Crystal Clear

Glossary

Australian Drinking Water Guidelines	The key Australian reference to drinking water quality published by the National Health and Medical Research Council (NHMRC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).
Backwashing	In water treatment, the process of reversing the flow of water back through the filter media to remove the entrapped solids.
Chloramines	Compounds formed by the reaction of hypochlorous acid (or aqueous chlorine) with ammonia. Used to disinfect water supplies.
Chlorination	The application of chlorine to water, generally for the purpose of disinfection.
Coagulation	The clumping together of very fine particles into larger particles caused by the use of chemicals (coagulants). The chemicals neutralise the electrical charges of the fine particles and destabilise the particles. This clumping together makes it easier to separate the solids from the water by settling, skimming, draining, or filtering.
Colloids	Very small, finely divided solids (particles that do not dissolve) that remain dispersed in a liquid for a long time due to their small size andelectrical charge. When most of the particles in water have a negative electrical charge, they tend to repel each other. This repulsion prevents the particles from clumping together, becoming heavier, and settling out.
Flocculation	The gathering together of fine particles in water by gentle mixing after the addition of coagulant chemicals to form larger particles.
Fluoridation	The addition of a chemical to increase the concentration of fluoride ions in drinking water to a predetermined optimum limit to reduce the incidence of tooth decay in children.
Ion	An atom or group of atoms which has gained or lost electrons and carries an electric charge
Ozonation	The application of ozone to water for disinfection or for taste and odour control.
pH	A measure of the basic (alkaline) or acidic condition of a solution. A pH of less than 7 is acidic, of 7 is neutral and of more than 7 is alkaline. Natural waters usually have a pH between 6.5 and 8.5.
Potable water	Water that is safe and satisfactory for drinking and cooking.
Scouring	Interrupting the first layer of the filter so it is unusable.
Sedimentation	A water treatment process in which solid particles settle out of the water being treated in a large clarifier or sedimentation basin.
Service reservoir/tank	A storage for drinking water generally within the distribution system used to meet fluctuating demands, accommodate emergency requirements and/or equalise operating pressures.
Total dissolved solids (TDS)	The concentration of dissolved solids in water. TDS is measured on a sample of water that has passed through a very fine mesh filter to remove suspended solids. The water passing through the filter is evaporated and the residue represents the dissolved solids.
Turbidity	The cloudy appearance of water caused by the presence of suspended and colloidal matter. The water quality parameter indicating the clarity of water. Turbidity is measured by the amount of light that is reflected off particles in the water. It is measured by a nephelometer in nephelometric turbidity units (NTU).
Water supply system	The collection, treatment, storage, and distribution of potable water from source to consumer.

Objectives of this Workshop

- Discover where our drinking water comes from and how it gets to our household tap
- Learn what makes water unclean and what harmful contaminants it can contain
- Understand the complexity of providing water to society
- Recognise the need to conserve and protect our environment and water sources
- Learn how water quality is tested and what Australia's quality requirements are
- Explore and identify the different processes in a Water Treatment Plant (WTP)
- Understand the role of technology in a WTP and its impact on society and the environment.

Safety Notes

Supervision is required as the activity uses aluminium sulfate Solution:

- *Use only in ventilated areas*
- *Do not drink any samples*

Preparation Time: 15 mins
Lesson Time: 55 mins

Background information

Civil engineers work to provide clean water to the general population. This workshop aims to give students insight into some water cleaning processes.

Each year there are nearly 2 million deaths attributable to waterborne diseases, particularly due to poor public sanitation in developing countries. We have few waterborne disease outbreaks in Australia, and most of those are traced back to sources outside the water mains (eg. swimming pools or internal water systems in buildings). Our water quality is governed by the Australian Drinking Water Guidelines, published by the National Health and Medical Research Council. Under these guidelines it is expected that water "should contain no harmful concentrations of chemicals or pathogenic microorganisms, and ideally it should be aesthetically pleasing in regard to appearance, taste and odour."

In Brisbane there are 3 treatment plants. The two Mt Crosby plants supply to an area south of a line that roughly runs from Enoggera across to Nundah. It also supplies Logan City, Ipswich City and occasionally Gold Coast City. North Pine supplies north of the same line, up to Redcliffe, and also supplements the Pine Shire and Caboolture's water. In winter North Pine can be turned off for up to three months and Mt Crosby's two plants supply all areas.

Script

Hi, I'm _____ , and I study engineering at QUT. Today we are going to look at the importance of water and what is done to ensure that we have a supply of clean drinking water. Living in Australia means we live on the driest inhabited continent on Earth. This seems hard to imagine when we are able to turn on a tap and out comes as much water as we need. But water is a limited resource. Less than one per cent of the earth's water can be utilised for human consumption. The amount of this water will never increase as the water cycle is a closed system, so it's very important to us to be able to preserve what water we have.

The process from rainwater to tap water is fairly complex. The water that comes out of your tap has been through various processes that clean it and change its original properties, physically and chemically.

Do you know what any of the processes are? The aim of this workshop is to introduce you to a number of Water Treatment Plant processes that are commonly used in getting clean water to your household.

One of the types of engineer is called a "civil engineer". Does anyone know what a civil engineer is? Civil engineers do a lot of things, which usually have something to do with structures and environments, so you see their work whenever you look at bridges, buildings or roads. Another thing a civil engineer might do is design, monitor and maintain water treatment plants and water supplies. Water supply is the water than comes from the water mains into your home, and civil engineers are vital in the treatment and delivery of your water supply. And of course it's really important that the water which comes into our homes be clean, because if it wasn't it would be unsafe for us to bathe in it, cook with it, and especially unsafe for us to drink it.

Drinking water is sometimes called potable water, and Australia has strict guidelines on what our water should be like when it comes out of the tap. Can anyone guess what any of the guidelines are, or what qualities we require in our water? It should be clear and colourless, have no bad odour, and not contain any harmful chemicals, pathogens or visible particles.

Show students the 3 samples of water – tap water, bottled water, river water.

Here you can see some different types of water. You probably wouldn't want to drink the river water! A Water Treatment Plant aims to ensure that water is safe for human consumption and tastes okay, all while not costing too much money.

There are many steps before a household turns on their tap and receives water. From the dam to the tap there is a very involved process, but each part of it is essential in ensuring high quality water for drinking.

This activity looks at two of these processes. One activity will involve coagulation and flocculation, which are processes which make particles in water clump together. The second activity will involve filtration.

QUT Extreme Engineering Workshop Activities

Divide the class into 4 groups and allocate them materials.

Each group follows the instruction sheets through the two activities.

Part A involves a Jar Test and sedimentation of the suspended solids.
Part B involves investigating filtration systems in the water treatment process.

Materials (per group)

- Activity instruction booklet
- Activity worksheet (one per person)

Part A – Coagulation and flocculation

- 4x 500mL plastic beakers
- 4x plastic stirring paddles
- 4x 120mL plastic jars
- 3x 25mL measuring containers
- 3x 1mL pipettes
- 2L jug
- Timer – stop watch
- White paper
- 10mg/L alum solution
- pH strip
- 2L water
- 1g soil

Part B – Filtration

- 4x 120mL plastic jars
- Plastic funnel
- Wet sand
- Special coal
- Small gravel
- Stand & holder for funnel
- Tweezers
- Filter paper
- White paper