Getting Grounded:

How to Stop Blue-Green Staining II

A Broader Solution

By Pete Ostwald

Summary: *A previous article on this topic appeared in WC&P in March 2001 by this author, discussing electrical grounding of water pipes and blue-green staining on household fixtures and related equipment. This follow-up article takes a broader view on these issues and solutions.*

In New Mexico, where resolution of blue-green staining of water fixtures has been documented, the problem was determined to have been caused in this manner: The premise is a simple physical reality—electricity that's inadequately grounded will seek ground any way it can!

Copper corrosion

For this reason, electricity that's grounding itself through the copper pipe is "plating" or leaching the copper into the water flowing through it. That's because the electricity going back through the flowing water to seek actual physical ground is causing an electrochemical response known as galvanic corrosion of the pipe and the water with the copper—which imparts a blue-green color—is delivered to every fixture in the house. This phenomenon isn't restricted to copper and other corrosion factors may affect it,[1] but in such cases it's called electrical cuprosolvency or, more simply, copper corrosion.

Copper in drinking water is regulated by the federal Lead & Copper Rule (see www.epa.gov/safewater/ leadcop.html). Copper, while it's a necessary trace element for human health, is considered harmful when it exceeds 1.3 milligrams per liter (mg/ L). As a prior article[1] on this topic notes: "Excess levels are excreted from the body, however, when high levels are ingested, liver or kidney damage and/or gastrointestinal disorders may result."

A home can be inadequately grounded because the soil conditions do not promote the conductivity of electricity or the improper installation of a grounding rod. Then this phenomenon occurs and is made evident by blue-green staining.

The way to verify that this situation is occurring requires lab testing. There are test strips for copper (for instance, Spectrum Labs offers such a product), but they cannot provide the accurate comparison you'll need between raw—or source water before it's entered the home—and the in-house water.

Testing for copper

First, check with the water provider, if there is one, to get an estimate of the copper content of the incoming water based on the content of the treated water as it enters the distribution system.

Assuming the dealer is cognizant of other causes such as low pH, it's critical that the test for copper should occur in the following areas:

- If the customer uses a private well, get a sample—if at all possible—before it enters the house.

- If they have a softener, check at the brine elbow, where you'll probably find the copper content diminished. This will prove that the softener does not cause the problem, but reduces it.

- Further, obtain a sample from the kitchen sink. This is commonly the one most used and will have the lowest reading in the home because it has the least amount of time for copper to build up.

- Then get a sample from the furthest point from the point-of-entry (POE) to the house. This could be a faucet on the second floor, back bathroom or master bathroom. This furthest location will consistently be the worst because water has had the longest time to be in contact with the copper.

Fixing the problem

Now that you know what copper levels your dealing with, you'll be able to make an educated guess as to how much grounding you'll have to put in to solve it. At a minimum, use all the grounding methods cited in this article. In one case, where all these methods were done, we had to return to add specific additional grounding on the hot water heater and the kitchen sink. The sink required attaching a ground wire to the cold and hot water lines, drilling through the wall and sinking a separate grounding rod for just this location.

I would dearly love to provide you with hard and fast rules to solve this problem—there aren't any! That's because unfortunately the problem and the solution are not exact and the science is still developing. We've consistently used the sledgehammer approach—we do everything in order to make sure the problem goes away and stays away. Here's what we've done that has proven successful in 10 cases to date:

Outside grounding rods

Establish if there's an outside grounding rod. If there is—attach two grounding clamps to it, so that you can add two additional grounding rods. Then—using bare grounding wire slightly buried about two inches depth or so—proceed out in a 'V" shape to a minimum of 15 feet on each leg with at least 15 feet between the ends of the "V" then install the rods at the base of each leg. I've used 18 feet as my minimum basis and would recommend this. The reason is, if you go below these limits, you run the risk of the grounding rods canceling each other out and defeating the whole purpose of what you're trying to do.

Before installing the grounding rods, review the National Electrical Code (see www.necdirect.org) as to what different methods can be used and follow them. Grounding rods are difficult to install eight feet straight down. Ways to install these rods:

- Have one person use a large pair of pliers to hold the rod as another person hits it with a sledgehammer while standing on a ladder secured by a third person.

