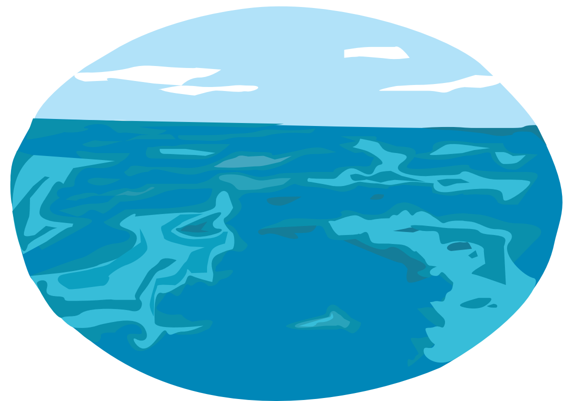
Smart News from Aqua Smart, Inc.

October, 2001 Volume 1, No. 3

Inside this Newsletter

1



Zebra Mussels

Zebra mussels that plague power plants and drinking water systems have a new enemy, SeaQuest manufactured in Atlanta, Georgia by Aqua Smart, Inc.. This is the same safe product used for years by numerous public and private water systems around the world to control corrosion, scale, lead & copper, distribution piping deposits, discolored water, and THM problems. SeaQuest joins with liquid sodium hypochlorite treatment used to control zebra mussel infestations.

The zebra mussel, and its imported relative, the quagga, represent one of the most economically staggering problems to face power and drinking water supply plants this century. By attaching themselves to water pipes or anything they can get a hold of, these damaging clams pollute drinking water, cut off flow through cooling water, and clog intake valves. Most important, they are life threatening when clogging safety system fire fighting pipelines. Potential damage estimates to the Great Lakes alone have exceeded $5 billion.

In attempts to wipe out this problem, scientists have studied and learned more about the zebra mussels life cycle. It is now known that zebra mussel spawning periods start earlier and end later in the year than previously thought. Also, the average female has the ability to produce over one million eggs yearly compared to previous thought 40,000. Today scientists know that infestations have spread much quicker than first predicted from Northeastern Canada to Florida and from New York to Denver. In addition, because spawning can occur in water temperatures down to 44oF, the infestations in the southern part of the US could last year-round.

Extensive research is seeking new treatments because current methods have problems:

1. Thermal shock this is limited to only a few power facilities having the design ability to use this approach,

2. Scraping this includes physical removal of mussels from the pipelines using divers, cleaning with compressible polyethylene plugs (known as pigs), or manually pressure cleaning. All are time-consuming and costly.

3. Chlorine or bromine gas this requires that a potable water supply be available to maintain and operate the treatment system and that air scrubbers filter polluting exhaust. Because of possible dangerous leaks and other handling hazards associated with chlorine and bromine gas, many power plants, manufacturing plants and municipalities are required by their insurance underwriters to switch to liquid sodium hypochlorite.

4. Potassium permanganate this is considerably more expensive than chlorine treatment. Also, residual manganese can cause piping tuberculation or pinkish discoloration in finished water.

5. Non-oxidizing cationic surfactant biocides use as a molluscide is currently approved in only a few states, and there is great concern as to its long term effect on the environment.

6. Liquid sodium hypochlorite this treatment is most widely used because it is in the year than previously thought.

However, there are three operating problems:

a. corrosion deposit build up within the liquid sodium hypochlorite feed lines and water intake lines,

b. stalagtite hard water deposits build up within the liquid sodium hypochlorite feed lines and water intakes.

c. “gassing” within the intake lines causing cavitation of the liqiuid sodium hypochlorite feed pumps.

The first two problems impede the treatment, while the third problem stops the treatment altogether. When SeaQuest is added directly to the liquid sodium hypochlorite tanks (or drums), all three operating problems disappear and effective continuous control is reestablished.

One example of this success occurred at a major northeastern system, heavily infested with zebra mussels. First they used liquid sodium hypochlorite to prevent clogging their intake lines. When they discovered hard water/corrosion deposits severely restricting the flow of treatment, they were forced to hire divers to manually scrape these deposits at a cost of $20,000 per dive. But after only 2 weeks, the problem returned. To get rid of the problem permanently without spending more money on divers, they decided on SeaQuest. After several SeaQuest applications, the deposits were removed and full design flow capacity returned.

