**	**67,329**	**0**	**744,535**	**2,773,316**
7664-93-9	Sulfuric acid	10	4,106,213	0	0	0	4,106,213
7664-39-3	Hydrogen fluoride	12	1,629,078	0	0	0	1,629,079
7647-01-0	Hydrochloric acid	6	128,304	0	0	0	128,304
—	Cyanides	1	0	0	0	0	0
—	Nitric acid and nitrate compounds	1	0	0	0	0	0
	Subtotal for Acids/Bases	**30**	**5,863,595**	**0**	**0**	**0**	**5,863,596**
	All Other Chemicals	**13**	**85,245**	**0**	**0**	**0**	**85,745**
	Total	**157**	**7,908,169**	**67,329**	**0**	**744,535**	**8,722,657**

CAS Number	Chemical	Treatment (except metals) (kg)	Sewage/POTWs (except metals) (kg)	Disposal (except metals) (kg)	Treatment/ Sewage/Disposal of Metals (kg)	Total Transfers (kg)	Total Releases and Transfers (kg)	Average Total Releases and Transfers per Form (kg/form)
—	Lead (and its compounds)	0	0	0	750,846	750,846	1,283,927	116,721
—	Zinc (and its compounds)	0	0	0	30,555	30,555	667,354	51,335
—	Chromium (and its compounds)	0	0	0	1,806	1,806	657,740	65,774
—	Copper (and its compounds)	0	0	0	51,223	51,223	464,858	24,466
—	Nickel (and its compounds)	0	0	0	31,162	31,162	297,114	29,711
—	Arsenic (and its compounds)	0	0	0	48,630	48,630	197,473	19,747
—	Cadmium (and its compounds)	0	0	0	120,136	120,136	160,678	26,780
—	Manganese (and its compounds)	0	0	0	50,136	50,136	96,758	6,047
—	Selenium (and its compounds)	0	0	0	30,344	30,344	39,624	9,906
—	Cobalt (and its compounds)	0	0	0	2,655	2,655	17,385	4,346
—	Antimony (and its compounds)	0	0	0	4,276	4,276	10,454	2,614
—	Mercury (and its compounds)	0	0	0	3,301	3,301	3,307	3,307
—	Silver (and its compounds)	0	0	0	95	95	1,558	312
7440-62-2	Vanadium (fume or dust)	0	0	0	0	0	251	251
	Subtotal for Metals	**0**	**0**	**0**	**1,125,165**	**1,125,165**	**3,898,481**	**34,197**
7664-93-9	Sulfuric acid	0	0	0	0	0	4,106,213	410,621
7664-39-3	Hydrogen fluoride	0	0	0	0	0	1,629,079	135,757
7647-01-0	Hydrochloric acid	0	0	0	0	0	128,304	21,384
—	Cyanides	0	0	0	0	0	0	0
—	Nitric acid and nitrate compounds	0	0	0	0	0	0	0
	Subtotal for Acids/Bases	**0**	**0**	**0**	**0**	**0**	**5,863,596**	**195,453**
	All Other Chemicals	**0**	**0**	**0**	**0**	**0**	**85,745**	**6,596**
	Total	**0**	**0**	**0**	**1,125,165**	**1,125,165**	**9,847,822**	**62,725**

Table 7-14

M 1997

TRI Releases and Transfers for Primary Nonferrous Metals (US SIC Code 333), 1997 (Single SIC Codes Only)

