



2017 Minerals Yearbook

POTASH [ADVANCE RELEASE]

POTASH

By Stephen M. Jasinski

Domestic survey data and tables were prepared by Linda M. Barnes, statistical assistant.

In 2017, domestic production decreased by 6% to 480,000 metric tons (t) potassium oxide (K_2O) equivalent from 510,000 t K_2O equivalent in 2016,¹ continuing a 5-year trend of reduced production. U.S. sales of potash (K_2O) were 18% lower in 2017 compared with those in 2016, but apparent consumption increased by 24%, to 6.2 million metric tons (Mt) of K_2O in 2017 from 5.0 Mt of K_2O in 2016 (table 1). In 2017, world potash production was 6% higher than that in 2016, at 41.4 Mt (tables 1, 5). The average value of all potash compounds, in terms of K_2O content, increased by 14% over that of 2017, owing primarily to higher prices for potassium sulfate (SOP) and sulfate of potash magnesia (SOPM) (tables 1, 2).

Potash denotes a variety of mined and manufactured salts, all of which contain the element potassium in water-soluble form. In agriculture, the term potash refers to potassic fertilizers, which are potassium chloride (KCl or sylvite), SOP (K_2SO_4 or sulfate of potash, usually a manufactured product), and SOPM ($K_2SO_4 \cdot 2MgSO_4$ or langbeinite or double sulfate of potash magnesia). 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.

Production

Domestic production data were developed by the U.S. Geological Survey (USGS) from a semiannual voluntary canvass of U.S. operations. All seven operations canvassed for production data responded to the surveys. 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 rounded to avoid disclosing proprietary data. Three companies produced potash from seven operations in two States.

In southeastern New Mexico, Intrepid Potash, Inc. produced MOP and SOPM from one solution and one underground mine, respectively. The Mosaic Company produced SOPM from one underground mine.

IC Potash Corp. (ICP) (Toronto, Ontario, Canada) sold its interest in the Ochoa polyhalite project east of Carlsbad in Lea County, NM, to Cartesian Capital Group, LLC in August 2017. ICP revised the project earlier in the year to market polyhalite directly as a slow-release fertilizer, instead of producing SOP to avoid the cost of building a processing plant. The company cited low potash prices and weak potash market conditions as reasons

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 percentage of potassium oxide (K_2O). A K_2O equivalent for muriate of potash (MOP) is 60%; sulfate of potash (SOP), 51%; and double sulfate of potash magnesia products (SOPM), 22%. All tonnages are reported in metric tons, K_2O equivalent, unless otherwise specified. All percentages are computed on rounded K_2O equivalent values, except for trade data.

for divesting the property. Cartesian did not have any time frame for development of the Ochoa Project (Green Markets, 2017d).

In Utah, Intrepid produced MOP from a solution mine in Moab and from a brine recovery facility in Wendover. Compass Minerals International, Inc. produced SOP at a solar evaporation facility in Ogden on the Great Salt Lake.

In 2017, Compass completed the expansion of the Ogden facility that increased its production capacity from 290,000 metric tons per year (t/yr) of SOP to 500,000 t/yr of SOP. This increase was accomplished by using both brine and purchased MOP (Compass Minerals International, Inc., 2018, p. 41).

Consumption

Domestic apparent consumption of all forms of potash in 2017 increased by 24% from that of 2016, owing to higher agricultural use and industrial uses, primarily for oil well-drilling additives, as the number of active drilling rigs increased in 2017 (Baker Hughes Inc., 2018). Lower prices and favorable planting conditions helped to increase fertilizer consumption. World consumption of all forms of potash in 2017 was 41.2 Mt of K_2O , compared with 40.0 Mt in 2016 (Prud'homme, 2017). The principal use of potash was as an agricultural fertilizer (plant nutrient) as 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. Potash and phosphorus are mined products, and fixed nitrogen is produced from the atmosphere using industrial processes. Modern agricultural practice uses large quantities 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, but the cost of transportation per metric ton of nutrient beyond relatively short distances can reduce their desirability.

