



2018 Minerals Yearbook

HELIUM [ADVANCE RELEASE]

HELIUM

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Domestic consumption of Grade-A helium (99.995% or greater purity) in 2018 was an estimated 40.0 million cubic meters² (about 1.44 billion cubic feet). Exports by private producers were reported by the U.S. Census Bureau to be 83.7 million cubic meters (about 3.02 billion cubic feet). Substantial increases in exports reported in recent years suggested that the data may be incorrect. The U.S. Census Bureau was reviewing the export data. Imports of helium were 7.5 million cubic meters (about 270 million cubic feet), a decrease of 59% from those in 2017. Total sales of U.S.-produced helium in 2018 totaled 89.9 million cubic meters (about 3.24 billion cubic feet), a decrease of 11% from those in 2017 (table 1).

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 continuation of the Federal helium program for a limited period of time with significant changes to its operation. The HSA sought to mitigate helium shortages by enabling the sale of crude helium from the Federal Helium Reserve with the expectation of increasing taxpayer returns while also stimulating investment in private helium sources through market-driven sales. The HSA provides for an orderly transition from a Federally managed helium program to a completely private sector industry 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 of 1996's (U.S. Congress, 1996) directive for the sale of much of the National Helium Reserve and prescribed sales volumes and conditions (U.S. Congress, 2013).

Phase B, Auction Implementation.—This phase began on October 1, 2014, and was prescribed to end when the crude helium stored in the Federal Helium Reserve reached 3 billion cubic feet. In July 2014, the Bureau of Land Management (BLM) conducted the first auction of helium for delivery during fiscal year 2015. The auction was open to all qualified bidders as defined in 50 U.S.C. 167d(b). The latest auction and sale were conducted in July 2018 for deliveries in fiscal year 2019. At the sale in July 2018, 5.8 million cubic meters (209 million cubic feet) were offered at auction and 2.5 million cubic meters

(90 million cubic feet) were sold at the allocated and non-allocated sale. This was the last auction and sale conducted under phase B because the volume of conservation helium in storage dropped to approximately 3 billion cubic feet.

Phase C, Continued Access for Federal Users.—This phase began at the start of 2019 because the remaining crude helium stored in the Federal Helium Reserve had reached 3 billion cubic feet. The BLM continues to provide crude helium for sale to Federal users. There are no more sales or auctions of helium to private entities, but deliveries to private entities of helium sold in phase B continues. Phase C was prescribed to continue until phase D is completed.

Phase D, Disposal of Assets.—During this phase, the Secretary of the Interior is required to dispose of assets in the Federal helium program no later than September 30, 2021. These assets include all underground natural resources and the United States' rights to those assets. Unlike the requirements of the Helium Privatization Act of 1996 (U.S. Congress, 1996), the BLM will no longer be 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 U.S. 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 2019. The DOE sponsored a low-Btu gas separation project. The BLM-sponsored assessment and 20-year strategic acquisition plan were completed in April 2015.

Production

In 2018, 8 companies operated 16 privately owned domestic helium plants. Of the 16 operating plants, 4 extracted helium from natural gas to produce a crude helium product, 6 produced Grade-A helium, and 6 produced gaseous helium. The six helium plants that produced a gaseous product used a combination of pressure swing adsorption and membrane technology to extract helium. All crude helium plants and Grade-A helium facilities used cryogenic extraction processes. The six privately owned plants that produced Grade-A helium also produced liquefied helium (table 2).

Total sales of U.S.-produced helium in 2018 decreased by 11% compared with those in 2017 (table 1). All natural gas processed for helium recovery came from gas fields in Colorado, Kansas, New Mexico, Oklahoma, Texas, Utah, and Wyoming

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²All metric helium volumes herein are at 101.325 kilopascals absolute (14.696 pounds per square inch absolute) and 15 degrees Celsius (°C) [59 degrees Fahrenheit (°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).

(figs. 1, 2). Domestic production data for helium were developed by the BLM from records of its own operations and from an annual voluntary canvass of private U.S. operations. All of the private companies provided production information, and those data, in conjunction with information from BLM operations, represent 100% of the total helium sales and recovery data listed in table 3.

