Boil Water Advisories in Newfoundland and Labrador: a Pilot Study

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Overview

- Amec to Wood
- BWA Refresher
- Pilot Study
- Conclusion

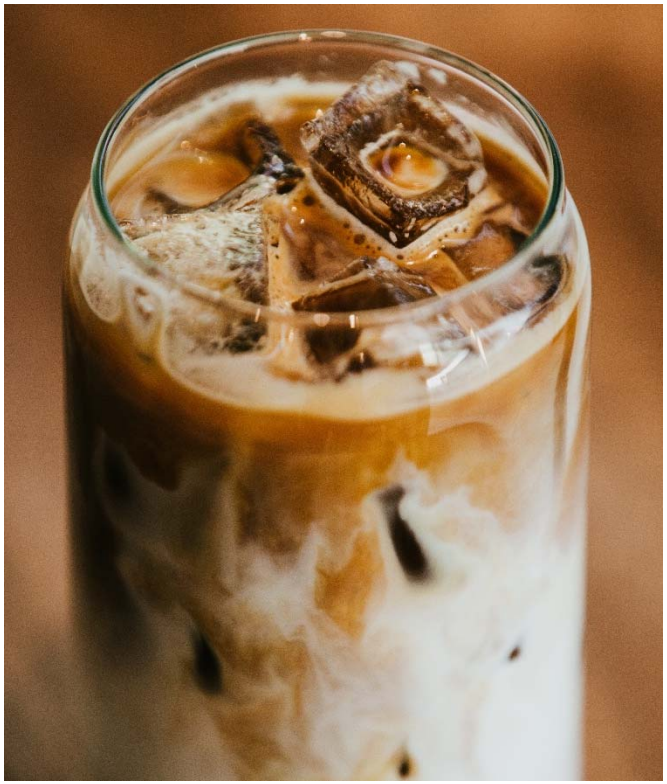
Amec … Amec Foster Wheeler … Wood

What is a BWA?

2018 Clean and Safe Drinking Water Conference

Informal pop quiz …

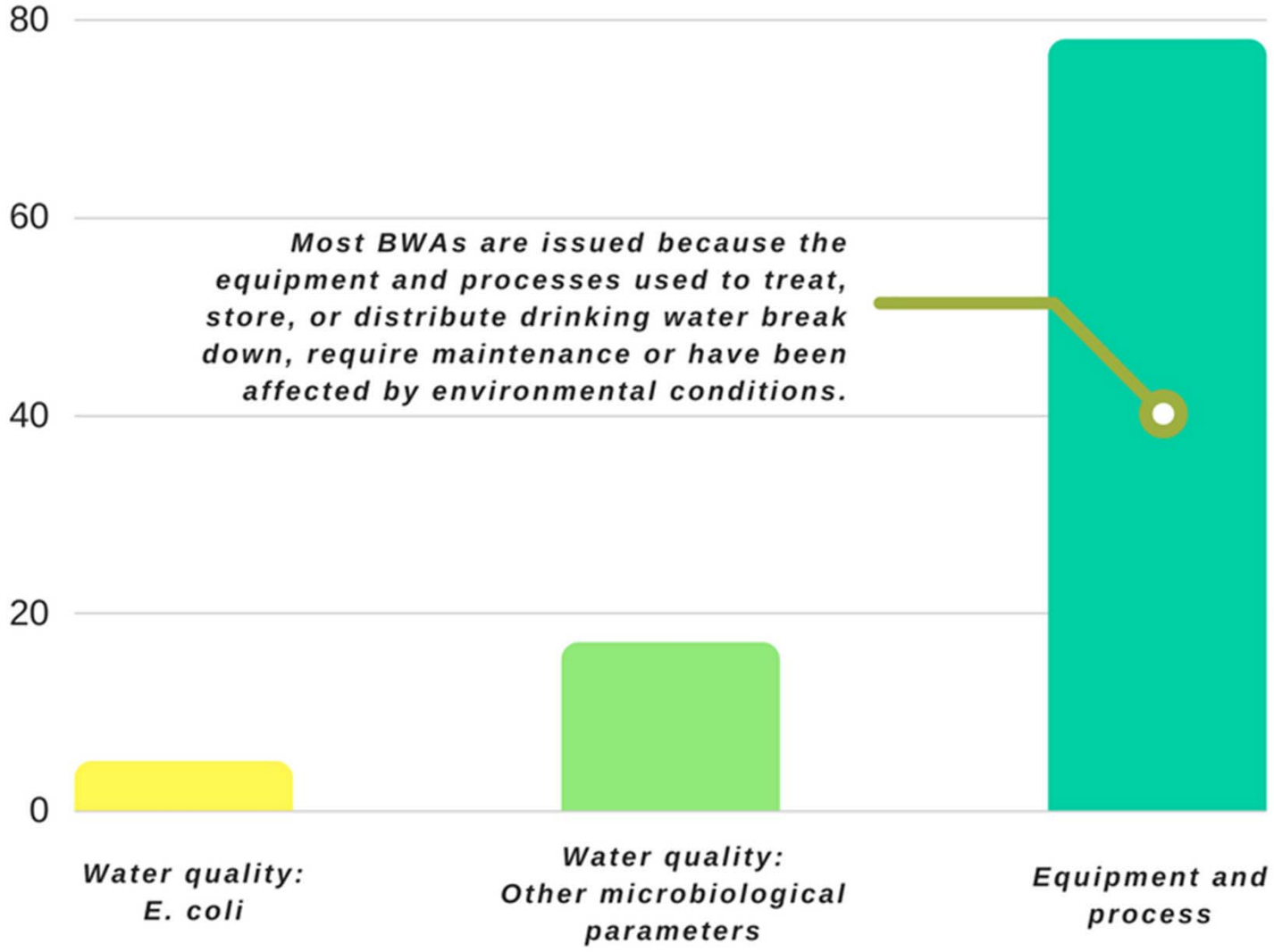
If a BWA is issued, use boil water for:

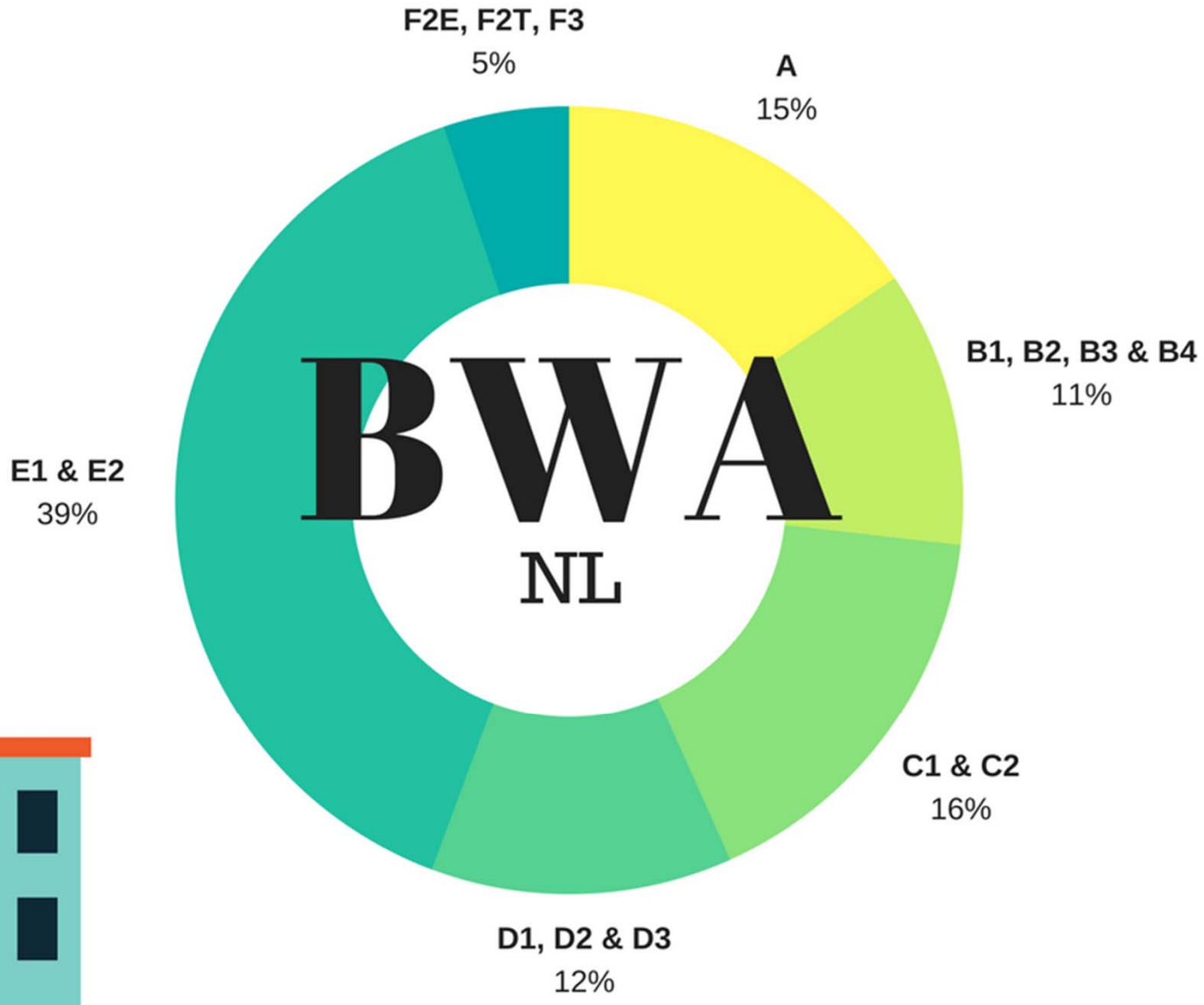


- Drinking
- Brushing teeth
- Making ice
- Cooking
- Washing fruits and vegetables
- Making coffee/tea and other hot drinks
- Making juice from concentrate and powders
- Making infant formula and cereal

