Do You Know Disinfection? By, Dave Cole

In all my travels and training sessions, I get to meet a great number of operators. Some of them new to our business, many have been doing this for several years. I have been in this business since the 70's and I find myself having to look up information quite often. It recently made me wonder how much I know and/or have forgotten about the disinfection process. As we all know, waterborne disease agents (pathogens) have been implicated in a variety of human illnesses. These pathogens belong to three broad groups – all very different from each other. Do you know what they are? They are the bacteria, the viruses and the protozoa. The diseases they cause in man can vary from comparatively mild Discomfort, to even death.

I get into many discussions about disinfection and it's alternatives. Several factors can determine the effectiveness of your process. The pH of water being treated can alter the efficiency of disinfectants. For example, chlorine disinfects water much faster at a pH of 7.0, than at a pH of over 8.0. I wonder how many of you with groundwater systems monitor your pH on a regular basis. We know it is a major factor in the disinfection process, yet we don't monitor it daily. Of course, surface water systems deal with another whole set of problems that effect the disinfection process. Excessive turbidity we know greatly reduces the efficiency of the disinfecting chemical or process. Did you also know that organics found in the water could consume great amounts of disinfectants while forming unwanted compounds? Most common would be trihalomethanes, which are undesirable compounds formed by reactions between chlorine and certain organics. Those of you from surface water systems are very familiar with them and know they may become even more stringent with the regulations.

When chlorine is added to water containing organic and inorganic materials, it will combine with these materials and form chlorine compounds. If you continue to add chlorine, you will eventually reach a point where the reaction with organic and inorganic materials stops. At this point, you have satisfied what is known as the "CHLORINE DEMAND." The chemical reactions between chlorine and these organic and inorganic substances produce compounds. Some of these compounds have disinfecting properties; others do not. In a similar fashion, chlorine reacts with the water itself and produces some substances with disinfecting properties. The total of all the compounds with disinfecting properties, PLUS any remaining free chlorine, is known as the "Chlorine Residual." The presence of this measurable chlorine residual is what indicates to you that all possible chemical reactions have taken place and that there is still sufficient "Available Residual Chlorine" to kill the microorganisms present in your water supply. Now if you add together the amount of chlorine needed to satisfy the chlorine demand, and the amount of chlorine residual needed for disinfection, you will get your "Chlorine Dose." This is basically the amount of chlorine you need to add to disinfect your system.

When determining how much chlorine you will need for disinfection, remember you will be attempting to produce a certain chlorine residual in the form of "Free Available Residual Chlorine". Chlorine in this form has the highest disinfecting ability. BREAKPOINT CHLORINATION is the name of this process of adding chlorine to water until the chlorine demand has been satisfied. Further additions of chlorine will result in a chlorine residual that is directly proportional to the amount of chlorine added beyond the breakpoint.

Another critical factor we need to know is that both chlorine residual and CONTACT TIME are essential for effective killing of pathogenic microorganisms. Contact time has been a very hot topic as of late. Contact time is determined by the amount of time elapsed before chlorine residual gets to your first customer. Complete initial mixing is very important. And as we already discussed, changes in pH affect the disinfection ability of chlorine and you must reexamine the best combination of contact time and chlorine residual when the pH fluctuates. The lower the pH, the better the disinfection. Most of us already know a lot of the information delivered in this article. The amazing part of this to me is that all this is included in the Grade C operator certification course. So if any of this was "news" to you, go back and refresh your knowledge. And remember, we at Rural Water are out there to help you. So give us a call.