



2019 Minerals Yearbook

HELIUM [ADVANCE RELEASE]

HELIUM

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Domestic consumption of Grade-A helium (99.995% or greater purity) in 2019 equaled 35.2 million cubic meters² (1.27 billion cubic feet). Exports by private producers were reported by the U.S. Census Bureau to be 57.8 million cubic meters (2.08 billion cubic feet). Imports of helium totaled 6.8 million cubic meters (243 million cubic feet). Total sales of U.S.-produced helium equaled 86.2 million cubic meters (3.11 billion cubic feet), a decrease of 4% from those in 2018 (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 established a timeline for the privatization of helium. The Federal helium program was to continue for a period of time but 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 provided 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 was a continuation of the Helium Privatization Act of 1996's directive for the sale of much of the National Helium Reserve located at the Cliffside Field in Amarillo, TX, and prescribed sales volumes and conditions (U.S. Congress, 2013).

Phase B, Auction Implementation.—Phase B was initiated on October 1, 2014, and prescribed to end when crude helium stored in the Federal Helium Reserve was reduced to a level of 3 billion cubic feet (83.2 million cubic meters). 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 July 2018 sale, 5.8 million cubic meters (210 million cubic feet) were offered at auction, and 2.5 million cubic meters (90 million cubic feet) were sold at the allocated and nonallocated sales. Allocated helium was the portion of the annual sale volume of conservation helium that will be set aside for purchase by the crude helium refiners. Nonallocated is the portion of the annual sale volume of

conservation helium that will be offered to all qualified bidders. This was the last auction and sale conducted under phase B because the volume of conservation helium in storage had dropped to approximately 3 billion cubic feet.

Phase C, Continued Access for Federal Users.—This phase began at the end of 2018, as the remaining crude helium stored in the Federal Helium Reserve reached 3 billion cubic feet. The BLM continued to provide crude helium for sale to Federal users. No auctions of helium to private entities took place in 2019, although deliveries to private entities of helium sold in phase B continued. Deliveries and sales of helium from the Cliffside Field were prescribed to continue until phase D was completed.

Phase D, Disposal of Assets.—During this phase, the Secretary of the Interior was required to dispose of assets in the Federal helium program no later than September 30, 2021. These assets included all underground natural resources and the United States' rights to those assets. Unlike the directive of the Helium Privatization Act of 1996 (U.S. Congress, 1996), the BLM would no longer be required to sell helium from the reserve in equal annual volumes. Under the HSA, sales could match the amount available for production from the reserve.

Production

In 2019, nine companies operated 16 privately owned domestic helium plants. Of the 16 operating plants, 5 extracted helium from natural gas to produce a crude helium product, 6 produced Grade-A helium, and 5 produced gaseous helium. The five helium plants producing 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 2019 decreased by 4% compared with those in 2018 (table 1, fig. 4). All natural gas processed for helium recovery came from gasfields in Colorado, Kansas, New Mexico, Oklahoma, Texas, and Wyoming (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 companies provided production information and those data, in conjunction with information from BLM operations, represented 100% of the total helium sales and recovery data listed in table 3. Helium production from the Government's helium reserve at Cliffside Field in 2019 was 23% less than that in 2018 (table 3).

Most domestic helium production was from the Midcontinent and Rocky Mountain regions of the United States. The measured U.S. helium reserves were held in fewer than 50 gasfields in eight States. Most of these reserves are contained in the Cliffside and Panhandle West Fields in Texas; the Hugoton Field in Kansas, Oklahoma, and Texas; the Keyes Field in Oklahoma;

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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).

the Panoma Field in Kansas; and the Riley Ridge Area Fields in Wyoming.

Consumption

In 2019, U.S. domestic helium consumption decreased by 12% to 35.2 million cubic meters (1.27 billion cubic feet) compared with consumption in 2018 (table 1). The major domestic end uses of helium were analytical, engineering, lab, scientific, and specialty gases (21%); controlled atmosphere, fiber optics, and semiconductors (18%); magnetic resonance imaging (17%); lifting gases (16%); and pressurizing, purging, and other gas and liquid (11%). Other uses, in decreasing order of use, included welding, leak detection, and diving (fig. 3) (Garvey, 2021).

