

PHE GUIDELINE: WATER SYSTEM DESIGN GUIDELINES FOR MOBILE AND SHORT-TERM CAMPS

1 Introduction

This document is to be used in conjunction with the *Northern Health Mobile Camps Drinking Water Policy*. The intention of this document is to provide the users some guidelines for the design of their drinking water system. The requirements set out in these guidelines should be considered as the minimum standard needed to provide potable water to camps that serve fewer than 500 people and are in one location for less than 5 months, in accordance with the definition of "short term industrial camp" in the current version of the *Industrial Camps Regulation* (BC Reg 70/2012) under the *Public Health Act*. Final approval of the proposed drinking water systems by the Issuing Official under the *Drinking Water Protection Act* is still required.

Questions on this document may be directed to the Northern Health Regional Public Health Engineer (PHE)

2 Application

Mobile and short-term camps must comply with all applicable legislation. Regarding water for domestic purposes, camps must satisfy both the *Industrial Camps Regulation* (Part 3, Division 2) and the *Drinking Water Protection Regulation*, which requires Construction Permit issued by the PHE and Operating Permit issued by the Environmental Health Officer (EHO).

3 Source

The water source should be protected from potential contamination.

For **surface sources**, proper strainers should be provided at the end of the intake pipes. The intake pipes should be located away from the bank and be placed not too close to the surface or bottom, preferably 12" below the water surface and 12" above the bottom of the creek or lake. Details on design of strainers may be obtained from the Department of Fisheries and Oceans publication: Fresh Water Intake End of Pipe Fish Screen Guideline @ www.dfo-mpo.gc.ca/Library/223669.pdf

For **groundwater sources**, the well should comply with the *Ground Water Protection Regulation* and the well log should be submitted with the construction permit application. Under this policy, groundwater sources are presumed to be at risk of containing pathogens, and therefore require full disinfection, equivalent to surface water.

In accordance with the *Northern Health Mobile Camps Drinking Water Policy*, mobile and short-term camp water systems may be permitted under the *Drinking Water Protection Act* **without** initial bacteriological and physico-chemical water quality analyses. The source should still be monitored for indicator coliform bacteria and any other parameter of concern identified in the Construction Permit or Operating Permit.

4 Pumping

1. Fuel, diesel pump or the electricity generator must be kept away from the water source and safely contained.
2. Refueling of any equipment should be carried out in a manner that fuel is not spilled on the ground. The fueling area should be surrounded with a berm and the ground should be covered with an impermeable liner.
3. If water is pumped from a sump or a bank side culvert, the sump must be covered and made insect-proof.
4. A positive pressure should be maintained in the distribution system, keeping the water storage tank at the highest possible point in the camp would help.

5 Filtration

1. Filtration is an essential step to reduce turbidity of water for further treatment, like UV or chlorination.
2. "1-micron absolute" filters, certified for cyst removal by third party testing, can be used to reduce *Crypto* and *Giardia* in water in place of UV treatment. However, the flow rates through these filters are very small and the replacement cost could be expensive. To prevent excessive blockage, raw water should be pre-filtered through a series of 20-micron and 5-micron filters.
3. Note that the flow rates through cartridge filters will vary with age of the filters and pump pressure. It may be necessary to use two or more 1-micron absolute filters in parallel to provide the necessary flow from the treatment system to meet the demand.
4. Chlorination of water is required in addition to filtration.