Fertilizer consumption information was collected by the American Association of Plant Food Officials on a crop-year (July 1 to June 30) basis. For crop-year 2014 (July 1, 2013, to June 30, 2014, the most recent year for which data were available), consumption of K_2O in fertilizers was 4.77 Mt compared with 4.40 Mt in crop-year 2013 (Slater and Kirby, 2017, p. 6).

In addition to its use as a fertilizer, potassium chloride is used in refining secondary aluminum, producing potassium hydroxide, electroplating, melting snow and ice, heat-treating steel, softening water, and in oil-well drilling mud.

Potassium hydroxide is used in industrial water treatment and in soap manufacturing, and is the precursor of potassium carbonate, several forms of potassium phosphate, and many

other potassic chemicals. Potassium carbonate is used to produce animal feed supplements, cement, fire extinguishers, food products, and textiles. It is also used in brewing beer, in pharmaceutical preparations, and as a catalyst for synthetic rubber manufacturing. Generally, these nonfertilizer uses have accounted for about 15% of annual potash consumption in the United States and 8% worldwide.

Prices

The price of standard-grade MOP, in terms of K_2O , produced in the United States, averaged \$395 per metric ton in the first half of 2017, \$505 per ton in the second half, and \$455 per ton for the entire year, compared with \$460 per ton in 2016, according to sales data reported to the USGS (table 2). The Vancouver, British Columbia, Canada, spot market price for MOP (gross weight of product), which is the benchmark price for North American potash shipments, began the year at \$215 per ton and ended the year at \$224 per ton (CRU Fertilizer Week, 2018).

Foreign Trade

Total U.S. imports of all forms of potash (K_2O equivalent) increased by 29% to 5.86 Mt of K_2O from 4.55 Mt of K_2O in 2016. Potassium chloride accounted for 98% of the import tonnage. Canada was the leading source for imports, accounting for 80% of all types of potash. Russia was a distant second with 7% of total potash imports. Total customs import value decreased by 5% from that of 2016, owing to lower international potash prices (table 4).

The United States is not a significant exporter of potash. Of the 128,000 t of potash exported, SOP and SOPM accounted for 84% of exports, in terms of K_2O content. In 2017, exports of all forms of potash (K_2O equivalent) increased by 33% from those of 2016 (table 3).

World Review

World production of potash was 41.4 Mt in 2017, 6% higher than that in 2016. Canada, Russia, Belarus, and China were the leading producing countries, by order of output, accounting for 78% of total production (table 5).

Belarus.—JSC Belaruskali continued to develop two projects in 2017, an 800,000-t/yr expansion of its processing facilities at Soligorsk and a new mine in the Petrikov district. The expansion to the Soligorsk facility was expected to be completed incrementally between 2017 and 2021. The new mine was planned to have an initial production capacity of 1.5 million metric tons per year (Mt/yr) of MOP. The projects were expected to be completed by 2025 and would increase the company's capacity to 15.1 Mt/yr of MOP (Green Markets, 2017c).

Slavkaliy Co. (Russia) continued construction of its Nezhinsky potash mine in central Belarus. The company planned to complete construction in 2020 and start production in 2021. The mine would produce about 2 Mt/yr of MOP, which would be sold by Belarusian Potash Co., the marketing company for JSC Belaruskali (Green Markets, 2017f).

Canada.—Canada was the leading potash producer in the world, with 38% of global production capacity. In 2017, three companies in Canada produced potash: Agrium Inc., Potash Corp. of Saskatchewan, Inc. (PotashCorp), and Mosaic. In 2016, Agrium and PotashCorp announced a merger agreement to create a new company, Nutrien, Ltd. The companies expected to complete the merger in early 2018, pending regulatory approval in the United States. In 2017, the merger was approved by government agencies in Brazil, Canada, India, and Russia. In the other countries where the two companies had operations, Nutrien was required to divest its interest in Arab Potash Co. (Jordan), Israel Chemicals (Israel), and SQM (Chile) as part of regulatory approval. Additionally, Nutrien sold its Conda, ID, phosphate rock mine and phosphoric acid and fertilizer plant to Itafos as a condition of the merger. The combined company would have 24% of world MOP capacity (Green Markets, 2017g).

