Recycled Metals

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Successful recycling depends, in large part, upon three conditions:

- **a source of recyclable material;**
- **an infrastructure to collect the recyclable material; and**
- **markets for the recyclable material.**

Metals possess a unique characteristic; when recycled, they retain their original elemental properties. Metal recycling is, in fact, the use and re-use of valuable raw materials. The value of metals and metal recycling is not a recent discovery. Metal recycling is the most mature and highly developed of all recycling industries.

Because of their intrinsic high value, metals are not discarded as waste. Metal recycling is an economic activity in which products, whose designed use has been served, now become raw materials in the recycling chain. Metal recycling embodies the spirit of sustainable development for metallurgical industries.

Canadian Scrap Metal Recycling Industry

Canada has a well-established, effective metal recycling industry. The Canadian scrap metal recycling industry comprises over 1000 companies and provides direct employment to approximately 20 000 persons. This employment figure does not include employees of ingot-makers, foundries, steel mills, smelters or refineries. While ingot-makers, foundries, smelters and refiners certainly form an essential part of the total recycling industry, many consider themselves to be wholly integrated. It may be difficult to differentiate clearly between personnel who are strictly involved in scrap recycling operations and those considered to be in manufacturing. Employment estimates indicate that an additional 60 000 jobs may be directly or indirectly involved in the Canadian metal recycling industry. Collectively, Canadian recycling companies handle in excess of 11 Mt of metals annually valued at more than C$3.0 billion.

Canadian Developments

The Royal Bank of Canada allocated $125 million to finance the growth of small- and medium-sized recycling businesses in Canada in an effort to provide risk capital for knowledge-based enterprises and export-oriented companies. The Royal Bank Capital Corporation is charged with investing the new funds in emerging growth companies with sales of $5 million or more.

The Quebec provincial government initiated a program to assist the development of the recycling industry. The aid program includes a financial assistance package totalling $9.5 million with $6.4 million in the form of loan guarantees and $3.1 million in grants. The program is administered under the Quebec Ministry of Industry, Science and Technology. The recycling industry development program will fund the start-up of new businesses and the expansion of existing operations.

Hydro-Québec, the Quebec government-owned electric utility company, developed an efficient technology through its subsidiary, Laboratoires des Technologies Électrochimiques et des Électrotechnologies d'Hydro-Québec (LTEE), to recover aluminum from aluminum dross. There can be up to 75% aluminum content in aluminum dross which, because of residual elements, is classified as a hazardous waste. A graphite electrode DC (direct current) electric arc rotary furnace separates the oxide from the aluminum. The molten aluminum and the residues can be tapped sequentially from the furnace. The recovery process has the advantage that it does not require salt additions and that the solid residues generated are not considered to be environmentally hazardous. Recyclage d'Aluminium de Québec, Canada's largest dross treatment company, reached

an agreement to be LTEE's first licensed process facility for the new dross technology.

Phillip Environmental Ltd., an Ontario-based waste management company, acquired I. Waxman & Sons Ltd. of Hamilton, Ontario. The new enterprise, Waxman Resources Ltd., began a joint venture with B.F. Goodrich Co. to process plastic residue generated from wire chopping lines. The technology, developed by Goodrich, separates the residue into vinyl, polyethylene, nylon and rubber fractions. Phillip Environmental Ltd. also acquired the assets of both Recyclage Côte Nord Inc. and Recyclage d'Aluminium de Québec, companies specializing in recycling aluminum dross generated from primary aluminum smelters.

Environment Canada, the U.S. Environmental Protection Agency, the International Lead-Zinc Research Organization and the Greater Vancouver Regional District jointly funded a study to investigate the behaviour of metals contained in municipal wastes when burned in a municipal solid waste incinerator. The study was conducted at the Burnaby facility in British Columbia. The study concluded that the inadvertent disposal of lead-acid batteries into an incinerator has no effect on air emissions. The lead contained in spent consumer products such as batteries or electronic components accumulated in the grate siftings. The lead components of these siftings could subsequently be reclaimed. The study also investigated the circulation of cadmium in the incineration system and found increased cadmium levels in boiler hopper and air pollution control systems. The increased cadmium levels were, however, present in relatively non-bioavailable forms that have minimal environmental consequences.

INTERNATIONAL DEVELOPMENTS

Steel

The European Commission contracted a study to investigate the sharp increase in European Union scrap steel prices in 1994. The European steel mills that consume scrap argued that if the price increases were the result of structural market shortages, export restrictions on steel scrap would have to be instituted. The results indicated, however, that the price increases were a natural consequence of higher demand for scrap following the economic recovery in the United States and the Far East.

U.S. automobile producers Chrysler, Ford and General Motors jointly operate a Vehicle Recycling Development Centre in efforts to find new ways of improving the recyclability of cars. The goals include creating new dismantling technologies and promoting the use of recyclable materials in new cars. The facility is located in Highland Park, Michigan.

BMW, Fiat and Renault car-makers signed a joint agreement to develop a European automobile recycling network. The new "recycling accord" will allow each manufacturer to establish an automobile recycling network in its home market using vehicles from all three manufacturers. The recycling infrastructure is expected to boost recycling rates to 85% by the year 2000 and to 95% by the year 2015. It is generally agreed that the current material recovery rate from automobiles is 75%.

Mercedes-Benz of Germany signed an agreement with metal recycler Kloeckner and Co. to ensure the environmentally sound recycling of used automobiles. The agreement will cover the take-back, recycling and disposal of residuals of used cars within the Mercedes group. At the same time, auto manufacturer "Seat" of Spain announced a joint-venture partnership with recycling companies to recycle used automobiles under a program similar to Mercedes-Benz's.

Japan annually recycles more than 5 million scrap vehicles. Scrap vehicles are traditionally purchased from vehicle owners for the value of the recoverable metal. The Japanese Automobile Manufacturers Association now wishes to impose a fee upon vehicle owners to offset the anticipated increased cost of recycling. Recycling costs are anticipated to rise when 1996 regulations will increase the disposal costs of automobile shredder residues.

Aluminum

Alcan Rolled Products Co. of Oswego, New York, is expanding its Oswego Works aluminum can recycling operation. The expanded facility, Recycle 11, is expected to triple the plant's aluminum recycling capacity to 6 billion used beverage cans per year by April 1995.

Reynolds Aluminum Recycling Co. began operation of a new recycling plant capable of processing 31 000 t/y of used aluminum beverage cans. The new plant at Alsip, Illinois, replaces an older Reynolds plant in Maywood, Illinois. Reynolds Aluminum Recycling Co. is part of the recycling division of Reynolds Metals Company.

Reynolds Metals Company commenced operations at its new Gum Springs, Arkansas plant, which is designed to recycle spent potliners. These potliners are a by-product of primary aluminum production and are designated as hazardous waste. The potliners are thermally treated, producing a non-hazardous ash for use in refractory and road erosion control processes. The new operation, with a capacity of 180 000 t/y, would be capable of treating all potliners generated by U.S. aluminum smelters.

Imco Recycling Inc. patented a process to produce by-product fertilizer rather than the typical salt cake

residue which must be sent for disposal. The new process uses 100% potash as a fluxing agent generating a potash/aluminum oxide by-product. The aluminum contained in the by-product is recoverable with the resultant production of a potassium-bearing granular fertilizer.

Lead

Metaleurop S.A. will install new "Sirosmelt-designed" smelting technology in its Weser Blei smelter in Nordenham, Germany, to replace its traditional lead shaft furnace. The new technology will reduce the company's primary smelting capacity but is expected to increase its overall secondary lead production. The Sirosmelt technology, while reducing capacity at Nordenham from 120 000 t/y to 90 000 t/y, will allow the smelter to process up to 100% secondary materials as well as all types of concentrates. The new plant is expected to come on stream by late 1995.

Rheinische Zinkgesellschaft, a German lead producer, will increase production of secondary lead at its Berzelius-Stolberg plant located in northeast Germany. The Berzelius-Stolberg plant is switching from a production feed ratio of 60% primary lead and 40% secondary lead to a production feed ratio of 70% secondary lead and 30% primary lead. Lead paste recovered from spent auto batteries will be the raw material feedstock.

Mitsui Mining & Smelting Co. Ltd., which operates the Kamioka Mining and Smelting Co. Ltd. lead smelter in Japan, will no longer use lead concentrate as feedstock. The plant will rely upon lead sourced from recycled batteries. Kamioka formerly imported 90% of the smelter's feed requirements. With the switch to feed from recyclable batteries, Kamioka can rely upon domestic sources for much of its raw material.

Boliden Mineral AB's Kaldo primary lead smelter in Ronnskar will be adapted to refine copper arising from electronic and computer scrap once reserves at the Laisavall lead mine are exhausted in 1999. The Ronnskar plant can currently treat 10 000-15 000 t/y of various secondary materials using an electric furnace and refinery to produce copper, lead, gold and silver from concentrate and scrap.

GNB Battery Technologies received approval for the construction of a US$40 million battery recycling plant in Columbus, Georgia. The facility will have the capacity to process 8-10 million spent lead-acid batteries annually and will have a production capacity of 80 000 t/y of refined lead. The new facility is expected to start production in April 1995.

RSR Corporation, the largest U.S. secondary lead producer, suspended plans to start up a 110 000-t/y battery recycling plant in Aiken, South Carolina. RSR was indicted for violations to the U.S. *Clean Water Act* **at its Indianapolis, Indiana facility. RSR proportedly discharged improperly treated wastewater into a nearby stream and sewer system. Local authorities in South Carolina suspended the permitting process pending resolution of the charges. RSR currently operates secondary plants in Middletown, New York (capacity 76 000 t/y), Indianapolis, Indiana (120 000 t/y), and Los Angeles, California (120 000 t/y). Starting, Lighting and Ignition battery recycling represents 85% of the company's feedstock; industrial lead-acid batteries comprise the balance of 15%.**

The Doe Run Company, the United States' largest primary lead producer and third largest secondary lead producer, was sold by parent company Fluor Corporation to a large New York-based privately owned company, Renco Group Inc. The Doe Run sale includes the 200 000-t/y primary smelter in Herculanium, Missouri, and the 70 000-t/y recycling plant in Boss, Missouri.

Copper/Brass

Southwire Co. of Gaston, South Carolina, will close its 80 000-t/y secondary copper smelter and refinery. Concern over the expenditures necessary to meet stricter environmental regulations was cited as the rationale for the closure. The plant will be mothballed but could be re-opened subject to favourable economic conditions. The Gaston facility consumed roughly 30 000 t/y of No. 2 copper scrap.

Shalimar Wire Industries Ltd. (Swil) of India procured land outside of Bombay to construct a new 50 000-t/y electrolytic copper smelter and refinery. Material feed for the facility will be sourced from copper residues and scrap. Swil is expected to consume 15% of the copper produced at the new facility in its downstream wire producing operations. Production is expected in 1998.

A consortium of Thai and Australian companies will build a copper extrusion busbar plant in Thailand to supply the Southeast Asian marketplace. The new company, Oriental Copper Co., will be 70% owned by World Biz Trade Company of Thailand and 30% by Consolidated Extrusions Company of Australia. The production capacity of the plant will be 120 000 t/y and the plant will use primary metal and high-grade scrap as material feed.

Miscellaneous

Johnson Matthey UK (JM) and Metallo-Chimique International (MCI) entered into an agreement to jointly recycle the precious metals contained in autocatalysts. MCI will be responsible for the de-canning processes and JM will refine the precious metals. Vehicle manufacturers and recycling facilities now

have a single point of contact in Europe for catalytic converter precious metal recycling.