Most domestic helium production was from the Midcontinent and Rocky Mountain regions. The measured helium reserves from which helium was produced are in approximately 104 gas fields in 11 States. Most of these reserves are contained in the Hugoton Field in Kansas, Oklahoma, 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 Fields in Wyoming. Helium production from the Government's helium reserve at Cliffside Field, near Amarillo, TX, in 2018 was unchanged compared with that in 2017.

Consumption

In 2018, U.S. domestic helium consumption decreased by 12% to an estimated 40.0 million cubic meters (about 1.44 billion cubic feet) compared with consumption in 2017 (table 1). The major domestic end uses of helium were magnetic resonance imaging (30%); scientific, engineering, analytical, lab, and specialty gases (20%); lifting gases (17%); welding (9%); and controlled atmosphere (9%) (fig. 3). Other uses included diving, leak detection, and pressurizing and purging (Campbell and Garvey, 2016).

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 2018, in-kind crude helium sales were about 5.1 million cubic meters (184 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 165.1 million cubic meters (5.95 billion cubic feet) on December 31, 2018. 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 (fig. 4). This privately owned helium is returned to the owners as needed for purification to supply private demand. During 2018, 3.1 million cubic meters (112 million cubic feet) of privately owned helium was delivered to the BLM's helium conservation system, and 31.2 million cubic meters (1.12 billion cubic feet) was withdrawn, for a net decrease of 31.4 million cubic meters (1.13 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 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 2018, the conservation price was based on the annual auction results and an independent, confidential, market survey of helium industry prices. The in-kind price was set at approximately 80% of the conservation price of the prior year. For fiscal year 2018, the conservation price was \$4.29 per cubic meter (\$119 per thousand cubic feet) and the in-kind price was \$3.10 per cubic meter (\$86 per thousand cubic feet).

Foreign Trade

During 2018, exports by private producers were reported by the U.S. Census Bureau to be 83.7 million cubic meters (about 3.02 billion cubic feet). Substantial increases in exports reported in recent years suggested that the data may be incorrect. The U.S. Census Bureau was reviewing the export data. Private industry supplied all of the U.S. helium exports in 2018. Regionally, Asia and the Pacific received 51.6% of the helium exported from the United States; North America, Central America, and the Caribbean, combined, received 23.9%; Europe, 14.1%; South America, 6.6%; the Middle East and Africa, combined, 3.3%; and Australia and New Zealand, combined, 0.5%. The average price of exports was \$4.09 per cubic meter (\$147 per thousand cubic feet).

For 2018, import tariffs on helium remained at 3.7% for normal trade relations (NTR) nations and 25% for non-NTR nations. Imports of helium were 7.5 million cubic meters (about 270 million cubic feet), a decrease of 59% from those in 2017 (table 1). The decrease of helium imports in 2018 was led by a decrease of imports from Qatar. The average price of imports was \$5.10 per cubic meter (\$184 per thousand cubic feet).

World Review

Total world production was approximately 159 million cubic meters (about 5.90 billion cubic feet) in 2018. Excluding the United States, world production capacity of helium was estimated to be about 110 million cubic meters (3.97 billion cubic feet) in 2018. U.S. helium production capacity accounted for an estimated 59% of the world helium production capacity (table 5). In addition to the United States, helium was produced in Algeria, Australia, Poland, Russia, and Qatar.

Outlook

From 2008 through 2012, total global sales of helium produced in the United States increased by about 3.5% per year. That trend reversed in 2013 with the addition of capacity in Qatar and a decrease in global demand. U.S. domestic helium consumption is expected to remain stable during 2019.

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

(Million cubic meters)

| Year | Volume ¹ | | | Total sales of U.S.-produced helium |
|------|-----------------------------------|----------------------|----------------------|-------------------------------------|
| | Domestic consumption ² | Exports ³ | Imports ³ | |
| 2014 | 42.2 | 67.5 | 7.4 | 102.3 |
| 2015 | 41.6 | 64.8 | 15.7 | 90.7 |
| 2016 | 52.8 | 60.8 | 23.7 | 89.9 |
| 2017 | 45.3 | 73.7 | 18.5 | 100.6 |
| 2018 | 40.0 ^{c, 4} | 83.7 | 7.5 | 89.9 |

^cEstimated.

