Copper

What is Copper?

Copper is reddish metal that occurs naturally in rock, soil, water, sediment and air. Its average concentration in the earth's crust is about 50 parts copper per million parts soil (ppm). Copper also occurs naturally in plants and animals. It is an essential element for all known living organisms including humans and other animals.

Copper can be easily molded or shaped. Its reddish color is most commonly seen in the United States penny, electrical wiring, and some water pipes. It is also found in many mixtures of metals, called alloys, such brass and bronze. Many compounds (substances formed by Joining two or more chemicals) of copper exist. These include natural occurring minerals as well as man-made chemicals. The most commonly used compound of copper is copper sulfate. Many copper compounds can be recognized by their blue-green appearance. When we speak of copper, we will not only be referring to copper metal but also to compounds of copper that may be in the environment.

Copper is extensively mined and processed in the United States and is primarily used as the metal or alloy in the manufacture of wire, sheet metal, pipe, and other metal products. Copper compounds are most commonly used in agriculture to treat plant diseases, like mildew, or for water treatment and as preservatives for wood, leather, and fabrics.

How might I be exposed to copper?

Copper is common in the environment. You may be exposed to copper by breathing air, drinking water, eating food, and by skin contact with soil, water, and other copper-containing substances. Most copper compounds found in air, water, sediment, soil, and rock are so strongly attached to dust and dirt or imbedded in minerals that they cannot easily affect your health. Copper found in hazardous waste sites is likely to be of this form. Some copper in the environment is less tightly bound to particles and may be taken up by plants and animals. Soluble copper compounds (those that dissolve in water) that are most commonly used in agriculture, are more likely to threaten your health. However, when soluble copper compounds are released into lakes and rivers, they generally become attached to particles in the water within approximately a day, and are then less of a threat to your health.

The concentration of copper in air ranges from a few nanograms (1 nanogram equals 1/1,000,000,000 of a gram) in a cubic meter of air (ng/m3) to about 200 ng/m3. Near smelters which process copper ore into metal, concentrations may reach 5000 ng/m3. You may breathe high levels of copper containing dust if you live or work near copper mines or processing facilities.

You may be exposed to high levels of soluble copper in your drinking water. The average concentration of copper in tap water ranges from 20 to 75 parts copper per billion parts water (ppb). However, many households have copper concentrations of over 1000 ppb. That is more than 1 milligram per liter of water. This is because copper is picked up from
copper pipes and brass faucets when the water sits in the pipes overnight. After the water is allowed to run for a while, the concentration of copper in the water decreases.

The average concentration of copper in lakes and rivers is 4 ppb. The average copper concentration in groundwater is similar to that in lakes and rivers; however, monitoring data indicate that some groundwater contains higher levels of copper. This copper is generally strongly attached to particles in the water. Lakes and reservoirs recently treated with copper compounds to control algae or receive cooling water from a power plant may have high concentrations of dissolved copper. Once in natural water, much of this copper soon attaches to particles or converts to forms that cannot easily enter the body.

Garden products containing copper that are used to control certain plant diseases are also a potential source of exposure.

Soil generally contains between 2 and 250 ppm copper, although concentrations close to 7000 ppm have been found near copper production facilities. High concentrations of copper may be found in soil because dust from these industries settles out of the air, or waste from mining and other copper industries are disposed of on the soil. Another common source of copper in soil results from spreading sludge from sewage treatment plants. This copper generally stays strongly attached to the surface layer of soil. You may be exposed to this copper by skin contact. Children may also be exposed to this copper by eating the dirt.

Food naturally contains copper. You eat and drink about 1 milligram (1/1000 of a gram) of copper every day. Copper is necessary in your diet for good health.

While some hazardous waste sites on the National Priorities List (NPL) contain high levels of copper, we do not always know how what form it is in at most of these sites. However, evidence suggests that most copper at these sites is strongly attached to soil.