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 2019, in-kind crude helium sales were 5.0 million cubic meters (179 million cubic feet) (table 3). 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 143 million cubic meters (5.14 billion cubic feet) on December 31, 2019. 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. The privately owned helium was returned to the owners as needed for purification to supply private demand. During 2019, 3.2 million cubic meters (115 million cubic feet) of privately owned helium was delivered to the BLM's helium conservation system, and 25.0 million cubic meters (901 million cubic feet) was withdrawn, for a net decrease of 21.8 million cubic meters (786 million cubic feet) of private helium in storage (table 3). Systemwide measurements showed that there were 600,000 cubic meters (21.6 million cubic feet) lost from the BLM's helium conservation system in 2019 (table 4).

Transportation

Private producers and (or) distributors shipped helium, predominantly as a liquid in semitrailers, to distribution centers, where some of it was gasified and compressed into trailers and 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 2019, 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 approximately 80% of the conservation price for the prior year. For fiscal year 2019, the conservation price was \$4.29 per cubic meter (\$119 per thousand cubic feet) and the in-kind price was \$3.43 per cubic meter (\$95 per thousand cubic feet).

Foreign Trade

During 2019, exports by private producers were reported by the U.S. Census Bureau to be 57.8 million cubic meters (2.1 billion cubic feet), a decrease of 31% from those in 2018. Private industry supplied all U.S. helium exports. For 2019, import tariffs on helium remained at 3.7% for normal trade relations (NTR) nations and 25% for non-NTR nations. Imports of helium equaled 6.8 million cubic meters (245 million cubic feet), a decrease of 9% from those in 2018 (table 1).

World Review

Total world helium production was approximately 163 million cubic meters (5.88 billion cubic feet) in 2019. Excluding the United States, world production capacity of helium was estimated to be 125 million cubic meters (4.51 billion cubic feet) in 2019 (table 5). Helium was produced in Algeria, Australia, Canada, Poland, Qatar, and Russia.

Worldwide, several projects were in the planning stage. Gazprom was planning to build 58.2 million cubic meters per year of liquid helium capacity in three 19.4-million-cubic-meter-per-year increments. The first liquefier was scheduled for startup in 2021, followed by additional liquefiers in 2022 and 2024. Two companies were in the early stages of exploring for helium in the Lake Rukwa area of Tanzania. The Virginia Gas Project in South Africa would produce liquified natural gas (LNG) and liquify helium as part of the project. This project was expected to be online by 2021 (Cockerill and Parkinson, 2020).

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. U.S. domestic helium consumption is expected to remain stable during 2020.

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

(Million cubic meters)

Year	Volume			Total sales of U.S.-produced helium
	Domestic consumption	Exports ¹	Imports ¹	
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	100.5 ^r
2018	40.0 ^{e,2}	83.7	7.5	89.9
2019	35.2	57.8	6.8	86.2

^eEstimated. ^rRevised.

¹Source: U.S. Census Bureau.

²Consumption 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 2019

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	Standby	Sublette County, WY	Do.
Energy Transfer	Sunray	Operating	Moore County, TX	Do.
ExxonMobil Gas Marketing Co.	LaBarge	do.	Sweetwater County, WY	Grade-A helium.
IACX Energy	Dineh-Bi-Keyah	do.	Apache County, AZ	Gaseous helium.
Do.	Harley Dome	Standby	Grand County, UT	Do.
Do.	Hodgeman	Operating	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.	Ulysses ²	do.	Grant County, KS	Grade-A helium.
Messer, LLC	Messer Otis ³	do.	Rush County, KS	Do.
Midstream Energy Services, LLC	Keyes	do.	Cimarron County, OK	Do.
Riviera Energy	Jayhawk ⁴	do.	Grant County, KS	Crude helium.

Do., do. Ditto.

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

²Previously owned by Praxair, Inc.

³Previously owned by Linde Global Helium, Inc.

⁴Previously owned by Linn Energy, LLC.

