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BROMATE IN SODIUM HYPOCHLORITE POTABLE WATER TREATMENT (11/19/04)

General

On December 16, 2001, Stage I of the Disinfectants/Disinfection Byproducts Rule required potable water plants to meet a bromate MCL of 10 parts per billion (ppb) in their effluents. Plants that use ozone in their treatment process will be required to test monthly for bromate. Plants that do not use ozone, but use sodium hypochlorite solutions will not need to test, they will be protected by certification to ANSI/NSF Standard 60 and/or the AWWA Standard for Hypochlorites (B-300). Industry worked with both organizations to develop specifications that meet this MCL. The sodium hypochlorite industry wants to provide a realistic safety margin so that testing for bromate will not be required in potable water treated with this chemical.

How did Bromates Get into Sodium Hypochlorite & Can they be Removed?

Bromide ions are found in the salt used to make both chlorine and sodium hydroxide, the two raw materials reacted to form sodium hypochlorite. Virtually all of the bromine in chlorine and the bromide in the sodium hydroxide quickly becomes bromate at the pH of NaOCl. The concentration of bromide varies tremendously in different salt sources. It also partitions between the two chemicals (chlorine and sodium hydroxide) differently depending on the type of electrochemical cells used in the process. Some plants can change their source of salt, while others are located near salt mines and are limited to the salt they have available. Current technology cannot easily or economically remove bromate or its precursor from either the initial salt, the two reactants or the final sodium hypochlorite solution. However, there are other solutions to the problem.

What Should My Facility Be Doing About This Issue?

If your plant uses sodium hypochlorite, but does not ozonate, chemicals certified to meet ANSI / NSF Standard 60 will allow you to easily meet the new bromate MCL up to the maximum dosage dictated in Standard 60. **It is very important that you do not exceed the maximum dosage rates listed for sodium hypochlorite solutions that are certified to meet NSF/ANSI Standard 60.** You should also be in contact with your supplier of sodium hypochlorite.

Each facility must make certain that the sodium hypochlorite they purchase is certified for their maximum anticipated dose. Certification to ANSI/NSF Standard 60 may be done to a lower MUL (maximum usage level) than the standard MUL of 10ppm as chlorine. In some cases, a product could be certified to a MUL as low as 2.0ppm.

If your water plant does not expect to exceed this value, then such a product is suitable for that site. It is important that you make certain the product you purchase is certified for your maximum anticipated dosage.

What if Your Facility Uses Both Ozone and Sodium Hypochlorite?

There are some facilities that use both of these disinfectants. Plants using ozone will be required to test for bromate. The ozonation of water containing bromide ions can produce bromate as well as brominated organic compounds. The amount of bromate produced varies tremendously from plant to plant and depends on bromide ion concentrations, organic carbon levels and other plant-specific treatment parameters. Therefore, plants using ozone should work with their sodium hypochlorite supplier to ensure that the combination of ozonation and sodium hypochlorite do not exceed the bromate MCL. Some of these sites may wish to consider disinfecting with gaseous chlorine which does not produce bromate. A national standard is not practical as there are two different and variable sources of bromate.

What Has Industry Done And What Is It Doing to Resolve This Issue?

The sodium hypochlorite industry became aware of this possible issue in 1997 at a water industry conference. At this conference a speaker from the UK reported unpublished information indicating high levels of bromate in sodium hypochlorite in the UK. Later that year the industry surveyed ten sodium hypochlorite manufacturing sites and learned that while US sodium hypochlorite bromate levels are much lower than those in the UK, the US sodium hypochlorite can be a significant source of bromate in finished water. The samples in this survey varied considerably from site to site without any apparent geographical trend. The industry informed EPA of this data in 1998.

The industry then prepared a strategy to identify' the sources of bromate in hypochlorite and develop methods to control the level of bromate in sodium hypochlorite. This research was extremely complex requiring the development of new analytical techniques for the measurement of bromate and bromate precursors in chlorine, sodium hydroxide and sodium hypochlorite. The industry used these new analytical techniques to study chlor-alkali plants and learned that mercury cell and membrane cell plants tend to partition virtually all of the bromide from the salt into the chlorine while diaphragm cell plants place most (70% to 80%) of the bromide into the sodium hydroxide.

This information allows sodium hypochlorite manufacturers to select raw materials from processes and production sites that are lower in bromate precursors. In addition, the study indicated that all of the bromine or bromide in these two chemicals converts quickly to bromate at the high pH and strength of sodium hypochlorite.

Also, the chlorine industry has developed a computer program that allows sodium hypochlorite manufacturers to determine the final bromate concentration in their sodium hypochlorite based on the bromide concentrations in their raw materials.

Recently, the industry did a second national survey of bromate in NaOCl with the help of an independent University in Wichita, Kansas. Over 60 samples were received and the results were consistent with the initial survey. The EPA, AWWA and NSF also received these data.

The Chlorine Institute has educated the industry about this problem, as well as, the EPA, the NSF and the AWWA. We have worked with sodium hypochlorite producers to reduce the level of bromate in their products. We are continuing to work with the NSF and the AWWA to develop realistic water industry standards. These must allow water plants using sodium hypochlorite to meet the MCL with an adequate margin of safety and at the same time provide viable sources of this chemical for drinking water treatment in the future.

Additional Information From The Chlorine Institute

The Chlorine Institute publishes Pamphlet 96, *Sodium Hypochlorite Manual* on sodium hypochlorite and produced a safety *video* on this chemical. The Institute also publishes Pamphlet 155 with an accompanying video covering the safe use of packaged chlorine for water and wastewater operators. Visit the "Publications" section of CI's website at *www.CL2.com* for pricing and ordering information for these and other publications.