

# Interference

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Just by looking at the title, one might initially assume that the following subject matter would seem to be a bit vague. Are we talking about pass interference taking place during a football game? Perhaps the interference is when you're right in the middle of the Super Bowl game as you're tossing down brewskies, brats, and nachos when someone comes into the room and says, "Can we talk?" Maybe it's when you're playing a nickel-bright salmon at your favorite fishing hole and a drift boat just happens to stray into your 'catch' area. (This could turn out to be MORE than interference!). And it could be as simple as a tree branch hanging in front of your satellite dish causing lines and snow on your TV. As you can see, these examples are but a few samples of interferences. Let's look at one interference in particular that, although sometimes never considered, could cause serious consequences when dealing with sampling and analytical results in your water system.

**Question:** "My DPD test kit shows that I have 3 ppm free chlorine in a freshly drawn water sample. I use another type of free chlorine test kit on the same sample and it shows 0 ppm of free chlorine. Which test is correct?" First, here is some background information: Free Available chlorine is that portion of chlorine in the distribution system that disinfects the water by killing bacteria that may be present. The two forms of chlorine present in the water are free chlorine and combined chlorine. Total chlorine is the measurement of both combined chlorine and the free chlorine. Combined chlorine is formed when organic and inorganic contaminants react with the available chlorine in the water. Chloramines are formed when the chlorine reacts with ammonia compounds. As foreign matter increases in the water – an increase in 'demand' for more chlorine will result. Hence, there can be more combined chlorine than free chlorine and disinfection capabilities diminish. Two remedies are to either remove the contaminants or increase the chlorine dose (breakpoint chlorination). But these are not the types of interferences in question. Sure, 'stuff' in the water *interferes* with the amount of free available chlorine that is necessary to assure disinfection capabilities.

**The larger picture:** The interference even more crucial is the one that takes place when testing for free chlorine residuals. To assume that you have sufficient residuals to support disinfection can cause a false sense of security. "I had a good free chlorine residual at collection time, yet I still had a 'positive' routine bacteria sample." When collecting routine bacteria samples at dedicated sample sites with a chlorinated water supply, you should also be testing for chlorine residuals at that site as well. Chlorine in the sample as hypochlorous acid or hypochlorite ion (free chlorine) immediately reacts with DPD (N,N-diethyl-p-phenylenediamine) indicator to form a magenta color which is proportional to the chlorine concentration. Contaminants (and other chemical properties) in the water sample can react with DPD and also form the magenta color. That means there may NOT be a sufficient level of free chlorine and yet a color still forms. Now that's an interference! False results are as useful as no results at all. The bottom line is that some water systems may think they are reaching disinfection levels that are desired and tested for – but may not be! Even worse - bacterial levels (and resulting positive samples) may be increasing due to a false sense of having sufficient levels of chlorine.

Manganese appears to be one of the most common interference substances at this time. However, according to Hach Chemical Company, there are additional substances that can cause interference. Acidity and alkalinity can affect DPD test results. Chloramines (organic) may interfere. Ozone interferes at all levels. There are many more interfering substances listed on Hach's list. I encourage you to consult Hach Chemical for the complete list as the specifics are too numerous to list here. They also mention how to treat samples to deal with the various interferences. It is important to remember that some test kits available may not have the same interferences as DPD. Please keep in mind that the Department should be contacted for a list of approved testing devices and materials.

Another reason for researching this subject was brought to our attention by a local laboratory. It was discovered in the lab that prior to performing a coliform bacterial analysis, a chlorine test on a 100 ml sample yielded a magenta color. That being the case, the sample had to be thrown out. However, after exploring the situation, it was the interference from manganese that caused the color in the sample.

With permission from Beth Meyers from Waterlab, I would like to site a portion of her letter that alerted us to this situation. I think her letter says it best:

“Just found out about a serious interference with the chlorine residual color development with DPD. Labs now are required to check ALL coliform bacteria samples for chlorine (chlorinated system or non-chlorinated system) before running the coliform bacteria test. Any pink color INVALIDATES the sample and requires another sample be taken. This rule started July 1. Bottles are supposed to have enough sodium thiosulfate to neutralize any chlorine in the water. The reasoning is that the pink color on DPD means the chlorine exceeded the neutralizing capability of the thiosulfate. However, we have had to invalidate several samples for pink color but didn't smell any Cl<sub>2</sub> odor. After a couple weeks of this, I decided to call Hach and see if anything else produced the pink color. Yes, Manganese and THMs (and a few other things) will produce the pink color on their own. Manganese is huge in the Willamette Valley and other parts of Oregon. This finally explains to me why I would have bacteria tests fail yet the customer recorded a chlorine residual of 0.4 or 0.6 or whatever. They probably had an interference color development. And thinking back, these were often those that had the higher manganese levels.”

Beth goes on to mention that there are some test strips on the market that have less but still some interference. “The dip test strips also have problems – are only usable at pH=7. (So am I going to have to test the water for pH and manganese and THMs BEFORE I can run a coliform test?) So for systems with manganese or THMs (specifically bromoform) in their water, the DPD chlorine kit may be reading color development for something else and their true Chlorine Residual level may be much lower than the kit reads.”

We constantly strive to meet the goals and requirements of the Safe Drinking Water Act to insure safe and affordable drinking water to the customer. Nature seems to always throw a ‘curve ball’ (interference?) that makes ‘going by the book’ more challenging. Thanks to the diligence of many dedicated people in this industry, we are able to discover new and more efficient ways to meet those goals. Regulations are one thing – making good drinking water is up to our own creative efforts and ingenuity. Thank you Beth for the helpful insight