CRTP

North Shore Micmac District Council Inc.

Circuit Rider Training Program

Primary and Secondary Disinfection

Presented by
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Primary and Secondary Disinfection

THE MATERIAL COVERED IN THIS PRESENTATION IS BASED ON INFORMATION FOUND IN THE

PROTOCOL FOR CENTRALIZED DRINKING WATER SYSTEMS IN FIRST NATION COMMUNITIES

AND

COMMUNITY-BASED DRINKING WATER QUALITY MONITORS – TRAINING MANUAL

- *A COPY OF THE **PROTOCOL** AND **CBWQM MANUAL** HAS BEEN PROVIDED FOR YOUR REFERENCE IN THE WORKSHOP BINDERS.*

Primary and Secondary Disinfection

- THE **MULTI-BARRIER APPROACH** MUST BE ACKNOWLEDGED BEFORE WE BEGIN OUR DISCUSSION BECAUSE IT FORMS THE FOUNDATION ON WHICH WE PERFORM OUR WORK AS OPERATORS AND WATER MONITORS.
- **MULTI-BARRIER APPROACH** IS A STRATEGY INTENDED TO PREVENT THE PRESENCE OF WATER-BORNE CONTAMINANTS IN DRINKING WATER BY ENSURING EFFECTIVE SAFE-GUARDS ARE IN PLACE AT EACH STAGE OF A DRINKING WATER SYSTEM. THIS INCLUDES EFFECTIVE DISINFECTION AND MONITORING OF THE DISINFECTION SAFE GUARD OR BARRIER!

Primary and Secondary Disinfection

Examples: Some other barriers that prevent contaminants from entering a drinking water supply and allow for better treatment down stream.

Lennox Is, PEI - well field protected with restricted land use

Conne River, NFLD - source water impoundment and screening first step in the treatment process.

Eel Ground, NB - Well head protection by enclosure.

Primary and Secondary Disinfection

- THE FOUR MAIN COMPONENTS OF THE MULTIPLE BARRIER APPROACH (MBA) ARE:

  - Protection of water sources;
  - Effective treatment of drinking water (particularly disinfection);
  - Maintenance of clean distribution systems; and
  - Comprehensive testing to confirm water quality.

*See **Protocol** – CHAPTER 3.0 MULTI-BARRIER APPROACH TO WATER PROTECTION page 4*

*See **CBWQM Training Manual** - CHAPTER 2: MULTI-BARRIER APPROACH TO SAFE DRINKING WATER 2-1*

Primary and Secondary Disinfection

WHAT ARE THE MINIMUM TREATMENT REQUIREMENTS?

- THE POINT WHERE WATER IS DELIVERED TO A TAP FOR HUMAN CONSUMPTION, DRINKING WATER MUST MEET THE HEALTH-BASED WATER QUALITY CRITERIA SET OUT IN THE LATEST EDITION OF THE **HEALTH CANADA'S GUIDELINES FOR CANADIAN DRINKING WATER QUALITY** (GCDWQ)
- THE MINIMUM LEVEL OF TREATMENT REQUIRED TO MAKE DRINKING WATER MICROBIOLOGICALLY SAFE DEPENDS ON THE QUALITY AND TYPE OF WATER SOURCE AS WELL AS SIZE AND TYPE OF POPULATION SERVED.

Primary and Secondary Disinfection

MINIMUM TREATMENT REQUIREMENTS

Now we shall discuss the main topic for today! Primary and Secondary disinfection which are separate treatment processes designed to provide different outcomes and are critical to the MBA in protection of the drinking water supplies from contamination. Operators must clearly understand their role to ensure disinfection systems are operated effectively in the maintenance of the disinfection barrier and not let the barrier fall!

- **THE MINIMUM LEVEL OF TREATMENT FOR DRINKING WATER IS BASED ON THE TYPE OF RAW WATER SOURCE**:

  - Groundwater source – minimum level of treatment is disinfection.
  - Surface water source – minimum level of treatment is filtration combined with disinfection.

Primary and Secondary Disinfection

MINIMUM TREATMENT REQUIREMENTS - PRIMARY DISINFECTION

- **Primary disinfection** is a contiguous (together in sequence) part of the treatment process and **is intended to kill or inactivate** (render non-infectious) pathogenic organisms that may be present in the source water before secondary disinfection (if installed) takes place.
- Many water treatment facilities have disinfection systems installed and operated specifically for this purpose of treating source water at the beginning of the treatment process. Often, stated in the industry as **Pre-disinfection**, pre-chlorination or pre-hypo-chlorination.

