



2020 Minerals Yearbook

HELIUM [ADVANCE RELEASE]

HELIUM

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Domestic consumption of Grade-A helium (99.99% or greater purity) in 2020 equaled 36.0 million cubic meters² (1.29 billion cubic feet). Exports by private producers were reported by the U.S. Census Bureau to be 52.2 million cubic meters (1.89 billion cubic feet). Imports of helium were 6.7 million cubic meters (242 million cubic feet). Total sales of U.S.-produced helium were 81.5 million cubic meters (2.94 billion cubic feet), a decrease of 5% from that in 2019 (table 1).

Government Actions and Legislation

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 would 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 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 directive in the Helium Privatization Act of 1996 (U.S. Congress, 1996) 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.—This phase was initiated on October 1, 2014, and was 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 (October 1, 2014, through September 30, 2015). The auction was open to all qualified bidders as defined in 50 U.S.C. 167d(b). The last 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) was offered at auction at the allocated sale, and 2.5 million cubic meters (90 million cubic feet) was sold at the nonallocated sale. These were the last auction and sale conducted under phase B as the volume of conservation helium in storage dropped to approximately 3 billion cubic feet.

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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).

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. In 2019, there were no more sales or auctions of helium to private entities, but 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 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 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 2020, 10 companies operated 18 privately owned domestic helium plants. Of the 18 operating plants, 5 extracted helium from natural gas to produce a crude helium product, 7 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 seven privately owned plants that produced Grade-A helium also produced liquefied helium. Two Grade-A helium plants and one crude helium plant were on standby in 2020 (table 2).

Total sales of U.S.-produced helium in 2020 decreased by 5% compared with those in 2019 (table 1). All natural gas processed for helium recovery came from gasfields in Arizona, Colorado, Kansas, New Mexico, Oklahoma, Texas, Utah, 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 removed from storage from the Government's helium reserve at Cliffside Field in 2020 was 56% less than that in 2019 (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 found 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; the Panoma Field in Kansas; and the Riley Ridge Area Fields in Wyoming.

Consumption

In 2020, U.S. domestic helium consumption slightly increased to 36.0 million cubic meters (1.29 billion cubic feet) compared with consumption in 2019 (table 1). The major domestic end uses of helium were analytical, engineering, lab, science, and specialty gases (21%); controlled atmospheres, fiber optics, and semiconductors (18%); magnetic resonance imaging (17%); lifting gases (16%); and pressurizing, purging, and other gas and liquid (11%). Other uses, in descending order of use, included welding, leak detection, and diving (fig. 3) (Garvey, 2021).

In-kind crude helium sales regulations (43 CFR part 3195) required helium refiners that sold helium to Federal agencies and their contractors to buy an equivalent amount of crude helium from the BLM. In 2020, in-kind crude helium sales equaled 5.9 million cubic meters (213 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 140 million cubic meters (5.03 billion cubic feet) on December 31, 2020. The storage system contained crude helium purchased under contract by the Government from 1962 to 1973, in addition to privately owned helium extracted by industry from natural-gas-supplying fuel markets and stored under contract (fig. 4). The privately owned helium was returned to the owners, as needed, for purification to Grade-A helium. During 2020, 5.1 million cubic meters (184 million cubic feet) of privately owned helium was delivered to the BLM's helium conservation system, and 14.7 million cubic meters (530 million cubic feet) was withdrawn, for a net decrease of 9.6 million cubic meters (346 million cubic feet) of private helium in storage (table 3). Systemwide measurements showed that there was 2.6 million cubic meters (93.7 million cubic feet) lost from the BLM's helium conservation system in 2020 (table 4).

Prices

The HSA required the BLM to use market-based pricing for its crude helium sales to private industry. In 2020, the conservation price was based on the annual auction results and an independent, confidential, market survey of helium industry prices. The in-kind price, which is the price set for private suppliers who supply helium to Federal agencies, was set at approximately 80% of the conservation price for the prior year. For fiscal year 2020, the conservation price was \$4.29 per cubic meter (\$119 per thousand cubic feet), unchanged from that in 2019. The in-kind price was \$3.10 per cubic meter (\$86 per thousand cubic feet), a decrease of 10% from that in 2019.

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, specialized vacuum tanks used for storing cryogenics, of various sizes.

