

HELIUM

By Norbert Pacheco¹

Sales of Grade-A helium (99.995% or greater purity) by private industry were 85.1 million cubic meters² (about 3.07 billion cubic feet) in the United States in 2004, and exports by private producers were 44.9 million cubic meters (about 1.62 billion cubic feet) for total sales of 130 million cubic meters (about 4.70 billion cubic feet) of U.S. helium, which was about a 6.6% increase from 2003 (table 1). During 2004, domestic helium sales increased by about 5.3%, while helium exports increased by about 8.7% when compared with 2003.

Legislation and Government Programs

The Federal Helium Program was established to promote the conservation of helium to provide Federal agencies with current and future helium needs to carry out Government programs authorized and funded by the U.S. Congress. The major Federal helium customers were the National Aeronautics and Space Administration, the U.S. Department of Defense, and the U.S. Department of Energy. On October 9, 1996, the President signed the Helium Privatization Act of 1996 (Public Law 104-273). This legislation directed the Federal Helium Program to discontinue production and sale of refined helium by April 9, 1998. The remaining key components of this legislation and applicable status updates are as follows:

- Begin selling Federal crude helium reserves in excess of 600 million cubic feet (16.6 million cubic meters) on or before January 1, 2005, and complete sales by January 1, 2015. STATUS: In kind crude helium sales for helium that is sold to Federal agencies and their contractors by private companies began in January 1998. Open market sales of crude helium were started in February 2003.
- Continue the operation of the helium storage field system, which includes the storage field and the crude helium pipeline system used for the storage and distribution of Government-owned and privately owned crude helium.
- Continue the collection of helium royalties and fees from sales of helium extracted from gas produced from Federal lands.
- Continue the helium resources evaluation and reserve tracking program to monitor helium availability for essential Government programs.
- Complete land transfers of the Landis Property to the Texas Plains Girl Scout Council and the Amarillo Plant to the General Services Administration (GSA). STATUS: The final affected

property assessment report (APAR) and response action plan (RAP) for the Amarillo Plant and the Landis Property were approved by the Texas Commission on Environmental Quality (TCEQ) in February 2004. All environmental cleanup has been completed and final documents were submitted to the TCEQ for review and approvals. The land transfer documents for the Landis Property were being prepared by the New Mexico State Office (NMSO), and disposal documents for the Amarillo Plant were submitted to GSA. Final land transfer of the Landis Property and disposal of the Amarillo Plant are projected to be completed by late 2005 or early 2006.

Production

In 2004, 13 companies operated 20 of 21 privately owned domestic helium plants, 15 of which extracted helium from natural gas (table 2). One of the crude helium plants did not produce or extract helium during 2004. All but two extraction plants used cryogenic extraction processes. The total sales of U.S. produced helium increased by about 6.6% compared with those of 2003. All natural gas processed for helium recovery came from gasfields in Colorado, Kansas, New Mexico, Oklahoma, Texas, Utah, and Wyoming (figure 1). During 2004, 10 private plants purified helium by using pressure swing adsorption technology. Nine 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 U.S. Bureau of Land Management (BLM) from records of its own operations as well as from its own 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.

Domestic measured helium reserves and indicated helium resources as of January 1, 2003, were estimated to be 8.5 billion cubic meters (305 billion cubic feet). The resources included measured helium reserves estimated to be 3.7 billion cubic meters (133 billion cubic feet) in natural gas from which helium is being extracted. The measured reserves included nearly 867 million cubic meters (31.2 billion cubic feet) stored by the BLM in the helium storage conservation system. Measured helium reserves from indicated resources of natural gas with helium content greater than 0.05% were estimated to be 1.8 billion cubic meters (65 billion cubic feet). Indicated helium resources, a category slightly less certain than measured reserves, in natural gas with less than 0.3% helium were estimated to be 3.0 billion cubic meters (107 billion cubic feet). The majority of these indicated reserves were derived from the Potential Gas Committee designation of unconfirmed/probable reserves (Curtis, 2002). Approximately 2.5 billion cubic meters (91 billion cubic feet), or 98%, of the domestic helium reserves

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²All 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).

under Federal ownership and from which helium is being extracted is located in the Riley Ridge area in Wyoming and the Cliffside field in Texas.