¹Data are rounded to no more than three significant digits.

²Defined as total sales of U.S.-produced helium plus imports minus exports; may not add to totals shown.

³Source: U.S. Census Bureau.

⁴Consumption is estimated because of unusually high exports reported by the U.S. Census Bureau.

TABLE 2
OWNERSHIP AND LOCATION OF HELIUM EXTRACTION PLANTS IN THE UNITED STATES IN 2018

| Owner or operator | Plant name | Status | Location | Product purity ¹ |
|--------------------------------|-----------------|-----------|-----------------------|-------------------------------|
| Air Products Corporation, Inc. | AP/MTG | Standby | Sublette County, WY | Grade-A helium. |
| Do. | Doe Canyon | Operating | Dolores County, CO | Do. |
| Do. | Liberal | do. | Seward County, KS | Do. |
| Do. | Panhandle | Standby | Hansford County, TX | Do. |
| DCP Midstream, LLC | Ladder Creek | do. | Cheyenne County, CO | Do. |
| Do. | National | Operating | Seward County, KS | Crude helium. |
| Do. | Rock Creek | do. | Hutchinson County, TX | Do. |
| Do. | Sher-Han | do. | Hansford County, TX | Do. |
| DenburyOnshore, LLC | Riley Ridge | do. | Sublette County, WY | Do. |
| Energy Transfer | Sunray | Standby | Moore County, TX | Do. |
| ExxonMobil Gas Marketing Co. | LaBarge | Operating | Sweetwater County, WY | Grade-A helium. |
| IACX Energy | Dineh-Bi-Keyah | do. | Apache County, AZ | Produced gaseous helium only. |
| Do. | Harley Dome | do. | Grand County, UT | Do. |
| Do. | Hodgeman | do. | Hodgeman County, KS | Do. |
| Do. | IACX Otis | do. | Rush County, KS | Do. |
| Do. | Paden | do. | Okfuskee County, OK | Do. |
| Do. | Roswell | do. | Chaves County, NM | Do. |
| Linde Global Helium, Inc. | Linde Otis | do. | Rush County, KS | Grade-A helium. |
| Linn Energy, LLC | Jayhawk | do. | Grant County, KS | Crude helium. |
| Midstream Energy Services, LLC | Keyes | do. | Cimarron County, OK | Grade-A helium. |
| Praxair, Inc. | Ulysses/Jayhawk | do. | Grant County, KS | Do. |

Do., do. Ditto.

¹Grade-A helium, including liquefaction, is at least 99.99% helium. Gaseous helium generally contains at least 98% helium. Crude helium generally contains between 60% and 80% helium.

TABLE 3
HELIUM RECOVERY IN THE UNITED STATES¹

(Million cubic meters)

| | 2014 | 2015 | 2016 | 2017 | 2018 |
|--|-------|-------|-------|-------|-------|
| Crude helium: | | | | | |
| Bureau of Land Management (BLM) sold (in-kind and open market) | 53.2 | 28.1 | 31.7 | 28.6 | 13.4 |
| Private industry: | | | | | |
| Private helium accepted and stored by BLM | 10.6 | 10.3 | 12.6 | 4.5 | 3.1 |
| Helium withdrawn from storage | -37.7 | -29.9 | -35.6 | -32.7 | -31.2 |
| Total net helium put into storage ² | -27.1 | -19.6 | -23.0 | -28.1 | -28.2 |
| Grade-A helium: | | | | | |
| Private industry sold | 102.3 | 90.7 | 89.9 | 100.6 | 89.9 |
| Total helium stored | -27.1 | -19.6 | -23.0 | -28.1 | -28.2 |
| Helium recovery from natural gas | 75.2 | 71.1 | 66.9 | 72.4 | 61.7 |

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.

²Data may not add to totals shown.