Eveready, the largest U.S. alkaline battery producer, developed a recycling technology to recover the zinc and manganese dioxide contained in household batteries. The recycling process involves placing the batteries in a reagent solution to solubilize their metal compounds. The steel battery casings will also be recycled. A pilot plant will be built within two years with full commercialization of the technology by the end of the century.

Two of the largest metal recycling companies in the United Kingdom have merged to form Europe's largest privately owned independent recycling company. Coopers Holdings Ltd. and the Sheppard Group Ltd. will merge under a holding company, European Metal Recycling Ltd. (EMR). Both Coopers and Sheppard will continue operations under their respective names. EMR will process approximately 3 Mt/y of recyclable ferrous and nonferrous metals.

Regulatory

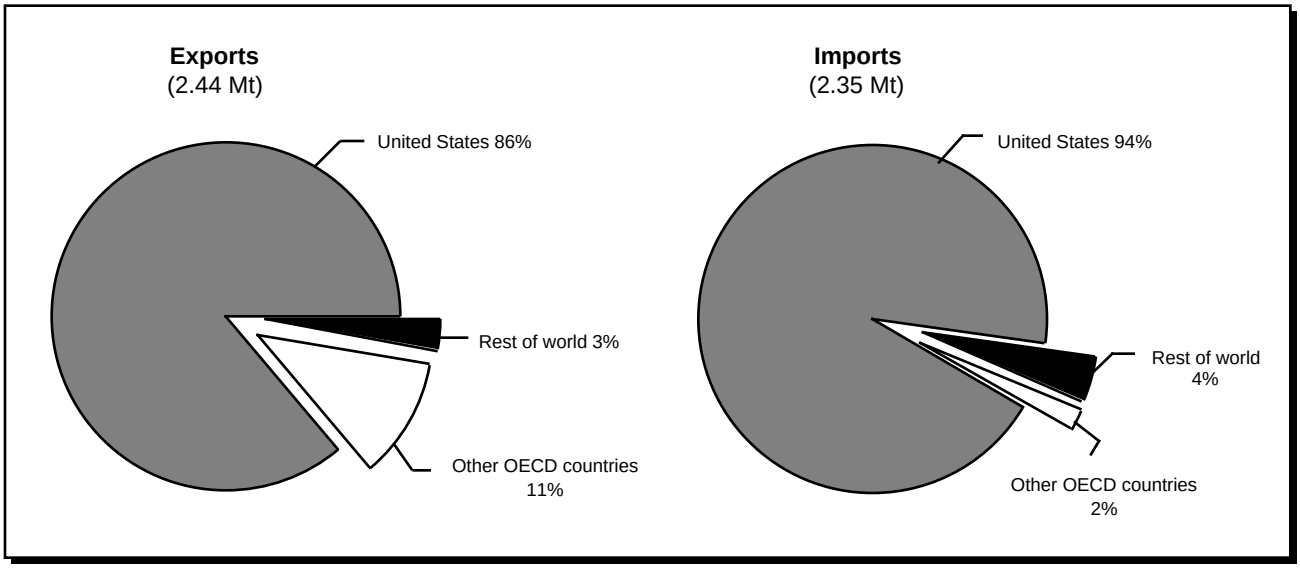
The European Union (EU) Regulation on the Supervision and Control of Shipments of Waste within, into and out of the European Community was enacted on May 6, 1994. This regulation enables the EU to fully ratify the Basel Convention. The EU has adopted the OECD Wastes Lists into its Regulations and, accordingly, exports of Amber or Red List wastes into or out of the EU can only occur with Basel Convention ratified member countries or countries with whom the EU has established bilateral/multilateral agreements. The regulation further requires non-OECD countries to recognize Green List wastes as being non-hazardous when destined for recycling operations. The response by non-OECD countries to the EU request for recognition of Green List wastes indicated that not all countries were prepared to accept Green List wastes as non-hazardous. EU member countries have extensive trade relations with many non-OECD countries and there are fears by industry that adoption of this regulation could jeopardize international trade.

The Japanese Health and Welfare Ministry plans to introduce a producer responsibility directive intended to stimulate a take-back requirement for consumer items such as televisions and refrigerators. Local governments are currently responsible for the disposal of these items. There is an increasing lack of available dump sites in close proximity to major cities and authorities cannot afford to truck these materials further afield. Motorcycles and auto batteries are also targeted for inclusion in this producer responsibility directive.

TRADE

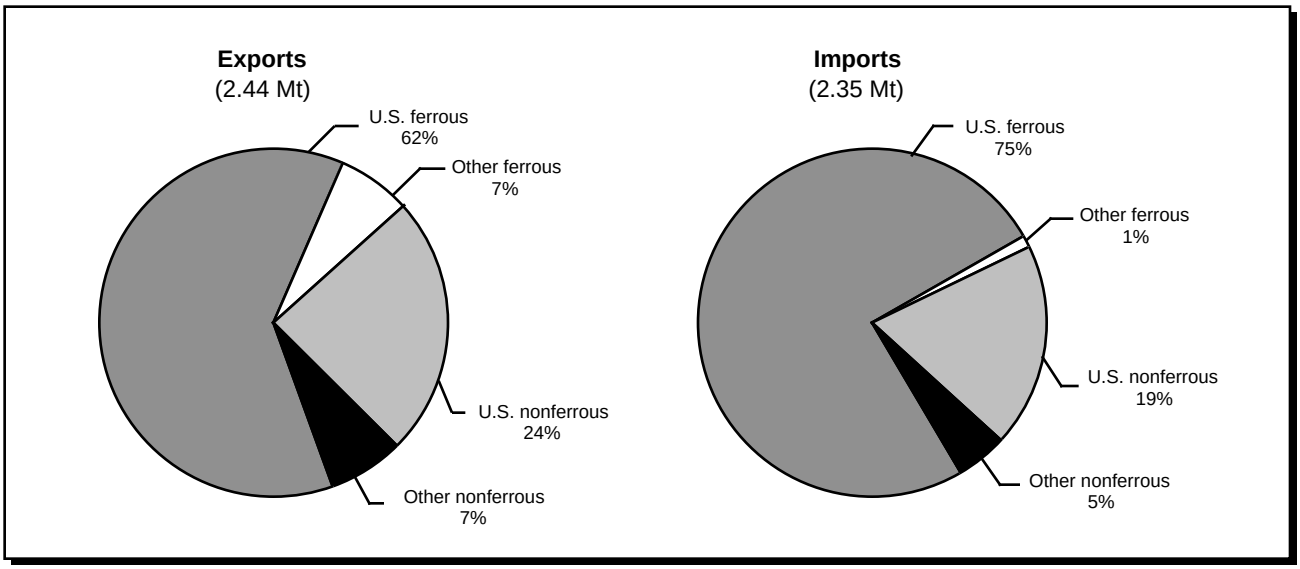
Canadian trade in recyclable metals during 1994 exceeded 4 Mt valued in excess of $2 billion. As illustrated in Figure 1, 86% of Canadian recyclable exports and 94% of Canadian recyclable imports are with the United States. Trade within the Organization for Economic Cooperation and Development (OECD) countries (Table 1) accounts for 97% of Canadian recyclable exports and 96% of Canadian recyclable imports.

Figure 1
Canadian Trade in Recyclable Metals by Region, 1994



Source: Statistics Canada.

Figure 2
Canadian Trade in Recyclable Metals by Product, 1994



Source: Statistics Canada.

Steel scrap metal recycling represents the largest tonnage of recycled material in Canada. Figure 2 illustrates the proportions of ferrous and nonferrous recyclables in Canada's international trade. Canada exported 1 673 369 t of ferrous scrap in 1994. This steel scrap export accounted for 69% of Canada's total recyclable export volume. Canada imported 1 791 222 t of ferrous scrap in 1994. This import trade accounted for 76% of the total Canadian recyclable import volume.

Nonferrous scrap metal recycling represents the majority of the value in Canada's international trade. Canada exported 763 260 t of nonferrous metal scrap valued at C$825 292 in 1994. These nonferrous scrap metal exports accounted for 74% of the value of total Canadian recyclable exports. Canada imported 892 168 t of nonferrous scrap metal valued at C$1 051 472 for the year 1994. These imports accounted for 85% of the value of Canada's total metal-recyclable imports. Table 2 provides a statistical summary of Canada's exports and imports by metal commodity group.

The province of Ontario is the major Canadian gateway for international trade in metal recyclables. More than 40% of both exports and imports cross Ontario borders. Table 3 provides a summary of Canada's recyclable exports and imports by province of lading.

ALUMINUM RECYCLING

Sources

Aluminum scrap arises in many different forms. Aluminum stampings, door and window frames, aluminum venetian blinds, aluminum car and home radiators, aluminum siding, automobile transmissions, and aluminum electrical wires are all sources of scrap aluminum. Aluminum packaging and aluminum use in containers represent roughly 30% of aluminum consumption.

Used Aluminum Beverage Cans

Used aluminum beverage can (UABC) recycling represents a growing sector for the aluminum recycling industry. Prompted both by environmental concerns for waste reduction and the cost savings realized through the use of recycled scrap products, there is a strong incentive to increase and improve the collection network for UABCs.

Unlike the majority of recyclable products arising from the municipal households, UABCs can be economically recycled. Post-consumer materials, such as newspapers, constitute 70% of the volume in the consumer waste stream, yet their value is relatively low. Aluminum, on the other hand, comprises less than 1% of the recyclable post-consumer waste volume, yet contributes exceptionally high economic value. The

average price paid by recyclers for UABCs in 1994 was C$2150/t. This compares to a value for newsprint of C$100/t.

ALUMINUM CAN RECYCLING RATES IN REPORTING OECD COUNTRIES

Country	Recycling Rate		
	1991	1992	1993
		(%)	
Sweden	83	86	90
Iceland	75	75	80
United States	64	68	63
Australia	62	61	61
Canada	60	68	80
Japan	42	54	n.r.
Switzerland	40	68	80
Greece	25	29	30
Austria	24	40	60
Italy	10	18	25
Ireland	8	13	16
United Kingdom	6	16	21
France	5	8	12

n.r. Not reported.

Environmental Benefits of Recycling Aluminum

Aluminum recycling is both economically and environmentally desirable. The table below quantitatively illustrates the environmental benefits gained through the production of aluminum using recycled materials versus the production of primary aluminum.

ENVIRONMENTAL BENEFITS OF ALUMINUM RECYCLING

Activity	Savings
	(%)
Energy conservation	95
Material conservation	79
Reduction of emissions	95
Reduction of effluents	97

Source: U.S. Environmental Protection Agency.

Secondary Aluminum

Uses

The largest end use for secondary aluminum is the automotive industry, which accounts for approximately 80% of demand. Other uses for secondary aluminum include its use as a deoxidizing agent in steel production and in the production of aluminum beverage cans. An average of 77 lb of aluminum was used in each new car produced in 1971. This figure rose to 151 lb of aluminum per car by 1994. Auto industry experts anticipate that aluminum usage will more than double by the year 2000. In North America, the 1994 average weight of aluminum used in cars was 219 lb by Ford Motor Co., 197 lb by General Motors and 156 lb by Chrysler Corp.

World Production

World production of secondary aluminum in 1994 is estimated at 6 133 000 t. This represents 29.7% of the world's refined aluminum production. Table 4 illustrates the world production of secondary aluminum by geographic region.

LME Secondary Aluminum Contract

The establishment of a formal trading contract on the London Metal Exchange (LME) for secondary aluminum underlines the importance of secondary aluminum to world metal industries. The LME contract began three-month trading on October 6, 1992, and cash trading on January 4, 1993. While there still remains significant reluctance on behalf of many aluminum producers and consumers to use the aluminum alloy contract, its presence provides an independent price reference point. Resistance to the secondary alloy use is most firmly felt in North America where industry maintains that the contract fails to provide a relevant price reference for North America as most LME alloy stocks are located in Europe. The LME confirmed that trading will begin in aluminum alloy option contracts on January 3, 1995, to complement the futures contract.

