

RIWMG302D

Reclaim and treat water (Release 3)



Assessor Guide

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Assessment Cover Sheet

Candidate Details		
Name	Phone	Email
Trainer/Assessor Details		
Name	Phone	Email
Assessment Details		
Time/Date	Location	Assessment Task/Setting

Assessment Result

Unit of Competency	Result	Feedback
RIIWVG302D - Reclaim and treat water	Competent <input type="checkbox"/> Not Yet Competent <input type="checkbox"/>	

Knowledge Evidence

Reclaiming and treating water

Reclaiming water is the process of recovering used water from mineral processing, slurry transport, or other operations. Reclaimed water is then subjected to treatment to remove contaminants, adjust chemical properties, and prepare it for reuse or safe discharge. Treatment is a step within the overall reclaiming process.

Water is used in large quantities for mineral processing, requiring about 500 litres for every tonne of ground material. As mined ores trend toward lower grades, the demand for water is expected to increase. The industry depletes water supplies through high usage and pollutes them with discharges from waste rock impoundments. Water is preferred in processing due to its low cost and low energy requirements for transporting materials between stages. It is a key ingredient for some chemical reactions and an efficient medium for supplying chemicals and mixing materials. It is also the most convenient medium for separating minerals from rocks.

In extraction and processing, water is used to recover metals from ore, with its primary uses including mineral separation, washing, dust suppression and slurry transport. Most water used in operations comes from groundwater, streams, lakes, rivers, or commercial suppliers.

Mineral contaminants and other solids accumulate in the water during processing, contaminating it. Contaminated water cannot be reused or returned to the environment without treatment. Some companies pay external contractors to collect and transport wastewater, which can be inefficient and costly. Retention ponds can be used to store wastewater, but their effectiveness decreases over time. Treating wastewater on-site using chemicals and filtration methods is one of the most effective approaches. Water used in mineral processing is called 'process water'.

Process water is classified into three categories based on quality:

- Raw water – Sourced from precipitation, rivers, and lakes. It is used for employee needs, process make-up water, shaft and underground mine requirements, mobile fleet washing, and fire protection.
- Compliant flow (non-contact water) – Clean surface runoff that is kept separate from contaminated areas to reduce treatment requirements and facility size.
- Non-compliant flow (contact water) – Water that has come into contact with mining, mineral processing, or tailings disposal. It cannot be released into the environment without treatment. To reduce freshwater consumption, this water is collected and reused on-site for various tasks. Any excess that is not reused requires treatment before discharge.

Once extracted, mineral ore is processed using the following methods:

- Size reduction – Crushing and grinding.
- Size control – Screening and classification.
- Enrichment – Washing, gravity separation, flotation, magnetic separation, and leaching.
- Upgrading – Sedimentation, mechanical dewatering, thermal drying, and thermal processing.
- Materials handling – Unloading, storing, feeding, and conveying.
- Slurry handling – Slurry transportation, agitation, and mixing.
- Wear management – Monitoring and addressing wear on equipment.
- Operational factors – Process efficiency and environmental considerations.

Metallurgical processes generate large volumes of acidic and alkaline water with high concentrations of sulphates, cyanides, and trace metals. Flotation causes metal elements to dissolve into process water due to mineral surface reactions.

Water contamination falls into five main categories: physical, chemical (organic), chemical (inorganic), biological, and radioactive. Biological pollutants originate mainly from domestic or sanitary sources. Radioactive pollutants come from uranium deposits and open-cut mines. In mining, physical and chemical pollutants are the most significant.

Main Category	Subcategory
Physical	Suspended solids (SS)
	Turbidity
	Colour
	Temperature
	Taste and odour
Chemical (organic)	Oils and grease
	Soaps and detergents
	Rubber
	Dyes and phenolic compounds
Chemical (inorganic)	Heavy metals (Cr, Hg, Cu, Cd, Pb, Zn, Ni, etc.)
	Acids
	Alkalis
	Cyanide
	Dissolved salts:
	- Cations: Mg, Ca, K, Na, Fe, Mn, etc.
- Anions: Cl^- , SO_4^{2-} , NO_3^- , HCO_3^- , PO_4^{3-}	
Biological	Bacteria, viruses, and small organisms
Radiological	Uranium, Tritium, and other radioactive materials from mine tailings

Wastewater Treatment in Mineral Processing

pH Adjuster Chemicals

Restoring the pH level to the correct range is one of the first steps in treating wastewater. Adjusting pH maintains water quality and prevents metals from remaining suspended or dissolving. A chemical reaction occurs when the pH is raised, forming insoluble metal particles that can be removed. Chemical pH adjusters reduce wastewater acidity, with the goal of reaching a pH of around 8 before additional treatment.

Using Flocculants and Coagulants

Coagulants and flocculants are chemicals that cause small metal particles and other suspended pollutants to clump together, making filtration easier. A wide range of wastewater coagulants is available, each designed for a specific application, so selecting the correct one is important.

Wastewater and Sludge Dewatering Techniques

Sludge produced during operations must be treated. One key step in this process is removing excess water from sludge to create solid waste that can be managed, transported, or disposed of more effectively. This process is called sludge dewatering.

Sludge Dewatering Processes

The best method depends on budget, available space, type of operation, environmental conditions, and local geology. Common processes include:

- **Hydrocyclones:** One of the most common techniques for sludge management, hydrocyclones efficiently remove solids from water using centrifugal force. This method processes large volumes of wastewater without requiring much space and has no moving parts. However, it must be used alongside other treatment methods.
- **Belt Press Filter:** A widely used method due to its low initial cost and quick setup. It consists of two moving belts running between rollers. Wastewater passes over the belts, and solids are collected in the form of clumps, known as cake, which can be easily removed.

Mine infrastructure used to reclaim and treat process water includes:

- **Settling ponds and tailings dams** – Used to settle suspended solids and reduce turbidity before further treatment or reuse.
- **Thickener tanks** – Separate water from solid waste by promoting sedimentation and improving water recovery.
- **Clarifiers** – Remove fine particles and impurities through coagulation and flocculation processes.
- **pH adjustment systems** – Use lime, caustic soda, or acid dosing to neutralise acidic or alkaline water.
- **Filtration systems** – Include sand filters, membrane filtration (reverse osmosis, ultrafiltration), and activated carbon filters to remove fine particulates and dissolved contaminants.
- **Chemical dosing systems** – Inject coagulants, flocculants, oxidants, or other treatment chemicals to aid in contaminant removal.
- **Oil-water separators** – Remove hydrocarbons from process water before further treatment or reuse.
- **Bioreactors and wetlands** – Use microbial activity to break down organic contaminants, nitrates, and sulphates.
- **Evaporation ponds** – Used to concentrate dissolved solids and contaminants by allowing water to evaporate.
- **Sludge dewatering equipment** – Includes belt presses, filter presses, and centrifuges to remove water from sludge for easier handling and disposal.
- **Ion exchange systems** – Remove dissolved metals and other charged contaminants by exchanging them with less harmful ions.
- **Dissolved air flotation (DAF) units** – Separate suspended solids, oils, and greases by injecting fine air bubbles to lift contaminants to the surface.

The process flow of reclaiming and treating mine process water from collection to discharge is shown below. The process may differ due to different contaminants requiring different or additional processing:

- Collection of process water from sumps, tailings ponds, or treatment circuits.
- Transfer of water to treatment facilities via pumps or gravity flow.
- Initial screening to remove large debris and sediments.
- Settling or thickening to allow suspended solids to separate.
- Coagulation and flocculation to aggregate fine particles.

- Sedimentation to further separate solids from water.
- Filtration through sand, multimedia, or membrane filters.
- pH adjustment using acids or alkalis.
- Chemical treatment to remove dissolved metals, sulphates, and other contaminants.
- Sludge removal and dewatering for disposal or reuse.
- Storage of treated water in holding tanks or reservoirs.
- Monitoring of water quality through sampling and testing.
- Discharge or reuse of treated water in processing or dust suppression.

Question 1.

Explain how to identify, assess, address and report hazards.

Your Answer:

Assessor Evidence Guide. Responses should cover the key principles/information of:

Identifying, assessing, addressing and reporting hazards

A hazard is a source or a situation with the potential for harm in terms of human injury or ill-health, damage to property, damage to the environment, or a combination of these.

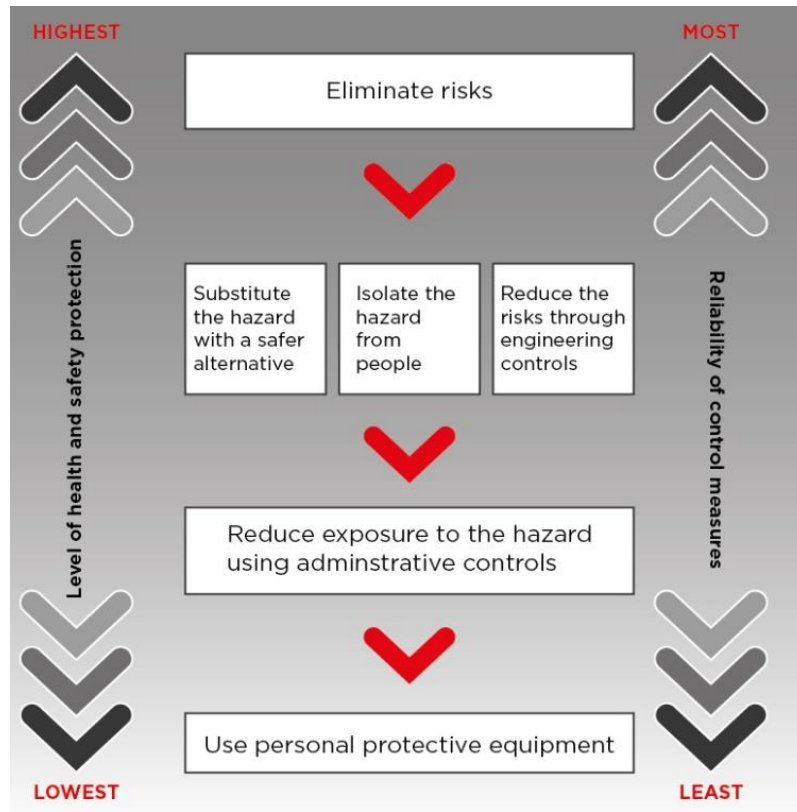
A risk is the chance of something happening that will have a negative effect. The level of risk reflects:

- The likelihood of the unwanted event (e.g., an incident or procedural breach).
- The potential consequences of the unwanted event.

Another key definition is a 'control'. A control is something you can do or put in place to either remove a hazard or risk, or make it less likely to cause harm, or reduce the severity of the harm.

Hierarchy of Control

The ways of controlling risks are ranked from the highest level of protection and reliability to the lowest, as shown in the diagram below. This ranking is known as the hierarchy of control measures.



The hierarchy of control measures can be applied in relation to any risk. The WHS Regulations make it mandatory for duty holders to work through this hierarchy when managing certain risks. It is also standard practice to apply the hierarchy of control to all risk management processes, whether mandated by legislation or not.

You must always aim to eliminate the risk, which is the most effective control. If this is not reasonably practicable, you must minimise the risk by working through the other alternatives in the hierarchy.

The lower levels in the hierarchy are less effective because controls that change the hazard or minimise exposure to the hazard can only minimise the risk. You cannot eliminate the risk without eliminating the hazard.

Administrative controls and personal protective equipment (PPE) are the least effective at minimising risk because they do not control the hazard at the source and rely on human behaviour and supervision. These control measures should only be used:

- To supplement higher level control measures (as a back-up).
- As a short-term interim measure until a more effective way of controlling the risk can be used.
- When there are no other practical control measures available (as a last resort).

The Hierarchy of Control Explained

Elimination

The most effective control measure involves eliminating the hazard and associated risk. The best way to do this is by, firstly, not introducing the hazard into the workplace. For example, you can eliminate the risk of a fall from height by doing the work at ground level.

Substitution, Isolation and Engineering Controls

If it is not reasonably practicable to eliminate the hazards and associated risks, you must minimise the risks using one or more of the following approaches, so far as is reasonably practicable.

Substitute the Hazard with Something Safer

For instance, replace solvent-based paints with water-based ones or manage both the physical and psychosocial risks by allowing workers to have more control of line speed instead of pacing line work by computer.

Isolate the Hazard from People

This involves physically separating the source of harm from people by distance or using barriers. For instance, install guardrails around exposed edges and holes in floors, use remote control systems to operate machinery, store chemicals in a fume cabinet, place barriers between workers and customers or move services online where there is a risk of violence or aggression or other harmful behaviours.

Use Engineering Controls

An engineering control is a control measure that is physical in nature, including a mechanical device or process. For instance, use mechanical devices such as trolleys or hoists to move heavy loads, place guards around moving parts of machinery, install residual current devices (electrical safety switches), set work rates on a production line to reduce fatigue, install sound dampening measures to reduce exposure to unpleasant or hazardous noise, ensure IT systems are fit for purpose to reduce job demands.

Administrative Controls

If risks remain, they must be minimised by implementing administrative controls, so far as is reasonably practicable. Administrative controls include work methods or procedures that are designed to minimise exposure to a hazard as well as the information, training and instruction needed to ensure workers can work safely. For instance, develop procedures on how to operate machinery safely, provide training and support to managers and workers to identify and manage both physical and psychosocial health and safety risks, implement workplace behavioural policies, limit exposure time to a hazardous task, and/or use signs to warn people of a hazard.

Some administrative measures will be necessary to ensure substitution, isolation and engineering controls are implemented effectively, for example, following safe work procedures when using equipment.

Personal Protective Equipment

Any remaining risks must be minimised with suitable PPE. Examples of PPE include earmuffs, respirators, face masks, hard hats, gloves, aprons and protective eyewear. PPE limits exposure to the harmful effects of a hazard, but only if workers wear and use the PPE correctly.

The Risk Management Process

The risk management process is cyclical, meaning that it is continuous, as shown in the diagram below.



A safe and healthy workplace does not happen by chance or guesswork. You have to think about what could go wrong at your workplace and what the consequences could be. Then, you must do whatever you can (in other words, whatever is 'reasonably practicable') to eliminate or minimise health and safety risks arising from the business or undertaking.

