

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.

Canadian shipments of all lime in 1996 amounted to nearly 2.5 Mt valued at \$212.3 million, based on preliminary data. Quicklime accounted for about 90% of the total volume, essentially the same ratio as in 1995; however, the total value of shipments increased nearly 5% in 1996. Production figures do not include some captive production from pulp and paper plants that burn sludge to recover lime for re-use in the causticization process.

THE CANADIAN INDUSTRY

The lime industry in Canada comprises 13 active companies operating 19 plants, of which 13 plants were in eastern Canada (Table 3). Total employment in the industry in 1995 (the most recent year for which data are available) was approximately 790, about 4% more than in 1994. Calcining capacity to produce quicklime did not change; effective capacity utilization was approximately 70%.

Global Stone Corp. of Oakville, Ontario, which owns the Ingersoll, Ontario plant, completed two company acquisitions in the United States in 1996. In addition to the Ingersoll plant, Global Stone now has operations relating to lime, chemical-grade limestone and construction aggregates in four states. This company is now 16% owned by Cominco Ltd. of Vancouver as the result of Cominco increasing its common share holdings in 1996.

CONSUMPTION

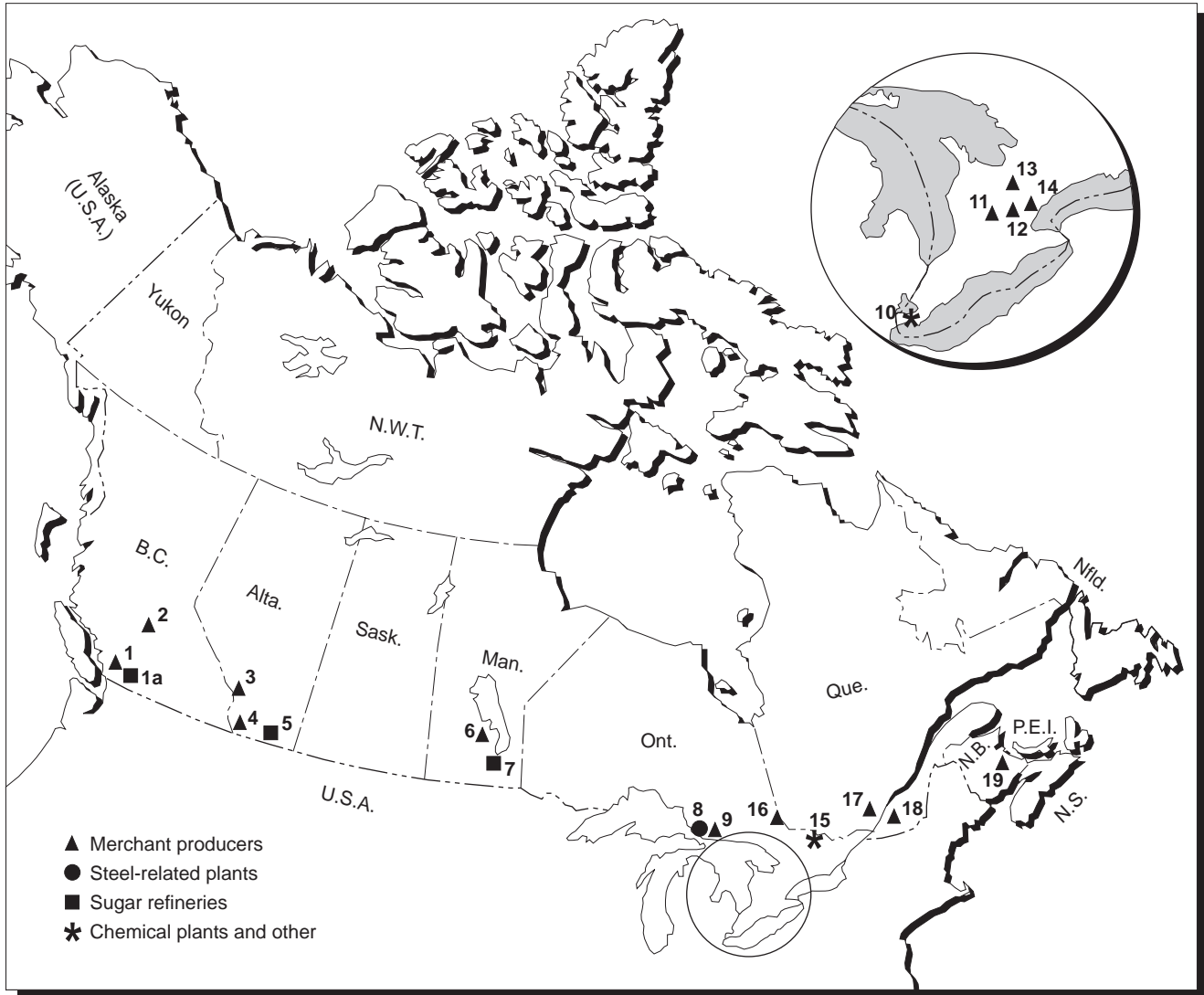
Lime is a high-bulk, comparatively low-cost commodity; however, it may be sold within a wide radius depending on transportation costs and supply and demand. Preferred locations are within close proximity to major lime markets and sources of high-quality limestones with convenient access to low-priced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

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 mainstream lime producers. In 1995, captive consumption, including relatively large quantities dedicated to specific established uses, was estimated to be about 585 000 t, accounting for approximately 25% of apparent consumption.