CAS Number	Chemical	Number of Forms	Total Air Emissions (kg)	Surface Water Discharges (kg)	Underground Injection (kg)	On-site Land Releases (kg)	Total Releases (kg)
—	Zinc (and its compounds)	16	118,809	3,233	83	29,101,241	29,223,366
—	Copper (and its compounds)	31	250,645	4,594	37,723	10,009,131	10,302,093
—	Lead (and its compounds)	17	195,515	1,576	230	5,990,953	6,188,274
—	Arsenic (and its compounds)	11	26,614	359	34,467	2,300,832	2,362,272
—	Nickel (and its compounds)	13	36,214	104	1,609	1,488,284	1,526,211
—	Manganese (and its compounds)	18	4,711	2,739	0	1,011,519	1,018,969
—	Antimony (and its compounds)	9	4,547	436	3,950	230,223	239,156
—	Chromium (and its compounds)	13	976	147	0	243,487	244,610
—	Cobalt (and its compounds)	4	278	124	0	126,208	126,610
—	Cadmium (and its compounds)	9	13,694	320	0	80,301	94,315
—	Selenium (and its compounds)	3	14,446	113	1,546	82,993	99,098
7429-90-5	Aluminum (fume or dust)	6	25,159	251	0	5	25,415
—	Silver (and its compounds)	7	1,114	130	71	14,490	15,805
7440-62-2	Vanadium (fume or dust)	1	0	0	0	0	0
	Subtotal for Metals	**158**	**692,722**	**14,126**	**79,679**	**50,679,667**	**51,466,194**
7647-01-0	Hydrochloric acid	10	1,504,525	0	0	0	1,504,525
7664-39-3	Hydrogen fluoride	15	1,416,392	0	0	0	1,416,392
—	Nitric acid and nitrate compounds	9	33,154	437,755	2	7,710	478,621
7664-93-9	Sulfuric acid	10	305,470	0	0	0	305,470
—	Cyanides	2	0	0	0	0	0
7664-38-2	Phosphoric acid	1	0	0	0	0	0
	Subtotal for Acids/Bases	**47**	**3,259,541**	**437,755**	**2**	**7,710**	**3,705,008**
7782-50-5	**Chlorine**	**16**	**26,837,252**	**2,317**	**0**	**0**	**26,839,569**
	All Other Chemicals	**14**	**90,211**	**2,290**	**2,268**	**5,926**	**100,695**
	Total	**235**	**30,879,726**	**456,488**	**81,949**	**50,693,303**	**82,111,466**

CAS Number	Chemical	Treatment (except metals) (kg)	Sewage/POTWs (except metals) (kg)	Disposal (except metals) (kg)	Treatment/ Sewage/Disposal of Metals (kg)	Total Transfers (kg)	Total Releases and Transfers (kg)	Average Total Releases and Transfers per Form (kg/form)
—	Zinc (and its compounds)	0	0	0	1,235,080	1,235,080	30,458,446	1,903,653
—	Copper (and its compounds)	0	0	0	340,897	340,897	10,642,990	343,322
—	Lead (and its compounds)	0	0	0	1,101,434	1,101,434	7,289,708	428,806
—	Arsenic (and its compounds)	0	0	0	667,337	667,337	3,029,609	275,419
—	Nickel (and its compounds)	0	0	0	4,932	4,932	1,531,143	117,780
—	Manganese (and its compounds)	0	0	0	15,073	15,073	1,034,042	57,447
—	Antimony (and its compounds)	0	0	0	479,367	479,367	718,523	79,836
—	Chromium (and its compounds)	0	0	0	1,511	1,511	246,121	18,932
—	Cobalt (and its compounds)	0	0	0	113	113	126,723	31,681
—	Cadmium (and its compounds)	0	0	0	21,370	21,370	115,685	12,854
—	Selenium (and its compounds)	0	0	0	356	356	99,454	33,151
7429-90-5	Aluminum (fume or dust)	0	0	0	44,317	44,317	69,732	11,622
—	Silver (and its compounds)	0	0	0	9,194	9,194	24,999	3,571
7440-62-2	Vanadium (fume or dust)	0	0	0	0	0	0	0
	Subtotal for Metals	**0**	**0**	**0**	**3,920,981**	**3,920,981**	**55,387,175**	**350,552**
7647-01-0	Hydrochloric acid	0	0	0	0	0	1,504,525	150,453
7664-39-3	Hydrogen fluoride	0	0	0	0	0	1,416,392	94,426
—	Nitric acid and nitrate compounds	11,066	0	0	0	11,066	489,687	54,410
7664-93-9	Sulfuric acid	0	0	0	0	0	305,470	30,547
—	Cyanides	23,299	0	0	0	23,299	23,299	11,650
7664-38-2	Phosphoric acid	0	0	0	0	0	0	0
	Subtotal for Acids/Bases	**34,365**	**0**	**0**	**0**	**34,365**	**3,739,373**	**79,561**
7782-50-5	**Chlorine**	**0**	**0**	**0**	**0**	**0**	**26,839,569**	**1,677,473**
	All Other Chemicals	**187**	**0**	**0**	**0**	**187**	**100,882**	**7,206**
	Total	**34,552**	**0**	**0**	**3,920,981**	**3,955,533**	**86,066,999**	**366,243**

