Surface Water Treatment Guide (rivers, dams and streams)

Introduction

Surface water includes water obtained from dams, streams and rivers. These sources may be more easily contaminated by animal and human wastes, and chemicals from runoff. Surface water may also be at risk of algal blooms. Due to the potential for contamination, surface water is not recommended as a source of drinking water unless filtered and disinfected.

Unless drinking water quality can be assured through disinfection and routine testing, surface water should only be utilised for purposes other than drinking such as toilet flushing, garden watering and irrigation. Treatment may still be necessary for such non-drinking uses.

Surface water should be tested for *E. coli* and chemicals of health concern on a regular basis. Depending upon the level of treatment involved, surface water systems would generally require regular sampling to assure drinking water quality (e.g. monthly). If there is any suspicion or evidence of algal blooms, an analysis should also be undertaken for any potential algal toxins.

It is important that tanks and associated plumbing, together with appropriate water treatment and disinfection systems are correctly selected, installed and regularly maintained in order to protect drinking water quality. Look for tanks, coatings and plumbing materials that have been tested for contact with drinking water to AS/NZS 4020:2005 and PVC-U pipes and fittings certified to AS/NZS 1477.

Refer to the *NSW Private Water Supply Guidelines* for information on surface water, hazards and testing.

http://www.health.nsw.gov.au/environment/water/Documents/NSW-Private-Water-Supply-Guidelines.pdf

Surface Water Health Risks

By far the greatest risk to health comes from the contamination of water with disease causing microorganisms, which come from human or animal waste. Drinking water sourced from surface water needs to be free of disease causing microorganisms (bacteria, viruses and protozoa) and harmful levels of chemicals.

The activities in the water catchment area and the associated run-off will determine the types and level of contamination in surface water. Disease causing microorganisms can enter surface water from human waste (sewage and septic tank seepage), animal waste (animal and bird droppings), and intensive farming practices (dairying, feedlots). Surface water may also contain agricultural chemicals such as pesticides and industrial wastes. Some surface water supplies may be susceptible to blooms of potentially toxic cyanobacteria (blue green algae).

Surface water should be disinfected before consumption to remove harmful microorganisms. Disinfection does not remove chemicals, so other treatment processes may be necessary to manage any associated risks to health.

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Surface Water Treatment Systems

There are several methods for treating surface water and professional advice should be sought for the design and installation of a water treatment system to remove any contaminants that may present a health risk. These treatment methods may include:

Filtration to remove particulate matter and some dissolved material from water. There are many filtration devices available and microorganism and particle removal varies with the filter type. Surface water supplies with a lot of suspended particles (dirty water) may also require pre-treatment, such as coagulation, before filtering the water. Some filter systems will require a power supply.

UV disinfection by ultraviolet light irradiation (UV) is effective against most bacteria, viruses and protozoa. UV systems require relatively low maintenance, do not require the addition of chemicals and can include warning alarms to indicate equipment faults. Specialist UV chambers for treating surface water are designed to provide a dosage of UV light at a given flow rate. UV systems are most effective when the water is clear and free of particles. Most surface water supplies will need to be filtered to ensure effective UV treatment. UV treatment does not remove chemicals from water. UV systems will require a power supply. Water that has been disinfected using UV should be used straight away, not stored in tanks.

Chlorine disinfection is a common form of disinfection that is effective against harmful bacteria, viruses and *Giardia*, but has limited effect against *Cryptosporidium*. Surface water supplies will commonly require filtration prior to chlorination due the presence of particulate matter, which must be removed in order for the chlorination process to be effective, and a storage tank to provide adequate chlorine contact time. Details for hand dosing chlorine can be found on page 25 of the *NSW Private Water Supply Guidelines*.