Causes of BWAs

Canada 2015

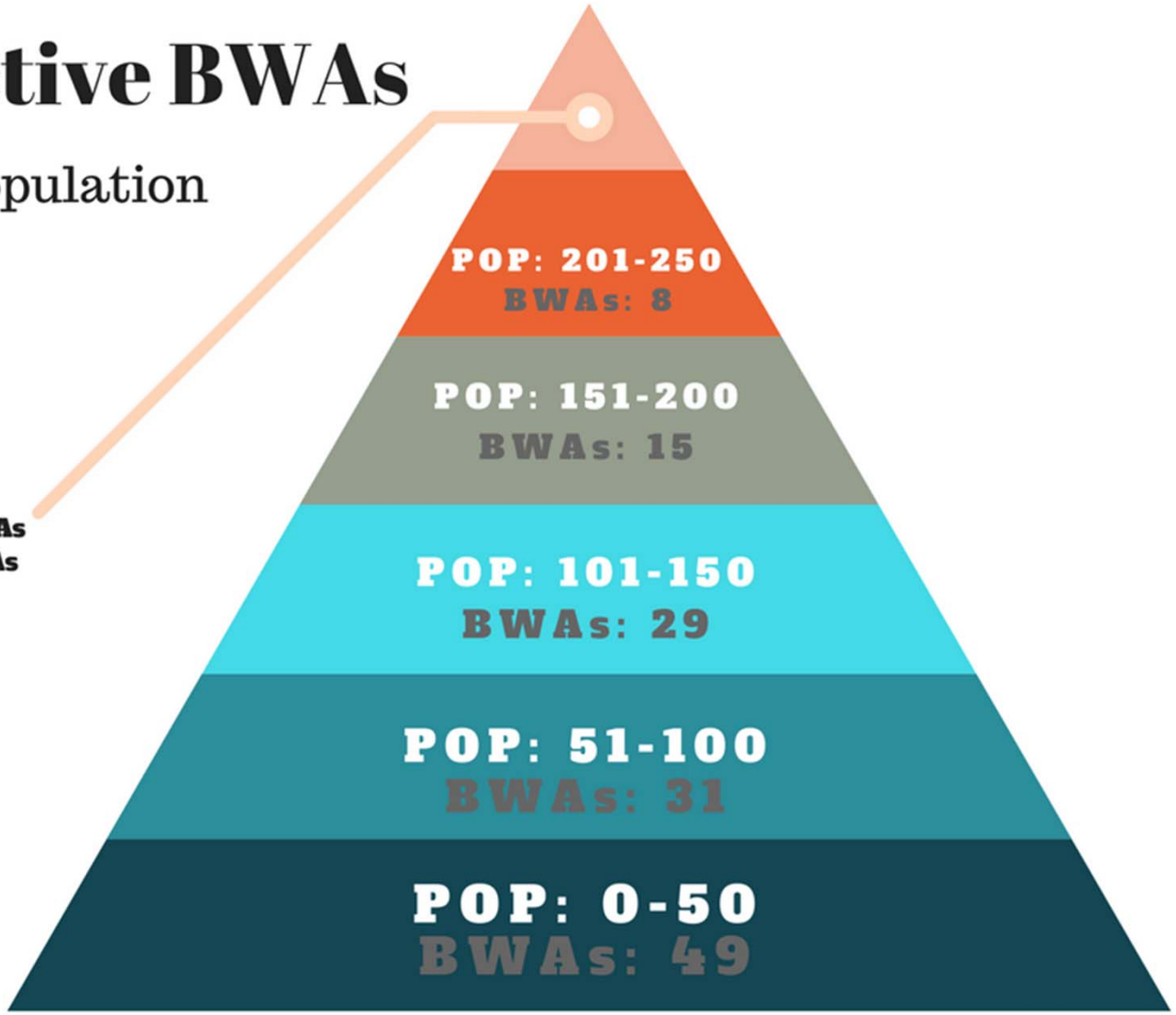




March 1, 2018: 146 communities affected servicing more than 35,000 people

of Active BWAs

by Population

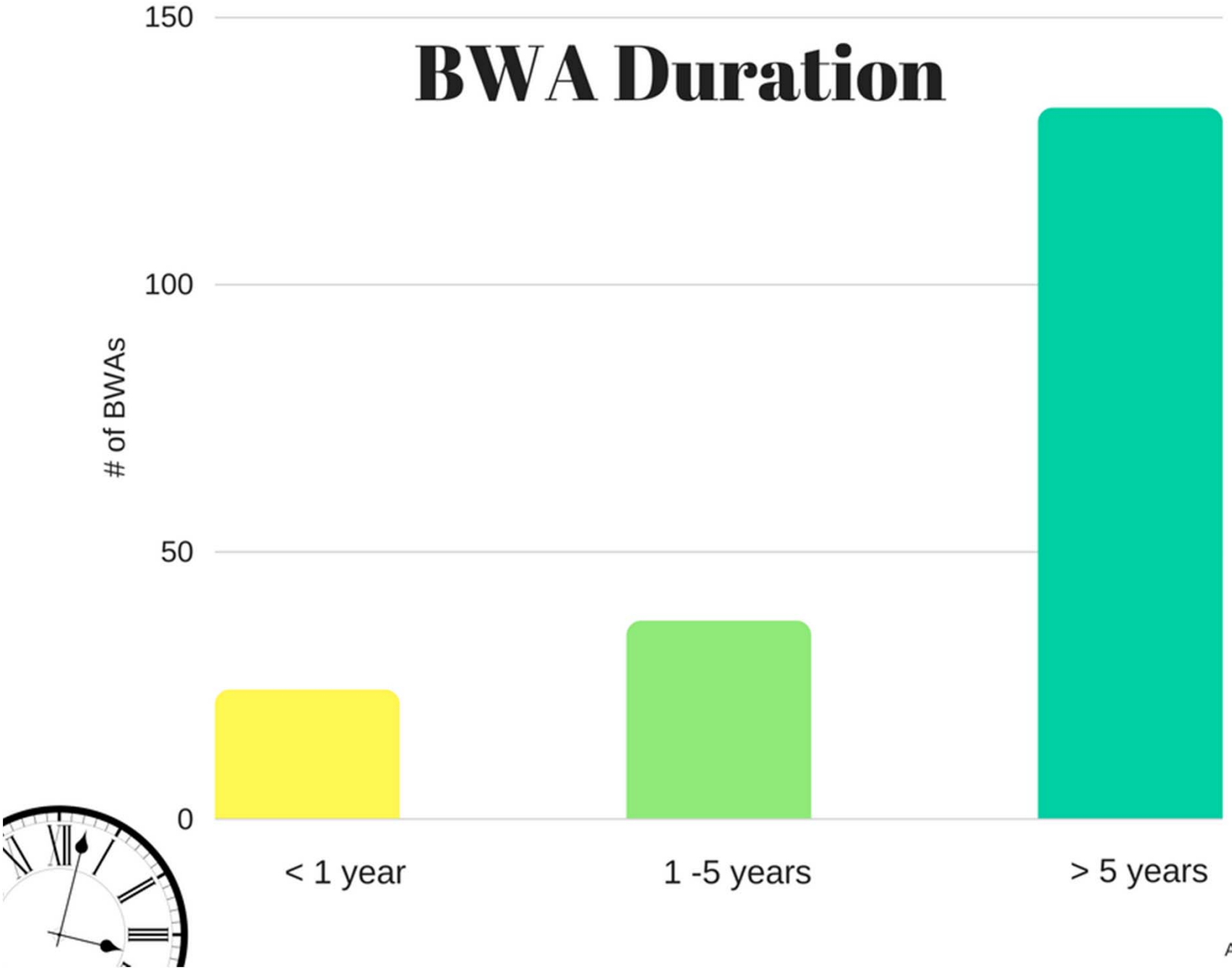


POP: 251 - 500: 12 BWAs
POP: 501 - 5000: 16 BWAs

As of March 1, 2018

Population affected by 26 BWA instances are not defined - and have been excluded from above statistical summary.

BWA Duration



As of March 1, 2018

Why are there so many BWAs?

Minnes, S. and Vodden, K. 2017. *The Capacity Gap Understanding Impediment to Sustainable Drinking Water System in Rural Newfoundland and Labrador.*

Risky Business

83% of Canadians get water from municipal drinking water plants:

- 300,000/year contract an acute stomach bug.

5.5 million Canadians rely on private wells or small systems.

- 103,000 gastro illnesses each year

Murphy et al. 2016. Estimating the number of cases of acute gastrointestinal illness (AGI) associated with Canadian municipal drinking water systems.