Most domestic helium resources are located in the Midcontinent and Rocky Mountain regions of the United States. The measured helium reserves are found in approximately 102 gasfields in 11 States. About 98% of these reserves is 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 2004, the BLM analyzed 115 natural gas samples from 9 States in conjunction with its program to survey and identify possible new sources of helium.

Consumption

In 2004, private industry supplied 100% of domestic helium demand. The major domestic end uses of helium were cryogenics (28%), pressurizing and purging (26%), welding (20%), and controlled atmospheres (13%). Other uses included chromatography/lifting gas/heat transfer (7%), leak detection (4%), and synthetic breathing mixtures (2%) (figure 3). Cryogenics, specifically magnetic resonance imaging applications, dominated liquid helium use. Estimated 2004 domestic consumption by end use was based on a 2003-04 end-use survey conducted by BLM's Helium Operations to determine the trends in helium usage.

In-kind crude helium sales regulations (43 CFR part 3195), which became effective on November 23, 1998, require helium refiners that sell helium to Federal agencies and their contractors to buy an equivalent amount of crude helium from the BLM. Such sales are referred to as "in-kind crude helium sales." In 2004, in-kind crude helium sales totaled 6.1 million cubic meters (220 million cubic feet). The sales were made by 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 788 million cubic meters (about 28 billion cubic feet) on December 31, 2004. The storage system contained crude helium purchased under contract by the BLM 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 2004, 19.1 million cubic meters (689 million cubic feet) of private helium was delivered to the BLM's helium conservation system, and 63.1 million cubic meters (about 2.28 billion cubic feet) was withdrawn for a net decrease of 44.0 million cubic meters (about 1.59 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 2004, the price that the BLM charged private companies for in-kind crude helium sales was \$1.947 per cubic meter (\$54.00 per thousand cubic feet).

Foreign Trade

In 2004, exports of Grade-A helium increased to 44.9 million cubic meters (1.62 billion cubic feet) (table 1). Helium exports increased by about 8.7% compared with those of 2003 and accounted for about 35% of sales of U.S.-produced helium; private industry supplied all U.S. helium exports. The increase in helium exports is attributed to increased demand for helium from Australia, Belgium, Canada, Germany, Mexico, New Zealand, and the United Kingdom. About 52% of the helium exported from the United States went to Asia, with Japan receiving nearly 25% of total exports. About 27% of the exported helium was shipped to Europe; collectively, Belgium, France, Germany, and the United Kingdom received 94% of the helium exported to Europe. Other exports were as follows: Canada and Mexico, 8%; South America, 4%; Australia and New Zealand, 4%; the Middle East, 3%; Africa, 1%; and Central America and the Caribbean, less than 1% each. Import tariffs on helium established on January 1, 1998, remained at the 3.7% rate for normal trade relations (NTR) nations and 25% for non-NTR nations.

World Review

Excluding the United States, world production capacity of helium remained at an estimated 29 million cubic meters (1.05 billion cubic feet) (table 5). All known helium that was produced outside the United States in 2004 was extracted in Algeria, Poland, and Russia.

Outlook

In 2004, total market sales for U.S.-produced helium increased by about 6.6% compared with those of 2003. From 1999 to 2004, the market growth rate was about 2.2% per year, while from 1994 to 2004, the market growth rate was less than 1% per year. Sales of U.S.-produced helium are expected to increase by between 2% and 3% for 2005. However, beginning in 2006, demand for U.S. produced helium is expected to start declining owing to the overseas helium projects that will be adding new helium production before the end of 2005 and into 2006. This addition of helium to the global market is expected to result in a decrease of U.S. export demand. The Skikda, Algeria, helium expansion project will be adding a minimum 8.3 million cubic meters (300 million cubic feet) of new production at startup, and the new helium extraction facility under construction in Qatar will have a helium production capacity of 8.3 million cubic meters (300 million cubic feet).