Primary and Secondary Disinfection

- **PRIMARY** and Secondary disinfection are separate treatment processes designed to provide different outcomes.

MINIMUM TREATMENT REQUIREMENTS - PRIMARY DISINFECTION

- **Bouctouche** pumping facilities, shown on right, has Pre-Disinfection operations for **PRIMARY DISINFECTION** prior to water storage to **kill or inactivate** (render non-infectious) pathogenic organisms that may be present in the source…

Primary and Secondary Disinfection

MINIMUM TREATMENT REQUIREMENTS – SECONDARY DISINFECTION

- **SECONDARY DISINFECTION** (distribution system disinfection) is **intended to protect the distribution system from re-contamination**. It is the maintenance of a free residual of the disinfectant throughout the distribution system to prevent re-growth of microorganisms in the system as well as to kill or inactivate microorganisms that may enter the distribution system. Distribution means a system of water mains, reservoirs, pumping stations, valves, and other appurtenance used to supply water for human consumption. Chlorine and chlorine compounds are the most commonly used water disinfectant for secondary (residual) disinfection. Often, in the industry it is referred to as **Post-Disinfection**, post-chlorination or post-hypo-chlorination.
- It is this disinfection process, “Secondary Disinfection”, that the CBWQM measures and verifies when performing their work in the community and also the responsibility of the operator to measure and verify secondary disinfection to operate and control disinfection equipment.

See CBWQM Training Manual “Primary and Secondary Treatment” page 4-3 and Protocol for Centralized Drinking Water Systems in First Nation Communities “3.2.1 and 3.2.2 Minimum Treatment Requirements”.

Primary and Secondary Disinfection

- REMEMBER! Primary and **SECONDARY** disinfection are separate treatment processes designed to provide different outcomes.

MINIMUM TREATMENT REQUIREMENTS – SECONDARY DISINFECTION

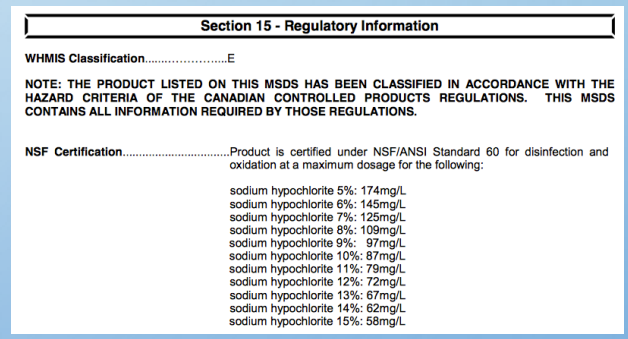
- **Wagmatcook** pumping facilities, shown on right, has Post-disinfection operations to provide **SECONDARY DISINFECTION** for the maintenance of a free chlorine residual in the distribution system to protect the distribution from re-contamination… to prevent re-growth of microorganisms in the system.

Primary and Secondary Disinfection

MINIMUM TREATMENT REQUIREMENTS

- Any drinking water system that provides disinfected water for human consumption must be equipped with working standby chlorination to ensure adequate disinfection in case of emergency, particularly if the duty disinfection equipment ceases to function as intended.

- All chemical additives used for water treatment must be certified to **NSF/ANSI Standard 60**: *Drinking Water Treatment Chemicals – Health Effects.* Check product labels and MSDS for this certification under NSF/ANSI Standard 60 to ensure chemical additives are safe!
- *More information on this **Standard** is found in **Protocol** for Centralized Drinking Water Systems in First Nation on page 5.*



Section 15 - Regulatory Information

WHMIS Classification.....E

NOTE: THE PRODUCT LISTED ON THIS MSDS HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CANADIAN CONTROLLED PRODUCTS REGULATIONS. THIS MSDS CONTAINS ALL INFORMATION REQUIRED BY THOSE REGULATIONS.

NSF Certification.....Product is certified under NSF/ANSI Standard 60 for disinfection and oxidation at a maximum dosage for the following:

sodium hypochlorite 5%: 174mg/L
sodium hypochlorite 6%: 145mg/L
sodium hypochlorite 7%: 125mg/L
sodium hypochlorite 8%: 109mg/L
sodium hypochlorite 9%: 97mg/L
sodium hypochlorite 10%: 87mg/L
sodium hypochlorite 11%: 79mg/L
sodium hypochlorite 12%: 72mg/L
sodium hypochlorite 13%: 67mg/L
sodium hypochlorite 14%: 62mg/L
sodium hypochlorite 15%: 58mg/L

MSDS Reference

Primary and Secondary Disinfection

What are the Minimum treatment requirements for GROUND WATER?

