Government of Alberta

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Water Policy Information Bulletin 2/2011

Advice on achieving 4-log virus reduction with groundwater containing high levels of naturally-occurring ammonia

Purpose

1. The purpose of this Information Bulletin is to provide advice regarding the implementation of Water Policy Information Bulletin 1/2011 where there are high levels of naturally-occurring ammonia in groundwater.

Scope

2. The scope of this Information Bulletin is confined to those systems operating under the provisions of the Code of Practice for Waterworks Systems using High Quality Groundwater (effective April 1, 2009) (CoP).

3. These arrangements for exceeding chlorine disinfection Maximum Use Limits (MULs) only apply to drinking water systems currently operating under the CoP.

Background

3. To achieve the requirements of 4-log virus inactivation set out in Information Bulletin 1/2010, the drinking water must be subject to appropriate levels of disinfection. While most viruses are susceptible to routine levels of disinfection (whether as ultraviolet light (UV) or chlorine), the adenovirus group represent a challenge due to the resistant nature of the virus particle.

4. When considering disinfection by chlorine the “CT” concept is used. This uses the combination of disinfectant residual concentration (mg/L) and the effective disinfection contact time (in minutes) at maximum hourly flows to measure reduction in pathogen numbers (virus inactivation, in this case). Tables for CT values are published in the Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems (January 2006).

5. Similarly, when considering disinfection by UV, the UV dose applied is considered using the product of the intensity of ultraviolet radiation (“I”) and the length of time (in seconds) the water is exposed to the UV light. It appears that double-stranded DNA viruses, such as adenoviruses, are more resistant to UV radiation than single-stranded RNA viruses such as hepatitis viruses (e.g.

hepatitis A virus (HAV) although HAV shows more resistance to chemical inactivation than other viruses and so HAV is used as the target organism for deriving disinfection CT targets).

6. The common UV dose of 40 mJ/cm^2 commonly applied in drinking water treatment plants for inactivation of bacterial and protozoan pathogens is insufficient to inactivate adenovirus[1] and the additional UV intensity is likely to be uneconomic for many small to medium-sized drinking water facilities to consider. This leaves chemical inactivation by chlorine. To be effective against viruses, free chlorine must be used. For drinking water systems with high levels of naturally-occurring ammonia, the ammonia must be first removed either using a specific ammonia-removal technique or by adding chlorine. When adding chlorine, the levels added must exceed the chlorine demand exerted by the ammonia (i.e. break-point chlorination must be achieved). For some systems achieving free chlorine residuals will mean departing from the requirements of section 5.1.14 of the Code of Practice for Waterworks Systems using High Quality Groundwater (effective April 1, 2009) (CoP).

7. Section 5.1.14 of the CoP at sub-section (b) limits the amount of chemical being dosed into a drinking water to the limits set as the Maximum Use dose as set out in NSF/ANSI Standard 60 "Drinking water treatment chemicals – health effect" unless "otherwise authorized in writing by the Director". This information letter sets out the procedure to follow where it is considered that the most appropriate method for 4.0-log virus inactivation will require a departure from the requirements of this section of the CoP.

Detail

8. The certification of chemicals to NSF/ANSI Standard 60 includes a Maximum Use Limit (MUL) which ensures that any potential trace contaminants do not exceed their respective health-based limit (single product allowable concentration (SPAC)) even at the maximum dose stated for the product. It is possible to exceed the MUL and not exceed the health-based concentration of trace contaminants if the product has contaminant levels well below the SPAC. Determination of whether the MUL can be exceeded depends on the supplier (or suppliers) releasing the data used to obtain the NSF/ANSI 60 certification in combination with additional monitoring of the drinking water system. Such determinations will be undertaken on a site-specific, case-by-case basis by the Department.

9. In addition to determining whether the MUL can be exceeded, additional monitoring requirements may be put in place. While these will vary somewhat depending on individual circumstances, typically the monitoring requirements

[1] The US EPA, for example, under the LT2ESWTR requires a UV dose of 186mJ/cm^2 to receive a 4.0-log credit for virus inactivation.

may include an increase in frequency of sampling for ammonia levels, free chlorine, combined chlorine and chlorine residual. These will be undertaken on a daily basis until the stability of the treatment can be shown over three months at which point weekly sampling will be required. In addition, product sampling of batches of hypochlorite may be required for bromated and chlorate levels. Strict stock control on-site will be required to be demonstrated to ensure that issues around concentration, age and storage conditions do not adversely affect the hypochlorite[2].

10. As a result of changes to disinfection practice some increase in disinfection by-products may occur. Utilities should make every effort to maintain concentrations as low as reasonably achievable without compromising the effectiveness of disinfection[3].

Enquiries

10. Enquiries on this Information Bulletin should be addressed to the Drinking Water Specialist, Provincial Programs Section, Regional Integration Branch (Dr Donald Reid, Donald.Reid@gov.ab.ca, telephone number 780-644-8061).

[2] Further details are available in "Pamphlet 96 – Sodium Hypochlorite Manual" Edition 3 – Revision 1, November 2008. The Chlorine Institute, Inc. [http://www.chlorineinstitute.org/Bookstore/ProductDetail.cfm?ItemNumber=2919]

[3] Guidelines for Canadian Drinking Water Quality: Guideline Technical Document. Trihalomethanes. May 2006. Health Canada.