RHENIUM

(Data in kilograms, rhenium content, unless otherwise specified)

Domestic Production and Use: During 2024, rhenium-containing products including ammonium perrhenate (APR), metal powder, and perrhenic acid were produced as byproducts from roasting molybdenum concentrates from porphyry copper-molybdenum deposits in Arizona and Montana. Total estimated U.S. primary production was approximately 9,500 kilograms in 2024, compared with 9,410 kilograms in 2023. The United States continued to be a leading producer of secondary rhenium, recovering rhenium from nickel-base superalloy scrap, spent oil-refining catalysts, and foundry revert. The major uses of rhenium were in superalloys used in high-temperature turbine engine components and in petroleum-reforming catalysts, representing an estimated 80% and 15%, respectively, of end uses. Bimetallic platinum-rhenium catalysts were used in petroleum reforming to produce high-octane hydrocarbons, which are used in the production of lead-free gasoline. Rhenium improves the high-temperature (>1,000 degrees Celsius) strength properties of some nickel-base superalloys. Rhenium alloys were used in crucibles, electrical contacts, electromagnets, electron tubes and targets, heating elements, ionization gauges, mass spectrographs, metallic coatings, semiconductors, temperature controls, thermocouples, vacuum tubes, and other applications.

Salient Statistics—United States:	2020	2021	2022	2023	2024[e]
Production[1]	8,830	9,290	8,870	9,410	9,500
Imports for consumption					
Rhenium, unwrought and powders[2]	15,900	15,900	11,900	10,200	13,000
Ammonium perrhenate[3]	9,320	6,020	8,810	4,890	6,900
Exports	—	—	267	2,010	2,200
Consumption, apparent[4]	34,000	31,200	29,400	22,500	27,000
Price, average value, gross weight, dollars per kilogram:[5]					
Metal pellets, 99.99% pure	1,030	977	1,120	1,070	1,370
Ammonium perrhenate	1,090	866	911	920	1,270
Employment, number	Small	Small	Small	Small	Small
Net import reliance[6] as a percentage of apparent consumption	74	70	70	58	65

Recycling: Nickel-base superalloy scrap and scrapped turbine blades and vanes continued to be recycled hydrometallurgically to produce rhenium metal for use in new superalloy melts. The scrapped parts also were processed to generate engine revert—a high-quality, lower cost superalloy meltstock—by an increasing number of companies, mainly in Canada, Estonia, France, Germany, Japan, Poland, Russia, and the United States. Rhenium-containing catalysts also were recycled. The rhenium recycled from spent catalysts was either returned to the oil companies or to the catalyst producer for production of new catalysts in what is considered a closed-loop system.

Import Sources (2020–23): Ammonium perrhenate: Kazakhstan, 26%; Canada, 24%; Poland, 15%; and other, 35%. Rhenium metal powder: Chile, 62%; Germany, 15%; Canada, 12%; Poland, 7%; and other, 4%. Total imports: Chile, 44%; Canada, 16%; Germany, 13%; Poland, 10%; and other, 17%.

Tariff: Item	Number	Normal Trade Relations 12–31–24
Salts of peroxometallic acids, other, ammonium perrhenate	2841.90.2000	3.1% ad valorem.
Rhenium, unwrought, waste and scrap	8112.41.1000	Free.
Rhenium, unwrought, powders	8112.41.5000	3% ad valorem.
Rhenium, other	8112.49.0000	4% ad valorem.
Rhenium (and other metals), wrought	8112.99.9100	4% ad valorem.

Depletion Allowance: 14% (domestic and foreign).

Government Stockpile: None.

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Events, Trends, and Issues: In 2024, the estimated price for catalytic-grade APR averaged $1,270 per kilogram, 38% more than the annual average price of $920 per kilogram in 2023. The estimated rhenium metal pellet price averaged $1,370 per kilogram in 2024, a 28% increase from the annual average price of $1,070 per kilogram in 2023.

In 2024, apparent consumption in the United States was about 20% more than that in 2023. During 2024, the United States continued to rely on imports for much of its supply of rhenium. Canada, Chile, Germany, Kazakhstan, and Poland supplied most of the imported rhenium. Imports of APR increased by an estimated 41% in 2024 compared with those in 2023. Imports of rhenium metal increased by an estimated 25% in 2024 compared with those in 2023. Estimated world rhenium production in 2024 was 62,000 kilograms compared with 62,600 kilograms in 2023.

The United States and Germany continued to be the leading secondary rhenium producers. Secondary rhenium production also took place in Canada, Estonia, France, Japan, Poland, and Russia. Available information was insufficient to make U.S. secondary production estimates; however, industry sources estimated that U.S. capacity was between 18,000 and 20,000 kilograms per year of rhenium. Industry sources estimated that approximately 25,000 kilograms of secondary rhenium was produced worldwide in 2024.

World Mine Production and Reserves:

	Mine production[e, 7]		Reserves[8]
	2023	2024	
United States	9,410	9,500	400,000
Armenia	210	200	95,000
Chile[9]	30,000	29,000	1,300,000
China	5,300	5,300	19,000
Kazakhstan	500	500	190,000
Korea, Republic of	2,800	3,000	NA
Poland	9,380	9,400	NA
Russia	NA	NA	310,000
Uzbekistan	5,000	5,000	NA
World total (rounded)	62,600	62,000	Large

World Resources:[8] Most rhenium occurs with molybdenum in porphyry copper deposits. Identified U.S. resources are estimated to be about 7 million kilograms. Rhenium also is associated with copper minerals in sedimentary deposits in Armenia, Kazakhstan, Poland, Russia, and Uzbekistan, where ore is processed for copper recovery and the rhenium-bearing residues are recovered at copper smelters.

Substitutes: Substitutes for rhenium in platinum-rhenium catalysts are continually being evaluated; one such application using iridium and tin has achieved commercial success. Other metals being evaluated for catalytic use include gallium, germanium, indium, selenium, silicon, tungsten, and vanadium. The use of these and other metals in bimetallic catalysts might decrease rhenium's share of the existing catalyst market; however, this would likely be offset by rhenium-bearing catalysts being considered for use in several proposed gas-to-liquid projects. Materials that can substitute for rhenium in various end uses are as follows: cobalt and tungsten for coatings on copper X-ray targets, rhodium and rhodium-iridium for high-temperature thermocouples, tungsten and platinum-ruthenium for coatings on electrical contacts, and tungsten and tantalum for electron emitters.

[e]Estimated. NA Not available. — Zero.

[1]Based on 80% recovery of estimated rhenium contained in molybdenum disulfide concentrates. Secondary rhenium production not included.

[2]Includes data for the following Harmonized Tariff Schedule of the United States (HTS) codes: 8112.92.5000 (2020–21) and 8112.41.5000 and 8112.49.0000 (2022–24). Does not include wrought forms or waste and scrap.

[3]The rhenium content of ammonium perrhenate is 69.42%.

[4]Defined as production + imports – exports.

[5]Average price per kilogram of rhenium in pellets or catalytic-grade ammonium perrhenate. Source: Argus Media Group, Argus Non-Ferrous Markets.

[6]Defined as imports – exports.

[7]Estimated amount of rhenium recovered in association with copper and molybdenum production. Secondary rhenium production not included.

[8]See Appendix C for resource and reserve definitions and information concerning data sources.

[9]Estimated rhenium recovered from roaster residues from Belgium, Chile, Mexico, and Peru.