



2014 Minerals Yearbook

HELIUM [ADVANCE RELEASE]

HELIUM

By John E. Hamak¹

Domestic consumption of Grade-A helium (99.995% or greater purity) was 42.2 million cubic meters² (about 1.52 billion cubic feet) in 2014, exports by private producers were 67.5 million cubic meters (about 2.43 billion cubic feet), and imports of helium were 7.4 million cubic meters (about 267 million cubic feet). Total sales of U.S.-produced helium were about 102 million cubic meters (about 3.69 billion cubic feet), a 13.3% decrease from that of 2013 (table 1). During 2014, domestic helium consumption increased by about 7.7% and helium exports decreased by 17% compared with those of 2013. Helium imports first began in 2013 and more than tripled in 2014 but still accounted for a limited volume of total helium sales.

Legislation and Government Programs

On October 2, 2013, the U.S. Congress passed the Helium Stewardship Act of 2013 (HSA) (U.S. Congress, 2013). With the passage of the HSA, Congress assured continued operation of the Federal helium program but with significant changes to its operation. The Act seeks to mitigate helium shortages by enabling the sale of crude helium from the Federal Helium Reserve, increasing taxpayer returns, and stimulating investment in private helium sources by selling crude helium at market-driven prices. The Act provides for an orderly transition in four phases:

Phase A, Allocation Transition.—This phase began upon passage of the HSA and ended on September 30, 2014. This phase was a continuation of the Helium Privatization Act's sales volumes and conditions.

Phase B, Auction Implementation.—This phase began on October 1, 2014, and will end when the crude helium stored in the Federal Helium Reserve reaches 3 billion cubic feet. During this phase, the Bureau of Land Management (BLM) was to implement auctions beginning in fiscal year (FY) 2015. In FY 2015, the BLM was to auction 10% of the total volume available for sale from the Federal Helium Reserve. The auction was open to all qualified bidders as defined in 50 U.S.C. 167d(b). The remainder each year is sold to refiners with connections to the crude helium pipeline. Each subsequent year, the percent auctioned is to increase by at least 15% from that of the previous year until 100% is achieved.

Phase C, Continued Access for Federal Users.—This phase will begin when the remaining crude helium stored in the Federal Helium Reserve reaches 3 billion cubic feet. The BLM would continue to provide crude helium for sale to Federal users.

There would be no sale or auction of helium to private entities, but deliveries to private entities of helium sold in Phase B may continue. Current projections show that this phase will begin on October 1, 2018, after helium sold for FY 2019 delivery is transferred to private accounts.

Phase D, Disposal of Assets.—In this phase, the Secretary of the Interior is required to dispose of assets by no later than September 30, 2021. These assets include all underground natural resources and the United States' rights to those assets.

Unlike the 1996 legislation, the BLM was no longer required to sell helium from the reserve in equal annual volumes. Under the HSA, sales can match the amount available for production from the reserve.

The HSA also contains four sections requiring studies and evaluations by the U.S. Geological Survey (USGS), the Department of Energy (DOE), and the BLM. The USGS is required to complete a helium gas resource assessment, and the DOE is required to support research into low-British thermal unit (Btu) gas separation and helium conservation and determine the feasibility of separating helium-3 gas from crude helium or other sources. The BLM, in cooperation with Federal users of helium, is to complete an assessment of consumption and demand for helium by Federal users and a 20-year strategic helium acquisition plan for Federal users.

The USGS is expected to complete the helium gas resource assessment by 2018. The DOE is sponsoring at least one low-Btu gas separation project. The BLM-sponsored assessment and 20-year strategic acquisition plan are expected to be complete by 2015.

