

# toxics release inventory

## Chemical Profile

*Environment  
Science & Technology Development*

## Selenium

### What is selenium?

Selenium (Se) is a solid black, gray, or reddish nonmetal that resembles sulfur but has no odor. It is commonly found as selenide minerals in rocks that also contain sulfides of silver, copper, lead, and nickel—and in other forms in water and dry soils. In nature, selenium combines with other substances to form selenium compounds. Some anti-dandruff shampoos owe their reddish color to selenium sulfide, a compound of selenium and sulfur.

Selenium is used in electronic and photographic equipment, glass, pigments, rubber, pesticides, dietary supplements, and livestock and poultry feed.

### How is selenium released by electric utilities?

Trace amounts of selenium are present in coal and oil. When electric utilities burn these fuels at their power plants, selenium is released in very small amounts. Some of this selenium combines with oxygen to form selenium dioxide. At high combustion temperatures, selenium dioxide turns to vapor. As it cools, most of this vapor forms tiny liquid droplets or thin films on tiny ash particles. Ash particles that are alkaline neutralize acidic selenium dioxide, decreasing the amount that enters the air.

Coal-burning power plants are equipped with devices to capture ash particles before they reach the air.

Particle control devices typically capture more than 99% of the ash, so very little ash enters the air. Some coal-burning power plants use pollution control devices to remove sulfur dioxide from gases leaving their stacks. These devices also remove some of the selenium dioxide vapor from stack gas before it reaches the air. Selenium-carrying wastes captured by these devices are usually sent to ash ponds or land disposal sites. The amount of selenium released by an individual power plant depends on operating and air pollution control practices at the plant.

The U.S. Environmental Protection Agency (EPA) estimates that U.S. power plants burning coal released about 150 tons of selenium and its compounds into the air in 1994.

### Is selenium also released by other sources?

Selenium is released into the air by soils as they erode in wind and rain, and by volcanoes when they erupt. It is released into the soil and water by eroding rocks.

Selenium released by human activities comes mainly from silver, copper, lead, and nickel mines and smelters, and industrial boilers that burn coal and oil. Industries reporting to EPA released about 132 tons of selenium and its compounds into the environment in 1996. About 80% was released to the soil.

### What happens to selenium after it is released by electric utilities?

Selenium dioxide vapor and ash particles carrying selenium are released into the air from power plants. In the air, selenium dioxide vapor cools and forms tiny liquid droplets or thin films on tiny dust particles. As droplets and particles—formed in the air or released from power plant stacks—incorporate water, the selenium they contain becomes more dilute. By the time these droplets and particles reach surface soil and water by settling to the ground or washing out of the air in rain and snow, the selenium they contain is very dilute. The amount of selenium that stays in the air or falls to the ground depends on local wind, rain, and moisture in the air. Selenium builds up in the flesh of fish and plants.

Ash pond wastewater discharged into public waterways may contain small amounts of selenium, but these amounts are regulated by local permits.

### How might people be exposed to selenium?

People are commonly exposed to trace amounts of selenium naturally present in the foods they eat, the water they drink, and the air they breathe. For example, seafood, organ meats, grains, and cereals are good natural sources of selenium in people's diets. People may increase their exposure by using selenium dietary supplements, eating grains

and vegetables grown in soils naturally high in selenium, eating fish that have built up selenium in their bodies, or drinking water in parts of the country where soils contain large amounts of selenium that can dissolve. Industrial workers may breathe selenium dust or fumes.

### **What are the potential effects of selenium on human health?**

Very small amounts of selenium in people's diets are necessary for good health. Too little selenium in the diet causes heart problems and degeneration of cartilage tissue that normally would become bone in growing children. Too much selenium in the diet causes breathing difficulties, irregular heartbeat, and stomach upset. In rare cases where excess exposure continues for years, people have damage to their skin, hair, teeth, kidneys, liver, and nervous system.

The health effects of selenium depend on its chemical form. For example, selenium in drinking water is usually selenate or selenite, present in amounts that are not harmful. However, accidentally drinking large amounts of either form would be unhealthy, and drinking selenite would have the most serious consequences.

Breathing large amounts of selenium dust can irritate the lungs, and cause headaches and dizziness. Although research is ongoing, the chemical forms of selenium found in foods, drinking water, and the environment have not been found to cause cancer in people.

### **How likely is it that utility releases pose a risk to human health?**

It is unlikely that selenium from power plants poses a significant risk to human health. EPA has evaluated the potential health risks of breathing selenium for people who live near power plants that burn coal or oil. In EPA's initial screening assessment, these risks were so low that the Agency eliminated utility selenium from further analysis as an inhalation health hazard.

EPRI has found that ash from power plants typically has about 70 times as much selenium as the soil. It is unlikely that ash from power plants significantly increases the amount of selenium in soils, water, or food, because airborne ash particles carrying selenium are widely scattered before they settle to the ground.

### **How is selenium regulated?**

EPA has established limits for selenium in drinking water. The Food and Drug Administration regulates the amount of selenium in bottled water. Under the National Pollutant Discharge Elimination System (NPDES), federal and state regulators determine how much selenium each power plant may release in wastewater discharges. The Occupational Safety and Health Administration and the National Institute for Occupational Safety and Health have set limits on the amount of selenium in workplace air.

### **Where can I get more information about selenium?**

The Agency for Toxic substances and disease Registry (ATSDR) has a fact sheet with answers to frequently asked health questions about selenium. It is available through the ATSDR Information Center at 1-800-447-1544, or on the Internet at <http://atsdr1.atsdr.cdc.gov:8080/tfacts92.html>

EPA also has a fact sheet that is available on the Internet at <http://www.epa.gov/ttnuatw1/hlthef/selenium.html>