



2007 Minerals Yearbook

POTASH [ADVANCE RELEASE]

POTASH

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Potash production declined about 5% in 2007, but the total value of sales increased by 17% compared with that of 2006 because the average unit value was higher. About 2.6 million metric tons (Mt) of minerals was mined to produce 1.1 Mt of potassium oxide (K_2O) equivalent.¹ Imports for consumption increased by 11% and the customs value increased by 15%. Exports were 40% lower in 2007 compared with those of 2006 (table 1).

Potash denotes a variety of mined and manufactured salts, all of which contain the element potassium in water-soluble form. The majority of domestic potash was produced near Carlsbad, NM, with most of the potash coming from the mineral sylvite. The term potash refers to potassic fertilizers, which are potassium chloride (KCl or sylvite), potassium sulfate [K_2SO_4 or sulfate of potash (SOP), usually a manufactured product], and potassium-magnesium sulfate [$K_2SO_4 \cdot 2MgSO_4$ or langbeinite or double sulfate of potash magnesia (SOPM or K-Mag)]. Muriate of potash (MOP) is an agriculturally acceptable mix of KCl (95% pure or greater) and sodium chloride (halite) for fertilizer use that includes minor amounts of other nontoxic minerals from the mined ore and is neither the crude ore sylvinite nor pure sylvite.

This publication has historically included potassium nitrate [KNO_3 or saltpeter or nitrate of potash (NOP), a mostly manufactured product] and mixed sodium nitrate and potassium nitrate ($NaNO_3$ and KNO_3 or Chilean saltpeter, a natural product) because these materials function as potassic plus nitrogenous fertilizers. Saltpeter and Chilean saltpeter are still noted in the import tables (tables 8, 9).

Production

Domestic production data were developed by the U.S. Geological Survey (USGS) from a semiannual voluntary canvass of U.S. operations. Of the seven operations canvassed for semiannual production data, all but one responded for the January through June survey, and for the July through December survey, representing 98% of the total production listed in table 1. Data for the nonrespondent were estimated on the basis of prior-year production levels.

Three companies produced potash from seven operations in three States. Most domestic production was from southeastern New Mexico, where Intrepid Mining LLC operated two mines and The Mosaic Company operated one mine. Mosaic also

operated a deep-solution mine in Michigan. The third State with potash production was Utah, where Intrepid produced potash from two operations and Great Salt Lake Minerals Corp. (GSLM) produced from another operation.

Potash companies in the United States produced MOP, SOP, and SOPM. Published production data of all types and grades of potash in the United States are adjusted to avoid disclosing the proprietary data of companies that produce SOP and SOPM, which together are known as sulfates.

Production decreased for the third consecutive year. By yearend, higher potash prices indicated that market conditions were becoming more favorable for producers, prompting an increase in exploration activity in North America. Most of the exploration activity in the United States was in the Paradox Basin Formation in southwestern Colorado and southeastern Utah.

GSLM announced that it planned to increase its SOP production at its Great Salt Lake, UT, facility by expanding the solar evaporation ponds and upgrading the processing plant. The company expects to implement the expansion over 3 years beginning in 2008 (Fertilizer Week, 2007c).

Intrepid plans to increase production at its Moab and Wendover, UT, facilities, which would increase its annual production capacity by 100,000 metric tons (t) by 2010. The company also was evaluating the conversion of three abandoned mines in the Carlsbad, NM, area to solution mines, which would increase production by about 200,000 metric tons per year (t/yr) (Fertilizer International, 2008).

