

Lime

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“Lime” 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. Temperatures are maintained sufficiently long until there is a complete breakdown of the limestone and a release of the carbon dioxide content. High-calcium quicklime containing mainly CaO and less than 5% MgO is the most common type of lime produced. However, dolomitic quicklime (or dolime) as well as its hydrated products are also produced; these products contain 35-40% MgO.

CANADIAN INDUSTRY

The lime industry in Canada comprises 20 operating plants, of which 12 plants were in eastern Canada (Table 3). Total employment in the industry in 1997 (the most recent year for which data are available) was approximately 812, about 10% more than in 1996. Calcining capacity to produce quicklime did not change; the effective capacity utilization rate was approximately 70%.

Canadian shipments of all lime in 1998 amounted to 2.51 Mt valued at \$221 million based on preliminary data. Quicklime accounted for about 90% of the total volume, essentially the same ratio as in 1997. 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. Similarly, beginning with 1996 data, General Chemical Canada Ltd. has not been included as a producer of lime. Changes in ownership continued in the industry.

In 1997, Redland Quarries Inc. of Dundas, Ontario, came under new ownership following the acquisition of its parent company, U.K.-based Redland plc, by Lafarge SA of France. The final stage of Redland Quarries' acquisition by Lafarge's U.S. affiliate, Lafarge Corporation, was completed in mid-1998. The Dundas plant now operates as Lafarge Lime (Canada) Inc. Ownership of this plant is now controlled by joint-venture partners, Carmeuse SA of Belgium and Lafarge SA of France, following a later agreement that combined these companies' lime operations in North America.

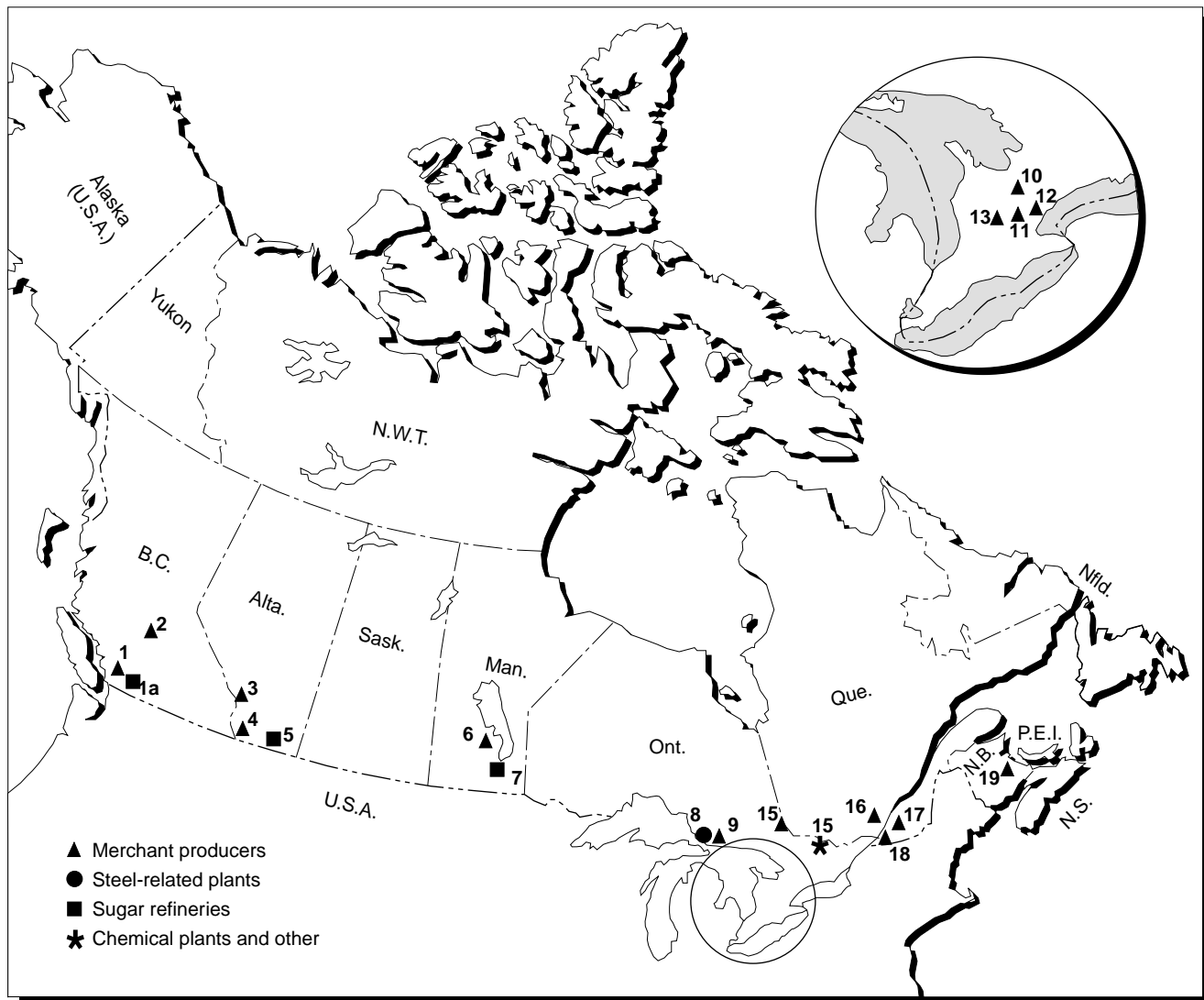
Oglebay Norton Co., of Cleveland, Ohio, purchased Global Stone Corp. of Oakville, Ontario, for approximately \$250 million based on a cash offer for Global's common shares. With this purchase, Oglebay now owns Global Stone Ingersoll Ltd., a major Ontario merchant lime producer.

