

Copper (Cu)

What is copper?

- Copper is a reddish metal that is naturally present in rock, soil, water, sediment and air.
- Copper is an essential element necessary for life in plants, animals, humans and microorganisms.
- Many compounds and items contain copper.

What are the uses of copper?

- Copper is used to make electrical wire, sheet metal, some U.S. coins, and brass and bronze pipes and faucets.
- Copper is used in pesticides to control algae, aquatic weeds, freshwater snails and leeches.
- Copper is used to treat mildew and other plant diseases and is a preservative for wood, leather and fabrics.
- Copper is a component in various multivitamin products.
- Copper may be a component of fluids injected underground to aid in the recovery of natural gas.

Is copper in the environment?

- Copper is present in the earth's crust at an average concentration of 50 parts per million (ppm).
- Copper may be found in the environment from natural sources such as windblown dusts, decaying vegetation, forest fires, volcanoes, and during mining and farming.
- Copper-containing waste water may be discharged into rivers and lakes during manufacturing.
- Most copper compounds found in air, water, sediment, soil and rock are bound up in dust and dirt or embedded in minerals.
- Copper attaches to the surface layer of soil during the use of biosolids (sludge) from sewage treatment plants when the sludge is used as a source of agricultural fertilizer.

- Soil generally contains between 2 and 250 ppm of copper. Copper concentrations in soil as high as 17,000 ppm have been found near copper and brass production facilities.
- Copper is present in surface water, such as rivers and lakes, at an average concentration of 4 parts per billion (ppb). Copper is present in groundwater at concentrations similar to that in surface water, although it can be higher in locations where naturally occurring copper-containing geological materials are present.
- Copper has been found in drinking water at concentrations ranging from 20 to 75 ppb.
- Copper concentrations above 1000 ppb (1 ppm) may be present in water in older homes that have copper pipes and brass faucets.
- Copper does not break down in the environment.
- Copper occurs naturally in foods such as nuts, grains and organ meats. Copper is also found in fish, mollusks and agricultural plants.
- Most plants contain less than 10 ppm of copper.
- Dairy products contain less than 1 ppm of copper.

How are people exposed to copper?

- Drinking water and food are the primary routes of exposure to copper.
- People consume an estimated 1 to 10 milligrams (mg) or more of copper each day in their diets.
- Breathing air and, to a limited degree, skin contact with soil and water are also ways people can be exposed to copper.

How does copper enter and leave the body?

- Copper rapidly enters the body through the gut when ingested.
- Water soluble forms of copper are more readily absorbed than insoluble forms.
- Zinc, molybdenum and some other metals can decrease dietary copper absorption.
- Absorption of copper following ingestion is normally handled by the body to balance copper intake and excretion. This causes the amount of copper in the body to remain constant.
- The amount of copper that can enter the body through the lungs and skin is not known.
- Most absorbed copper is transported to the liver, with small amounts going to bone and other tissues.

- Most of the copper in the body is excreted in the bile and feces, with only 2 to 4 percent excreted in the urine.
- It takes several days to several weeks for copper to leave the body.

How harmful is exposure to copper?

- Toxicity is not seen in healthy individuals with normal dietary intake of copper.
- While small amounts of copper are essential for good health, exposure to high amounts can be harmful.
- Drinking water containing copper concentrations of 30 milligrams per liter (mg/L) or greater can cause vomiting, diarrhea, stomach cramps and nausea.
- Ingestion of large amounts of copper can cause liver and kidney damage and even death in cases of extremely large exposures.
- People with certain genetic defects, such as Wilson's disease, experience an accumulation of copper in their body tissues. This excess copper can cause anemia and damage the liver, kidney and brain. It can also cause changes in the appearance of the cornea in the eye.
- Various copper compounds cause skin and eye irritation with direct contact.
- If toxicity is due to long-term accumulation of copper, the health impact depends on how much damage there is to body organs.

Can exposure to copper cause cancer?

- The International Agency for Research on Cancer (IARC) has stated that copper is not a human carcinogen.

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

- Copper can be measured in blood, urine, hair and nails.
- Elevated levels of copper in blood, urine, hair and nails can show that a person has been exposed to higher than normal levels of copper. However, the levels of copper do not correlate well with the degree of exposure or symptoms and, therefore, have little clinical relevance.

What is the treatment for copper?

- Copper poisoning is treated by removing the person from the source, followed by medical care in a hospital setting.
- The medicines dimercaprol and penicillamine are sometimes used as antidotes in treating copper poisoning.

Are there recommendations to protect public health?

- The Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limit (PEL) for copper fumes (vapor from heating copper) in air is 0.1 milligram per cubic meter of air (mg/m³) averaged over an eight-hour work shift.
- The Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limit (PEL) for copper dusts in air is 1.0 mg/m³ averaged over an eight-hour work shift.
- The Environmental Protection Agency (EPA) has set an enforceable limit, the Maximum Contaminant Level (MCL), of 1.3 milligrams per liter (mg/L) for copper in drinking water.
- The Food and Drug Administration (FDA) allows 1.0 mg/L of copper in bottled water.
- The National Academy of Sciences (NAS) has recommended 2 to 3 mg of copper as a safe and adequate daily intake for adults.

What can I do to reduce or prevent exposure to copper?

- The greatest source of copper exposure is from drinking water, especially water that is drawn in the morning after sitting in copper pipes and brass faucets overnight.
- To reduce copper in drinking water, run the water for at least 15 – 30 seconds before using it.
- If there is concern that the concentration of copper in drinking water may exceed the EPA's MCL of 1.3 mg/L, the water should be tested at a certified environmental laboratory.

What should I do if I believe I am ill as a result of exposure to copper?

- Terminate exposure and seek medical treatment if your condition or history suggests copper poisoning.

Where can I get more information?

For more information, contact:

The Pennsylvania Department of Health, Division of Environmental Health Epidemiology, P.O. Box 90, Harrisburg, PA, 17108. Telephone number: 717-787-1708.

The U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR), Atlanta, GA. Telephone number: 800-CDC-INFO (800-232-4636).

References

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- (2) U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR). September 2004, Toxicological Profile for Copper.
- (3) U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR). September 2004. Public Health Statement, Copper.
- (4) World Health Organization (WHO), Copper in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality, 2004.
- (5) U.S. Department of Energy, Argonne National Laboratory, Environmental Science Division, Copper Human Health Fact Sheet, August 2005.
- (6) U.S. Environmental Protection Agency (EPA), Office of Pesticide Programs, Copper Facts, June 2008.
- (7) U.S. National Library of Medicine (NLM), National Institutes of Health, MedlinePlus – Trusted Health Information for you, searched September 5, 2012 at <http://www.nlm.nih.gov/medlineplus/ency/article/002496.htm>.

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