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

(Million cubic meters)

| | 2014 | 2015 | 2016 | 2017 | 2018 |
|--|-------|-------|-------|-------|-------|
| Helium in conservation storage system on January 1: | | | | | |
| Stored under BLM conservation program ³ | 242.9 | 188.4 | 159.5 | 126.3 | 97.9 |
| Stored for private producers under contract | 51.1 | 77.7 | 86.5 | 95.5 | 98.6 |
| Total ³ | 294.0 | 266.1 | 246.0 | 221.8 | 196.5 |
| Additions to system: | | | | | |
| Stored for private producers under contract | 10.6 | 10.3 | 12.6 | 4.5 | 3.1 |
| Redelivery of helium stored for private producers under contract | -37.7 | -29.9 | -35.6 | -32.7 | -31.2 |
| Systemwide measurement and plant losses or gains | -0.8 | -0.5 | -1.1 | 2.8 | -3.3 |
| Total ³ | -27.9 | -20.1 | -24.1 | -25.4 | -31.4 |
| Helium in conservation storage system on December 31: | | | | | |
| Stored under BLM conservation program ³ | 188.4 | 159.5 | 126.3 | 97.9 | 83.1 |
| Stored for private producers under contract | 77.7 | 86.5 | 95.5 | 98.6 | 82.0 |
| Total ³ | 266.1 | 246.0 | 221.8 | 196.5 | 165.1 |

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.

TABLE 5
ESTIMATED WORLD GRADE-A HELIUM ANNUAL PRODUCTION
CAPACITY AND PRODUCTION AS OF DECEMBER 31, 2018

(Million cubic meters)

| | Capacity | Production |
|----------------------------|----------|------------|
| United States ¹ | 160 | 90 |
| Rest of world | 110 | 69 |
| Total | 270 | 159 |

¹Includes plants on standby as well as operating plants.



Figure 1. Major helium-bearing natural gas fields in the United States. The Panoma Field underlies the western two-thirds of the Kansas portion of the Hugoton Field.

