USGS
science for a changing world

2011 Minerals Yearbook

HELIUM

U.S. Department of the Interior
U.S. Geological Survey

December 2013

Helium

By Joseph B. Peterson[1] and Peter J. Madrid[2]

Sales of Grade-A helium (99.995% or greater purity) by private industry were 48.3 million cubic meters[3] (about 1.74 billion cubic feet) in the United States in 2011, and exports by private producers were 84.0 million cubic meters (about 3.03 billion cubic feet) for total sales of about 132 million cubic meters (about 4.77 billion cubic feet) of U.S. helium, a 3.3% increase from that of 2010 (table 1). During 2011, domestic helium sales decreased by 5.7%, while helium exports increased by 9.3% compared with those of 2010.

Legislation and Government Programs

The Helium Privatization Act of 1996, Public Law 104.273, directed the Federal Helium Program to discontinue production and sale of refined helium by April 9, 1998. The Act also directed the Government to offer for sale the helium stored in the Federal helium reserve, in excess of 600 million cubic feet, between January 1, 2005, and January 1, 2015.

The Act called for a National Academy of Sciences (NAS) study to determine the impact of selling the reserve using the pricing mechanism described in the Act. The first study was completed in 1998. Operational problems experienced by the helium plants in Algeria and Qatar during 2005 and the continued increase of helium exports from the United States have had an impact on pricing (helium suppliers increased the price of helium) and availability of cryogenic helium (helium supplies were disrupted), in particular, to the scientific community. During 2009, the NAS initiated a second study to reevaluate the impact of selling the reserve under the existing pricing mechanism to determine whether adjustments were needed that would optimize future availability of helium for its many scientific and industrial uses. The second study was completed in January 2010, and some recommendations by the NAS have been implemented by the U.S. Bureau of Land Management (BLM). One of the more noteworthy recommendations was to increase helium prices by developing a pricing strategy that better reflected market based helium prices.

The sale and disposal of the Exell Helium Plant in December 2010 completed all closure requirements for helium production by the Federal Government.

Production

In 2011, 9 companies operated 17 privately owned domestic helium plants; an additional 5 plants were idle during the year. Of the 17 operating plants, 9 extracted crude helium from natural gas, and 8 plants produced Grade-A helium. Three of the idle plants were crude helium plants and two were Grade-A helium plants. No new helium plants came online in 2011. All but two extraction plants used cryogenic extraction processes.

Total sales of U.S.-produced helium in 2011 increased by about 3.3% compared with those of 2010. All natural gas processed for helium recovery came from gasfields in Colorado, Kansas, Oklahoma, Texas, Utah, and Wyoming (figure 1). During 2011, 10 private plants purified helium by using pressure swing adsorption technology. Eight privately owned plants that produced Grade-A helium also liquefied helium. The plant operators and plant locations are listed in table 2.

Domestic production data for helium were developed by the BLM from records of its own operations as well as from its high-purity helium survey, an annual voluntary canvass of private U.S. operations. Of the eight operations to which a survey request was sent, all responded, and those data plus data from BLM operations represent 100% of the total helium sales and recovery data listed in table 3.

About 3.28% more helium was produced from the Government's helium reserve at Cliffside field in 2011 than during 2010. Most domestic helium production comes from the Midcontinent and Rocky Mountain regions of the United States. The measured helium reserves from which helium is produced are located in approximately 102 gasfields in 11 States. Most of these reserves are contained in the Hugoton field in Oklahoma, Kansas, and Texas; the Panoma field in Kansas; the Keyes field in Oklahoma; the Panhandle West and Cliffside fields in Texas; and the Riley Ridge area in Wyoming.

During 2011, the BLM analyzed one natural gas sample from Texas in conjunction with its program to survey and identify possible new sources of helium. During the past 2 years, considerable efforts were focused on digitizing the information in the helium resources database, with the main goal of producing an updated map of helium reserves in the United States by 2014.

Consumption

In 2011, private industry supplied 100% of domestic helium for U.S. consumption. The major domestic end uses of helium were cryogenics (26%), controlled atmospheres (22%), pressurizing and purging (17%), and welding (17%); other uses included chromatography, cryogenics, lifting gas, and magnetic resonance imaging applications dominated liquid helium use. Estimated 2011 domestic consumption by end use was based on revised figures for a 2009 end-use survey conducted by BLM's Helium Operations to determine trends in helium usage.

[1]Assistant Field Manager, Helium Resources, U.S. Bureau of Land Management, Amarillo Field Office—Helium Operations, Amarillo, TX.

