

Lime

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“**L**ime” is a general term referring to burned or calcined limestone (burnt lime or quicklime) and its secondary products, including slaked lime and hydrated lime (or calcium hydroxide). In the calcining process, quicklime (CaO or CaO.MgO) begins to form when the dissociation temperature of the limestone occurs. (This occurs from 402°C for the magnesium carbonate component to 898°C for the calcium carbonate portion.) Temperatures are maintained sufficiently long until there is a complete breakdown of the limestone and a release of the carbon dioxide content.

In 1994, shipments of all lime amounted to 2.4 Mt valued at \$203.6 million, based on preliminary data. Quicklime accounted for 90% of the total volume, the same ratio as in 1993; however, the total value of shipments increased nearly 3% in 1994. Production figures do not include some captive production from pulp and paper plants, which burn sludge to recover lime for re-use in the causticization process.

THE CANADIAN INDUSTRY

In 1994, the lime industry in Canada comprised 13 active companies operating 19 plants, of which 13 plants were in eastern Canada (Table 3). Total employment in the industry in 1993 (the most recent year for which data are available) was approximately 730, about 5% less than in 1992. Calcining capacity to produce quicklime did not change; effective capacity utilization was approximately 70%.

Lime is a high-bulk, comparatively low-cost commodity; however, it may be sold within a wide radius depending on transportation costs and supply and demand. Preferred locations are within close proximity to major lime markets and sources of high-quality limestones, with convenient access to low-priced energy.

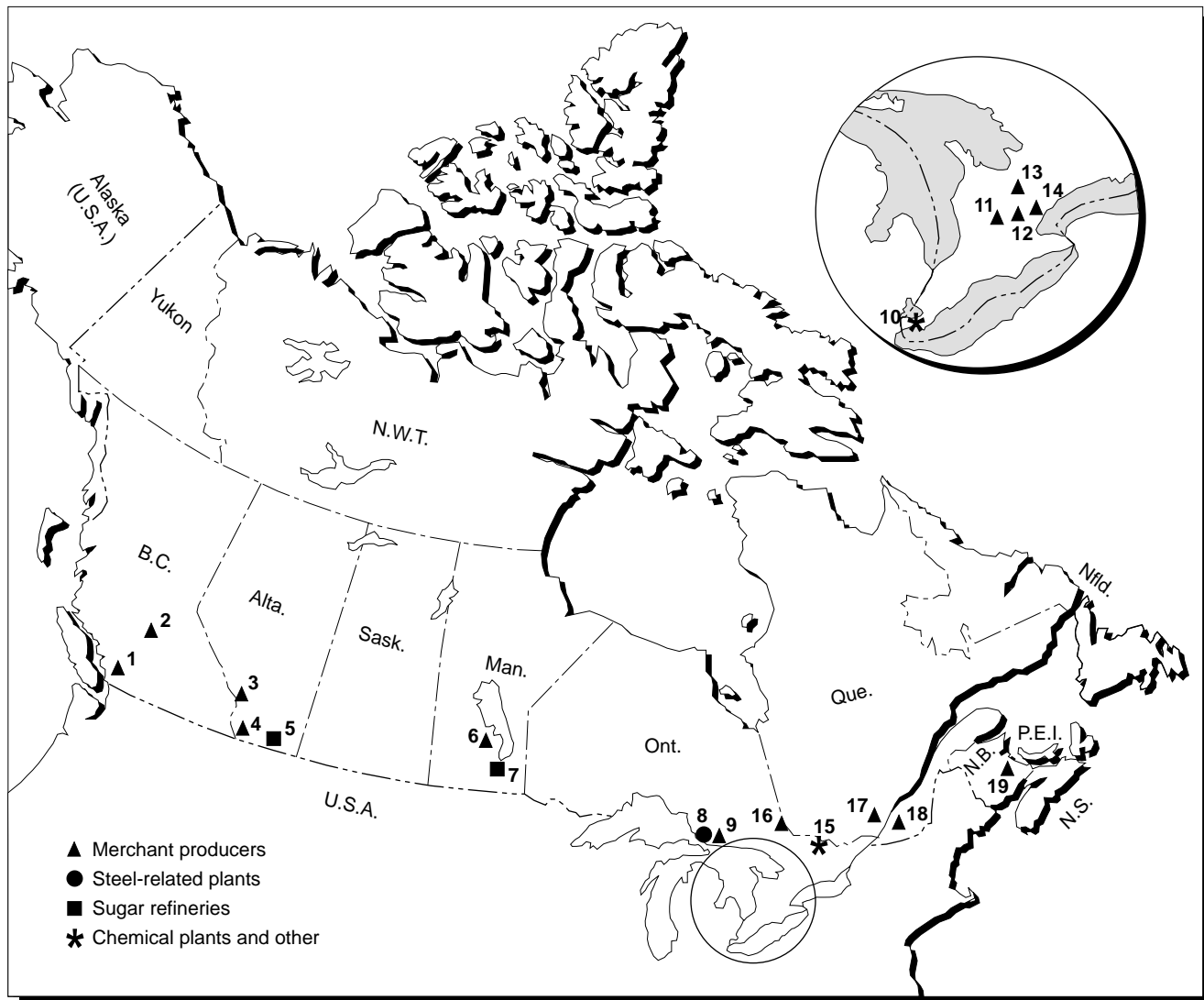
High-calcium quicklime is commercially available in six forms: lump, crushed, pebble, ground, pulverized, and as briquettes or pellets. Slaked lime is produced from mixing quicklime and water, and may be purchased as a putty, dry powder or slurry. Hydrated lime is produced from slaked lime after drying and regrinding. The resulting hydrated lime products, which are categorized by their chemistry, include the following types: high-calcium lime, dolomitic lime, and magnesian or hydraulic lime. (The latter type contains siliceous, aluminous or ferrous compounds.) Aglime, or agricultural lime, refers to pulverized limestone used for soil neutralization, primarily during the fall and spring spreading seasons.