Canadian Secondary/Scrap Aluminum Production and Consumption

Canada produced approximately 121 000 t of secondary aluminum in 1993. Canadian manufacturing companies purchased 170 000 t of aluminum scrap and 97 200 t of secondary aluminum for consumption in 1993. These scrap and secondary aluminum purchases represent roughly 36% of total Canadian consumer aluminum purchases. Table 5 presents Canada's purchases of scrap and secondary aluminum, together with the percentage of the total Canadian consumer aluminum purchases. Canada recycled an estimated 483 000 t of scrap aluminum in 1994 (Table 6).

Canada is a net exporter of recycled aluminum scrap. Canada exported 239 653 t and imported 66 426 t of scrap aluminum in 1994 (Tables 7 and 8). The United States received 90% of Canada's total scrap aluminum exports in 1994. Japan was the second largest recipient at 5% of the total aluminum export volume.

Prices

Prices for both secondary aluminum alloy and scrap aluminum (Figure 3) increased significantly throughout 1994 and are expected to remain strong throughout 1995. The aluminum alloy enjoyed significant price increases on the LME over the past year, rising from US$966/t in January to US$1870/t in December. The price improvements were largely due to increased primary aluminum prices and an increase in demand by the automotive industries whose alloy consumption represents the largest market for aluminum alloy. The yearly average alloy price in 1994 was US$1460/t. Aluminum alloy stocks on the LME in December 1994 were 30 480 t, a steady reduction from 48 880 t in December 1993.

LEAD RECYCLING

Uses of Lead

The majority of lead is used to produce lead-acid batteries. The average automotive lead-acid battery contains approximately 10 kg of lead. Lead is also used as a construction material in roofing and, because of its density and sound-absorbing properties, is being used more and more frequently as a partition sound barrier in multiple-dwelling complexes.

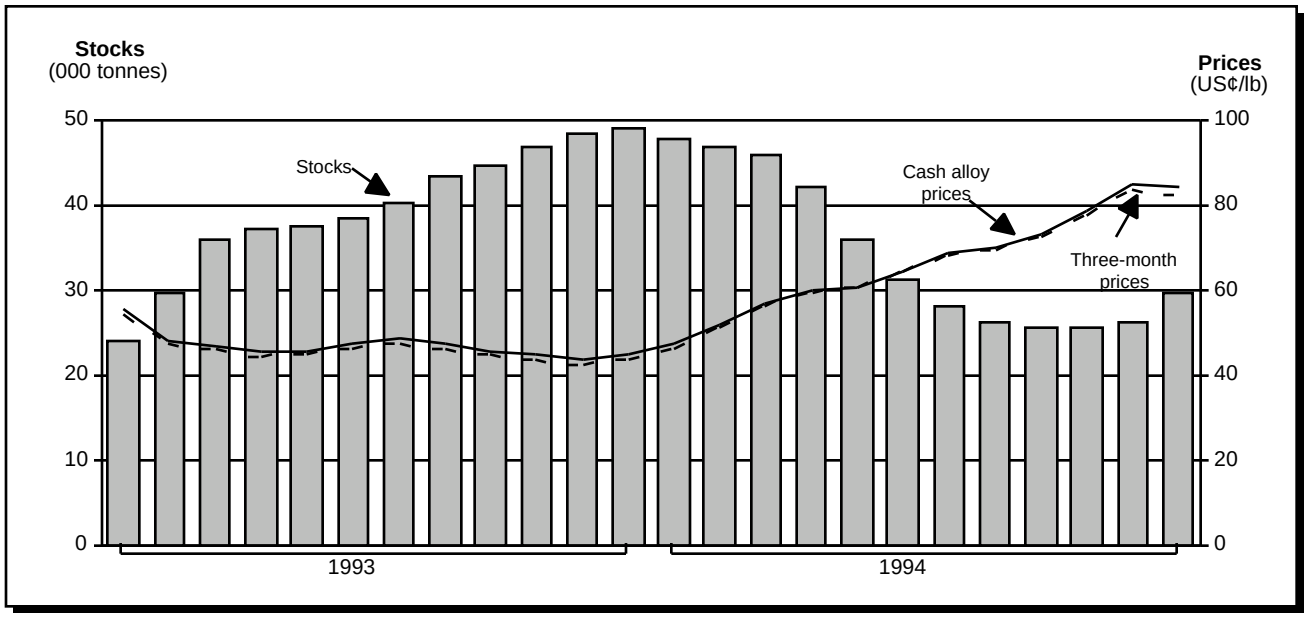
Lead is the metal of choice in the nuclear industry because of its resistance to gamma radiation and X rays. Accordingly, it is used as a protective shielding around X-ray equipment, cathode ray tubes and nuclear installations.

Lead is also used in a variety of other applications, including the production of crystal, light bulbs, television and computer screens, keels for pleasure boats, and protective wrappings for underwater electrical transmission cables.

Sources

Lead is one of the most recycled and recyclable metals. More than 90% of all the lead consumed in Canada can be economically recycled. Lead scrap arises principally from batteries, battery plates, drosses, skimmings, and industrial scrap such as cables, printing lead, solders and babbitts. Scrap lead is also recovered from lead weights used in automotive wheel balancing and in the demolition of buildings and chemical plants. Lead-acid batteries, however, represent the dominant source of recoverable lead. While some lead is present in metallic

Figure 3
Aluminum Prices and Stocks,[1] 1993 and 1994



Source: Natural Resources Canada.

[1] Average monthly LME aluminum alloy prices and stocks.

form and needs only to be remelted and refined, the majority of lead scrap is present as a combination of metallic lead, oxides and sulphates. The recycling of these lead compounds requires complex metallurgical reduction processes.

Lead recycling has a significant advantage because of the very large proportion of lead used in one specific market: lead-acid batteries. A recycling chain has been established dedicated to the return of spent lead-acid batteries. Studies show that spent lead-acid batteries are rarely disposed of in landfills. There is a far greater likelihood that the spent lead-acid battery will be stored in a consumer's garage. This storage results in spent batteries not entering the recycling chain in a timely fashion. Programs aimed at improving the recycling rates of spent lead-acid batteries include mandatory take-back requirements for retailers, deposit/refund systems, and a tax on the sale of new batteries used to subsidize transport of the spent product from isolated regions.

Lead-Acid Battery Recycling Rates

Lead-acid battery recycling rates are calculated in the United States on behalf of the Battery Council International. The most recent report, 1992, estimated the battery recycling rate in the United States to be 94.4%. The 1990 and 1991 U.S. recycling rates were calculated to be 97.8% and 96.8% respectively. Natural Resources Canada estimated the Canadian lead-acid battery recycling rate in 1991 to be 94%. It appears reasonable to conclude that Canadian recycling rates closely mirror those calculated in the United States.

BATTERY RECYCLING RATES IN REPORTING OECD COUNTRIES

Country	1991
Australia	>90
Canada	94
France	90
Germany	>95
Japan	93
Norway	50
Sweden	>100
United Kingdom	93
United States	97

Lead Recycling in Canada

There are seven lead smelters located in Canada. Table 9 shows their location and processing capacities.

Canadian Production of Secondary Lead

Canada produced 97 800 t of recycled lead in 1994. This figure represents roughly 40% of total Canadian lead production. Canadian primary lead smelters use increasingly larger quantities of scrap lead-bearing materials to supplement their concentrate-based material feed. This development is being mirrored by many international facilities (see previous International Developments section). Lead scrap from spent lead-acid batteries is relatively homogeneous in metallic consistency compared to many of the complex lead concentrates typically processed by primary lead smelters.

There are nine battery-breaking facilities in Canada; Table 10 shows their locations.

World Secondary Lead Production

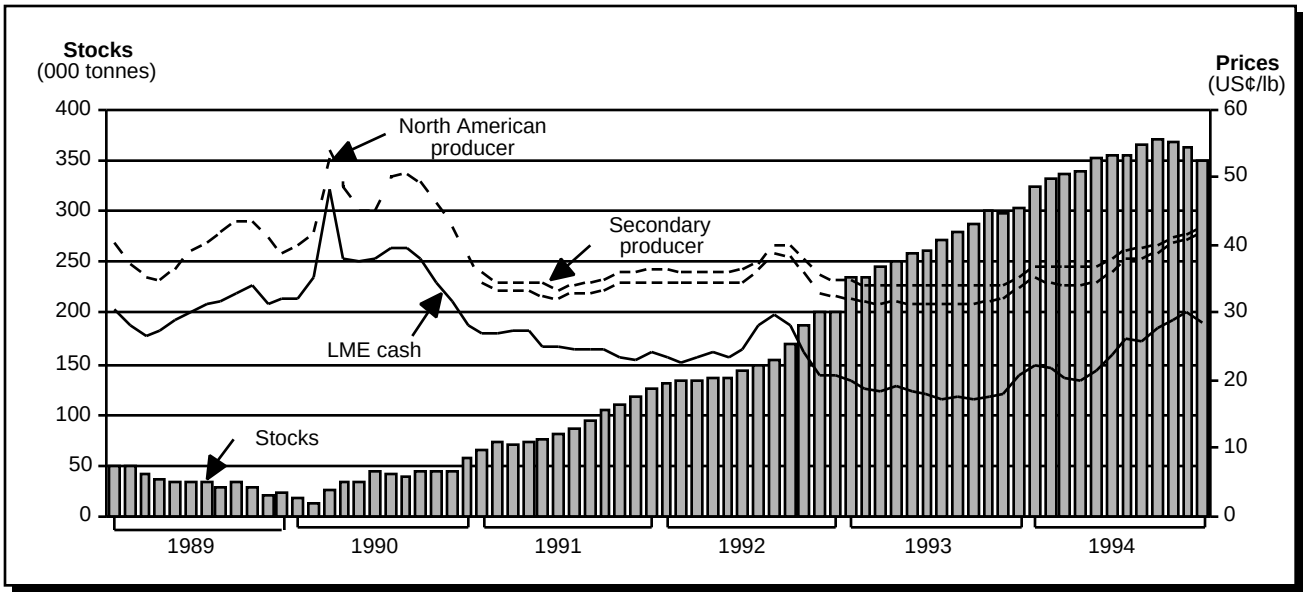
Secondary lead production, including remelted lead and lead alloys, accounts for close to 50% (Table 11) of the total world refined lead production. Secondary lead smelters produced 2 296 000 t of secondary lead in 1994. The United States, the dominant producer of secondary lead, produced an estimated 919 000 t in 1994.

Economics, Prices and Outlook

As with other metals, lead enjoyed a significant price appreciation throughout 1994. Lead prices on the LME averaged US24.9¢/lb in 1994, up substantially from US18.4¢/lb in 1993. The lead price increases did not maintain the traditional price/inventory relationship. LME lead inventories increased steadily in 1994, reaching a peak of 372 000 t in September. November and December stock inventories both declined from this level to end the year at 343 425 t. The availability of scrap batteries was strong and, accordingly, the prices offered for spent lead-acid batteries did not keep pace with LME price increases. North American demand for lead remained strong with most North American producers in sold-out positions for the coming few months.

Figure 4 illustrates the historical prices for lead superimposed upon the published LME lead stock levels.

Figure 4
Lead Prices and Stocks, 1989-94
LME Average Monthly Spot Prices and Stocks



Source: Natural Resources Canada.