Foreign Trade

During 2020, exports by private producers were reported by the U.S. Census Bureau to be 52.2 million cubic meters (1.89 billion cubic feet), a decrease of 10% from those in 2019. Private industry supplied all U.S. helium exports. For 2020, import tariffs on helium remained at 3.7% for normal trade relations (NTR) nations and 25% for non-NTR nations. Imports of helium totaled 6.7 million cubic meters (242 million cubic feet), a slight decrease from those in 2019 (table 1).

World Review

Total world production was an estimated 170 million cubic meters (6.13 billion cubic feet) in 2020 (table 5). World production capacity of helium was estimated to be about 300 million cubic meters (10.8 billion cubic feet) in 2020 (table 6). Helium was produced in Algeria, Australia, Canada, Poland, Qatar, Russia, South Africa, and the United States.

Worldwide, several helium projects were in the planning stage. PJSC Gazprom (Russia) planned to build an additional liquid helium capacity of 58.2 million cubic meters per year in three 19.4-million-cubic-meter-per-year increments in Amur, Russia. The first liquefier was scheduled for startup in 2021 followed by additional liquefiers in 2022 and 2024. Irkutsk Oil Company (Russia) planned to have 7.5 million cubic meters per year of liquid helium capacity in Irkutsk, Russia, starting up in 2023. The Saudi Arabian Oil Group (Saudi Arabia) planned to have 6.9 million cubic meters per year of liquid helium capacity starting up in 2023. Qatargas Operating Co. Ltd. (Qatar) planned to increase its liquid helium capacity by 27.7 million cubic meters per year by 2025. Two companies were exploring for helium in the Lake Rukwa area of Tanzania. Multiple companies were exploring for nonhydrocarbon-sourced helium deposits throughout North America (Garvey, 2020).

Outlook

U.S. domestic helium consumption is expected to remain stable during 2021. Several small projects to recover helium from natural gas are continuing to be developed in the United States (Garvey, 2020). The BLM is expected to dispose of assets in the Federal helium program in 2021. The BLM and the General Services Administration are working together to determine how to transition all Federal helium assets to private ownership (Burton, 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 ¹	Exports ²	Imports ²	
2016	52.8	60.8	23.7	89.9
2017	45.3	73.7	18.5	100.6 ^r
2018	40.0 ^{e,3}	83.7	7.5	89.9
2019	35.2	57.8	6.8	86.2
2020	36.0	52.2	6.7	81.5

^eEstimated. ^rRevised.

¹Defined as total sales of U.S.-produced helium plus imports minus exports; may not add to totals shown.

²Source: U.S. Census Bureau.

³Consumption 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 2020

Owner or operator	Plant name	Status	County and State	Product purity ¹
Air Products Corporation, Inc.	AP/MTG	Standby	WY, Sublette	Grade-A helium.
Do.	Doe Canyon	Operating	CO, Dolores	Do.
Do.	Liberal	do.	KS, Seward	Do.
Do.	Panhandle	Standby	TX, Hansford	Do.
DCP Midstream, LLC	National	Operating	KS, Seward	Crude helium.
Do.	Rock Creek	do.	TX, Hutchinson	Do.
Do.	Sher-Han	do.	TX, Hansford	Do.
DenburyOnshore, LLC	Riley Ridge	Standby	WY, Sublette	Do.
Energy Transfer	Sunray	Operating	TX, Moore	Do.
ExxonMobil Gas Marketing Co.	LaBarge	do.	WY, Sweetwater	Grade-A helium.
IACX Energy	Dineh-Bi-Keyah	do.	AZ, Apache	Gaseous helium.
Do.	Harley Dome	do.	UT, Grand	Do.
Do.	Hodgeman	do.	KS, Hodgeman	Do.
Do.	IACX Otis	do.	KS, Rush	Do.
Do.	Paden	do.	OK, Okfuskee	Do.
Do.	Roswell	do.	NM, Chaves	Do.
Linde Global Helium, Inc.	Ulysses	do.	KS, Grant	Grade-A helium.
Messer, LLC	Otis	do.	KS, Rush	Do.
Midstream Energy Services, LLC	Keyes	do.	OK, Cimarron	Do.
Scout Energy	Jayhawk ²	do.	KS, Grant	Crude helium.
Tumbleweed Resources	Ladder Creek ³	do.	CO, Cheyenne	Grade-A helium.

