WATER MANAGER 101

Best Practice Guidelines

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Water Manager 101

- **Overview:**
- The management of a water utility needs to cover a variety of skills and technical issues.
- There are five key questions that need to be asked and understood by water managers.
  - How do I know that the drinking water that I am currently supplying is safe to drink?
  - How do I know when the water is unsafe?
  - What do I do if the water is unsafe?
  - Who do I tell if the water is unsafe?
  - How do I know the water is again safe for the consumers?

Water Manager 101

Overview continued:

- Build relationships with water quality personnel within your organisation and stay informed of issues that maybe being experienced in their areas of responsibility
- Select a Local Water Utility (LWU) that has similar environmental and operational issues, consult with them and share information and ideas on a regular basis
- The seven key components below will offer advice on each area of required knowledge
- Read and understand all the components of the Water Quality 101 section which follows on after the seven main areas listed below. It provides detailed information that should be understood by not only managers, but all personnel who are involved in supplying safe drinking water to consumers

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Catchment

- **Catchment:**
- Raw water can be obtained from three main water sources: Bores, which supply groundwater, surface waterways (usually rivers) and storage dams.
- **Issues:**
- Many aquifers can no longer be assumed to be secure from external contamination sources (i.e. surface water/groundwater interactions), as evidenced by the Havelock North contamination event in New Zealand
- Raw water quality in rivers is highly influenced by the activities that occur across their catchment, such as the use of agricultural chemicals and runoff from feedlots. Where possible, these sources of contaminants need to be managed, or at least identified
- Bores need to have casing heads that are sealed against contamination during flood events, or other types of inundation

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Catchment

Issues continued:

- Old mine site containments (e.g. tailings dams) can become breached and allow hazardous residues to be mobilized into river systems
- Flood events can greatly change raw water quality, rendering the raw water untreatable
- Dams can be impacted by algal or cyanobacteria blooms or runoff from agricultural activities
- Dams can become stratified and cause the water to ‘turn over’ during spring or autumn months, resulting in poor raw water quality

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Catchment

Solutions:

- The bore head area should be raised up off the ground and kept clean, by regular site maintenance
- Ensure all components around the bore head are fully sealed and maintained, particularly the cabling and any sensors
- River catchment areas need to be inspected/surveyed for any major changes in land use, or the presence of new developments that may result in poor quality runoff
- Catchment management activities are to be encouraged, in consultation with property owners along the river system, in order to reduce direct livestock access to waterways and manage intensive farming activities in close proximity to the waterway

Catchment

Solutions continued:

- Check historical records for old mine sites and as appropriate, visit the sites to inspect for any deteriorating containment systems and adjust monitoring programs to detect the presence of mine byproducts (particularly heavy metals)
- Prepare for flood events and have emergency plans in place in the event that the water source becomes untreatable
- Inspect storage dams regularly for algal or cyanobacteria blooms, particularly during the warmer months. Conduct regular monitoring to understand growth patterns. Drones are good for providing an overview of developing blooms
- Have a mixing system in the dam to reduce stratification

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Treatment

- **Treatment:**
- Raw water needs to be treated to make it a safe, food grade product. Treatment can vary considerably, depending on the quality of the source water.
- **Issues:**
- Some water treatment systems need to be able to adapt to varying source water quality and have appropriate monitoring and alarms for early warning of any changes in raw water quality
- If treatment upgrades are required, short and long-term improvement plans need to be developed and these plans need to be incorporated into planning budgets

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Treatment

Issues continued:

- Treatment systems are usually expensive to initially build, so it important to ensure adequate planning is undertaken so that necessary components are not left out, or downgraded for cheaper solutions, as retro-fitting a completed system is often very expensive
- Operators must be appropriately trained, or technically equipped to operate the treatment system as designed
- Longer term maintenance, such as filter bed upgrades, need to be factored into operational budgets
- An Institute of Enterprise Risk Practitioners (IERP) assessment needs to be undertaken to allow the plant be taken out of service if unscheduled issues arise

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Treatment

Solutions:

- Long term WQ assessments and a review of historical data relating to the source water need to be undertaken when planning a particular treatment system. Consult with local personnel who will be familiar with the prevailing conditions
- Project budgets need reasonable contingency budgets for the construction phase, to allow for price increases and necessary variations
- Allow for an expansion capability when designing the plant. Some things can be left until later, as population increases, but do not leave out key items that will require expensive rectification works to install at a future date
- Provide ‘fit for purpose’ training to operators and have back up personnel available

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Treatment

Solutions continued:

- Consider all necessary maintenance issues during the planning stages, even if they may be 10 to 20 years away
- Design for part operation of the plant when unforeseen issues develop or when there is a need for emergency maintenance to be carried out. Run yearly IERP sessions to factor in changing conditions and scenarios

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Storage

- **Storage:**
- Treated water needs to be stored in holding tanks to create a reserve for when catchment supply or treatment are interrupted, or treated water production capacity is not able to cope with periods of high usage.
- **Issues:**
- Tanks are generally made from either concrete or steel and each have different maintenance requirements
- There is a current trend to use cheaper build tanks, and expect the same asset performance as existing, better built, longer design life structures
- Tanks need to be effectively sealed against external contamination events and predictable rain water ingress
- Population growth is rapid, so ensure there is adequate storage capacity available and in the right geographical areas

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Storage

Issues continued:

- Ensure each particular water storage can be bypassed for maintenance, without disrupting normal supply. Some maintenance projects can take months, not days, to complete
- Have a regular, up-to-date, asset inspection program for all tanks/storages, so that maintenance issues can be identified and budgeted for, and immediate issues that could adversely impact to quality of the stored drinking water can be addressed. This is particularly relevant after severe weather events

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Storage

Solutions:

- Develop a maintenance program based on experienced information that has been gained by inspecting all the tanks, both those in operation and those that are offline
- Take a longer-term view to cheaper build options and don't believe everything the salesman tells you about asset life and asset performance
- Many water quality sealing issues are not apparent to the untrained eye. Use proven and experienced inspection personnel to assess the potential for a contamination issue to occur
- Plan and build for the future, and not just on today's requirements. Leave a legacy of good outcomes for the next generation of water utility management

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Storage

Solutions continued:

- Work towards making each storage able to be taken out of the system, without interrupting supply. Install by-pass pipework, plan new storages if a particular tank is nearing the end of its design life, or has developed significant structural defects
- Have an in-house inspection process, which is undertaken by trained staff, who carry out regular checks after storm events, or when there are reports of unauthorized access or vandalism. Drones can be useful for a quick overview of assets with height access issues

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Distribution

- **Distribution:**
- Treated water is distributed across a system of pumps and pipework from the storages to the consumers. The aim of distribution is to ensure that the water that is supplied to a customer's property is still of a drinking water standard
- **Issues:**
- Whilst not solely an issue related to distribution systems, local knowledge is quickly lost when key staff leave or retire. In general, insufficient amounts of this corporate information are captured in effective storage and retrieval systems
- Older pipework and valves are prone to structural failures and require regular inspection
- Contamination issues are not readily recognised or managed during repair works

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Distribution

- There is often insufficient time spent on managing backflow, and investing in a program to check and maintain backflow prevention devices, especially those devices placed at high-risk sites
- **Solutions:**
- Develop a system of capturing individual and group knowledge on distribution system design and operation, preferably on an ongoing basis, but definitely from staff who might be nearing retirement
- Maintain a cost-effective replacement program based on known and anticipated asset failures, and consider developing a risk-based program for asset renewal and replacement
- Ensure all relevant staff are trained on mains repair procedures that minimise the possibility of contamination or cross-contamination
- Put in place a program to check, maintain and repair or replace faulty backflow prevention devices, especially devices that are situated at high-risk sites

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Testing

- **Testing:**
- To verify that the drinking water supplied to customers is safe to drink, regular testing is required.
- **Issues:**
- The water quality testing program is not risk-based, so that the parameters included in the program, and frequency at which the parameters are tested does not adequately reflect the level of associated risk
- Water quality testing points are not representative of the distribution system they are meant to represent
- The personnel collecting the samples are not adequately trained, so poor-quality samples are submitted for laboratory testing
- The personnel conducting the testing are not competent in proper analytical technique, so the results are not accurate

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Testing

- **Issues continued:**
- The results of the testing are never reviewed
- **Solutions:**
- The water quality testing program needs to be properly designed. Advice on how to design a risk-based water quality testing program can be found in the Australian Drinking Water Guidelines
- Provide adequate training to all personnel who are involved in the collection of samples, or employ an adequately trained external service provider
- Provide adequate training to all personnel who are involved in the analysis of samples or contract a NATA-accredited external service provider
- Ensure that there is a process in place to review and trend sample results

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Maintenance

Maintenance:

All components of a water supply system require both scheduled and periodic maintenance to ensure supply is not interrupted or compromised.

+ **Issues:**
+ Relevant personnel are unaware of their assets and maintenance requirements for each type of asset
+ There is no strategic plan for asset maintenance or asset renewal
+ **Solutions:**
+ Begin an asset condition assessment process
+ Formulate a maintenance plan
+ Formulate a strategic asset renewal plan

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Human Resources

Human Resources:

Ensuring the staff of a water supply system are focused on their various assigned tasks and are committed to the production of safe drinking water.

