Chlorine Blamed for Turning Hair Green

This question comes up every summer. Swimmers and spa goers complain that the chlorine in the pool or spa has caused their hair to turn green, their fingernails blue or turquoise and their bathing suit blue-green.

The short answer is: It's NOT the chlorine, it's the copper.

A simple explanation: Chlorine after all, is a bleach. When you add laundry bleach to the washing machine, it makes clothes whiter, removes discoloration and stains, and kills organisms – it does not make your clothes green, blue, turquoise or any other color. Any amount of chlorine in water more than about 15 ppm (parts per million) starts the bleaching process. Although typically a load of laundry in a washing machine has about 600 ppm of chlorine.

If it is the copper, where does the copper come from?

Copper can get into the pool or spa a number of different ways. First, drinking water (source or tap water) has a small amount of copper in it already. So each time makeup water is added due to evaporation, a little more copper is added. Since copper does not biodegrade or go away on its own, it builds up.

Second, some algaecides have as their active ingredient copper. The copper in algaecides usually has a special ingredient added to it that prevents it from staining people and vessels. This ingredient is called a chelating agent (pronounced KEY-lating) and copper algaecides that have this ingredient are said to be chelated. However, sunlight, constant high levels of chlorine or bromine, ozone, superchlorination and even non-chlorine shock treatments can oxidize the chelating agent. Once this happens, the copper stain protecting ability is decreased.

A third way copper gets into the pool is from the equipment. Water that has a low pH actually dissolves a small portion of the copper metal in components such as copper pipes, heater headers, heater heat sinks, bronze or brass pump parts such as impellers or volute assemblies, and even metals used in the filters. This is called corrosion. This small amount of copper gets dissolved from the equipment or components and then mixes with the main body of water in the pool or spa.

Another related way copper gets into the water is by water velocity through copper pipes and fittings. Water that is moving faster than the recommended velocity through a pipe will erode the pipe. This happens when too large of a pump is used on a system than it was designed for and sometimes when a solar water heating system is used for a pool or spa.

The final way that copper can get into the water also comes from the equipment but for a different reason. A common practice is to chlorinate a pool by placing a trichlor tablet (trichloro-s-triazinetrione) into the pool or spa skimmer. Also, some pool owners have placed bromine tablets in their skimmers. Water flowing over the tablet dissolves a small portion of the tablet and carries it through the equipment and back to the pool or spa. Trichlor tablets have a very low pH of about 2.8 while bromine tablets are about 4.0. If enough of the tablet dissolves, the pH of the water flowing over the tablet acquires a low pH too. We have seen pHs from 3.0 to 7.0 – all of which can cause metal components to dissolve. Please note: Some manufacturers have produced special trichlor tablets and sticks that are designed to placed in the skimmer. These products will not be a problem if used properly.

Pumps in residential pools run about 6-8 hours a day. Spas run 2-3 hours. This means that a pump can be off 16-18 hours a day in a pool and more than 20 hours in a spa. When the equipment is not running, the trichlor or bromine tablet in the skimmer continues to dissolve. This causes all of the water in the skimmer and even down the pipe below the skimmer to get a really low pH. Then, when the equipment turns on tomorrow, this low pH body of water in the skimmer heads straight for the equipment where it dissolves some of metal.

Copper also gets into the water is by adding chemicals through the skimmer with the pump running. With many chemicals, this is OK. Check and follow manufacturer's directions for adding chemicals. However, if acid or acidic chemicals are added, the same corrosion occurs.

Copper can get into water on purpose by using an ionizer (sometimes called a copper/silver or copper ionizer). However, it is very important when using these devices that you follow all manufacturer's directions for use. Keep the pH in the recommended range (usually a little lower than NSPI recommended levels). Test the water with a copper test kit and adjust the output to maintain the recommended level of copper (usually 0.2 to 0.5 ppm). Add a sequestering or chelating agent if directed. Ionizers will not cause staining if used properly.

Copper does not biodegrade or break down in the water so it just builds up. Eventually, the water can no longer keep the amount of copper dissolved. This is called the saturation point. The saturation point for copper in most pools and spas is about 0.2 ppm or maybe 0.4 ppm depending on pH and alkalinity. Higher levels cause stains. You may remember that calcium and magnesium also reach a saturation point in the water. Once copper reaches its saturation point, copper combines with certain other chemicals present in the water and forms a precipitate. Copper usually combines with sulfates ( ) in the water to make copper sulfate ($CuSO_4$) – a blue-green particle. This copper sulfate then attaches to the walls of the pool or spa and a stain is created. This stain can be on the walls or on people. Copper and other metals can also combine with hydroxides, carbonates, phosphates, silicates, cyanurates to form any number of stains and precipitates which can be almost any color.

The copper sulfate bluish-green stains show up on kids first because they spend many hours in the water and second, many kids have blond hair when they are young. The green color shows up on blond or white hair better than on brown, black or red hair. The white part of fingernails are next, then cotton, white bathing suits.

To remove the copper or other metals from the water, use a sequestering or chelating product. These are usually called metal inhibitors or metal removal products.

As you can see, it's really not the chlorine that causes the green hair, it's the copper. Chlorine gets blamed because the most common suspect is the chlorine tablet in the skimmer. This caused it, but it's not the chlorine in the tablet, it's the low pH.

To remove the stain from hair or fingernails use one of the commercially available "chlorine removing" shampoos or enzyme products. You also could dilute a metal removal or inhibiting pool or spa chemical with a lot of water, apply to hair, leave on for a few seconds and rinse. This is not the best approach as these chemicals may damage the hair or get into eyes but, as a last resort and carefully, it could be done. Better to use a product designed for this purpose.

Don't blame chlorine for copper's problems.