You may be exposed to copper in the workplace. If you work in mining copper or processing the ore, you may be exposed to copper by breathing copper-containing dust or by skin contact. If you grind or weld copper metal you may breathe high levels of copper dust and fumes. Occupational exposure to forms of copper that are soluble or not strongly attached to dirt or dirt would most commonly occur in agriculture, water treatment, and industries such as electroplating, where soluble copper compounds are employed.

**How can Copper enter and leave my body?**

Copper can enter your body when you drink water or eat food, soil, or other substances that contain copper. Copper can also enter your body if you breathe air or dust containing copper. Copper may enter the lungs of workers exposed to copper dust or fumes.

Copper rapidly enters the bloodstream and is distributed throughout the body after you eat or drink it. Other foods eaten with copper can affect the amount of copper that enters the bloodstream. Your body is very good at blocking high levels of copper from entering the bloodstream. After you eat or drink high levels of copper, you may vomit or have diarrhea; this will also prevent copper from entering the blood. We do not know how
much copper enters the body through the lungs or skin. Copper then leaves your body in feces and urine, mostly in the feces. It takes several days for copper to leave your body.

**How can copper affect my health?**

Copper is necessary for good health. However, very large single or daily intakes of copper can harm your health. Long-term exposure to copper dust can irritate your nose, mouth, and eyes, and cause headaches, dizziness, nausea, and diarrhea. If you drink water that contains higher than normal levels of copper, you may experience vomiting, diarrhea, stomach cramps, and nausea.

Intentionally high intakes of copper can cause liver and kidney damage and even death. Very young children are sensitive to copper, and long-term exposure to high levels of copper in food or water may cause liver damage and death.

Copper is not known to cause cancer. We do not know if copper can cause birth defects in humans. The seriousness of the effects of copper can be expected to increase with both level and length of exposure.

**What levels of exposure have resulted in harmful health effects?**

The levels of copper in air that can result in harmful health effects in people are not known. Exposure to low levels of copper in air (0.1–3 ppm) affects the lungs of animals.

You can usually taste copper in your drinking water before experiencing adverse effects. If you drink too much copper at one time (approximately 30 ppm or greater), you may vomit, have diarrhea, and experience stomach cramps. Infants drinking water that has high levels (500–2,000 ppm) of copper may have harmful health effects at lower levels than adults. High levels of copper in drinking water or food have been shown to damage the livers and kidneys in animals.

**Is there a medical test to show whether I've been exposed to copper?**

There are reliable and accurate ways of measuring copper in the body. It can be measured in the urine and blood. High levels of copper in these fluids can show that you have been exposed to high levels of copper. Samples of your blood plasma or urine can be properly collected in a doctor's office and sent to a laboratory that has special equipment to measure copper levels. However, we do not know if such a measurement can predict the extent of exposure or potential health effects.

**Has the federal government made recommendations to protect human health?**

The Environmental Protection Agency (EPA) has determined that the level of copper in water (lakes, streams) should be limited to 1 ppm to protect human health from the toxic properties of copper ingested through water and contaminated aquatic organisms. The EPA has also determined that drinking water should not contain more than 1.3 ppm of copper. The EPA has developed regulations on the amount of copper released by industry.
The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams/cubic meter (mg/m³) of copper fume (vapor generated from heating copper) and 1.0 mg/m³ copper dusts (fine metallic copper particles) and mists (aerosol of soluble copper) of workroom air to protect workers during an 8-hour work shift (40-hour workweek).

The National Institute for Occupational Safety and Health (NIOSH) recommends that the concentration in workroom air be limited to 0.1 mg/m³ for copper fumes and 1 mg/m³ for copper mist, averaged over an 8-hour work shift. The National Academy of Science (NAS) has recommended that 2-3 milligrams copper is a safe and adequate daily intake. This provides enough copper for adult nutrition.

The federal recommendations have been updated as of July 1999.

*This factsheet was adapted from [ATSDR](https://www.atsdr.cdc.gov) and [EPA](https://www.epa.gov).*

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