- **Issues:**
- Staff capability is poor, relative to treatment systems operated by the utility
- Training is underfunded or not fit for purpose
- OH&S is given priority over all other competing issues
- Management have little understanding of what field staff encounter during their working day
- Staff are left out of decision making when it directly affects their work
- Staff are not motivated to do their best or to innovate practical solutions to ongoing problems

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Human Resources

- **Solutions:**
- Use a common-sense approach to staff issues and think, “what would I feel like in this particular situation”?
- Make sure any training is fit-for-purpose, and provides staff with practical and useful skills
- Re-think OH&S and ask the persons involved for their input in each situation, and how they might achieve a safe result
- Undertake monthly site tours of each ongoing project or maintenance situation, and learn what is required to complete the works. Be an active member of the team once in a while
- Tool box meetings should not be one sided, but allow input from anyone who has a relevant point to make

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Human Resources

- **Solutions continued:**
- Encourage staff to attend conferences, or other relevant training or networking opportunities and make them feel important when they offer ideas to problems
- View training as an investment in the future, not just a cost to be borne

Water Quality 101 Introduction

- Water organisation personnel and external contractors will all have received safety inductions as part of their job functionality. These inductions can be presented at many levels. Beginning with the simple – look both ways when crossing the road, wear high visibility clothing and steel cap boots. Or they can be complex, taking into account the environment and the public, as well as OH&S issues.
- One induction subject is obvious by its absence – water quality, and how it affects any works supervised or carried out by the respective personnel.
- Water quality has long been assumed to be the domain of the scientific fraternity, but it can be significantly affected by everyday operations carried out on water storage and delivery assets.

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Water Quality 101 Introduction

- Access to safe drinking water is a fundamental requirement for life. Water that is classified as being fit for human consumption is a food grade product and is required to meet specific quality standards prior to being supplied to customers.

- The quality and safety of drinking water can be affected by coming into contact with various people and activities. This contact can occur both directly and indirectly and be intentional or unintentional. In extreme cases, this contact can lead to customers becoming very ill.

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Objective

- This water quality training aims to provide utilities and personnel that may interact with drinking water, some basic guidance and best practice information to protect the integrity of the water supply to ensure that water remains safe and fit for human consumption.

- The information covers all processes from water that is in the catchment, which then becomes drinking water and through to the customers tap. It aims to identify potential contamination points and adverse interactions at different stages along the drinking water supply path.

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How to…

The water quality training is divided into two key sections:

- **Section 1: General Advice** - which is to be read and understood by ALL personnel. It provides broad knowledge, guidance and information relating to common issues that could adversely impact on drinking water quality.
- **Section 2: Specific Advice** - is aimed at individual industries and/or specific work activities in and around catchments and drinking water systems.

Within each of these two sections there is information that details:

- Hazards or issues associated with a particular threat to drinking water quality
- Common causes of contamination or harmful interactions with drinking water
- Best practice solutions/options to eliminate and/or minimise the effects of these interactions on drinking water quality

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Questionnaire

After each learning module, there will be a series of questions related to information learned in the previous slides. Questions may include scenarios, true or false, or most correct answer.

To complete each questionnaire, you will need to answer ALL questions correctly. If a question is incorrect, you will be advised to go back to the question to select again.

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Contents

GENERAL ADVICE to be read by all

- Basic Principles
- Pathogens
- Chemicals
- Security

Please complete general advice before moving on to the specific advice section.

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SPECIFIC ADVICE to be read by individual groups

- Water Utilities
- Utility Service Providers (including Mechanical Maintenance)
- Maintenance Service Providers (including Weeds and Maintenance, Pest Control Services, and Landscaping and Painting)
- Information Technology (IT) Consultants
- Supply Chain and Storage
- Equipment and Personnel
- Designers and Engineers
- Storage Tanks

Glossary

Unfamiliar or unknown words are underlined throughout the training modules. Please click these words to be taken to the glossary to find out more information.

Click the Return button to be taken back to your current slide.

Basic Principles

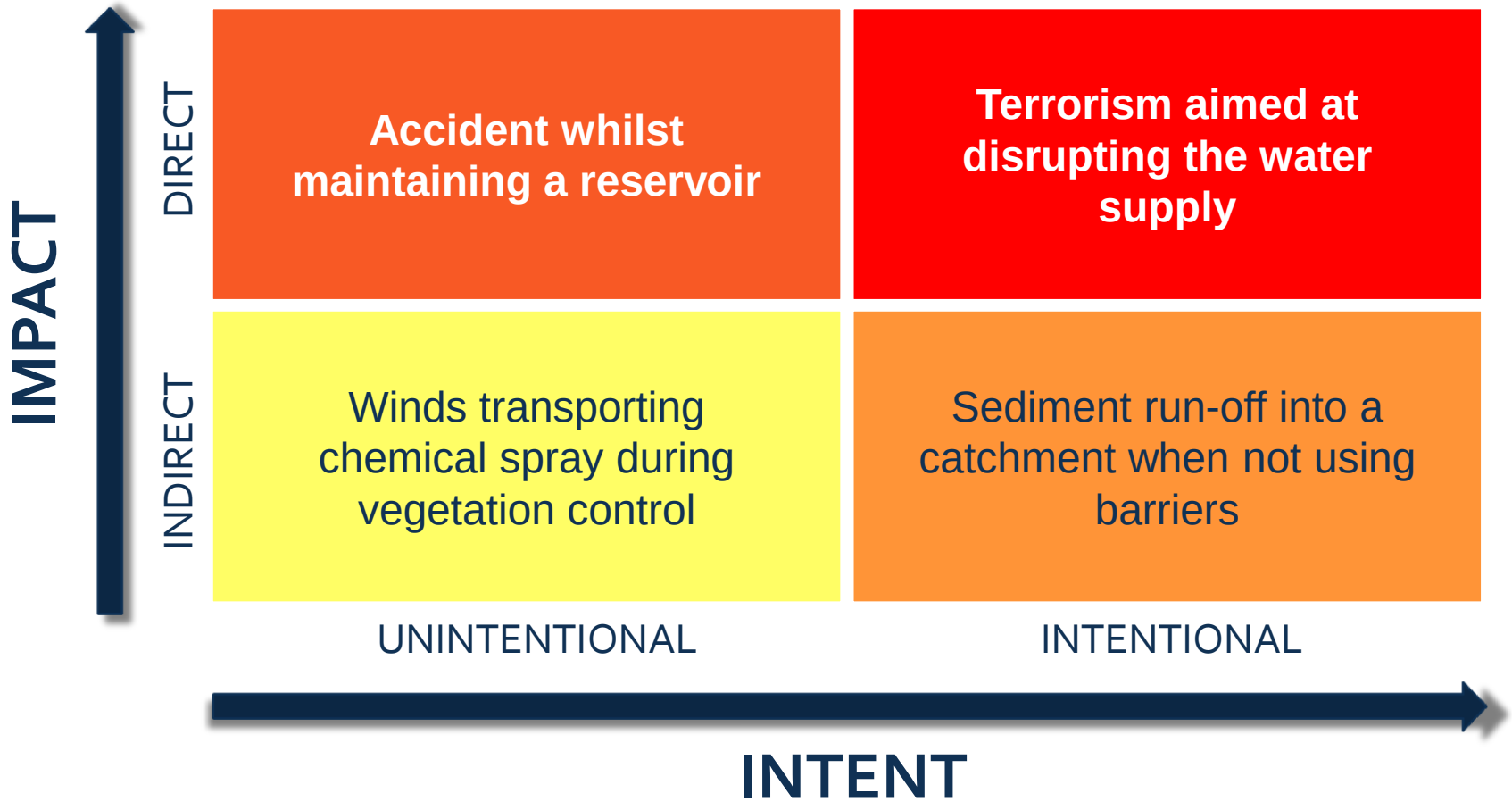
Next

Basic Principles

Safe drinking water may be impacted in many ways, which usually fall into two categories, **indirect** and **direct action**.

- An **indirect action** is an activity that is carried out in the vicinity of, or may flow into an asset, infrastructure, catchment area or waterway and eventually leads to drinking water, or water that is destined to become drinking water, being contaminated. An accidental fuel or chemical spill is an example of an indirect action.
- A **direct action** is more specific and closer to the drinking water or water that is destined to become drinking water. This includes weed and vermin eradication, pipeline repairs and everyday maintenance projects.

Basic Principles - Matrix



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Questionnaire

You will now be presented with a series of questions related to the basic principles of how water may be compromised.

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Basic Principles

An example of direct, unintentional action is:

a) Winds transporting chemical spray during vegetation control.

b) Sediment run-off into a catchment when not using barriers.

c) An accident whilst maintaining a reservoir.

d) Terrorism aimed at disrupting the water supply.

Sorry

That answer is incorrect. Please try again.

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Correct

Please move to the next question.

Next

Basic Principles

An accidental fuel or chemical spill is an example of:

a) Direct action

b) Indirect action

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Basic Principles

True of false:

Allowing sediment to run off into a catchment without the use of barriers is intentional indirect action.

a) True

b) False

Sorry

That answer is incorrect. Please try again.

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Correct

Please move to the next module – *Pathogens and Chemicals*.

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Pathogens and Chemicals

Next

Contamination Types

Pathogens

Chemicals

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Pathogens

- The most common health risk associated with drinking water is contamination. This can occur directly or indirectly, from contact with human or animal excreta.
- Pathogenic organisms include human infectious bacteria, viruses and protozoa. The diseases they cause vary from mild gastroenteritis, through to severe and sometimes fatal diarrhoea.
- There are many pathways by which pathogens can enter the water supply but the most relevant ones are cross connections, contamination events or poor hygiene within work practices.

Every effort must be made to ensure that faecal material does not come into contact with drinking water

- Drinking (potable) water that has been adequately treated should not contain any pathogens, so the only way it can become unsafe is if the protective barriers are disrupted, allowing contaminant entry to occur.