COPPER AND BRASS RECYCLING

Sources of Scrap Copper and Brass

The production of copper wire accounts for 40% of the total consumption of refined copper. Accordingly, copper wire is the single most important source of scrap. For recovery purposes, scrap copper is segregated into four principal categories: No. 1 copper wire, No. 2 copper wire, No. 3 copper, and copper-bearing scrap. The differentiation between No. 1 and No. 2 copper wire relates to the minimum copper content of the wire. Other major sources of scrap copper include copper tubing, electrical motors and copper sheeting. Copper scrap also arises in the form of residues and can be recovered from metallurgical compounds, metallic dusts, electronic scrap, copper-containing ashes, and copper-containing sludges.

Bronze alloys contain varying percentages of copper and tin as their principal elements. They may also contain smaller proportions of both lead and zinc. Brass alloys contain copper and zinc as their principal elements and may also contain smaller proportions of both tin and lead. Brass and bronze scrap arises in forms such as water valves, plumbing fixtures, auto radiators, cast machinery, train brake linings, ship propellers, brass pipes, water condenser tubes, and lighting fixtures.

The recovery of copper from recycled sources can have significant energy savings when compared to the production of primary copper.

RELATIVE ENERGY REQUIREMENTS TO PRODUCE COPPER FROM VARIOUS SOURCES (PRIMARY = 100)

Copper Source	Energy Requirements
	(%)
No. 1 scrap copper	3
No. 2 scrap copper	14
Copper-bearing scrap	35
Brass and bronze scrap	6

Source: Kusik & Kenahan, *Energy Use Patterns for Metal Recycling*.

World Copper Scrap Recovery

There were 4 426 000 t of scrap copper recovered in 1994 (Table 12). The United States is the largest source of scrap copper; it is estimated that the United States recovered 1 359 000 t of scrap copper in 1994. Copper scrap recovery includes both the production of secondary refined copper and the direct scrap copper used by manufacturers. The useful service life of copper-containing products is estimated to be 35 years for residential housing, 30 years for electrical plants, 15 years for non-electrical machinery, 10 years in transportation applications, and generally

10 years in other end uses. Due to the long life of many consumer and industrial products containing copper, the calculation of pure recycling rates presents a challenge. The Statistical Committee of the International Copper Study Group is proposing to focus on obtaining more reliable and comprehensive statistics on the production and consumption of scrap copper.

Scrap in Production and Consumption

Scrap copper competes directly with primary forms. Smelters and refineries can, to some extent, substitute scrap for concentrate or blister copper. Foundries and other consumers may use either primary refined copper or scrap. Scrap copper accounts for close to 40% (Table 13) of the raw material input of refined copper production and consumption (Table 14).

Exports of Copper Scrap

Canada exported a total of 111 965 t of scrap copper and scrap copper-tin alloys in 1994. The United States (Table 15) was the destination for the majority of this exported product. Tables 15 and 16 illustrate the major scrap copper exports from, and imports to, Canada by selected countries.

Scrap Copper Prices and Outlook

Increased worldwide demand for copper metal spurred a steady rise in LME copper prices throughout 1994. Stock levels of copper correspondingly decreased from 610 350 t in the first week of January to 342 125 t in the last week of December. The No. 1 scrap price in January was US$1.00/lb; the December year-end No. 1 scrap price was US$1.17/lb. The increased prices stimulated an increased supply of copper scrap into the marketplace. Accordingly, the discount in the price offered for scrap copper from the primary copper quotation widened considerably through the second half of 1994. While some analysts maintain it is unlikely that this copper bull market can be sustained over the longer term, demand expectations from the brass and rod mills indicate a continued strong market for the short term. Market fundamentals, including strong demand, reduced stock levels and a projected copper supply deficit, all point to firm price level maintenance throughout 1995.

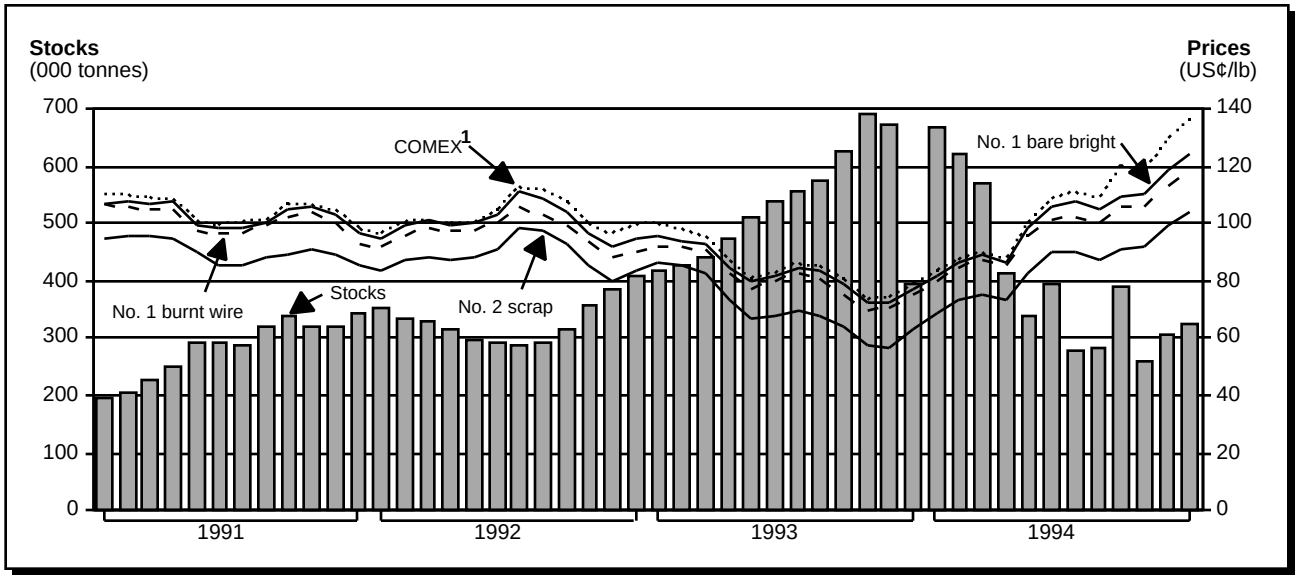
STEEL RECYCLING

Sources of Scrap Steel

Iron and steel scrap represent by far the largest tonnage of recyclable material in Canada. Scrap steel arises via three principal channels: internally generated and consumed steel scrap, new production steel scrap, and obsolete steel scrap.

Scrap is generated in the steel production process. This form of scrap never leaves the steelmaking production area. It is re-fed into the "heat" and, in essence, becomes a circulating load. It is called "home" scrap and accounts for approximately 25% of total scrap steel consumed by steel mills.

Figure 5
Copper Prices and Stocks, 1991-94

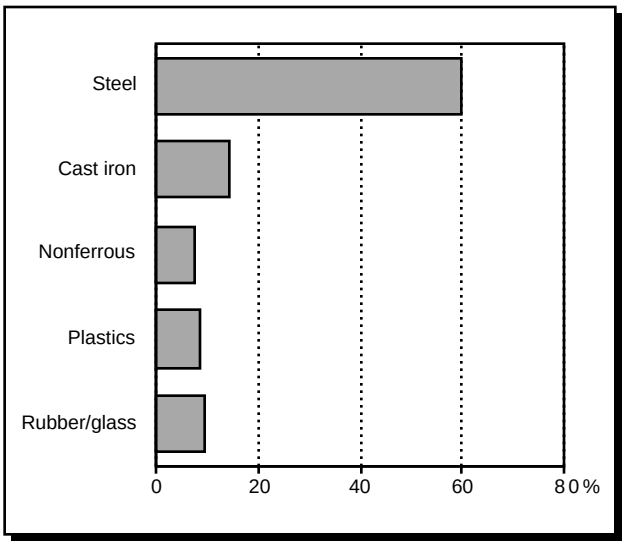


Sources: *Metals Week; Metals Bulletin*.
[1] New York Commodity Exchange.

New production scrap steel arises from the manufacturing sector. As new products are produced from steel, the excess steel material generated by these processes forms new production scrap steel. This material is typically sold to the scrap metal industry which processes it for sale to steel mills and foundries.

Obsolete scrap steel arises when industrial and consumer steel products have served their useful life. It is impossible to directly estimate the generation of obsolete scrap steel. This material can be generated at any time from the moment of production to well beyond the end of a product's useful life. Scrap cars represent a significant proportion of obsolete scrap steel within this category and are processed by a subindustry group, the Canadian Automobile Shredding Industry. Steel recovered from the shredding of scrap cars represents a high-quality feedstock to consuming steel mills. There are 19 car shredders in Canada representing a total estimated annual production capacity of 1 800 000 t (Table 19). Figure 6 illustrates the component fractions recycled from used automobiles.

Figure 6
Automobile Shredder Components
Component Fractions by Weight



Consumers of Scrap Steel

Steel mills and ferrous foundries consume the majority of scrap steel products. The Canadian iron and steel industry consumed more than 8 Mt of scrap iron and steel in 1994 (Table 17). This consumption tonnage of scrap steel represents more than 50% of the raw material requirements of Canadian steelmaking producers. There are 16 electric arc iron and steel mills and 255 iron and steel foundries in Canada.

The apparent Canadian recycling figures for iron and steel scrap are presented in Table 18.

Scrap Steel Pricing

World demand for scrap steel increased sharply in 1994, principally due to a strengthening in demand from both the automotive and appliance sectors. Additional demand has also been generated by increased steelmaking capacities. North America and Europe are both scrap exporting markets. Annual surplus estimates from these regions for scrap steel total 10-12 Mt. Asian markets, particularly China, showed increased levels of scrap steel consumption which were largely being satisfied via imports from North America and Europe. The 1993 scrap steel deficit for Asian countries was estimated at 12.5 Mt. There is increasing evidence, however, that scrap resources are growing rapidly in these Asian countries with Japan soon to become an important scrap exporter. Figure 7 illustrates the historical scrap steel composite price as published in *Iron Age*.

Environmental Benefits of Steel Recycling

Scrap steel recycling conserves energy, defers the development of less economic mineral resources, and eases the burden on municipal landfills. The table below quantitatively illustrates the environmental benefits gained through the production of steel using recycled materials versus the production of primary steel.