The first auction and sale of helium under Phase B of the HSA was completed in 2014 for deliveries in FY 2015. The total volume of helium available for auction and sale was 32.7 million cubic meters (1.18 billion cubic feet), of which 6.9 million cubic meters (250 million cubic feet) was a forward sale for FY 2016 deliveries as mandated in the HSA. Of the remaining 25.7 million cubic meters (928 million cubic feet), 10% (2.6 million cubic meters or 93 million cubic feet) was auctioned at an average price of \$161 per million cubic feet. The remaining 23.2 million cubic meters (835 million cubic feet) was sold to helium refiners with connections to the BLM's crude helium pipeline based on the company's percent share of total refining capacity in 2000. The helium was sold at \$106 per million cubic feet determined by a formula using helium sales survey data collected under contract by the BLM in combination with the auction sales price. For 2015, 25% of the available helium will be auctioned and the conservation helium sale price will be the average auction price.

Production

In 2014, 10 companies operated 17 privately owned domestic helium plants. Of the 17 operating plants, 7 extracted helium from natural gas to produce a crude helium product, 5 produced Grade-A helium, and 5 produced a near-pure helium product

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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).

containing about 95% to 98% helium. The five near-pure helium plants use a combination of pressure swing adsorption and membrane technology to extract helium. All crude helium plants and Grade-A helium facilities use cryogenic extraction processes. The five privately owned plants that produced Grade-A helium also produced liquefied helium. Plant operators and plant locations are listed in table 2.

Total sales of U.S.-produced helium in 2014 decreased by about 13.3% compared with those of 2013. All natural gas processed for helium recovery came from gas fields in Colorado, Kansas, Oklahoma, Texas, Utah, and Wyoming (figs. 1, 2). Domestic production data for helium were developed by the BLM from records of its own operations as well as from an annual voluntary canvass of private U.S. operations. Of the 11 operations to which a survey request was sent, 9 responded, and those data, in conjunction with information from BLM operations, represent 100% of the total helium sales and recovery data listed in table 3.

About 50% less helium was produced from the Government's helium reserve at Cliffside field in 2014 than during 2013. 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.

Consumption

In 2014, private industry supplied 100% of domestic helium for U.S. consumption. The major domestic end uses of helium were cryogenics (26%), controlled atmosphere (22%), pressurizing and purging (17%), and welding (17%) (fig. 4). Other uses included chromatography, cryogenics, leak detection, lifting gas, and magnetic resonance imaging applications. Estimated 2014 domestic consumption by end use was based on revised figures from a 2009 end-use survey conducted by BLM's Helium Operations to determine trends in helium usage.

In 2014, U.S. domestic helium consumption increased by 7.7% to 42.2 million cubic meters (1.52 billion cubic feet) compared with revised consumption for 2013. During 2014, U.S. helium exports decreased by 17% to 67.5 million cubic meters (about 2.43 billion cubic feet) compared with those of 2013 (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 2014, in-kind crude helium sales were about 3.2 million cubic meters (117 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 approximately 266 million cubic meters (9.59 billion cubic feet) on December 31, 2014. 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 2014, 10.6 million cubic meters (383 million cubic feet) of privately owned helium was delivered to the BLM's helium conservation system, and 37.7 million cubic meters (1.36 billion cubic feet) was withdrawn, for a net decrease of 27.1 million cubic meters (978 million 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

The HSA required the BLM to use market-based pricing for its crude helium sales to private industry. In 2014, the conservation price was based on the annual auction results and an independent, confidential, market survey of helium industry prices. The in-kind price is set at 80% of the conservation price for the prior year. For FY 2014, the conservation price was \$3.43 per cubic meter (\$95 per thousand cubic feet) and the in-kind price was \$2.49 per cubic meter (\$69 per thousand cubic feet).

Foreign Trade

In 2014, exports of Grade-A helium decreased to 67.5 million cubic meters (2.43 billion cubic feet), a 17% decrease compared with those of 2013, and accounted for about 61.5% of sales of U.S.-produced helium; private industry supplied all U.S. helium exports. Regionally, Asia received 42% of the helium exported from the United States; North America, Central America, and the Caribbean, combined, 31%; Europe, 12%; South America, 11%; the Middle East and Africa, combined, 2%; and Australia and New Zealand, combined, 2%.