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

²Formerly owned by Riviera Energy.

³Formerly owned by DCP Midstream.

TABLE 3
HELIUM RECOVERY IN THE UNITED STATES¹

(Million cubic meters)

	2016	2017	2018	2019	2020
Bureau of Land Management (BLM) crude helium sold (in-kind and open market)	31.7	28.6	13.4	5.0 ²	5.9 ²
Crude helium accepted and stored by BLM	12.6	4.5	3.1	3.2	5.1
Crude helium withdrawn from storage	-35.6	-32.7	-31.2	-25.0	-14.7
Total net crude helium put into storage ³	-23.0	-28.1	-28.2	-21.8	-9.6
Private industry gaseous or Grade-A helium sold	89.9	100.6 ¹	89.9	86.2	81.5
Total helium recovered from natural gas ³	66.9	72.4	61.7	64.4	71.9

¹Revised.

²Negative numbers denote a net withdrawal from BLM's underground storage facility, a partially depleted natural gas reservoir at the Cliffside Field near Amarillo, TX.

³Open market sales ended in 2018 and this represents only the in-kind sales.

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

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

(Million cubic meters)

	2016	2017	2018	2019	2020
Helium in conservation storage system on January 1:					
Stored under BLM conservation program	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
Additions to system:					
Stored for private producers under contract	12.6	4.5	3.1	3.2	5.1
Redelivery of helium stored for private producers under contract	-35.6	-32.7	-31.2	-25.0	-14.7
Systemwide measurement and plant losses/gains	-1.1	2.8	-3.3	-0.6	-2.6
Net addition to system ⁴	-24.1	-25.4	-31.4	-22.4	-12.2
Helium in conservation storage system on December 31:					
Stored under BLM conservation program ⁴	126.3	97.9	83.1	77.5	68.9
Stored for private producers under contract	95.5	98.6	82.0	65.2	61.7
Total ³	221.8	196.5	165.1	142.7	130.6

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.

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 AS OF DECEMBER 31, 2020¹

(Million cubic meters)

Country or locality	Production
United States	81.5
Rest of world ^{e,2}	88
Total ^c	170

^eEstimated.

¹Data may not add to total shown.

²Includes Qatar, 61; Algeria, 14; Russia, 5; Australia, 4; Poland, 3. Canada and South Africa are less than ½ unit each.

TABLE 6
ESTIMATED WORLD ANNUAL GRADE-A HELIUM
PRODUCTION CAPACITY, DECEMBER 31, 2020¹

(Million cubic meters)

Country or locality	Capacity
Algeria	50
Australia	6
Canada	3
Poland	6
Qatar	72
Russia	8
South Africa	1
United States	156
Total	300

¹Includes capacity at operating plants as well as at plants on standby basis. Data may not add to total shown.