Filtration Treatment Systems Include

Polypropylene & ceramic cartridge type filters can effectively treat water by removing sediment and bacteria, but will not remove viruses

Activated carbon filters are most effective in removing and/or reducing chemicals such as iron and hydrogen sulphide, objectionable tastes, odours and colour, but will not remove bacteria or viruses. NSF/ANSI Standard 42 refers to the removal of specific aesthetic or non-health-related contaminants (chlorine, taste, odour and particulates)

Micro/Ultra filtration membrane filters (0.1 - 0.01 micron) can effectively treat water by removing sediment and bacteria. Ultrafiltration membrane filters may also remove viruses. Installations should include a pre-filtration stage of 30 micron rating, an automatic filter backwash cleaning function and a suitable disposal method for the small amount of dirty backwash water from the filters. NSF/ANSI Standard 53 refers to the removal of specific health related contaminants

Reverse osmosis filters (0.001 micron) are the most sophisticated and are extremely efficient and effective for the removal of microorganisms and most residual chemicals from water. The filters produce a constant waste stream when operating, and usually need to be connected to a drain and power source. Installations should include a pre-filtration stage of 5 micron rating, an automatic filter backwash cleaning function, and suitable disposal method for the waste stream and small amount of dirty backwash water from the filters. NSF/ANSI Standard 58 refers to the removal of total dissolved solids and other optional reduction claims.

Checklist for selection and purchasing a filtration system

- Determine the volume of water to be treated and ensure the filtration equipment has the capacity (e.g. litres/hour) to treat all the water needed. The smaller the micron size, the finer the filtration, the greater the reduction of the flow rate and available pressure through the filter, resulting in a higher the frequency of maintenance
- Determine the type of filter required for any dirt or debris and/or chemicals of health concern present in the water
- Determine any pre-filtration screening requirements, to remove larger solid particles to prevent fouling or clogging of the filter
- Ensure that the filtration system carries the WaterMark or Plumbing Safety Type Test Mark and it complies with at least one of the following standards, ANSI/NSF Standard 53 or AS/NZS4348. Filters being installed to remove a specific contaminant should have been tested to demonstrate their effectiveness against that contaminant
- Where the filtration equipment may be subject to normal water mains pressure (i.e. greater than 150 kPa) then the filtration equipment must comply with AS/NZS 3497.

Checklist for selection and purchasing a UV disinfection system

- Determine the volume of water to be treated and ensure the equipment has the capacity (e.g. litres/hour) to treat all the water needed
- It is equipped with a pre-filter to remove any dirt and debris that can interrupt the UV light. Generally a 20 micron filter is installed between the pump and the UV unit
- It is equipped with a second stage filter (1 micron) before the UV unit to reduce parasitic cysts such as *Cryptosporidium* and *Giardia* that are more resistant to UV light than bacteria and viruses OR It delivers a sufficient dose of light at full operating capacity to effectively disinfect the water.
- It has a built in light sensor that can monitor the UV intensity, connected to an alarm system to alert the user in case of low UV level
- It has a safety control system that can shut off the water supply in case of a low UV level alarm or loss of power
- It is connected to a constant power supply of sufficient capacity to suit the system
- The UV disinfection system carries the WaterMark or Plumbing Safety Type Test Mark and at least one of the following standards, ANSI/NSF Standard 55 Class A systems (40 mJ/cm^2), AS/NZS 3497 or AS/NZS 4348 and treatment classification level.

Checklist for selection and purchasing a chlorine disinfection system

- Determine the volume of water to be treated and ensure the equipment has the capacity (e.g. litres/hour) to treat all the water needed
- It is equipped with a pre-filter to remove any iron, manganese and other dirt and debris that can either absorb and/or deplete chlorine residual levels. Water for chlorine disinfection should have a turbidity of less than 1 NTU.
- Adequate post chlorine dosing detention time is available within the water supply system, typically at least 30 minutes is required to complete the disinfection process and ensure a minimum free residual chlorine level of 0.5 mg/L

- Includes a residual chlorine test kit to be used for regular monitoring (e.g. daily or weekly) of residual chlorine levels in the supplied drinking water
- The chlorine disinfection system carries the WaterMark or Plumbing Safety Type Test Mark and AS/NZS4348.

Before purchasing a treatment system it is recommended that the following information be obtained from the supplier

- Product specifications – including contaminant removal claims and data
- Product certifications
- Maintenance and replacement requirements and associated costs
- Operating costs.