Changes in ownership continued in the industry: Koch Minerals of Canada Limited and Northern Lime Limited announced in November 1994 that Northern Lime had acquired Koch's lime manufacturing assets located at Spragge, near Blind River, Ontario. Northern Lime has now joined BeachviLime Limited of Ingersoll, Ontario, and Guelph DoLime Limited as affiliates of Calcitherm Nederland BV of the Netherlands. Other recent changes in ownership have included: (a) the purchase of Chemical Lime Works by Global Stone Corp., (b) the purchase of Steetley Quarry Products Inc. by Redland Quarries Inc., and (c) the purchase of Texada Lime (Mining Division of BP Resources Canada Limited) by Chemstar Lime Co. Chemstar's new operating company in Canada is the Chemical Lime Company of Canada. Calcitherm is a holding company for several major limestone- and lime-producing subsidiaries in Europe and the United States. Global Stone Corp. is a privately owned company that has a management group associated with the production of construction materials and lime in the United Kingdom. Chemstar Lime Co., a member of the Chemical Lime Group (CLG), is the largest lime producer in the United States. CLG, in turn, is controlled by business interests in the Netherlands and Belgium.

CONSUMPTION

The consumption of lime produced in Canada consists of two basic categories: the captive market, which mainly includes lime produced internally by chemical plants, one steel producer, and two sugar refineries; and the merchant market, which is served by the

Figure 1
Lime Producers in Canada, 1994



Numbers refer to locations on map above.

MERCHANT PRODUCERS

1. Chemical Lime Company of Canada, Fort Langley
2. Continental Lime Ltd., Pavilion Lake
3. Continental Lime Ltd., Exshaw
4. Summit Lime Works Limited, Hazell
6. Continental Lime Ltd., Faulkner
9. Northern Lime Limited
11. Guelph DoLime Limited, Guelph
12. Global Stone (Ingersoll) Ltd.
13. Redland Quarries Inc., Dundas
14. BeachvilLime Limited, Ingersoll
16. Miller Minerals, Haileybury
17. Graybec Calc Inc., Joliette
18. Graybec Calc Inc., Marbleton
19. Havelock Lime, a division of Goldcorp Inc., Havelock

STEEL-RELATED PRODUCERS

8. The Algoma Steel Corporation, Limited, Sault Ste. Marie

SUGAR REFINERIES

5. The British Columbia Sugar Refining Company, Limited, Taber
7. The British Columbia Sugar Refining Company, Limited, Fort Garry

CHEMICAL PLANTS AND OTHER

10. General Chemical Canada Ltd., Amherstburg
15. Timminco Limited, Haley Station

mainstream lime producers. In 1993, captive consumption, including relatively large quantities dedicated to specific established uses, was estimated to be about 677 500 t, accounting for approximately 41% of total domestic sales. (Domestic sales are defined as output for captive use, plus all sales in the merchant market.)