For 2014, 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 165 million cubic meters (about 5.96 billion cubic feet) in 2014. Excluding the United States, world production capacity of helium was estimated to be about 97.5 million cubic meters (3.52 billion cubic feet) in 2014 (table 5). Helium was produced in Algeria, Australia, Poland, Russia, and Qatar. Worldwide, one new helium plant was scheduled for startup by 2018 and several projects were in the planning stage.

Outlook

From 2008 through 2012, the total global market for helium produced in the United States increased steadily by about 3.5% per year. That trend reversed in 2013 with the addition of capacity in Qatar and some demand destruction owing to several years of shortages. U.S. domestic helium consumption is expected to remain stable during 2015. Because of increased capacity of foreign plants and lower helium production in the United States, exports are expected to decrease during 2015 and imports will continue.

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

(Million cubic meters)

| Year | Volume | | | Total sales of U.S.-produced helium |
|------|-------------------|----------------------|----------------------|--|
| | Domestic sales | Exports ² | Imports ² | |
| 2010 | 50.2 ^r | 76.8 | -- | 127.0 ^r |
| 2011 | 47.8 ^r | 82.3 ^r | -- | 130.1 ^r |
| 2012 | 48.0 | 84.9 ^r | -- | 132.9 ^r |
| 2013 | 39.2 ^r | 81.2 ^r | 2.4 | 118.0 ^r |
| 2014 | 42.2 | 67.5 | 7.4 | 102.3 |

^rRevised. -- Zero.

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 2014

| Owner or operator | Plant Name | Status | Location | Product purity |
|--------------------------------|-----------------|-------------------|-----------------------|--------------------------------|
| Air Products Corporation, Inc. | Liberal | operating | Seward County, KS | Grade-A helium. ¹ |
| Do. | Panhandle | standby | Hansford County, TX | Do. ¹ |
| Do. | Doe Canyon | startup 2015 | Dolores County, CO | Do. ¹ |
| DCP Midstream, LLC | Ladder Creek | operating | Cheyenne Wells, CO | Near-pure helium. ² |
| Do. | National | do. | Seward County, KS | Crude helium. ³ |
| Do. | Rock Creek | do. | Hutchinson County, TX | Do. ³ |
| Do. | Sher-Han | do. | Hansford County, TX | Do. ³ |
| Denbury Onshore, LLC | Riley Ridge | standby | Sublette County, WY | Do. ³ |
| Eagle Rock Energy | Sunray | operating | Moore County, TX | Do. ³ |
| ExxonMobil Gas Marketing Co. | LaBarge | do. | Sweetwater County, WY | Grade-A helium. ¹ |
| IACX Energy | Dineh-Bi-Keyah | do. | Apache County, AZ | Near-pure helium. ² |
| Do. | Harley Dome | do. | Grand County, UT | Do. ² |
| Do. | Hodgeman | do. | Hodgeman County, KS | Do. ² |
| Do. | IACX Otis | do. | Rush County, KS | Do. ² |
| Do. | Badger Wash | under development | Mesa County, CO | Do. ² |
| Do. | Paden | do. | Okfuskee County, OK | Do. ² |
| Do. | Woodside Dome | do. | Emery County, UT | Do. ² |
| Linde Global Helium, Inc. | Linde Otis | operating | Rush County, KS | Grade-A helium. ¹ |
| Linn Energy, LLC | Jayhawk | do. | Grant County, KS | Crude helium. ³ |
| Do. | Ulysses/Satanta | do. | do. | Do. ³ |
| Midstream Energy Services, LLC | Keyes | do. | Cimarron County, OK | Grade-A helium. ¹ |
| Pioneer Natural Resources Co. | Fain | do. | Opotter County, TX | Crude helium. ³ |
| Praxair, Inc. | Ulysses/Jayhawk | do. | Grant County, KS | Grade-A helium. ¹ |
| Do. | Bushton | standby | Ellsworth County, KS | Do. ¹ |

Do., do. Ditto.