At another northeastern system, a ìgassing ì problem developed just where the sodium hypochlorite feed entered into the intake line. This ìgassingî built up so much pressure that the liquid sodium hypochlorite feed pumps stopped pumping. After several SeaQuest applications, the problem disappeared totally and never returned upon continued use of SeaQuest.

2 Plastic Piping & Rubber Gaskets

Below is a reprint of a English translated French abstract published in Sciences, Methodes, 1993, 88, No 7/8, 355-360 entitled ìEncrustation of Surface of Plastic Materialsî authored by J. Ledion, Y Gueugnon, C. Ribal, P. Combaz, and J. Verdu.

“Scale formation might occur more rapidly on plastic surfaces in certain cases than on metals when both were in contact with the same water. The formation of a deposit of calcium carbonate as a consequence of chemical reaction between the water constituents was assisted by the electrostatic charge imparted to the surface of a plastic pipe by the action of flowing water. The finer the nuclei around which precipitation took place, the more rapid was the process of scale formation. The results of laboratory experiments with a variety of polymeric materials are reported in which the effects of different waters, methods of initiation of precipitation, and rate of circulation were studied. The least polar of the polymers were those that were most susceptible to scale formation (ie PE, PP and PTFE). The extent of mineralization of the water was a secondary factor controlling scale deposition especially where sealing had been initiated earlier; it was also possible for scale formation to occur due to contact with relatively soft water over a sufficiently long period.”

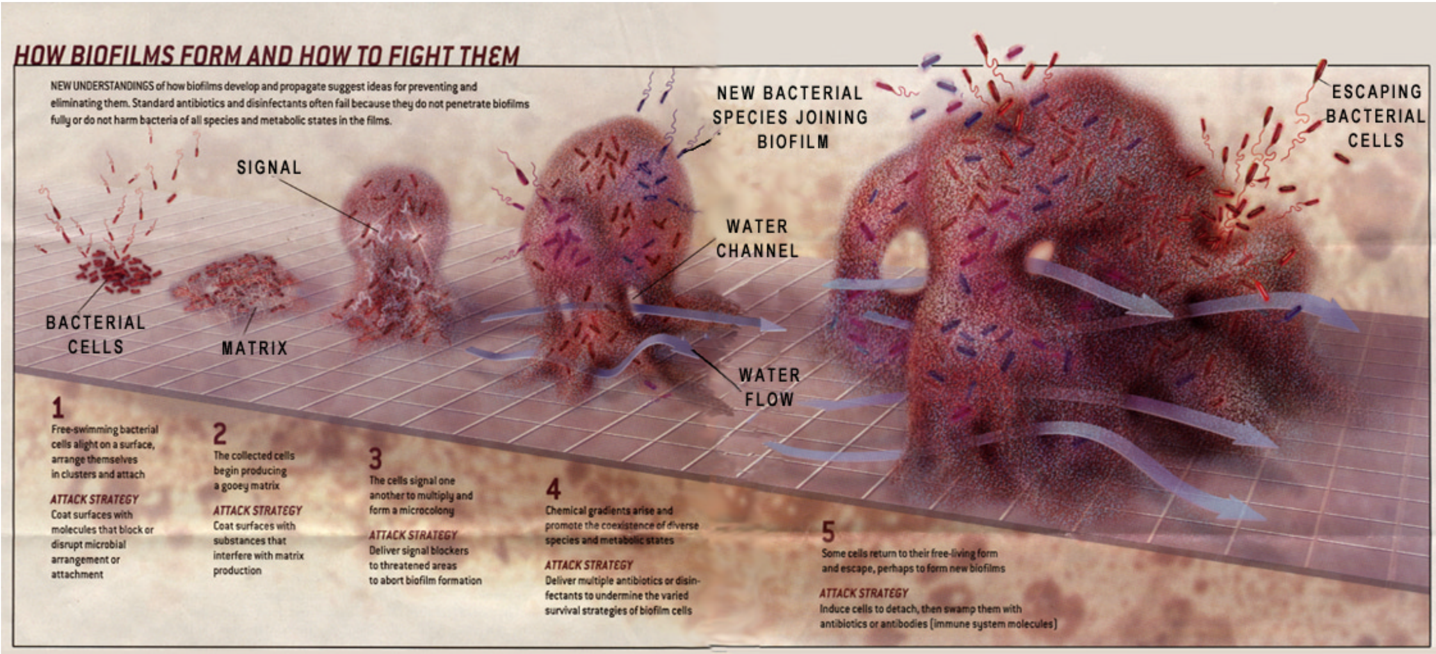
Reprinted from WaterWorks NSF International Summer 2001.