TABLE 3
HELIUM RECOVERY IN THE UNITED STATES¹

(Million cubic meters)

	2015	2016	2017	2018	2019
Crude helium:					
Bureau of Land Management (BLM) sold (in-kind and open market)	28.1	31.7	28.6	13.4	5.0 ²
Private industry:					
Private helium accepted and stored by BLM	10.3	12.6	4.5	3.1	3.2
Helium withdrawn from storage	-29.9	-35.6	-32.7	-31.2	-25.0
Total net helium put into storage ³	-19.6	-23.0	-28.1	-28.2	-21.8
Grade-A helium:					
Private industry sold	90.7	89.9	100.5 ^r	89.9	86.2
Total helium stored	-19.6	-23.0	-28.1	-28.2	-21.8
Helium recovery from natural gas ³	71.1	66.9	72.4	61.7	64.4

^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.

²Open market sales have ended in 2018, and this represents only the in-kind sales.

³Numbers may not add to totals shown owing to rounding and conversions to cubic meters.

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

(Million cubic meters)

	2015	2016	2017	2018	2019
Helium in conservation storage system on January 1:					
Stored under BLM conservation program	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
Additions to system:					
Stored for private producers under contract	10.3	12.6	4.5	3.1	3.2
Redelivery of helium stored for private producers under contract	-29.9	-35.6	-32.7	-31.2	-25.0
Systemwide measurement and plant losses or gains	-0.5	-1.1	2.8	-3.3	-0.6
Total ^{3,4}	-20.1	-24.1	-25.4	-31.4	-22.4
Helium in conservation storage system on December 31:					
Stored under BLM conservation program ⁴	159.5	126.3	97.9	83.1	77.5
Stored for private producers under contract	86.5	95.5	98.6	82.0	65.2
Total ³	246.0	221.8	196.5	165.1	142.7

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.

³Numbers may not add to totals shown owing to rounding and conversions to cubic meters.

⁴Net 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
AND ESTIMATED PRODUCTION AS OF DECEMBER 31, 2019¹

(Million cubic meters)

	Capacity	Production
United States	160	86
Rest of world ^{e, 2}	125	77
Total ^e	285	163

^eEstimated.

¹Includes plants on standby as well as operating plants.

²Includes Algeria, Australia, Canada, Poland, Qatar, and Russia.



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. CO₂, carbon dioxide.