Graymont Limited, of Vancouver, British Columbia, the owner of Canadian-based companies Continental Lime Ltd. and Graybec Calc. Inc., purchased Bellafonte Lime Co. of Bellafonte, Pennsylvania, as well as Genlime Group LP of Genoa, Ohio, in mid-1998. Graymont, including its other affiliated plants in the United States, is now one of North America's major lime producers.

CONSUMPTION

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.

Figure 1
Lime Producers in Canada, 1998



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, Spragge
- 10. Guelph DoLime Limited, Guelph
- 11. Global Stone (Ingersoll) Ltd.
- 12. Lafarge Lime (Canada) Inc., Dundas
- 13. Beachville Lime Limited, Ingersoll
- 15. Miller Minerals, Haileybury
- 16. Graybec Calc Inc., Joliette
- 17. Graybec Calc Inc., Marbleton
- 18. Graybec Calc Inc., Bedford
- 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 PLANT OR OTHER

- 14. Timminco Limited, Haley Station

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 three sugar refineries; and the merchant market, which is served by the mainstream lime producers.

The consumption of quicklime, based on sales in the merchant market, amounted to 1 593 506 t in 1997. The major end uses were steel-making (51%), environmental control (15%), pulp and paper (14%), chemicals (8%), and other industrial uses, including metal concentration (12%). Hydrated lime shipments in the merchant market amounted to 168 828 t in 1997, and were sold mainly for environmental control (54%), other industrial uses (16%), metal concentration (3%), agricultural uses (3%), masonry (4%), and other miscellaneous uses related mainly to road and soil stabilization and other construction (20%). Eastern Canada, comprising Ontario eastward, accounted for about three quarters of total merchant sales of quicklime in 1997.

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 fluor-spar.) 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.

The industrial markets for lime mainly include the pulp and paper, mining, chemicals manufacturing, and environmental control industries. 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.

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 increasingly needed for environmental control because of more stringent regulations. The neutralization of lakes has attracted attention in the past; 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. In Canada, wet scrubbing processes using limestone or lime are becoming more important.

