RHENIUM

(Data in kilograms of rhenium content unless otherwise noted)

Domestic Production and Use: During 2005, ores containing rhenium were mined by five operations (two in Arizona, one each in Montana, New Mexico, and Utah). Rhenium compounds are included in molybdenum concentrates derived from porphyry copper deposits, and rhenium is recovered as a byproduct from roasting such molybdenum concentrates. Rhenium-containing products included ammonium perrhenate, perrhenic acid, and metal powder. The major uses of rhenium were in petroleum-reforming catalysts and in superalloys used in high-temperature, turbine engine components, representing about 40% and 50%, respectively, of the total demand. Rhenium was used in petroleum-reforming catalysts for the production of high-octane hydrocarbons, which are used in the production of lead-free gasoline. Bimetallic platinum-rhenium catalysts have replaced many of the monometallic catalysts. Rhenium improves the high-temperature (1,000° C) 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. The estimated value of rhenium consumed in 2005 was about $32 million.

Salient Statistics—United States:	**2001**	**2002**	**2003**	**2004**	**2005[e]**
Production[1]	5,500	4,000	3,900	5,900	6,900
Imports for consumption	23,400	16,900	14,500	20,200	28,900
Exports	NA	NA	NA	NA	NA
Consumption, apparent	28,900	20,900	18,400	26,100	35,800
Price,[2] average value, dollars per kilogram, gross weight:					
Metal powder, 99.99% pure	910	1,030	1,090	1,090	1,170
Ammonium perrhenate	790	820	790	630	670
Stocks, yearend, consumer, producer, dealer	NA	NA	NA	NA	NA
Employment, number	Small	Small	Small	Small	Small
Net import reliance[3] as a percentage of apparent consumption	81	81	79	77	81

Recycling: Small amounts of molybdenum-rhenium and tungsten-rhenium scrap have been processed by several companies during the past few years. All spent platinum-rhenium catalysts were recycled.

Import Sources (2001-04): Rhenium metal: Chile, 91%; Kazakhstan, 3%; Germany, 3%; and other, 3%. Ammonium perrhenate: Kazakhstan, 48%; Germany, 15%; Netherlands, 14%; Estonia, 10%; and other, 13%.

Tariff: Item	**Number**	**Normal Trade Relations 12-31-05**
Other inorganic acids, other—rhenium, etc.	2811.19.6050	4.2% ad val.
Salts of peroxometallic acids, other—ammonium perrhenate	2841.90.2000	3.1% ad val.
Rhenium, etc., (metals) waste and scrap	8112.92.0500	Free.
Rhenium, (metals) unwrought; powders	8112.92.5000	3% ad val.
Rhenium, etc., (metals) wrought; etc.	8112.99.0100	4% ad val.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

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RHENIUM

Events, Trends, and Issues: During 2005, average rhenium metal price was about $1,170 per kilogram, about 7% more than that of 2004. Rhenium imports increased by about 43% owing to a strong recovery in the superalloy market and improved demand in the catalyst market. Rhenium recovery in the United States increased by about 17% owing to increased production of byproduct molybdenum concentrates from porphyry copper deposits. Byproduct molybdenum production from the five working copper-molybdenum mines increased to near capacity in 2005. The United States relied on imports for much of its supply of rhenium. Chile and Kazakhstan supplied the majority of the rhenium imported. Recent analysis has indicated that rhenium production in Kazakhstan increased significantly as a result of the formation of the Republican State Company Zhezkazganredmet under the Ministry of Industry and Trade in Kazakhstan.

Owing to the scarcity and minor output of rhenium, its production and processing pose no known threat to the environment. In areas where it is recovered, pollution control equipment for sulfur dioxide removal also prevents most of the rhenium from escaping into the atmosphere.

World Mine Production, Reserves, and Reserve Base:

	Mine production[4]		Reserves[5]	Reserve base[5]
	2004	2005		
United States	5,900	6,900	390,000	4,500,000
Armenia	1,000	1,000	95,000	120,000
Canada	1,700	1,000	—	1,500,000
Chile	18,100	18,900	1,300,000	2,500,000
Kazakhstan	2,600	8,000	190,000	250,000
Peru	5,000	5,000	45,000	550,000
Russia	1,400	1,400	310,000	400,000
Other countries	1,000	1,000	91,000	360,000
World total (rounded)	36,700	43,200	2,400,000	10,000,000

World Resources: Most rhenium occurs with molybdenum in porphyry copper deposits. Identified U.S. resources are estimated to be about 5 million kilograms, and the identified resources of the rest of the world are approximately 6 million kilograms. In Kazakhstan, rhenium also exists in sedimentary copper deposits.

Substitutes: Substitutes for rhenium in platinum-rhenium catalysts are being evaluated continually. Iridium and tin have achieved commercial success in one such application. 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 may decrease rhenium's share of the catalyst market. 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 estimated rhenium contained in MoS_2 concentrates assuming 90% recovery of rhenium content.

[2]Average price per kilogram of rhenium in pellets or ammonium perrhenate, based on U.S. Census Bureau customs value.

[3]Defined as imports – exports + adjustments for Government and industry stock changes.

[4]Estimated amount of rhenium extracted in association with copper and molybdenum production.

[5]See Appendix C for definitions.