- Ground-waters are located in subsurface soil aquifers where the overburden is sufficient to act as an effective filter to remove contaminants. A ground water that supplies drinking water serving five or more households or one or more public facilities, the minimum required treatment is:

PRIMARY & SECONDARY DISINFECTION

Eel Ground
One of two new wells!

See *Protocol section 3.2.1 Minimum Treatment Requirements for Groundwater Sources page 5*

Primary and Secondary Disinfection

What are the Minimum treatment requirements for GROUND WATER?

- Primary disinfection is for inactivation of microbes and Secondary disinfection with maintenance of a chlorine residual of at least 0.2 mg/L or more of free chlorine (or 1.0 mg/L combined chlorine for disinfection processes that employ chloramination) throughout the distribution system [and at all times provide at least 2-log (99 percent) removal or inactivation of *Giardia lamblia*, *Cryptosporidium parvum cysts*, and *virus* before water enters the distribution system].

Eel Ground
One of two new wells!

Primary and Secondary Disinfection

What are the Minimum treatment requirements for GROUND WATER?

- Plants designed for disinfecting groundwater using a treatment processes other than chlorine or chlorine dioxide disinfection (i.e. ultraviolet light, ozonation, membranes) must provide a treatment that achieves at least 4-log (99.99 percent) removal or inactivation of viruses. If a plant does not employ chlorination in its primary disinfection process, then it shall employ disinfection after treatment for the development and maintenance of a free chlorine residual in the distribution system.

Eel Ground
One of two new wells!

Primary and Secondary Disinfection

What are the Minimum treatment requirements for

SURFACE WATER AND GROUND WATER UNDER DIRECT INFLUENCE?

- Surface water, which is susceptible to microbiological contamination through various sources, or a groundwater source under direct influence of surface water (GUDI), that supplies drinking water for human consumption to a distribution system serving five or more households or one or more public facilities, the minimum required treatment design is:

Filtration, Primary and Secondary Disinfection

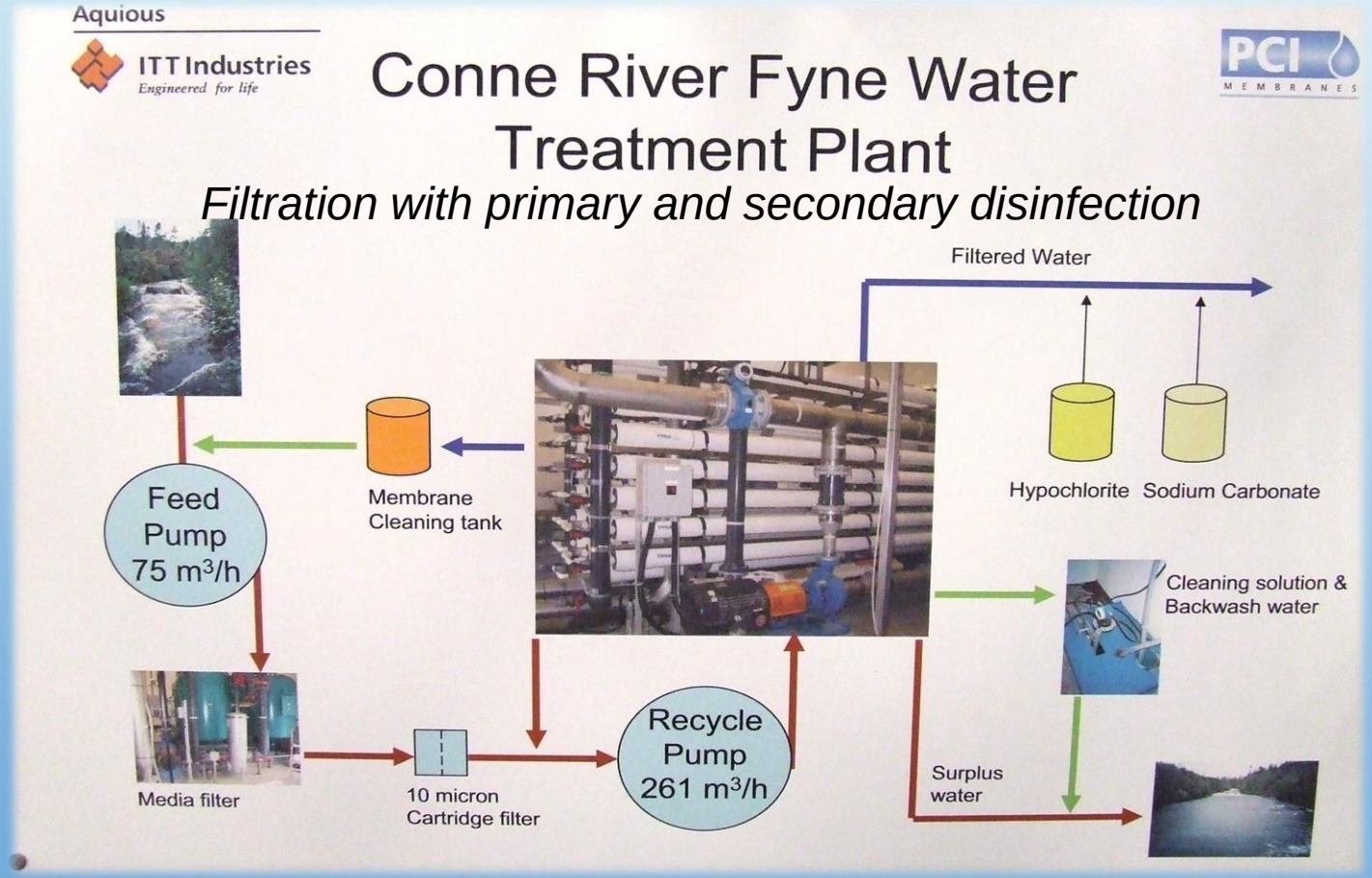
See Protocol section 3.2.2 Minimum Treatment Requirements for Surface Water and Groundwater under Direct Influence page 6.

