



2010 Minerals Yearbook

HELIUM

HELIUM

By Joseph B. Peterson¹ and Peter J. Madrid²

Sales of Grade-A helium (99.995% or greater purity) by private industry were 51.2* million cubic meters¹ (about 1.85* billion cubic feet) in the United States in 2010, and exports by private producers were 76.8 million cubic meters (about 2.77 billion cubic feet) for total sales of about 128* million cubic meters (about 4.61* billion cubic feet) of U.S. helium, a 8.4%* increase from that of 2009 (table 1). During 2010, domestic helium sales increased by 10.1%*, while helium exports increased by 8% compared with those of 2009.

Legislation and Government Programs

The Helium Privatization Act of 1996, Public Law 104.273 (The Act), 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 recommendations by the NAS were being reviewed by the Bureau of Land Management (BLM) personnel at yearend.

The final provision of the legislation to be implemented was the disposal of the Exell Helium Plant. In June 2010, the Texas Commission on Environmental Quality and the U.S. Environmental Protection Agency (EPA) issued a ready for reuse (RFR) certificate for the property, and the property was sold in December 2010.

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

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

³All 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).

*Correction posted January 13, 2012.

Production

In 2010, 13 companies operated 19 of 22 privately owned domestic helium plants, 13 of which extracted helium from natural gas. Two of the crude helium plants did not produce or extract helium during 2010, one Grade-A helium plant did not produce helium in 2010, and no new helium plants came online in 2010. All but two extraction plants used cryogenic extraction processes. Total sales of U.S.-produced helium in 2010 increased by about 8.4%* compared with those of 2009. All natural gas processed for helium recovery came from gas fields in Colorado, Kansas, Oklahoma, Texas, Utah, and Wyoming (figure 1). During 2010, 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 8.4%* more helium was produced from the Government's helium reserve at Cliffside Field in 2010 than during 2009. 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 gas fields 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 2010, the BLM analyzed 18 natural gas samples from 5 States 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 goal of producing an updated map of helium reserves in the United States by 2012.

Consumption

In 2010, private industry supplied 100% of domestic helium consumption. The major domestic end uses of helium were cryogenics (26.0%), controlled atmospheres (22.0%), pressurizing and purging (17.0%), welding (17.0%); other uses included chromatography/lifting gas/heat transfer (12.0%), leak detection (4.0%), and synthetic breathing mixtures (2.0%) (Figure 3). In cryogenics, magnetic resonance imaging applications dominated liquid helium use. Estimated 2010 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.

In 2010, U.S. domestic helium consumption increased 8.4%* to 51.2* million cubic meters (about 1.85* billion cubic feet) compared with consumption for 2009. During 2010, U.S. helium exports increased 8% to 76.8 million cubic meters (about 2.77 billion cubic feet), compared with those of 2009 (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 2010, in-kind crude helium sales were about 4.88 million cubic meters (175.9 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 465 million cubic meters (about 16.8 billion cubic feet) on December 31, 2010. 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 2010, 12.4 million cubic meters (447 million cubic feet) of privately owned helium was delivered to the BLM's helium conservation system, and 65.2 million cubic meters (about 2.35 billion cubic feet) were withdrawn, for a net decrease of 52.8 million cubic meters (about 1.90 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 2010, the price that the BLM charged private companies for crude helium was \$2.33 per cubic meter (\$64.75 per thousand cubic feet), about 4% higher than that of 2009. 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 2010, exports of Grade-A helium increased to 76.8 million cubic meters (2.77 billion cubic feet), an 8% increase compared with those of 2009, and accounted for about 51.2% of sales of U.S.-produced helium; private industry supplied all U.S. helium exports. The increase in helium exports was attributed to increased shipments of helium to Australia, Belgium, Brazil, Canada, Germany, Republic of Korea, and Singapore. About 50% of the helium exported from the United States went to Asia, with Japan receiving about 20% of total U.S. exports.

About 25% of the exported helium was shipped to Europe; collectively, Belgium, France, Germany, Italy, and the United Kingdom received 94% of the helium exported to Europe. Other export destinations and percentages received were Canada and Mexico, combined, 14%; South America, 8%; Australia and New Zealand, 1%; the Middle East and Africa, 1% each; Central America, and the Caribbean, less than 1% each. For 2010, import tariffs on helium remained at 3.7% for normal trade relations (NTR) nations and 25% for non-NTR nations.

