Source Water Characterization Workshop
Itinerary
April 28th 2011, Lord Nelson Hotel, Halifax, NS

Hosts: Nova Scotia Environment and the Centre for Water Resources Studies, Dalhousie University

Panelists: Jennifer Clancy, Stephanie McFadyen, Ian Douglas, Bob Andrews, Reid Campbell

Attendees: Members of Nova Scotia Environment, Health Canada, local consulting industry representatives, academia, Nova Scotia utilities, Canadian Water Network students

Purpose: Reducing the risk of microbial pathogens in drinking water is one of the most important aspects of drinking water management because pathogens can lead to disease outbreaks and death. To ensure safe drinking water, it's important to assess the risk associated with a source and install adequate treatment. Various approaches exist to characterize source waters and set required treatment levels.

The purpose of this workshop is to explore what approach is most appropriate to protect public health in Nova Scotia while having regard for the local setting and capacity of water utilities. The results of the workshop will be used to help guide revisions to Nova Scotia's water treatment standards and related policies and guidelines.

Thursday April 28th

8:30 – 8:45: Opening remarks and welcome to invited speakers and graduate students – Graham Gagnon

8:45 – 9:00: Nova Scotia context to source water characterization, including a basic overview of the Source Water Protection Plan process in Nova Scotia – Judy MacDonald

9:00 – 10:30: Theme 1 - Characterizing Source Water

Currently Nova Scotia Environment mandates the following parameters be sampled in raw water for surface water supplies: turbidity (daily grab), water volume (continuous). Temperature and pH are also to be monitored but at the CT control point for temperature and as required by process control monitoring if pH adjustment is practiced. A source water protection monitoring program is also required; specific parameters to be monitored are determined by municipal water utilities. In addition, the 31 parameters in the Nova Scotia Guidelines for Monitoring Public Drinking Water Supplies are to be sampled annually in raw water; this includes alkalinity, colour, hardness, pH, total organic carbon, metals and the nitrogen cycle. A full scan of the health-related parameters in the Guidelines for Canadian Drinking Water (published by

Health Canada) is also required every five years. Nova Scotia Environment can request that municipal water utilities have raw water quality analysed for viruses, *Giardia* and *Cryptosporidium* in raw water. Bacterial analyses (total coliforms and *E. coli*) are required for water leaving the treatment facility and in the distribution system. Other monitoring is required for treated water.

Proposed updates to Nova Scotia's Treatment Standards require raw water monitoring for *E. coli* where the municipal water utility and Nova Scotia Environment do not agree on the categorization of the source. Data from 13 facilities that currently voluntarily monitor for bacterial quality was assessed as part of this source characterization study; this includes information from the least to most impacted sources in Nova Scotia. Information from the other 27 surface water facilities was either not available or they do not collect this information.

Theme Leader: Ian Douglas

Key Questions:

1. What information should be collected and evaluated to assess risks in a watershed?
2. What baseline data should be collected to assess the vulnerability to microbial contamination? At what frequency?
3. What other factors should be considered to assess vulnerability?

10:30 – 10:45: Refreshment Break

10:45 – 12:15: Theme 2 - Microbial monitoring

Nova Scotia Environment proposed a "source categorization" process for the proposed updates to its Treatment Standards to recognize that more contaminated waters may require more than 3-log reduction for protozoa. Currently, Nova Scotia's Treatment Standards require 3-log reduction for *Giardia* regardless of whether the source is pristine or impacted. Categories were suggested on a qualitative basis to avoid the cost of raw water quality monitoring. Where the municipal water utility and Nova Scotia Environment did not agree on the categorization of the source, it was proposed that *E. coli* be monitored once every two weeks for a one year period. If average levels were below 10/100 mL for a lake or surface water impoundment or 50/100 mL for other sources, treatment requirements would be set at 3-log reduction. Where average *E. coli* levels exceeded these values, protozoa testing was to be conducted at least every two for a one year period using EPA Method 1623. The source was to be categorized based on concentrations of *Giardia* or *Cryptosporidium* (which was worst) using the average value where little variability was observed or 90^{th} percentile where significant variability was observed.