ENVIRONMENTAL BENEFITS OF STEEL RECYCLING

Benefit	Savings
	(%)
Energy savings	74
Virgin materials savings	90
Emission reduction	86
Effluent reduction	40
Water pollution reduction	76
Mining waste reduction	97

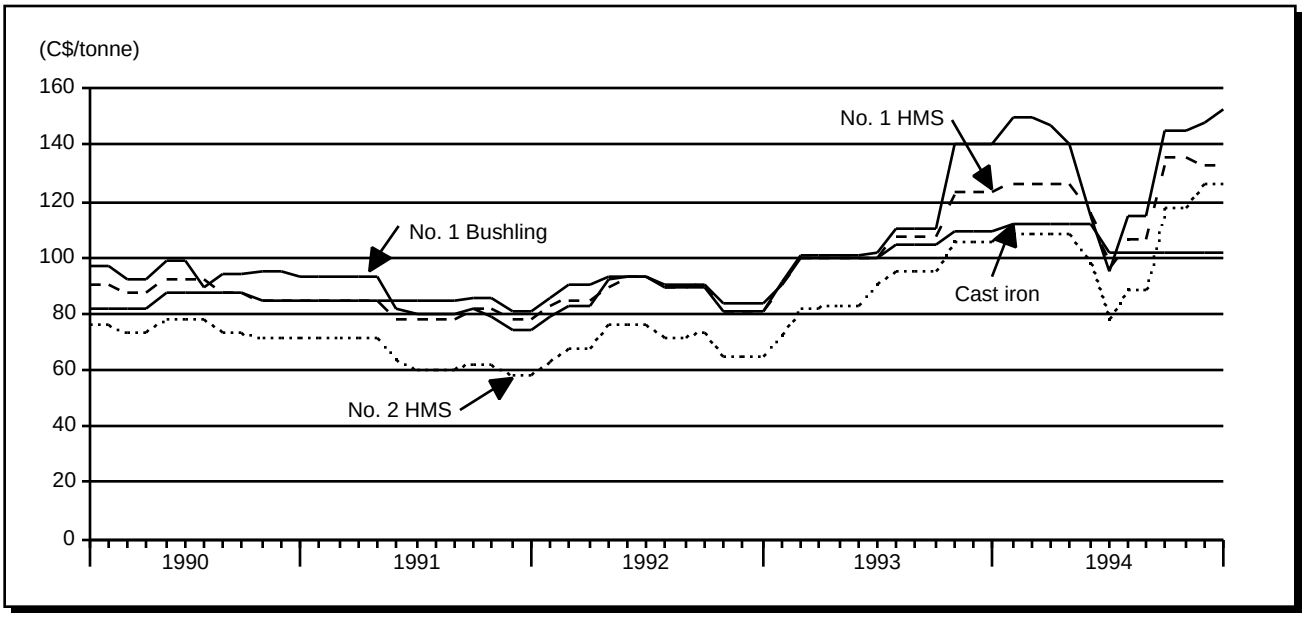
Source: U.S. Institute of Scrap Recycling Industries.

CANADIAN FEDERAL REGULATIONS IMPACTING ON METAL RECYCLING

Export and Import of Hazardous Wastes Regulations

The Canadian Export and Import of Hazardous Wastes Regulations are key elements of federal legislation affecting the Canadian metal recycling

Figure 7
Ferrous Scrap,[1] 1990-94



Source: *Iron Age*.
HMS: Heavy melting steel.
1 Hamilton, Ontario, broker's buying prices.

industry. The regulations establish the legal requirements for the international trade of hazardous metal recyclables. All metal recyclables are presently defined as "wastes" in Canada. A metal recyclable is considered "hazardous waste" if it exhibits any one of nine hazard characteristics as defined under the Transport of Dangerous Goods Regulations. These hazard characteristics are listed below.

HAZARD CHARACTERISTICS

Class 1	-	Explosives
Class 2	-	Gases: compressed, deeply refrigerated, liquefied, or dissolved under pressure
Class 3	-	Flammable and combustible liquids
Class 4	-	Flammable solids
Class 5	-	Oxidizing substances
Class 6	-	Poisonous (toxic) and infectious substances
Class 7	-	Radioactive materials
Class 8	-	Corrosives
Class 9	-	Miscellaneous substances considered to be dangerous to life, health, property, or the environment, including leachability

The key regulatory elements of the Export and Import of Hazardous Wastes Regulations include:

- **the requirement of prior notification to, and acceptance from, the competent environmental authority of the importing country;**
- **the prohibition of exports to those countries that have banned imports;**
- **the requirement to return wastes to the country of origin or find acceptable disposal alternatives should the original disposal activities prove not to be possible in accordance with the contractual agreement;**
- **the requirement to obtain insurance sufficient to cover either the return of the exported hazardous wastes or the clean-up activity of these wastes in the event of an accident; and**
- **the requirement to use an authorized tracking document in the shipment of these hazardous wastes.**

The regulations were amended in 1993 to allow an importer to assume the responsibilities of an exporter in cases where the exporting country did not regulate the substance as a hazardous waste. In such cases, the Canadian importer could apply for an Equivalent Level of Safety Permit under the Transport of Dangerous Goods Regulations and assume the signing authority for the Hazardous Waste Manifest in lieu of the exporter.

The regulations were further amended in 1994 to allow the use of Electronic Data Interchange for sending import notification information to Environment Canada. This permits information to be directly incorporated into computer systems without

retyping. It is expected to improve the response time and increase the accuracy of data input by the authorities.

Issues Under Consideration

The provincial authorities have agreed to review both their "waste" and "hazard" definitions. Environment Canada has been mandated to lead this definitional review process and is proceeding with a study to evaluate the various "waste" definitions and regulatory controls for recyclable materials used in Canada. Included in this study is a review of the U.S. regulatory control of recyclables as the United States represents Canada's largest trading partner. This review is expected to be completed for presentation to the Canadian Council of Ministers of the Environment by early summer 1995.

INTERNATIONAL REGULATIONS IMPACTING ON METAL RECYCLABLES

Canada-U.S. Agreement on the Transboundary Movement of Hazardous Wastes

This agreement seeks to ensure that the treatment, storage and disposal of hazardous wastes are conducted in a manner that properly manages the risks to public health, property and environmental quality. The Canada-U.S. Agreement controls and monitors the flow of hazardous wastes between the two countries. This bilateral agreement was negotiated in 1986 and automatically renewed itself in 1992.

Under the provisions of the agreement, all hazardous wastes destined for transboundary movement between Canada and the United States are subject to the requirements of:

- notification and consent prior to shipment;
- re-admission of any shipment of hazardous waste that may be returned by the country of import or transit;
- maintenance of insurance or other financial guarantee in respect of damage during the entire movement; and
- utilization of an authorized manifest or tracking document.

There are differences in the hazardous waste controls between the two countries as they apply to metal recyclables. Many of the materials controlled as hazardous wastes in Canada are not so controlled in the United States.

Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal was designed to restrict the transboundary movement of hazardous wastes to protect countries (particularly developing) that may not have the capability and technology to properly handle the wastes. The Basel Convention defines recycling as a "disposal" activity, and recyclable materials as "wastes." Recyclables that exhibit a hazardous characteristic are classified as hazardous wastes and are subject to strict Basel Convention control procedures. The Basel Convention does not adequately distinguish between wastes destined for disposal and recyclables destined for recovery operations. The Basel Convention prohibits trade in hazardous wastes between ratified and non-ratified countries unless there exists a bilateral agreement between them provided such agreements do not derogate from the environmentally sound management of the materials. There is no harmonization in the definition of "hazardous waste" among member countries as this proved impossible to attain during negotiations of the Basel Convention. Currently, national procedures are used, reflecting the diversity of regulatory abilities, recycling practices and "hazard" definitions. Accordingly, it becomes unclear which materials are considered to be both "wastes" and "hazardous" among importing and exporting member countries. Definitional discrepancies can lead to serious allegations of illegal dumping of hazardous wastes.

The Basel Convention came into force on May 5, 1992, and Canada ratified it on August 28, 1992. Canada has been an active participant in all working group meetings and the two Conference of Parties (COP) meetings to the Basel Convention.

Ban on the Export of Hazardous Waste

During the second COP in Geneva March 21-25, 1994, developing countries, together with the Scandinavian countries and GreenPeace International, called for an immediate and complete ban on exports of hazardous wastes destined for disposal and recovery/recycling operations from OECD countries to developing countries. This was despite the legal ability of any developing or developed country to instigate a ban for their country by a single letter to the Basel Secretariat. Opposition to the ban proposal was initially expressed by most European Union countries, Canada, Australia and Japan. Member countries unanimously agreed to an immediate ban on the export of hazardous wastes destined for final disposal from OECD to non-OECD countries. In the end, no countries opposed the decision calling for a ban from OECD to non-OECD countries on exports of hazardous wastes destined for recovery operations, effective December 31, 1997. No opposition to the ban decision was voiced by developing countries.

The "ban" decision was raised for discussion at an Ad-Hoc Committee meeting in December 1994. Concerns were raised regarding the implementation of the "ban" decision by China, Korea, India, Israel, the Czech Republic and Hungary. It was felt that premature implementation of the ban on recyclable materials could result in damage to growing recycling industries in many developing countries. Senegal offered to host a workshop to be held in March 1995 which could allow an opportunity to objectively evaluate the implications, principally for developing countries, of the "ban" decision.

Protocol on Liability and Compensation

The Basel Convention recommends the establishment of protocols on liability and compensation which will offer protection to the environment and legal recourse to third parties in the event of damage caused by the transboundary movement of hazardous wastes. The scope of this protocol could include any damages occurring to either individuals or the environment up to and including 30 years after the completion of disposal operations. Recycling is defined as a disposal operation. There has been no consideration, to date, on funding mechanisms for this protocol.

A working group of legal and technical experts was established to advise on both issues of liability and compensation. Recommendations for the formal adoption of a protocol are expected to be presented at the third COP to be held in September/October 1995. Countries would then have the option of whether or not to agree to be bound by the protocol.

OECD Decision

The OECD Decision C(92)39/FINAL concerning the control of the transfrontier movement of wastes destined for recovery operations is a multilateral agreement, as envisaged under the Basel Convention, to allow the continuation of trade in recyclable materials among OECD member countries. The Decision was adopted on March 30, 1992, by OECD member countries, prior to the entry into force of the Basel Convention.

The Decision fully recognizes a difference between wastes destined for final disposal and wastes destined for recovery/recycling operations. Furthermore, the Decision recognizes that differing levels of perceived risk in the transfrontier movement of recyclable materials exists for different materials.

The OECD Decision divides recyclable materials into three lists: Green, Amber and Red. If a material is not identified on one of these lists, the transfrontier movement of the material must conform to the movement control procedures governing hazardous wastes destined for final disposal as prescribed under the Basel Convention.

The Green OECD List contains recyclable materials considered to be of a non-hazardous nature. Table 20 provides a list of the major metal recyclables contained on the Green OECD List. These Green List metal recyclables can freely move under normal commercial control mechanisms. Countries are free to impose movement restrictions upon Green List materials if the materials are considered to be hazardous by their national regulations.

The Amber OECD List of wastes includes metals that exhibit one or more hazardous characteristics. These metals have been reviewed by an experts committee which has determined that the risk posed by the movement of these hazardous recyclable metals is limited. Accordingly, they are permitted to move internationally under less onerous transportation control mechanisms than those prescribed under the Basel Convention.

Two control system procedures are provided under the Amber control mechanism. These procedures relate to cases where transactions require consent for specific shipments to a recovery facility, and where transactions involve shipments to specific preconsented recovery facilities. The control procedures for specific shipments to a recovery facility include:

- prior notification of the intended shipment with a 30-day tacit consent provision;
- required use of an authorized tracking document;
- recovery facility to provide signed copy of receipt of waste;
- insurance requirements; and
- movement may occur only under the terms of a valid written contract.

The control procedures for shipments to specific preauthorized recovery facilities include a seven-day tacit consent for the notification of the intended shipment. This effectively reduces the time delay between material purchases and actual shipment.

Table 21 provides a summary of the major metal recyclables on the Amber OECD List.

The Red OECD List does not specifically include any metals or metal compounds. It includes materials contaminated with polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), or polybrominated biphenyls (PBBs) at a concentration level of 50 mg/kg or more.

It is important to note that while OECD countries have agreed to these three lists of recyclable materials, individual countries have the authority to determine whether a material is, or is not, considered hazardous under their own national regulations.

Accordingly, movement control procedures may vary among OECD member countries for individual materials.

ENVIRONMENTAL ISSUES IMPACTING ON METAL RECYCLABLES

Waste vs. Product Definitions

The OECD Review Committee responsible for assigning the placement of recyclables onto the Green, Amber or Red OECD Lists is reviewing criteria that could be used to differentiate between a "waste" and a "product." Recent applications submitted to the review committee meetings have focussed on declaring substances as products and requesting their formal removal from the OECD "waste" lists. This concentration on definitional issues has prompted the group to propose developing criteria that could be used on a consistent basis to differentiate between a "waste" and a "product." A draft report on this study is to be presented at the April 1995 meeting of the Waste Management Policy Group.