World Review

Excluding the United States, world production capacity of helium was estimated to be about 70 million cubic meters (2.53 billion cubic feet) for 2010 (table 5). During 2010, the helium market began to slowly recover from the economic downturn of 2008–09. Helium production levels were 20% to 25% higher than in 2009. Two new plants in the Riley Ridge, WY, area started construction during 2010. Worldwide, several new helium plant projects were scheduled for startup sometime during 2012–18. Other new plants were to be constructed in Algeria, Australia, Indonesia, Qatar, and Russia. All known helium that was produced outside the United States during 2010 was extracted in Algeria, Australia, Poland, Qatar, and Russia.

Outlook

From 2005–10, the total sales of U.S. produced helium increased about 2% per year, while from 2000–10; the average growth rate was near zero. Owing to the slow U.S. economic recovery, U.S. domestic helium consumption is expected to increase only slightly during 2011. Foreign helium demand also is expected to increase slightly during 2011. With the anticipation that foreign helium production will remain stable during 2011, increased foreign demand is expected to result in increased U.S. helium exports of about 5% compared with 2010 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.

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 STATES¹

(Million cubic meters)

Year	Volume		Total sales
	Domestic sales	Exports ²	
2006	75.2	61.9	137
2007	73.5	64.2	138
2008	59.6	69.9	130
2009	46.5	71.1	118
2010	51.2	76.8	128

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

²Source: U.S. Census Bureau.

TABLE 2
OWNERSHIP AND LOCATION OF HELIUM EXTRACTION PLANTS IN THE UNITED STATES IN 2010

Owner or operator	Location	Product purity
Air Products Helium, Inc.	Hansford County, TX	Grade-A helium. ¹
Do.	Liberal, KS	Do.
BP America Production Co.	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.	Moab, UT	Crude and Grade-A helium. ¹
ExxonMobil Gas Marketing Co.	Shute Creek, WY	Do.
IACX Energy ²	Otis, KS	Crude helium.
K-L Energy Partners, LLC ³	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 ⁵	Shiprock, NM	Grade-A helium.
ONEOK, Field Services ³	Bushton, KS	Crude helium.
ONEOK, Field Services ⁶	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. ⁷	Dodge City, KS	Crude helium.
Do. Ditto.		

¹Including liquefaction.

²Plant came online May 2009.

³Plant did not produce helium during 2010.

⁴Midstream Energy Services, LLC purchased plant from Nathaniel Energy in March 2009.

⁵Nacogdoches Oil & Gas Shiprock Helium Plant did not produce helium during 2010.

⁶Output is piped to Ulysses, KS, for purification.

⁷Plant shut down April 2009.

TABLE 3
HELIUM RECOVERY IN THE UNITED STATES¹

(Thousand cubic meters)

	2006	2007	2008	2009	2010
Crude helium:					
Bureau of Land Management (BLM) sold (in-kind and open market)	63,500	58,800	50,300	30,200	66,000
Private industry:					
Private helium accepted and stored by BLM	18,100	15,800	21,600	15,800	12,400
Helium withdrawn from storage	-75,800	-76,500	-71,500	-55,400	-65,200
Total net helium put into storage	-57,700	-60,700	-49,900	-39,600	-52,800
Grade-A helium:					
Private industry sold	137,100	137,700	129,500	117,600	127,900 *
Total helium stored	-57,700	-60,700	-49,900	-39,600	-52,800
Helium recovery from natural gas	79,400	77,000	79,600	78,000	75,100 *

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

*Correction posted on January 13, 2012.

TABLE 4
SUMMARY OF BUREAU OF LAND MANAGEMENT HELIUM CONSERVATION STORAGE
SYSTEM OPERATIONS^{1,2}

(Thousand cubic meters)

	2008	2009	2010
Helium in conservation storage system on January 1:			
Stored under BLM conservation program ³	583,500	532,500	500,500
Stored for private producers under contract	27,600	28,000	18,600
Total ³	<u>611,100</u>	<u>560,500</u>	<u>519,100</u>
Input to system:			
Net deliveries from BLM plants	--	--	--
Stored for private producers under contract	21,600	15,800	12,400
Total ³	<u>21,600</u>	<u>15,800</u>	<u>12,400</u>
Redelivery of helium stored for private producers under contract			
Net addition to system ³	<u>-71,500</u>	<u>-55,400</u>	<u>-65,200</u>
Helium in conservation storage system on December 31:			
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	<u>560,500</u>	<u>519,100</u>	<u>464,800</u>

-- Zero.

¹Crude 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.