Tourism and BWAs

People come to Newfoundland to:

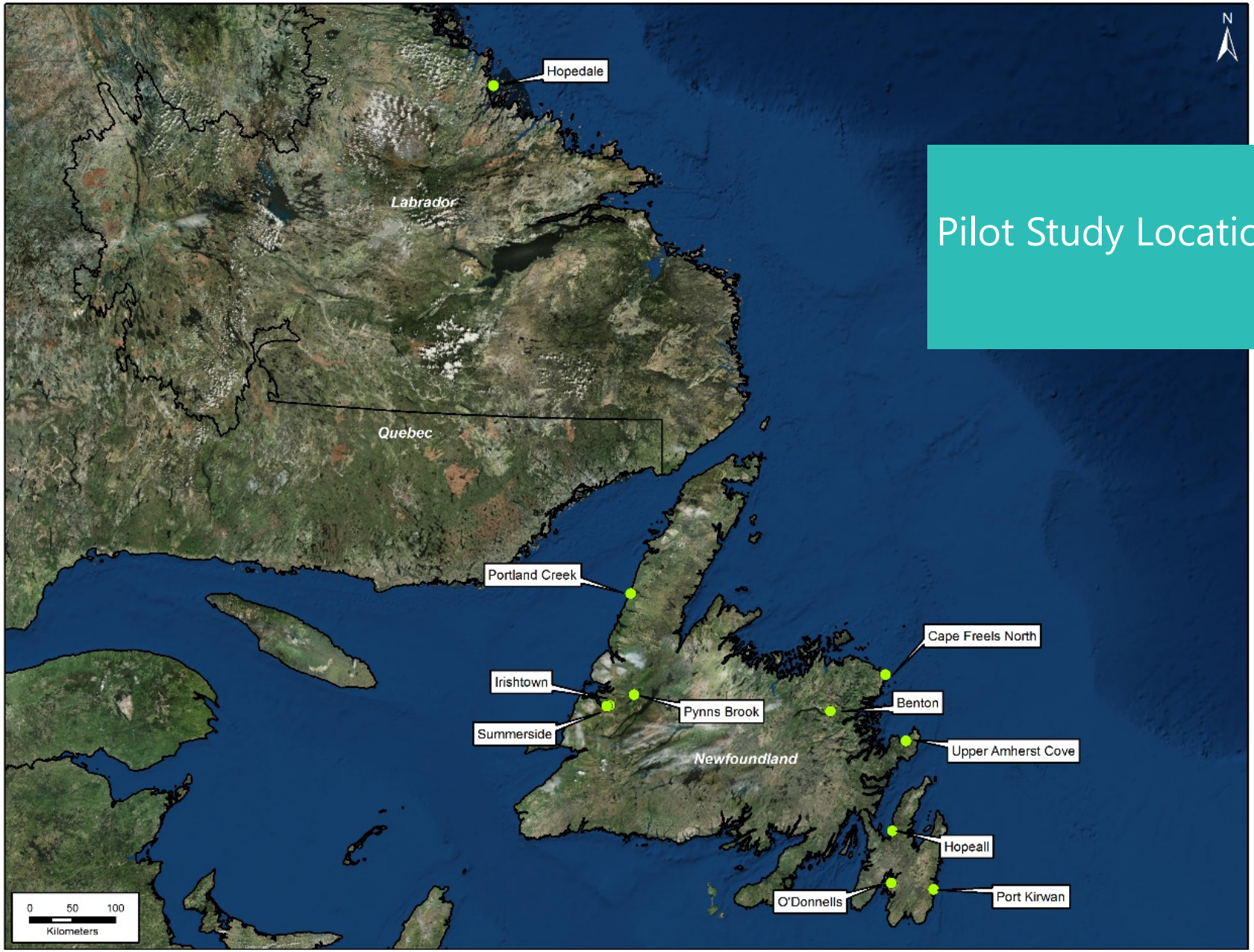
- See nature.
- For the hospitality.
- Boil their water?

What's the easy way to get off a BWA?

Pilot Study

- Wood was retained by MAE to assess 10 communities under a BWA.
  - 5 Eastern (6 BWAs)
  - 2 Central (2 BWAs)
  - 3 Western (4 BWAs)
  - 1 Labrador (1 BWA)
- Mixture of short-term & long-term BWAs
- First step was to contact the community to setup a site visit...

Pilot Study Locations



A lack of communication …

How do you use pink, green and yellow in a sentence?

