RHENIUM
(Data in kilograms of rhenium content, unless noted)

Domestic Production and Use: During 1995, ores containing rhenium were mined by eight operations. Rhenium compounds are included in molybdenum concentrates derived from porphyry copper deposits in the southwestern United States, and rhenium itself was recovered as a byproduct from roasting such molybdenum concentrates. Rhenium-containing products included ammonium perhenate, perhenic acid, and metal powder. The major uses of rhenium were in petroleum-reforming catalysts and in high-temperature superalloys used in jet engine components, representing about 20% and 70%, 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 is used in superalloys, improving the strength properties, at high temperatures (1,000° C), of nickel alloys. Some of the uses for rhenium alloys were in thermocouples, temperature controls, heating elements, ionization gauges, mass spectographs, electron tubes and targets, electrical contacts, metallic coatings, vacuum tubes, crucibles, electromagnets, and semiconductors. The estimated value of rhenium consumed in 1995 was $8 million.

Product: Content 19,200 16,200 12,200 15,500 18,000
Imports for consumption 14,400 12,100 5,900 8,200 11,000
Exports Negligible
Consumption: Estimated 8,900 6,800 6,900 12,900 14,000
Apparent W W W W W
Price, average value, dollars per kilogram:
   Metal powder, 99.99% pure 1,500 1,500 1,500 1,560 1,600
   Ammonium perhenate 1,300 1,100 1,100 1,100 1,100
Stocks, yearend, consumer, producer, dealer W W W W W
Employment 2 Small
Net import reliance 3 as a percent of apparent consumption W W W W W

Recycling: Small amounts of molybdenum-rhenium and tungsten-rhenium scrap were processed during the past few years by several companies.

Import Sources (1991-94): Chile, 57%; Germany, 27%; United Kingdom, 8%; and other, 8%.

Tariff: Item Number Most favored nation (MFN) 12/31/95 Non-MFN 12/31/95
Other inorganic acids, 2811.19.5050 4.2% ad val. 25% ad val.
other—rhenium, etc. Salts of peroxyMetallic acids, 2841.90.2000 3.1% ad val. 25% ad val.
other—ammonium perhenate Rhenium, etc., (metals) waste and scrap 8112.91.0500 Free Free.
Rhenium, etc., (metals) unwrought; powders 8112.91.5000 3.7% ad val. 25% ad val.
Rhenium, etc., (metals) wrought; etc. 8112.99.0000 5.5% ad val. 45% ad val.

Depletion Allowance: 14% (Domestic), 14% (Foreign).

Government Stockpile: None.

Prepared by John W. Blossom, (703) 648-4964.
**RHENIUM**

**Events, Trends, and Issues:** During 1995, the rhenium metal price was about the same as in 1994, averaging about $1,600 per kilogram for rhenium metal and $1,100 per kilogram for ammonium perrhenate. Imports of rhenium increased for 1995 compared with those of 1994. Chile, Germany, Japan, and Sweden supplied the majority of the rhenium imported. The United States relies on imports for much of its supply of rhenium.

It is estimated that in 1996, U.S. consumption of rhenium will be about 14,000 kilograms.

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 also prevents most of the rhenium from escaping into the atmosphere.

**World Mine Production, Reserves, and Reserve Base: Revised 4-19-96**

<table>
<thead>
<tr>
<th></th>
<th>Mine production</th>
<th>Reserves</th>
<th>Reserve base</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1994</td>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>15,500</td>
<td>18,000</td>
<td>390,000</td>
</tr>
<tr>
<td>Armenia</td>
<td>100</td>
<td>100</td>
<td>95,000</td>
</tr>
<tr>
<td>Canada</td>
<td>3,000</td>
<td>3,000</td>
<td>32,000</td>
</tr>
<tr>
<td>Chile</td>
<td>4,000</td>
<td>4,000</td>
<td>1,300,000</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>200</td>
<td>200</td>
<td>190,000</td>
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<tr>
<td>Peru</td>
<td>3,000</td>
<td>3,000</td>
<td>45,000</td>
</tr>
<tr>
<td>Russia</td>
<td>500</td>
<td>500</td>
<td>310,000</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>300</td>
<td>300</td>
<td>59,000</td>
</tr>
<tr>
<td>Other countries</td>
<td>100</td>
<td>100</td>
<td>91,000</td>
</tr>
<tr>
<td>World total (may be rounded)</td>
<td>26,700</td>
<td>29,200</td>
<td>2,500,000</td>
</tr>
</tbody>
</table>

**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.

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*Estimated. W Withheld to avoid disclosing company proprietary data.
1Calculated rhenium contained in MoS2 concentrates. Recovered quantities are considerably less and are withheld.
2Less than 100.
3Defined as imports - exports + adjustments for Government and industry stock changes.
4See Appendix B.
5See Appendix C for definitions.