PotashCorp completed a capacity expansion to its Rocanville, Saskatchewan, mine in October. MOP production capacity was increased to 6.5 Mt/yr from 3.0 Mt/yr, making it the world's largest potash mine (Green Markets, 2017h).

Mosaic planned to complete a 1.0-Mt/yr expansion to its Esterhazy, Saskatchewan, mine by 2018. The mine would increase its total Canadian production capacity to 12.9 Mt/yr of MOP (Prud'homme, 2017).

German potash producer K+S Aktiengesellschaft began production at its 2.0-Mt/yr Bethune solution mine in Saskatchewan. The company planned to ramp up production to near the 2.0-Mt/yr-of-MOP capacity. K+S planned to add 0.86 Mt/yr of MOP capacity after 2022 (Green Markets, 2017e).

BHP Billiton Group held exploration rights to about 14,500 square kilometers in Saskatchewan, which includes five potash properties, and continued with development activities at the Jansen project east of Saskatoon. The Jansen Mine was designed to produce up to 8 Mt/yr of MOP, but BHP was not expected to begin production until well after 2023, depending on market conditions (Green Markets, 2017b).

Russia.—PJSC Uralkali continued work on modernization of its processing facilities and construction of new mines at Solikamsk, Polovodovsky, and Ust-Yayvinsky that would increase its capacity incrementally to 18.7 Mt/yr of MOP after 2020 from 12.4 Mt/yr of MOP in 2017. The company planned to complete a new underground mine by 2020 at the Solikamsk 2 Mine, which was closed by flooding in 2014, to mine the remaining reserves (PJSC Uralkali, 2018, p. 28–29).

EuroChem MCC, OJSC had two mines under development in 2017. The VolgaKaliy project, which would mine potash ore from the Gremyachinskoe deposit, was scheduled to be completed in two phases, each with a production capacity of 2.3 Mt/yr of MOP. The first phase was projected to open in 2018, and the second phase was expected to be completed after 2020. The Usolskiy project, which would exploit the Verkhnekamskoe deposit, also was planned to be completed in two phases. The first 2.3-Mt/yr phase was expected to begin production of MOP in early 2018. The opening of the 1.4-Mt/yr second phase was scheduled for 2021 depending on market conditions (Fertilizer International, 2018).

JSC Acron Group continued development of its Talitsky Mine project through its subsidiary, Verkhnekamsk Potash Co. The mine was planned to have an initial capacity of 1.3 Mt/yr of MOP and then increase to full capacity of 2.0 Mt/yr of MOP 2 years later. Acron delayed commissioning of its mine until after 2022 (Green Markets, 2017a).

Turkmenistan.—A new underground potash mine and processing plant with a capacity of 1.4 Mt/yr of MOP in Lebap Oblast were commissioned in March. The mine was operated by the state-owned Turkmenkhiya State Concern. The mine was expected to produce about 300,000 t of MOP in 2017, but production data were not released by the Government, and industry analysts could not verify actual production data (Green Markets, 2018).

Outlook

Potash is an essential fertilizer nutrient that cannot be substituted. About 90% of world potash consumption is in fertilizer products. The growing world population and its need for food will require continued growth in potash production and consumption. Additionally, increased ethanol production from corn and other crops will require a proportional growth in fertilizer use.

Potash exploration and development is expected to remain very active during the next decade. Global potash production capacity is expected to increase to 58.5 Mt/yr of K₂O in 2022 from 52.5 Mt/yr of K₂O in 2017, primarily from projects in Belarus, Canada, China, and Russia (Prud'homme, 2018). In 2017, about 25 potash-mining projects were in progress worldwide that are expected to be completed between 2017 and 2022. Other significant potash projects are under development in Australia, Brazil, Congo (Brazzaville), Eritrea, Ethiopia, Kazakhstan, Laos, Peru, Thailand, and the United Kingdom. None of these projects, however, are to be completed before 2023 (Prud'homme, 2017).