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 include sugar refining (removal of acids from the crude sugar liquids) 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 50% of the kilns in service use natural gas, with coal and electricity accounting for the remainder. Long rotary kiln systems, typically with no preheat capability, consume from 7 to 13 gigajoules per tonne (GJ/t) of calcined lime, according to producers. New rotary kilns, with preheaters, consume less than 5.0 GJ/t, and short, vertical 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 1998.

INTERNATIONAL DEVELOPMENTS

In 1998, world lime production was an estimated 121 Mt, compared to 120 Mt in 1997 (Table 5). The United States and China, each accounting for more than 20 Mt or about 17% of world output, were followed by Germany and Japan each with about 7% of world output.

Although Canada ranks in the top ten lime-producing countries (2.5 Mt), it is a relatively small producer because of fewer industrial requirements. However, reserves of limestone are relatively large and the proximity of lime plants to U.S. markets has resulted in a favourable balance of trade in lime products, as shown in Table 2.

The United States produced 20.4 Mt of lime in 1998 compared to 19.7 Mt in 1997, according to preliminary figures. Apparent consumption amounted to 20.6 Mt in 1998 compared to 19.9 Mt in 1997. Environmental uses for lime in the United States, which include flue gas desulphurization (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 wastewater 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 in mine reclamation.

OUTLOOK

The production of lime in Canada in 1999 is expected to increase marginally based on continued strength in the pulp and paper, steel, and chemicals industries. Although demand for steel is expected to be stronger by mid-1999, according to the Canadian Steel Producers Association, increased imports of

steel from outside of North America may effectively decrease domestic production and the need for lime in this sector. Canada's favourable balance of trade in lime products with the United States is expected to continue.

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, more use of fluxed iron ore 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 an increase in the treatment of effluents in the industrial and mining sectors. Ontario Power Generation Inc. (formerly 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. Commercial-quality synthetic gypsum has now become an important coal combustion product resulting from the installation of these scrubbers; this is referred to in detail in a separate chapter entitled *Gypsum and Anhydrite*.

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 to respond to any major increases in demand.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of February 1, 1999.

PRICES

Canadian lime prices quoted in <i>Camford Chemical Report</i>	December 1997	December 1998
	(\$ 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 1999, Revenue Canada; Harmonized Tariff Schedule of the United States, 1999.

TABLE 1. CANADA, LIME PRODUCTION AND TRADE, 1996-98

Item No.	1996		1997		1998p		
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	
PRODUCTION¹							
	By type						
	Quicklime	2 134 437	176 774	2 219 385	187 347	2 263 400	194 854
	Hydrated lime	267 595	25 805	257 186	25 691	250 200	25 654
	Total	2 402 032	202 579	2 476 571	213 038	2 513 600	220 509
	By province						
	New Brunswick	x	x	x	x	x	x
	Quebec	x	x	x	x	x	x
	Ontario	1 317 393	103 535	1 343 834	108 884	1 331 900	108 793
	Manitoba	x	x	x	x	x	x
	Alberta	x	x	x	x	x	x
	British Columbia	x	x	x	x	x	x
	Total	2 402 032	202 579	2 476 571	213 038	2 513 600	220 509
IMPORTS²							
2522.10	Quicklime						
	United States	28 575	3 416	39 204	4 741	23 327	3 244
	Other countries	54	24	18	6	15	2
	Total	28 629	3 440	39 222	4 747	23 342	3 246
2522.20	Slaked lime						
	United States	4 266	826	5 286	1 016	5 389	1 221
	Other countries	89	40	18	8	29	27
	Total	4 355	866	5 304	1 024	5 418	1 248
2522.30	Hydraulic lime						
	United States	3 643	746	2 793	589	5 166	1 235
	Belgium	-	-	53	13	58	20
	Other countries	12	2	10	6	4	2
	Total	3 655	748	2 856	608	5 228	1 257
2518.20	Calcined dolomite						
	United States	4 113	866	6 459	952	2 946	584
	Canada	-	-	-	-	143	13
	Total	4 113	866	6 459	952	3 089	597

TABLE 1 (cont'd)