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Pathogen Issues

- Direct entry of faecal material into the treated drinking water supply
- Lack of personal hygiene
- Not washing hands between working on sewerage and then drinking water systems
- Wearing boots and clothing or using tools and equipment that were previously used on sewerage works, then on a drinking water system without suitable cleaning and disinfection protocols

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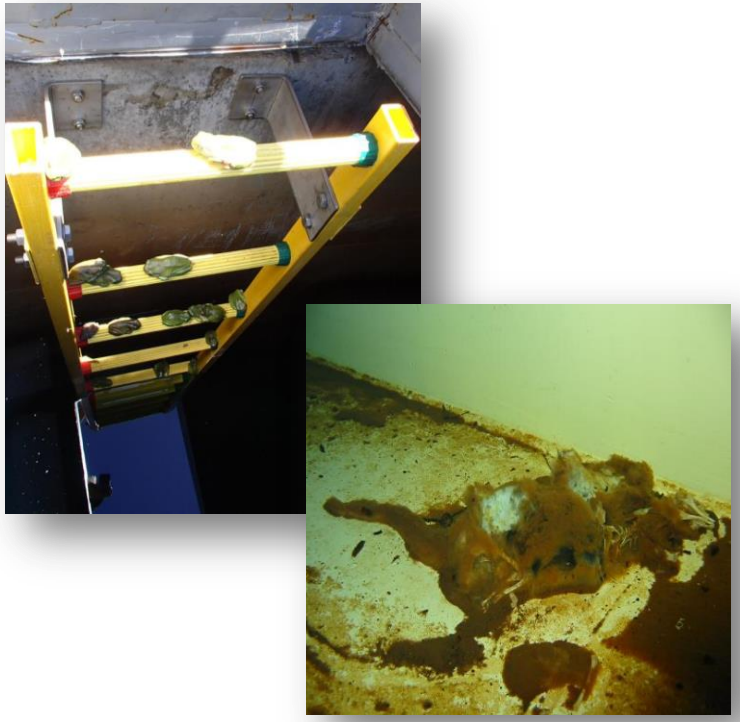
Entry Points

Faecal entry

Vermin entry



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Pathogen Solutions

- Have separate clothing and tools for use on drinking water systems
- Ensure all materials and substances in contact with the water comply with AS/NZS 4020:2005 - *Testing of products for use in contact with drinking water*
- Ensure untreated water cannot enter treated water storages through ill-fitting, poorly designed or poorly maintained structures
- Ensure adequate labelling on pipework to minimise potential cross connections
- Ensure backflow prevention devices are in place and are regularly serviced
- Do not isolate or shut down treatment facilities or plant sections without authorisation (e.g. operate valves or interrupt power supplies)
- Utilise calibrated in-line analysers to measure chlorine residuals

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Questionnaire

You will now be presented with a series of questions related to pathogens and chemicals.

Next

Pathogens

Health related issues occurring from pathogens can be caused from

a) Using tools or equipment that were not suitably cleaned from work on a sewage system.

b) The lack of personal hygiene and not washing hands between work

c) Wearing contaminated boots and clothing prior to work on drinking water systems

d) Direct entry of faecal material into water supply

e) All of the above

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Pathogens

When is it okay to isolate or shutdown treatment facilities or plant sections without authorisation?

a) Always

b) Sometimes

c) Never

Sorry

That answer is incorrect. Please try again.

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Correct

Please move to the next section.

Next

Chemicals

- Chemical contamination can be both direct and indirect.
- Direct contamination can come from paints, oils, lubricants etc. that can be introduced inadvertently, or deliberately into drinking water systems.
- Indirect introduction could occur through maintenance or wash down activities that are undertaken in, on or around drinking water storages, assets or systems.

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Chemical Issues

- Petrol, oils and greases from machinery used during construction and maintenance on or around drinking water systems
- Weed spraying undertaken near or around a drinking water treatment process or storage, raw water off-take pipes, or in the catchment, where there is the potential of runoff into the source water
- Paints/sealants used in a water treatment plant, water storages and the distribution network that are not compliant with the requirements of AS4020:2005: *Testing of products for use in contact with drinking water*
- The incorrect chemical, or concentration of a chemical, is used in the treatment of drinking water

Back Next

Chemical Solutions

- Protect buffer zones around reservoirs and feeder streams, in order to minimise the chances of chemical runoff and subsequent contamination of raw water sources
- Ensure refuelling is conducted in a bunded or non-spill area around water infrastructure and waterways
- Ensure plant and wheel washing activities are carried out in a designated area of hard standing, at least ten (10) metres from any watercourse or surface water drain
- Ensure that all paints, lubricants and sealants used for fittings that could potentially come in contact with treated drinking water are compliant with the requirements of AS4020

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Chemical Solutions cont.

- Take care working around chemical dosing or feed lines so you don't kink, restrict solution, or cause any blockage or interruption to the dosing system or feedlines
- Ensure that chemical signage, labelling and on-site management practices are robust, so it is not possible to deliver the wrong type, grade of chemical or cross contaminate chemicals during delivery or dosing
- Fit locks on chemical fill points so delivery drivers cannot fill tanks unattended
- Ensure that all onsite stored chemicals are adequately bunded and that there is no leakage possible to the environment
- Install anti-syphon valves in pipework between chemical storage containers and pumps

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Questionnaire

You will now be presented with a series of questions related to the basic principles of how water may be compromised.

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Chemical Solutions

Chemical contamination can be avoided with which simple precaution/s:

a) Paints used in a water treatment plant do not need to be compliant with the requirements of AS4020:2005.

b) Conduct laboratory tests on chemicals every 12 months to determine correct strength.

c) Fit locks on chemical fill points.

d) Ensure plant and wheel washing activities are carried out in a designated area of hard standing, at least twenty (20) metres from any watercourse or surface water drain

Sorry

That answer is incorrect. Please try again.

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Correct

Please move to the next section.

Next

Security

- Site security of all water assets is an important part of protecting drinking water from source to customer. Limit access to catchment areas and control who can enter water treatment facilities, pumping stations, disinfection dosing sites and treated water storage tanks. Have appropriate access control mechanisms including issued keys, electronic fobs etc.
- Maintain an up to date key register and install security cameras that will allow sites to be monitored. Regularly check for evidence of unauthorised access (e.g. graffiti, fence damage, tyre tracks etc.) and inform the appropriate persons in your organisation if anything suspicious is noticed.

Next

Security

Next

Congratulations! You have successfully completed the ***GENERAL ADVICE*** water quality training.

Please click the following link to access your certificate. (LINK TO PDF DOCUMENT?????)

Certificate

Specific Advice

Next

Specific Advice

This section should be read by personnel involved with specific activities involving contact, or potential contact, with treated drinking water.

It is recommended that managers and supervisory personnel complete all of the sections, to gain an overview of their responsibilities and requirements.

Please click on the SPECIFIC ADVICE link related to your area of work.

- Water Utilities
- Utility Service Providers
- Maintenance Service Providers
- Information Technology Consultant
- Supply Chain and Storage
- Equipment and Personnel
- Designers and Engineers
- Storage Tanks

Water Utilities

Next

Pathogen Issues

- Direct entry of faecal material into the treated drinking water supply
- Lack of personal hygiene
- Wearing boots and clothing that were worn whilst working on or near sewerage systems without suitable cleaning and disinfection protocols being applied prior to working on drinking water systems
- Not washing hands between working on sewerage systems and then drinking water systems
- Using tools and equipment that were previously used on sewerage system works, then on a drinking water system without suitable cleaning and disinfection protocols prior to use

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Pathogen Solutions

Design Considerations:

- Use only materials that are designed for use in drinking water systems
- Ensure all substances in contact with the water comply with AS/NZS 4020:2005 - *Testing of products for use in contact with drinking water*
- For dual reticulation systems (drinking water and recycled water), ensure that the pipe work is correctly colour coded to eliminate potential cross connections (blue for drinking water or purple for recycled water)
- Ensure adequate labelling on pipework to minimise potential cross connections
- Ensure untreated water cannot enter treated water storages through ill-fitting, poorly designed or poorly maintained structures
- Ensure backflow prevention devices are in place and are regularly serviced

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Pathogen Solutions cont.

Maintenance Considerations:

- Have separate clothing and tools for use on drinking water systems
- Wash and disinfect old or restored parts and fittings before installing them on drinking water systems and tag clean items whilst in storage. A chlorine concentration of 1% solution is recommended for effective disinfection
- Ensure an adequate chlorine/disinfectant residual is present after any repairs to drinking water mains to guarantee disinfection of 1% solution is recommended
- Flush any water pipes or mains after the completion of works to remove any debris, sediment or contaminants and restore adequate disinfection levels
- Test back flow prevention devices regularly (have a testing program in place for high risk customers and chemical dosing or transfer lines)

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Pathogen Solutions cont.

Operational Considerations:

- Prioritise work on drinking water systems before work on wastewater or recycled water systems
- Wash and/or disinfect contaminated clothing and equipment before working on or around drinking water systems and assets
- Ensure repairs do not allow soil and contaminants to enter the pipework
- Do not isolate or shut down treatment facilities or plant sections without authorisation (e.g. operate valves or interrupt power supplies)

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Pathogen Solutions cont.

Operational Considerations:

- Suitable training in testing procedures should be mandatory
- Test conductivity of the water in the main under repair if unsure whether it contains drinking water or recycled water (for Class A recycled water schemes only). Recycled water will give a higher conductivity reading
- Test for disinfectant levels of mains if unsure which is the raw water (for raw water systems only)
- Test for fluoride levels of mains if unsure which is the raw water (for raw water systems and systems with fluoride dosing only)
- Utilise calibrated in-line analysers to measure chlorine residual

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Chemicals

- Contamination from maintenance practices are the most common cause of chemicals inadvertently entering drinking water systems. They are also the easiest to avoid by following a few basic precautions.
- Direct contamination can come from paints, oils, lubricants etc. that can be introduced inadvertently, or deliberately into drinking water systems. Indirect introduction could occur through maintenance or wash down activities that are undertaken in, on or around drinking water storages, assets or systems.