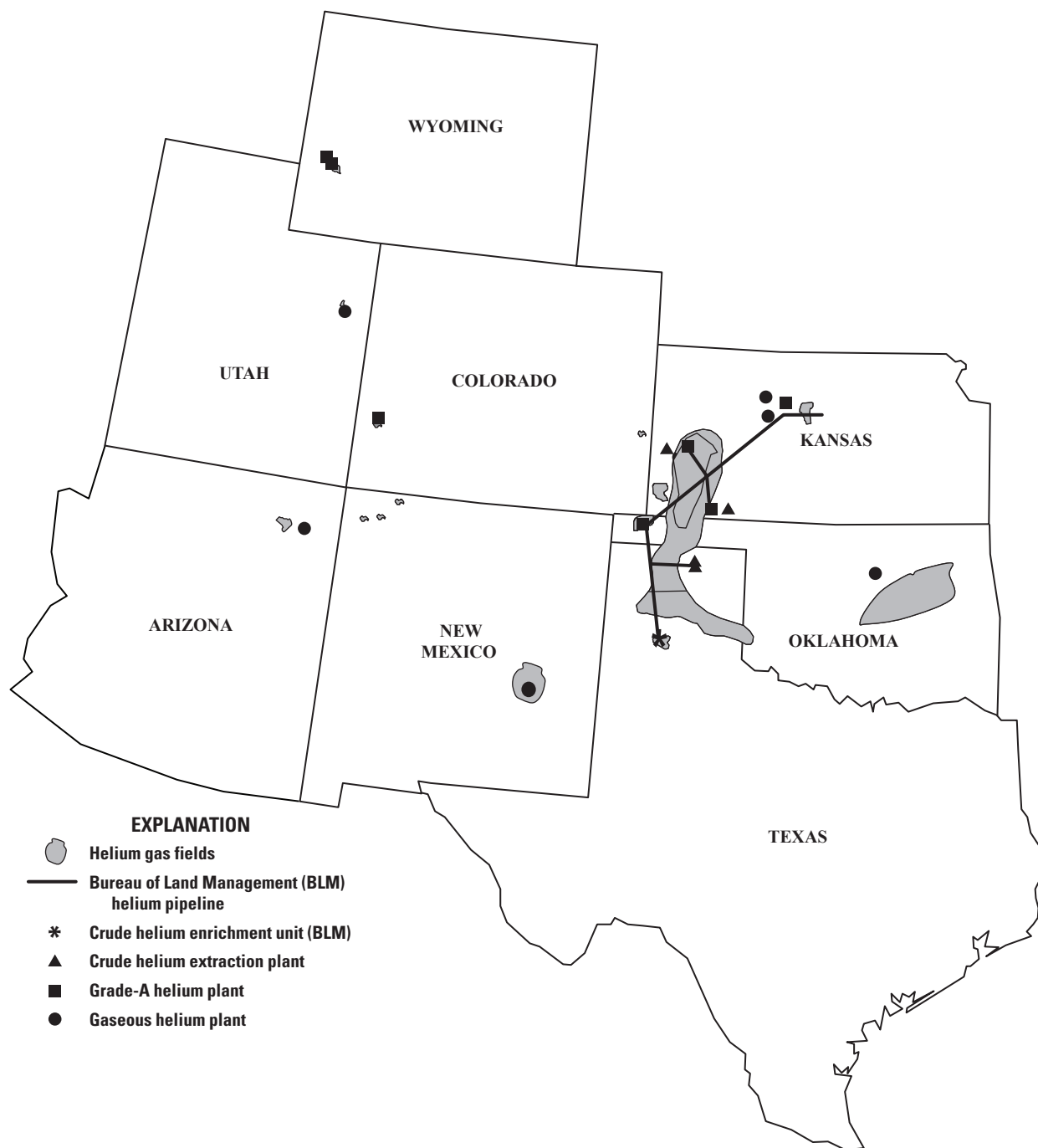


Figure 2. Active helium extraction and refining plants in the United States.