[2]Chemical Engineer, Resources Evaluation, U.S. Bureau of Land Management, Amarillo Field Office—Helium Operations, Amarillo, TX.

[3]All metric helium volumes herein are at 101.325 kilopascals absolute (14.696 pounds per square inch absolute) and 15° C (59° F). Helium volumes, reported in parentheses following metric units, are measured in cubic feet at 14.7 pounds per square inch absolute and 70° F—1,000 cubic feet (14.7 pounds per square inch absolute and 70° F) equals 27.737 cubic meters (101.325 kilopascals absolute and 15° C) and 1 cubic meter (101.325 kilopascals and 15° C) equals 36.053 cubic feet (14.7 pounds per square inch absolute and 70° F).

In 2011, U.S. domestic helium consumption decreased 5.7% to 48.3 million cubic meters (about 1.74 billion cubic feet) compared with consumption for 2010. During 2011, U.S. helium exports increased 9.3% to 84 million cubic meters (about 3.03 billion cubic feet), compared with those of 2010 (table 1).

In-kind crude helium sales regulations (43 CFR part 3195) require helium refiners that sell helium to Federal agencies and their contractors to buy an equivalent amount of crude helium from the BLM. In 2011, in-kind crude helium sales were about 4.55 million cubic meters (164 million cubic feet). The sales were made to eight companies through contracts with the BLM.

Stocks

The volume of helium stored in the BLM helium conservation storage system, including the conservation pipeline network and the Cliffside field, totaled about 403 million cubic meters (about 14.5 billion cubic feet) on December 31, 2011. The storage system contained crude helium purchased under contract by the Government from 1962 to 1973 and privately owned helium extracted by industry from natural-gas-supplying fuel markets and stored under contract. This privately owned helium is returned to the owners as needed for purification to supply private demand. During 2011, 10.9 million cubic meters (about 393 million cubic feet) of privately owned helium was delivered to the BLM's helium conservation system, and 72.0 million cubic meters (about 2.60 billion cubic feet) were withdrawn, for a net decrease of 61.1 million cubic meters (about 2.20 billion cubic feet) of private helium in storage (table 4).

Transportation

Private producers and (or) distributors shipped helium, predominantly as a liquid, in semitrailers, which delivered the liquid helium to distribution centers, where some of it was gasified and compressed into trailers and small cylinders for delivery to end users. The remaining liquid helium was sold as bulk liquid or repackaged in Dewars of various sizes for delivery.

Prices

In fiscal year 2011, the price that the BLM charged private companies for crude helium was $2.70 per cubic meter ($75.00 per thousand cubic feet), about 15.8% higher than that of 2010. The BLM crude helium price is set by the helium Act of 1996 and is adjusted yearly based on the Consumer Price Index for the previous year.

Foreign Trade

In 2011, exports of Grade-A helium increased to 84.0 million cubic meters (3.03 billion cubic feet), a 9.3% increase compared with those of 2010 and accounted for about 63.5% of sales of U.S.-produced helium; private industry supplied all U.S. helium exports. Regionally, Asia received 48% of the helium exported from the United States; Europe, 27%; North America, Central America, and the Caribbean, combined, 14%; South America, 6.5%; the Middle East and Africa, combined, 2.5%; and Australia and New Zealand, combined, 1%. For 2011, import tariffs on helium remained at 3.7% for normal trade relations (NTR) nations and 25% for non-NTR nations.

World Review

Total world production was approximately 172 million cubic meters (about 6.20 billion cubic feet) in 2011. Excluding the United States, world production capacity of helium was estimated to be about 40 million cubic meters (1.43 billion cubic feet) in 2011 (table 5). Helium was produced in Algeria, Australia, Poland, Russia, and Qatar. Worldwide, several new helium plant projects were scheduled for startup between 2012 and 2018.

Outlook

From 2006 through 2011, the total global market for U.S. produced helium increased steadily by about 2% per year. Owing to the slow U.S. economic recovery, U.S. domestic helium consumption is expected to remain stable during 2012. Foreign helium demand is expected to increase during 2012. Even with the anticipation that foreign helium production will increase during 2012, increased foreign demand is expected to result in increased U.S. helium exports of about 5% compared with 2011 exports.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Helium. Ch. in Mineral Commodity Summaries, annual.
Helium. Ch. in United States Mineral Resources, Professional Paper 820, 1973.
Historical Statistics for Mineral and Material Commodities in the United States, Data Series 140.