Item No.	1996		1997		1998P	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS						
2522.10	Quicklime					
	United States	149 664	17 852	185 996	22 515	143 541
	Chile	42	31	—	—	91
	Total	149 706	17 883	185 996	22 515	143 632
2522.20	Slaked lime					
	United States	21 333	2 638	36 996	4 534	27 661
	Bermuda	16	3	—	—	—
	China	—	—	—	—	10
	Total	21 349	2 641	36 996	4 534	27 671
2522.30	Hydraulic lime					
	United States	45 763	4 171	1 240	154	136
	Bermuda	31	6	—	—	—
	China	—	—	—	—	7
	Total	45 794	4 177	1 240	154	143
2518.20	Calcined dolomite					
	United States	33 827	6 346	33 620	6 390	32 515
	Venezuela	26 422	887	26 602	355	—
	Trinidad and Tobago	—	—	50 559	670	—
	Other countries	562	135	40	11	—
	Total	60 811	7 368	110 821	7 426	32 515
	Total	60 811	7 368	110 821	7 426	6 459

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 1985-98

	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	2 134 437	267 595	2 402 032	36 639	216 849	2 221 822
1997	2 219 385	257 186	2 476 571	47 382	224 232	2 299 721
1998P	2 263 400	250 200	2 513 600	33 988	171 446	2 376 142

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, 1998

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	330	Merchant	High-calcium ¹
Graybec Calc Inc.	Joliette	200	Merchant/captive	High-calcium ¹
Graybec Calc Inc.	Bedford	200	Merchant	High-calcium
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
Guelph DoLime Limited	Guelph	100	Merchant	Dolomitic ¹
Northern Lime Limited	Spragge	200	Merchant	High-calcium
Lafarge Lime (Canada) 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, 1993-97

End Uses	1993	1994	1995	1996	1997
	(tonnes)				
CHEMICAL AND INDUSTRIAL					
Steel-making	746 111	825 605	836 826	780 386	807 000
Water and sewage treatment	237 766	219 438	236 315	260 221	278 987
Water purification	62 808	69 611	57 715	46 572	52 026
Gas scrubbing	13 736	14 274	12 058	8 276	9 376
Metal concentration	125 919	120 837	146 461	144 224	151 258
Pulp and paper mills	256 770	235 746	245 007	229 659	225 363
Chemicals	77 193	136 607	194 033	129 835	125 889
Other industrial uses	102 975	152 329	178 705	82 753	74 365
CONSTRUCTION					
Road and soil stabilization	9 395	6 757	2 504	7 337	14 458
Mason and finishing lime	6 060	3 387	3 834	3 427	7 252
Other	22 114	26 191	28 194	22 401	11 851
AGRICULTURE					
	11 001	12 500	5 600	5 056	4 509
Total	1 671 848	1 823 282	1 947 252	1 720 147	1 762 334

Source: Natural Resources Canada, based on producing companies' surveys, 1993-97.

¹ Includes merchant market only; excludes companies that are completely captive producers/consumers.

TABLE 5. WORLD PRODUCTION OF QUICKLIME AND HYDRATED LIME, INCLUDING DEAD-BURNED DOLOMITE SOLD AND USED, 1994-98

	1994	1995	1996	1997	1998P
	(000 tonnes)				
China	19 500	20 000	20 000	20 500	21 000
United States	17 400	18 500	19 100	19 700	20 400
Japan ¹	7 710	7 900	7 676	7 850	7 800
Germany	7 500	8 000	8 000	8 000	8 000
Mexico	6 500	6 600	6 600	6 600	6 600
Brazil	5 700	5 700	5 700	5 700	5 700
Italy ²	3 500	3 500	3 500	3 500	3 500
France	2 500	2 600	3 000	2 800	2 800
Poland	2 500	2 500	2 500	2 500	2 500
United Kingdom	2 500	2 500	2 500	2 500	2 500
Canada	2 450	2 450	2 400	2 500	2 500
Other countries	40 350	39 200	40 200	37 850	37 700
Total	118 110	119 450	121 180	120 000	121 000

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

P Preliminary.

¹ Quicklime only. ² Includes hydraulic lime.