International Maritime Organization HNS Convention

The International Maritime Organization (IMO) has, since 1984, been developing a convention for compensation and liability for damage caused during the carriage by sea of hazardous and noxious substances. The formal name for this draft convention is the IMO Convention on Liability and Compensation for Damage in Connection With the Carriage of Hazardous and Noxious Substances by Sea (HNS). Hazardous and noxious substances are defined by reference to existing lists of hazardous and/or noxious substances when moved at sea. Most recyclable metals considered hazardous under the Basel Convention will also be considered hazardous under the IMO HNS Convention. The convention proposes two tiers of liability: the ship-owner and the importer. The ship-owner will be required to maintain a yet-to-be-determined level of liability insurance coverage. In the event of a damage claim that exceeds the ship-owner's insurance coverage, the liability scheme would collect additional funds from the second tier of the compensation scheme. It is proposed that a shipping charge, or levy per tonne, be assigned to hazardous and/or noxious cargoes to fund the liability and compensation scheme. A conference is being planned for early 1996 to conclude the convention. Limits on both liability and compensation are proposed to be established at this meeting. The amount of these financial limits will determine the size of the "levy" to be assigned against hazardous recyclables and other materials.

Note: Information in this review was current as of February 1, 1995.

TABLE 1. CANADA, EXPORTS AND IMPORTS OF METAL RECYCLABLES, 1990-94

	1990		1991		1992[r]		1993		1994[e]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)
RECYCLABLE EXPORTS										
Exports to United States	1 947 911	855 086	1 549 000	628 566	1 610 665	702 579	1 998 492	752 876	2 094 712	982 252
% of total exports	76.04	80.77	85.04	81.68	86.02	84.25	89.40	86.66	85.97	88.17
Ferrous exports to United States	1 517 056	221 161	1 153 095	150 230	1 145 849	119 891	1 439 066	201 099	1 517 182	277 873
% of total ferrous exports	83.20	78.43	84.89	82.84	89.33	77.42	86.19	88.25	90.66	96.23
Nonferrous exports to United States	430 855	633 925	395 905	478 336	464 816	582 688	559 426	551 777	577 530	704 379
% of total nonferrous exports	58.36	81.62	85.46	81.32	78.82	85.81	92.66	86.10	93.08	89.57
Exports to OECD countries	2 341 904	991 236	1 644 055	715 429	1 688 291	782 623	2 101 427	826 949	2 354 464	1 068 486
% of total exports	91.42	93.63	90.25	92.97	90.17	93.85	94.00	95.19	96.63	95.91
Exports to non-OECD countries	219 851	67 445	177 531	54 116	184 098	51 281	134 099	41 809	82 164	45 579
% of total exports	8.58	6.37	9.75	7.03	9.83	6.15	6.00	4.81	3.37	4.09
Exports to EU countries	35 197	76 142	31 837	48 622	13 750	37 395	55 071	32 154	16 114	31 859
% of total exports	1.37	7.19	1.75	6.32	0.73	4.48	2.46	3.70	0.66	2.86
Total exports	2 561 755	1 058 681	1 821 586	769 545	1 872 389	833 904	2 235 526	868 758	2 436 628	1 114 065
RECYCLABLE IMPORTS										
Imports from United States	1 434 667	630 029	1 089 447	585 193	1 649 903	638 818	1 865 919	1 029 476	2 220 028	1 100 011
% of total imports	96.72	88.93	96.83	87.27	94.68	82.86	95.53	90.60	94.46	88.78
Ferrous imports from United States	1 235 222	127 820	884 956	104 699	1 332 195	145 922	1 519 744	212 560	1 772 857	275 852
% of total ferrous imports	98.93	97.97	99.07	99.14	98.78	98.88	99.74	99.15	98.97	98.74
Nonferrous imports from United States	199 445	502 209	204 927	480 494	317 726	493 406	346 175	816 916	447 171	824 159
% of total nonferrous imports	84.96	86.88	88.38	85.05	80.63	79.15	80.58	88.61	80.00	85.88
Imports from OECD countries	1 459 695	675 504	1 113 715	646 896	1 680 507	704 368	1 887 697	1 088 302	2 266 246	1 171 394
% of total imports	98.40	95.34	98.98	96.47	96.43	91.37	96.65	95.77	96.43	94.54
Imports from non-OECD countries	23 688	32 987	11 424	23 639	62 149	66 562	65 527	48 034	83 919	67 682
% of total imports	1.60	4.66	1.02	3.53	3.57	8.63	3.35	4.23	3.57	5.46
Imports from EU countries	16 021	33 372	21 187	50 341	15 466	52 508	14 537	47 313	11 860	48 478
% of total imports	1.08	4.71	1.88	7.51	0.89	6.81	0.74	4.16	0.50	3.91
Total imports	1 483 383	708 491	1 125 139	670 535	1 742 656	770 930	1 953 224	1 136 336	2 350 165	1 239 076

Source: Statistics Canada.
EU European Union.
[e] Estimated; [r] Revised.

TABLE 2. CANADA, EXPORTS AND IMPORTS BY COMMODITY GROUP, 1990-94

	1990		1991		1992[r]		1993		1994	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)
METAL RECYCLABLE EXPORTS										
Aluminum ash and residues	49 546	6 181	25 820	4 640	7 103	1 515	3 709	991	3 018	921
Aluminum scrap	185 971	278 527	173 675	227 539	197 582	263 996	199 207	246 638	236 635	379 396
Total aluminum	235 517	284 708	199 494	232 179	204 685	265 511	202 916	247 629	239 653	380 317
% total recyclable	10.48	34.04	10.95	30.17	10.93	31.84	9.09	28.50	9.84	34.14
Copper ash and residues	5 847	5 605	1 792	2 151	1 742	2 443	1 218	1 142	1 291	1 215
Copper scrap	18 298	37 167	86 368	178 682	102 044	211 065	115 593	233 685	110 674	253 209
Total copper recyclable	24 145	42 772	88 160	180 833	103 786	213 498	116 811	234 827	111 965	254 424
% total recyclable	1.07	5.11	4.84	23.50	5.4	25.60	5.23	27.03	4.60	22.84
Lead ash and residues	741	352	216	151	1 246	318	681	249	803	326
Lead scrap	17 382	6 398	5 237	2 675	6 608	2 576	3 354	1 096	6 361	2 840
Total lead recyclable	18 123	8 750	5 453	2 825	7 854	2 894	4 035	1 345	7 164	3 166
% total recyclable	0.81	0.81	0.30	0.37	0.42	0.35	0.18	0.15	0.29	0.28
Zinc ash and residues	9 007	8 624	9 723	6 322	12 762	10 612	9 645	7 837	10 795	8 667
Zinc scrap	38 118	22 925	33 327	18 497	32 223	19 911	40 964	21 389	54 925	31 065
Total zinc recyclable	47 125	31 549	43 050	24 819	44 985	30 523	50 609	29 226	65 720	39 732
% total recyclable	2.10	3.77	2.36	3.23	2.40	3.66	2.27	3.36	2.70	3.57
Nickel ash and residues	–	–	–	–	–	–	–	–	–	–
Nickel scrap	7 748	39 385	4 232	19 866	4 178	16 557	2 443	9 719	2 258	10 790
Total nickel recyclable	7 748	39 385	4 232	19 866	4 178	16 557	2 443	9 719	2 258	10 790
% total recyclable	0.34	4.71	0.23	2.58	0.22	1.99	0.11	1.12	0.09	0.97
Vanadium ash and residues	1 085	1 426	680	622	1 481	1 169	952	697	679	265
Vanadium scrap	–	–	–	–	–	–	–	–	–	–
Total vanadium recyclable	1 085	1 426	680	622	1 481	1 169	952	697	679	265
% total recyclable	0.05	0.17	0.04	0.08	0.08	0.14	0.04	0.08	0.03	0.02
Magnesium ash and residues	–	–	–	–	–	–	–	–	–	–
Magnesium scrap	3 358	8 569	3 035	4 051	1 067	946	517	984	462	1 156
Total magnesium recyclable	3 358	8 569	3 035	4 051	1 067	946	517	984	462	1 156
% total recyclable	0.15	1.02	0.17	0.53	0.06	0.11	0.02	0.11	0.02	0.10
Tin ash and residues	–	–	–	–	–	–	–	–	–	–
Tin scrap	529	449	460	490	486	627	847	519	638	596
Total tin recyclable	529	449	460	490	486	627	847	519	638	596
% total recyclable	0.02	0.05	0.03	0.06	0.03	0.08	0.04	0.06	0.03	0.05
Precious metal ash and residues	–	–	–	–	–	–	–	–	–	–
Precious metal scrap	204	97 997	300	87 960	201	77 301	154	64 575	184	63 336
Total precious metal recyclable	204	97 997	300	87 960	201	77 301	154	64 575	184	63 336
% total recyclable	0.01	11.72	0.02	11.43	0.01	9.27	0.01	7.43	0.01	5.69
N.e.s. ash and residues	85 785	40 913	118 377	34 543	221 012	70 015	222 454	51 362	191 751	32 594
N.e.s. scrap	–	–	–	–	–	–	–	–	–	–
Total n.e.s. recyclable	85 785	40 913	118 377	34 543	221 012	70 015	222 454	51 362	191 751	32 594
% total recyclable	3.82	4.89	6.50	4.49	11.80	8.40	9.96	5.91	7.87	2.93

TABLE 2 (cont'd)

	1990		1991		1992r		1993		1994	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)	(tonnes)	($000)
METAL RECYCLABLE EXPORTS (cont'd)										
Stainless steel ash and residues	–	–	–	–	–	–	–	–	–	–
Stainless steel scrap	36 878	41 282	24 041	20 719	144 101	33 763	159 138	36 843	142 786	38 916
Total stainless steel recyclable	36 878	41 282	24 041	20 719	144 101	33 763	159 138	36 843	142 786	38 916
% total recyclable	1.64	4.94	1.32	2.69	7.70	4.05	7.12	4.24	5.86	3.49
Ferrous slags	522 176	61 428	281 795	28 355	164 109	4 927	337 661	30 245	181 931	47 043
Ferrous scrap	1 264 404	179 227	1 052 508	132 282	974 443	116 173	1 134 989	160 787	1 491 438	241 721
Total ferrous recyclable	1 786 580	240 855	1 334 303	160 638	1 138 552	121 100	1 472 650	191 032	1 673 369	288 764
% total recyclable	79.51	28.77	73.25	20.87	60.81	14.52	65.93	21.99	68.68	25.92
Total recyclable exports	2 247 077	836 455	1 821 586	769 545	1 872 388	833 904	2 233 526	868 758	2 436 629	1 114 056
METAL RECYCLABLE IMPORTS										
Aluminum ash and residues	1 750	709	1 923	1 293	3 379	1 536	2 331	964	3 065	1 540
Aluminum scrap	52 603	73 271	46 433	52 717	52 674	62 396	53 466	64 385	63 361	86 687
Total aluminum	54 353	73 980	48 357	54 010	56 053	63 932	55 797	65 349	66 426	88 227
% total recyclable	3.66	10.23	4.30	8.05	3.22	8.29	2.86	5.75	2.83	7.12
Copper ash and residues	37 248	30 136	19 269	13 191	14 955	14 124	29 681	32 207	31 417	38 261
Copper scrap	65 540	109 673	47 687	65 512	41 939	52 145	53 648	63 689	98 452	173 972
Total copper recyclable	102 788	139 809	66 957	78 703	56 894	66 269	83 329	95 896	129 869	212 233
% total recyclable	6.92	19.34	5.95	11.74	3.26	8.60	4.27	8.44	5.53	17.13
Lead ash and residues	1 764	4	95	110	23	100	262	1 151	7 111	7 617
Lead scrap	34 831	12 496	58 044	10 640	50 538	9 671	38 716	8 358	67 931	15 201
Total lead recyclable	36 595	12 500	58 139	10 750	50 561	9 771	38 978	9 509	75 042	22 818
% total recyclable	2.46	1.73	5.17	1.60	2.90	1.27	2.00	0.84	3.19	1.84
Zinc ash and residues	567	439	472	255	1 028	767	1 054	745	1 350	674
Zinc scrap	1 615	1 890	655	670	1 526	1 541	1 974	1 892	1 049	899
Total zinc recyclable	2 182	2 329	1 127	925	2 554	2 308	3 028	2 637	2 399	1 573
% total recyclable	0.15	0.32	0.10	0.14	0.15	0.30	0.16	0.23	0.10	0.13
Nickel ash and residues	–	–	–	–	–	–	–	–	–	–
Nickel scrap	9 314	22 978	14 811	35 145	18 238	35 803	17 967	27 265	20 950	40 889
Total nickel recyclable	9 314	22 978	14 811	35 145	18 238	35 803	17 967	27 265	20 950	40 889
% total recyclable	0.63	3.18	1.32	5.24	1.05	4.64	0.92	2.40	0.89	3.30
Magnesium ash and residues	–	–	–	–	–	–	–	–	–	–
Magnesium scrap	41	116	260	688	2 159	5 672	2 746	7 123	2 161	6 477
Total magnesium recyclable	41	116	260	688	2 159	5 672	2 746	7 123	2 161	6 477
% total recyclable	0.003	0.02	0.02	0.10	0.12	0.74	0.14	0.63	0.09	0.52
Tin ash and residues	–	–	–	–	–	–	–	–	–	–
Tin scrap	94	545	167	846	466	1 575	187	685	305	1 235
Total tin recyclable	94	545	167	846	466	1 575	187	685	305	1 235
% total recyclable	0.01	0.08	0.01	0.13	0.03	0.20	0.01	0.06	0.01	0.10