Consumption of quicklime, based on sales in the merchant market, amounted to 1 534 208 t in 1993. The major end uses were steel-making (49%), environmental control (16%), pulp and paper (17%), chemicals (5%), and other industrial uses, including metal concentration (13%). Hydrated lime shipments in the merchant market amounted to 137 640 t in 1993, and were sold mainly for environmental control (52%), other industrial uses (24%), agricultural uses (8%), masonry (4%), metal concentration (2%), and other miscellaneous uses related mainly to road and soil stabilization and other construction (10%). Eastern Canada, comprising Ontario eastward, accounted for about three quarters of total merchant sales of quicklime in 1992.

Lime is used widely in the metallurgical, industrial (including environment), agricultural, and construction sectors. In the metallurgical industry, lime is consumed mainly as a basic flux in steel furnaces allowing impurities, including silica, alumina, phosphorus and sulphur, to form a slag. (Other fluxing agents may include limestone, dolomite, and fluorspar. Limestone and dolomite (or dolostone) are used mainly in blast furnaces for making pig iron and in sinter plants at steel mills; limestone, lime and dolime are used in both basic oxygen and electric-arc steel furnaces.)

Industrial markets for lime mainly include the pulp and paper industry, the mining industry, chemicals manufacturing, and environmental control. The pulp and paper industry is one of the major consumers of lime, mainly for the preparation of digesting liquor for manufacturing kraft or sulphate paper, and for pulp bleaching during a primary stage of production. Most of the input lime is recovered by calcining dewatered calcium carbonate sludges; however, an important volume of lime is required as "make-up." The increasing use of precipitated calcium carbonate in coated and uncoated printing and writing papers in North America has led to major growth in the demand for lime.

In the mining sector, acidic effluents are treated with alkalis or related industrial products. These include lime, limestone, soda ash, and ammonium and magnesium hydroxide to raise pH levels (for neutralization) and to precipitate metals. In the uranium industry, lime controls hydrogen-ion concentration in the extraction process as well as in the recovery of sodium carbonate and for neutralization of waste sludges. Lime is also used for cyanidation and neutralization in recovering gold and silver by flotation. Chemical manufacturers require lime to produce

sodium carbonate (soda ash) and bicarbonate of soda, and also to produce chloralkali, calcium carbide, and calcium cyanamide.

Lime is increasingly needed for environmental control with the introduction of more stringent regulations. Major uses include the treatment of liquid wastes and industrial effluents; lime is also used in the clarification and softening of potable water. In addition, the neutralization of lakes has attracted much attention over the last two decades. In certain areas, these bodies of water have been acidified by precipitation of sulphur dioxide and nitrogen dioxide emissions. Effective interim actions include liming with limestone, calcite, quicklime, hydrated lime, dolomite, sodium bicarbonate, fly ash, and industrial slags. However, research conducted mainly in Ontario has shown that pure limestone (or calcite) is the most cost-effective method.

Air pollution control is a major developing market for lime and limestone in North America. Major coal-fired power stations are taking measures to reduce emissions from the burning of high-sulphur coal, oil and lignite. Several methods apply, including the use of Flue Gas Desulphurization (FGD) units, or scrubbers. There are several options for scrubbing, including the following: wet scrubbing with limestone or lime; dry scrubbing with lime; dry injection using sodium reagents (sodium bicarbonate and sodium sesquicarbonate), trona, or nahcolite; dry injection with limestone integrated with calcium oxide activation; and dry injection of hydrated lime. Wet scrubbing processes using limestone or lime now appear to be gaining importance.

Agricultural uses apply mainly to neutralizing soil acidity. The current practice principally involves the use of pulverized limestone (or aglime). In the case of some sandy soils, dolomitic liming is carried out to help balance magnesium deficiencies.

Miscellaneous uses for lime relate to sugar refining (removal of acids from the crude sugar liquids), the control of storage conditions for fruit and vegetables, and petroleum refining (neutralization of sulphur compounds and sulphur dioxide emissions). Lime is also used in making plaster, mortar, leather and rubber, paint, glass, dolomitic refractories, and calcium-silicate bricks.