References Cited

- Baker Hughes Inc., 2018, North American rig count: Houston, TX, Baker Hughes Inc. (Accessed August 8, 2018, at <http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsother>.)
- Compass Minerals International, Inc., 2018, Form 10-K—2017: Securities and Exchange Commission, 125 p. (Accessed May 8, 2018, at <https://investors.compassminerals.com/investors-relations/financials-information/annual-reports/default.aspx>.)
- CRU Fertilizer Week, 2018, Potash weekly report: CRU Fertilizer Week, January 5, 13 p. (Accessed January 5, 2018, via <https://www.cruonline.crugroup.com>.)
- Fertilizer International, 2018, Usolskiy enters production: Fertilizer International, no. 483, March–April, p. 54–57.
- Green Markets, 2017a, Acron keeps Talitsky K project on hold: Green Markets, v. 41, no. 30, July 28, p. 29–30.
- Green Markets, 2017b, BHP delays decision on Jansen; over-capacity to persist: Green Markets, v. 41, no. 34, August 25, p. 1, 31.
- Green Markets, 2017c, BPC to sell Slavkaliy; firm guarantees needed to rekindle Uralkali partnership: Green Markets, v. 41, no. 36, September 8, p. 26.
- Green Markets, 2017d, IC Potash changes name, stock exchange; reiterates cannabis as primary focus: Green Markets, v. 41, no. 48, December 1, p. 25.
- Green Markets, 2017e, K+S produces its first potash from Bethune: Green Markets, v. 41, no. 24, June 16, p. 25.
- Green Markets, 2017f, New Belarus K mine targets 2021 start-up: Green Markets, v. 41, no. 41, October 13, p. 27.
- Green Markets, 2017g, Nutrien selected as name for new fertilizer giant: Green Markets, v. 41, no. 25, June 23, p. 1, 28.
- Green Markets, 2017h, PotashCorp completes Rocanville expansion: Green Markets, v. 41, no. 41, October 13, p. 1, 29.
- Green Markets, 2018, Turkmenistan said to be set to file a claim over Belarus-built Garlyk K plant: Green Markets, v. 42, no. 14, April 6, p. 30.
- PJSC Uralkali, 2018, Mining for enrichment—Integrated report 2017: Berezniki, Russia, PJSC Uralkali, 106 p. (Accessed June 13, 2018, at https://www.uralkali.com/upload/iblock/4f4/uralkali_ar2017_eng.pdf.)
- Prud'homme, Michel, 2017, Global fertilizer supply and trade 2017–2018: IFA Strategic Forum, Zurich, Switzerland, November 14–15, 2017, presentation, 60 p. (Accessed January 12, 2018, via <https://www.fertilizer.org>.)
- Prud'homme, Michel, 2018, Medium-term outlook on fertilizer supply: IFA annual conference, Berlin, Germany, June 18–20, 2018, presentation, 37 p. (Accessed July 31, 2018, via <https://www.fertilizer.org>.)
- Slater, J.V., and Kirby, B.J., 2017, Commercial fertilizers 2014: Columbia, MO, Association of American Plant Food Control Officials, Inc., 42 p.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

- Evaporites and Brines. Ch. in *United States Mineral Resources*, Professional Paper 820, 1973.
- Historical Statistics for Mineral and Metal Commodities in the United States. Data Series 140.
- Potash. Ch. in *Mineral Commodity Summaries*, annual.
- Potash—A Global Overview of Evaporite-Related Potash Resources, Including Spatial Databases of Deposits, Occurrences, and Permissive Tracts. Scientific Investigations Report 2010–5090–S, 2014.
- Potash—A Vital Agricultural Nutrient Sourced From Geologic Deposits. Open-File Report 2016–1167, 2016.