Consumption of quicklime, based on sales in the merchant market, amounted to 1 784 212 t in 1995. The major end uses were steel-making (47%), environmental control (13%), pulp and paper (13%), chemicals (11%), and other industrial uses including metal concentration (16%). Hydrated lime shipments in the merchant market amounted to 163 040 t in 1995, and were sold mainly for environmental control (49%), other industrial uses (23%), metal concentration (5%), agricultural uses (3%), masonry (2%), and other miscellaneous uses related mainly to road and soil stabilization and other construction (18%). Eastern Canada, comprising Ontario eastward, accounted for about three quarters of total merchant sales of quicklime in 1995.

Figure 1
Lime Producers in Canada, 1996



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. BeachviLime 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. Algoma Steel Inc., Sault Ste. Marie

SUGAR REFINERIES

- 1a. Rogers Sugar Ltd., Vancouver
- 5. Rogers Sugar Ltd., Taber
- 7. Rogers Sugar Ltd., Fort Garry

CHEMICAL PLANTS AND OTHER

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

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 the 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 due to the introduction of more stringent regulations. Major uses include the treatment of liquid wastes and industrial effluents. In terms of tonnage, lime is the most important chemical 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.

The miscellaneous uses for lime relate to sugar refining (removal of acids from the crude liquid sugars), 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 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 at the end of 1996.

INTERNATIONAL DEVELOPMENTS

In 1996, world lime production was an estimated 121.0 Mt, compared to 119.5 Mt in 1995, based on revised figures. The major producers were China, which accounted for 17%, followed by the United States at 16% and Germany and Japan each with about 6.5%. Other countries, mainly the former Soviet Union, accounted for about 33%.

The United States produced 19 Mt of lime in 1996 compared to 18.5 Mt in 1995, according to preliminary figures. Apparent consumption amounted to 19.2 Mt in 1996 compared to 18.7 Mt in 1995. Environmental uses for lime in the United States, which include flue gas desulfurization (FGD), water treatment and waste-water treatment, have grown rapidly and are expected to surpass use by the iron and steel industry. FGD-related uses are now the second most important use after the steel industry.

Stricter rules are now in effect concerning waste-water treatment and the use of sewer sludges. As a result, it is expected that lime consumption will increase, and that the biosolids produced will find acceptable uses as fertilizers, soil amendments, covers for landfill sites, and for mine reclamation.

OUTLOOK

The production of lime in Canada in 1997 is expected to increase 2-4% based on economic recoveries in the

pulp and paper, steel, and chemicals industries. In the medium to longer term, 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 iron ore pellets, as well as 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.

The lime industry has become more concentrated as fewer companies control more operations. These companies, or corporate groups (often diversified geographically and by 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 to respond to any major increases in demand.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 70. (2) Information in this review was current as of February 2, 1997.

PRICES

Canadian lime prices quoted in "Camford Chemical Report"	December 1995	December 1996
	(\$ 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 1997, Revenue Canada; Harmonized Tariff Schedule of the United States, 1997.

TABLE 1. CANADA, LIME PRODUCTION AND TRADE, 1994-96

Item No.	1994		1995		1996p	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION¹						
By type						
Quicklime	2 250 205	180 129	2 244 800	184 852	2 221 320	212 301
Hydrated lime	198 818	20 218	216 916	22 081	269 180	27 721
Total	2 449 023	200 347	2 461 716	206 933	2 490 500	212 301
By province						
New Brunswick	x	x	x	x	x	x
Quebec	x	x	x	x	x	x
Ontario	1 455 496	111 251	1 383 659	110 138	1 330 200	107 129
Manitoba	x	x	x	x	x	x
Alberta	215 155	21 136	210 006	21 015	226 600	22 553
British Columbia	x	x	x	x	x	x
Total	2 449 023	200 347	2 461 716	206 933	2 490 500	212 301
IMPORTS²						
2522.10 Quicklime						
United States	50 378	5 096	40 706	4 456	28 575	3 416
Other countries	640	103	1	1	54	24
Total	51 018	5 199	40 707	4 457	28 629	3 440
2522.20 Slaked lime						
United States	5 264	949	3 735	738	4 266	826
Belgium	39	17	46	21	89	40
Canada	-	-	15	2	-	-
Total	5 303	966	3 796	761	4 355	866
2522.30 Hydraulic lime						
United States	9 765	1 754	8 256	1 527	3 643	746
Switzerland	-	-	-	-	12	2
United Kingdom	800	152	-	-	-	-
Belgium	-	-	120	31	-	-
Japan	-	-	5	2	-	-
Total	10 565	1 906	8 381	1 560	3 655	748
EXPORTS						
2522.10 Quicklime						
United States	167 827	15 648	244 731	26 996	149 664	17 852
Chile	-	-	-	-	42	31
Total	167 827	15 648	244 731	26 996	149 706	17 883
2522.20 Slaked lime						
United States	15 666	1 995	20 249	2 880	21 333	2 638
Bermuda	-	-	16	3	16	3
Total	15 666	1 995	20 265	2 883	21 349	2 641
2522.30 Hydraulic lime						
United States	10 391	1 003	1 479	210	45 763	4 171
Bermuda	18	4	-	-	31	6
Total	10 409	1 007	1 479	210	45 794	4 177

