

HELIUM

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Grade-A helium (99.995% or greater purity) sales by private industry were 89.0 million cubic meters (3,209 million cubic feet) in the United States in 2001, and exports by private producers were 43.0 million cubic meters (1,550 million cubic feet) for total sales of 132.0 million cubic meters (4,757 million cubic feet) of U.S. helium, about a 3.9% increase from 2000 (table 1). For 2001, domestic helium sales growth remained relatively stable. However, helium exports increased by about 16%. The increase in exported helium was mostly due to continued increased European demand for helium.

Legislation and Government Programs

The Federal Helium Program was established to provide all Federal agencies with current and estimated 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 (NASA), 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. Some of the remaining key components of this legislation and applicable status updates are as follows:

- Dispose of all assets related to helium production, refining, and sales not later than 24 months after helium refinery closing.

STATUS: Through cooperation with the General Services Administration, final disposition of personal properties was completed via auction in March 2000. Through an interagency agreement with the National Parks Service (NPS), the following documents were completed:

- (1) the phase I cultural landscape inventory was completed during 1999 for the Amarillo and Exell helium plants and the Landis property,

- (2) the historical structures inventory was completed during 1999 for the Amarillo and Exell helium plants, and

- (3) phase II archeological testing was completed for the Landis property during 2000.

Currently [2001], a draft of a historic architectural engineering report (HAER), prepared by the NPS for the Amarillo and Exell helium plants, is being reviewed. An environmental contractor was secured, and phase I environmental assessments and health and safety plans were completed for the Amarillo and Exell helium plants and the Landis property during 1999.

Additionally, an application was filed, and the Landis property was accepted into the Voluntary Compliance Program (VCP) under the Texas Natural Resources Conservation Commission during 2000. Phase II environmental site assessment work plans and initial characterization sampling were completed for the

Landis property during 2001. Final characterization and delineation sampling were recently completed, and lab results are pending. A new application was filed, and the Amarillo helium plant was accepted into the VCP during 2001. Initial characterization sampling is scheduled to start at the plant site in late 2002.

- Begin selling Federal crude helium reserves in excess of 600 million cubic feet on or before January 1, 2005, and complete sales by January 1, 2015.

STATUS: Crude helium sales (in kind) for helium that is sold to Federal agencies and their contractors by private companies began in January 1998. Open market sales of the crude helium were reviewed in a legislatively mandated study conducted by the National Academy of Sciences (NAS) concerning the impact on national, scientific, and military interests. The NAS study was completed in March 2000. Helium regulations, however, are currently [2001] being written and, once in place, will be used to guide open market sales of the crude helium reserves.

- Continue operation of the helium storage field system, which includes the storage field and the crude helium pipeline used for storage and distribution of Government-owned and privately owned crude helium.

- Continue collection of helium royalties and fees from sales of helium extracted from gas produced from Federal lands.

- Continue helium resources evaluation and reserve tracking to monitor helium availability for essential Government programs.

- Complete land transfer to the Girl Scout Council.

STATUS: Historical/archeological reviews and environmental assessments continue to be carried out.

Production

In 2001, 12 companies operated 22 privately owned domestic helium plants, 16 of which extracted helium from natural gas (table 2; figures 1, 2). All but two extraction plants used cryogenic extraction processes. The total sales of U.S. produced helium increased by 3.9% compared with those of 2000. All natural gas processed for helium recovery came from gasfields in Colorado, Kansas, Oklahoma, Texas, Utah, and Wyoming. During 2001, 11 private plants purified helium by using pressure swing adsorption technology. Nine privately owned plants that produced Grade-A helium also liquified 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, a single voluntary canvass of private U.S. operations. Of the 10 operations to which a survey request was sent, 100% responded, and those data plus data from BLM operations represent 100% of the total helium sales and recovery data

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shown in table 3.

Domestic measured helium reserves and indicated helium resources as of January 1, 2001, were estimated to be 8.9 billion cubic meters (323 billion cubic feet). The resources include measured helium reserves estimated to be 4.1 billion cubic meters (147 billion cubic feet) in natural gas from which helium is being extracted. The measured reserves included nearly 951 million cubic meters (34.3 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% are estimated to be 1.8 billion cubic meters (65 billion cubic feet). Indicated helium resources, a category of reserves slightly less certain than measured reserves, in natural gas with less than 0.3% helium were estimated to be 3.1 billion cubic meters (111 billion cubic feet). The majority of these indicated reserves were derived from the Potential Gas Committee designation of unconfirmed/probable reserves (Curtis, 2000). Approximately 2.6 billion cubic meters (94 billion cubic feet) (or 98%) of the domestic helium reserves that are under Federal ownership, from which helium is being extracted, are located in the Riley Ridge area in Wyoming and the Cliffside Field in Texas.