Consumption

Consumption of K_2O equivalent in 2007 was 14% higher compared with that of 2006. The large increase was attributed to higher fertilizer use, primarily for corn. The planting and harvesting of corn increased significantly in 2007 owing to increased domestic ethanol production for biofuel. The principal use of potash is as an agricultural fertilizer (plant nutrient) because it is a source of soluble potassium, which is one of the three primary plant nutrients required for plant growth and maturation; the others are fixed nitrogen and soluble phosphorus. Phosphorus and potash are mined products, and fixed nitrogen is produced from the atmosphere using industrial processes. Modern agricultural practice uses large amounts of these primary nutrients and additional nutrients, such as boron, calcium, chlorine, copper, iron, magnesium, manganese, molybdenum, sulfur, and zinc, to ensure plant health and proper maturation. The three major plant nutrients have no cost-effective substitutes. Low-nutrient-content alternative potash sources, such as animal manure and guano, bone meal, compost, glauconite, and "tankage" from slaughterhouses, are available,

¹The potash industry has established a common standard of measurement for defining a product's potassium content [or purity] because the potassium content of its common salts varies in terms of equivalent percentages of potassium oxide (K_2O). A K_2O equivalent for muriate of potash is 60%; sulfate of potash, 51%; and double sulfate of potash magnesia products, 22%. All tonnages are reported in metric tons, K_2O equivalent, unless otherwise specified. All percentages are computed on unrounded K_2O equivalent values.

but the cost of transportation per metric ton of nutrient beyond relatively short distances, can reduce their desirability. In addition to its use as a fertilizer, potassium chloride is important in industrialized economies, where it is used in aluminum recycling, by the chloralkali industry to produce potassium hydroxide, in metal electroplating, oil-well drilling mud, snow and ice melting, steel heat-treating, and water softening.

Potassium hydroxide is used for industrial water treatment and is the precursor of potassium carbonate, several forms of potassium phosphate, many other potassic chemicals, and soap manufacturing. Potassium carbonate is used to produce animal feed supplements, cement, some types of fire extinguishers, food products, photographic chemicals, and textiles. It is also used in brewing beer, pharmaceutical preparations, and as a catalyst for synthetic rubber manufacturing. The glass industry uses potassium carbonate for television and computer monitor production; this use, however, has dropped to very small amounts with the prevalence of liquid crystal displays. Generally, these nonfertilizer uses have accounted for about 15% of annual potash consumption in the United States.

Foreign Trade

U.S. exports of potash decreased by 40% in 2007 from those of 2006, owing to increased domestic consumption of potash. Exports of 199,000 t were reported, of which 56% was MOP, 30% was SOPM, 13% was SOP, and 1% was NOP (table 3). Brazil, Mexico, Chile, and Canada, in declining order, received 62% of the total exports of potash from the United States (table 4). Of the total quantity of exports by world region, 44% went to South America, 31% went to North America, 12% went to Central America, 8% went to Asia, and the remainder was distributed between the other regions. Exports of MOP to all regions decreased by 46%, SOP exports decreased by 32%, SOPM decreased by 30%, and NOP increased by 25% (table 3). Total potash exports, reported by K_2O content, decreased by 40% in 2007 compared with those of 2006.

Potash imports into the United States for 2007 increased by 11% to 8.19 Mt compared with 7.38 Mt in 2006 (table 5). The leading source of all potash imports was Canada with 89% of the total. MOP imports were 12% higher at 4.86 Mt of K_2O and represented 97% of total potash imports. Mixed potassium salts increased by 14% to 41 t; NOP imports, 71% of which were from Chile, decreased by 9%; and SOP imports, 71% of which came from Germany, decreased by 17%.

World Industry Structure

Estimated 2007 world potash production increased by 10% to 34.6 Mt, with increased output from most of the major producing countries (table 7). North America was the leading producing region in the world, with 35% of world production, followed by Eastern Europe, with 33%. Only about 15 countries are notable potash producers, with Belarus, Canada, Germany, Israel, Jordan, and Russia accounting for 90% of global production capacity (Fertilizer International, 2008).

World Review

Argentina.—Potasio Rio Colorado S.A. (PRC) (a subsidiary of Rio Tinto) was evaluating a large potash deposit in Mendoza Province that contains sufficient high-grade sylvinitic reserves to produce up to 2.9 million metric tons per year (Mt/yr) of MOP via solution mining. The company has built a pilot plant to test solution mining extraction. PRC also holds potash mineral rights in Neuquen Province, adjacent to the Mendoza site (Potasio Rio Colorado S.A., 2006). Total indicated and inferred resources were 1,037 Mt of potash ore, with an average grade of 31.1% KCl. The company anticipates starting production in 2012, pending approval of all necessary permits (Rio Tinto, 2008, p. 72).