Precious metal ash and residues	–	–	–	–	–	–	–	–	–	–
Precious metal scrap	14 144	287 888	9 702	288 044	4 132	310 096	17 317	626 175	16 466	481 020
Total precious metal recyclable	14 144	287 888	9 702	288 044	4 132	310 096	17 317	626 175	16 466	481 020
% total recyclable	0.95	39.82	0.86	42.96	0.24	40.22	0.89	55.10	0.70	38.82
N.e.s. ash and residues	17 372	37 873	31 589	80 177	202 039	99 343	209 538	81 872	244 665	97 700
N.e.s. scrap	964	14 447	757	15 640	938	28 584	716	5 424	661	7 519
Total n.e.s. recyclable	18 336	52 320	32 346	95 817	202 977	127 927	210 254	87 296	245 326	105 219
% total recyclable	1.23	7.24	2.87	14.29	11.65	16.59	10.76	7.68	10.44	8.49
Stainless steel ash and residues	–	–	–	–	–	–	–	–	–	–
Stainless steel scrap	20 337	20 962	20 508	20 972	147 146	47 388	218 236	68 341	333 224	91 781
Total stainless steel recyclable	20 337	20 962	20 508	20 972	147 146	47 388	218 236	68 341	333 224	91 781
% total recyclable	1.37	2.90	1.82	3.13	8.44	6.15	11.17	6.01	14.18	7.41
Ferrous slags	245 750	6 754	83 546	2 561	116 743	2 580	65 134	2 812	65 632	2 071
Ferrous scrap	981 979	102 717	789 220	82 073	1 084 733	97 609	1 240 251	143 248	1 392 366	185 526
Total ferrous recyclable	1 227 729	109 471	872 766	84 634	1 201 476	100 189	1 305 385	146 060	1 457 998	187 597
% total recyclable	82.62	15.14	77.57	12.62	68.95	13.00	66.83	12.85	62.04	15.14
Total recyclable imports	1 485 913	722 898	1 125 139	670 535	1 742 656	770 930	1 953 224	1 136 336	2 350 166	1 239 069

Source: Statistics Canada.
– Nil; n.e.s. Not elsewhere specified; r Revised.

TABLE 3. CANADA, RECYCLABLE METAL EXPORTS AND IMPORTS, BY PROVINCE OF LADING, 1991-94

	1991		1992[r]		1993		1994	
	(tonnes)	(%)	(tonnes)	(%)	(tonnes)	(%)	(tonnes)	(%)
EXPORTS								
British Columbia	348 834	19.85	442 622	23.64	458 557	20.51	446 643	18.33
Alberta	18 864	1.07	18 185	0.97	21 824	0.98	27 323	1.12
Saskatchewan	562	0.03	19 989	1.07	35 748	1.60	22 613	0.93
Manitoba	16 474	0.94	14 773	0.79	20 645	0.92	19 235	0.79
Ontario	886 164	50.42	858 645	45.87	1 336 331	59.78	1 297 926	53.27
Quebec	452 002	25.72	506 344	27.05	335 044	14.99	586 114	24.05
New Brunswick	8 533	0.49	5 960	0.32	13 903	0.62	15 653	0.64
Nova Scotia	25 402	1.45	4 531	0.24	13 294	0.59	8 547	0.35
Newfoundland	229	0.01	982	0.05	156	0.01	10 250	0.42
Prince Edward Island	1	–	–	–	–	–	20	–
Northwest Territories	523	0.03	45	–	24	–	2 305	0.09
Total	1 757 587		1 872 076		2 235 526		2 436 629	
IMPORTS								
British Columbia	17 201	1.53	83 313	4.76	94 734	4.85	116 565	4.96
Alberta	16 973	1.51	33 948	1.94	33 558	1.72	41 961	1.79
Saskatchewan	309 660	27.52	392 594	22.42	501 652	25.68	601 771	25.61
Manitoba	21 004	1.87	65 680	3.75	180 134	9.22	184 736	7.86
Ontario	633 038	56.27	997 902	57.00	860 020	44.03	1 053 555	44.83
Quebec	123 493	10.98	170 288	9.73	210 804	10.79	292 799	12.46
New Brunswick	1 098	0.10	1 757	0.10	1 369	0.07	9 074	0.39
Nova Scotia	2 583	0.23	5 245	0.30	70 953	3.63	49 542	2.11
Newfoundland	–	–	4	–	–	–	129	0.01
Prince Edward Island	–	–	–	–	–	–	–	–
Northwest Territories	–	–	–	–	–	–	33	–
Total	1 125 050		1 750 731		1 953 224		2 350 165	

Source: Statistics Canada.
– Nil; [r] Revised.

TABLE 4. ALUMINUM, WORLD SECONDARY PRODUCTION, PERCENTAGE OF TOTAL PRODUCTION, 1990-94

	1990		1991		1992		1993		1994[e]	
	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)
Europe	1 727	30.6	1 700	31.1	1 804	34.4	1 678	33.7	1 694	34.7
Africa	27	4.3	35	5.4	45	6.8	28	4.3	28	4.3
Asia	1 168	49.8	1 200	48.1	1 177	46.1	1 085	41.5	1 213	43.6
Americas	2 040	21.6	2 354	22.9	2 521	24.0	2 776	16.6	3 151	29.5
Oceania	38	2.5	34	2.2	47	3.1	47	2.8	47	2.9
Total	5 008	25.6	5 334	26.1	5 576	27.2	5 613	27.2	6 133	29.7

Source: World Bureau of Metal Statistics.
[e] Estimated.

TABLE 5. CANADA, CONSUMER PURCHASES OF SCRAP AND SECONDARY ALUMINUM, 1990-93

	1990	1991	1992	1993
	(000 tonnes)			
Secondary aluminum purchases	82.6	74.1	88.6	97.2
Scrap aluminum purchases	131.1	117.8	161.4	170.5
Total secondary and scrap purchases	213.7	191.9	250.0	267.7
% of total consumer purchases	35.8	33.2	38.2	35.8

Source: Natural Resources Canada.

TABLE 6. CANADA, QUANTITY OF ALUMINUM RECYCLED, 1990-94

	1990	1991	1992	1993	1994[e]
			(000 tonnes)		
Secondary consumption	115.1	101.5	127.8	131.2	135.0
Scrap consumption	131.1	117.8	161.4	170.5	175.0
Scrap exports	186.0	173.7	197.6	199.2	236.6
Scrap imports	52.6	46.4	52.7	53.5	63.4
Scrap recycled[e]	379.6	346.6	434.1	447.4	483.2

Sources: Natural Resources Canada; World Bureau of Metal Statistics.
[e] Estimated.

TABLE 7. ALUMINUM, EXPORTS TO SELECTED COUNTRIES, 1993 AND 1994

	1993		1994	
	(tonnes)	($000)	(tonnes)	($000)
United States	178 693	219 072	215 260	346 442
Japan	16 981	24 064	11 807	20 547
Taiwan	911	763	5 526	7 021
Hong Kong	1 487	1 278	2 590	3 396
South Korea	412	435	653	977
People's Republic of China	277	253	502	635
United Kingdom	47	66	163	219
Other	4 108	1 698	3 152	1 080
Total	202 916	247 629	239 653	380 317

Source: Statistics Canada.

TABLE 8. ALUMINUM, IMPORTS FROM SELECTED COUNTRIES, 1993 AND 1994

	1993		1994	
	(tonnes)	($000)	(tonnes)	($000)
United States	50 001	60 443	59 908	82 286
United Kingdom	1 653	1 766	2 184	2 905
Russia	706	769	845	913
France	–	–	233	196
Netherlands	321	437	71	95
Other	3 116	1 934	3 185	1 832
Total	55 797	65 349	66 426	88 227

Source: Statistics Canada.
– Nil.

TABLE 9. CANADA, LEAD SMELTERS

	Location	Capacity
		(t/y)
Cominco Ltd.	Trail, British Columbia	135 000
Metalex Products Ltd.[1]	Burnaby, British Columbia	6 000
Canada Metal Company	Winnipeg, Manitoba	10 000
Canada Metal Company	Toronto, Ontario	12 000
Tonolli Canada Ltd.[1]	Mississauga, Ontario	50 000
Nova Pb Inc.[1]	Ville Sainte-Catherine, Quebec	60 000
Brunswick Mining and Smelting Corporation Limited	Belledune, New Brunswick	72 000
Total		345 000

[1] Fully integrated (breaking, smelting, refining) smelters.

TABLE 10. CANADIAN BATTERY-BREAKING FACILITIES

Lead Smelter	Location
K.C. Recycling Inc.	Trail, British Columbia
Metallex Products Ltd.	Burnaby, British Columbia
Wild Rose Recycling Inc.	Wetaskewan, Alberta
Chisick Metals Ltd.[1]	Winnipeg, Manitoba
Holt Metals Inc.	Winnipeg, Manitoba
Raw Materials Corporation	Port Colborne, Ontario
Tonolli Canada Ltd.	Mississauga, Ontario
Nova Pb Inc.	Ville Sainte-Catherine, Quebec
Bathurst Steel Inc.	Bathurst, New Brunswick

[1] Not currently in operation.