This process is known as risk management and involves four steps (see the diagram above):

- Identify hazards: Find out what could cause harm.
- Assess risks, if necessary: Understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening. This step may not be necessary if you are dealing with a known risk with known controls.
- Control risks: Implement the most effective control measure that is reasonably practicable in the circumstances and ensure it remains effective over time.
- Review hazards and control measures to ensure they are working as planned.

Identifying Hazards

Hazards generally arise from the following aspects of work and their interaction:

- Physical work environment.
- Equipment, materials and substances used.
- Work tasks and how they are performed.
- Work design and management.
- Workplace interactions or behaviours.

Hazards are generally split into six main categories:

- Safety Hazards:
 - Hazards relating to safety are the most common workplace risks and are usually the cause of creating unsafe working conditions. Exposed electrical wiring or damaged flooring resulting in tripping accidents fall under this category.
- Biological Hazards:
 - Biological hazards refer to any substances that can bring harm to workers. These include exposure and contact with viruses, bacteria, insect bites, and animals, etc., resulting in adverse health impacts.
 - Other common biological hazards are mould, harmful plants, sewage, dust, vermin, blood, and other bodily fluids.
 - This type of workplace hazard can be found mostly in schools, daycare facilities, universities, hospitals, laboratories, nursing homes, and other outdoor occupations.
- Physical Hazards:
 - Despite its name, physical hazards are not always something that is visible to the eyes or can be touched. In fact, this type might be the least obvious than the rest.
 - Physical hazards are environmental factors that can harm the body without necessarily being in contact with it.
 - Common physical hazards include height risks, noise, radiation, pressure, high exposure to sunlight or ultraviolet rays, gases, and temperature extremes.
- Ergonomic Hazards:

- Ergonomic hazards are mostly a result of physical factors resulting in musculoskeletal injuries. These include poor workstation setup, bad posture when sitting and standing, and incorrect manual handling.
- Chemical Hazards:
 - Chemical hazards mainly threaten workers dealing with dangerous solvents, liquids, or flammable gases.
 - Workers who are most likely to be exposed or affected by these hazards work in engineering, cleaning facilities, and other field-based occupations.
 - Exposure and being in contact with harmful chemicals can lead to skin irritation, breathing difficulties, severe allergic reactions, and in extreme cases, death.
- Psychosocial Hazards:
 - Psychosocial hazards refer to situations where they can negatively impact a worker's mental health and well-being. For example, deadlines, hectic schedules, work stress, sexual harassment, and workplace violence.

Hazards can be identified using a range of methods, including:

- Inspecting the work area.
- Using monitoring equipment.
- Reading Safety Data Sheets (SDS) for chemicals.
- Looking at site maps and plans.
- Consulting with a supervisor and other workers.
- Reading Safe Operating Procedures and Manufacturer's Instructions for plant and equipment.
- Reading Codes of Practice, guidance materials and other information published by WHS and other regulators.
- Reviewing past risk assessments, hazard reports and incident reports.
- Reading workplace signage, labels, stickers and warnings.
- Conducting a risk assessment.

Assessing Risk

Once hazards have been identified, you must conduct a risk assessment before planning to implement risk controls. A risk assessment is simply asking:

- What could happen if I am exposed to the hazard. E.g., if the electric tool I am using malfunctions, or a heavy item falls on me. The answer could be death or serious injury. (However, the maximum reasonable risk is more likely to be serious injury rather than death, as death may occur in some circumstances but not in the majority)
- How likely is it that harm of that severity (death or serious injury) will occur in this situation.

Once you have answered these questions, you can use the consequence and likelihood descriptors and a risk matrix to determine the level of risk.

Consequence Descriptors:

1. Negligible: No injuries or property damage. Minimal impact on operations.
2. Minor: Minor injuries or property damage. Minor disruption to operations.
3. Moderate: Moderate injuries or property damage. Significant disruption to operations.

4. Major: Major injuries or property damage. Severe disruption to operations.
5. Catastrophic: Fatalities or extensive property damage. Complete shutdown of operations.

Likelihood Descriptors:

1. Rare: Unlikely to occur in normal circumstances. Almost impossible.
2. Unlikely: May occur sporadically or under exceptional circumstances.
3. Possible: May occur occasionally or under specific conditions.
4. Likely: Will probably occur in most circumstances.
5. Almost Certain: Will occur in most circumstances.

Risk Matrix

	Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost Certain (5)
Negligible	Low (1)	Low (2)	Low (3)	Medium (4)	High (5)
Minor	Low (2)	Low (3)	Medium (4)	Medium (5)	High (5)
Moderate	Low (3)	Medium (4)	Medium (4)	High (5)	High (5)
Major	Medium (4)	Medium (4)	High (5)	High (5)	High (5)
Catastrophic	Medium (4)	High (5)	High (5)	High (5)	High (5)

The risk rating is the point where the consequence and likelihood intersect, e.g., Moderate + Possible (3) = Medium (4)

If the risk rating is Medium or High, the controls to be implemented will be more robust, and workers should seek to remove the hazard completely. Work activities with a high-risk rating may also require a supervisor's approval prior to commencing.

You can carry out a risk assessment using a Job Hazard Analysis (JHA) worksheet or another format, such as the example shown below. A simple template will suffice as long as it allows you to list the hazards associated with each task, assess the risk of exposure to them, and then plan the controls to be implemented.

Task	Hazards	Risk	Consequence	Likelihood	Risk Rating	Control	Responsible Person

Job Safety/Hazard Analysis (JHA/JSA)

A JSA (Job Safety Analysis) is a form of risk assessment that details step-by-step how a task is to be carried out safely. Sometimes, the JSA/JHA is called a JSEA and includes environmental aspects as well. Other than the employer's general duty of care to ensure workers are trained and competent for their work, there are no specific legal requirements to have a JSA or any regulations prescribing the format or content for JSAs.

JSA's have four main components, these include:

1. Job steps in chronological order.
2. Hazards and risks associated with each job step.
3. A risk assessment including consequences, likelihood and risk rating for each hazard or risk in each job step.
4. Control measures to be implemented according to the hierarchy of controls, to eliminate or control the hazards and risks.

A JSA template can be accessed here:

- https://www.commerce.wa.gov.au/sites/default/files/atoms/files/job_safety_analysis.doc

Reporting Hazards

Hazards that have the potential to cause immediate or serious harm to people or damage to equipment, infrastructure or the environment must be reported immediately. Hazards that do not pose an immediate or serious risk can be reported at the end of the shift or as soon as practicable.

Hazards can be reported by:

- Notifying your supervisor verbally, either in person or using a two-way radio or mobile phone where permitted.
- Completing a hazard report card and handing this to your supervisor.
- Entering a hazard into a safety management application on your phone, tablet or laptop. e.g., MyOSH or INX – InControl.

All hazards should be communicated verbally to ensure that your supervisor has received the message, even if you have also reported them in writing.

Example of a hazard report card as part of a Take 5 booklet.

HAZARD RISK RATING TABLE

MHA published Nov 2015 041.224 - Risk Management

Likelihood Rating (How likely is the hazard?)	Consequence Rating (How severe is the potential harm?)				
	1 Catastrophic Death/Disability	2 Major Hospitalization	3 Moderate Medical treatment	4 Minor First Aid injury	5 Insignificant No threat of injury
A Certain to occur Exposed to occur in most circumstances.	High risk	High risk	High risk	Medium risk	Medium risk
B Very likely Will probably occur in most circumstances.	High risk	High risk	Medium risk	Medium risk	Medium risk
C Possible High occur occasionally.	High risk	High risk	Medium risk	Medium risk	Low risk
D Unlikely Could happen at some times.	Medium risk	Medium risk	Medium risk	Low risk	Low risk
E Rare May happen only in exceptional circumstances.	Medium risk	Medium risk	Medium risk	Low risk	Low risk

High risk: Workplace Manager agrees with control.
Medium risk: Workplace Supervisor agrees with control.
Low risk: Task person in charge agrees with control.

Severity – is a measure of an injury, illness, incidents or disease occurring. When assessing severity, the most severe category that would be most reasonable expected should be selected.

Likelihood – is defined as the potential that an accident will happen that may cause injury or harm to a person. When making assessment of likelihood, you must establish which of the categories most closely describes the probability of the hazardous incident occurring.

CONSEQUENCE TABLE
High Risk: Consider elimination of the activity. Otherwise determine controls that are reasonably practicable to minimise the risk.
Medium Risk: Determine controls that are reasonably practicable to minimise the risk.
Low risk: Manage by routine procedures.

HIERARCHY OF CONTROLS

HIGHEST **MOST**

Eliminate the hazards.
E.g. by removing trip hazards on the floor.

Substitute the hazard with something safer.
Isolate the hazard from people.
Reduce the risks through engineering controls.
E.g. replace solvent-based paints with water-based ones.

Use personal protective equipment.
Reduce exposure to the hazard using administrative actions.
E.g. provide PPE including ear muffs, respiratory aids, etc.

LOWEST **LEAST**

↑ Level of health and safety protection ↓ Reliability of control measures

HAZOB REPORT

000001

This form is for reporting hazards, complete this form if you notice a hazardous situation. Rectify the hazard immediately if you are able to do so and report what action you have taken. If unable to rectify the hazard, state what action you recommend and give this report to your supervisor or manager.

1. DETAILS OF THE PERSON REPORTING THE HAZARD

Name: _____ Date: _____
 Job Reference: _____ Location: _____

2. IDENTIFY THE HAZARD

Location of hazard: _____
 Describe the hazard: _____
 Why/how is it a hazard? _____

3. ASSESS THE RISK

The risk rating of a hazard is based on the combination of likelihood, consequence and amount of exposure to a hazard.

4. CORRECTIVE ACTION PLAN – HOW DO YOU RECOMMEND THE HAZARD IS CONTROLLED?

Please use the Hierarchy of Controls to complete the corrective action plan, give priority to the hazard being eliminated
 1. Eliminate 2. Substitute / Isolate / Reduce the risk 3. PPE / Reduce exposure

Actions recommended to be taken	By whom	By when

Consultation with work colleagues, management and other affected parties will assist in identifying effective controls. Do not identify a person to action an item unless you have spoken to them.

MANAGER / SUPERVISOR TO COMPLETE:

5. HAVE THE CONTROL MEASURES BEEN IMPLEMENTED?

YES Date: _____ NO – Provide comments on action taken to remedy the hazard, or proposed actions.

Signature: _____

6. HAS THE HAZARD BEEN CONTROLLED EFFECTIVELY, IS ANY FOLLOW UP ACTION REQUIRED?

YES Date: _____ NO – Provide comments on action taken to remedy the hazard, or proposed actions.

Signature: _____

7. IS A FOLLOW UP RISK ASSESSMENT REQUIRED?

8. IS ENTRY ONTO THE SITE RISK REGISTER REQUIRED?

YES Date: _____ NO YES NO

Actioned by: _____ Date: _____

Question 2.

List examples of reports and data relevant to reclaiming and treating water and how you can interpret these when carrying out associated tasks.

Your Answer:

Assessor Evidence Guide. Responses should cover the key principles/information of:

Interpreting reports and data

The types of reports and data used or created during the reclamation and treatment of process water will depend on the type of contaminants present and the treatment processes that will be used.

Water Quality Analysis Reports:

- Chemical and physical data on reclaimed water include pH, turbidity, total suspended solids (TSS), total dissolved solids (TDS), heavy metals, sulphates, nitrates, ammonia, and cyanide levels.
- Interpretation: Reviewing this data determines whether water meets operational and regulatory standards or requires additional treatment, such as chemical dosing or filtration.

Flow Rate and Volume Records:

- Flow meters and level sensors track the volume of water entering, passing through, and exiting the treatment system.
- Interpretation: Comparing recorded values with expected flow rates identifies inefficiencies or blockages affecting water movement. Deviations may indicate equipment malfunctions or excessive losses that require corrective action.

Chemical Dosing Logs:

- Recorded quantities of pH adjusters, coagulants, flocculants, and oxidising agents show how chemicals are applied in the treatment process.
- Interpretation: Checking dosage records confirms correct chemical application and prevents overdosing or underdosing, which can impact water quality and treatment performance.

Sludge and Waste Management Reports:

- Volume, composition, moisture content, dewatering methods, and disposal records track sludge produced during sedimentation, filtration, or precipitation.
- Interpretation: Analysing sludge data identifies whether solid separation processes are working efficiently and whether adjustments are needed to improve dewatering or disposal methods.

Discharge and Compliance Reports:

- Treated water is tested against environmental discharge permits and regulatory limits to determine suitability for release or reuse.
- Interpretation: Comparing test results with permitted limits determines whether water can be discharged or if additional treatment is required.

Process Monitoring Logs:

- Daily entries record pump speeds, filtration efficiency, clarifier operation, and retention times in settling tanks.
- Interpretation: Identifying trends in recorded values detects abnormal conditions early, allowing intervention to prevent equipment failures or quality issues.

Equipment Maintenance Records:

- Inspections, servicing, repairs, and component replacements for pumps, filters, aerators, and dosing systems are tracked to maintain operational reliability.
- Interpretation: Reviewing maintenance history schedules preventative servicing and reduces unexpected breakdowns that could disrupt water treatment.

Incident Reports:

- System failures, water quality breaches, spills, or deviations from standard operating conditions are documented for review.
- Interpretation: Examining reported incidents highlights recurring issues, determines root causes, and provides data to adjust operations and prevent similar problems.

Environmental Monitoring Data:

- Surface and groundwater sampling results assess potential contamination risks from reclaimed water discharge or seepage.
- Interpretation: Comparing this data against background levels measures whether water treatment is effective in preventing environmental impact.

Reclamation Efficiency Assessments:

- Water recovery rates, treatment system performance, and reclaimed water suitability for reuse in processing, dust suppression, or other site applications are evaluated.
- Interpretation: Reviewing efficiency assessments maximises water reuse while reducing waste and treatment costs.

Question 3.

Explain how to identify and address contaminants present in process water.