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

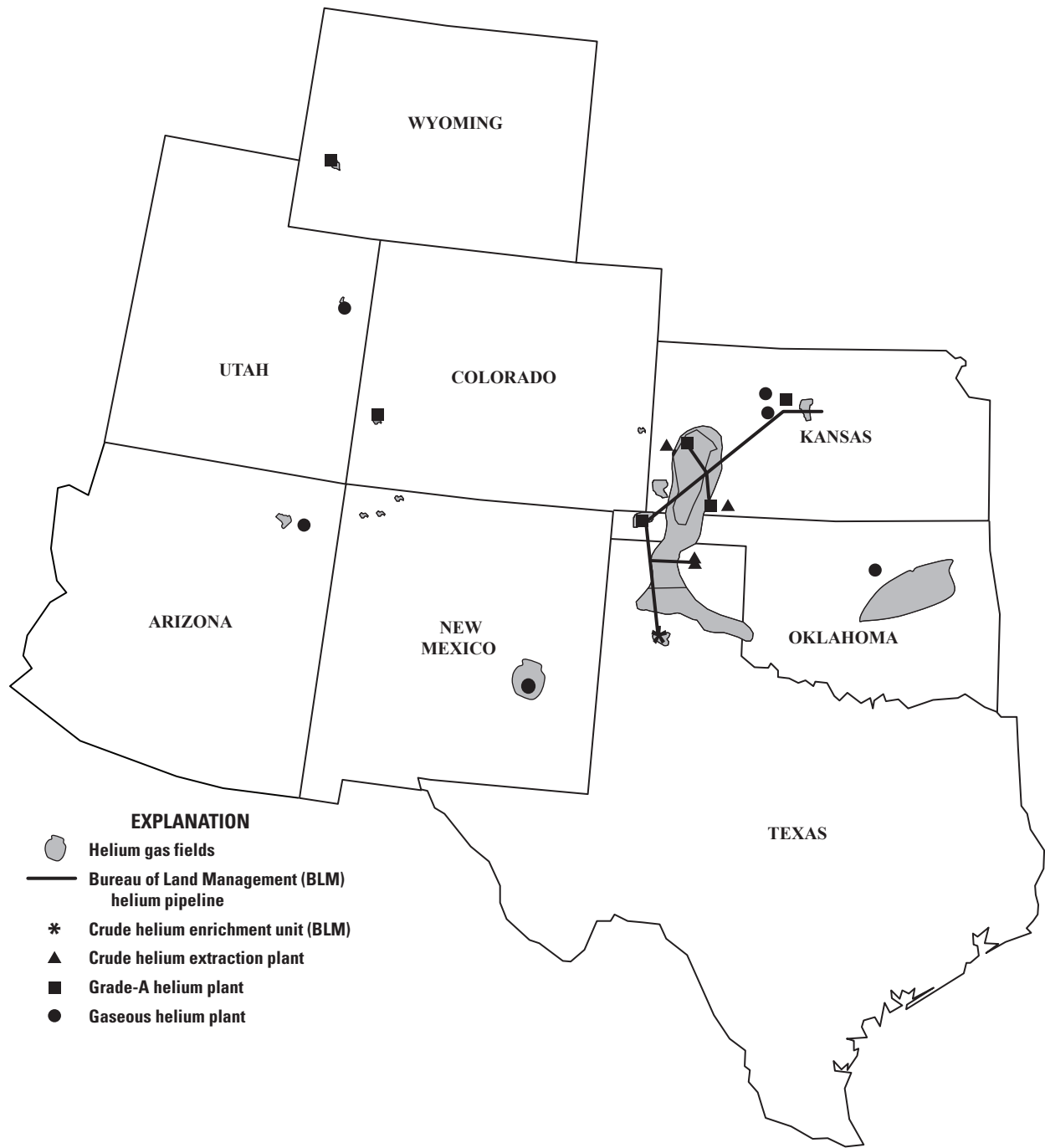


Figure 2. Active helium extraction and refining plants in the United States.