Miawpukek (Conne River), NFLD

Primary and Secondary Disinfection

What are the Minimum treatment requirements for

SURFACE WATER AND GROUND WATER UNDER DIRECT INFLUENCE?



Primary and Secondary Disinfection

What are the Minimum treatment requirements for

SURFACE WATER AND GROUND WATER UNDER DIRECT INFLUENCE?

Miawpukek, as illustrated in the previous slide has a surface water source thus it's design requires as per the **Protocol**:

- Filtration; and
- **Primary** disinfection <u>for inactivation of microbes</u> and **Secondary** disinfection with <u>maintenance of a chlorine residual</u> of 0.2 mg/L free chlorine or more (or 1.0 mg/L combined chlorine for disinfection processes that employ chloramination) throughout the distribution system [and at all times provide 2-log (99 percent) removal or inactivation of *Giardia lamblia*, 3-log (99.9 percent) removal or inactivation *Cryptosporidium parvum cysts*, and at 4-log (99.99 percent) removal or inactivation of viruses before water enters the distribution system].

Miawpukek (Conne River), NFLD

Primary and Secondary Disinfection

CONCENTRATION – Time (CT) Requirements

- The water system designer should ensure that an appropriate contact time between the drinking water and disinfectant(s) is provided to the water before it reaches the first consumer in the distribution system. The design of the water system should allow for peak flow rates based on the type, temperature, and quality of water source. The effectiveness of chlorination depends primarily on four factors:

CONTACT TIME
CONCENTRATION
TEMPERATURE
pH

- The water system operator, in turn, shall ensure that an adequate disinfectant is added, as per water system design requirements, such that an adequate residual is maintained in the distribution system at all times. Don't let a barrier drop to allow the entry of contaminants into your drinking water system!

Miawpukek (Conne River), NFLD

Primary and Secondary Disinfection

CONCENTRATION – Time (CT) Requirements

- The small water system operator cannot change the plant design once built nor adjust temperature and usually cannot correct for pH for more effective disinfection. Operators can, by understanding what influences disinfection performance ensure that an adequate disinfectant is added. Operators can monitor residual and control disinfection equipment, apply the right **CONCENTRATION** of disinfectant as per water system design requirements, such that an effect kill or inactivation of disease causing organisms will occur and provide for an adequate residual that will protect the distribution system. This is the practice of Primary and Secondary disinfection.

Miawpukek (Conne River), NFLD

Primary and Secondary Disinfection

Questions?

Thank you!