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Chemical Issues

- Petrol, oils and lubricants from machinery used during construction and maintenance on or around drinking water systems
- Weed spraying undertaken near or around a drinking water treatment process or storage, raw water off-take pipes, or in the catchment, where there is the potential of runoff into the source water
- Paints, lubricants, sealants and materials used in a water treatment plant, water storages and the distribution network that are not compliant with the requirements of AS4020:2005: *Testing of products for use in contact with drinking water*
- The incorrect chemical, or the incorrect concentration of a chemical, is used in the treatment of drinking water
- Chemical lines failing or blocking, leading to either the under-dosing or overdosing of treatment chemicals

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Chemical Solutions

- Protect buffer zones around reservoirs and feeder streams, in order to minimise the chances of chemical runoff and subsequent contamination of raw water sources
- Ensure refuelling is conducted in a bunded or non-spill area around water infrastructure and waterways
- Ensure plant and wheel washing activities are carried out in a designated area of hard standing, at least ten (10) metres from any watercourse or surface water drain
- Ensure that all lubricants and sealants used for fittings that could potentially come in contact with treated drinking water are compliant with the requirements of AS4020

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Chemical Solutions cont.

- Take care working around chemical dosing or feed lines so you don't kink, restrict solution, or cause any blockage or interruption to the dosing system or feed lines
- Audit chemical suppliers - where possible only use suppliers that have quality control and assurance systems in place, which specify and verify the specifications for chemicals in the contract
- Ensure that chemical signage, labelling and on-site management practices are robust, so it is not possible to deliver the wrong type, grade of chemical or cross contaminate chemicals during delivery or dosing
- Fit locks on chemical fill points so delivery drivers cannot fill tanks unattended

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Chemical Solutions cont.

- Conduct laboratory tests on chemicals when they are delivered to determine correct strength i.e. sodium hypochlorite concentration percentage
- Ensure that chemical delivery procedures are adequate to prevent any accidental release or poor clean up practices onsite
- Ensure that all onsite stored chemicals are adequately bunded and that there is no leakage possible to the environment
- Install anti-syphon valves in pipework between chemical storage containers and pumps
- Fit lockable valves and trigger guns on pipework from storage containers

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Water Utilities

Water Main Replacement and Repair

- Water mains may be repaired by water utility staff or by external contractors. Either way, there is a potential that the method of repair, or parts and equipment used during the repair, may introduce contaminants and adversely impact the safety of drinking water. If the location of the main repair is within the reticulation system, downstream of the water treatment plant, there will be no way to prevent contaminants reaching customers before any online monitoring would detect changes to drinking water quality.
- In effect, anything that is introduced may go undetected and consequently result in water contamination and a risk to public health. Beyond the general advice detailed in Section 1, there are several other activities that may have a detrimental effect on the quality of drinking water within a distribution system.

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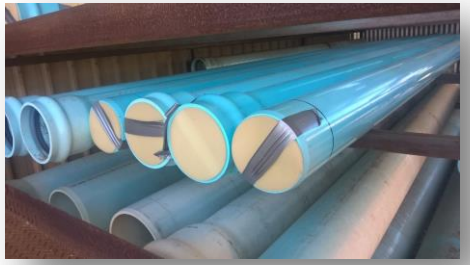
Water Utilities - Issues

- Spare pipes left unsealed whilst in storage, with the potential for debris, foreign material and vermin to enter the pipes
- Insufficient excavation size and/or shoring to prevent soil and contaminants entering open ended pipe sections during pipe laying
- The use of non-compliant gaskets and sealants to join pipes together (not compliant with the requirements of AS4020). This could be experienced where there is a difficulty pushing pipe sections together and so a lubricant is introduced to assist the process



A simple solution to avoid the entry of contaminants

Poor pipe management - note ingress of soil and foreign matter into open pipe ends

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Water Utilities – Issues cont.

- Cross contamination from tools, equipment and clothing being used for maintenance or repair work on both drinking water and sewerage systems
- Reuse of fittings and piping that have previously been used in other applications (e.g. sewage systems)
- Contamination of tools, equipment and spare parts that may have occurred off site or in transit to the repair job. Storage within a supplier's premises cannot guarantee that the materials are currently fit for drinking water use

Working in a dirty environment – highlights the importance of cleaning clothes and footwear

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Water Utilities - Solutions

- Keep sections of new pipe sealed at both ends until they are ready to be installed
- Protect the ends of the existing open water main pipes from ingress until the repair is completed
- Keep a positive flow of water out of the pipe (where possible) to prevent ingress
- Properly excavate around the pipe repair site to minimise the possible entry of soil/water into the opened pipe sections
- Maintain a de-watering system within excavations to minimise sediment contaminated water from entering into the pipe and consequently entering the water reticulation network
- Ensure sediment control plans are developed before undertaking excavation works near drinking water reservoirs or catchments

Back Next

Water Utilities – Solutions cont.

- Only use products for any installations or repairs in drinking water systems, that are compliant with the requirements of AS4020; this includes items such as lubrication, gaskets, spare parts etc.
- Ensure all tools, equipment and other items that may come into contact with drinking water are cleaned and disinfected properly
- Ensure proper disinfection by spraying all pipes and fittings with a concentrated sodium hypochlorite solution, especially if they have been used previously or have been kept in storage
- Proactively identify and assess possible sources of cross contamination during the planning of any repair - examples include failure of back flow devices, leaking valves, excavating soils within a contaminated area etc.

Back Next

Water Utilities – Solutions cont.

- Implement disinfection and flushing procedures after all repairs
- Ensure that a disinfectant residual is present and adequate before returning any drinking water main back into service
- Implement disinfection and flushing procedures after all repairs
- Ensure that a disinfectant residual is present and adequate before returning any drinking water main back into service

Mains flushing following a repair and a chlorine residual test being completed at nearest downstream hydrant to the repair

Back Next

Questionnaire

You will now be presented with a series of questions related to Water Utilities.

Next

Water Utilities

Water main replacement or repair within the reticulation system downstream of the water treatment plant runs no risk to water quality as the online monitoring system will detect any changes.

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Water Utilities

Activities that may have a detrimental effect on drinking water quality include:

a) Using compliant gaskets and sealants to join pipes together

b) Cross contamination of tools, equipment and clothing from maintenance and repair work on both drinking water and sewerage systems

c) Adequate disinfection procedures of tools and equipments

d) Sealed pipes correctly stored

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Pathogens

A design consideration for dual reticulation systems (drinking water and recycled water) is colour coding the pipework to eliminate potential cross contamination.

True or false – Drinking water pipes are coloured purple?

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Congratulations! You have successfully completed the ***Water Utilities*** water quality training.

Please click the following link to access your certificate. (LINK TO PDF DOCUMENT?????)

Certificate

Utility Service Providers

Next

Utility Service Providers

Examples of utility services or contractors who may have access to drinking water systems:

- Gas, electrical and telecommunications entities
- Contractors engaged to work on, near or around drinking water assets, catchments or waterways
- Fitters, mechanics, plumbers or electricians engaged to work on drinking water assets or infrastructure, or undertake works in water catchment areas

In most cases the effect on drinking water is caused by indirect actions that have a consequential impact on various parts of the system.

Back Next

U.S.P. General - Issues

- Painting water treatment plant infrastructure or water treatment assets in areas of the catchment where contamination can occur to drinking water or water destined to become drinking water
- The welding, cutting or grinding of materials, especially where dust residues are generated that could end up in source waters, or open or exposed treatment infrastructure
- Sediment from excavation or construction activities that could potentially run into a water course

Excavation works can affect drinking water storages or catchments by stirring up sediment

It is important that sufficient bunding is provided to minimise the impacts of sediment run off

U.S.P. General - Solutions

- Develop and carry out suitable hazard identification and risk assessments prior to commencing a task on or around drinking water catchments/systems to identify where your interactions could have an impact on water quality
- Consult with catchment managers and treatment operators/technicians regarding proposed works to actively identify issues and plan suitable control measures
- Capturing and retrieving sediment before it enters a water course (this can be done by developing and implementing a sediment control plan)
- Prompt reporting of any issues that have occurred that could affect the quality of drinking water further down stream

Back Next

U.S.P. General – Solutions cont.

- Ensuring that chemicals/fuels/paint cannot be spilled or inadvertently knocked over when working on or around drinking water assets/catchments. Place materials into bunded containers to contain spillage
- Ensuring all waste from wash down, manufacturing, welding or cutting operations is captured close to the source of emission to prevent it entering the water

Mechanical

- All assets require maintenance and repairs at some stage. This can range from a simple wire brush or paint, to complex repairs involving welding, cutting, grinding etc.
- No matter what the repair or maintenance task, if it is performed around drinking water, or water destined to become drinking water, the interaction of the work and any potential impacts it could have on water quality must be identified and carefully managed.

Back Next

Mechanical - Issues

- Petrol, oils and greases from machinery that is used during construction or maintenance activities on or around drinking water systems
- Paints and coatings that are used in a water treatment plant, that are not compliant with the requirements of AS4020. Also consideration needs to be taken of the paint used in and around water storages and the distribution network
- Sealants and lubricants used during construction, repair and maintenance that are not compliant with the requirements of AS4020
- Water system parts, such as valves and pipework, that are not compliant with the requirements of AS4020 for contact with drinking water
- Debris from maintenance activities entering the water system.

Back Next

Mechanical – Issues cont.

Grease gun being used directly over a treated water storage

Paint being applied from an open can directly over a drinking water supply.

Filling up equipment directly next to a water storage without adequate spill control - note the lid left off the oil container

Back Next

Mechanical - Solutions

- Thoroughly induct all persons involved in performing tasks around drinking water assets on the potential inputs of contamination from the works activity
- Ensure that suitable risk assessments for the works practice have identified all possible interactions with the drinking water and that actions to prevent/eliminate the possibility of contamination have been implemented. Where this is not possible, reduce the risk through suitable control measures
- Ensure that all lubricants and sealants used for fittings on drinking water systems are compliant with the requirements of AS4020
- Ensure that emissions from items such as grinders, welders or cutting equipment do not enter water storages or treatment processes

Back Next

Mechanical – Solutions cont.