Your Answer:

Assessor Evidence Guide. Responses should cover the key principles/information of:

Identifying and addressing contaminants

In metalliferous mining, the water being reclaimed and treated contains contaminants from ore extraction, processing, and associated activities. The contaminants present will vary according to the product being mined and the type and extent of the process's operation, but may include:

- Suspended solids – Fine particles of ore, gangue, and processing residues that can cause turbidity (the cloudiness of water caused by suspended particles).
- Heavy metals – Elements such as lead, cadmium, arsenic, mercury, copper, and zinc, which leach from ore during processing.
- Acidic or alkaline compounds – Resulting from acid mine drainage (AMD) or the use of alkaline reagents in processing.
- Cyanide – Used in gold and silver extraction processes.
- Sulphates – Released from sulphide minerals during oxidation or from processing chemicals.
- Nitrate and ammonia – From explosives used in blasting.
- Flotation reagents – Such as xanthates, frothers, and depressants used in ore separation.
- Oils and greases – From machinery, pumps, and hydraulic systems.
- Salinity – Increased from mine dewatering, evaporation, or chemical additions.
- Radioactive elements – Depending on the orebody, uranium and thorium may be present.
- Pathogenic organisms – If wastewater from mine facilities (e.g., camps or workshops) is mixed with process water.

The identification of contaminants is not something that will be left to chance or be unplanned. Site management knows what is being mined, what extraction and processing methods they are using, what reagents or chemicals are used, and will therefore already know what contaminants will be present in process water. They will design treatment and implement processes within the plant and site infrastructure.

Methods used to identify contaminants can include:

- Sampling and laboratory analysis – Assess physical, chemical, and biological properties of process water.
- Water quality parameters – pH, turbidity, total suspended solids (TSS), and total dissolved solids (TDS) indicate contamination levels.
- Chemical tests – Detect heavy metals, sulphates, cyanide, nitrates, ammonia, and other dissolved substances.
- Biological analysis – Identifies bacteria, viruses, and other microorganisms.
- Advanced testing methods – Spectroscopy, chromatography, and mass spectrometry examine specific compounds in detail.
- Sensors and meters – Provide continuous data on water composition and contamination trends.

However, as a process plant operator or similar, it is unlikely you will be required to use complex processes in the identification of contaminants. Therefore, you would rely more on visual checks and monitoring. You can identify contaminants by:

- Monitoring equipment readings, conducting basic field tests, and observing changes in water characteristics.
- Looking for cloudiness, discolouration, or unusual odours.
- Using pH meters, turbidity sensors, and conductivity meters to check for acidity, suspended solids, and dissolved salts.
- Using grab sampling and test kits to check for metals, chemicals, or other pollutants.

Treatment methods depend on the specific contaminants and regulatory requirements for discharge or reuse. Examples of the processes used to remove each example of contaminant are provided below:

- Suspended solids – Sedimentation, coagulation, flocculation, and filtration.
- Heavy metals – Precipitation, ion exchange, adsorption (activated carbon or zeolites), or membrane filtration.
- Acidic or alkaline compounds – Neutralised with lime, caustic soda, or acid dosing to adjust pH.
- Cyanide – Oxidation (hydrogen peroxide, chlorine, or SO₂/air process) or biological treatment.
- Sulphates – Precipitation (lime or barium compounds), membrane filtration, or biological sulphate reduction.
- Nitrate and ammonia – Biological denitrification, ion exchange, or reverse osmosis.
- Flotation reagents – Advanced oxidation (ozone, UV, or Fenton's reagent) or adsorption onto activated carbon.
- Oils and greases – Separated using skimmers, dissolved air flotation (DAF), or oil-water separators.
- Salinity – Reverse osmosis, electrodialysis, or evaporation ponds.
- Radioactive elements – Ion exchange, adsorption, or precipitation methods.
- Pathogenic organisms – Chlorination, ozonation, UV disinfection, or biological treatment.

Question 4.

Explain equipment processes used in reclaiming and treating process water and the technical capability and limitations of the equipment used.

Your Answer:

Assessor Evidence Guide. Responses should cover the key principles/information of:

Identifying equipment processes, technical capability and limitations

Equipment processes used for reclaiming and treating process water:

- Settling ponds and clarifiers – Remove suspended solids through sedimentation.
- Thickeners – Separate water from slurry to improve recovery.
- Filtration systems – Use sand filters, activated carbon, or membranes (reverse osmosis, ultrafiltration) to remove fine particulates and dissolved contaminants.
- pH adjustment systems – Add lime, caustic soda, or acid to neutralise acidity or alkalinity.
- Coagulation and flocculation units – Bind fine particles with chemicals for easier removal.
- Oil-water separators – Extract hydrocarbons from process water.

- Dissolved air flotation (DAF) units – Inject air bubbles to lift suspended solids, oils, and greases to the surface.
- Ion exchange systems – Remove dissolved metals and other charged contaminants.
- Bioreactors and wetlands – Break down organic contaminants and nitrates using microbial processes.
- Sludge dewatering equipment – Includes belt presses, filter presses, centrifuges, and hydrocyclones to remove water from sludge.
- Evaporation ponds – Concentrate dissolved solids by allowing water to evaporate.

Operating manuals and Standard Operating Procedures (SOPs) for reclamation and treatment equipment and facilities will detail how it should be used, what it can do and what it cannot or should not do or be used for. You must review the manual and SOP before operating equipment as well as any warning or information labels and decals on equipment, to make sure that you are not using it outside of its capabilities or limitations.

Technical capabilities of reclamation and treatment equipment and facilities will vary based on their type, but can include:

- Removing suspended solids, dissolved metals, and organic contaminants.
- Adjusting pH to control acidity or alkalinity.
- Reducing turbidity to improve water quality.
- Separating oil, grease, and hydrocarbons for reuse or disposal.
- Filtering, precipitating, and using biological treatment to eliminate contaminants.
- Recovering and recycling water to reduce reliance on freshwater sources.
- Monitoring and controlling treatment processes with automated systems.
- Managing fluctuations in flow rates and contaminant concentrations.
- Using non-chemical methods where applicable.
- Treating water with advanced technologies to maximise contaminant removal.

Examples of limitations of reclamation and treatment equipment and facilities:

- Different treatment processes target different contaminants therefore, several processes must be used.
- Equipment can clog, foul, or suffer from excess scaling.
- Some contaminants require multiple treatment stages for effective removal.
- Evaporation ponds require large land areas and are affected by climate conditions.
- Variability in influent water quality can impact treatment effectiveness and require process adjustments.

Question 5.

Explain how to identify what reagents are required and how they are used.

Your Answer:

Assessor Evidence Guide. Responses should cover the key principles/information of:

Identifying and using reagents

A reagent is a substance added to a system to cause a chemical reaction, aid in the detection of another substance, or modify a process by altering chemical or physical properties. A reagent in mine wastewater treatment is a chemical added to alter water chemistry, remove contaminants, or facilitate separation processes by promoting sedimentation, filtration, oxidation, reduction, or biological treatment.

There are many reagents that can be used to treat specific water qualities and contaminant types and levels, but the three most common reagents used in a mining operation to treat mine water from processing are:

- pH adjusters – Used widely to neutralise acidic mine drainage, stabilise water chemistry, and optimise conditions for other treatment processes. Lime is common due to its cost-effectiveness and ability to precipitate metals.
- Coagulants – Used for removing fine suspended solids and metal particulates, improving sedimentation and filtration efficiency. Ferric chloride and aluminium sulphate are commonly used coagulants.
- Flocculants – Work alongside coagulants to aggregate fine particles, speeding up solid-liquid separation and improving water clarity. Polyacrylamide is a commonly used example of a flocculant used for this purpose.

Handling Reagents

pH Adjusters (Lime, Sodium Hydroxide, Sulphuric Acid, Hydrochloric Acid):

- Form:
 - Lime ($\text{Ca}(\text{OH})_2$) – Powder or slurry.
 - Sodium hydroxide (NaOH) – Solid pellets, flakes, or liquid.
 - Sulphuric acid (H_2SO_4) and hydrochloric acid (HCl) – Liquid.
- Storage:
 - Lime – Stored in dry silos or tanks as a slurry.
 - Sodium hydroxide – Stored in plastic or stainless steel tanks.
 - Acids – Stored in corrosion-resistant tanks with secondary containment.
- Transport:
 - Lime – Delivered in bulk tankers or bags.
 - Sodium hydroxide – Transported in drums, IBCs, or bulk liquid tankers.
 - Acids – Transported in chemical-resistant bulk tankers or drums.
- Application:
 - Dosed into water treatment systems via controlled dosing pumps or slurry feeders.
 - Lime slurry is injected into neutralisation tanks.

- Acids and bases are added gradually to maintain pH within treatment parameters.
- Personnel Handling:
 - Process plant operators handle dosing and monitor pH adjustments.
 - Requires PPE including chemical-resistant gloves, face shields, and respiratory protection for lime dust.
- Where and How:
 - pH adjustment occurs in mixing tanks, reaction chambers, or inline dosing systems within water treatment plants.
 - Automated dosing pumps regulate chemical addition based on pH sensor readings.

Coagulants (Aluminium Sulphate, Ferric Chloride, Poly Aluminium Chloride):

- Form:
 - Liquid or granular solid.
- Storage:
 - Stored in chemical-resistant tanks or silos.
 - Dry coagulants are kept in sealed containers to prevent moisture absorption.
- Transport:
 - Delivered in bulk tankers, IBCs, or sealed bags for solid forms.
 - Liquids are transported in lined tanks or drums.
- Application:
 - Added to process water via metering pumps or dry feed systems.
 - Rapid mixing ensures uniform distribution before flocculants are introduced.
- Personnel Handling:
 - Process plant operators manage dosing systems and inspect coagulation performance.
 - PPE required includes gloves, goggles, and protective clothing.
- Where and How:
 - Applied in clarifiers, settling tanks, or dedicated coagulation-flocculation basins.
 - Dosing rate is controlled based on turbidity and suspended solids concentration.

Flocculants (Polyacrylamide, Starch-Based Polymers, Chitosan):

- Form:
 - Powder, liquid, or emulsion.
- Storage:
 - Stored in sealed containers to prevent contamination and degradation.
 - Liquid flocculants are kept in bulk tanks with agitation to prevent settling.
- Transport:
 - Delivered in bags (powder) or IBCs (liquid).

- Emulsions require controlled temperature conditions during transport.
- Application:
 - Dosed into treated water after coagulation to bind suspended solids.
 - Added using automated dosing pumps or manual batch mixing.
- Personnel Handling:
 - Process plant operators monitor dosing and adjust concentrations based on turbidity levels.
 - PPE includes gloves and respirators for handling powdered forms.
- Where and How:
 - Applied in sedimentation tanks, clarifiers, or filter feed systems.
 - Mixed with process water using mechanical agitators or inline static mixers.

Safety Data Sheets (SDS)

An SDS is a document that provides detailed information about a hazardous chemical, including:

- The identity of the chemical product and its ingredients.
- The hazards of the chemical, including health hazards, physical hazards and environmental hazards.
- Physical properties of the chemical, like boiling point, flash point and incompatibilities with other chemicals.
- Workplace exposure standards for airborne contaminants.
- Safe handling and storage procedures for the chemical.
- What to do in the event of an emergency or spill.
- First aid information.
- Transport information.

The information in an SDS is arranged under 16 headings to allow relevant information to be easily located by the person using the chemical.

When working with reagents and other chemicals used in the treatment of process water, you must refer to the relevant SDS for the substance and follow the directions for handling and use of PPE. You should also read the emergency response information to make sure you have the correct equipment and procedures in place before using the substance.

The following is an excerpt from an SDS for a flocculant used in water treatment. You can access the full SDS here: <https://www.gemmchemicals.com.au/wp-content/uploads/2018/09/Flocculant-SDS.pdf>

Safety Data Sheet



8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National occupational exposure limits: No value assigned for this specific material by Safe Work Australia.

Biological Limit Values: As per the "National Model Regulations for the Control of Workplace Hazardous Substances (Safe Work Australia)" the ingredients in this material do not have a Biological Limit Allocated.

National occupational exposure limits: Natural ventilation should be adequate under normal use conditions..

Personal Protection Equipment: SAFETY SHOES, OVERALLS

Wear safety shoes and overalls.

Hygiene measures: Keep away from food, drink and animal feeding stuffs. When using do not eat, drink or smoke. Wash hands prior to eating, drinking or smoking. Avoid contact with clothing. Avoid eye contact and repeated or prolonged skin contact. Avoid inhalation of vapour, mist or aerosols. Ensure that eyewash stations and safety showers are close to the workstation location.

Knowledge Evidence Checklist

Assessor Evidence Guide. Evidence should demonstrate the candidate has knowledge of the following.

Evidence Criteria	Assessment Evidence Gathered	Satisfactory	Not Yet Satisfactory
The candidate must demonstrate knowledge in reclaiming and treating water through:		<input type="checkbox"/>	<input type="checkbox"/>
identifying, assessing, addressing and reporting hazards		<input type="checkbox"/>	<input type="checkbox"/>
interpreting reports and data		<input type="checkbox"/>	<input type="checkbox"/>
identifying and addressing contaminants		<input type="checkbox"/>	<input type="checkbox"/>
identifying equipment processes, technical capability and limitations		<input type="checkbox"/>	<input type="checkbox"/>
identifying and using reagents		<input type="checkbox"/>	<input type="checkbox"/>

Knowledge Evidence Assessment Outcome

Unit of Competency	Knowledge Evidence Outcome	Feedback
RIIWVG302D - Reclaim and treat water	Satisfactory <input type="checkbox"/> Not Yet Satisfactory <input type="checkbox"/>	

Elements and Performance Criteria

Element 1. Plan and prepare to reclaim and treat water

Assessment Task: Plan and prepare to reclaim and treat water

Scenario:

You are a process plant operator on a lithium (spodumene) mine site in Western Australia. Your supervisor has assigned your duties for the shift. They include:

- Treat process water by dosing reagents in the coagulation and flocculation stage, monitoring sedimentation, and taking samples to check pH and turbidity.
- Pump treated water to storage by transferring it from the settling or thickening stage to the holding tanks or reservoirs, ensuring flow rates are within operating limits.

You are required to carry out your tasks according to workplace policies and procedures, equipment operating instructions and relevant environmental and WHS legislation.