Other

Analyses of Natural Gases, 1917–1985. U.S. Bureau of Mines Information Circular 9129, 1987.
Analyses of Natural Gases, 1986–1990. U.S. Bureau of Mines Information Circular 9301, 1991.
Analyses of Natural Gases, 1991. U.S. Bureau of Mines Information Circular 9318, 1992.
Analyses of Natural Gases, 1992. U.S. Bureau of Mines Information Circular 9356, 1993.
Analyses of Natural Gases, 1993. U.S. Bureau of Mines Information Circular 9400, 1994.
Analyses of Natural Gases, 1996–1997. U.S. Bureau of Land Management Technical Note 404, 1998.
Analyses of Natural Gases, 1998–2001. U.S. Bureau of Land Management Technical Note 412, 2003.
Analyses of Natural Gases, 2002–2004. U.S. Bureau of Land Management Technical Note 418, 2005.
Analyses of Natural Gases, 2005–2007. U.S. Bureau of Land Management Technical Note 427, 2009
Helium. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.
Helium Resources of the United States, 1991. U.S. Bureau of Mines Information Circular 9342, 1993.

Helium Resources of the United States, 1997. U.S. Bureau of Land Management Technical Note 403, 1998.
Helium Resources of the United States, 2001. U.S. Bureau of Land Management Technical Note 408, 2001.
Helium Resources of the United States, 2003. U.S. Bureau of Land Management Technical Note 415, 2004.
Helium Resources of the United States, 2007, U.S. Bureau of Land Management Technical Note 429, 2009.

TABLE 1
TOTAL SALES OF GRADE–A HELIUM
PRODUCED IN THE UNITED STATES[1]

(Million cubic meters)

	Volume		
Year	Domestic sales	Exports[2]	Total sales
2007	73.5	64.2	138
2008	59.6	69.9	130
2009	46.5	71.1	118
2010	51.2	76.8	128
2011	48.0	84.0	132

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Source: U.S. Census Bureau.

TABLE 2
OWNERSHIP AND LOCATION OF HELIUM EXTRACTION PLANTS IN THE UNITED STATES IN 2011

Owner or operator	Location	Product purity
Air Products Helium, Inc.	Hansford County, TX	Grade–A helium.[1]
Do.	Liberal, KS	Do.
BP America Production Company.	Sunray, TX	Crude helium.
Do.	Ulysses, KS	Do.
DCP Midstream	Cheyenne Wells, CO	Crude and Grade–A helium.[1]
Do.	Hansford County, TX	Crude helium.
Do.	Liberal, KS	Do.
Do.	Borger, TX	Do.
EnCana Oil & Gas (USA) Inc.[2]	Moab, UT	Crude and Grade–A helium.[1]
ExxonMobil Gas Marketing Co.	Shute Creek, WY	Do.
IACX Energy[3]	Otis, KS	Crude helium.
K-L Energy Partners, LLC[2]	Lakin, KS	Do.
Linde Global Helium, Inc.	Otis, KS	Grade–A helium.[1]
Midstream Energy Services, LLC[4]	Keyes, OK	Crude and Grade–A helium.[1]
Nacogdoches Oil & Gas[2]	Shiprock, NM	Grade–A helium.
ONEOK, Field Services[2]	Bushton, KS	Crude helium.
Do.[5]	Scott City, KS	Do.
Pioneer Natural Resources Co.	Fain, TX	Do.
Do.	Satanta, KS	Do.
Praxair, Inc.	Bushton, KS	Grade–A helium.[1]
Do.	Ulysses, KS	Do.
SemGas, L.P.[6]	Dodge City, KS	Crude helium.

Do. Ditto.
[1]Including liquefaction.
[2]Plant did not produce helium during 2011.
[3]Plant came online May 2009.
[4]Midstream Energy Services, LLC purchased plant from Nathaniel Energy in March 2009.
[5]Output is piped to Ulysses, KS, for purification.
[6]Plant shut down April 2009.

TABLE 3
HELIUM RECOVERY IN THE UNITED STATES[1]

(Thousand cubic meters)

	2007	2008	2009	2010	2011
Crude helium:					
Bureau of Land Management (BLM) sold (in-kind and open market)	58,800	50,300	30,200	66,000	63,800
Private industry:					
Private helium accepted and stored by BLM	15,800	21,600	15,800	12,400	10,900
Helium withdrawn from storage	-76,500	-71,500	-55,400	-65,200	-72,000
Total net helium put into storage	-60,700	-49,900	-39,600	-52,800	-61,100
Grade–A helium:					
Private industry sold	137,700	129,500	117,600	127,900	132,300
Total helium stored	-60,700	-49,900	-39,600	-52,800	-61,100
Helium recovery from natural gas	77,000	79,600	78,000	75,100	71,200

[1]Negative numbers denote a net withdrawal from BLM's underground storage facility, a partially depleted natural gas reservoir at the Cliffside field near Amarillo, TX.