- Ensure that any windborne debris or particles cannot enter drinking water storages or treatment processes
- Use suitable bunding and containment to capture fuels/oils and chemicals during refuelling and servicing (e.g. use a drip tray)
- Have suitable chemical recovery systems and equipment in place in the event of an emergency (e.g. spill kits)
- When petrol, oil or chemical drums are not in use, ensure the lids are fastened when working on or around drinking water assets or storages (or remove from site if possible)

Back Next

Questionnaire

You will now be presented with a series of questions related to Utility Service Providers.

Next

Utility Service Providers

During an accidental spill of paint, fuel, etc whom should you contact…Prompt reporting of issues and incidents that may have directly affected the quality of drinking water or processes for treating water that is destined to become drinking water

a) Other workers onsite

b) Work cover

c) Council

d) Site supervisor

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Utility Service Providers

True or False:

Whilst on site, the impact of rain or wind events need to be considered as sediment or debris can be washed into the catchment?

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Congratulations! You have successfully completed the ***Utility Service Providers*** water quality training.

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Certificate

Maintenance Service Providers

Next

Maintenance Service Providers

This section is relevant to the following activities:

- Contractors or landscapers/gardeners engaged to maintain grounds or eradicate weeds in, on or around drinking water assets or water supply areas
- Pest controllers engaged to work in, on or around drinking water assets or water supply areas
- Persons with property adjoining water treatment or storage facilities (farmers, market gardeners etc.)

Back Next

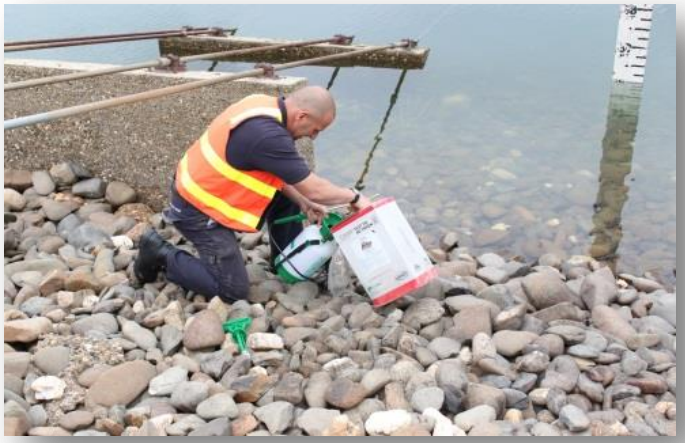
Weeds and Maintenance

- Controlling and removing noxious weeds and plants on or around drinking water assets is required under environmental regulations. It is also an important part of dam safety, as the root systems can undermine the structural integrity of a dam
- Chemicals are often used to control outbreaks of weeds and these chemicals can be a source of contamination of drinking water. Once the product has passed the last barrier of the treatment process it is very difficult to rectify any chemical intrusion to the drinking water system, therefore creating a requirement for strict management procedures

Back Next

Weeds and Maintenance - Issues

- Weed spraying undertaken near or around a water course, raw water off-takes, water treatment plants, or drinking water storages where there is the possibility for run-off into a water supply
- Wind-borne chemical residue



Decanting weed killer and spraying directly adjacent to a raw water or clear water storage

Weeds and Maintenance - Solutions

- Ensure products that are used are approved and safe to use on and around drinking water systems
- Only spray herbicide/pesticide chemicals when it is not windy, to ensure that chemicals are not blown into any water treatment process or water storage area, which could then result in contamination
- Whipper snipper around drinking water assets instead of spraying chemicals
- Use alternate design technology such as matting to eliminate weeds

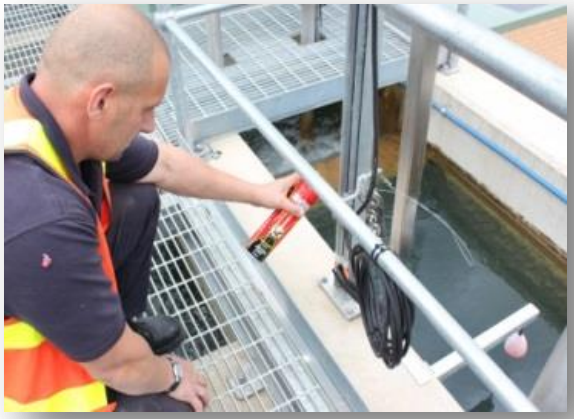
Back Next

Pest Control Services

- Drinking water can be compromised by the presence of pests; this may be in the form of faecal material excreted by animals, or other biological intrusions, such as deceased fauna, shredding or nesting
- Any foreign body that can enter drinking water has the potential to adversely affect its quality and make it unfit for human consumption

Pest Control Services - Issues

- Pest control (pesticide application) that is undertaken near or around the catchment area, raw water off-take pipes, storages or drinking water treatment plants, with the potential for accidental run-off or entry into the supply
- Carcasses of exterminated animals entering the water supply or water storages, or poisoned fauna entering the water storage and then dying



Spraying pests in close proximity to a water treatment process

Pest Control Services - Solutions

- Ensure that any products that are used are safe to use on and around water treatment assets
- Only spray pesticide/herbicide chemicals when it is not too windy, to ensure that chemicals are not blown into any water treatment process or water storage area
- Do not spray pesticide/herbicide control chemicals directly onto water infrastructure, e.g. raw water pumps
- Lay rodent baits with an anchored system to prevent accidental release into a water supply area
- Consider using means other than chemicals to remove pests (brush away spider webs or use ultra-sonic devices to keep rodents away)

Back Next

Landscaping and Planting

- It is often a requirement for planning consent that infrastructure, such as water treatment plants and tanks, are screened for environmental aesthetics, to reduce their impact on the natural countryside. This can lead to issues that may affect drinking water quality if not properly planned and assessed

Back Next

Landscaping and Planting - Issues

- Tall plants and trees dropping leaves, bark and branches onto the roofs of tanks, or falling into open water storages and other infrastructure. This can also cause structural damage to roofs, as well as allowing vermin access/entry to sites (e.g. possums)
- Roots from larger plants can intrude into infrastructure or undermine the structural integrity of tanks/bunds
- Plants that require regular maintenance, pruning or pest spraying to ensure their upkeep can introduce additional hazards to water quality

Trees starting to intrude onto storage tanks, causing roof impact damage or root intrusion

Overhanging trees deposit leaf debris and allow vermin to access roof areas

Back Next

Landscaping and Planting - Solutions

- Plan landscaping to minimise weed growth and the need for on-going weed maintenance
- Select plants that will not undermine tanks with root intrusion and will not deposit leaves/branches or overgrow the sites of water storages or treatment facilities
- If planting flora that will attract native wildlife, conduct a careful assessment to ensure that attracted wildlife will not subsequently impact the drinking water quality (nesting on infrastructure and defecating in and around drinking water assets)

Back Next

Questionnaire

You will now be presented with a series of questions related to Maintenance Service Providers.

Next

Maintenance Service Providers

True or False

Materials used on site need to comply with the AS4020 before potable use.

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Maintenance Service Providers

Inadequate planning and assessment of vegetation plantation can result in:

a) The attraction of native wildlife to reservoir area (nesting on infrastructure and defecating in drinking water)

b) Structural damage from root intrusion.

c) Debris build up effecting drainage.

d) All of the above.

Sorry

That answer is incorrect. Please try again.

Back

Congratulations! You have successfully completed the ***Maintenance Service Providers*** water quality training.

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Certificate

Information Technology Consultants

Next

Information Technology Consultants

- IT consultants engaged to work on drinking water systems
- Engineers, designers and personnel involved in the planning of construction and changes within drinking water treatment facilities
- Water utility management system representatives
- Modern drinking water systems in Australia are controlled and monitored using some type of technology/computer software. Within water treatment/supply systems, there are often Critical Control Points (CCPs) for the monitoring and safe supply of drinking water. Information Technology plays an important role in maintaining/monitoring these CCPs
- Changes to CCPs or system monitoring and controls require careful management by water utilities; however, it is possible for inadvertent changes to be introduced. One of the most common ways that this can occur is through software introductions, upgrades and maintenance

Back Next

IT Consultants - Issues

- Monitoring set points and CCPs being inadvertently changed without notification or tracking
- Introduced software bypassing critical limit applications within existing systems
- Impacts from set point changes that have not been fully assessed to identify all potential risks that could result from the changes
- IT personnel who have insufficient knowledge of the ongoing operational requirements of drinking water quality
- Incorrect logic controlling the key elements of a drinking water system