Canada.—As the leading potash-producing country, the bulk of Canadian potash production comes from mines in Saskatchewan. Approximately one-third of global potash capacity is in Canada. The Canadian potash producers were, in descending order of capacity, Potash Corp. of Saskatchewan Inc. (PCS), Mosaic, and Agrium Inc.

PCS announced plans for a new 2 Mt/yr potash mine and expansion of its potash mill in New Brunswick. The new mine would replace the company's existing underground mine in the Province, which has an annual production capacity of 0.8 Mt/yr. The existing mine will remain open during the 4-year construction project. PCS also started expansion and de-bottlenecking at its Cory, Lanigan, and Patience Lake Mines in Saskatchewan. After the scheduled completion of the expansion projects in 2011, the company's production capacity was planned to increase to 14.9 Mt/yr from the current 10.7 Mt/yr (Fertilizer Week, 2007e).

Increasing demand and rising prices for potash have resulted in an increase in exploration for and development of new potash deposits in Manitoba and Saskatchewan. From mid-2006 to January 2008, the Government of Saskatchewan issued 36 potash exploration permits and one potash lease (Fertilizer International, 2008). The major area under evaluation in Manitoba is the Russell-Bincarth potash deposit located near the Manitoba-Saskatchewan border. In 2007, BHP Billiton bought a 51% share of Manitoba Potash Corp., the holding company for the project. BHP has committed \$15 million to explore the deposit (Fertilizer Week America, 2007).

Jordan.—Arab Potash Co. began an expansion program that plans to increase its MOP production capacity to 2.5 Mt/yr from 2 Mt/yr by mid-2009. The project will entail optimizing the solar ponds at the south end of the Dead Sea, which is part of the routine maintenance associated with the falling water levels in the Dead Sea, building a new refinery, and expanding the compaction facility (Fertilizer Week, 2007a).

Russia.—EuroChem Mineral and Chemical Co. planned to develop the Gremyachinskoye potash deposit in the Volgograd region and build an ore mining and processing facility to produce potash fertilizers. The company expected to begin production in 2012 (Fertilizer Week, 2007d).

United Kingdom.—Cleveland Potash Ltd. [a subsidiary of Israel Chemicals Ltd. (ICL)] received a development grant to

extend the life of its Boulby Mine by at least 20 years. The 3-year investment program was expected to cost about \$35 million and allow ICL and Cleveland Potash to make improvements to the mine's infrastructure to continue operations at the deepest mine in Europe (Fertilizer Week, 2007b).

Outlook

In 2007, the world potash market experienced growth in consumption concurrent with low producer inventories and high operating rates, which resulted in tight supplies and high prices. A similar supply situation is expected through 2012, when demand for the period is expected to rise faster than supply, reducing the surplus. The new capacity will come from mine expansions in Canada, China, the Middle East, and Russia, and a new mine in Argentina, which are scheduled to be completed incrementally by 2012 (Heffer and Prud'homme, 2008). Additionally, new projects in Belarus, Canada, and Congo (Brazzaville) could increase production capacity further (Fertilizer International, 2008).

The International Fertilizer Industry Association (IFA) expected that global potash capacity would increase to 83.8 Mt/yr of KCl equivalent in 2012 from 68.7 Mt/yr in 2007. World demand is projected to increase to 61.0 Mt/yr KCl equivalent in 2012 from 54.2 Mt/yr in 2007 (Heffer and Prud'homme, 2008).

Asia, primarily China, is expected continue to be the leading consuming region. New projects in China are likely to be for internal consumption only, unlike other projects that are expected to supply the global market (Fertilizer International, 2008). Consumption in the United States was expected to increase at a slower rate during the next several years owing to normal agricultural demand and drop in corn-based biofuels. After expanding rapidly during the last 2 years, production of ethanol from corn was expected to level off and gradually decline in favor of other types of biofuel such as cellulosic ethanol and biodiesel (Heffer and Prud'homme, 2008).