TABLE 4
SUMMARY OF BUREAU OF LAND MANAGEMENT HELIUM CONSERVATION STORAGE SYSTEM OPERATIONS[1, 2]

(Thousand cubic meters)

	2009	2010	2011
Helium in conservation storage system on January 1:			
Stored under BLM conservation program[3]	532,500	500,500	433,000
Stored for private producers under contract	28,000	18,600	31,800
Total[3]	560,500	519,100	464,800
Input to system:			
Net deliveries from BLM plants	--	--	--
Stored for private producers under contract	15,800	12,400	10,900
Total[3]	15,800	12,400	10,900
Redelivery of helium stored for private producers under contract	-55,400	-65,200	-72,000
Net addition to system[3]	-39,600	-52,800	-61,100
Helium in conservation storage system on December 31:			
Stored under BLM conservation program[3]	500,500	433,000	368,500
Stored for private producers under contract	18,600	31,800	34,400
Total[3]	519,100	464,800	402,900

-- Zero.

[1]Crude helium is injected into or withdrawn from BLM's underground storage facility, a partially depleted natural gas reservoir at the Cliffside field near Amarillo, TX.

[2]Negative numbers denote a net withdrawal from BLM's storage facility.

[3]Net additions to system do not include in-kind crude sales or transfers. Totals, however, do include crude sales and transfers.

TABLE 5
WORLD GRADE–A HELIUM
ANNUAL PRODUCTION CAPACITY
AS OF DECEMBER 31, 2011

(Million cubic meters)

	Capacity
United States[1]	132
Rest of world[e]	40
Total[e]	172

[e]Estimated.

[1]Includes plants on standby as well as operating plants.