Most of the domestic helium resources are in the midcontinent and the Rocky Mountain regions of the United States. The measured helium reserves are in approximately 102 gasfields in 11 States. About 97% 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 the Cliffside Fields in Texas; and the Riley Ridge area in Wyoming. During 2001, the BLM analyzed 340 natural gas samples from 8 States in conjunction with its program to survey and identify possible new sources of helium.

Consumption

In 2001, private industry supplied 100% of the domestic demand. The major domestic end uses of helium were cryogenics (24.4%), pressurizing and purging (19.9%), welding (18.2%), and controlled atmospheres (16.0%). Minor uses included leak detection (5.6%), synthetic breathing mixtures (3.1%), and chromatography/lifting gas/heat transfer (total 12.8%) (figure 3). Cryogenics, specifically magnetic resonance imaging applications, dominated liquid helium use. Estimated 2001 domestic consumption by end use was based on a 1996 end-use survey conducted by BLM's Helium Operations to determine the trends in helium usage.

In-kind crude helium sales regulations, which became effective November 23, 1998, were published in 43 CFR chapter II, part 3195. These regulations require that helium refiners that sell helium to Federal agencies and their contractors must buy an equivalent amount of crude helium from the BLM. Such sales are referred to as "in-kind crude helium sales." In 2001, in-kind crude helium sales were 6.9 million cubic meters (249 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 907 million cubic meters (32.7 billion cubic feet) on December 31, 2001. 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 2001, 18.0 million cubic meters (648 million cubic feet) of private helium was delivered to the BLM's helium conservation system, and 62.9 million cubic meters (2,269 million cubic feet) was withdrawn for a net decrease of 44.9 million cubic meters (1,621 million cubic feet) of private helium in storage (table 4).

Transportation

Private producers and/or distributors shipped helium, predominantly as a liquid, in semitrailers. These semitrailers 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

The price charged for crude helium to private companies for in-kind crude helium sales was \$1.803 per cubic meter (\$50.00 per thousand cubic feet) for fiscal year 2001.

Foreign Trade

In 2001, exports of Grade-A helium increased to 43.0 million cubic meters (1.55 billion cubic feet) (table 1). Helium exports increased by 16.2% compared with that of 2000 and accounted for 32.6% of the U.S.-produced helium sales; private industry supplied all U.S. helium exports. The large increase in helium exports is attributed to increased European demand for helium. About 55% of the U.S. helium exports went to Asia, with Japan receiving about 38% of those exports. About 26% of the exported helium was shipped to Europe; collectively, Belgium, France, Germany, and the United Kingdom received 98% of the helium exported to Europe. Other exports were as follows: Canada and Mexico, 8%; South America, 4%; Australia and New Zealand, 3%; the Middle East, 4%; 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 at the 25% for non-NTR nations.

World Review

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

Outlook

The total market for U.S.-produced helium increased by 3.9% compared with that of 2000. From 1996 to 2001, the market

growth rate was about 6.9%. From 1991 to 2001, however, the market growth rate was about 5.1%.

Expansion of the Asian helium market over the next 2 years is expected to be moderate owing to the uncertain economic condition in that region of the world. Competition from foreign helium producers will provide continued uncertainty in the strength of the U.S. exports to the global helium market. Helium sales in the private sector are expected to continue at a moderate growth rate of 5% during the next 3 years. Use of high-temperature superconductor materials in electric motor windings and increased fiber optics demand are expected to increase helium demand.

