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## **Mobile Camps Drinking Water System Design Guidelines (Version 1, 2006)**

### **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 mobile camps that serve less than 500 people and are in one location for less than three months. 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.

### **Water Source**

The water source should be protected from potential contamination.

For surface source, 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 @ <http://www.dfo-mpo.gc.ca/Library/223669.pdf>

For underground source (wells), water must be tested for water quality first and well log should be submitted with the construction permit application.

### **Pumping**

1. Fuel, diesel pump or the electricity generator must be kept away from the water source and properly 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 pump 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.

### **Filtration**

1. Filtration is an essential step to reduce turbidity of water for further treatment, like UV or chlorination.
2. "One-micron absolute" filters can be used to reduce parasites 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 more than one filter 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.

### Ultra Violet Treatment

1. The Ultra Violet (UV) unit must be certified to meet the NSF 55A standards; this means that the equipment will have a minimum Ultra Violet (UV) dose of 40 mJ/cm<sup>2</sup> at the alarm set point.
2. Raw water to be treated should have UV Transmittance (UVT) of more than 80%; preferably, more than one sample has been tested for UVT. Note that turn around time for testing could be 2 weeks. Allow sufficient time for the test to be done close to the time when water will be used. If the UVT is less than 80%, pre-treatment by using activated carbon filter will most likely improve the UVT values.
3. Maximum flow rate must be determined and the unit properly sized to meet the demand; for example, a single tap could discharge as much as 2gpm.
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 layout plan with explanation that indicates that all features are present is needed. Features must include:
  - Flow restriction device (like 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 that are supplied)
5. The assembly should include the following monitoring devices:
  - UV lamp intensity sensor (mostly built-in)
  - UVT sensor (mostly built-in)
  - Flow meter
  - 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 of the 5 micron filters too quickly. 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, the switch should be installed before the filters and the UV system.
8. A treatment bypass is not allowed.
9. Whenever the UV unit is not in operation, untreated water should be boiled (rolling boil) for at least 2 minute before consumption.
10. Chlorination of water is required in addition to UV treatment.

### Chlorination

1. Chlorination 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' of 12 mg/L-min must be provided, i.e. maintaining a residual free chlorine level of 1 mg/l for 12 minutes, or 2 mg/L for 6 minutes etc. The chlorine concentration is to be measured at the end of the storage period.
4. The amount of chlorine added should 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 1 mg/L of free chlorine should be available and regularly used on site to verify residual chlorine concentrations. Meters with digital readouts are easy to use and are recommended.

### **Control Of Cross Connection And Other Contamination**

1. Potable and non-potable water systems must be separated physically, preferably right from the source with separate pumps. This is to reduce the risks of untreated water being pumped into the potable water system while the treatment units are turned off.
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. Dual Check Valve Backflow Preventers 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 preferable be disconnected from the water system.
3. Signs to clearly indicate the water is non-potable must be posted at all taps and water outlets for non-potable water.
4. For filling up chemical containers (fertilizers for example), 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. Attention should be given to possible contamination of drinking water through splashing from the ground or cross contamination from drinking bottles. 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. The attached information, *Cleaning And Disinfecting Your Drinking Water Small Storage Tank*, may be used for reference.
7. Hoses used for treated water must be of potable water grade.

### **Information to be submitted for Construction Permit Application**

1. Location Plans of the intakes for all the proposed campsites, showing distances from camp and other potential sources of pollution (e.g. pit privies, generators, fuel cache, etc).
2. Layout plan of the camp.
3. Schematic layout plan of the proposed water system, including the non-potable water section, for the whole camp.
4. Specifications of equipment used, for example, size and capacity of filters, type and make of UV systems etc.
5. Source of hauled water and the hauler's name, if water is hauled in.
6. Operational details, for example, how the water will be chlorinated.
7. Quality assurance plan including proposal for monitoring and record keeping.

## CLEANING AND DISINFECTING YOUR DRINKING WATER SMALL STORAGE TANK

Ensure all materials used for storage tanks are intended for the use of potable water. If materials not suitable for potable water contact are used, harmful chemicals such as heavy metals or hydrocarbons could leach into your drinking water. Storage tanks should be sealed and kept fly tight to prevent onsite contamination.

Delivered water should be potable (safe for human consumption) and obtained from an approved source. Surface water is continually susceptible to contamination from wild life, aquatic life, domesticated animals and humans. All surface water used for domestic use should be treated to ensure a safe supply. The water hauler is required to disinfect this water for your safety.

Storage tanks should be cleaned and disinfected at least twice a year (spring and fall). This is to remove algae (plant growth which produces bad tastes and odours), silt, and bacteria which may be harmful.

### PROCEDURES

- 1) Drain water from tank.
- 2) Physically scrub or pressure wash the interior walls to remove sediment and grime.
- 3) Rinse the inside surfaces of tank with clean potable water. Drain wash water.
- 4) Fill tank with clean potable water.
- 5) Add the required amount of unscented household bleach to the water in the storage tank (see table below). Mix well.
- 6) To disinfect the plumbing lines and fixtures, open all taps in distribution system until chlorine smell is apparent at each outlet. Close taps.
- 7) Let chlorine solution sit in the water system for **at least 12 hours**. Do not consume this highly concentrated solution.
- 8) Drain the water tank but not into a septic system or fish bearing stream.
- 9) Refill with fresh potable water.
- 10) Open valve to distribution lines. Run water from the taps until there is no smell of chlorine.

Dosage of Household Bleach (~ 5% chlorine) required for the Cleaning and Disinfecting of Water Holding Tanks				
Tank Size		Amount of Household Bleach to obtain 50 ppm Chlorine		
Litres	Imp. Gallons	mL	Imp. Ounces	Cups
227	50	227	8	1
455	100	511	18	2
909	200	909	32	4
1137	250	1136 (1.2 L)	40	5
2273	500	2273 (2.3 L)	80	10
4546	1000	4546 (4.5 L)	160	20
6819	1500	6818 (6.8 L)	240	30
9092	2000	9091 (9.1 L)	320	40
11365	2500	11340 (11.5 L)	400	50