Other

- Fertilizer Week. CRU International Ltd., weekly.
- Green Markets. Kennedy Information, LLC, weekly.
- Potash. Ch. in *Canadian Minerals Yearbook*, Natural Resources Canada, annual.
- Potash. Ch. in *Industrial Minerals and Rocks* (7th ed.), Society for Mining, Metallurgy, and Exploration Inc., 2006.
- Potash. Ch. in *Mineral Facts and Problems*, U.S. Bureau of Mines Bulletin 675, 1985.

TABLE 1
SALIENT POTASH STATISTICS^{1,2}

(Thousand metric tons and thousand dollars unless otherwise specified)

	2013	2014	2015	2016	2017	
United States:						
Production: ³						
Gross weight	2,200	1,800	1,800	1,400	1,300	
K ₂ O equivalent	960	850	740	510	480	
Sales by producers:						
Quantity: ³						
Gross weight	2,000	2,000	1,500	1,400	1,300	
K ₂ O equivalent	880	930	620	600	490	
Value ^{3,4}	630,000	680,000	550,000	410,000	380,000	
Average value: ⁵						
Gross weight	dollars per metric ton	315	345	350	290	285
K ₂ O equivalent	do.	715	735	880	680	775
Exports:						
Gross weight	611	292	387	346 ^r	462	
K ₂ O equivalent	257	100	106	96 ^r	128	
Imports for consumption: ⁶						
Quantity:						
Gross weight	7,660	8,200	8,250	7,490	9,670	
K ₂ O equivalent	4,650	4,970	5,000	4,550	5,870	
Value, customs	2,750,000	2,390,000	2,720,000	2,120,000	2,010,000	
Consumption, apparent: ^{3,7}						
Gross weight	9,100	9,900	9,400	8,600	11,000	
K ₂ O equivalent	5,300	5,800	5,500	5,000	6,200	
World, production, marketable K ₂ O equivalent	36,100	41,300 ^r	40,700	39,000 ^r	41,400	

^rRevised. do. Ditto.

¹Table includes data available through September 14, 2018. Data are rounded to no more than three significant digits unless otherwise specified.

²Includes muriate of potash, sulfate of potash, potassium magnesium sulfate, and some parent salts. Excludes other chemical compounds that contain potassium.

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. Includes nitrate of potash.

⁷Calculated from sales plus imports minus exports.

TABLE 2
PRICES OF U.S. POTASH, BY TYPE AND GRADE^{1,2,3}

(Dollars per metric ton of K₂O equivalent)

Type and grade	2016			2017		
	January– June	July– December	Yearly average	January– June	July– December	Yearly average
Muriate, 60% K ₂ O minimum:						
Standard	550	370 ^r	460 ^r	395	505	455
Granular	345	305 ^r	325 ^r	400	375	385

^rRevised.

¹Table includes data available through September 14, 2018.

²Average prices, free on board mine, based on sales.

³Data rounded to nearest \$5.

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

	Approximate average K ₂ O equivalent content (percentage)	Quantity (metric tons)		Value (thousands)		Principal destinations, by gross weight
		Gross weight	K ₂ O equivalent ^e	Customs	C.i.f. ²	
2016:						
Potassium chloride	61	22,400 ^r	13,700 ^r	\$12,200		Mexico, 58%; Canada, 28%; Honduras, 2%.
Potassium sulfate ²	25 ^r	316,000 ^r	79,200 ^r	111,000		Canada, 27%; Mexico, 12%; China, 11%.
Potassium nitrate	45	7,980 ^r	3,590 ^r	7,690		Mexico, 67%; Canada, 19%; Belgium, 4%.
Total	XX	346,000 ^r	96,400 ^r	131,000		Canada, 27%; Mexico, 15%; China, 10%.
2017:						
Potassium chloride	61	26,500	16,100	\$11,500		Mexico, 59%; Canada, 24%; Malaysia, 4%.
Potassium sulfate ²	25	426,000	108,000	104,000		Canada, 25%; Brazil, 11%; Japan, 10%.
Potassium nitrate	45	9,120	4,100	6,760		Mexico, 68%; Canada, 22%; Republic of Korea, 3%.
Total	XX	462,000	128,000	122,000		Canada, 61%; Mexico, 32%; Malaysia, 1%.