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TABLE 1
SALIENT POTASH STATISTICS^{1,2}

(Thousand metric tons and thousand dollars unless otherwise specified)

	2003	2004	2005	2006	2007	
United States:						
Production: ³						
Gross weight	2,300	2,700	2,500	2,400	2,600	
K ₂ O equivalent	1,100	1,200	1,200	1,100	1,100	
Sales by producers:						
Quantity: ³						
Gross weight	2,600	2,700	2,500	2,400	2,600	
K ₂ O equivalent	1,200	1,300	1,200	1,100	1,200	
Value ^{3,4}	280,000	340,000	410,000	410,000	480,000	
Average value: ⁵						
Gross weight	dollars per metric ton	\$110	\$125	\$165	\$170	\$185
K ₂ O equivalent	do.	\$230	\$270	\$350	\$375	\$400
Exports:						
Gross weight	801	640	569	809	510	
K ₂ O equivalent	329	233	200	332	199	
Imports for consumption: ^{6,7}						
Quantity:						
Gross weight	7,810	8,140	8,110	7,380	8,190	
K ₂ O equivalent	4,720	4,920	4,920	4,470	4,970	
Value, customs	646,000	751,000	1,170,000	1,150,000	1,310,000	
Consumption, apparent: ^{3,8}						
Gross weight	9,600	10,000	10,000	9,000	10,000	
K ₂ O equivalent	5,600	6,000	5,900	5,200	5,900	
World, production, marketable K ₂ O equivalent	29,900 ^r	32,100 ^r	33,800 ^r	31,400 ^r	34,600 ^c	

^cEstimated. ^rRevised. do. Ditto.

¹Includes muriate of potash, sulfate of potash, potassium magnesium sulfate, and some parent salts. Excludes other chemical compounds that contain potassium.

²Data are rounded to no more than three significant digits unless otherwise specified.

³Data are rounded to no more than two significant digits.

⁴Free on board mine.

⁵Rounded to the nearest \$5 to avoid disclosing proprietary data.

⁶Excludes potassium chemicals and mixed fertilizers.

⁷Includes nitrate of potash.

⁸Calculated from sales plus imports minus exports.

TABLE 2
PRICES OF U.S. POTASH, BY TYPE AND GRADE^{1,2}

(Dollars per metric ton of K₂O equivalent)

Type and grade	2006			2007		
	January- June	July- December	Yearly average	January- June	July- December	Yearly average
Muriate, 60% K ₂ O minimum:						
Standard	290	310	295	305	370	320
Granular	290	275	280	290	330	305

¹Average prices, free on board mine, based on sales.

²Data rounded to nearest \$5.

TABLE 3
U.S. EXPORTS OF POTASH, BY TYPE¹

	Approximate average K ₂ O equivalent content (percentage)	Quantity (metric tons)	
		Gross weight	K ₂ O equivalent ^e
2006:			
Potassium chloride, all grades	61	337,000	206,000
Potassium sulfate	51	75,400	38,400
Potassium magnesium sulfate	22	392,000	86,200
Potassium nitrate	45	3,750	1,690
Total	XX	809,000	332,000
2007:			
Potassium chloride, all grades	61	181,000	111,000
Potassium sulfate	51	51,300	26,200
Potassium magnesium sulfate	22	273,000	60,000
Potassium nitrate	45	4,670	2,100
Total	XX	510,000	199,000

^eEstimated. XX Not applicable.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 4
U.S. EXPORTS OF POTASH, BY COUNTRY¹

(Metric tons of product)