ENERGY AND TECHNOLOGY

Energy costs to produce quicklime account for about 40% of total production costs, one of the highest ratios in the mineral processing sector. Calcining takes place mainly in vertical (shaft-type) or rotary-type kilns, the latter technology being most common in North America. Preheater systems and computerized process control systems are now commonplace.

About 80% of the kilns in service use natural gas, with coal and electricity accounting for the remainder. Long rotary kiln systems consume an average of about 6.4 gigajoules per tonne (GJ/t) of calcined lime. New rotary kilns, with preheaters, consume less than 5.0 GJ/t, and short-shaft kilns consume about 4.2 GJ/t of calcined lime. Other types of kilns, of comparatively recent design, are the rotary hearth, travelling grate, fluo-solid, and the inclined vibratory kiln. Dust-collecting equipment to meet current environmental control regulations is required for all systems.

PRICES

Published prices for lime represent only a broad range. Actual prices vary according to marketing strategies and supply and demand. Average prices for high-calcium quicklime and high-calcium hydrated lime, f.o.b. plant, in Ontario, in bulk, were quoted at \$70.80/t and \$80.40/t, respectively.

INTERNATIONAL DEVELOPMENTS

In 1994, world lime production was an estimated 126.5 Mt, compared to 125.0 Mt in 1993, based on revised figures. The former Soviet Union and China each accounted for 16%, followed by the United States (14%), and Germany and Japan (each with 6%). Canada ranked thirteenth with a 2% share.

The United States produced 17.3 Mt of lime in 1994, compared to 19.5 Mt in 1993, according to preliminary figures. Apparent consumption in 1994 amounted to 17.4 Mt, compared to 17.1 Mt in 1993. Flue gas desulphurization has become a major market for lime, and is now second in importance after the steel industry.

OUTLOOK

The production of lime in Canada in 1995 is expected to increase about 3% because of strength in the pulp and paper, steel, and chemicals industries. In the medium to longer term, however, demand for lime as a flux in steel-making is forecast to decline because of several factors. These include: improved efficiencies in steel production and energy inputs, the use of larger amounts of scrap in basic oxygen furnaces, improved ore grades and more use of fluxed pellets, and growth of the mini-mill sector, which makes steel from scrap iron in electric furnaces.

Consumption in the environmental sector will expand in the short term with increased treatment of effluents in the industrial and mining sectors. Ontario Hydro has installed wet scrubbers using limestone at two of its coal-fired units at the Lambton Generating Station near Sarnia, Ontario. Similarly, limestone technology has been installed for controlling sulphur dioxide emissions at major power installations in Nova Scotia and New Brunswick.

After some consolidation, restructuring, and recent plant improvements, the lime industry has become more concentrated as fewer companies control more operations. These companies, or corporate groups (often diversified geographically and in product line), will be in a better position to meet future economic downturns. However, the current low rate of capacity utilization, along with ongoing plant modernization, will allow the lime industry to be well positioned in response to any major increases in demand.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 60. (2) Information in this review was current as of February 1, 1995.

PRICES

Canada lime prices quoted in "Camford Chemical Report"	December 1993	December 1994
	(\$ per tonne)	
Lime, carload and truckload f.o.b. Ontario plant		
High calcium quicklime, bulk	70.80	70.80
High calcium hydrated lime, bulk	80.40	80.40

f.o.b. Free on board.

TARIFFS

Item No.	Description	Canada			United States
		MFN	GPT	USA	Canada
2522.10	Quicklime	Free	Free	Free	Free
2522.20	Slaked lime	Free	Free	Free	Free
2522.30	Hydraulic lime	Free	Free	Free	Free

Sources: Customs Tariff, effective January 1995, Revenue Canada; Harmonized Tariff Schedule of the United States, 1995.