BWA Assessment Tool

BWA ASSESSMENT TOOL — **SUPPLY SYSTEM ASSESSMENT QUESTIONNAIRE**

GENERAL OVERVIEW:

Community Name: _____ Date visited: _____

Have there been any recent weather events (high precipitation, overland flooding, snow melt): _____

Is water quality (clarity, colour, odour) affected by weather? _____

Service/Existing Population: _____ _____

No. of homes public WW collection system: _____ No. of homes on private septic: _____

Number of homes on private wells: _____ No. of industrial users: _____

Treatment and Disinfection Building

Year of Construction: _____ Treatment Processes: _____

Type of building construction (metal, wood, brick): _____

Condition of treatment building: _____

Design capacity: _____ Typical Flows: _____

Does system meet peak demand? Y / N Are any unsanitary conditions present? Y / N

Describe any obvious maintenance requirements: _____

Describe any upgrades completed in last 5 years: _____

- General Risk
- Source Water Risk
- Disinfection Risk
- Treatment Risk
- Distribution Risk
- Storage Risk
- Other Risks

Improved Communication

Assessment Tool provides an opportunity for open discussion and to build coordination.

Opportunity to normalize risk as risk isn't the result of poor performance.

Risk is simply the natural result of a set of factors that need to be identified, assessed and managed.

Risk is a strange thing …

Response to Risk / Risk Management

STANDARD OPERATING PROCEDURE

SOP #	10	REASON CODE:	E1—Water entering the distribution system or facility, after a minimum 20 minute contact time does not have a free chlorine residual of at least 0.3 mg/L or equivalent CT value.	REV:	0	DATE:	Dec. 2015

BWA CAUSE IDENTIFICATION

Complete Assessment Tool

Identify Potential Cause(s)

Cause #1
Increased flows (demand) on the distribution system and the disinfection system is operating in manual mode

Cause #2
Change in water quality affecting the chlorine demand

Cause #3
Disinfectant strength weak due to long storage beyond shelf life

Cause #4
Design of system did not provide for adequate contact time

Cause #5
Insufficient chlorine dosages

RECOMMENDED STEPS TO ADDRESS BOIL WATER ADVISORY

Implement Unique Short Term Corrective Measures

- ☐ Continue to monitor water usage, particularly when larger water users have high flows (e.g., fish plant start-up/shut down operations for the season). Adjust chlorine dosage rates accordingly.
- ☐ Owner to switch equipment to flow proportioning mode if this function is available on the unit.
- ☐ If required, increase the strength of chlorine stock solution.
- ☐ Determine the minimum residual that must be provided to meet the CT requirement at peak flow.
- ☐ Owner to increase free chlorine residual testing at end of chlorine contact chamber (if available) and throughout the distribution system. If no contact chamber test at first user. Distribution system testing should be conducted at locations to be representative of the system, such as at the end of all main distribution lines.
- ☐ Confirm disinfectant has not expired or test the strength of the chemical for any deterioration.
- ☐ Continue to monitor raw water quality, especially during periods of high rainfall and snowmelt, or when larger water users typically have high flows (e.g., fish plant start-up/shut down operations for the season). Adjust chlorine dosage rates accordingly.

Implement Short Term Corrective Measures

- ☐ Check that disinfection system is operational.
- ☐ Owner should increase free chlorine residual in the distribution system. This may be accomplished by either increasing the dosage rate using the pump stroke length and frequency settings, or increasing the strength of the chlorine solution. It is recommended that the dosage rate be attempted first.

Confirm Operation and Lift BWA

- ☐ Owner to test disinfectant residuals to confirm compliance with applicable disinfection and treatment standards.
- ☐ Owner to contact Service NL office to request an Environmental Health Officer to re-sample the drinking water system for compliance with provincial drinking water bacteriological and disinfection standards.

Implement Long Term Corrective Measures

- ☐ Install chlorine residual analyzer; operate, maintain, and calibrate as directed by manufacturer.
- ☐ Owner to determine where in the distribution system the required 20 minute contact time at peak flow occurs.
- ☐ Install a flow proportioning disinfection system (if not already installed).
- ☐ Install contact chamber or pipe (if none currently exists on the system and adequate contact time is not available).

Implement Long Term Corrective Measures (cont'd)

- ☐ Initiate water conservation strategy for users.
- ☐ Owner to assess alternate disinfectant methods.
- ☐ Owner to assess water treatment options to address changes in raw water quality impacting chlorine demand.
- ☐ Owner to initiate leak detection and repair program if flows are higher than expected based on number of users or there are known leaks on the system.
- ☐ Owner should provide opportunities for training to increase operators knowledge associated with cause and corrective measures.
- ☐ Owner should ensure operators have appropriate level of training/education to allow operators to be eligible for certification in accordance with provincial standards. Operator training may be obtained via ACWWA, on-line courses, and MAE Operator Education, Training and Certification.

Capital Works Funding

- ☐ Contact nearest MAE regional office to initiate evaluation of existing water infrastructure.
- ☐ .Owner to work with stakeholders (MAE, engineering consultants, etc.) to identify sustainable options.
- ☐ Owner to make an application to MIGA for project funding. Online applications can be made at: http://www.mae.gov.nl.ca/capital_works/cwfunding.html.