Note: You must carry out the following on more than one occasion.

Assessment Instructions:

1.1. Access, interpret and apply water reclaiming and treating documentation and ensure the work activity is compliant:

- Locate and review operator's manuals for pumps, lines, storage tanks, discharge lines, generators, hand and power tools, hoses, level indicators, pump systems, strainers, and sampling and testing equipment.
- Read and interpret work instructions, work orders, or work plans relevant to the shift.
- Check site notices for the work area, including specific work being conducted or identified hazards.
- Review handover reports from the previous shift for relevant information.
- Read and follow Safe Operating Procedures (SOPs) for assigned tasks and equipment.
- Check emergency procedures applicable to the work area and task.
- Refer to risk assessment documentation, such as Job Hazard Analysis (JHA) forms and Take 5 booklets.
- Complete and review equipment pre-start checklists before commencing work.
- Verify if a Permit to Work is required and obtain necessary approvals.

1.2. Obtain, read, interpret, clarify and confirm work requirements:

- Attend the pre-shift briefing to receive assigned tasks and discuss work requirements.
- Review shift sheets or work instructions for details on the work to be completed.
- Confirm production targets, including volume requirements and water transfer points.
- Identify required reagents and confirm dosing specifications.
- Verify health and safety requirements, including necessary PPE and signage.
- Clarify equipment requirements, such as pump selection, hoses, and storage locations.
- Confirm personnel roles, responsibilities, and authorisations.

- Check communication requirements, including reporting procedures and escalation points.
- Raise and report any discrepancies or unclear instructions before starting work.
- Double-check task details to confirm accuracy before proceeding.

1.3. Use appropriate communication methods:

- Use two-way radios to communicate with supervisors and team members.
- Provide updates and report issues through the designated communication channel.
- Use email or shift reports for written communication where required.
- Communicate work progress and hazards in pre-shift or post-shift meetings.
- Use hand signals when working in areas with high noise levels.
- Follow site-specific radio communication procedures, including call signs and response procedures.

1.4. Select and wear personal protective equipment appropriate for work activities:

- Identify required PPE based on task risk assessment and site procedures.
- Check PPE condition before use, ensuring it is clean and undamaged.
- Wear a hard hat, safety glasses, gloves, steel-toed boots, and high-visibility clothing as standard site PPE.
- Use respirators, chemical-resistant gloves, and face shields when handling reagents.
- Wear hearing protection in high-noise areas and personal flotation devices when working near water storage.
- Ensure PPE is worn correctly and remains in place throughout the task.

1.5. Select appropriate reagents:

- Refer to SDS and work instructions to determine required reagents.
- Verify reagent type and concentration needed for treatment.
- Check reagent storage areas for correct labelling and availability.
- Inspect reagent containers for leaks or contamination before use.
- Use appropriate handling and dosing methods based on reagent type.
- Store unused reagents according to site procedures.

1.6. Carry out equipment pre-start checks:

- Conduct a visual inspection of pumps, lines, valves, and storage tanks.
- Check for leaks, blockages, or damage to pipelines and hoses.
- Verify fluid levels and pressure readings on gauges.
- Confirm that emergency stop controls and alarms are functional.
- Ensure dosing pumps and reagent feeders are set to required levels.
- Run a test cycle if necessary before beginning full operation.
- Record findings in pre-start checklists and report any faults.

1.7. Identify and address potential risks, hazards and environmental issues, and implement control measures:

- Conduct a Take 5 or JHA risk assessment before starting work.
- Identify potential hazards such as chemical spills, equipment malfunctions, or confined workspaces.
- Implement controls such as spill containment, barricading, and correct PPE use.
- Monitor for environmental risks, including contamination or uncontrolled discharge.
- Report hazards and implement corrective actions as required.

1.8. Obtain and interpret emergency procedures, and be prepared for fire/accident/emergency:

- Review site emergency response plans before starting work.
- Identify the nearest emergency exits and muster points.
- Ensure access to fire extinguishers, spill kits, and first aid stations.
- Follow reporting procedures in case of an incident.

Assessment Criteria:

- 1.1. Accessed, interpreted, and applied water reclaiming and treating documentation and ensured the work activity was compliant.
- 1.2. Obtained, read, interpreted, clarified, and confirmed work requirements.
- 1.3. Used appropriate communication methods.
- 1.4. Selected and wore personal protective equipment appropriate for work activities.
- 1.5. Selected appropriate reagents.
- 1.6. Carried out equipment pre-start checks.
- 1.7. Identified and addressed potential risks, hazards, and environmental issues, and implemented control measures.
- 1.8. Obtained and interpreted emergency procedures, and prepared for fire/accident/emergency.

Evidence:

Assessor Evidence Guide. Evidence should demonstrate the candidate can perform the key skills of the following:

1.1. Access, interpret and apply water reclaiming and treating documentation and ensure the work activity is compliant

Prior to commencing work activities, either as part of normal operations or ad hoc tasks, you must access, interpret and apply the following examples of work-related documentation and procedures to ensure that the work is authorised and can be conducted safely and correctly:

- Operator's manuals for:
 - Pumps.

- Lines.
 - Storage tanks (if applicable).
 - Discharge lines.
 - Generators.
 - Hand and power tools.
 - Hoses (water and air).
 - Level indicators.
 - Pump system.
 - Strainers.
 - Sampling and testing equipment.
- Work instruction, work order or work plan for the task or shift.
 - Work area inspection forms.
 - Site notices for the work area, e.g., specific work being conducted or hazards.
 - Hand-over reports.
 - Safe Operating Procedures (SOPs) for the task and related equipment.
 - Emergency procedures.
 - Risk assessment documentation and paperwork, e.g., JHA form, Take 5 booklet.
 - Equipment pre-start checklists.
 - Permit to Work documentation, e.g., a permit request form and permit, if required.

This information can be accessed by:

- Site filing or intranet system.
- Being handed it at pre-shift meetings.
- Email.

Interpreting and applying this documentation includes:

- Reading them carefully.
- Reviewing any attachments or referenced documents or information.
- Following/adhering to the conditions and instructions contained within the documentation.
- Keeping copies of key documentation, e.g., JHA, permits, and work instructions, with you at the work area.

Confirming that the planned work activities are compliant means checking and ensuring that the tasks to be conducted and how they are planned to be conducted are compliant with site policies and procedures and applicable legislative requirements. Compliance requirements can include the following:

- You are authorised and competent to operate equipment required for the work.
- The means of conducting the work are as specified in workplace procedures.
- The equipment and systems used will be inspected prior to use to confirm that they are functioning correctly.

- Vehicle operations, e.g., if transporting reagents, hoses and other equipment, will be carried out with reference to site-specific requirements listed in the traffic management plan (TMP) and risk management procedures.
- You have the necessary clearances and approvals to enter work areas.
- You have the required PPE and equipment, e.g., two-way radio, to enter work areas.

1.2. Obtain, read, interpret, clarify and confirm work requirements

Almost all sites will start the shift with a pre-shift briefing or meeting where the day's tasks are discussed and assigned, production requirements are explained, crews are assigned to specific work areas, and hazards or general site information is communicated. At this meeting or in conversations with your supervisor, you will be given a shift sheet or work instruction for the task/shift.

Work requirements include:

- The work to be done, e.g., water to be treated or extracted/pumped.
- Production targets and directions, e.g., how much must be treated or pumped and to and from where.
- Reagents to be used and dosing requirements.
- Health and safety requirements, including PPE, signage, barricading, and any required permits or authorisations.
- Equipment requirements, e.g., what pump, hoses, lines, tanks, or other attachments should be used.
- Work team requirements, including the number of personnel, their roles, responsibilities, and levels of competency and/or authorisation.
- Communication and coordination requirements, e.g., to whom work progress, issues and hazards should be reported, by when and how.

Work requirements can be obtained from or via:

- Supervisor.
- Email.
- Phone call.
- Face-to-face conversation or meeting.

Work plans containing work requirements may come in the form of:

- Scope of work.
- Process flow diagrams.
- Production schedule.
- Diagrams and maps.
- Work plans/shift sheets.

To interpret, clarify and confirm work plans, you should:

- Read them or listen to them carefully.
- Review any attachments or referenced documents or information.
- Discuss and confirm the details with the person who has assigned the work.
- Raise and report issues and mistakes in the work instructions if applicable, i.e., don't assume they are correct.
- Double-check details before enacting work instructions. (measure twice – cut once!)

1.3. Use appropriate communication methods

The main types of communications equipment used on most mine sites are:

- Two-way radios, handheld and vehicle mounted. These can include:
 - UHF (Ultra High Frequency) radios – Common for surface and underground operations, providing communication over short to medium distances.
 - VHF (Very High Frequency) radios – Used for long-distance communication in open areas, such as haul roads and remote locations.
 - Digital Mobile Radios (DMR) – Provide encrypted communication with features like GPS tracking and text messaging.
 - TETRA (Terrestrial Trunked Radio) systems – Used for secure, high-capacity communication across multiple channels.
 - Intrinsically Safe (IS) radios – Specialised radios designed for hazardous environments where explosive gases or dust are present.
 - Repeater-based radio networks – Extend coverage across large or obstructed areas by boosting signals between radios.
- Mobile phones, where permitted, and where there is reception.
- Satellite phones for remote areas or where there is no mobile reception.
- Email.
- Video conferencing.
- Telemetry systems for remote control and monitoring in control rooms.

The types of equipment used will depend on the site's location and topography and the availability of mobile and internet services.

The communication methods you use will also be determined by the equipment available, your location, the location of the people you are communicating with and the purpose of communication.

Communication methods can include:

- Face-to-face meetings, e.g., discussing workplans at pre-shift meetings and handovers.
- Two-way radio conversations with colleagues, supervisor, or the control room.
- Informal discussions in person.
- Hand signals with spotters or workers at a distance.
- Cap lamp signals for underground mines.
- Emailing reports and other information.

1.4. Select and wear personal protective equipment appropriate for work activities

It is important to select PPE that specifically controls the hazards associated with the work activities and work environment. Therefore, a range of documentation and information must be referenced to ensure that the PPE selected is correct and applicable to the hazards and risks associated with the job. PPE can be selected by:

- Reading safe operating procedures and manufacturer's instructions for equipment.
- Reading Safety Data Sheets (SDS) for chemicals and substances such as reagents.
- Reading workplace signage, labels, stickers and warnings.
- Completing a Take 5 or Take Time pre-task hazard assessment.
- Conducting a Job Hazard Analysis (JHA) with the work team.
- Consulting with a supervisor and other workers.

Under the WHS Act, workers have a duty of care to take reasonable care for their own health and safety and that of others who may be affected by their actions or omissions. They must also:

- Comply, so far as they are reasonably able, with any reasonable instruction given by the PCBU (employer) to allow the Person Conducting the Business or Undertaking (PCBU) to comply with WHS laws.
- Cooperate with any reasonable policy or procedure of the PCBU relating to health or safety at the workplace that they have been notified about.

This means that if PPE is required for a task, they must wear it as directed and as per the site safety procedures. This includes:

- Selecting the correct PPE for the task.
- Ensuring that the PPE is in good working order, e.g., hard hat harness is correctly affixed, safety boots hard toe is not showing and it not damaged, gloves do not have holes or tears, safety glasses are not cracked and are clear, respirator filters are replaced or cleaned.
- Wearing PPE as per the instructions.
- Wearing PPE in areas and for tasks mandated by PPE signage and safe operating procedures.

PPE for personnel working with and around mobile equipment will include standard site PPE, such as long pants, long sleeved shirt, safety boots, and the following as per procedures and work area/task hazards:

- Hard hat, bump cap or sun hat.
- Safety glasses, shaded or 'clears' for indoor work.
- Earplugs/earmuffs (as required).
- Dust mask (as required).
- Gloves.
- Sunscreen or barrier creams for outdoor work.
- Personal flotation devices (PFD), if working around water such as ponds, dams and tanks.

If you are operating the ITC in an underground mining environment, you will also need standard underground PPE, including:

- Hard hat.
- Cap lamp.

- Miners belt.
- Self-rescuer.
- Reflective banding on shirt and pants.

Safety Data Sheets (SDS)

An SDS is a document that provides detailed information about a hazardous chemical, including:

- The identity of the chemical product and its ingredients.
- The hazards of the chemical, including health hazards, physical hazards and environmental hazards.
- Physical properties of the chemical, like boiling point, flash point and incompatibilities with other chemicals.
- Workplace exposure standards for airborne contaminants.
- Safe handling and storage procedures for the chemical.
- What to do in the event of an emergency or spill.
- First aid information.
- Transport information.

The information in an SDS is arranged under 16 headings to allow relevant information to be easily located by the person using the chemical.

When working with reagents and other chemicals used in the treatment of process water, you must refer to the relevant SDS for the substance and follow the directions for handling and use of PPE. You should also read the emergency response information to make sure you have the correct equipment and procedures in place before using the substance.

The following is an excerpt from an SDS for a flocculant used in water treatment. You can access the full SDS here: <https://www.gemmchemicals.com.au/wp-content/uploads/2018/09/Flocculant-SDS.pdf>

Safety Data Sheet



8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National occupational exposure limits: No value assigned for this specific material by Safe Work Australia.

Biological Limit Values: As per the "National Model Regulations for the Control of Workplace Hazardous Substances (Safe Work Australia)" the ingredients in this material do not have a Biological Limit Allocated.

National occupational exposure limits: Natural ventilation should be adequate under normal use conditions..

Personal Protection Equipment: SAFETY SHOES, OVERALLS

Wear safety shoes and overalls.

Hygiene measures: Keep away from food, drink and animal feeding stuffs. When using do not eat, drink or smoke. Wash hands prior to eating, drinking or smoking. Avoid contact with clothing. Avoid eye contact and repeated or prolonged skin contact. Avoid inhalation of vapour, mist or aerosols. Ensure that eyewash stations and safety showers are close to the workstation location.

1.5. Select appropriate reagents

A reagent is a substance added to a system to cause a chemical reaction, aid in the detection of another substance, or modify a process by altering chemical or physical properties. A reagent in mine wastewater treatment is a chemical added to alter water chemistry, remove contaminants, or facilitate separation processes by promoting sedimentation, filtration, oxidation, reduction, or biological treatment.