¹Including liquefaction, at least 99.99% helium.

²Generally contains between 95% and 98% helium.

³Generally contains between 60% and 80% helium.

TABLE 3
HELIUM RECOVERY IN THE UNITED STATES¹

(Million cubic meters)

| | 2010 | 2011 | 2012 | 2013 | 2014 |
|--|--------------------|--------------------|--------------------|--------------------|-------|
| Crude helium: | | | | | |
| Bureau of Land Management (BLM) sold (in-kind and open market) | 65.3 ^r | 62.8 ^r | 60.6 | 61.8 | 53.2 |
| Private industry: | | | | | |
| Private helium accepted and stored by BLM | 12.2 ^r | 11.4 ^r | 10.2 ^r | 11.7 ^r | 10.6 |
| Helium withdrawn from storage | -64.2 ^r | -70.8 ^r | -70.3 ^r | -60.8 ^r | -37.7 |
| Total net helium put into storage | -52.0 | -59.4 | -60.1 | -49.1 | -27.1 |
| Grade-A helium: | | | | | |
| Private industry sold | 127.0 ^r | 130.1 ^r | 132.9 ^r | 118.0 ^r | 102.3 |
| Total helium stored | -52.0 | -59.4 | -60.1 | -49.1 | -27.1 |
| Helium recovery from natural gas | 75.0 | 70.7 | 72.8 | 68.9 | 75.2 |

^rRevised.

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}

(Million cubic meters)

| | 2010 | 2011 | 2012 | 2013 | 2014 |
|--|-------|--------------------|--------------------|--------------------|-------|
| Helium in conservation storage system on January 1: | | | | | |
| Stored under BLM conservation program ³ | 500.6 | 433.0 | 368.5 | 306.1 | 242.9 |
| Stored for private producers under contract | 18.6 | 31.8 | 34.4 | 37.4 | 51.1 |
| Total ³ | 519.2 | 464.8 | 402.9 | 343.5 | 294.0 |
| Input to system: | | | | | |
| Net deliveries from BLM plants | -- | -- | -- | -- | -- |
| Stored for private producers under contract | 12.2 | 11.4 ^r | 10.2 ^r | 11.7 ^r | 10.6 |
| Total ³ | 12.2 | 11.4 | 10.2 | 11.7 | 10.6 |
| Redelivery of helium stored for private producers under contract | -64.2 | -70.8 ^r | -70.3 ^r | -60.8 ^r | -37.7 |
| Systemwide measurement and plant losses/gains ⁴ | -2.4 | -2.6 | 0.6 | -0.4 | -0.8 |
| Net addition to system ³ | -54.4 | -59.4 | -60.1 | -49.1 | -27.1 |
| Helium in conservation storage system on December 31: | | | | | |
| Stored under BLM conservation program ³ | 433.0 | 368.5 ^r | 306.1 ^r | 242.9 ^r | 188.4 |
| Stored for private producers under contract | 31.8 | 34.4 | 37.4 ^r | 51.1 ^r | 77.7 |
| Total ³ | 464.8 | 402.9 | 343.5 | 294.0 | 266.1 |

^rRevised. -- 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 underground storage facility.

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

⁴Previously not reported.

TABLE 5
WORLD GRADE-A HELIUM
ANNUAL PRODUCTION CAPACITY
AS OF DECEMBER 31, 2014

(Million cubic meters)

| | Capacity |
|----------------------------|----------|
| United States ¹ | 132 |
| Rest of world ^c | 97 |
| Total ^c | 229 |

^cEstimated.

¹Includes plants on standby as well as operating plants.