IMPLEMENT PREVENTATIVE MAINTENANCE

DAILY

- ☐ Measure and record flow rates.
- ☐ Complete daily disinfection and treatment logs.
- ☐ Visual inspection of chemical feed pumps and feed lines.
- ☐ Measure and record chemical usage.
- ☐ Measure and record free and total chlorine residual throughout the distribution system (first user, end of main and branch lines).

WEEKLY

- ☐ Visual inspection of chlorine injector for leaks and ensure operating normal.

MONTHLY

- ☐ Inspect and clean intake structure, intake screens and pipeline.
- ☐ Inventory all consumables and order supplies as necessary.
- ☐ If a back-up metering pump is available, replace operating pump with back-up pump and inspect internal components.

3 MONTHS

- ☐ Clean chemical feed lines and solution tanks.

6 MONTHS

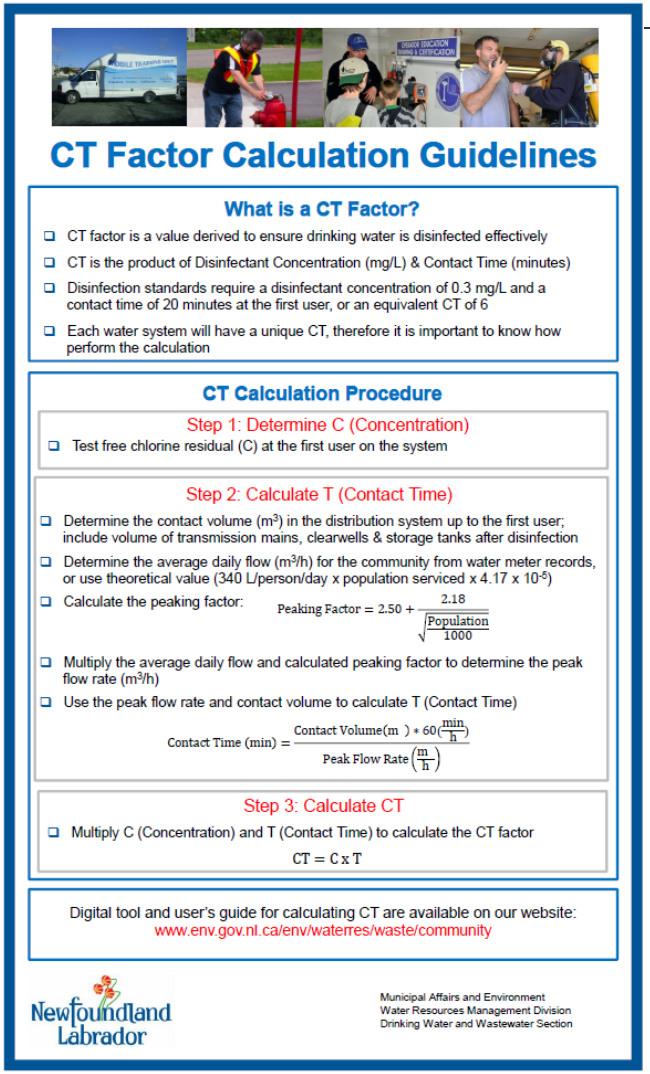
- ☐ Inspect watershed for potential sources of contamination (including development activity, storage of chemicals/fuels and animal activity).

ANNUAL

- ☐ Inspect dam and spillway for signs of deterioration, malfunction, blockages and public safety.

For more detailed information on preventative maintenance schedules for water infrastructure visit http://www.mae.gov.nl.ca/waterres/waste/community.html

The CT Factor Calculation



CT Factor Calculation Guidelines

What is a CT Factor?

- CT factor is a value derived to ensure drinking water is disinfected effectively
- CT is the product of Disinfectant Concentration (mg/L) & Contact Time (minutes)
- Disinfection standards require a disinfectant concentration of 0.3 mg/L and a contact time of 20 minutes at the first user, or an equivalent CT of 6
- Each water system will have a unique CT, therefore it is important to know how perform the calculation

CT Calculation Procedure

Step 1: Determine C (Concentration)

- Test free chlorine residual (C) at the first user on the system

Step 2: Calculate T (Contact Time)