^eEstimated. ^rRevised. XX Not applicable.

¹Table includes data available through September 14, 2018. Data 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 4
U.S. IMPORTS FOR CONSUMPTION OF POTASH, BY TYPE¹

	Approximate average K ₂ O equivalent content (percentage)	Quantity (metric tons)		Value (thousands)		Principal sources, by gross weight
		Gross weight	K ₂ O equivalent ^e	Customs	C.i.f. ²	
2016:						
Potassium chloride ³	61	7,310,000	4,460,000	\$2,030,000	\$2,100,000	Canada, 86%; Russia, 6%; Belarus, 3%.
Potassium sulfate ⁴	51	113,000	57,700	40,700	42,100	Germany, 53%; Canada, 34%; Chile, 7%.
Potassium nitrate ⁵	45	66,000	29,700	43,900	45,800	Chile, 74%; Germany, 19%; India, 2%.
Potassium sodium nitrate mixture ⁶	14	4,130	578	1,910	1,990	Canada, 76%; China, 18%; Netherlands, 2%.
Total	XX	7,490,000	4,550,000	2,120,000	2,190,000	Canada, 85%; Russia, 6%; Belarus, 3%.
2017:						
Potassium chloride ³	61	9,420,000	5,740,000	1,910,000	1,990,000	Canada, 81%; Russia, 8%; Belarus, 6%.
Potassium sulfate ⁴	51	127,000	64,800	46,000	48,500	Germany, 60%; Canada, 30%.
Potassium nitrate ⁵	45	106,000	47,800	62,000	64,300	Chile, 75%; Germany, 13%; Jordan, 6%.
Potassium sodium nitrate mixture ⁶	14	5,470	766	1,580	1,700	Canada, 51%; Brazil, 22%; Netherlands, 16%.
Total	XX	9,660,000	5,860,000	2,020,000	2,100,000	Canada, 80%; Russia, 7%; Belarus, 6%.

^eEstimated. XX Not applicable.

¹Table includes data available through September 14, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

²Cost, insurance, and freight.

³Harmonized Tariff Schedule of the United States (HTS) code 3104.20.0000.

⁴HTS code 3104.30.0000.

⁵HTS code 2834.21.0000.

⁶HTS code 3105.90.0010.

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

TABLE 5
MARKETABLE POTASH: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Thousand metric tons, K₂O equivalent)

Country or locality ²	2013	2014	2015	2016	2017
Belarus	4,243	6,340	6,468	6,180	7,102
Brazil	311	311	293	306 ^r	290
Canada	10,196	10,818	11,462	10,790 ^r	12,214
Chile	1,130 ^r	1,200 ^r	1,200	1,200	1,100 ^e
China	5,300	6,110	5,710	5,780 ^r	5,510
Germany	3,075	3,130 ^e	3,110	2,800	2,700
Israel	2,268	2,213	1,540	2,050 ^e	2,000
Jordan	1,046	1,255	1,413	1,202	1,392
Laos	86	211	350 ^e	350 ^e	350 ^e
Russia	6,100	7,439	6,954	6,588 ^r	7,300 ^e
Spain ^c	711	685	690	670	610
United Kingdom	549	610 ^e	610 ^e	450 ^e	250 ^e
United States ³	960	850	740	500	480
Uzbekistan	85	110	158	138 ^r	150 ^e
Total	36,100	41,300 ^r	40,700	39,000 ^r	41,400

^eEstimated. ^rRevised.

¹Table includes data available through August 14, 2018. All data are reported unless otherwise noted. Totals and estimated data are rounded to three significant digits; may not add to totals shown.

²Turkmenistan began production at a new mine in 2017, but information was inadequate to estimate output.

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