Table 7-15

M 1997

TRI Releases and Transfers for Primary Nonferrous Metals (US SIC Code 333), 1997 (Single and Multiple SIC Codes)

CAS Number	Chemical	Number of Forms	Total Air Emissions (kg)	Surface Water Discharges (kg)	Underground Injection (kg)	On-site Land Releases (kg)	Total Releases (kg)
—	Zinc (and its compounds)	20	370,507	3,408	83	30,504,149	30,878,147
—	Copper (and its compounds)	43	2,262,312	4,804	37,723	16,956,984	19,261,823
—	Lead (and its compounds)	21	210,763	1,626	230	6,374,872	6,587,491
—	Arsenic (and its compounds)	13	30,997	359	34,467	2,585,085	2,650,908
—	Manganese (and its compounds)	27	6,802	2,865	0	1,012,012	1,021,679
—	Nickel (and its compounds)	20	37,677	260	1,609	1,514,027	1,553,573
—	Antimony (and its compounds)	11	5,448	436	3,950	385,604	395,438
—	Chromium (and its compounds)	22	1,923	379	0	429,479	431,781
—	Cadmium (and its compounds)	12	15,559	329	0	129,089	144,977
7429-90-5	Aluminum (fume or dust)	9	29,835	251	0	23,588	53,674
—	Cobalt (and its compounds)	6	594	124	0	153,426	154,144
—	Selenium (and its compounds)	6	16,048	113	1,546	94,809	112,516
—	Silver (and its compounds)	8	1,341	130	71	17,302	18,844
—	Mercury (and its compounds)	1	68	0	0	0	68
7440-62-2	Vanadium (fume or dust)	1	0	0	0	0	0
	Subtotal for Metals	**220**	**2,989,874**	**15,084**	**79,679**	**60,180,426**	**63,265,063**
7664-39-3	Hydrogen fluoride	25	2,128,778	34	0	0	2,128,812
7647-01-0	Hydrochloric acid	14	2,002,552	0	0	0	2,002,552
—	Nitric acid and nitrate compounds	12	36,492	933,187	2	7,710	977,391
7664-93-9	Sulfuric acid	11	379,846	0	0	0	379,846
—	Cyanides	3	0	544	0	0	544
7664-38-2	Phosphoric acid	2	0	499	0	0	499
	Subtotal for Acids/Bases	**67**	**4,547,668**	**934,264**	**2**	**7,710**	**5,489,644**
7782-50-5	**Chlorine**	**26**	**26,916,049**	**2,670**	**0**	**0**	**26,918,719**
	All Other Chemicals	**31**	**420,722**	**6,013**	**2,268**	**5,926**	**434,929**
	Total	**344**	**34,874,313**	**958,031**	**81,949**	**60,194,062**	**96,108,355**