Numerous comments were received on this concept during public consultation, particularly that the qualitative assessment could be too subjective. Recognizing that *E. coli* is not considered the best indicator for protozoa but it is a simple and inexpensive test, Nova Scotia Environment undertook a source characterization project with Dalhousie University to further assess what microbial monitoring is most appropriate to characterize a source.

Theme Leader: Jennifer Clancy

Key Questions:

1. What microbial monitoring is best to assess the level of contamination of a source?
2. What are the advantages and disadvantages of protozoa versus *E. coli* monitoring?
3. How should monitoring results be evaluated when there is little variability (e.g. use an average?) or significant variability (e.g. use the 90^{th} percentile?)?
4. What constitutes "significant variability"?

12:15 – 1:00: Lunch

1:00 – 2:30: Theme 3 - Risk Management Frameworks

The Guidelines for Canadian Drinking Water Quality set health-based treatment goals for protozoa and viruses. For protozoa, a minimum of 3-log reduction of *Giardia* and *Cryptosporidium* is recommended. For viruses, a minimum of 4-log reduction is recommended. Depending on source water quality, a greater log reduction may be required. Updated technical guideline documents for protozoa and viruses were released for national consultations in 2010. The updated documents included a comprehensive discussion on quantitative microbial risk assessment (QMRA) as a risk assessment tool to estimate the burden of disease associated with drinking water. Burden of disease estimates are compared to an acceptable level of risk which is set at 10^{-6} disability adjusted life years (DALYS) per person per year in Canada. QMRA is a useful tool in estimating whether a drinking water system can meet the DALY target because disease surveillance systems in developed nations are not able to detect illness at such a low level.

Nova Scotia has adopted the multiple-barrier approach to drinking water management. Surface water supplies must meet a minimum of 3-log reduction for *Giardia* and 4-log reduction for viruses through a combination of filtration and disinfection. Disinfection must provide a minimum of 0.5-log inactivation for *Giardia*. Proposed updates to the Treatment Standards are intended to include requirements for a minimum 3-log reduction of *Cryptosporidium*, as well as establish a science-based framework to determine when a greater log reduction is required. Other components of Nova Scotia's multiple-barrier approach include the preparation of source water protection plans,

monitoring to demonstrate performance and the completion of a system assessment report every 10 years.

Theme Leader: Stephanie McFadyen

Key Questions:

1. What are the advantages and disadvantages of different risk assessment approaches from a utility comparison perspective?
2. Can QMRA be used as a tool by Nova Scotia Environment to assess microbial risks in source waters?

2:30 – 2:45: Refreshment Break

2:45 – 4:15: Theme 4 – Determination of required treatment levels

The updated protozoa and virus documents released for national consultations in 2010 identified the log reduction requirements associated with various concentrations of *Giardia*, *Cryptosporidium* and viruses. Recognizing that:

- limited lab capacity exists to test for *Giardia*, *Cryptosporidium* and viruses
- the tests are labour- and cost-intensive for municipal water utility levels
- that *E. coli* is not considered the best indicator for protozoa
- most watersheds in Nova Scotia have limited fecal pollution inputs
- 3-log reduction for protozoa achieves significant risk reduction and public health protection

Under what conditions should 3-log, 4-log, 5-log or 5.5-log reduction for protozoa apply for surface water supplies in Nova Scotia?

Theme Leaders: Bob Andrews and Ian Douglas

Key Questions:

1. How do you correlate vulnerability to a required log reduction treatment goal?
2. What are the advantages and disadvantages of other approaches, including but not limited to:
    - US EPA “treatment bin” model
    - Alberta – modified EPA approach
    - Quebec – use of E. coli
    - Health Canada protozoa guidelines
3. Is the quantification of *E. coli* or protozoa necessary or could a more qualitative approach be used?
4. If a qualitative approach is possible, how do you avoid misinterpretations or bias?

Summary and wrap-up

4:15 – 5:00 - Summary of conclusions from the four themes
- Discussion of outstanding issues
- Developing the path forward

5:30 – 7:30 Networking wine and cheese event with students, invited speakers and representatives from industry, government, and academia.