6 Ultraviolet Treatment

1. The Ultraviolet (UV) unit must be certified to meet the NSF 55 Class A standards; this means that the equipment will have a minimum UV dose of 40 mJ/cm^2 at the alarm set point.
2. Raw water to be treated should have UV Transmittance (UVT) of more than 80%. If the UVT is low, pre-treatment with an activated carbon filter will most likely improve the UVT values.
3. Maximum water usage (gallons per minute) must be determined and the UV unit properly sized to meet the demand; for example, a single tap could discharge as much as 2 gpm.
4. The safety features that are provided in the unit should be listed; some of these features may be built in but some may be optional components that have to be installed. A treatment schematic with explanation that indicates that all features are present is needed. Features must include:
 - Flow restrictor (eg, a diaphragm valve that matches the maximum flow capacity of the UV unit)
 - Automatic shut off when the dose rate is not met or when the unit is unplugged (solenoid valve connected to the sensor of the UV unit)
 - System failure alarms (list the alarms).
5. The assembly should include the following monitoring devices:
 - UV lamp intensity sensor (mostly built-in)
 - UV dose sensor (mostly built-in)
 - Pressure gauge at the downstream end of the UV unit.
6. A 5-micron filter is needed before the UV unit for protection. Normally, a set of multi-size filters (50-micron, 20-micron then 5-micron) is installed to avoid plugging. As noted earlier, a carbon filter may be required before the UV unit if the UVT values of the raw water are less than 80%.
7. If the pump is controlled by pressure switch, it should be installed before the filters and the UV system.
8. A UV bypass is not allowed. If the UV unit is not operational, the camp operator must declare a Boil Water Notice. Whenever the UV unit is not in operation, untreated water should be boiled (rolling boil) for at least 1 minute before consumption.
9. Chlorination of water is required in addition to UV treatment.

7 Chlorination

1. Chlorination (hypochlorite) must be provided, regardless of whether UV and/or filtration are used.
2. Water should be clear (low in turbidity) for chlorine to be effective; it should be adequately filtered before chlorine solution is added.
3. A minimum 'concentration-time' (C-T) of 12 min·mg/L must be provided, eg, maintaining a residual free chlorine level of 1 mg/L for 12 minutes, or 0.5 mg/L for 24 minutes, etc. The free chlorine is measured at the *end* of the storage period, and must be at least 0.5 mg/L, not to exceed 4.0 mg/L.
4. Chlorine may be added using a dosing pump or in batch. The amount of chlorine added must be measured with reasonable accuracy.

5. Adequate mixing should be provided and there should be sufficient time allowed after chlorine is added before the water is used.
6. A chlorine test kit that can measure below 0.2 mg/L of free chlorine should be available and regularly used on site to verify residual chlorine concentrations. Meters with digital readouts are recommended.
7. Point-of-use devices such as activated carbon filters that remove free chlorine may be used with prior notice and approval from Northern Health.

8 Control of cross-connections and other contamination

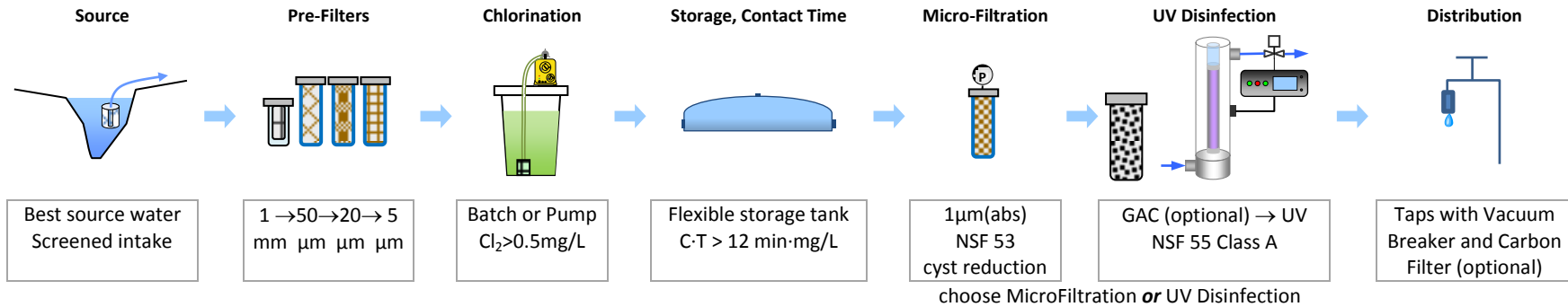
1. Non-potable water may be used for non-consumptive domestic uses including showers, toilets and sanitation. Potable and non-potable water systems must be separated physically, preferably right at the source with separate pumps and water lines.
2. If potable and non-potable water are pumped and supplied from the same intake pipe, adequate cross connection control devices must be used separate the two systems. A double check valve assembly (DCVA) backflow preventer must be installed on the lines going to the non-potable section of the water system. In addition, whenever the water treatment units are turned off, the potable water section must be valved off or disconnected from the water system.
3. Signs indicating the water is *non-potable* must be posted at all taps and water outlets for non-potable water.
4. For filling chemical containers (eg, fertilizers), an air gap must be provided between the top of the container and the end of the hose. In addition, hose bib vacuum breakers should be installed on all taps.
5. Proper faucets and filling stations for use by the crew should be provided.
6. Drinking water containers like water bladders or cisterns should be kept clean and should be disinfected when camps are first set up. See *Cleaning and Disinfecting Small Drinking Water Storage Tanks*.
7. Hoses used for treated water must be of potable water grade.