TABLE 1. CANADA, LIME PRODUCTION AND TRADE, 1992-94

Item No.	1992		1993		1994 ^p	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION¹						
By type						
	Quicklime	2 193 752	172 066	2 186 749	178 275	2 193 167
	Hydrated lime	190 592	19 246	192 247	19 212	197 533
	Total	2 384 344	191 313	2 378 996	197 487	2 390 700
By province						
	New Brunswick	x	x	x	x	x
	Quebec	x	x	x	x	x
	Ontario	1 455 801	108 470	1 430 956	112 600	1 404 300
	Manitoba	x	x	x	x	x
	Alberta	191 399	18 463	210 490	20 477	210 700
	British Columbia	x	x	x	x	x
	Total	2 384 344	191 313	2 378 996	197 487	2 390 700
IMPORTS						
2522.10	Quicklime					
	United States	43 802	3 869	40 796	4 070	50 378
	Canada ²	-	-	-	-	1 054
	India	1
	Total	43 803	3 869	40 797	4 070	51 432
2522.20	Slaked lime					
	United States	2 727	491	5 445	958	5 263
	Belgium	64	28	34	15	39
	United Kingdom	6	2	-	-	-
	Total	2 797	522	5 479	973	5 302
2522.30	Hydraulic lime					
	United States	7 606	1 284	6 007	1 065	9 765
	United Kingdom	-	-	407	312	800
	Germany	1 500	334	-	-	-
	Total	9 106	1 618	6 414	1 378	10 565
EXPORTS						
2522.10	Quicklime					
	United States	135 699 ^r	12 345 ^r	149 750	13 799	167 827
	Bermuda	-	-	16	2	-
	Total	135 699 ^r	12 345 ^r	149 766	13 801	167 827
2522.20	Slaked lime					
	United States	18 858	2 161	21 851	2 482	15 666
	Bermuda	-	-	16	2	-
	Total	18 858	2 161	21 867	2 485	15 666
2522.30	Hydraulic lime					
	United States	18 659	1 747	18 419	1 722	10 391
	Bermuda	32	4	-	-	18
	Other countries	1	...	16	3	-
	Total	18 691	1 752	18 435	1 726	10 408

Sources: Natural Resources Canada; Statistics Canada.

- Nil; ... Amount too small to be expressed; ^p Preliminary; x Confidential.

¹ Producers' shipments and quantities used by producers. ² Includes re-imports.

Notes: Numbers may not add to totals due to rounding. HS code 2522.30, as interpreted, applies mainly to hydrated lime.

TABLE 2. CANADA, LIME PRODUCTION, TRADE AND APPARENT CONSUMPTION, 1970, 1975, 1980, AND 1985-94

	Production ¹			Imports	Exports	Apparent Consumption ²
	Quick	Hydrated	Total			
(tonnes)						
1970	1 296 590	224 026	1 520 616	30 649	181 994	1 369 271
1975	1 533 944	199 195	1 733 139	30 099	234 034	1 529 204
1980	2 364 000	190 000	2 554 000	40 901	403 166	2 191 735
1985	2 054 294	157 286	2 211 580	23 056	194 097	2 040 539
1986	2 069 043	173 534	2 242 577	46 917	189 512	2 099 982
1987	2 140 793	189 278	2 330 071	44 290	163 767	2 210 594
1988 ^a	2 306 831	211 151	2 517 982	32 543	122 900	2 427 625
1989	2 349 312	202 622	2 551 934	39 095	83 608	2 507 421
1990	2 137 996	202 741	2 340 737	43 715	138 409	2 246 043
1991	2 184 836	190 424	2 375 260	45 012	134 405 ^r	2 285 867 ^r
1992	2 193 752	190 592	2 384 344	55 706	173 248 ^r	2 266 802 ^r
1993	2 186 749	192 247	2 378 996	52 690	190 068	2 241 618 ^r
1994 ^p	2 193 167	197 533	2 390 700	67 299	193 901	2 264 098

Sources: Natural Resources Canada; Statistics Canada.

^p Preliminary; ^r Revised.

^a Beginning in 1988, Exports and Imports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. Imports and Exports include HS classes 2522.10, 2522.20 and 2522.30.

¹ Producers' shipments and quantities used by producers. ² Production plus imports, less exports.