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TABLE 1
TOTAL SALES OF GRADE-A HELIUM
PRODUCED IN THE UNITED STATES¹

(Million cubic meters)

Year	Volume		Total sales
	Domestic sales	Exports ²	
2000	89.6	37.0	127
2001	89.0	43.0	132
2002	87.6	39.5	127
2003	80.8	41.3	122
2004	85.1	44.9	130

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 2004

Owner or operator	Location	Product purity
Air Products and Chemicals, Inc.	Hansford County, TX	Grade-A helium. ¹
Do.	Liberal, KS	Do.
BCCK Engineering, Inc.	Dodge City, KS	Crude helium.
BOC Gases	Otis, KS	Grade-A helium. ¹
BP America Production Company	Sunray, TX	Crude helium.
Do.	Ulysses, KS	Do.
Nathaniel Energy Corp. ²	Keyes, OK	Crude and Grade-A helium. ¹
Regency Gas Services LLC ³	Lakin, KS	Crude helium.
Duke Energy Field Services	Cheyenne Wells, CO	Crude and Grade-A helium. ¹
Do.	Hansford County, TX	Crude helium.
Do.	Liberal, KS	Do.
Do.	Borger, TX	Do.
Exxon Mobil Corp.	Shute Creek, WY	Crude and Grade-A helium. ¹
Newpoint Gas Services, Inc. ⁴	Shiprock, NM	Grade-A helium.
ONEOK, Inc. ⁵	Bushton, KS	Crude helium.
Do. 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.
Tom Brown, Inc.	Moab, UT	Crude and Grade-A helium. ¹

¹Including liquefaction.

²Nathaniel Energy Corp. purchased plant from Colorado Interstate Gas Co. in April 2003.

³Regency Gas Services LLC purchased plant from Colorado Interstate Gas Co. in June 2003.

⁴Plant produced only in the first 5 months of 2004.

⁵Plant did not produce helium during 2004.

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

TABLE 3
HELIUM RECOVERY IN THE UNITED STATES¹

(Thousand cubic meters)

	2000	2001	2002	2003	2004
Crude helium:					
Bureau of Land Management (BLM) sold (in-kind and open market)	--	--	--	51,800	29,300
Private industry:					
Private helium accepted and stored by BLM ¹	23,300	18,000	16,600	19,400	19,100
Helium withdrawn from storage	-51,900	-62,900	-56,300	-54,500	-63,100
Total net helium put into storage	-28,600	-44,900	-39,700	-35,100	-44,000
Grade-A helium:					
Private industry sold	127,000	132,000	127,000	122,000	130,000
Total helium stored	-28,600	-44,900	-39,700	-35,100	-44,000
Helium recovery from natural gas	98,000	87,000	87,400	86,900	86,000

-- Zero.

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.

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

(Thousand cubic meters)

	2002	2003	2004
Helium in conservation storage system on January 1:			
Stored under BLM conservation program ³	829,000	822,000	770,000
Stored for private producers under contract	78,000	45,000	62,000
Total³	907,000	867,000	832,000
Input to system:			
Net deliveries from BLM plants	--	--	--
Stored for private producers under contract	16,600	19,400	19,100
Total³	16,600	19,400	19,100
Redelivery of helium stored for private producers under contract	-56,300	-54,500	-63,100
Net addition to system³	-39,700	-35,100	-44,000
Helium in conservation storage system on December 31:			
Stored under BLM conservation program ³	822,000	770,000	741,000
Stored for private producers under contract	45,000	62,000	47,000
Total³	867,000	832,000	788,000

-- 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, 2004

(Million cubic meters)

	Capacity
United States ¹	152
Rest of world ^c	29
Total^c	181

^cEstimated.

¹Includes plants on standby as well as operating plants.