CAS Number	Chemical	Treatment (except metals) (kg)	Sewage/POTWs (except metals) (kg)	Disposal (except metals) (kg)	Treatment/ Sewage/Disposal of Metals (kg)	Total Transfers (kg)	Total Releases and Transfers (kg)	Average Total Releases and Transfers per Form (kg/form)
—	Zinc (and its compounds)	0	0	0	11,787,687	11,787,687	42,665,834	2,133,292
—	Copper (and its compounds)	0	0	0	1,393,728	1,393,728	20,655,551	480,362
—	Lead (and its compounds)	0	0	0	1,474,429	1,474,429	8,061,920	383,901
—	Arsenic (and its compounds)	0	0	0	667,342	667,342	3,318,250	255,250
—	Manganese (and its compounds)	0	0	0	1,224,143	1,224,143	2,245,822	83,179
—	Nickel (and its compounds)	0	0	0	365,008	365,008	1,918,581	95,929
—	Antimony (and its compounds)	0	0	0	479,367	479,367	874,805	79,528
—	Chromium (and its compounds)	0	0	0	157,718	157,718	589,499	26,795
—	Cadmium (and its compounds)	0	0	0	270,811	270,811	415,788	34,649
7429-90-5	Aluminum (fume or dust)	0	0	0	151,346	151,346	205,020	22,780
—	Cobalt (and its compounds)	0	0	0	113	113	154,257	25,710
—	Selenium (and its compounds)	0	0	0	2,678	2,678	115,194	19,199
—	Silver (and its compounds)	0	0	0	9,194	9,194	28,038	3,505
—	Mercury (and its compounds)	0	0	0	8,617	8,617	8,685	8,685
7440-62-2	Vanadium (fume or dust)	0	0	0	0	0	0	0
	Subtotal for Metals	**0**	**0**	**0**	**17,992,181**	**17,992,181**	**81,257,244**	**369,351**
7664-39-3	Hydrogen fluoride	0	0	0	0	0	2,128,812	85,152
7647-01-0	Hydrochloric acid	0	0	0	0	0	2,002,552	143,039
—	Nitric acid and nitrate compounds	11,066	0	161	0	11,227	988,618	82,385
7664-93-9	Sulfuric acid	0	0	0	0	0	379,846	34,531
—	Cyanides	35,997	0	340	0	36,337	36,881	12,294
7664-38-2	Phosphoric acid	0	0	0	0	0	499	250
	Subtotal for Acids/Bases	**47,063**	**0**	**501**	**0**	**47,564**	**5,537,208**	**82,645**
7782-50-5	**Chlorine**	**0**	**0**	**0**	**0**	**0**	**26,918,719**	**1,035,335**
	All Other Chemicals	**36,847**	**0**	**2,404**	**0**	**39,251**	**474,180**	**15,296**
	Total	**83,910**	**0**	**2,905**	**17,992,181**	**18,078,996**	**114,187,351**	**331,940**

Figure 7–7

M 1997

NPRI and TRI Average Releases and Transfers per Form for Primary Nonferrous Metals (US SIC Code 333), by Chemical Group, 1997 (Single and Multiple SIC Codes)