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

³Net 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, 2010

(Million cubic meters)

	Capacity
United States ¹	177
Rest of world ^c	70
Total ^c	<u>247</u>

^cEstimated.

¹Includes plants on standby as well as operating plants.

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

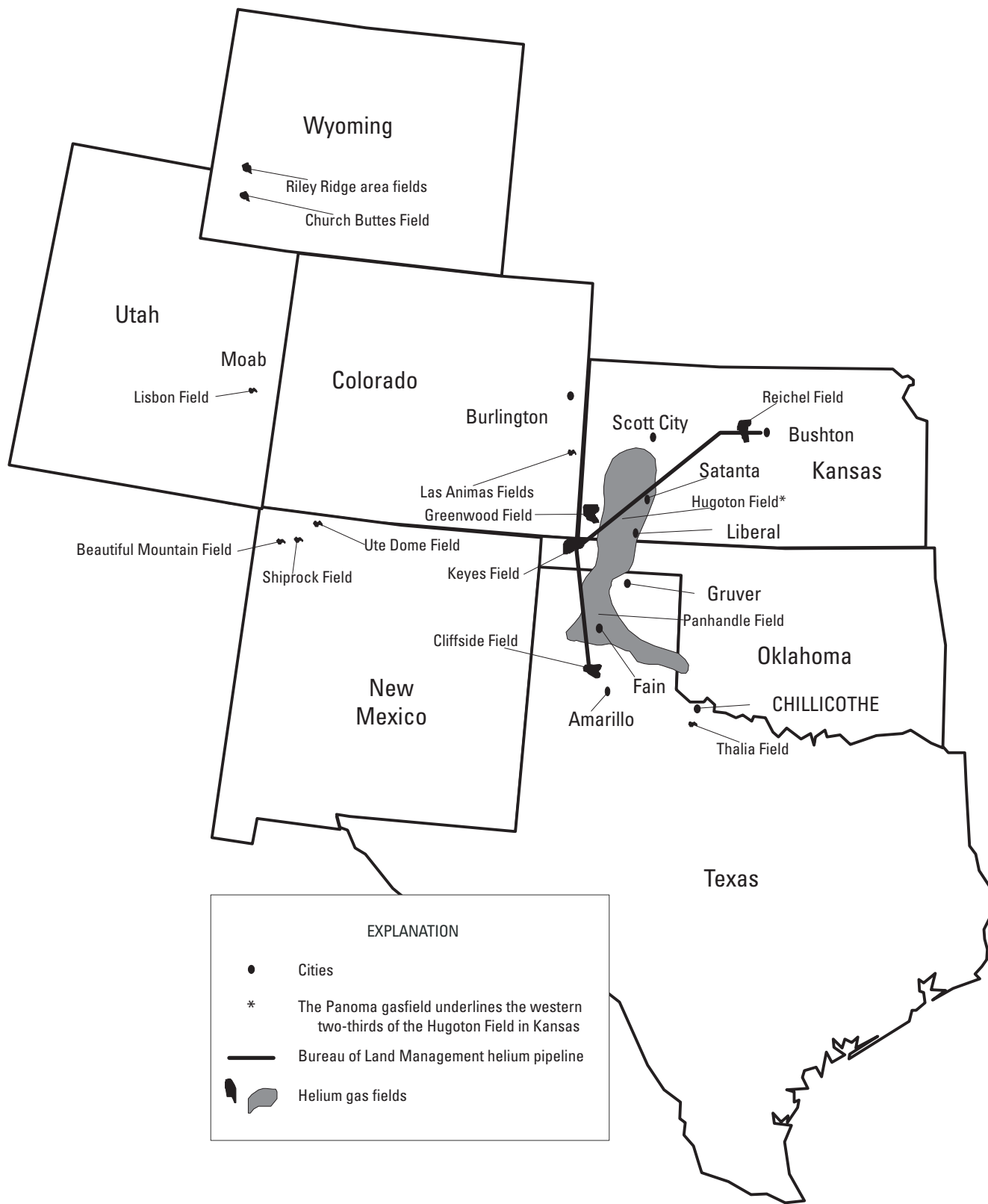