There are many reagents that can be used to treat specific water qualities and contaminant types and levels, but the three most common reagents used in a mining operation to treat mine water from processing are:

- pH adjusters – Used widely to neutralise acidic mine drainage, stabilise water chemistry, and optimise conditions for other treatment processes. Lime is common due to its cost-effectiveness and ability to precipitate metals.
- Coagulants – Used for removing fine suspended solids and metal particulates, improving sedimentation and filtration efficiency. Ferric chloride and aluminium sulphate are commonly used coagulants.
- Flocculants – Work alongside coagulants to aggregate fine particles, speeding up solid-liquid separation and improving water clarity. Polyacrylamide is a commonly used example of a flocculant used for this purpose.

Handling Reagents

pH Adjusters (Lime, Sodium Hydroxide, Sulphuric Acid, Hydrochloric Acid):

- Form:
 - Lime ($\text{Ca}(\text{OH})_2$) – Powder or slurry.
 - Sodium hydroxide (NaOH) – Solid pellets, flakes, or liquid.
 - Sulphuric acid (H_2SO_4) and hydrochloric acid (HCl) – Liquid.
- Storage:
 - Lime – Stored in dry silos or tanks as a slurry.
 - Sodium hydroxide – Stored in plastic or stainless steel tanks.
 - Acids – Stored in corrosion-resistant tanks with secondary containment.
- Transport:
 - Lime – Delivered in bulk tankers or bags.
 - Sodium hydroxide – Transported in drums, IBCs, or bulk liquid tankers.
 - Acids – Transported in chemical-resistant bulk tankers or drums.
- Application:
 - Dosed into water treatment systems via controlled dosing pumps or slurry feeders.
 - Lime slurry is injected into neutralisation tanks.
 - Acids and bases are added gradually to maintain pH within treatment parameters.
- Personnel Handling:
 - Process plant operators handle dosing and monitor pH adjustments.
 - Requires PPE, including chemical-resistant gloves, face shields, and respiratory protection for lime dust.

- Where and How:
 - pH adjustment occurs in mixing tanks, reaction chambers, or inline dosing systems within water treatment plants.
 - Automated dosing pumps regulate chemical addition based on pH sensor readings.

Coagulants (Aluminium Sulphate, Ferric Chloride, Poly Aluminium Chloride):

- Form:
 - Liquid or granular solid.
- Storage:
 - Stored in chemical-resistant tanks or silos.
 - Dry coagulants are kept in sealed containers to prevent moisture absorption.
- Transport:
 - Delivered in bulk tankers, IBCs, or sealed bags for solid forms.
 - Liquids are transported in lined tanks or drums.
- Application:
 - Added to process water via metering pumps or dry feed systems.
 - Rapid mixing ensures uniform distribution before flocculants are introduced.
- Personnel Handling:
 - Process plant operators manage dosing systems and inspect coagulation performance.
 - PPE required includes gloves, goggles, and protective clothing.
- Where and How:
 - Applied in clarifiers, settling tanks, or dedicated coagulation-flocculation basins.
 - Dosing rate is controlled based on turbidity and suspended solids concentration.

Flocculants (Polyacrylamide, Starch-Based Polymers, Chitosan):

- Form:
 - Powder, liquid, or emulsion.
- Storage:
 - Stored in sealed containers to prevent contamination and degradation.
 - Liquid flocculants are kept in bulk tanks with agitation to prevent settling.
- Transport:
 - Delivered in bags (powder) or IBCs (liquid).
 - Emulsions require controlled temperature conditions during transport.
- Application:
 - Dosed into treated water after coagulation to bind suspended solids.
 - Added using automated dosing pumps or manual batch mixing.
- Personnel Handling:

- Process plant operators monitor dosing and adjust concentrations based on turbidity levels.
- PPE includes gloves and respirators for handling powdered forms.
- Where and How:
 - Applied in sedimentation tanks, clarifiers, or filter feed systems.
 - Mixed with process water using mechanical agitators or inline static mixers.

1.6. Carry out equipment pre-start checks

All equipment must be inspected at the commencement of the shift and following shut down. You should use a specific pre-start inspection checklist for pre and post-operational checks, as well as the manufacturer's manual.

The equipment that should be checked includes:

- Pumps.
- Lines.
- Storage tanks (if applicable).
- Discharge lines.
- Generators.
- Hand and power tools.
- Hoses (water and air).
- Level indicators.
- Pump system.
- Strainers.
- Sampling and testing equipment.

Pre-start books and manuals should be on or near the pumps and other equipment in a weatherproof folder.

An example of a pre-start inspection checklist for a pump is provided below.

affected, you must tag the pump or other equipment 'Out of Service' using an 'Out of Service tag' and report the fault to your supervisor.



Note: Any person may place an Out of Service tag on any item of equipment that is faulty or unsafe to use. Do not start or operate an item of equipment that has an Out of Service Tag attached. Only a person qualified to repair the equipment can remove an Out of Service Tag once it has been placed.

1.7. Identify and address potential risks, hazards and environmental issues, and implement control measures

Whether the tasks to be conducted are scheduled and regular tasks or special projects, you must identify the hazards and environmental issues associated with the work and the work area. This can be part of a formal risk assessment using a Job Hazard Analysis worksheet or an undocumented risk assessment using your experience and knowledge of the work area, the equipment and the tasks. In this case, a Take 5 or similar pre-task risk assessment may suffice.

You must then review SOPs and other workplace procedures to identify and implement controls to eliminate the hazards or mitigate the risks associated with exposure to the hazards.

Before you can begin to identify and control hazards and environmental issues and risks, it is important to gain a basic understanding of key elements of the risk management process.

The risk management process is cyclical, meaning that it is continuous, as shown in the diagram below.

Key WHS Definitions

A hazard is a source or a situation with the potential for harm in terms of human injury or ill-health, damage to property, damage to the environment, or a combination of these.

A risk is the chance of something happening that will have a negative effect. The level of risk reflects:

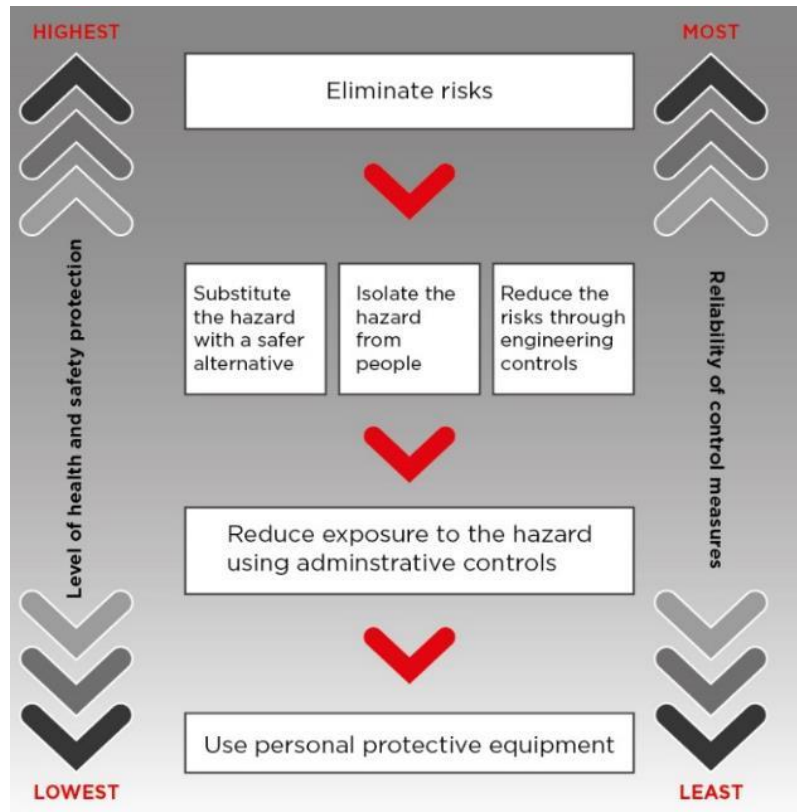
- The likelihood of the unwanted event.
- The potential consequences of the unwanted event.

Another key definition is a 'control'. A control is something you can do or put in place to either remove a hazard or risk, or make it less likely to cause harm, or reduce the severity of the harm.

Hierarchy of Control

The ways of controlling risks are ranked from the highest level of protection and reliability to the lowest, as shown in the diagram below. This ranking is known as the hierarchy of control measures.





The hierarchy of control measures can be applied in relation to any risk. The WHS Regulations make it mandatory for duty holders to work through this hierarchy when managing certain risks. It is also standard practice to apply the hierarchy of control to all risk management processes, whether mandated by legislation or not.

You must always aim to eliminate the risk, which is the most effective control. If this is not reasonably practicable, you must minimise the risk by working through the other alternatives in the hierarchy.

The lower levels in the hierarchy are less effective because controls that change the hazard or minimise exposure to the hazard can only minimise the risk. You cannot eliminate the risk without eliminating the hazard.

Administrative controls and personal protective equipment (PPE) are the least effective at minimising risk because they do not control the hazard at the source and rely on human behaviour and supervision. These control measures should only be used:

- To supplement higher level control measures (as a back-up).
- As a short-term interim measure until a more effective way of controlling the risk can be used.
- When there are no other practical control measures available (as a last resort).

The Hierarchy of Control Explained

Elimination

The most effective control measure involves eliminating the hazard and associated risk. The best way to do this is by, firstly, not introducing the hazard into the workplace. For example, you can eliminate the risk of a fall from height by doing the work at ground level.

Substitution, Isolation and Engineering Controls

If it is not reasonably practicable to eliminate the hazards and associated risks, you must minimise the risks using one or more of the following approaches, so far as is reasonably practicable.

Substitute the Hazard with Something Safer

For instance, replace solvent-based paints with water-based ones or manage both the physical and psychosocial risks by allowing workers to have more control of line speed instead of pacing line work by computer.

Isolate the Hazard from People

This involves physically separating the source of harm from people by distance or using barriers. For instance, install guardrails around exposed edges and holes in floors, use remote control systems to operate machinery, store chemicals in a fume cabinet, place barriers between workers and customers or move services online where there is a risk of violence or aggression or other harmful behaviours.

Use Engineering Controls

An engineering control is a control measure that is physical in nature, including a mechanical device or process. For instance, use mechanical devices such as trolleys or hoists to move heavy loads, place guards around moving parts of machinery, install residual current devices (electrical safety switches), set work rates on a production line to reduce fatigue, install sound dampening measures to reduce exposure to unpleasant or hazardous noise, ensure IT systems are fit for purpose to reduce job demands.

Administrative Controls

If risks remain, they must be minimised by implementing administrative controls, so far as is reasonably practicable. Administrative controls include work methods or procedures that are designed to minimise exposure to a hazard as well as the information, training and instruction needed to ensure workers can work safely. For instance, develop procedures on how to operate machinery safely, provide training and support to managers and workers to identify and manage both physical and psychosocial health and safety risks, implement workplace behavioural policies, limit exposure time to a hazardous task, and/or use signs to warn people of a hazard.

Some administrative measures will be necessary to ensure substitution, isolation and engineering controls are implemented effectively, for example, following safe work procedures when using equipment.

Personal Protective Equipment

Any remaining risks must be minimised with suitable PPE. Examples of PPE include earmuffs, respirators, face masks, hard hats, gloves, aprons and protective eyewear. PPE limits exposure to the harmful effects of a hazard, but only if workers wear and use the PPE correctly.

The risk management process involves four main steps:

- Identify hazards: Find out what could cause harm.
- Assess risks, if necessary: Understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening. This step may not be necessary if you are dealing with a known risk with known controls.
- Control risks: Implement the most effective control measure that is reasonably practicable in the circumstances and ensure it remains effective over time.
- Review hazards and control measures to ensure they are working as planned.

Identifying Hazards

Hazards generally arise from the following aspects of work and their interaction:

- Physical work environment.
- Equipment, materials and substances used.
- Work tasks and how they are performed.
- Work design and management.

- Workplace interactions or behaviours.

Hazards are generally split into six main categories:

- Safety Hazards:
 - Hazards relating to safety are the most common workplace risks and are usually the cause of creating unsafe working conditions. Exposed electrical wiring or damaged flooring resulting in tripping accidents fall under this category.
- Biological Hazards:
 - Biological hazards refer to any substances that can bring harm to workers. These include exposure and contact with viruses, bacteria, insect bites, and animals, etc., resulting in adverse health impacts.
 - Other common biological hazards are mould, harmful plants, sewage, dust, vermin, blood, and other bodily fluids.
 - This type of workplace hazard can be found mostly in schools, daycare facilities, universities, hospitals, laboratories, nursing homes, and other outdoor occupations.
- Physical Hazards:
 - Despite its name, physical hazards are not always something that is visible to the eyes or can be touched. In fact, this type might be the least obvious than the rest.
 - Physical hazards are environmental factors that can harm the body without necessarily being in contact with it.
 - Common physical hazards include height risks, noise, radiation, pressure, high exposure to sunlight or ultraviolet rays, gases, and temperature extremes.
- Ergonomic Hazards:
 - Ergonomic hazards are mostly a result of physical factors resulting in musculoskeletal injuries. These include poor workstation setup, bad posture when sitting and standing, and incorrect manual handling.
- Chemical Hazards:
 - Chemical hazards mainly threaten workers dealing with dangerous solvents, liquids, or flammable gases.
 - Workers who are most likely to be exposed or affected by these hazards work in engineering, cleaning facilities, and other field-based occupations.
 - Exposure and being in contact with harmful chemicals can lead to skin irritation, breathing difficulties, severe allergic reactions, and in extreme cases, death.
- Psychosocial Hazards:
 - Psychosocial hazards refer to situations where they can negatively impact a worker's mental health and well-being. For example, deadlines, hectic schedules, work stress, sexual harassment, and workplace violence.

Hazards can be identified using a range of methods, including:

- Inspecting the work area.
- Using monitoring equipment.
- Reading Safety Data Sheets (SDS) for chemicals.
- Looking at site maps and plans.

