

Hypochlorite Treatment Chemicals Specifications in NSF/ANSI Standard 60

By Blake Stark

The U.S. EPA enacted the Disinfectants/Disinfection Byproducts Rules to reduce drinking water exposure to disinfection byproducts. In many cases, disinfection of water is necessary to inactivate (or kill) microbial pathogens. However, disinfectant chemicals can react with naturally occurring materials in the water to form byproducts, some of which may increase health risks if consumed over many years in excess of the EPA's standard. This article focuses on test parameters in NSF/ANSI 60 for hypochlorite chemicals, which are used commonly for disinfection of drinking water, and how these parameters may be used as a screening tool for many contaminants which are regulated under the disinfection byproducts regulations.

Bromate

The EPA Disinfectants and Disinfection Byproducts Rule establishes an MCL of 10 ppb for bromate ion. As hypochlorite treatment chemicals, in addition to ozonation systems, are a known potential contributing source of bromate ion to drinking water, the single product allowable concentration (SPAC) for bromate in NSF/ANSI 60 was established at 3.3 ppb (one-third of the EPA MCL). Thus, an NSF/ANSI 60 compliant

chemical is verified not to contribute more than 3.3 ppb bromate ion, when dosed into drinking water at its maximum use level.

In addition, as many water utilities manufacture sodium hypochlorite chemicals through on-site hypochlorite generators (in lieu of, or in addition to, purchased bleach), criteria were also established in NSF/ANSI 60 to address the bromate-forming potential of sodium chloride salt, which is used as the feedstock for on-site hypochlorite generators. Many natural salt formations contain a small level of bromide, which can form and release bromate ion during the electrochlorination process when hypochlorite effluent is generated. Under the NSF/ANSI 60 requirements for electrochlorination salt:

- > Each certified manufacturer provides a declaration of the maximum bromide concentration of the product. Analytical verification is then made by the product certifier, on an annual basis, that the product's bromide concentration is less than or equal to the product specification.
- > The product's bromide specification may not exceed 59/kg in sodium chloride salt for electrolytic hypochlorite

generators at a maximum feed rate of 10 mg/L (as chlorine)⁺.

- > A higher concentration of bromide is permitted in NaCl salt used in generators that deliver lower maximum feed concentrations of chlorine, so that the total concentration of bromate does not exceed 3.3 ppb.
- > ⁺The 50 mg/kg limit is based on a base assumption that 3.3 ug/L (ppb) bromate will be produced from 3.5 pounds of NaCl containing 59 mg/kg bromide with 15 gallons of water to produce (via electrolysis) one pound of free available chlorine (FAC) equivalent disinfectant and dosed to affect a 10 mg/L FAC in the finished drinking water.

Perchlorate

Following the EPA draft health advisory of 15 ppb for perchlorate, and state regulatory limits for perchlorate established in California (6 ppb) and Massachusetts (2 ppb), NSF/ANSI 60 includes a general perchlorate SPAC/limit of 5 ppb (one-third of the EPA health advisory level) for all hypochlorite products. In addition, bleach manufacturers

may also have products evaluated and certified to the California SPAC of 2 ppb (one-third of the CA state MCL) or a Massachusetts SPAC of 0.7 ppb (one-third of the MA state MCL), for special evaluations tailored to these state regulatory limits.

Chlorate

NSF/ANSI 60 includes pass/fail criteria for chlorate as a required test parameter. A Health Canada guideline of 1 ppm has been established for chlorate. Accordingly, a SPAC for chlorate of 300 ppb (one-third of the Health Canada Guideline) is in place as evaluation criteria for chlorate in bleach chemicals.

As the concentration of perchlorate and chlorate in sodium hypochlorite has been shown to increase over time (as bleach is stored), a corresponding update to the labeling requirements in NSF/ANSI 60 requires a born-on date (original bleach manufacturing date) and any subsequent bleach repackaging dates to be shown on the product label or other documentation provided with the product shipment. This enables water utility operators to take steps to prevent accumulation of significant levels of chlorate and perchlorate in stocks of hypochlorite.

The Southern Nevada Water Authority completed an American Water Works Association (AWWA)/Water Research Foundation (WRF) sponsored study in 2009, *Hypochlorite-An Assessment of Factors that Influence the Formation of Perchlorate and Other Contaminants*. Whereas NSF/ANSI 60 is a health effects standard for the chemical vendors/products, many recommendations from the Southern Nevada study relate to the storage, use and handling of sodium hypochlorite by water utilities. These recommendations were incorporated into the AWWA B300 Hypochlorites Standard and include the following instructions:

- > Dilute hypochlorite solutions on delivery. Dilute a 15 percent solution by a factor of 2, which decreases perchlorate formation by a factor of 7.
- > Reduce storage temperature. Each 5 degree reduction in temperature reduces the rate of decomposition by a factor of 2.
- > Control pH between 11 and 13. Below pH 11, chlorate formation increases. Above pH 13, perchlorate formation increases. On-site generators typically are between pH 9-10 and the solutions should be used within one to two days.
- > Control the concentration of metal ions. Purchase filtered sodium hypochlorite solutions and use low metal ion concentration feed water for on-site generators.
- > Use fresh hypochlorite solutions when possible.

- > Use a low bromide salt in on-site generators to reduce the formation of bromate.

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