TABLE 11. WORLD, PRODUCTION OF SECONDARY REFINED LEAD AND PERCENTAGE OF TOTAL REGIONAL LEAD PRODUCTION, 1990-94

	1990		1991		1992		1993		1994	
	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)
Europe	853.20	53.75	820.30	50.21	763.30	49.23	758.30	48.95	810.00	56.60
Africa	44.10	29.70	45.30	29.70	45.20	30.50	53.30	34.30	53.30	36.90
Asia	277.30	50.20	264.10	46.90	259.60	42.40	250.70	39.20	267.10	48.80
Americas	1 128.40	59.50	1 091.70	59.80	1 139.70	60.10	1 112.70	58.90	1 144.10	59.60
Oceania	22.00	9.40	24.40	10.00	22.10	9.30	25.00	10.40	21.20	9.00
Total	2 325.00	52.60	2 245.80	50.80	2 229.90	50.20	2 200.00	49.20	2 295.60	53.60

Source: World Bureau of Metal Statistics.

TABLE 12. WORLD, COPPER SCRAP RECOVERY, 1990-94

	1990		1991		1992		1993		1994[e]	
	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)
EUROPE										
Secondary production	706	16.4	737	17.0	734	16.8	782	17.6	734	16.6
Direct scrap use	944	21.9	1 015	23.5	952	21.8	1 036	23.3	1 019	23.0
Total Europe	1 650	38.2	1 752	40.5	1 686	38.7	1 818	40.9	1 753	39.6
ASIA										
Secondary production	122	2.8	116	2.7	122	2.8	105	2.4	94	2.1
Direct scrap use	805	18.6	834	19.3	815	18.7	798	17.9	817	18.5
Total Asia	927	21.5	950	22.0	937	21.5	903	20.3	911	20.6
AFRICA										
Secondary production	–	–	–	–	–	–	–	–	–	–
Direct scrap use	30	0.7	28	0.7	31	0.7	28	0.6	30	0.7
Total Africa	30	0.7	28	0.7	31	0.7	28	0.6	30	0.7
AMERICAS										
Secondary production	531	12.3	510	11.8	565	13.0	592	13.3	547	12.4
Direct scrap use	1 116	25.6	1 015	23.5	1 077	24.7	1 047	23.5	1 127	25.5
Total America	1 647	38.1	1 525	35.3	1 642	37.7	1 639	36.8	1 674	37.8
OCEANIA										
Secondary production	24	0.6	35	0.8	32	0.7	24	0.5	24	0.6
Direct scrap use	40	0.9	34	0.8	34	0.8	38	0.9	36	0.8
Total Oceania	64	1.5	69	1.6	66	1.5	62	1.4	60	1.4
Total world	4 318		4 324		4 362		4 450		4 426	

Source: World Bureau of Metal Statistics.
– Nil; [e] Estimated.

TABLE 13. WORLD, COPPER SCRAP RECOVERY AS A PERCENTAGE OF TOTAL REFINED PRODUCTION, 1990-94

	1990		1991		1992		1993		1994[e]	
	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)
Europe	1 650	100.9	1 752	107.3	1 686	114.4	1 818	109.7	1 753	108.6
Asia	927	61.0	950	59.1	937	52.6	903	49.9	911	51.4
Africa	30	3.7	28	3.9	31	4.6	28	4.6	30	5.2
Americas	1 647	39.0	1 525	35.4	1 642	36.2	1 639	34.9	1 674	36.4
Oceania	64	23.4	69	24.7	66	21.8	62	20.1	60	17.8
Total	4 318	39.9[a]	4 324	40.5[a]	4 362	38.9[a]	4 450	38.5[a]	4 426	39.4[a]

Source: World Bureau of Metal Statistics.
[e] Estimated.
[a] Final percentage calculation includes refined copper from other countries.

TABLE 14. WORLD, COPPER SCRAP RECOVERY AS A PERCENTAGE OF REFINED COPPER CONSUMPTION, 1990-94

	1990		1991		1992		1993		1994[e]	
	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)
Europe	1 650	52.6	1 752	55.6	1 686	52.1	1 818	59.9	1 753	55.0
Asia	927	34.3	950	32.2	937	33.6	903	30.5	911	29.9
Africa	30	31.3	28	30.2	31	30.7	28	26.9	30	22.1
Americas	1 647	61.0	1 525	57.7	1 642	58.9	1 639	54.1	1 674	51.0
Oceania	64	51.2	69	66.4	66	52.6	62	41.3	60	41.7
Total	4 318	40.1[a]	4 324	40.4[a]	4 362	39.4[a]	4 450	39.8[a]	4 426	37.5[a]

Source: World Bureau of Metal Statistics.
[e] Estimated.
[a] Final percentage calculation includes refined copper from other countries.

TABLE 15. CANADA, EXPORTS OF COPPER SCRAP BY SELECTED COUNTRIES, 1993 AND 1994

Country	1993		1994	
	(tonnes)	($000)	(tonnes)	($000)
United States	102 181	214 324	97 806	232 495
People's Republic of China	3 829	3 898	3 840	5 052
South Korea	2 920	5 343	2 077	3 876
Italy	341	520	1 847	4 103
India	2 422	3 217	1 586	1 849
Hong Kong	1 782	2 233	1 346	1 705
Japan	1 424	2 577	1 318	2 831
Other	1 912	2 715	2 145	2 513
Total	116 811	234 827	111 965	254 424

Source: Statistics Canada.

TABLE 16. CANADA, IMPORTS OF COPPER SCRAP BY SELECTED COUNTRIES, 1993 AND 1994

Country	1993		1994	
	(tonnes)	($000)	(tonnes)	($000)
United States	52 949	62 494	96 905	170 806
Netherlands	33	68	531	1 291
Sweden	–	–	459	1 270
Cuba	–	–	91	148
Other	30 347	33 334	31 883	38 718
Total	83 329	95 896	129 869	212 233

Source: Statistics Canada.
– Nil.

TABLE 17. CANADA, SCRAP STEEL CONSUMPTION AS A PERCENT OF RAW STEEL PRODUCTION, 1990-94

	1990		1991		1992		1993		1994	
	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)	(000 tonnes)	(%)
Home scrap	2 152	16.0	2 381	16.8	2 404	15.8	2 428	15.4	2 157	14.2
Purchased scrap	5 029	37.9	4 918	34.6	5 353	35.1	5 724	36.3	5 893	38.7
Total	7 244	53.9	7 299	51.4	7 757	50.9	8 152	51.7	8 050	52.9

Sources: Statistics Canada; Canadian Steel Producers Association.

TABLE 18. CANADA, APPARENT IRON AND STEEL RECYCLING TONNAGE, 1990-94

	1990	1991	1992	1993	1994
			(000 tonnes)		
Steel consumed (1)	7 244	7 299	7 757	8 152	8 050
Iron consumed (2)	568	508	575	590	586
Ferrous imports (3)	1 228	873	1 202	1 305	1 458
Ferrous exports (4)	1 787	1 334	1 139	1 473	1 673
Tonnes recycled (1) + (2) – (3) + (4)	8 371	8 268	8 269	8 910	8 851

Sources: Statistics Canada; Canadian Steel Producers Association; Canadian Foundry Association.

TABLE 19. CANADIAN AUTOMOBILE SHREDDERS

Company	Location	Total Annual Capacity[1]
		(000 t/y)
Cyclomet Inc.[2]	Scoudouc, New Brunswick	140
Québec Métal Recyclé Inc.	Laval, Quebec	140
Capitale Métal Recyclé Inc.	St-Augustine, Quebec	140
Associées de L'Acier Ltée	Ville Sainte-Catherine, Quebec	140
Fers et Métaux Recyclés Ltée[2]	La Prairie, Quebec	140
Sidbec-Ferruni inc.	Contrecoeur, Quebec	140
Bakermet Inc.	Ottawa, Ontario	140
Lake Ontario Steel Company	Whitby, Ontario	140
Triple M Metals Inc.	Brampton, Ontario	140
Intermetco Limited	Hamilton, Ontario	140
Zalev Brothers Limited	Windsor, Ontario	80
Lakehead Scrap Metals Inc.	Thunder Bay, Ontario	40
Wheat City Metals Inc.	Regina, Saskatchewan	40
General Scrap & Car Shredder Ltd.	Winnipeg, Manitoba	40
Mandak Metal Processors Ltd.	Selkirk, Manitoba	40
Navajo Metals Inc.	Calgary, Alberta	40
Altasteel Ltd.	Edmonton, Alberta	40
Richmond Steel Recycling Limited	Burnaby, British Columbia	40
Budget Steel Inc.	Victoria, British Columbia	40
Total		1 800

[1] Eight-hour shift, five-day week. [2] Operated by Intermetco Ltd.

TABLE 20. OECD GREEN LIST OF WASTE METAL RECYCLABLES, METAL AND METAL-ALLOY WASTES IN METALLIC, NON-DISPERSIBLE FORM

WASTE AND SCRAP OF PRECIOUS METALS AND THEIR ALLOYS

Gold waste and scrap[1]
Platinum group metals waste and scrap[1]
Other precious metals, e.g., silver[1]
Waste and scrap of cast iron
Waste and scrap of stainless steels
Waste and scrap of other alloy steels
Waste and scrap of tinned iron or steel
Turnings, shavings, chips, milling waste, fillings, trimmings and stampings, whether or not in bundles
Other ferrous waste and scrap
Remelting scrap ingots
Used iron and steel rails

WASTE AND SCRAP OF NONFERROUS METALS AND THEIR ALLOYS

Aluminum
Antimony
Beryllium
Bismuth
Cadmium
Chromium
Cobalt
Copper
Germanium
Lead
Magnesium
Manganese
Molybdenum
Nickel
Tantalum
Tin
Titanium
Tungsten
Vanadium
Zinc
Zirconium

WASTE AND SCRAP OF

Gallium
Hafnium
Indium
Niobium
Rare earths
Rhenium
Selenium
Tellurium
Thallium
Thorium

OTHER METAL-BEARING WASTES ARISING FROM MELTING, SMELTING AND REFINING OF METALS

Hard zinc spelter
- Galvanizing slab zinc top dross (90% Zn)
- Galvanizing slab zinc bottom dross (92% Zn)
- Zinc die cast dross (85% Zn)
- Hot dip galvanizers slab zinc dross (batch) (92% Zn)
- Zinc skimmings

Aluminum skimmings
Slags from precious metals and copper processing for further refining
Tantalum bearing tin slags with less than 0.5% tin

OTHER WASTES

Electrical assemblies
Spent catalysts
- Fluid catalytic cracking catalysts
- Precious metal-bearing catalyst
- Transition metal catalysts

Slag from iron or steel
Granulated slag from iron/steel
Electronic scrap
Vessels and floating structures
Motor vehicle wrecks, drained of liquids
Slag from copper production
Neutralized red mud
Cermet waste and scrap
Basic slag from iron/steel

[1] Mercury is specifically excluded as a contaminant of these metals or alloys.

TABLE 21. OECD AMBER LIST OF WASTE METAL RECYCLABLES

Dross, scalings and other wastes from the manufacture of iron and steel
Zinc ash and residues
Lead ash and residues
Copper ash and residues
Aluminum ash and residues
Vanadium ash and residues
Ash and residues containing metals or metal compound not otherwise specified
Residues from alumina production not otherwise specified
Lead-acid batteries, whole or crushed
Zinc slags containing up to 18% zinc
Liquors from the pickling of metals
Precious metal-bearing residues in solid form which contain traces of inorganic cyanides
Thallium waste and residues
Galvanic sludges
Arsenic waste and residues
Mercury waste and residues
Precious metal ash, sludge, dust and other residues
    Ash from incineration of printed circuit boards
    Film ash
Waste catalysts not on green list
Leaching residues from zinc processing
Waste hydrates of aluminum
Waste alumina
Wastes that contain, consist or are contaminated with any of the following:
    Inorganic cyanides, excepting precious metal-bearing residues in solid form containing traces of inorganic cyanides
Used batteries, other than lead-acid batteries