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

(Million cubic meters)

Year	Volume		Total sales
	Domestic sales	Exports 2/	
1997	77.4	29.5	107
1998	84.2	27.8	112
1999	89.8	26.8	117
2000	89.6	37.0	127
2001	89.0	43.0	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 2001

Owner or operator	Location	Product purity
Air Products and Chemicals, Inc.	Hansford County, TX	Grade-A helium. 1/
Do.	Liberal, KS	Do. 1/
BOC Gases, Inc.	Otis, KS	Do. 1/
BP plc	Sunray, TX	Crude helium.
Do.	Ulysses, KS	Do.
CIG Co. (a subsidiary of El Paso Corp.)	Keyes, OK	Grade-A helium. 1/
Do.	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. 2/	Borger, TX	Do.
Do. 3/	Moore County, TX	Do.
Exxon-Mobil Corp.	Shute Creek, WY	Crude and Grade-A helium. 1/
Nitrotec Energy Corp. 4/	Cheyenne Wells, CO	Grade-A helium.
Do. 5/	Chillicothe, TX	Do.
ONEOK, Inc. 6/	Bushton, KS	Crude helium.
Do. 7/	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. 1/
Tom Brown, Inc.	Moab, UT	Crude and Grade-A helium. 1/
Williams Field Services Co. 8/	Baker, OK	Crude helium.

1/ Including liquefaction.

2/ Plant started up in October 2001.

3/ Plant shut down in April 2002.

4/ Stopped production in late 1999.

5/ Plant sold to Cardinal Resources, Inc., in March 2001.

6/ Plant closed for most of 2002. Reported production for November 2002 only.

7/ Output is piped to Ulysses, KS, for purification.

8/ Plant sold to Duke Energy and shut down in February 2002.

TABLE 3
HELIUM RECOVERY IN THE UNITED STATES 1/ 2/

(Thousand cubic meters)

	1997	1998	1999	2000	2001
Crude helium:					
Bureau of Land Management (BLM) total storage	(6,130)	(100)	--	--	--
Private industry:					
Stored by BLM	36,700	33,000	32,000	23,300	18,000
Withdrawn	(21,300)	(31,400)	(35,100)	(51,900)	(62,900)
Total private industry storage	15,400	1,600	(3,100)	(28,600)	(44,900)
Total crude helium	9,270	1,500	(3,100)	(28,600)	(44,900)
Grade-A helium:					
BLM sold	5,260	2,000	--	--	--
Private industry sold	102,000	110,000	117,000	126,600	131,900
Total sold	107,000	112,000	117,000	126,600	131,900
Total stored	9,270	1,500	(3,100)	(28,600)	(44,900)
Grand total recovery	116,000	114,000	114,000	98,000	87,000

-- Zero.

1/ Negative numbers are enclosed in parentheses to denote net withdrawal from the BLM's underground storage facility, a partially depleted natural gas reservoir at the Cliffside Field near Amarillo, TX.

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

TABLE 4
SUMMARY OF BUREAU OF LAND MANAGEMENT HELIUM CONSERVATION STORAGE SYSTEM
OPERATIONS 1/ 2/ 3/

(Thousand cubic meters)

	1999	2000	2001
Helium in conservation storage system on January 1:			
Stored under BLM conservation program 4/	847,000	841,000	836,000
Stored for private producers under contract	135,000	138,000	116,000
Total 4/	983,000	979,000	952,000
Input to system:			
Net deliveries from BLM plants	--	--	--
Stored for private producers under contract	32,000	23,300	18,000
Total 4/	32,000	23,300	18,000
Redelivery of helium stored for private producers under contract	(35,100)	(51,900)	(62,900)
Net addition to system 4/	(3,100)	(28,600)	(44,900)
Helium in conservation storage system on December 31:			
Stored under BLM conservation program 4/	841,000	836,000	829,000
Stored for private producers under contract	138,000	116,000	78,000
Total 4/	979,000	952,000	907,000

-- Zero.

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

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

3/ Numbers in parentheses indicate net withdrawal from storage.

4/ Net additions to system do not include in-kind crude sales or transfers. However, totals do include crude sales and transfers.

TABLE 5
WORLD GRADE-A HELIUM
PRODUCTION ANNUAL
CAPACITY, DECEMBER 31, 2001

(Million cubic meters)

	Capacity
United States 1/	152
Rest of world e/	29
Total e/	181

e/ Estimated.

1/ Includes plants on standby, as well as operating plants.