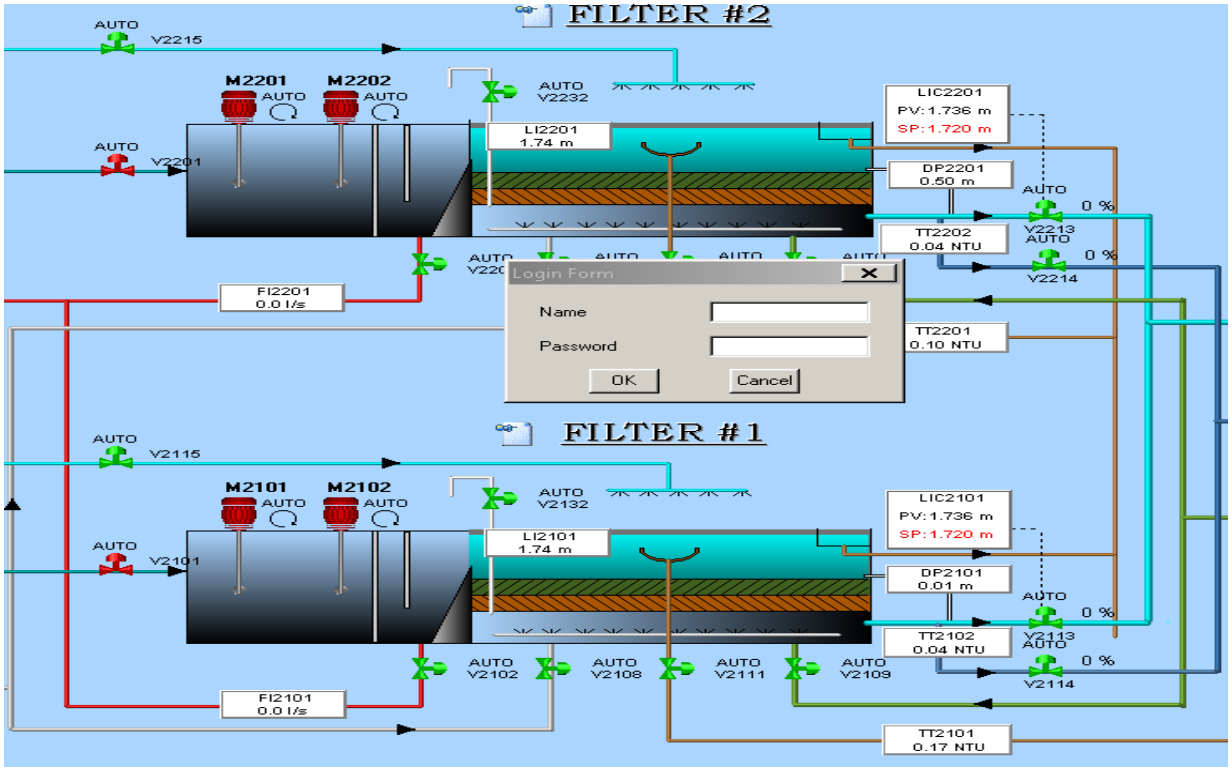
Back Next

IT Consultants - Solutions

- Conducting detailed inductions for personnel and the completion of risk assessments prior to working on any drinking water treatment system electronics
- Lock down protocols to limit access to drinking water control systems
- Careful assessment of the software interactions and the ramifications of CCP set point changes
- Security software to monitor interactions and logins, including password login protection
- Procedures for the monitoring and follow up of CCP set point changes
- Physical and electronic barriers created in series to protect downstream settings as a result of an inadvertent change
- Hardwired chemical maximum dosing set points
- Log off requirement when system is not in use

Back Next

IT Consultants - Solutions



Login/password required to access any plant control

WATER QUALITY IS EVERYONE'S RESPONSIBILITY

Back Next

Questionnaire

You will now be presented with a series of questions related to Information and Communication Consultants.

Next

IT Consultants

Question 1

Issues regarding IT consultants and water quality do not include:

a) Insufficient knowledge of the ongoing operational requirements of drinking water.

b) Being aware of the latest software security and monitoring protections

c) Notifying relevant personnel about software upgrades

d) All of the above

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Congratulations! You have successfully completed the ***Information Technology Consultants*** water quality training.

Please click the following link to access your certificate. (LINK TO PDF DOCUMENT?????)

Certificate

Supply Chain and Storage

Next

Supply Chain and Storage

- Plumbers or any person who stores items for use in a drinking water system
- Water utility asset managers
- Water utility distribution system workers
- Any person who is installing or replacing items on drinking water assets
- It would be reasonable to assume that an item that has been stored on the shelf and is suitably sealed would be clean enough for immediate use. However, we do not always know the history of the item, where it was stored or if it has been repackaged at some point

Supply Chain and Storage

- Some items also utilise a preserving substance to enhance the shelf life that may not be compatible with contact to drinking water. Never assume that an item is acceptable unless it is suitably packaged and labelled as fit for food grade or drinking water use
- The recycling and reusing of valves and equipment is a common practice that could potentially present a risk of cross contamination that must be carefully managed. This does not mean that a valve previously used in the sewerage network could not be reused as a valve within a drinking water system. It just means that there must be a high level of diligence to ensure that the quality and safety of the drinking water is not compromised

Back Next

Supply Chain and Storage - Issues

- Chemicals stored in close proximity to equipment and materials that will be used on drinking water systems
- Contamination of equipment and materials from welding, cutting, grinding or other workshop activities
- Storing items that may have been used or have come into contact with other items used in sewerage systems
- Storage areas that allow the intrusion of pests, such as rodents and birds (faecal material from these pests creates a pathogen risk)
- Keeping tools previously used for sewerage system works close to, or in contact with, tools designed or designated for use on drinking water systems

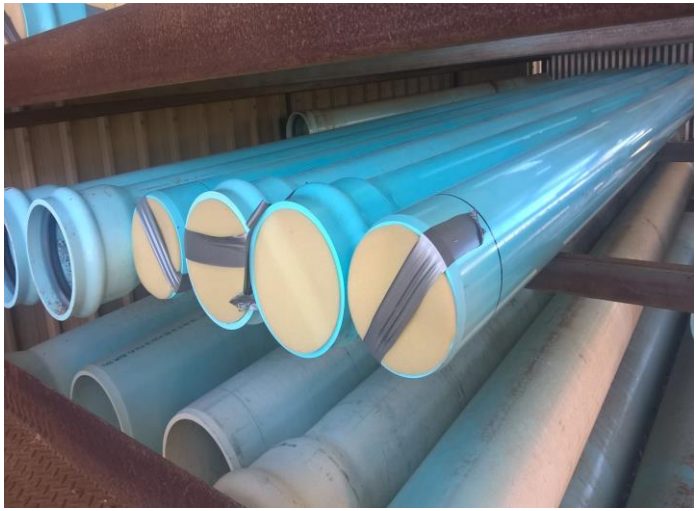
Back Next

Supply Chain and Storage - Solutions

- Cleaning items that may be reused as soon as they are taken out of service and labelling them as fit for use as drinking water assets
- Tagging items to show whether they came from a dirty or a clean process
- Physically separating drinking water and wastewater tools & materials on vehicles and in workshops
- Ensuring that protective packaging is maintained wherever possible and re-package as necessary, into clean and sealed plastic bags
- Storing items in clean areas of work vehicles (isolated from chemicals) and preventing impact damage (tearing of packaging) from movement whilst in transit

Back Next

Good storage examples



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Questionnaire

You will now be presented with a series of questions related to Supply Chain and Storage.

Next

Supply Chain and Storage

True or False

The risk of cross contamination from previous jobs does not present an issue with water quality.

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Supply Chain and Storage

True or False

Any equipment sent away for repairs needs to be disinfected immediately prior to use on drinking water

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Supply Chain and Storage

Issues regarding the storage of items in this picture include:

a) New items should be capped or sealed

b) Dirty or old fittings are next to clean ones

c) Accumulation of dirt and contaminants on shelving

d) All of the above

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Congratulations! You have successfully completed the ***Supply Chain and Storage*** water quality training.

Please click the following link to access your certificate. (LINK TO PDF DOCUMENT?????)

Certificate

Equipment and Personnel

Next

Equipment and Personnel

- People, materials and equipment working around water treatment plants, filter beds, water storages and pump wells. When in doubt, stop and question the actions being considered before creating an incident that could have been avoided

Back Next

Equipment and Personnel - Issues

- Pumps, pipework and fittings that have been removed and sent away for repairs should not be assumed to be fit for immediate use when returned (i.e. disinfected)
- Lifting pipework, pumps and fittings (which have been properly cleaned) into a drinking water storage with equipment such as chains and slings that may have been previously contaminated and not disinfected
- Installing Cathodic Protection anodes, sensors or instrumentation into tanks. These items can be contaminated from transport to site or from being laid out on unclean areas before installation
- Vacuum and tanker trucks cleaning out filter beds, storages and pump wells can have hoses that were previously used in unclean environments. There is also the risk of a back-flow event occurring to the area being worked upon
- Personnel or divers entering into storages, filter beds or pump wells to carry out cleaning, maintenance work or inspections. The risk of cross contamination from previous jobs cannot be underestimated - this includes the vehicles, all equipment, PPE and the personnel themselves

Back Next

Equipment and Personnel - Solutions

- Clean and disinfect all items (however small) before they are used in the maintenance of drinking water facilities and storages
- Cranes that are used to lift in larger items should only use new and/or disinfected lifting equipment when working on pump wells, WTP facilities and storage tanks
- Cathodic Protection anodes, sensors or instrumentation should all be disinfected onsite before installation
- Vacuum or tanker trucks working on drinking water sites need to be carefully managed. Only new and/or disinfected hoses should be used and backflow prevention devices should be installed and tested
- Divers working inside storage tanks and treatment facilities should be drinking water dedicated (DWD) - this includes their personnel, equipment and support vehicles

Back Next

Questionnaire

You will now be presented with a series of questions related to Equipment and Personnel.

Next

Equipment and Personnel

True or False

Cathodic Protection anodes and instrumentation sensors are safe to be installed immediately without disinfecting.

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Equipment and Personnel

True or False

Vacuum and tanker trucks can be directly connected to water storages.

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Equipment and Personnel

True or False

Personnel or divers entering into potable water after operating in waste water environments can be assumed to be safe if they have disinfected the same equipment prior to use

a) True

b) False

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Congratulations! You have successfully completed the ***Equipment and Personnel*** water quality training.

Please click the following link to access your certificate. (LINK TO PDF DOCUMENT?????)