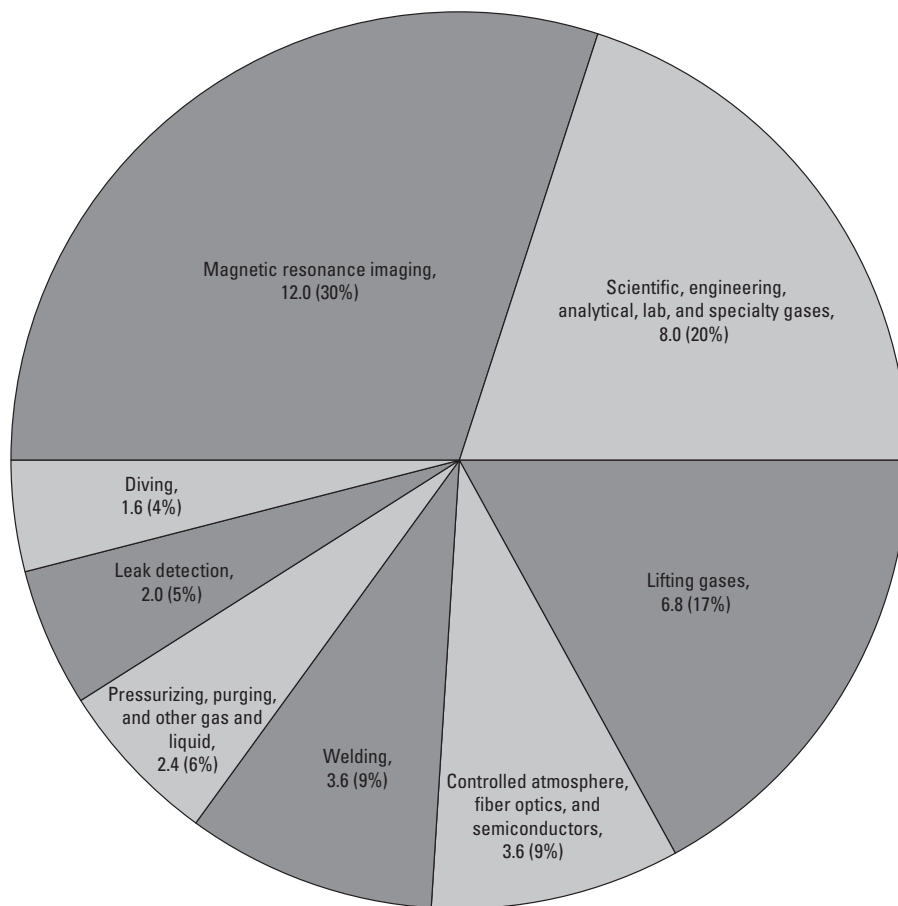


Figure 3. Estimated helium consumption in the United States in 2018, by end use, reported in million cubic meters (Campbell and Garvey, 2016). Total helium used in the United States in 2018 was estimated to be 40.0 million cubic meters.

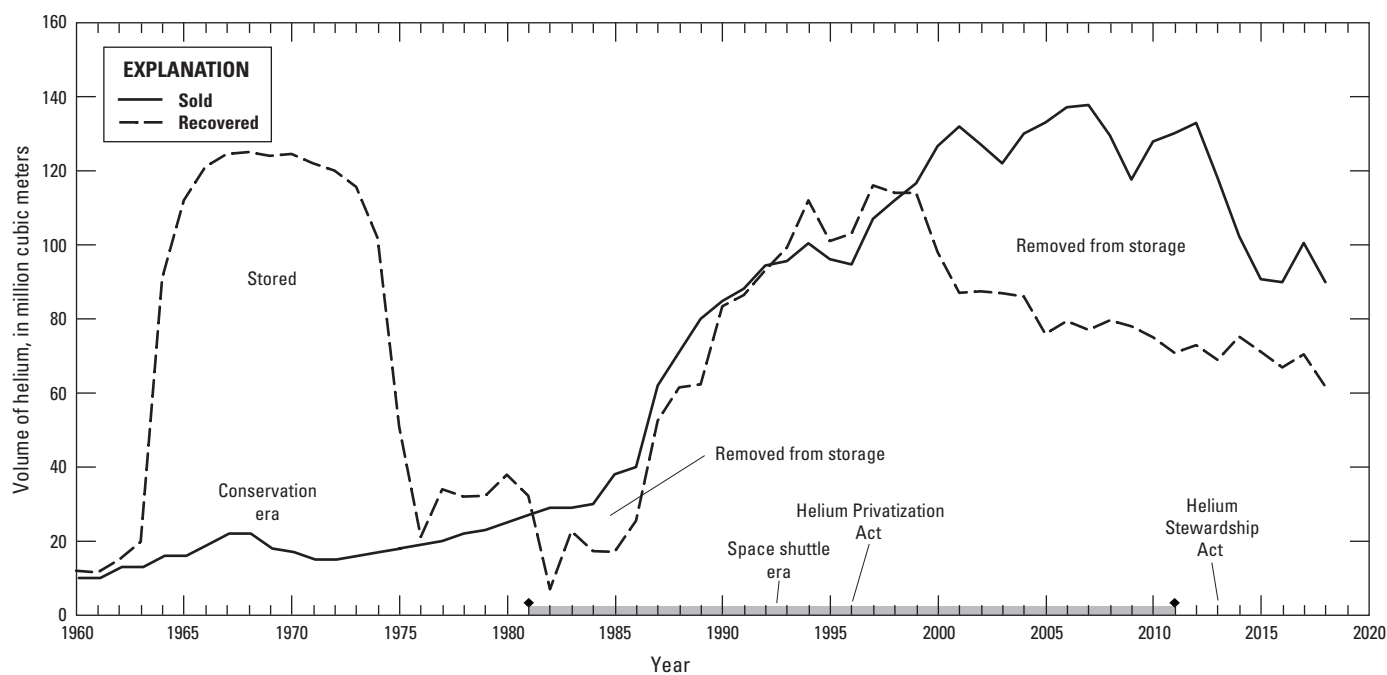


Figure 4. Helium recovery in the United States, 1960–2018.