Wanted: Copper & Lead: Dirty Dozen Science Lab Gang Members

What's the Problem with Copper (Cu) and Lead (Pb)?

A chemistry teacher was having students do a qualitative laboratory activity and noticed that their results were very poor. The teacher shared his concern about the poor results with the department head. The department head asked if the blue/green tinted water coming out of the laboratory water faucets might have anything to do with the results. The teacher discovered that students had used the water from laboratory faucets in lieu of distilled water. It was decided that the laboratory water should be tested by an analytical laboratory and was found to contain relatively high levels of copper.

A biology teacher taught an elective course in oceanography last year in a high school. Students had to set up aquariums and create an experimental design incorporating different types of environmental conditions. Plans were made to implement the experiment and collect laboratory data on various species of tropical fish considering the different factors. Two days after setting up the aquariums, there was a major “fish kill!” Undaunted, the biology teacher used this as a “teachable moment.” She had students investigate the cause of the carnage. It was determined that relatively high concentrations of copper in the water were the agents of destruction.

Aging plumbing, especially in older schools, can be a contributing factor to establishing unacceptable levels of lead and/or copper in drinking water. More than just altering laboratory results, there can be health risks associated with such a phenomenon for employees and students, not to mention laboratory flora and fauna.

What Is The History?

In 1974, Congress passed the Safe Drinking Water Act which requires the U.S. Environmental Protection Agency or EPA to determine safe levels of chemicals commonly occurring in our drinking water. Each was identified as chemicals which do or may cause health problems. In 1991, the EPA published the Lead and Copper Rule, a regulation to control lead and copper in drinking water. In January 2000, minor revisions to the 1991 Rule were made. The EPA requires water systems to control the corrosiveness of their water if the level of lead or copper exceeds an Action Level. The Lead and Copper Rule uses a 90th percentile Action Level (0.015 mg/L for lead and 1.3 mg/L for copper), which triggers certain specific activities. These standards are met through the National Primary Drinking Water Regulations that all public water supplies must abide. In addition, the World Health Organization (WHO) recommends maximum drinking water concentrations of 2 mg/L for copper and 0.01 mg/L for lead.

How Bad Is Lead And Copper To Human Health?

Although elemental lead is more notorious than copper, both can cause serious health problems. Short-term effects of lead include interference with red blood cell chemistry, delays in normal physical and mental development in young children, deficits in the attention span, hearing and learning abilities of children. Long-term effects include stroke and kidney disease, cancer.

Short-term effects of excessive copper include vomiting, nausea, stomach cramps and diarrhea. Long-term effects of excessive copper include liver and kidney damage, and anemia. Copper is also a concern to individuals having Wilson's Disease, a potentially fatal inability to excrete copper form the body.
How Does Lead And Copper Get Into The Water?

Although copper and lead in drinking water can occur naturally, there presence is usually from corrosion of the plumbing system containing these elements; e.g., lead containing supply pipes, copper pipes or lead solder. This tends to be facilitated by acidic water. Grounding of electrical systems to plumbing may also facilitate corrosion. Lead and Copper levels are likely to be highest in faucets or fittings of brass containing lead, a water system having lead or copper pipes, and/or copper pipes having solder containing lead. Sulfides in water can greatly accelerate copper corrosion in water pipes. Copper corrosion symptoms include blue/green color in water, fine black particles floating about and/or a metallic taste.

Copper and lead may also be in the water being supplied to the plumbing system. Industrial pollution, weathering of copper or lead bearing rocks, domestic wastewater, agricultural fungicides, fertilizers, certain aquatic plant control chemicals, etc, are major sources of copper and lead in surface and ground waters.

What Actions Can Be Taken To Reduce Lead and Copper in Drinking Water?

There are several actions which can be taken to reduce the amounts of lead and copper in drinking water. These include:

Flushing Programs: If water in a faucet has not been used for six hours or more, flush the cold-water pipes by running the water until it becomes as cold as it will get. This usually takes about 15 seconds to several minutes, depending on the size of the plumbing system. The longer water is sitting in pipes and the higher its temperature, the more lead and copper it may contain. This should only be considered as a temporary remedy.

Use Cold Water: Hot water tends to contain higher levels of lead and copper. Use only water from the cold-water tap for drinking, cooking, etc.

Get the Water Tested: This is the only way to make sure copper and lead are at acceptable levels. Have testing conducted by a competent lab. If a school system is considered to be the water supplier (e.g., well water), monitoring of lead and copper may be required on a quarterly schedule by the health department.

After Testing: There are a number of alternatives to correct lead and copper problems ranging from corrosion control devices and filtering systems to bottled water.

Final Thoughts!

From an instructional laboratory and health standpoint, lead and copper in water can cause many problems. Be proactive and adopt the actions noted. It also would be a good idea to have home water tested.

For Additional Information:

World Health Organization (WHO) Website: http://www.who.ch/

American Water Works Association: (303) 794-7711

EPAs Safe Drinking Water Hotline: (800) 426-4791

EPAs Website: http://www.epa.gov/safewater/standard
State Department of Health

State Department of Environmental Protection

Local Water supplier

Local Health Department

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LIVE LONG AND PROSPER WITH SAFETY!

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