Certificate

Designers and Engineers

Next

Designers and Engineers

- Designers, engineers, architects and any person involved in the design, construction or renovation of any asset that is required to hold, treat or store drinking water
- Asset managers and personnel involved in change management processes to any infrastructure that holds, treats or stores drinking water

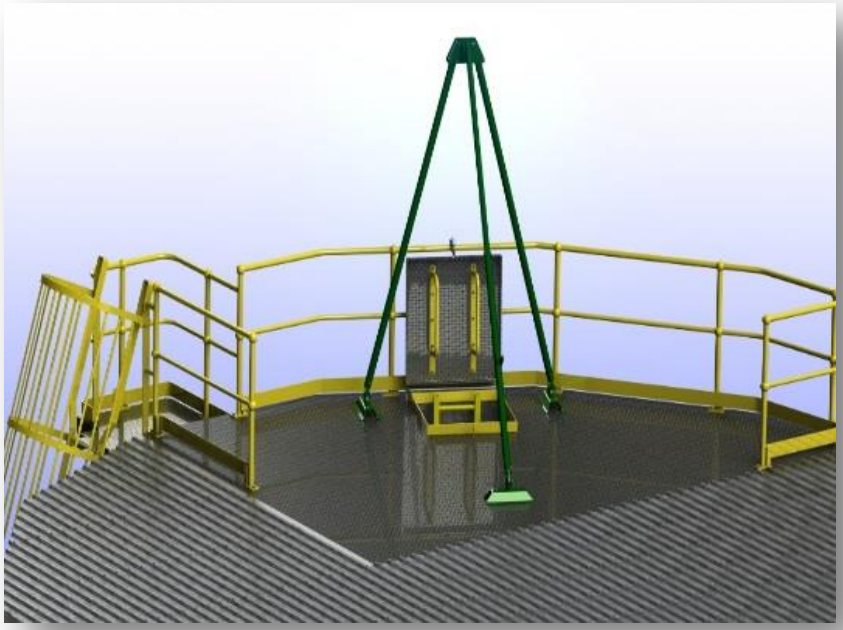
Back Next

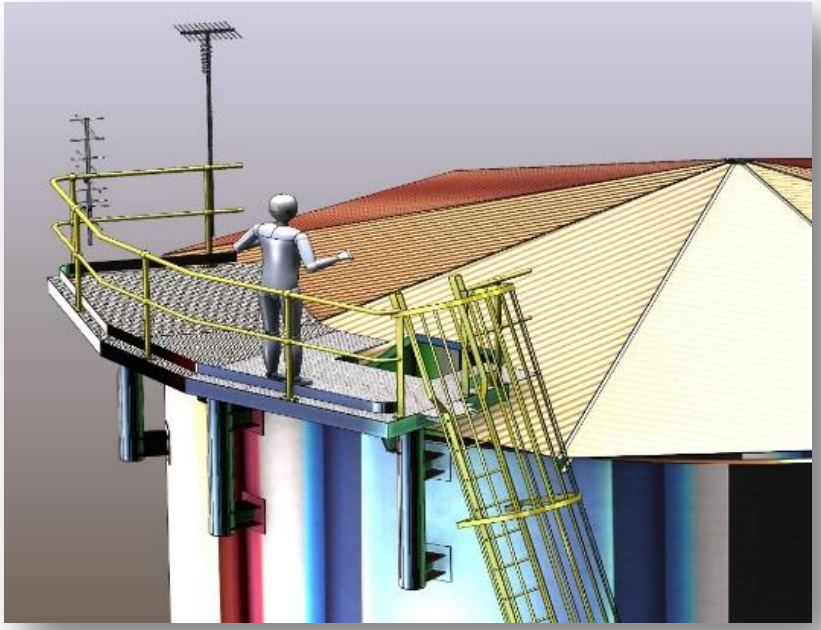
Designers and Engineers - Issues

- The design of drinking water systems needs to be a well understood process. A balance is required to ensure that safety legislation and environmental requirements are not compromised, while maintaining the utmost protection of drinking water
- A Hazard and Operability study (HAZOP) process, in consultation with key stakeholders is an ideal forum to discuss design issues and identify any hazards that may evolve over time. It is a proactive review of the design, to fully understand how it will be maintained and used along the journey of its design life and how it will interact with its environment and vice versa
- Despite all of the HAZOP and risk assessment processes that are employed issues may still arise from designs that can affect the quality of the drinking water. Additional hazards are also presented where retro-fitting and conducting modifications to drinking water systems occur at a later date

Back Next

Designers and Engineers - Issues





Prepare clear and concise specifications for construction projects - do not create guidelines that can be misinterpreted or changed by the designers or builders

Back Next

Designers and Engineers - Solutions

Within each node of the HAZOP and within the final review, consider the following:

- **Pest control:** will there be a requirement, and is the design suitable to block out pests?
- **Wildlife attraction:** is the design a natural attraction for wildlife & will wildlife interaction lead to increased maintenance activities and/or risks to drinking water quality?
- **Maintenance requirements:** are the materials of construction suitable - will they need on-going maintenance and are they compatible with the asset/process and all of its by-products and inputs?
- **Environment:** will the surrounding environmental features impact on the design and cause maintenance and/or drinking water quality issues now, or in the future?
- **Operational maintenance and servicing:** does the design minimise the need for human intervention for ongoing maintenance/servicing into the future?
- **Future growth and development:** does the design take into account the future growth and development of the surrounding areas, and stakeholder requirements?

Back Next

Questionnaire

You will now be presented with a series of questions related to Designers and Engineers.

Next

Designers and Engineers

What is not a consideration in the HAZOP process

a) Maintenance requirements

b) Financial and budgeting

c) Furture growth and development

d) Pest control

Sorry

That answer is incorrect. Please try again.

Back

Correct

Please move to the next question.

Next

Congratulations! You have successfully completed the ***Designers and Engineers*** water quality training.

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Certificate

Storage Tanks

Next

Storage Tanks

- Storage tanks come in many shapes, sizes, designs and uses. Each structure must be suitable for the safe storage of drinking water and the way people may interact with the storage, for operational, maintenance and indirect activities

Back Next

Storage Tanks - Issues

- Fitting external cabinets and fixtures that compromise security and allow unauthorised access to occur
- Damaged roof sheeting and vent mesh from the installation of cabling or piping
- Gaps in roofs and platforms that could allow debris/vermin to enter tanks
- Flashings fitted around roof edges that prevent water from draining off
- Railings and aerials that attract birds to roost close to the tank hatch opening areas or above open sections of a water treatment facility
- Roof and entry hatches or other openings that are not secured, raised or sealed against drainage and debris entry
- Recesses that collect debris and are difficult or unsafe to clean

Storage Tanks – Issues cont.

- Centre or roof edge gutters that collect debris that could block and cause run off into water storages
- Poor design of in-tank pipework, such as inlets, that allow sediment to be disturbed within the tank, or that allow short-circuiting to occur, which compromises disinfection levels (chlorine contact time)
- Outlets that are too close to the tank floor and create a scour effect for settled sediments
- Overflow pipe external outlets that are not screened, allowing vermin/animals to enter tanks
- Using materials that will degrade and adversely affect the drinking water quality, such as rotting timber, rusting metals and coatings peeling off

Back Next

Storage Tanks - Solutions

- Hazard identification and risk assessment practices undertaken in consultation with persons that have suitable knowledge and expertise in drinking water supply management and operation
- Ensure that tanks are suitably secured to prevent unauthorised access, including the input/ingress of materials from a natural or introduced source (suitably sized vent mesh)
- Check tanks regularly for maintenance and security, particularly after storm events (e.g. defective rotating vents or roof sheeting detachment)
- Install/retrofit hatches that do not allow debris and contaminates to enter the tank when they are both opened and closed

Storage Tanks – Solutions cont.

- Ensure suitable seals exist around tank roof areas, platforms, entry hatches, vents and other openings
- Ensure that fittings/features (e.g. davits, solar panels, aerials, lighting and security equipment) are positioned so that they do not attract birds to roost and defecate around hatches and other openings
- Install guttering (if required) that is easily cleaned and prevents debris ingress or rainwater drainage overflowing into the tank
- Check that drainage control points on the roof and platform areas are properly connected and sealed on the underside
- Use materials that can endure the humid and moist environment that they will be exposed to without degradation (chlorine is also an oxidant and will attack poorly protected metals)

Back Next

Storage Tanks – Solutions cont.

- Ensure renovations, such as additional pipework and cabling installations, do not compromise the sealing integrity or vermin/bird proofing of the tank
- Outlet penetrations and foot valves should be located above the tank floor area, with sufficient stand-off space to prevent sediment accumulation being drawn into the downstream pipework
- Use directional nozzles on inlets, or common inlet/outlet pipework, to avoid sediment disturbance and to promote more effective blending of water within the tank
- Develop standard design specifications that have undergone a HAZOP review

Back Next

Storage Tanks – Issues cont.

- The following images include identification of issues relating to water quality