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

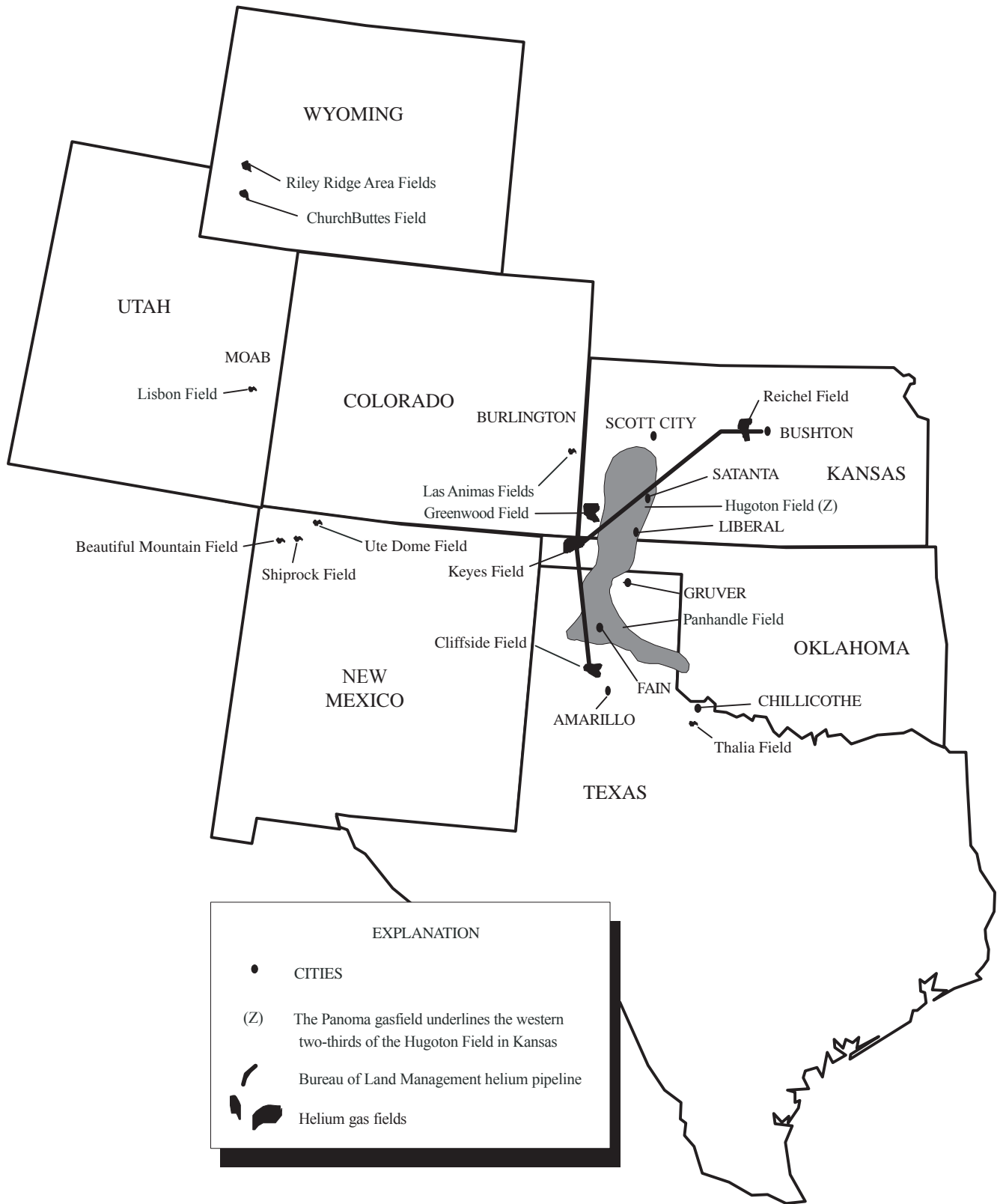


FIGURE 2
HELIUM RECOVERY IN THE UNITED STATES

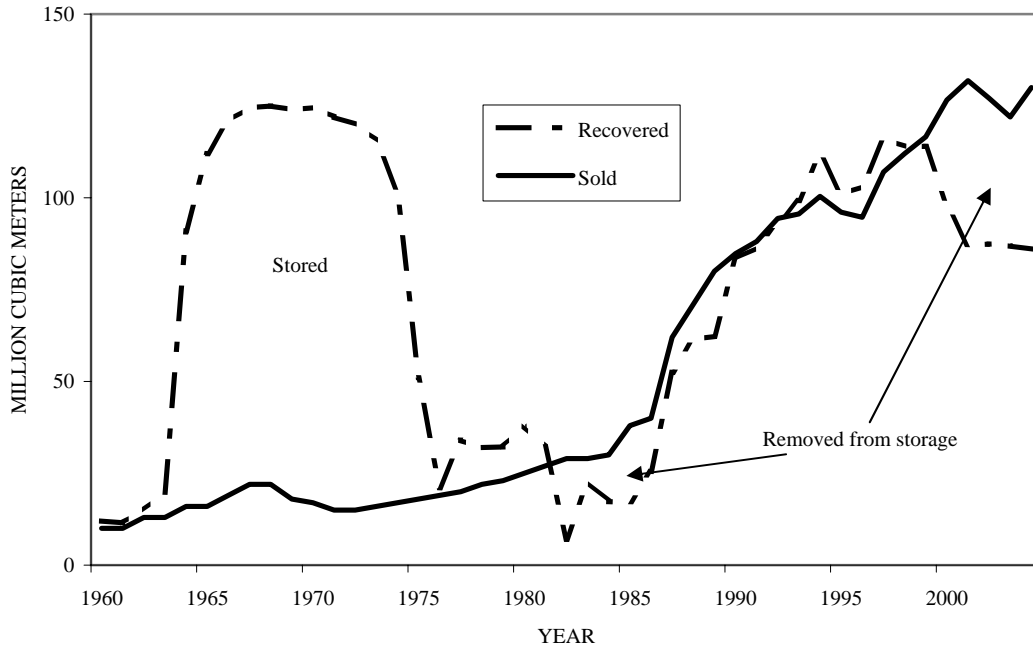