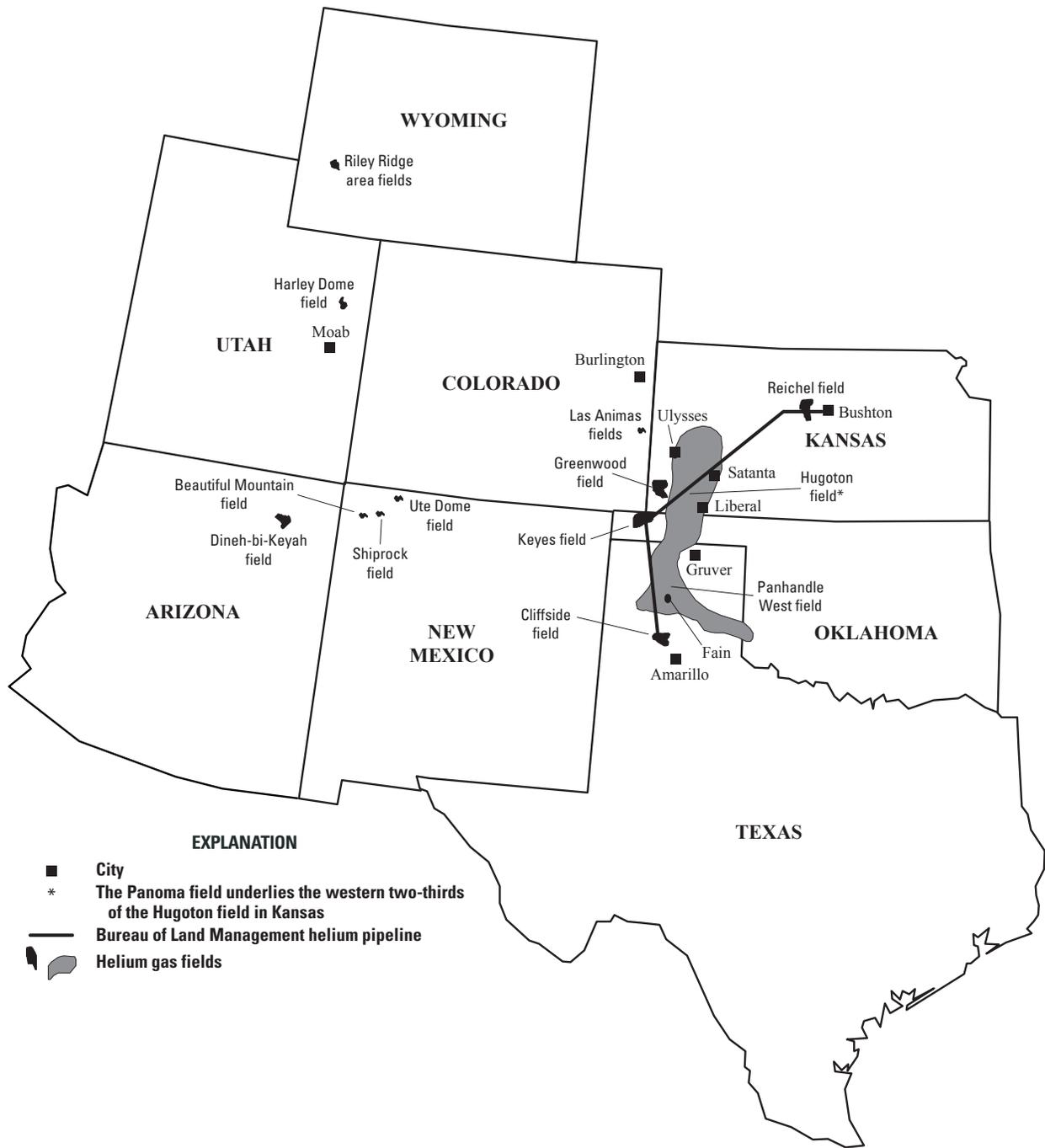


Figure 1. Major helium-bearing natural gas fields in the United States.