TABLE 3. CANADIAN LIME INDUSTRY, 1994

Company	Plant Location	Calcining Capacity	Market	Type of Quicklime and Other Products
(000 t/y)				
NEW BRUNSWICK				
Havelock Lime, a division of GoldCorp. Inc.	Havelock	175	Merchant	High calcium ¹
QUEBEC				
Graybec Calc Inc.	Marbleton	300	Merchant	High calcium ¹
Graybec Calc Inc.	Joliette	282	Merchant/captive	High calcium ¹
ONTARIO				
Algoma Steel Inc.	Sault Ste. Marie	200	Captive	High calcium and dolomitic
Beachville Lime Limited	Ingersoll	600	Merchant	High calcium ¹
Miller Minerals, a division of Miller Paving Limited	Haileybury	40	Merchant	High calcium
General Chemical Canada Ltd.	Amherstburg	292	Captive	High calcium
Guelph DoLime Limited	Guelph	122	Merchant	Dolomitic ¹
Northern Lime Limited	Spragge	200	Merchant	High calcium
Redland Quarries Inc.	Dundas	345	Merchant	Dolomitic
Global Stone (Ingersoll) Ltd.	Ingersoll	215	Merchant/captive	High calcium
Timminco Limited	Haley	53	Captive	Dolomitic
MANITOBA				
The British Columbia Sugar Refining Company, Limited	Fort Garry	16	Captive	High calcium
Continental Lime Ltd.	Faulkner	117	Merchant	High calcium
ALBERTA				
The British Columbia Sugar Refining Company, Limited	Taber	66	Captive	High calcium
Continental Lime Ltd.	Exshaw	130	Merchant	High calcium ¹
Summit Lime Works Limited	Hazell	50	Merchant	High calcium and dolomitic ¹
BRITISH COLUMBIA				
Continental Lime Ltd.	Pavilion Lake	235	Merchant	High calcium
Chemical Lime Company of Canada Inc.	Fort Langley	135	Merchant	High calcium ¹

Source: Natural Resources Canada.

¹ Production of hydrated lime.

TABLE 4. CANADA, CONSUMPTION¹ OF DOMESTIC LIME, QUICK AND HYDRATED, 1990-93

End Uses	1990	1991	1992	1993
(tonnes)				
CHEMICAL AND INDUSTRIAL				
Steel-making	438 000	780 978	794 700	746 111
Water and sewage treatment	412 710	292 346	201 685	237 766
Water purification	42 329	71 212	71 589	62 808
Gas scrubbing	13 922	17 088	20 608	13 736
Metal concentration	59 248	70 856	163 777	125 919
Pulp and paper mills	234 917	220 735	264 223	256 770
Chemicals	119 587	116 939	92 609	77 193
Other industrial uses	88 531	90 401	175 410	102 975
CONSTRUCTION				
Road and soil stabilization	14 329	12 723	14 676	9 395
Mason and finishing lime	7 095	5 971	12 176	6 060
Other	21 230	11 079	17 784	22 114
AGRICULTURE				
	10 519	9 584	9 616	11 001
Total	1 462 417	1 699 912	1 838 853	1 671 848

Sources: Natural Resources Canada; producing companies' surveys, 1990-93.

¹ Includes merchant market; excludes companies that are completely captive producer/consumers.**TABLE 5. WORLD PRODUCTION OF QUICKLIME AND HYDRATED LIME, INCLUDING DEAD-BURNED DOLOMITE SOLD AND USED, 1990-94**

	1990	1991	1992	1993	1994p
(000 tonnes)					
Former Soviet Union	27 996	26 036	23 043	20 000	20 000
China	16 964	18 507	19 051	19 500	20 000
United States	15 832	15 667	16 200	16 900	17 300
Japan ¹	8 528	8 954	8 528	8 000	8 000
Germany	10 197	9 317	7 711	7 500	7 500
Mexico	5 996	6 505	6 505	6 500	6 500
Brazil	5 697	5 498	5 534	5 700	5 700
Italy ²	3 846	3 602	3 602	3 600	3 600
France	2 994	2 994	2 994	3 000	3 000
Romania	3 202	3 003	2 540	3 000	3 000
Poland	4 400	3 103	3 000	2 500	2 600
United Kingdom	2 604	2 604	2 540	2 500	2 500
Canada	2 341	2 375	2 384	2 400	2 400
Other countries	27 799	20 634	20 865	23 850	24 350
Total	142 023	132 569	127 320	124 950	126 450

Sources: Natural Resources Canada; Statistics Canada; U.S. Bureau of Mines' Mineral Commodity Summaries, 1994.

p Preliminary.

¹ Quicklime only. ² Includes hydraulic lime.