- Consulting with a supervisor and other workers.
- Reading Safe Operating Procedures and Manufacturer's Instructions for plant and equipment.
- Reading Codes of Practice, guidance materials and other information published by WHS and other regulators.
- Reviewing past risk assessments, hazard reports and incident reports.
- Reading workplace signage, labels, stickers and warnings.
- Conducting a risk assessment.

Once hazards have been identified, you must conduct a risk assessment before planning to implement risk controls. A risk assessment is simply asking:

- What could happen if I am exposed to the hazard. E.g., if the electric tool I am using malfunctions, or a heavy item falls on me. The answer could be death or serious injury. (However, the maximum reasonable risk is more likely to be serious injury rather than death, as death may occur in some circumstances but not in the majority)
- How likely is it that harm of that severity (death or serious injury) will occur in this situation.

Once you have answered these questions, you can use the consequence and likelihood descriptors and a risk matrix to determine the level of risk.

Consequence Descriptors:

1. Negligible: No injuries or property damage. Minimal impact on operations.
2. Minor: Minor injuries or property damage. Minor disruption to operations.
3. Moderate: Moderate injuries or property damage. Significant disruption to operations.
4. Major: Major injuries or property damage. Severe disruption to operations.
5. Catastrophic: Fatalities or extensive property damage. Complete shutdown of operations.

Likelihood Descriptors:

1. Rare: Unlikely to occur in normal circumstances. Almost impossible.
2. Unlikely: May occur sporadically or under exceptional circumstances.
3. Possible: May occur occasionally or under specific conditions.
4. Likely: Will probably occur in most circumstances.
5. Almost Certain: Will occur in most circumstances.

Risk Matrix

	Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost Certain (5)
Negligible	Low (1)	Low (2)	Low (3)	Medium (4)	High (5)
Minor	Low (2)	Low (3)	Medium (4)	Medium (5)	High (5)
Moderate	Low (3)	Medium (4)	Medium (4)	High (5)	High (5)
Major	Medium (4)	Medium (4)	High (5)	High (5)	High (5)
Catastrophic	Medium (4)	High (5)	High (5)	High (5)	High (5)

The risk rating is the point where the consequence and likelihood intersect, e.g., Moderate + Possible (3) = Medium (4)

If the risk rating is Medium or High, the controls to be implemented will be more robust, and workers should seek to remove the hazard completely. Work activities with a high-risk rating may also require a supervisor's approval prior to commencing.

You can carry out a risk assessment using a Job Hazard Analysis (JHA) worksheet or another format, such as the example shown below. A simple template will suffice as long as it allows you to list the hazards associated with each task, assess the risk of exposure to them and then plan the controls to be implemented.

Task	Hazards	Risk	Consequence	Likelihood	Risk Rating	Control	Responsible Person

Job Safety/Hazard Analysis (JHA/JSA)

A JSA (Job Safety Analysis) is a form of risk assessment that details step-by-step how a task is to be carried out safely. Sometimes, the JSA/JHA is called a JSEA and includes environmental aspects as well. Other than the employer's general duty of care to ensure workers are trained and competent for their work, there are no specific legal requirements to have a JSA or any regulations prescribing the format or content for JSAs.

JSAs have four main components, these include:

1. Job steps in chronological order.
2. Hazards and risks associated with each job step.
3. A risk assessment including consequences, likelihood and risk rating for each hazard or risk in each job step.
4. Control measures to be implemented according to the hierarchy of controls, to eliminate or control the hazards and risks.

A JSA template can be accessed here:

https://www.commerce.wa.gov.au/sites/default/files/atoms/files/job_safety_analysis.doc

Examples of hazards and environmental issues and relevant controls relating to reclaiming and treating water are provided in the table below.

Hazards/Environmental Issues	Risks/Consequences	Controls
Chemical Exposure	Burns, inhalation, skin irritation	PPE, ventilation, safe handling procedures
Slip, Trip, and Fall Hazards	Injuries from falls	Non-slip surfaces, good housekeeping
Confined Spaces	Toxic atmosphere, restricted movement	Ventilation, gas monitors, rescue plans

Noise	Hearing loss	Hearing protection, equipment maintenance
Extreme Temperatures	Heat stress, hypothermia	Hydration, appropriate clothing, breaks
Moving Machinery	Entanglement, crushing, amputation	Guarding, safety training, emergency stops
Electrical Hazards	Shocks, burns, electrocution	Regular electrical inspections, PPE
Falling Objects	Injury from impact	Securing tools, wearing hard hats
Pressure Systems	Explosions, bursts causing injury	Pressure relief valves, regular inspections
Ergonomic Hazards	Musculoskeletal disorders	Manual handling training, ergonomic tools
Drowning Hazards	Risk of fatality	Safety barriers, personal flotation device, buoyancy aids
UV Exposure	Skin damage	Sunscreen, protective clothing
Equipment Failure	Unexpected material release, shutdown	Regular maintenance, safety checks
Vehicular Movement	Collisions, injuries	Speed limits, pedestrian pathways
Drainage	Water contamination	Drainage systems
Dust	Respiratory health impact	Dust control measures
Emissions	Air pollution, health impact	Emission control systems
Flora and Fauna	Disturbance to ecosystems, bites and stings	Environmental impact assessments, PPE
Hazardous Chemicals	Health and safety hazards	Safe storage, handling procedures, clean up spills
Noise Pollution	Hearing loss, stress	Sound barriers, maintenance schedules, PPE
Recycling	Inefficient resource usage	Effective recycling programs
Run-off	Water contamination	Containment systems
Spills	Environmental contamination	Spill kits, training in spill response
Waste Management and Disposal	Environmental harm, regulatory penalties	Segregation of waste, disposal plans
Water Quality	Degraded water quality	Water treatment, monitoring

1.8. Obtain and interpret emergency procedures, and be prepared for fire/accident/emergency

All sites must have emergency plans and emergency response procedures, and you will be informed of these during your workplace induction and subsequent task or equipment-specific training. You must factor emergency procedures into your work plan and ensure they are clearly listed on your JHA or SWMS as applicable.

In an emergency situation, you should raise an alarm using a two-way radio. The procedure is as follows:

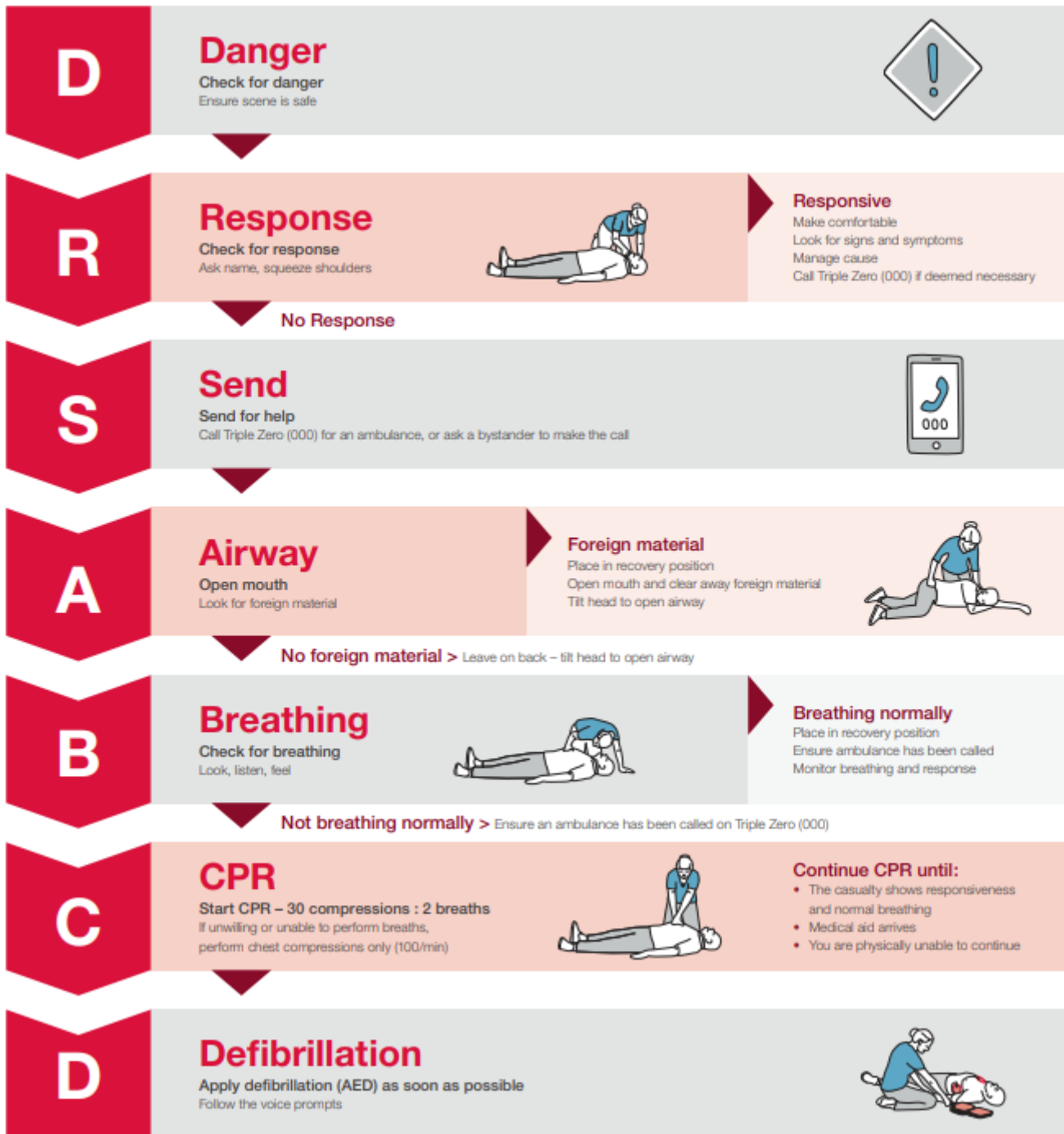
- Transmit the words 'Emergency, Emergency, Emergency' over the radio and wait for a response from the onsite emergency response officer. If you do not receive a response within a few seconds, retransmit the call.
- Once a reply is received, provide emergency personnel with the following details:
 - Your name.
 - Location and nature of the emergency.
 - Type of emergency situation (accident or injury).
 - Equipment or personnel involved.
 - Assistance that is required (ambulance, fire, mine rescue).
 - Hazards that may exist or any additional information.
- Remain by the radio (if it is safe to do so) until advised to leave. Leaving your radio may place you and others in the area in greater danger.

All incidents, even minor injuries or near misses where there were no consequences at all, must be reported immediately. You must report these immediately to your supervisor verbally, initially using a phone, two-way radio or by going to their location. You should then follow this up with a written report using the site incident report form. If an incident occurs, you must implement immediate local risk controls to limit the impact of the incident. For example:

- Raise the alarm as per site procedures and, if required, based on the type of incident.
- Administer first aid to injured personnel, according to DRSABCD.
- Use fire extinguishers and hoses to fight a fire.
- Evacuate the work area if required.
- Make the area safe and barricade it to avoid further incidents or injury.

First Aid

DRSABCD is an acronym used in first aid to guide providers when helping a sick or injured person. It stands for Danger, Response, Send, Airway, Breathing, CPR, Defibrillation.



(Source: <https://www.stjohnvic.com.au/media/2024/fa-sjv-drsabcd-action-plan-poster-a2-print-v02.pdf>)

Fire

Fires can occur due to equipment malfunctions, electrical issues, or chemical reactions. For example, a fire might break out in a processing plant due to a malfunctioning pump, causing a flammable liquid to leak. Procedures that must be implemented to identify and control the risk of fires include:







- Placement of fire extinguishers, hoses, blankets, emergency evacuation routes and plans, emergency signage and lighting.
- Use of fast attack mobile firefighting unit, fire appliance (engine), ambulance, emergency or rescue trailers.
- Nomination of fire and evacuation wardens and marshals.
- Establishing muster points.
- Training, induction and emergency drills and exercises.

If you notice a fire, you should respond by:

1. Activate the nearest fire alarm or raise the alarm over the radio.
2. Use a fire extinguisher if trained and if it's safe to do so, or activate the fire suppression system of the deluge system, if installed.
3. Evacuate while following the designated escape routes and the marshal's instructions.

Fire extinguishers:

- Types: There are 5 main fire extinguisher types in Australia – Water, Foam, Dry Powder, CO₂ and Wet Chemical. There are six classes of fire – Class A, Class B, Class C, Class D, Class E, and Class F:
 - Class A fires (combustible materials): Caused by flammable solids, such as wood, paper, and fabric.
 - Class B fires (flammable liquids): Such as petrol, turpentine or paint.
 - Class C fires (flammable gases): Like LPG, hydrogen, butane or methane.
 - Class D fires (combustible metals): Chemicals such as magnesium, aluminium or potassium.
 - Class E fires (electrical equipment): Once the electrical item is removed, the fire changes class.
 - Class F fires (cooking oils): Typically, a chip-pan fire.
- The correct type of fire extinguisher for the class of fire is shown in the table below.

	Class A Flammable Materials (eg: paper & wood)	Class B Flammable Liquids (eg: paint & petrol)	Class C Flammable Gases (eg: butane & methane)	Class D Flammable Metals (eg: lithium & potassium)	Class E Electrical Equipment (eg: computers & generators)	Class F Cooking Fats and Oils (eg: fryers & chip pans)
 Water	✓	✗	✗	✗	✗	✗
 Dry Chemical Powder ABE	✓	✓	✗	✗	✓	✗
 Dry Chemical Powder BE	✗	✓	✗	✗	✓	limited ✓
 Carbon Dioxide CO ₂	limited ✓	limited ✓	✗	✗	✓	✗
 Foam	✓	✓	✗	✗	✗	limited ✓
 Wet Chemical	✓	✗	✗	✗	✗	✓

(Source: <https://www.fireextinguisheronline.com.au/blog/post/types-of-fire-extinguisher-in-australia-all-you-need-to-know>)

Evacuation

In certain emergencies, such as a fire, gas leak or a mine collapse, evacuations may be necessary to protect workers. If you are required to evacuate, you should:

- Follow the marshal's instructions.

- Remain calm.
- Proceed to the muster point or follow the marshal.
- Remain at the muster point until instructed to leave.