FIGURE 2
HELIUM RECOVERY IN THE UNITED STATES

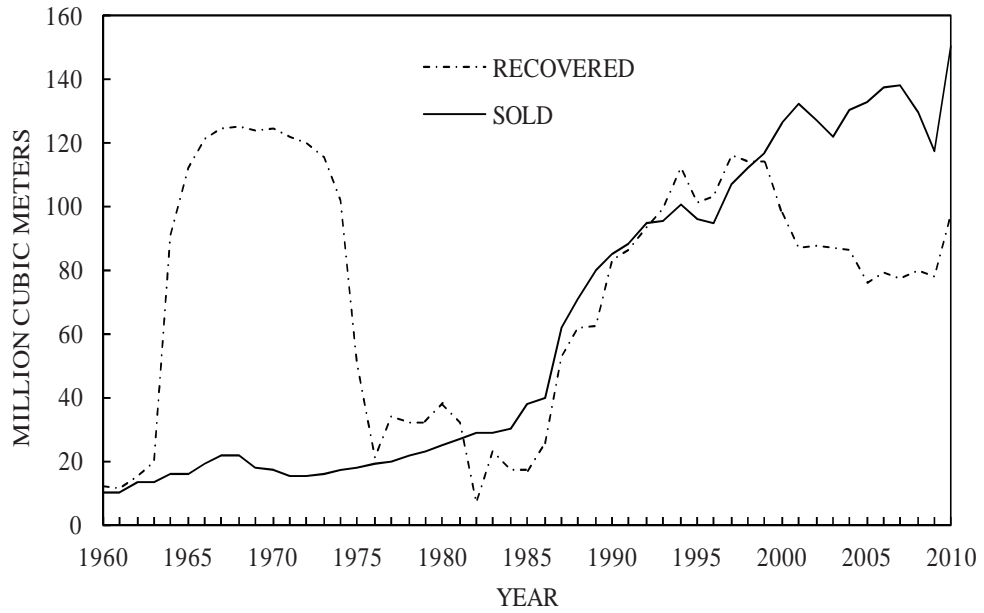
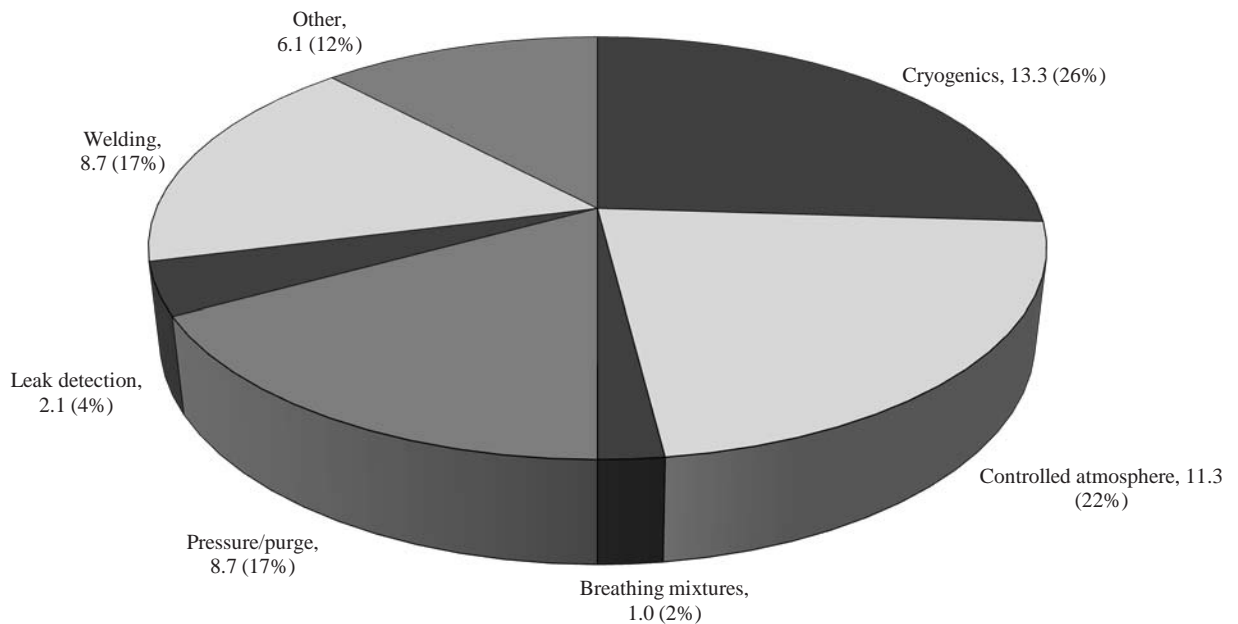


FIGURE 3
ESTIMATED HELIUM CONSUMPTION, BY END USE,
IN THE UNITED STATES IN 2010^{1, *}



¹Total helium used in the United States in 2010 was estimated to be 51.2 million cubic meters.

*Correction posted on January 13, 2012.