Site security easy to bypass

Poor roof design

Back Next

Poor roof framing materials

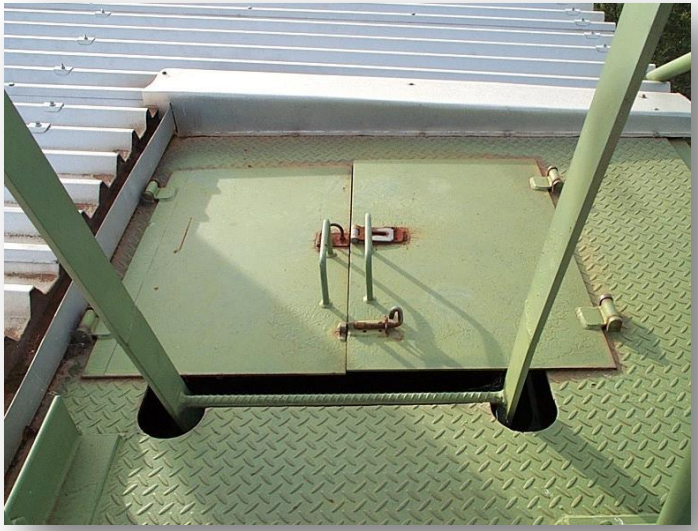
Good roof framing materials

Back Next

Roof drainage not effective

Back Next

Hatches unsealed



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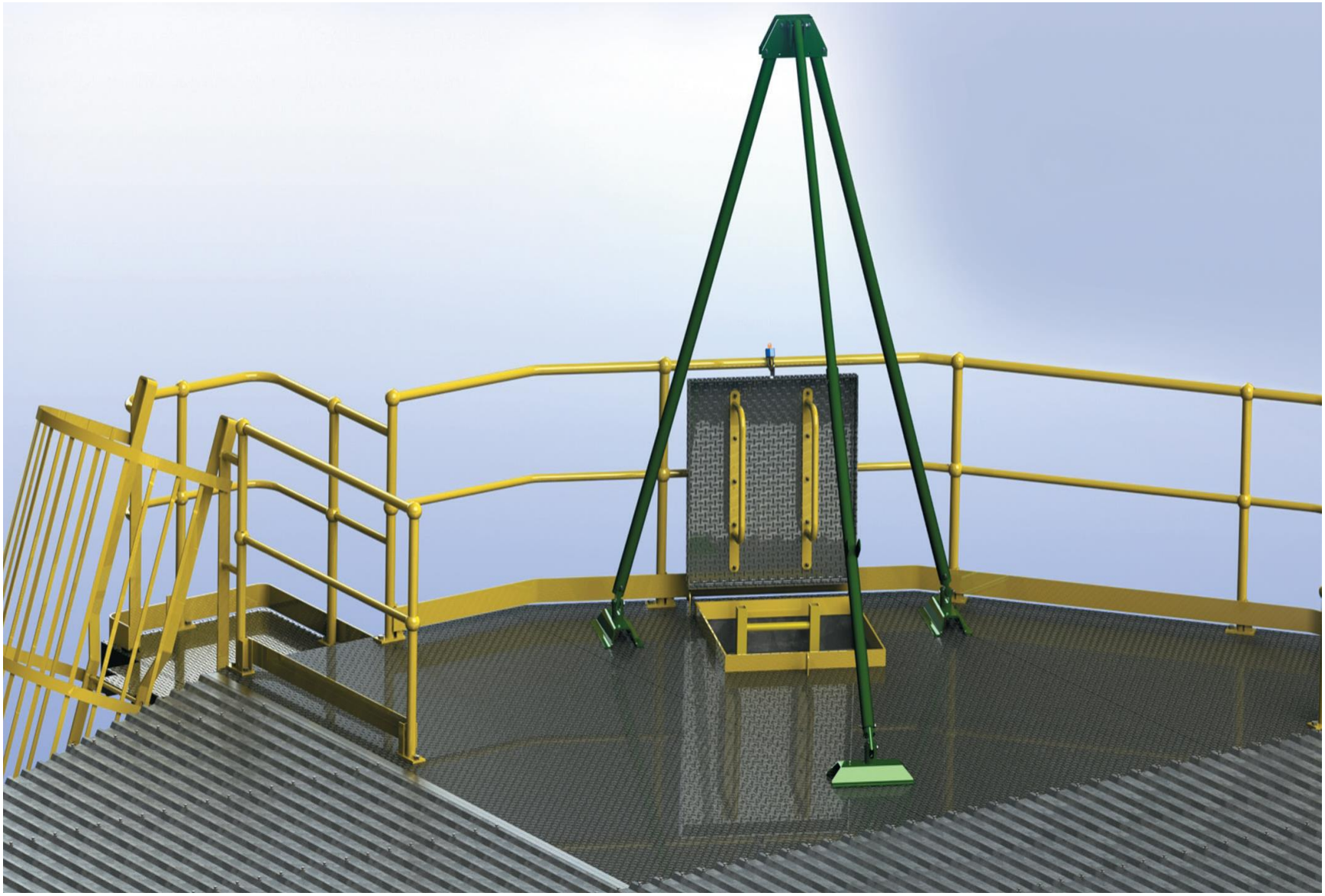

Hatch and platform solutions

WATER QUALITY IS EVERYONE'S RESPONSIBILITY

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Roof pipework unsealed or not connected

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Vent mesh unsecured or unsealed

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Vent mesh unsecured or unsealed

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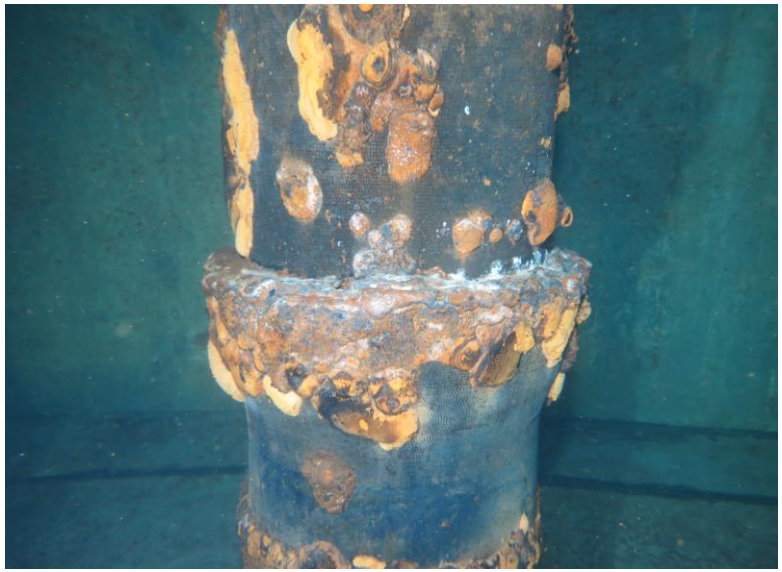

Unsuitable pipework materials – ductile iron and asbestos cement

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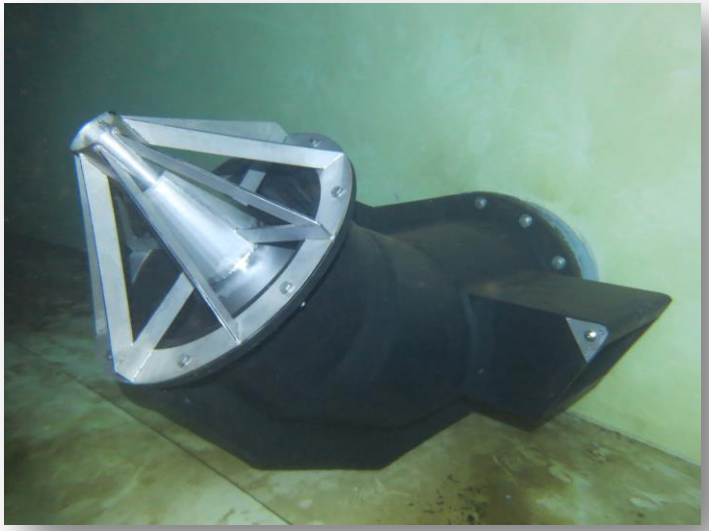
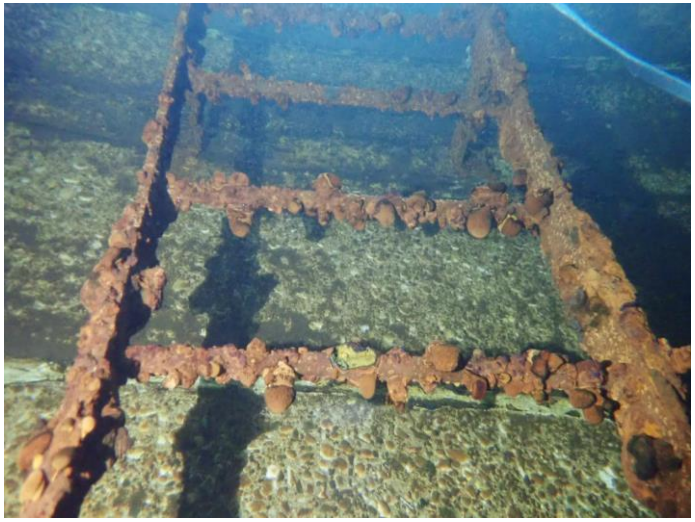
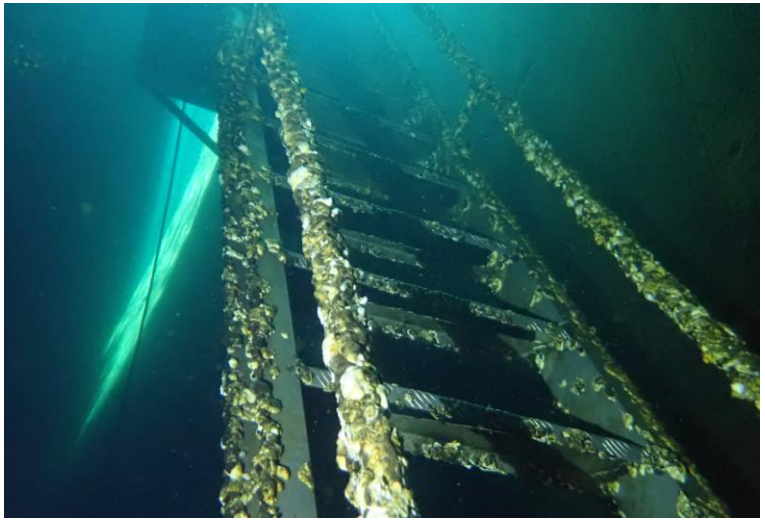
Penetrations poorly designed and HDPE solutions



Corroded ladder structures





Questionnaire

You will now be presented with a series of questions related storage tanks.

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Storage Tanks

Important considerations in tank/structure design include

a) Effective security against unauthorized access

b) Access hatches do not allow debris or contaminants to enter the water

c) Materials used are adequate for humid and moist conditions, whilst maintaining structuring integrity

d) All of the above

Sorry

That answer is incorrect. Please try again.

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Correct

Please move to the next question.

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Storage Tanks

True or false

Pipework type, size and positioning is an important factor in water circulation and avoiding sediment disturbances.

a) True

b) False

Sorry

That answer is incorrect. Please try again.

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Congratulations! You have successfully completed ***Storage Tanks*** water quality training.

Please click the following link to access your certificate. (LINK TO PDF DOCUMENT?????)

Certificate

Glossary

- **BUNDING** – "*A secondary enclosure, typically consisting of a wall or berm which surrounds a tank or fluid-handling mechanism, intended to contain any spills or leaks"* **Bunding, also called a bund wall, is the area within a structure designed to prevent inundation or breaches of various types.**
- **PATHOGENS**– a bacterium, virus or other microorganism that can cause disease.

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