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

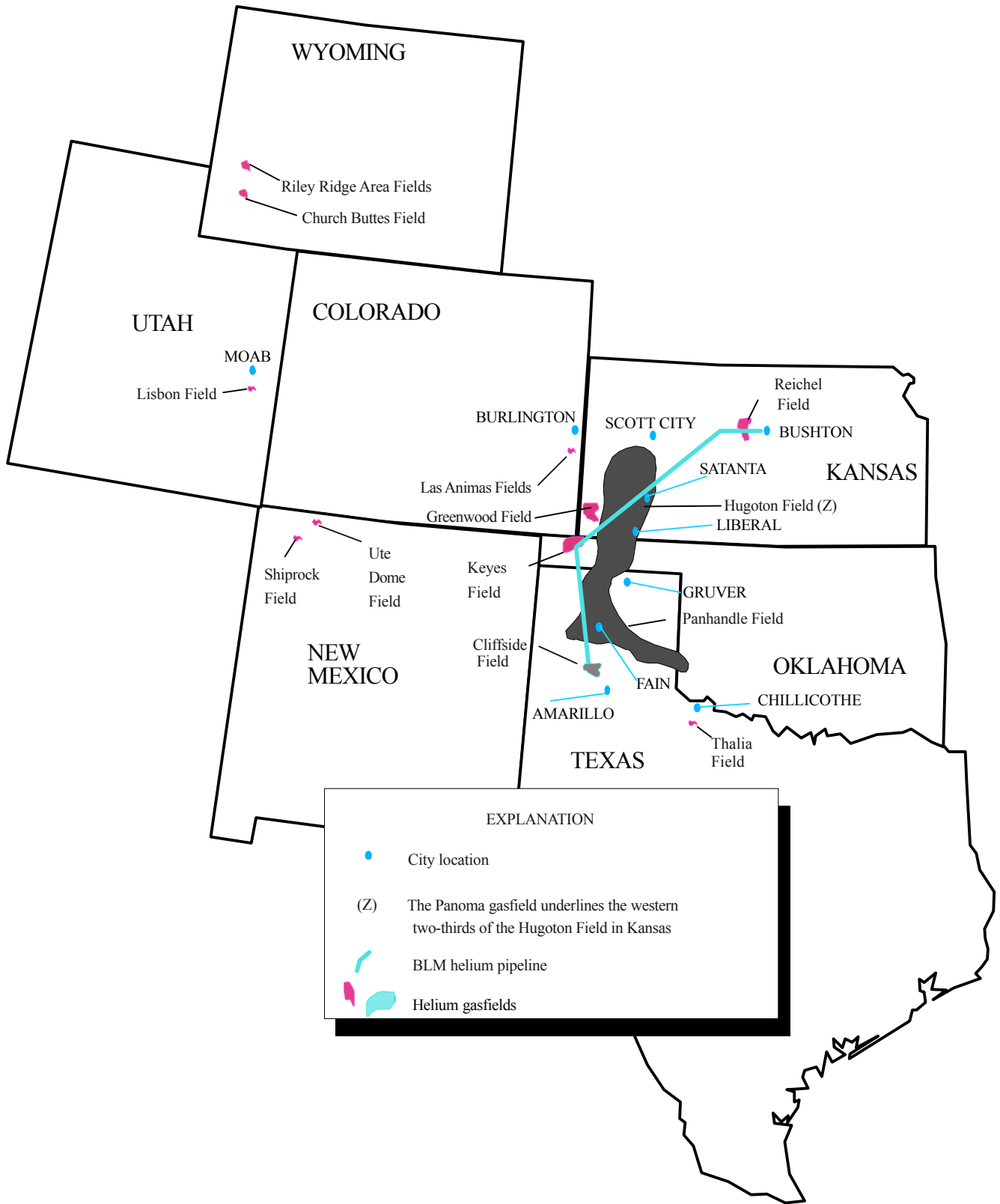


FIGURE 2
HELIUM RECOVERY IN THE UNITED STATES

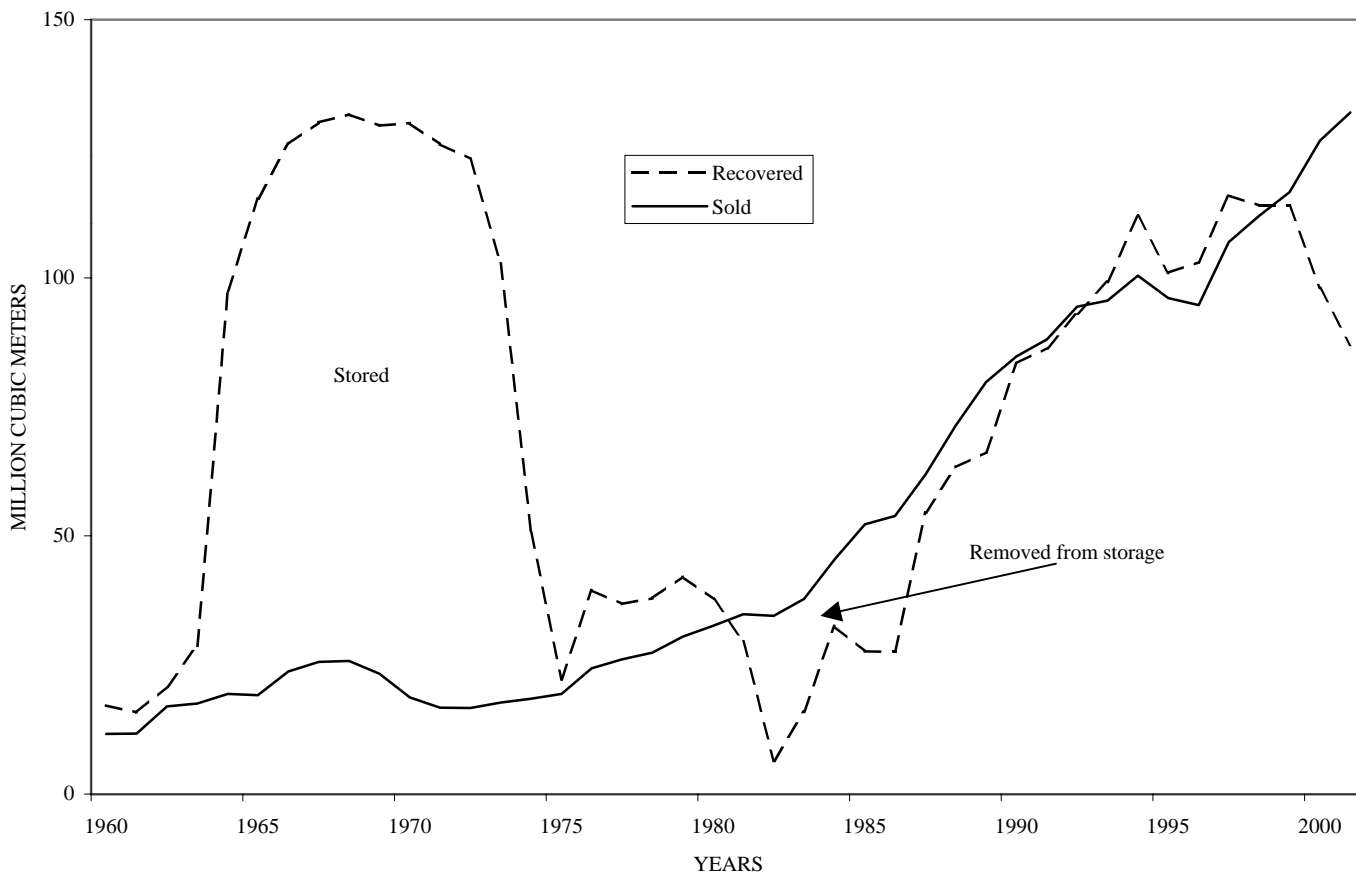
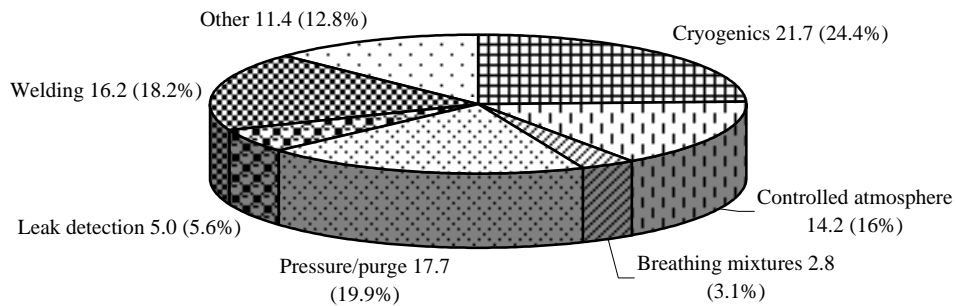


FIGURE 3
ESTIMATED HELIUM CONSUMPTION, BY END USE, IN THE UNITED STATES IN 2001
(MILLION CUBIC METERS)



Estimated total helium used: 89.0 million cubic meters