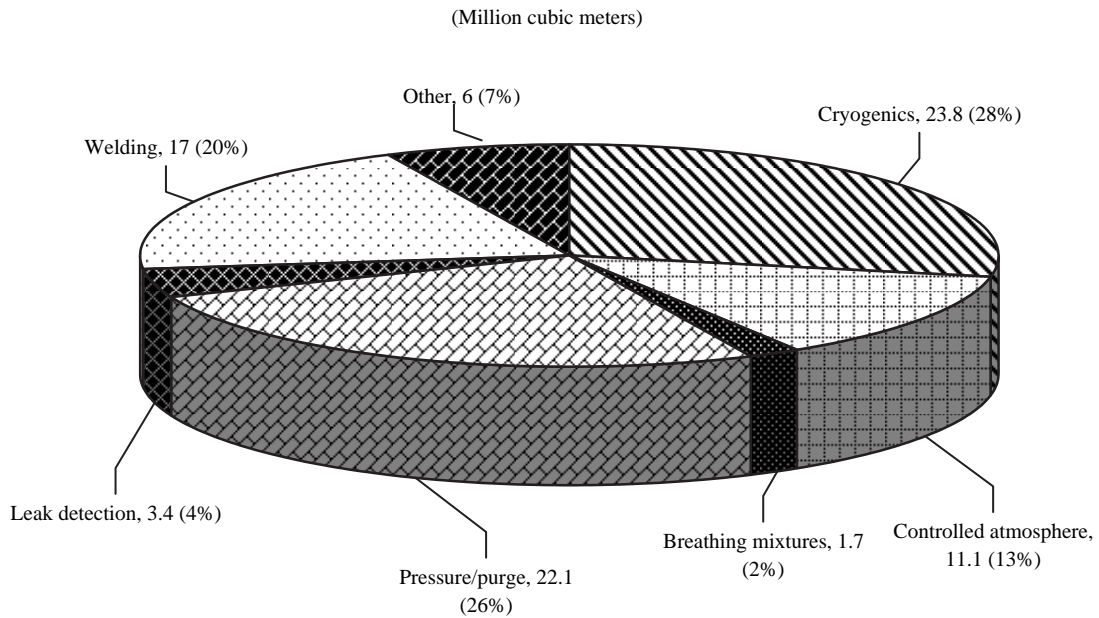


FIGURE 3
ESTIMATED HELIUM CONSUMPTION, BY END USE, IN THE UNITED STATES IN 2004¹



¹Total helium used in the United States in 2004 was estimated to be 85.1 million cubic meters.