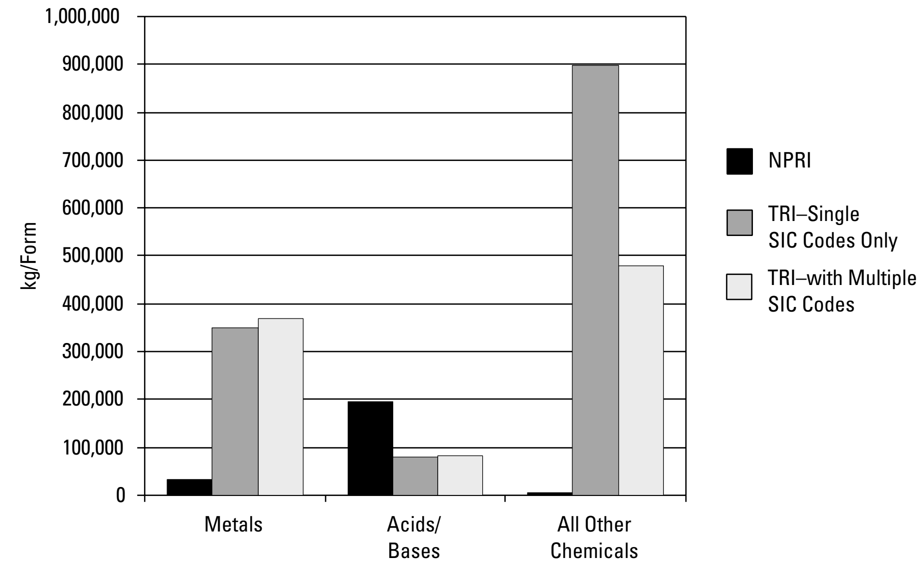


Table 7-16

M 1997

NPRI and TRI Releases and Transfers for Primary Nonferrous Metals (US SIC Code 333), 1995–1997

	NPRI				TRI*			
	1995	1997	Change 1995–1997		1995	1997	Change 1995–1997	
	Number	Number	Number	%	Number	Number	Number	%
Total Facilities	33	30	-3	-9.1	48	54	6	12.5
Total Forms	157	157	0	0.0	225	235	10	4.4
On-site Releases	**kg**	**kg**	**kg**	**%**	**kg**	**kg**	**kg**	**%**
Total Air Emissions	6,823,008	7,908,169	1,085,161	15.9	31,925,251	30,879,726	-1,045,525	-3.3
Surface Water Discharges	71,169	67,329	-3,840	-5.4	12,048	456,488	444,440	3,688.9
Underground Injection	0	0	0	—	79,753	81,949	2,196	2.8
On-site Land Releases	49,043	744,535	695,492	1,418.1	52,962,808	50,693,303	-2,269,505	-4.3
Matched On-site Releases	**6,950,197**	**8,722,657**	**1,772,460**	**25.5**	**84,979,860**	**82,111,466**	**-2,868,394**	**-3.4**
Off-site Transfers								
Treatment (except metals)	11,800	0	-11,800	-100.0	20,079	34,552	14,473	72.1
Sewage/POTWs (except metals)	70,990	0	-70,990	-100.0	0	0	0	—
Disposal (except metals)	30,000	0	-30,000	-100.0	31,301	0	-31,301	-100.0
Treatment/Sewage/Disposal of Metals	123,157	1,125,165	1,002,008	813.6	4,417,331	3,920,981	-496,350	-11.2
Matched Off-site Transfers	**235,947**	**1,125,165**	**889,218**	**376.9**	**4,468,711**	**3,955,533**	**-513,178**	**-11.5**
Total Releases and Transfers	**7,186,144**	**9,847,822**	**2,661,678**	**37.0**	**89,448,571**	**86,066,999**	**-3,381,572**	**-3.8**

* TRI data for single SIC codes only.

Changes in Releases and Transfers for the Primary Nonferrous Metals Subsector, 1995–1997, and Projected Changes, 1997–1999

From 1995 to 1997, NPRI facilities in the primary nonferrous metals subsector reported substantial increases in both releases and transfers: 26 percent increase for on-site releases (largely due to an increase in releases of sulfuric acid) and a fourfold increase in off-site transfers (all of the latter was due to increases in off-site transfers of metals). Much of the fourfold increase was due to transfers of wastes stored on-site to off-site landfills at two facilities, Noranda's Brunswick Smelting Division facility in Belledune, New Brunswick, with an increase of 484,370 kg, and Metalex Products Ltd. in Richmond, British Columbia, with an increase of 467,400 kg (see **Section 7.7.1**, above). TRI facilities in this subsector, however, reported decreases of about three percent in releases and 12 percent in transfers, despite more facilities reporting in 1997 than in 1995. The TRI decreases were in air emissions, on-site land releases and off-site transfers of metals (**Table 7–16**).