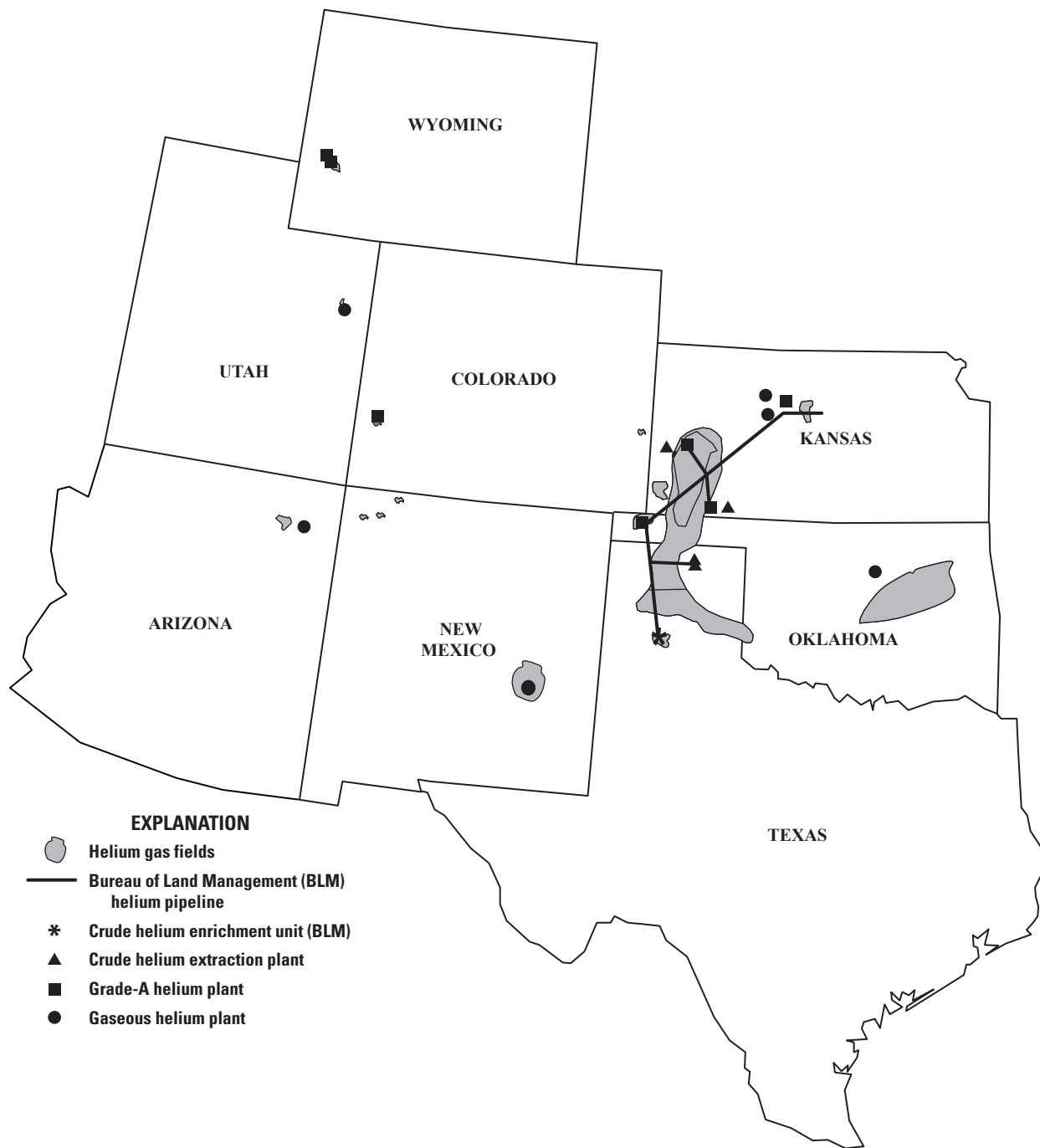


Figure 2. Active helium extraction and refining plants in the United States.