Electrical Shock

It is important to note that an electric shock and electrocution are not the same. While both involve the passage of electricity through the body, they differ in severity and outcome:

- **Electric shock:** This is a non-fatal passage of electric current through the body. It can cause tingling, muscle spasms, pain, burns, and even unconsciousness, depending on the voltage, duration, and pathway of the current.
- **Electrocution:** This is a fatal electric shock, resulting in death due to the disruption of the heart's electrical rhythm. The high voltage or prolonged current disrupts the heart's ability to function, leading to cardiac arrest and death.

If you suspect someone is having an electric shock, do not touch them directly, as the current can pass through you as well.

Immediate Actions:

1. **Break the contact:** The first and most critical step is to stop the flow of electricity through the person's body. If possible, turn off the power source at the main switch or breaker box. If unable to turn off the power, try to dislodge the person from the source using non-conductive materials like dry wood, plastic, or rubber gloves. Never use metal or wet objects as they can conduct electricity.
2. **Call for help:** Immediately dial emergency services and inform them of the situation.
3. **Check for breathing and pulse:** Once the injured person is free from the electricity source, check for responsiveness, breathing, and pulse. If they are unresponsive and not breathing, start CPR immediately.

While waiting for emergency services or ERT:

- Assess them for burns, wounds, or other injuries caused by the shock.
- Keep them warm and comfortable by covering them with a blanket or coat, but avoid overheating.
- Monitor their breathing and pulse, continue checking for signs of life, and continue CPR if necessary.
- Do not give them anything to eat or drink.
- Stay calm and reassure them.

Additional Tips:

- If you must approach the person before dislodging them, stand on a dry, non-conductive surface like rubber mats or cardboard.
- Wear dry rubber gloves if available.
- Do not move the person unless necessary, as movement can worsen injuries.
- Be aware of your own safety, and do not enter an area where you could be exposed to the electricity yourself.

Falls

You do not have to be working at height in an Elevated Work Platform (EWP) or on a roof to fall. In fact, most falls that lead to injury are either on the same level, e.g., they trip over, or they fall from a relatively low height, such as falling when entering or exiting mobile equipment or from a ladder.

If you suspect someone has fallen, you should:

1. Raise the alarm, e.g., on the radio, phone or verbally
2. Ensure your own safety by looking for potential hazards like live wires, falling debris, or unstable structures.
3. Do not move the injured person unless necessary, as moving them can worsen injuries, especially to the spine.
4. Commence first aid if required using DRSABCD.

Explosions

Explosions can occur for a range of reasons, including:

- Gas Leaks: Propane, butane, hydrogen sulphide, carbon monoxide, etc., from fuel sources, machinery, or explosions themselves.

Ignition Sources:

- Open flames: Burning torches, welding equipment, cigarettes, electrical sparks.
- Friction: Metal-on-metal contact, overheated bearings, faulty machinery.
- Static electricity: Build-up and discharge from conveyor belts, clothing, and equipment.
- Blasting: Undetonated explosives (misfires) or stray sparks from blasting operations.
- Chemicals: Uncontrolled reactions, mixing incompatible reagents, overheating, sparks from handling.
- Batteries: Overcharging, short circuits, incorrect disposal, heat exposure.
- Hot Works: Grinding, cutting, welding near flammable materials or chemical storage.

Other Contributing Factors:

- Poor ventilation: Insufficient air circulation allows the buildup of flammable gases and dust.
- Inadequate maintenance: Faulty equipment and machinery can create ignition sources.
- Unsafe practices: Ignoring safety procedures, working in hazardous conditions, and incorrect storage of explosives and chemicals.
- Incompatible storage: Storing incompatible chemicals together or near flammable materials.
- Gas and fuel storage: Leaks, faulty valves, inadequate ventilation in storage areas.
- Geologic factors: Unstable rock formations, sudden releases of gas, seismic activity.

Explosions will most likely lead to fire and injury. Therefore, you should follow evacuation, firefighting and first aid procedures.

Extreme Weather

Many mine sites are situated in remote locations, which can experience a range of extreme weather conditions that have the potential to place personnel at risk. These include:

- Cyclones.
- Strong winds.

- Heavy rain, sleet or snow.
- Extremes of hot and cold.
- Lightning storms.

Each of the above will have associated management plans that you must follow when instructed. Examples of associated procedures include:

- Cyclones and strong wind:
 - Tie down materials and equipment.
 - Lower drill masts and crane booms.
 - Move indoors.
 - Prepare to evacuate the site if directed.
- Heavy rain, sleet or snow:
 - Cease high risk work.
 - Disconnect electrical tools and equipment, if being used outside or in an open workshop.
 - Move indoors as directed.
- Extremes of hot and cold:
 - Postpone the work if possible or reschedule to a warmer or cooler part of the day.
 - Wear appropriate PPE, e.g., warm clothes for cold, wide brimmed hats for hot.
 - Rotate tasks to reduce exposure.
 - Monitor workers for hypothermia (too cold) and hyperthermia (too hot).
 - Set up refuge areas such as shade tents or a vehicle with the aircon set to warm or cold.

Lightning Storms

Lightning proximity alerts and alert stages are important safety measures used in mining and other remote sites. These systems are designed to detect the proximity of lightning and provide warnings to workers to take appropriate safety precautions. Systems commonly used to inform lightning distances and alert levels include portable lightning detectors, which are handy but inaccurate, and software systems such as WeatherZone.

Lightning alerts can be communicated over the two-way radio or by lights. The warning lights used for lightning proximity alerts are typically mounted on towers or structures at strategic locations around the worksite. The radio calls and lights are activated when lightning is detected within a certain distance from the site. For example:

- “Blue Alert” Lightning within 40 km.
- “Yellow Alert” Lightning within 20 km.
- “Red Alert” Lightning within 10 km.

When lightning alerts are announced or lights are illuminated, you must act in accordance with site lightning procedures. For example:

- Blue Alert:
 - Be alert and prepare for yellow alert.
- Yellow Alert:

- Crane and drilling masts lowered.
- EWP and scissor lifts lowered.
- No refuelling.
- No transportation of fuels or chemicals.
- Red Alert:
 - Cease all outdoor work.
 - Move to shelter.
 - Await all clear.

Key Emergency Equipment

Emergency equipment must be relevant to the types of emergencies that may occur. Common examples of key emergency equipment include:

- Fire extinguishers, hoses, blankets.
- Buoyancy aids or personal flotation devices (PFD), if working around water such as ponds, dams and tanks.
- Emergency evacuation routes and plans.
- Refuge chambers underground.
- Emergency signage and lighting.
- First aid kits, defibrillators, emergency showers, eyewash stations and spill kits.
- Muster points.
- Vests, helmets and loud hailers for evacuation wardens and marshals.
- Communication equipment, e.g., alarms, sirens, lights, stench gas, phones, two-way radios.
- Fast attack mobile firefighting unit, fire appliance (engine), ambulance, emergency or rescue trailers.
- First aid room.
- Firefighting PPE, including turn out gear and breathing apparatus, lines, hoses and branches.
- Fire hydrants.
- Sprinkler and deluge systems.
- Fire suppression systems.
- Fire and smoke alarms and gas detectors.
- Stench gas systems for underground mines.

Emergency Escape Routes

Accessible escape routes should include escape stairways, fresh air bases and refuge chambers in underground mines, muster points and emergency lighting. Escape routes should have maps and signage, and drills should be used to ensure that people know where they are and how to use them.

Element 2. Treat water

Assessment Task: Treat water

Scenario:

You are a process plant operator on a lithium (spodumene) mine site in Western Australia. Your supervisor has assigned your duties for the shift. They include:

- Treat process water by dosing reagents in the coagulation and flocculation stage, monitoring sedimentation, and taking samples to check pH and turbidity.
- Pump treated water to storage by transferring it from the settling or thickening stage to the holding tanks or reservoirs, ensuring flow rates are within operating limits.

You are required to carry out your tasks according to workplace policies and procedures, equipment operating instructions and relevant environmental and WHS legislation.

Assessment Instructions:

2.1. Dose reagents at approved levels:

- Determine correct reagent dosage based on contaminant concentration, water flow rate, pH, and process requirements.
- Use dosing systems such as metering pumps, dry feeders, or manual batch mixing to introduce reagents into process water.
- Adjust reagent dosing using automated systems that respond to sensor readings for pH, turbidity, or conductivity.
- Monitor dosing rates to prevent chemical waste, excessive sludge production, scaling, or incomplete treatment.
- Refer to SOPs, chemical supplier guidelines, equipment manuals, and site treatment logs to verify correct dosing amounts.
- Record reagent usage, adjustments, and treatment performance in operational logs.

2.2. Take sample and test:

- Collect grab samples at key locations such as inlet water, dosing points, mixing tanks, clarifiers, filters, and discharge points.
- Use clean sample bottles suitable for the test being conducted, ensuring safe handling to prevent contamination.
- Conduct pH, turbidity, jar, settling rate, filter performance, and suspended solids tests using field test kits and meters.
- Follow site procedures for sampling methods, including rinsing sample bottles, using dippers for deep samples, and maintaining correct depth positioning.
- Store and preserve samples correctly for laboratory analysis when required.
- Record test results in logs and compare with operational targets to verify treatment effectiveness.
- Report any deviations or unexpected results to supervisors.

2.3. Monitor water storage levels and reject and/or permeate flows

- Check storage levels in tanks, ponds, and reservoirs using sight glasses, dipsticks, pressure sensors, or ultrasonic level sensors.

- Monitor reject and permeate flows for separation of treated water and waste streams.
- Use flow meters, pressure gauges, and conductivity sensors to track water movement and quality.
- Detect and report fluctuations in storage levels, indicating potential leaks, blockages, or abnormal inflow rates.
- Maintain SCADA or control panel monitoring to track flow variations and adjust processes accordingly.
- Prevent overflows or low levels that may impact system operation by adjusting pumping rates and valve positions.
- Log storage level measurements, flow rate changes, and any corrective actions taken.

Assessment Criteria:

- 2.1. Dosed reagents at approved levels.
- 2.2. Took samples and tested.
- 2.3. Monitored water storage levels and reject and/or permeate flows.

Evidence:

Assessor Evidence Guide. Evidence should demonstrate the candidate can perform the key skills of the following:

2.1. Dose reagents at approved levels

The correct dosage is determined based on factors such as contaminant concentration, water flow rate, pH, and process requirements.

Dosing systems use metering pumps, dry feeders, or manual batch mixing to introduce reagents into process water. Automated dosing systems adjust chemical addition based on sensor readings, such as pH, turbidity, or conductivity, ensuring consistent treatment. Operators monitor dosing rates to maintain efficiency, prevent chemical waste, and avoid issues such as excessive sludge production, scaling, or incomplete treatment.

The correct dosing level is determined by checking water quality, running small tests, adjusting for flow rate, and monitoring treatment results:

- Checking water quality – Measure pH, turbidity, and solids levels to determine necessary adjustments.
- Running small tests (jar tests) – Take samples and mix them with different reagent amounts to identify the required dose.
- Adjusting for flow rate – Match dosing to the volume of water being treated.
- Using dosing equipment settings – Set pumps or feeders and adjust them based on supplier recommendations and previous results.
- Monitoring treatment results – Check water after dosing to confirm solids are settling correctly, pH is balanced, or contaminants are being removed, with adjustments made as needed.

You can also refer to sources of information to confirm the correct dosing amount for reagents, including:

- Standard operating procedures (SOPs).
- Chemical supplier guidelines.
- Equipment manuals.
- Site treatment logs and historical data.

Example dosing levels, amounts, and measurements for pH adjusters, coagulants, and flocculants:

- pH Adjusters:
 - Lime ($\text{Ca}(\text{OH})_2$) – Used as a slurry with 5–15% solids concentration. Dosage ranges from 100–1000 mg/L, depending on acidity.
 - Sodium hydroxide (NaOH) – Applied in 0.5–5% solutions, with doses from 50–500 mg/L based on pH correction needs.
 - Sulphuric acid (H_2SO_4) – Used in 0.5–5% concentrations, with dosage varying from 10–1000 mg/L depending on alkalinity reduction.
 - Hydrochloric acid (HCl) – Applied in 0.1–10% solutions, with dosing levels based on the acid demand of the water.
- Coagulants
 - Aluminium sulphate ($\text{Al}_2(\text{SO}_4)_3$) – Dosed at 10–200 mg/L, depending on turbidity and suspended solids concentration.
 - Ferric chloride (FeCl_3) – Applied at 20–150 mg/L, with higher doses used for heavy metal removal.
 - Poly aluminium chloride (PAC) – Dosage varies from 5–50 mg/L, depending on particle size and water chemistry.
- Flocculants:
 - Polyacrylamide (PAM) – Diluted to 0.1–1% solutions before dosing at 0.2–10 mg/L based on settling requirements.
 - Natural starch-based polymers – Applied at 5–50 mg/L, depending on water characteristics.
 - Chitosan – Dosed between 1–10 mg/L, commonly used with coagulants.
- Dosing control and adjustment methods:
 - Jar testing, process monitoring, and flow rate calculations determine dosing rates.
 - Turbidity sensors, pH meters, and settling tests track reagent levels.
 - Seasonal variations, water chemistry changes, and treatment performance influence adjustments.
 - Controlling dosing prevents excess chemical use and optimises reclaimed water quality for reuse.

Specific dosing requirements can vary based on factors such as water chemistry, contaminant concentrations, and treatment objectives. Therefore, while guidelines serve as a useful reference, site-specific assessments and testing should be carried out to determine the correct dosing parameters for a particular application.

2.2. Take sample and test

Grab samples are single, discrete water samples collected at a specific time and location to assess water quality parameters such as pH, turbidity, and chemical concentrations. Types of grab samples that are conducted to confirm dosing requirements and confirm levels will depend on the types of contaminants, the sampling location and the parameters of equipment.

Types of samples typically taken and the values they test for include:

- pH samples – Acidity or alkalinity levels before and after dosing adjustments.
- Turbidity samples – Suspended solids and the effectiveness of coagulants and flocculants.
- Jar test samples – Coagulant and flocculant dosage by simulating treatment conditions.
- Settling rate samples – How well solids are aggregating and settling after dosing.
- Filter performance samples – To ensure flocculated particles are being effectively removed in filtration systems.
- Residual coagulant samples – That excess coagulant is not present in treated water.
- Suspended solids samples – Effectiveness of sedimentation and clarify water quality.