- Order a grounding bar socket for a specific electric chipping hammer (I would recommend the largest rental available) and use it to drive the rod into the ground. You will still need the ladder and sledge for difficult places.

- We have now ordered a grounding bar socket for an air powered jack hammer, compressor (this is towed by our truck), hoses and oiler are rented, because of the very rocky ground in New Mexico.

If the grounding rod is located inside the wall, as is per the new national electrical code, then you'll have to go to the outside of the wall where the electrical panel is located, put a hole in the wall below the box and attach the grounding wire to the ground bar within the box.

Then, proceed as above with the two additional grounding rods in a "V" formation. A qualified electrician should do this final step. A more extreme alternative method to repair the grounding bar is to further tear open the wall, find the bar and connect directly to the grounding bar inside the panel box. This isn't highly recommended.

Outside water faucets

In order to increase the grounding as much as possible around the complete house, we have always installed magnesium grounding rods. These are needed because magnesium is a more noble metal and therefore is more readily electrically conductive then copper. They are about 30 inches long and can easily be driven in below each outside faucet and attached to it. Please be aware of the spacing from any other grounding rods that are present or which you may have added. As mentioned before, too close a spacing will cancel the beneficial effect of what you are doing. The rods are manufactured with a plastic driving cap, wire and pipe clamp with a contact pin so a good grounding contact can be achieved. One source for such rods is Farwest Corrosion Control Co., of Gardena, Calif., with costs running near $40 for 25 or fewer and $30 for 50 or more.

Inside grounding

Hot water tank: Install die-electric unions between the copper flex pipe and the softener. In New Mexico, the hot water tank—by code—is required to be grounded to cold and hot water lines by a bare grounding wire to the ground bar located in the electrical panel box. If this isn't the case in your state, have this grounding wire installed. (Note: All hot water heaters must be handled this way. If a second hot water heater is remotely located within the home, ground it separately with die-electric unions and a grounding rod or rods as noted above.)

Water softener: Use a ground wire to connect the incoming and outgoing lines as close as possible to the wall where it exits. This is critical due to plastic by-pass valves and plastic pre-filter housings that interrupt the grounding conductivity. Then, ground from there to the hot water heater. In this manner, it's thoroughly grounded back to the electrical panel.

An additional issue

Recently, I've encountered a blue-green, semi-transparent gel forming in the hot water heater and causing restricted water flow through hot water pipes. It also has caused the electric hot water recirculating pumps to actually shut down completely. This occurred to three different widely separated customers on three entirely different water systems in the last four months.

We've tracked this down to poor or no electrical grounding on additional hot water heaters. What occurred was the electricity grounded itself through the aluminum anode rod into the hot water heater and dissolved the rod prematurely. Lab test results of the customer's sample included the following:

- Copper 3.6 percent
- Aluminum 19 percent
- Calcium 1 percent

The only source of aluminum in a home that could enter the potable water supply in any quantity had to be the anode rod in the hot water heater.

A grounding package was installed and follow-up tests showed this solved the problem. There has been no more evidence of staining or blue-green jelly in over a year.

Conclusion

The above protocol for dealing with blue-green staining proves effective if the source of the problem is proven to be electrical cuprosolvency—copper leaching caused by galvanic corrosion—as a result of poor grounding in your customer's home or building. Be sure to test the water and investigate other causes of copper corrosion that may exist. These could include poor alloys used in the pipe's manufacture, weather exposure or certain water conditions such as higher flow rates for the size of pipe being used or certain bacteria.[1] This last is referred to as microbially induced corrosion (MIC). Whatever the case, proper grounding of copper water lines is integral to preventing blue-green staining. □

References

1. Henke, Larry, "Solving Blue-Green Water: What It Is and How to Deal with It/' *WC&P,* January 2000.

2. Ostwald, Pete, "Blue Stains: Copper Pipe Leaching & Proper Electrical Grounding/' *WC&P,* March 2001.

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