Country	Potassium chloride		Potassium sulfates, all grades ²		Potassium nitrate		Total	
	2006	2007	2006	2007	2006	2007	2006	2007
Argentina	--	--	4,030	--	--	--	4,030	--
Australia	36	138	15,900	1	--	--	15,900	139
Barbados	34	69	156	--	3	--	193	69
Belize	1	--	175	16	23	14	199	30
Brazil	236,000	106,000	2,960	7,500	--	1	239,000	114,000
Canada	2,090	1,680	70,300	42,900	614	502	73,000	45,100
Chile	--	20	51,100	47,000	--	--	51,100	47,100
China	--	21	35,500	5,490	5	72	35,500	5,590
Colombia	69	6	35,400	14,400	23	23	35,500	14,400
Costa Rica	12,600	--	32,700	33,000	15	6	45,300	33,000
Côte d'Ivoire	--	--	9,050	--	--	--	9,050	--
Czech Republic	240	240	--	--	--	--	240	240
Dominican Republic	--	--	1,810	1,720	--	--	1,810	1,720
Ecuador	17	2	17,000	6,000	--	--	17,000	6,000
El Salvador	--	6,650	2,800	3,310	--	--	2,800	9,960
Ghana	--	--	--	11,000	--	--	--	11,000
Guatemala	2,120	3,800	2,400	4,750	--	--	4,520	8,550
Guyana	2,750	--	--	--	--	--	2,750	--
Honduras	--	--	12,500	7,300	--	--	12,500	7,300
India	--	--	--	7,580	9	--	9	7,580
Indonesia	19	38	454	230	--	--	473	268
Israel	--	--	477	20	--	42	477	62
Jamaica	3,730	--	--	--	--	--	3,730	--
Japan	40	6,440	50,000	16,800	--	--	50,100	23,200
Korea, Republic of	--	--	3	5,430	29	22	32	5,450
Martinique	7,380	6,450	3,450	2,640	--	--	10,800	9,090
Mexico	51,400	48,400	61,700	59,600	2,540	2,440	116,000	110,000
Morocco	--	--	947	20	--	--	947	20
New Zealand	--	--	7,590	4,000	55	63	7,640	4,060
Nicaragua	--	--	500	2,000	--	--	500	2,000
Panama	--	10	3,260	--	--	--	3,260	10
Peru	45	160	17,000	9,550	--	10	17,000	9,720
Russia	209	153	--	--	--	--	209	153
Saudi Arabia	--	177	--	--	--	814	--	991
South Africa	--	--	6,350	--	--	--	6,350	--
Suriname	73	--	--	--	--	--	73	--
Thailand	204	--	--	153	74	--	278	153
Trinidad and Tobago	--	113	2	--	--	--	2	113
Venezuela	17,400	7	21,200	31,500	--	--	38,700	31,500
Other	906	322	610	142	362	662	1,880	1,130
Total	337,000	181,000	467,000	324,000	3,750	4,670	809,000	510,000

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes potassium magnesium sulfate.

Source: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 5
U.S. IMPORTS FOR CONSUMPTION OF POTASH, BY TYPE¹

	Approximate average K ₂ O equivalent content (percentage)	Quantity (metric tons)		Value (thousands)	
		Gross weight	K ₂ O equivalent ^c	Customs	C.i.f. ²
2006:					
Potassium chloride ³	61	7,130,000	4,350,000	1,070,000	1,130,000
Potassium sulfate	51	99,200	50,600	22,100	25,200
Potassium nitrate	45	150,000	67,300	52,300	59,900
Potassium sodium nitrate mixture	14	259	36	184	193
Total	XX	7,380,000	4,470,000	1,150,000	1,210,000
2007:					
Potassium chloride ³	61	7,970,000	4,860,000	1,240,000	1,290,000
Potassium sulfate	51	82,100	41,900	24,100	28,100
Potassium nitrate	45	136,000	61,200	49,900	56,000
Potassium sodium nitrate mixture	14	296	41	168	174
Total	XX	8,190,000	4,970,000	1,310,000	1,370,000

^cEstimated. XX Not applicable.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Cost, insurance, and freight.

³Contains imports listed under Harmonized Tariff Schedule of the United States code 3104.10.0000.