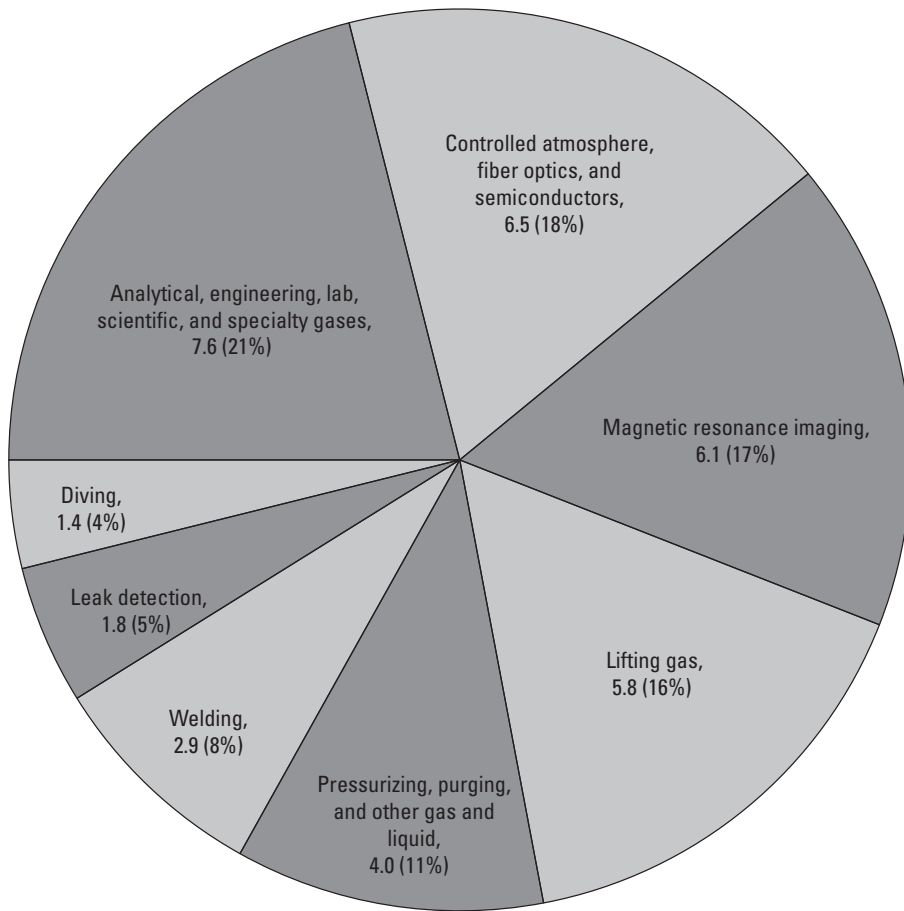


Figure 3. Estimated helium consumption in the United States in 2020, by end use, reported in million cubic meters. Total helium used in the United States in 2020 was estimated to be 36.0 million cubic meters (Garvey, 2021).

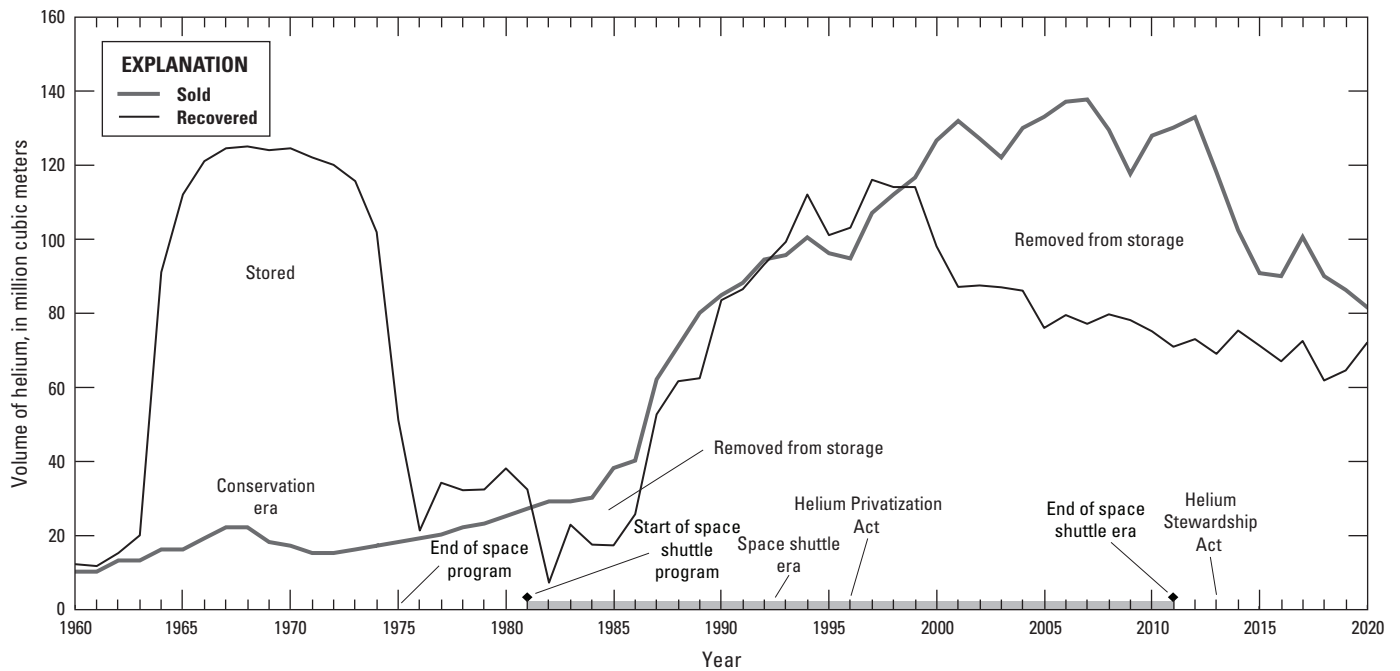


Figure 4. Helium recovery in the United States, 1960–2020.