FIGURE 1
MAJOR U.S HELIUM-BEARING NATURAL GAS FIELDS

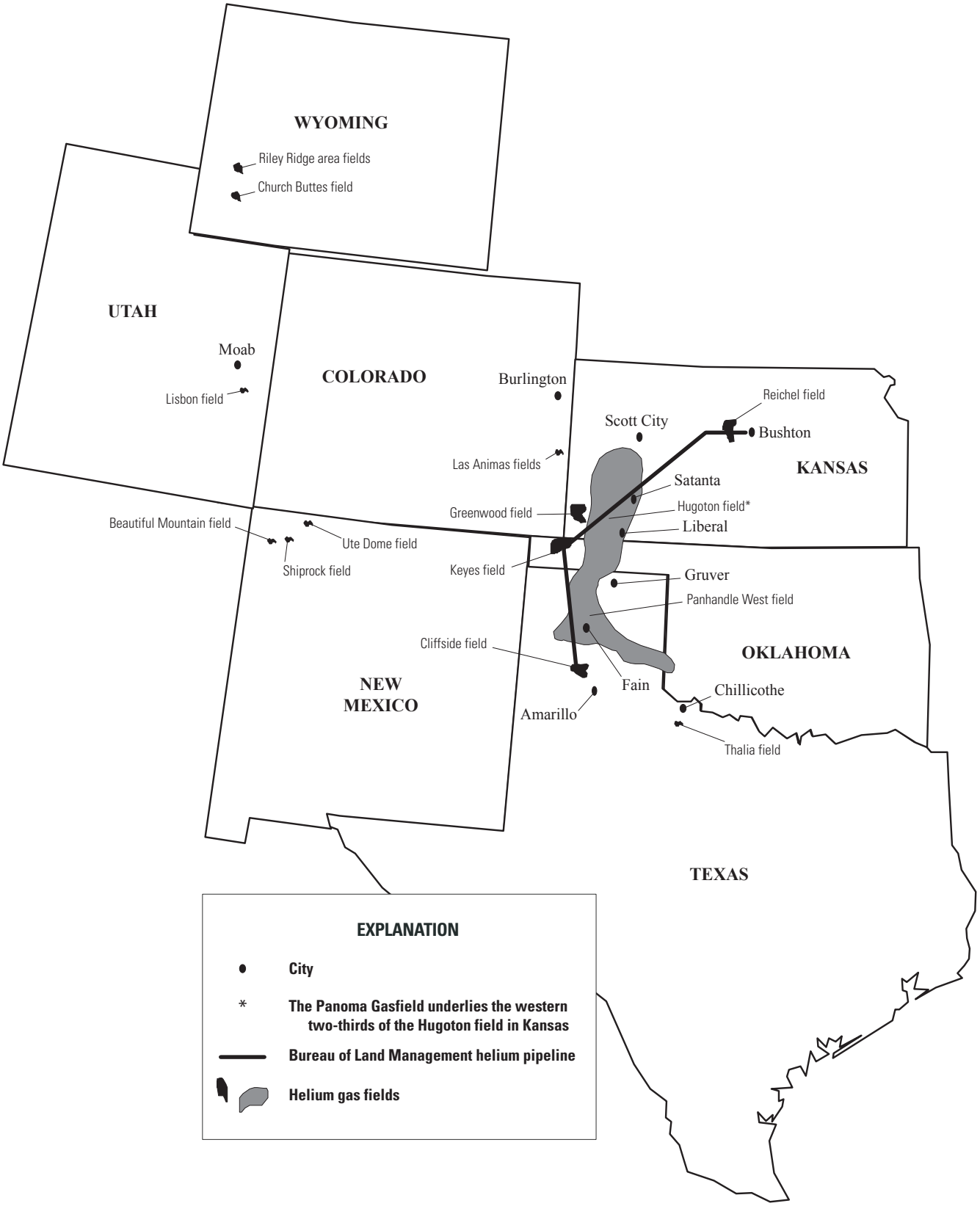

FIGURE 2
HELIUM RECOVERY IN THE UNITED STATES, 1960–2011

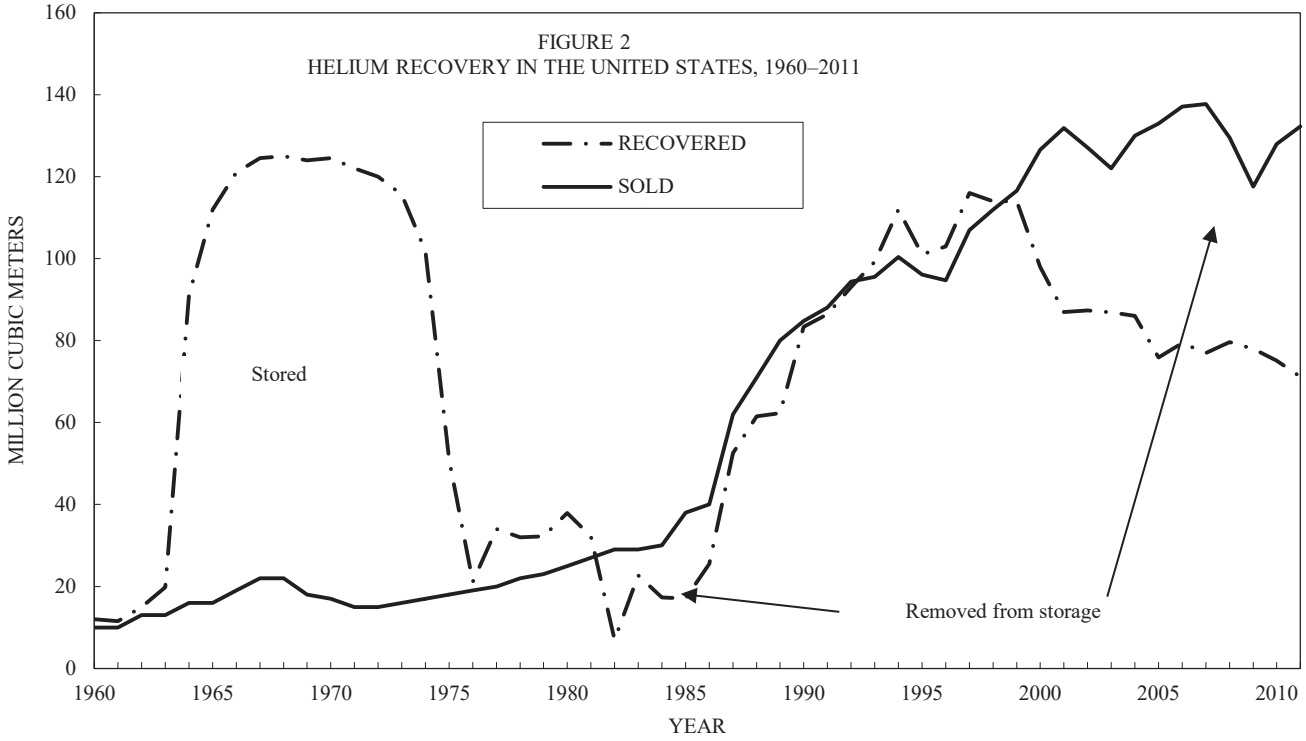

FIGURE 3
ESTIMATED HELIUM CONSUMPTION, BY END USE, IN THE UNITED STATES IN 2011[1]

(Million cubic meters)