9 Information to be submitted for Construction Permit application

1. Completed Waterworks Construction Permit Application.
2. Cover letter explaining purpose and nature of the camp and how potable water will be managed.
3. *Regional Location Plan* showing nearest community and road names with driving directions.
4. *Site Plan* showing of the source water intakes for all the proposed camps, distances from camp and other potential sources of pollution (e.g. pit privies, generators, fuel cache, etc.) and the overall layout plan of the camp including water distribution pipes and taps, valve locations, non-potable water lines, etc.
5. *Schematic* plan of the proposed water treatment system (P&ID).
6. Specifications of equipment used, eg, size and capacity of filters, type and make of UV systems, etc. including all options.
7. If water is hauled, source of hauled water and the hauler's name.

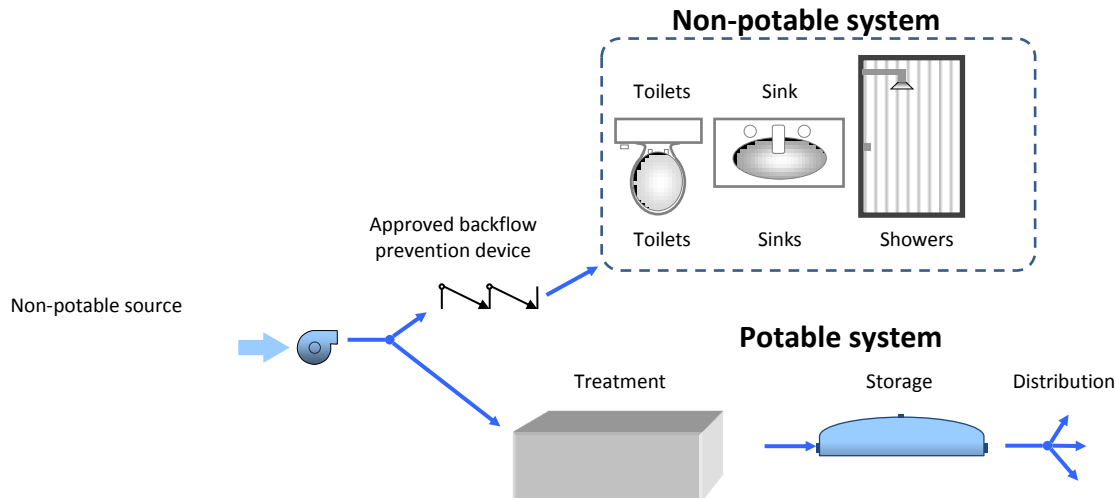
10 Example schematic diagram

Based on the above information, the following is a typical potable water system schematic for mobile camps:



Pumps, valves, pipes, pressure tank, etc. omitted for clarity.

If non-potable water use is approved for showers and toilets, it must be separated from the potable water system by an approved, testable backflow prevention device (eg, DCVA, RPZA).



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