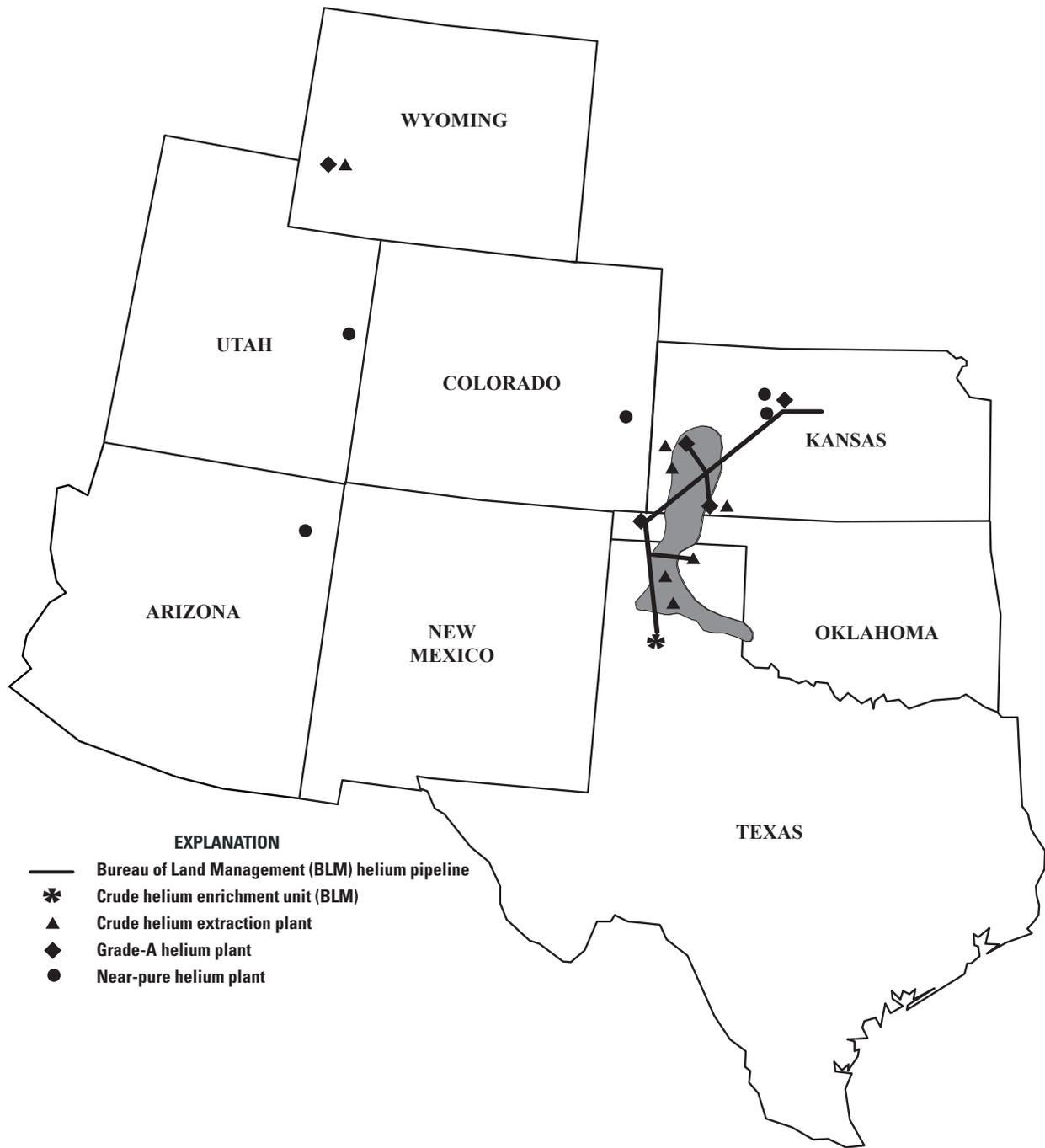


Figure 2. Active helium extraction and refining plants in the United States.