Sources: Natural Resources Canada; Statistics Canada.

- Nil; 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 1985-96

	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	2 285 867
1992	2 193 752	190 592	2 384 344	55 706	173 248	2 266 802
1993	2 186 749	192 247	2 378 996	52 690	190 068	2 241 618
1994	2 250 205	198 818	2 449 023	66 886	193 902	2 322 007
1995	2 244 800	216 916	2 461 716	52 884	266 475	2 248 125
1996 ^P	2 221 320	269 180	2 490 500	36 639	216 849	2 310 290

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary.

^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, 1996

Company	Plant Location	Calcining Capacity (000 t/y)	Market	Type of Quicklime and Other Products
NEW BRUNSWICK				
Havelock Lime, a division of GoldCorp. Inc.	Havelock	175	Merchant	High-calcium ¹
QUEBEC				
Graybec Calc Inc.	Marbleton	290	Merchant	High-calcium ¹
Graybec Calc Inc.	Joliette	190	Merchant/captive	High-calcium ¹
ONTARIO				
Algoma Steel Inc.	Sault Ste. Marie	200	Captive	High-calcium and dolomitic
BeachviLime 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 Station	53	Captive	Dolomitic
MANITOBA				
Rogers Sugar Ltd.	Fort Garry	16	Captive	High-calcium
Continental Lime Ltd.	Faulkner	117	Merchant	High-calcium
ALBERTA				
Rogers Sugar Ltd.	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
Rogers Sugar Ltd.	Vancouver	. .	Captive	High-calcium

Source: Natural Resources Canada.

. . Not available.

¹ Production of hydrated lime.

Note: Lantic Sugar Limited operates sugar refineries in Quebec and New Brunswick.

TABLE 4. CANADA, CONSUMPTION¹ OF DOMESTIC LIME, QUICK AND HYDRATED, 1991-95

End Uses	1991	1992	1993	1994	1995
(tonnes)					
CHEMICAL AND INDUSTRIAL					
Steel-making	780 978	794 700	746 111	825 605	836 826
Water and sewage treatment	292 346	201 685	237 766	219 438	236 315
Water purification	71 212	71 589	62 808	69 611	57 715
Gas scrubbing	17 088	20 608	13 736	14 274	12 058
Metal concentration	70 856	163 777	125 919	120 837	146 461
Pulp and paper mills	220 735	264 223	256 770	235 746	245 007
Chemicals	116 939	92 609	77 193	136 607	194 033
Other industrial uses	90 401	175 410	102 975	152 329	178 705
CONSTRUCTION					
Road and soil stabilization	12 723	14 676	9 395	6 757	2 504
Mason and finishing lime	5 971	12 176	6 060	3 387	3 834
Other	11 079	17 784	22 114	26 191	28 194
AGRICULTURE					
	9 584	9 616	11 001	12 500	5 600
Total	1 699 912	1 838 853	1 671 848	1 823 282	1 947 252

Sources: Natural Resources Canada; producing companies' surveys, 1991-95.

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, 1992-96

	1992	1993	1994	1995	1996P
(000 tonnes)					
China	19 051	19 500	19 500	20 000	20 000
United States	16 200	16 900	17 400	18 500	19 000
Japan ¹	8 528	8 000	7 710	7 900	7 900
Germany	7 711	7 500	7 500	8 000	8 000
Mexico	6 505	6 500	6 500	6 600	6 600
Brazil	5 534	5 700	5 700	5 700	5 700
Italy ²	3 602	3 600	3 500	3 500	3 500
France	2 994	3 000	2 500	2 600	2 600
Poland	3 000	2 500	2 500	2 500	2 500
United Kingdom	2 540	2 500	2 500	2 500	2 500
Canada	2 384	2 400	2 450	2 450	2 500
Other countries	46 448	46 850	40 350	39 200	40 200
Total	127 320	124 950	118 110	119 450	121 000

Sources: Natural Resources Canada; Statistics Canada; U.S. Geological Survey.

P Preliminary.

¹ Quicklime only. ² Includes hydraulic lime.