Source: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF POTASH, BY COUNTRY¹

Country	Total																
	Potassium chloride (metric tons)			Potassium sulfate (metric tons)			Potassium nitrate (metric tons)			Potassium sodium nitrate (metric tons)			Quantity (metric tons)		Value (thousands)		C.i.f. ²
	2006	2007	2007	2006	2007	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	
Australia	20	76	--	--	--	--	--	--	--	--	20	76	\$38	\$46	\$40	\$46	
Belarus	680,000	663,000	--	--	--	--	--	--	--	680,000	663,000	102,000	112,000	114,000	114,000	127,000	
Belgium	--	--	25,200	34	12	--	--	--	--	25,200	34	2,650	28	2,850	2,850	28	
Canada	6,240,000	7,270,000	9,160	13,000	--	--	233	201	233	6,250,000	7,290,000	942,000	1,130,000	983,000	1,160,000	1,160,000	
Chile	--	--	2,910	7,300	100,000	96,000	--	--	--	103,000	103,000	38,900	40,600	42,100	43,300	43,300	
China	--	57	185	180	57	45	--	--	--	242	282	114	103	166	166	148	
France	--	--	1,030	1,810	--	22	--	--	--	1,030	1,830	261	253	314	314	299	
Germany	69,300	344	60,400	58,300	2,080	1,710	--	--	--	132,000	60,400	20,800	16,900	24,400	24,400	20,300	
Iceland	15	--	--	--	--	--	--	--	--	15	--	9	--	12	12	--	
India	2	6	2	1	620	214	--	--	--	624	221	198	84	210	210	89	
Israel	11,600	712	--	--	45,600	36,700	21	--	--	57,200	37,400	15,000	10,400	19,400	19,400	14,000	
Italy	--	--	187	1,250	--	--	--	--	--	187	1,250	44	161	50	50	185	
Japan	--	--	122	173	1,020	1,090	--	--	--	1,140	1,260	419	481	484	558	558	
Jordan	--	--	--	--	--	--	--	95	--	--	--	--	56	--	--	61	
Mexico	--	8	--	30	6	52	--	--	--	6	90	12	47	12	12	50	
Netherlands	--	53	--	--	1	--	2	--	--	3	53	12	30	14	14	31	
Poland	--	--	--	--	200	65	--	--	--	200	65	108	24	128	128	28	
Romania	--	--	--	--	38	--	--	--	--	38	--	6	--	11	11	--	
Russia	136,000	32,500	--	--	--	--	--	--	--	136,000	32,500	22,900	5,140	25,000	25,000	5,140	
Spain	--	--	63	--	--	--	3	--	--	66	--	156	--	177	177	--	
Switzerland	1	14	--	--	--	--	--	--	--	1	14	4	12	4	4	13	
United Kingdom	41	100	--	--	1	--	--	--	--	42	100	69	166	76	76	170	
Total	7,130,000	7,970,000	99,200	82,100	150,000	136,000	259	296	296	7,380,000	8,190,000	1,150,000	1,310,000	1,210,000	1,210,000	1,370,000	

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Cost, insurance, and freight.

Source: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 7
MARKETABLE POTASH: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Thousand metric tons of K₂O equivalent)

Country	2003	2004	2005	2006	2007 ^e
Belarus	4,230	4,600	4,844	4,605	4,972 ³
Brazil	416	403	405	403 ^r	405 ^p
Canada	9,104	10,100	10,140 ^r	8,518 ^r	11,112 ³
Chile ^c	563	559	547	496 ^r	500
China ^c	650 ^r	770 ^r	1,500 ^r	1,800 ^r	2,000
Germany	3,564	3,627	3,664	3,625 ^r	3,600
Israel	1,960 ^r	2,140 ^r	2,224 ^r	2,190 ^r	2,200
Jordan	1,194 ^r	1,180 ^r	1,115	1,036	1,090 ³
Russia ^c	5,465 ^r	6,405 ^r	7,131 ^r	6,610 ^r	6,600
Spain ^c	594 ^{r,3}	590 ^r	575 ^r	580 ^r	580
Ukraine	10 ^{r,e}	10 ^r	13 ^r	8 ^r	12
United Kingdom	1,040 ^r	547 ^r	439 ^r	420 ^r	427
United States ^{c,4}	1,100	1,200	1,200	1,100	1,100 ³
Total	29,900 ^r	32,100 ^r	33,800 ^r	31,400 ^r	34,600

^eEstimated. ^pPreliminary. ^rRevised.

¹World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through April 24, 2008.

³Reported figure.

⁴Rounded to within 100,000 metric tons to avoid disclosing proprietary data.