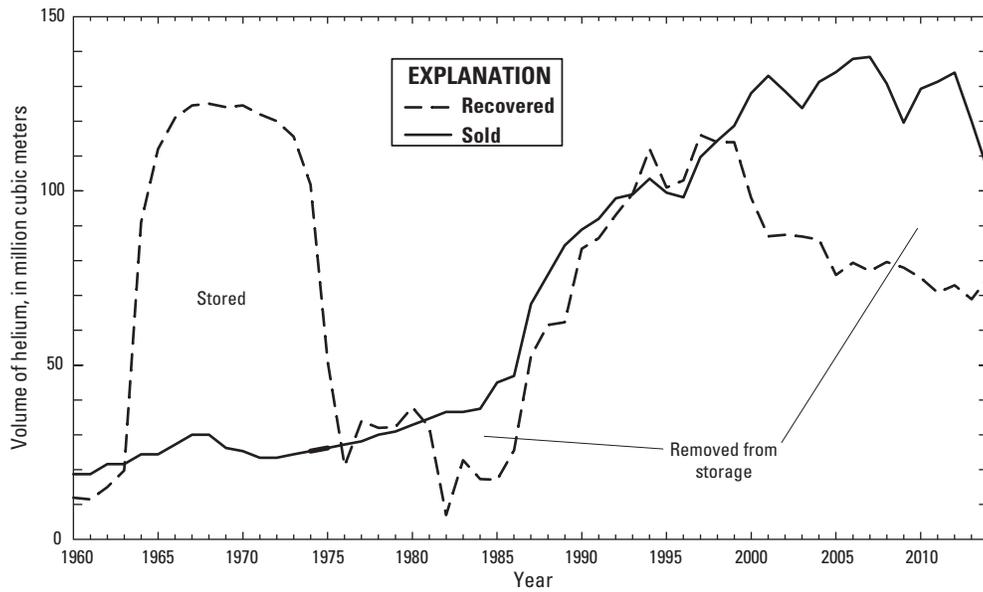


Figure 3. Helium recovery in the United States, 1960–2014.

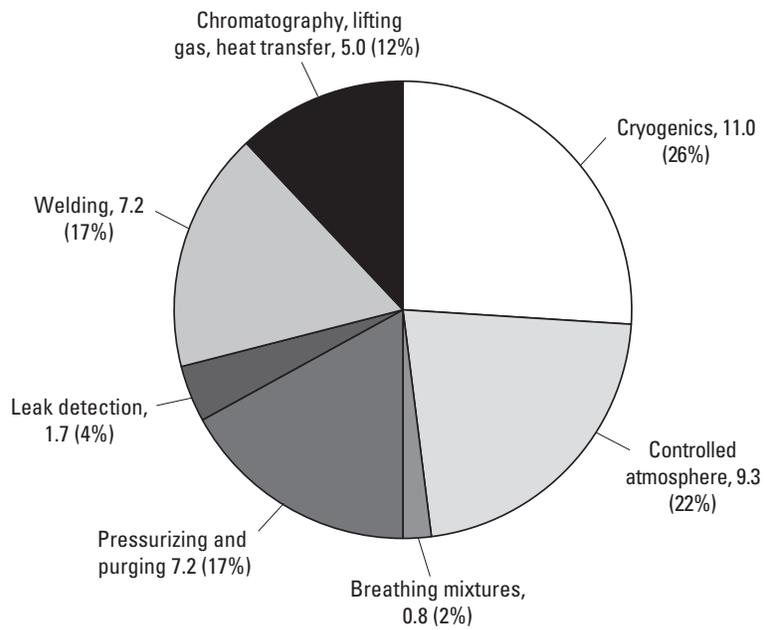


Figure 4. Estimated helium consumption in the United States in 2014, by end use, reported in million cubic meters. Total helium used in the United States in 2014 was estimated to be 42.2 million cubic meters.