“A troubling question in the water industry today is the length of time that rubber products (elastomer products such as gaskets and O-rings) will function properly under water conditions with a chlorine residual and/or chloramines present.

Specifically at issue is how chlorine and chloramines (formed from reaction of chlorine with nitrogen-containing compounds) affect the performance of elastomeric materials.

To address this concern, the American Water Works Association Research Foundation (AWWARF) supported a study on how rubber materials performed under exposure to these substances. The study found that chloraminated water was most detrimental to certain elastomers formulated with natural rubber or synthetic isoprene variations. These materials had greater cracking, loss of elasticity, and loss of tensile strength than completely synthetic polymers specifically developed for chemical resistance.

Based on that study, the American Society of Testing Materials (ASTM) developed a standard test method to evaluate the *Effect of Aqueous Solutions with Available Chlorine and Chloramine (ASTM D 6284).* The method monitors changes in mass, volume, and hardness with a visual turbidity rating of elastomers exposed to aqueous solutions with chlorine and chloramines.”



3 How do biofilms form and how do we fight them?

[As condensed from ìBattling Biofimsî by J. W. Costerton and Philip S. Stewart appearing in Scientific American, July 2001.]

Some biologists long ago attempted examining bacteria living in biofilms using ordinary microscopes. They always saw some bacteria, but not being able to see beneath the surface always concluded that cells inside were mostly dead and jumbled in random clumps. This view remained consistent until about 10 years ago when bacteriologists employed a technique called laser scanning confocal microscopy. This technology enabled investigators to view slices at different depths within living biofilms, stack the planes together, and create a three-dimensional representation. Now scientists realize bacterium, once viewed to be the lowest form of existence, occupies a much higher rank in the scheme of life.

Applying this approach, John Lawrence of the Canadian National Water Research, Douglas E. Caldwell of the University of Saskatchewan, and J. W. Costerton from the Center for Biofilm Engineering at Montana State University, demonstrated for the first time that bacteria grow in colonies and consist of only 1/3 of what is there. The rest is a gooey substance cells secrete, which invariably absorbs water and traps small particles.

The goo holds each microcolony together. This goo allows biofilm to be built of countless colonies separated only by a network of water channels. The water traversing the channels bathes each congregation of colonies, providing dissolved nutrients while removing waste products. The outer cells are served well by this plumbing system, but the interior cells are cut offÖeven though they can stay alive and dormant indefinitely. The density of the aggregation and the biofilm matrix act as barriers to water flow. So inside cells must make do with nutrients that diffuse toward them. Because the biofim is mostly water, most small molecules and ions can move through freely.

Such chemical reactivity gives rise to small scale changes within the biofilm. For example, oxygen concentration varies radically between locations as close as five hundredths of a millimeter apart (about the width of one human hair). This means that one cell may look and act very different from its neighbor even though they are genetically identical. Similarly, local conditions affect production of toxins and other disease causing substances. Consequently, some cells may inflict little harm, whereas others (genetically the same) can be lethal. This wide range of conditions also allows several different species to live side by side symbiotically where both aid each other (i.e. one thriving on the metabolic waste of the other).

Why, exactly, are these bugs so tough to kill? The fact is that anything normally lethal to the bacteria (such as chlorine, chloramines, etc.) has great difficulty penetrating biofilm containing cells that produce enzymes known as beta-lactamases. These enzymes degrade the lethal agent faster than it can diffuse inward, so the

HOW BIOFILMS FORM cont'd.

lethal agent never is able to reach the deeper layers of the biofim. Too, lethal agents must pass layer by layer consuming more lethal agent then what is normally thought to be effective. It is easy therefore to be lulled into thinking there is enough lethal agent present to do the job when there really is notÖleaving many bacteria still alive and active.

Other factors now understood aid in keeping these bugs alive. Consider if a biofilm contains regions that are starved of an essential nutrient. The cells in these areas, which are alive and not reproducing, will survive exposure to lethal agents. Because active and inactive cells are so close to one another within the biofilm, and because the surviving bacteria can use the dead bacteria as a nutrient source, the surviving bacteria then can restore the biofilm to its original state in only a manner of hours.

