Selenium

U.S. Geological Survey mineral commodity specialist Micheal W. George compiled the following information on selenium.

Selenium is a trace mineral needed in small amounts for good health; however, in any significant amount, it is toxic. As a relatively rare metallic element, selenium has a surprising diversity of uses.

In humans, selenium is important for the immune system, and its antioxidant and curative properties have been demonstrated to assist with a number of health problems, including AIDS, Alzheimer's disease, arthritis, asthma, cancer, cardiovascular diseases, pancreatitis, reproductive problems, thyroid dysfunction and viral infections. Too much selenium, however, can kill a person. It causes hair and fingernail changes, damage to the nervous and circulatory systems, the liver and the kidneys.

In glass containers, the mineral is used to decolorize the green tint caused by iron impurities. It is also used in art and other glass, such as that used in traffic lights, to produce a ruby red color, and in architectural plate glass to reduce solar heat transmission through the glass. Because it has good heat stability, reacts well to moisture and is resistant to ultraviolet or chemical exposure, selenium, such as that in cadmium sulfoselenide compounds, is used as pigments in ceramics, glazes, paints and plastics.

Selenium is now widely used in alloys with bismuth as a substitute for lead in plumbing, in response to requirements of the Safe Drinking Water Act Amendments of 1996, which restrict the use of lead in any fixtures, fluxes, pipes and solders used for the installation or repair of facilities that provide water for human consumption.

In China, selenium dioxide is substituted for sulfur dioxide to increase yields in the electrolytic production of manganese. By using selenium dioxide instead of sulfur dioxide, the plant reduces the power required to operate the electrolytic cells.

Although selenium is widely distributed within Earth's crust, it does not occur in concentrations high enough to justify mining solely for the selenium content. It is recovered as a byproduct of nonferrous metal mining and processing, principally from the anode slimes associated with electrolytic refining of copper. Slimes from primary copper refining can average up to 10 percent selenium, but are generally much lower. U.S. copper reserves contain about 10,000 metric tons of selenium — about 12 percent of the selenium contained in world copper reserves.

Global selenium output cannot be accurately determined because not all companies report production and because the trade in anode slimes and semi-refined products is not easily tracked. As selenium is a byproduct of copper, its rate of production may not be directly influenced by its industrial demand. Owing to a large increase in consumption of selenium in China and the relatively unchanged global production of selenium, there has been a supply shortfall in recent years. Consequently, the price of selenium increased from $4 per pound at the beginning of 2003, to a peak of $55 per pound in the middle of 2005 and fell to $34 per pound at the

beginning of 2007. Even though global copper production has increased over the past five years, the production of selenium is believed to have remained essentially unchanged, as the increased copper output has come from low selenium content ores and from ores processed through leaching, which precludes the recovery of selenium. Unless alternative sources of selenium are found, selenium's future use will likely be restricted to the more specialized, high-value-added applications.

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Selenium is found in economic quantities in sulfide ores such as pyrite (shown here). Image from *Minerals in Your World*.