- Determine the contact volume (m^3) in the distribution system up to the first user; include volume of transmission mains, clearwells & storage tanks after disinfection
- Determine the average daily flow (m^3/h) for the community from water meter records, or use theoretical value (340 L/person/day x population serviced x 4.17×10^{-5})
- Calculate the peaking factor: $\text{Peaking Factor} = 2.50 + \frac{2.18}{\sqrt{\frac{\text{Population}}{1000}}}$
- Multiply the average daily flow and calculated peaking factor to determine the peak flow rate (m^3/h)
- Use the peak flow rate and contact volume to calculate T (Contact Time)

$$\text{Contact Time (min)} = \frac{\text{Contact Volume}(m^3) * 60(\frac{\text{min}}{h})}{\text{Peak Flow Rate}(\frac{m^3}{h})}$$

Step 3: Calculate CT

- Multiply C (Concentration) and T (Contact Time) to calculate the CT factor

$$CT = C \times T$$

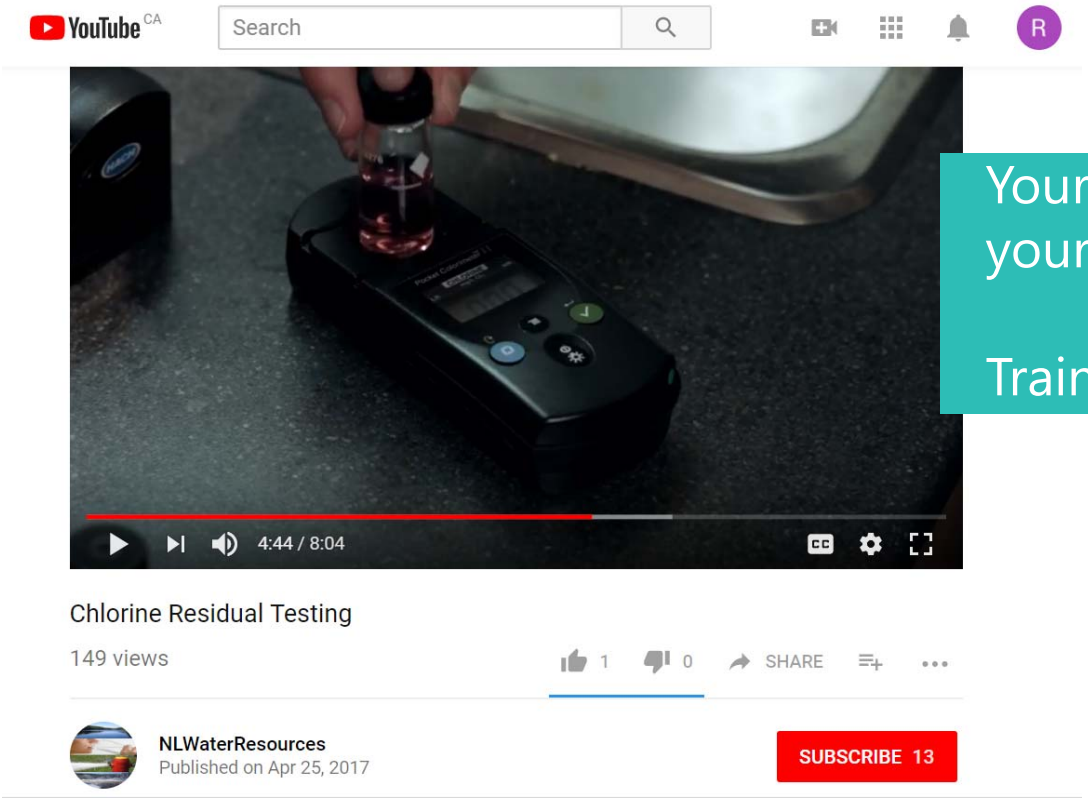
Digital tool and user's guide for calculating CT are available on our website:
www.env.gov.nl.ca/env/waterres/waste/community

Newfoundland Labrador

Municipal Affairs and Environment
Water Resources Management Division
Drinking Water and Wastewater Section

- Short Term Corrective Measure:
  - Determine the minimum residual that must be provided to meet the CT requirement at peak flow.
- Disinfection Concentration x Contact Time
- System details determine required amount of free chlorine at first user.
- Operational SOP developed by MAE.
- Contact MAE for assistance:
  - Darren Patey (St. John's)
  - Jim Pollett (Grand Falls)
  - Chris Blanchard (Corner Brook)
  - Gerry Lahey (Corner Brook)

The Colorimeter



Your colorimeter is one of your first lines of defence.

Training is available!

Preventative Maintenance (Daily … Annually)

DAILY

Measure and record flow, chemical usage, free and total chlorine throughout the system.

Complete daily disinfection and treatment logs.

Visual inspection of chemical feed pumps and feed lines.

WEEKLY

Visual inspection of chlorine injector for leaks and ensure operating normal.

MONTHLY

Inspect and clean intake structure, intake screens and pipeline.

Inventory consumables.

Order supplies.

If backup metering pump available, replace operating pump and inspect internals.


FINAL
THOUGHTS

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