Research recently has revealed that species attaching themselves to substrates such as the wall of a water supply pipe, can start producing gelatinous polymers making up much of the biofilm within 15 minutes of attachment. How do they know to do this? There seemingly is a mechanism whereby these bacteria communicate with one another through the production of a very specific chemical. Once there is enough production of the communicative chemical, it triggers production.

Biofilms now have been linked to all of the following: periodontal disease, prostrate infections, tuberculosis, kidney stones, Legionnaires disease, and some infections of the middle ear. Methods of eradication being considered now are;

1. **reduction in the bacterias ability to bind to substrates,**
2. **interference with synthesis of biofims by coating the substrate,**
3. **and targeting the communicative chemistry responsible for activating biofilm production.**

For drinking water distribution piping, consider now the action of SeaQuest.

4 On line

NSF is the only body in the United States that certifies all drinking water additives and equipment, as well as now taking over products certified for USDA applications. There is no other body in the US and any additive or equipment used to treat or service drinking water supplies must have NSF certification to insure maximum health standards

A problem recently noted by NSF dealt with products originating from an NSF listed manufacturing plant (inspected and certified by NSF personnel) that may not necessarily be certified at it point of final use. How is this so?

a. Reused or recycled containers may not have met pre-established certified wash out procedures,
b. Onsite storage tanks may not have verification of certification unless inspected by NSF,
c. Certified products sold through intermediate distributors could have been repackaged at a non NSF certified location.

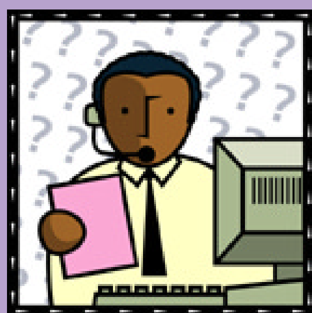
All the above may result in product contamination from the repacking or transfer operations outside the scope of NSF. Water utilities must be confident that any additives which are NSF certified are in compliance with ANSI/NSF Standard 60 from production to delivery. As a plant operator or regulatory official with jurisdiction, one must be aware of the process of transportation and all other handling of drinking water additives being used by the treatment facility.

5

Thought of the month

The goal of a drinking water distribution system is to deliver quantities of water to wherever and whenever it is needed at an acceptable level of water quality. Although water quality may be acceptable when leaving a treatment plant, changes can and do occur through distribution piping. In the past, only hydraulics and economics formed the basis of maintaining distribution operations, with little attention being paid to water quality. Today, it is understood that in order to optimize water quality, much more time, effort, and money must be spent on maintaining clean and protected distribution piping.

6



Anyone know the answers?

1) Which two anions dramatically increase corrosion rates and iron uptake (into the water from the pipe)?

2) What is the difference between soft, moderately hard, hard, and very hard water?

3) What is the name of the only corrosion control product proven to provide optimum corrosion control to desalinated and reverse osmosis water supplies.

7

The ice man cometh

Stuart, a professional ice carver, ran into one of our SeaQuest representatives and began discussing problems he was having with his ice carvings from the well water at his house. Stuarts well water was very hard and causing white flaking and a haze in his ice blocks he was trying to prepare for carving. Stuart called us and asked about SeaQuest. We told him to put a DF 2 non-electric dry SeaQuest feeder on the water line coming into the house from his private well, fill it with SeaQuest, and then watch what happens.

Shortly after Stuart did the installation, he called all excited. ìMy ice blocks are crystal clear and boy am I a happy carver!î Stuart called those in charge of the professional organization for ice block carvers (where he is a member) to express his great success. Now Stuart is selling the SeaQuest to other professional ice carvers and to other friends owning private wells who have heard about his success.

We wish Stuart the best of success and look forward to viewing his crystal clear ice carvings for many years to come.

8

Desal and RO

Phosphate Blend Provides Optimum Corrosion Control in Desalination and Reverse Osmosis Water

INTRODUCTION

Over the past ten years, the development of Desalination and Reverse Osmosis systems have come into their own as excellent alternative drinking water supplies, particularly within locals which have either a shortage of natural ground/surface water or who are very near seawater supplies. Although these technologies today are well developed and frequently integrated within the general scheme of high quality drinking water supply alternatives, there still remains certain problems associated with producing such high quality water.