Both NPRI and TRI facilities projected decreases from 1997 to 1999. While total releases and transfers of the substances that NPRI facilities reported in this subsector for 1997 showed an increase of 43 percent since 1995, the facilities projected a decrease of five percent from 1997 to 1999 for these same substances. For substances reported by TRI facilities in this subsector in 1997, small changes were reported from 1995 to 1997 and projected through 1999. For single SIC code reporters in 333, TRI facilities reported a two percent decrease from 1995 to 1997 and projected a six percent decrease from 1997 to 1999. When multiple SIC codes are included, the reported increase from 1995 to 1997 was five percent and the projected decrease from 1997 to 1999 was nine percent (**Figure 7–8** and **Table 7–17**).

Four facilities (two reporting single SIC codes and two reporting multiple SIC codes) in the primary nonferrous metals subsector were among the 50 TRI facilities with the largest increases in total releases and transfers from 1995 to 1997. (**Table 5–42** lists the 50 facilities.) These four facilities reported increases of 14.5 million kg. As described above, these increases resulted primarily from increased production.

Five facilities in the primary nonferrous metals subsector were among the 50 NPRI facilities with the largest increases in total releases and transfers from 1995 to 1997. (**Table 5–40** lists the 50 facilities.) These five facilities reported increases of 3.0 million kg in total releases and transfers from 1995 to 1997, or more than the net increase of 2.7 million kg from all NPRI facilities in this subsector. As described above, these increases resulted from new equipment start-up.

Figure 7–8 M 1997

Percent Change in Total Releases and Transfers for Primary Nonferrous Metals (US SIC Code 333), NPRI and TRI, 1995–1997 and Projected 1997–1999

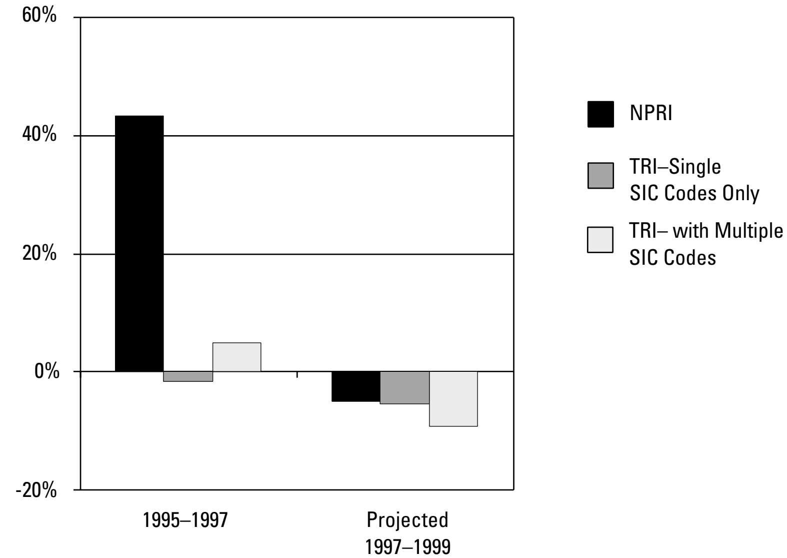


Table 7-17 M 1997

Change in Total Releases and Transfers for Primary Nonferrous Metals (US SIC Code 333), NPRI and TRI, 1995–1997 and Projected 1997–1999

	Total Releases and Transfers				
	1995* (kg)	1997 (kg)	1999 Projected (kg)	% Change 1995–1997	Projected % Change 1997–1999
NPRI	6,865,411	9,847,822	9,345,494	43.4	-5.1
TRI—Single SIC codes only**	86,433,880	85,092,318	80,417,520	-1.6	-5.5
TRI—Single and Multiple SIC codes**	105,385,006	110,501,340	100,196,958	4.9	-9.3

* Data for same facility and chemical as reported for 1997.
** Data from Section 8 of TRI Form R.

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