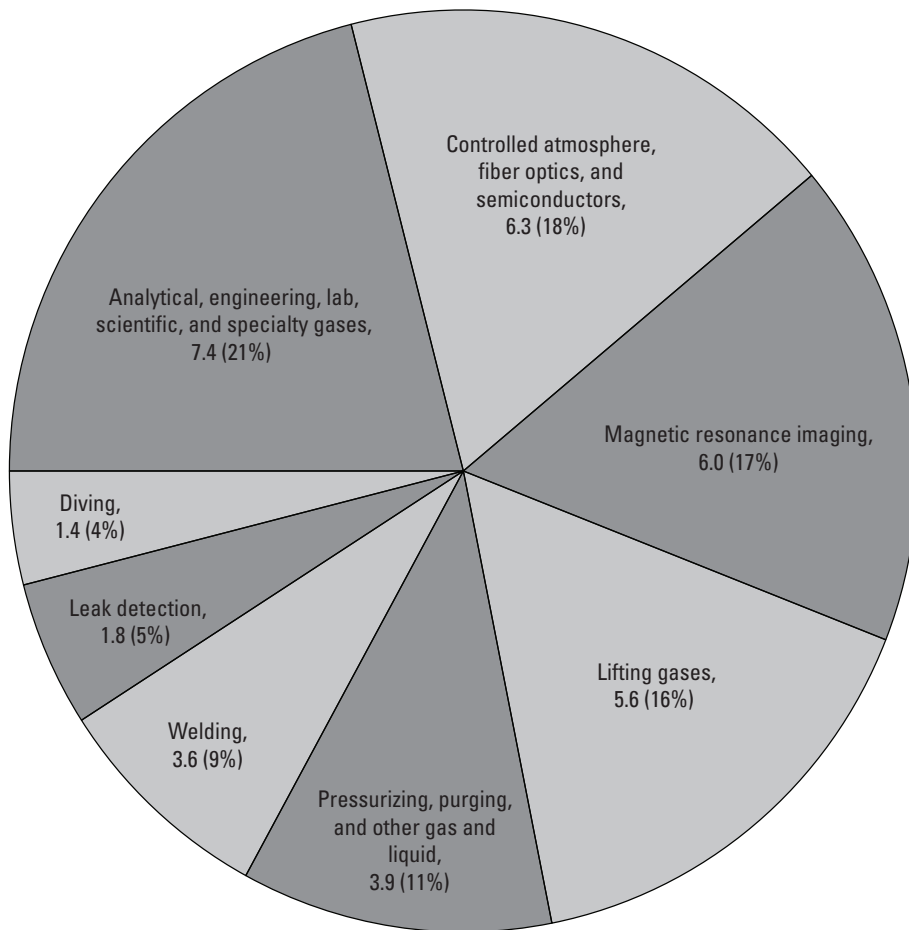


Figure 3. Estimated helium consumption in the United States in 2019, by end use, reported in million cubic meters (Garvey, 2021). Total helium used in the United States in 2019 was estimated to be 35.2 million cubic meters.

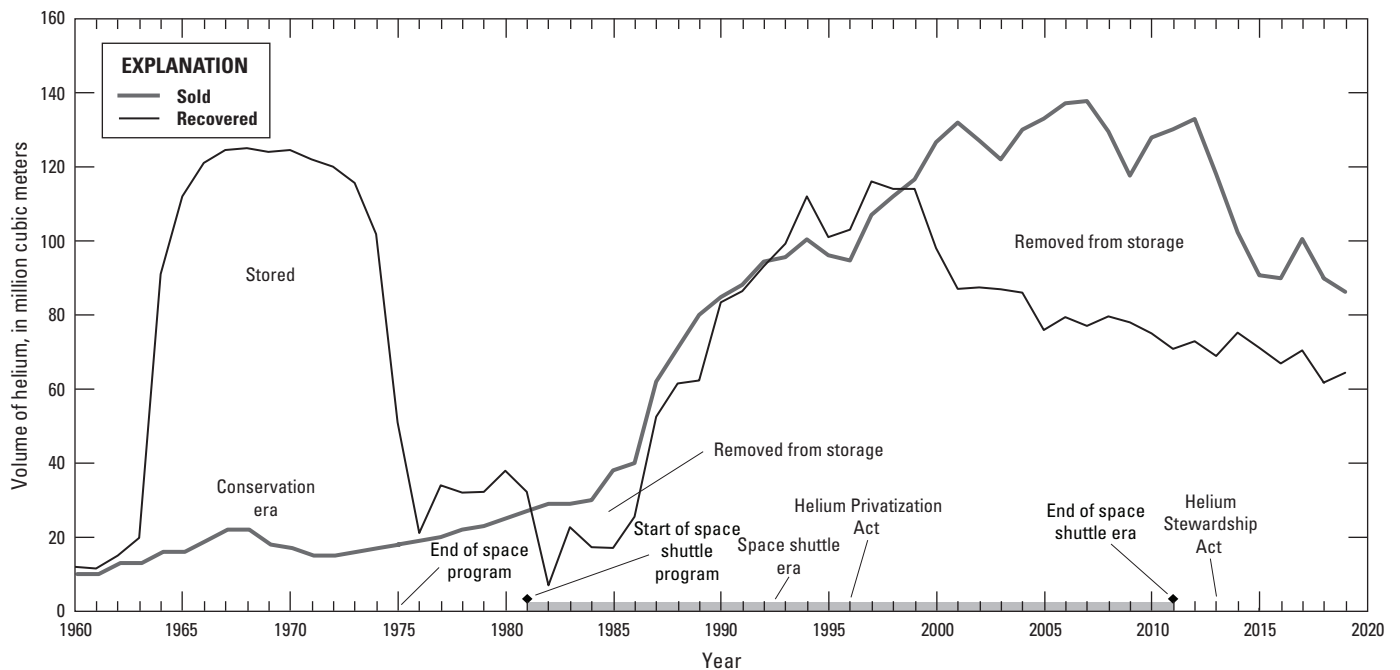


Figure 4. Helium recovery in the United States, 1960–2019.