The method for collecting samples will be detailed in the SOP for sampling. The following steps are applicable to a range of samples taken.

Sampling Locations:

- Inlet water – Before treatment, to determine raw water conditions.
- Dosing points – To check reagent addition effectiveness.
- Mixing tanks or reaction chambers – To assess coagulation, flocculation, and pH adjustment.
- Clarifiers and settling tanks – To check suspended solids and floc formation.
- Filter outlets – To confirm turbidity reduction and removal efficiency.
- Discharge points or reclaimed water storage – To verify treated water quality before reuse.

Equipment:

- Sample bottles – Plastic or glass, depending on the test requirements.
- Dippers or sampling poles – Used when sampling from tanks, ponds, or deep containers.
- Automatic samplers – Used in continuous processes for time-based or flow-based sampling.
- Field test kits and meters – pH meters, turbidity meters, and conductivity probes for immediate testing.
- Preservatives and coolers – Used when sending samples for laboratory analysis to maintain sample integrity.

Method:

- Select a clean sample bottle suitable for the test (plastic or glass).
- If sampling from a tank or pond, use a dipper or sampling pole to collect from the correct depth.
- For automated sampling, check that the automatic sampler is set correctly.
- If laboratory testing is required, prepare preservatives and a cooler to maintain sample integrity.
- Rinse the sample bottle three times with the water being sampled.

- Hold the bottle mid-stream or at depth to avoid surface contaminants.
- Fill the bottle without overfilling, leaving space if preservatives are required.
- For automatic samplers, confirm the correct collection timing and flow rate.

Testing

To carry out field tests, you need to refer to the SOP to determine the correct test and then follow the testing instructions provided with the test.

Instructions for Measuring pH, Turbidity, and Conductivity

Measuring pH with a pH Meter:


- Calibrate the pH meter using standard buffer solutions (e.g., pH 4, 7, and 10) according to the manufacturer's instructions.
- Rinse the electrode probe with distilled water before and after each measurement.
- Submerge the probe into the sample, ensuring it is fully immersed and not touching the container's sides or bottom.
- Wait for the reading to stabilise, then record the pH value.
- Rinse the probe again and store it in an electrode storage solution if not in use.


Example instruction manual:

ATC, two displays, auto calibration

PH METER

Model : PH-221 *ISO-9001, CE, IEC1010*







pH electrode
(optional)

FEATURES

- * 0 to 14.00 pH, $\pm 1,999$ mV.
- * LCD show both pH and the temperature.
- * ATC or manual TEMP. compensation.
- * Auto calibration for pH 4 and pH 7.
- * Optional pH electrode and the ATC probe.
- * RS232 computer interface.
- * DC 9V battery (006P) or DC 9V adapter in.



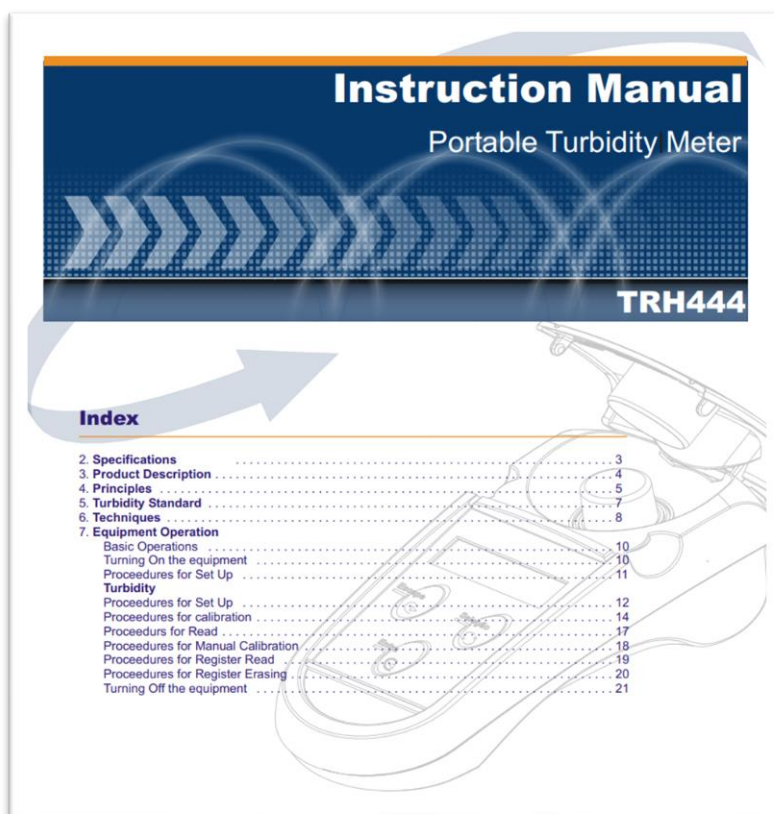
LUTRON ELECTRONIC



The Art of Measurement

Measuring Turbidity with a Turbidity Meter:

- Shake the sample gently to resuspend any settled particles, avoiding air bubbles.
- Pour the sample into a clean, dry turbidity vial, filling it to the marked level.
- Wipe the outside of the vial with a lint-free cloth to remove water spots or fingerprints.
- Insert the vial into the turbidity meter, aligning it correctly according to the meter's guide.
- Close the lid and press the measurement button to obtain a reading.
- Record the turbidity value and clean the vial before the next test.



Source: <https://assets.omega.com/manuals/M4713.pdf>

Measuring Conductivity with a Conductivity Probe:

- Calibrate the probe using a standard conductivity solution if required.
- Rinse the probe with distilled water before inserting it into the sample.
- Submerge the probe fully, ensuring no air bubbles are trapped around the sensor.
- Allow the reading to stabilise before recording the conductivity value.
- Rinse the probe after use and store it according to the manufacturer's guidelines.



TDS-21 TDS CONDUCTIVITY METER

INSTRUCTION MANUAL

TDS/Salt/Conductivity/Resistivity/Temperature



ISO9001:2008



CAS Instruments by CRYSTAL AQUATIC SYSTEMS



www.crystalas.com



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+61 7 55935494

Source: <https://crystalas.com/wp-content/uploads/2023/01/N01286-TDS-Manual-210419.pdf>

2.3. Monitor water storage levels and reject and/or permeate flows

Water in a process plant is stored in different tanks, ponds, and reservoirs depending on whether it is being reclaimed, treated, or removed as waste. Monitoring storage levels ensures efficient water use, treatment performance, and system operation.

Storage for Permeate Flow (Treated or Reclaimed Water):

- Reclaimed water tanks – Treated water ready for reuse in processing, cooling, or dust suppression.
- Process water tanks – Treated water that is recirculated for mineral processing or slurry transport.
- Filtration tanks – Hold water before and after filtration to remove suspended solids.
- pH adjustment tanks – Hold water undergoing neutralisation before further use.
- Surge tanks and buffer ponds – Absorb flow variations to prevent system overloads.

Storage for Reject Flow (Wastewater or Concentrated Contaminants):

- Reject water ponds – Contain concentrated waste streams from membrane filtration or separation processes.
- Thickener tanks – Separate solids from wastewater, recovering process water while concentrating waste material.
- Clarifiers and settling tanks – Allow suspended solids to settle, reducing turbidity before further treatment.

Reject and/or permeate flows are the two main streams produced in a membrane filtration process, such as reverse osmosis or ultrafiltration, used in water treatment:

- Permeate flow – The treated water that passes through the membrane, containing fewer contaminants and meeting quality requirements for reuse or discharge.
- Reject flow (or concentrate flow) – The waste stream that contains concentrated contaminants removed from the water, which is typically directed for further treatment, disposal, or recirculation.

Water storage levels must be monitored to keep water available for processing, treatment, and reuse. Tracking levels prevents overflows, pump failures, or disruptions in flow between storage areas. Monitoring also detects leaks, blockages, and variations in usage, allowing adjustments to be made to match process demands.

Fluctuations in storage levels can occur due to changes in inflow from process circuits, variations in treatment system performance, evaporation, or unplanned losses. Regular monitoring allows operators to respond by adjusting pumping rates, opening or closing valves, or modifying chemical dosing to match water quality requirements. Some storage levels must stay within set limits to prevent excessive retention times, which can lead to the settling of solids, chemical imbalances, or operational inefficiencies.

Methods of measuring water storage levels:

- Sight glass or level indicators – Transparent tubes or external markings on tanks show the current water level.
- Dipsticks or manual measurements – Operators use a calibrated dipstick or measuring rod to check levels in smaller tanks.
- Float switches – Mechanical devices that rise and fall with water levels, triggering alarms or pump controls.

- Pressure sensors – Installed at the base of tanks to measure the weight of the water column and calculate the level.
- Ultrasonic or radar level sensors – Mounted above storage tanks to provide continuous level readings.
- SCADA and control panels – Automated systems that display water levels and send alerts when levels are too high or low.

Operators use these methods to prevent overflows, detect low levels that could affect processing, and ensure sufficient flow between storage areas.

Monitoring reject and/or permeate flow:

- Flow meters:
 - Installed on pipelines to measure the volume of water moving through reject and permeate lines.
 - Readings indicate whether flow rates are within expected limits.
 - Sudden drops in permeate flow may suggest membrane clogging, while excessive reject flow can indicate inefficiencies in the filtration process.
- Pressure gauges:
 - Used on membrane systems to track pressure differences between inlet and outlet flows.
 - A rising pressure in the reject line may indicate fouling, scaling, or blockages within membranes.
 - Low pressure in the permeate line could signal membrane damage or inaccurate flow regulation.
- Conductivity sensors:
 - Measure the level of dissolved solids in permeate water to assess treatment performance.
 - Higher-than-expected readings may indicate membrane leaks, reduced efficiency, or incomplete separation of contaminants.
- Turbidity meters:
 - Check the clarity of permeate water and detect suspended particles.
 - Excess turbidity can signal filter membrane wear, incorrect chemical dosing, or the presence of fine solids that should have been removed earlier.
- Visual inspections:
 - Used to check for leaks, pipe damage, or abnormal flow patterns at reject discharge points and permeate storage tanks.
 - Signs of excessive foaming, uneven discharge rates, or pipe stress may indicate mechanical failure.
- SCADA or control panels:
 - Display flow data from sensors, providing automated monitoring and alerts for abnormal conditions.
 - Tracking trends over time enables operators to detect gradual performance declines before they cause process disruptions.
 - Some setups include remote access for off-site monitoring.

Element 3. Extract water

Assessment Task: Extract water

Scenario:

You are a process plant operator on a lithium (spodumene) mine site in Western Australia. Your supervisor has assigned your duties for the shift. They include:

- Treat process water by dosing reagents in the coagulation and flocculation stage, monitoring sedimentation, and taking samples to check pH and turbidity.
- Pump treated water to storage by transferring it from the settling or thickening stage to the holding tanks or reservoirs, ensuring flow rates are within operating limits.

You are required to carry out your tasks according to workplace policies and procedures, equipment operating instructions and relevant environmental and WHS legislation.

Assessment Instructions:

3.1. Pump water to storage:

- Inspect the pump and pipeline system for leaks, blockages, or abnormal conditions.
- Confirm that the storage tank or reservoir has space for incoming water.
- Check pressure gauges and flow meters to verify system status before starting.
- Start the pump following the correct procedure for manual or remote activation.
- Adjust inlet and outlet valves if required to regulate water flow.
- Monitor flow rates, pressure, and water levels during pumping.
- Identify and respond to any unusual noises, vibration, or irregular pressure fluctuations.
- Stop the pump if operational issues arise and investigate the cause.
- Record flow data, operational parameters, and any issues encountered.

Assessment Criteria:

- 3.1. Pumped water to storage.

Evidence:

Assessor Evidence Guide. Evidence should demonstrate the candidate can perform the key skills of the following:

3.1. Pump water to storage

Water is pumped to storage following treatment using different pumping systems designed to handle different flow rates, pressures, and water quality conditions. The method depends on factors such as storage location, required pressure, and system design.

Pump Types Used:

- Centrifugal pumps – The most common type, using rotating impellers to move large volumes of water efficiently.

- Positive displacement pumps – Used when high pressure is needed, particularly for transferring water through pipelines over long distances.
- Submersible pumps – Installed inside tanks or sumps to lift water to higher storage locations.
- Booster pumps – Increase pressure when transferring treated water to elevated storage or process circuits.

The process flow from treatment to storage:

- Treated water exits clarifiers, filtration units, or membrane systems and enters a pump station.
- Pumps control flow rate and pressure based on demand and storage capacity.
- Water is transferred through dedicated pipelines to process water tanks, reclaimed water storage, or discharge points.
- Flow is monitored using flow meters, pressure sensors, and level indicators to adjust pump operation.
- If additional treatment is needed (such as pH adjustment or final filtration), water may pass through a secondary treatment stage before storage.

The procedure for activating pumps to move treated water to storage will be included in the SOP for the equipment or water treatment tasks. Instructions for the operation of pumps or controls can be found in the operator's manual for the pump or control panel and on stickers or decals on the equipment.

Procedure for activating pumps to transfer water to storage:

- Inspect the pump and pipeline system for leaks, blockages, or abnormal conditions.
- Confirm that the storage tank or pond has space for incoming water.
- Check pressure gauges and flow meters to verify system status before starting.
- Start the pump as per the instructions on the pump:
 - Manual Start (Local Control Panel):
 - Open the local pump control panel near the pump.
 - Set the pump to manual mode if required.
 - Press the start button to engage the pump.
 - Observe motor and pump operation for unusual noise or vibration.
 - SCADA or Remote Control Panel:
 - Access the control room interface or SCADA system.
 - Select the specific pump from the system menu.
 - Click the start command and check system feedback.
 - Valve Adjustments (if required):
 - Open or adjust inlet and outlet valves to regulate water flow.
 - Confirm that flow rates meet operational requirements.
- Observe flow meters and pressure gauges to confirm water movement.
- Listen for unusual noises or vibrations that may indicate mechanical issues.
- Monitor storage tank levels to prevent overfilling or dry running.

- Stop the pump immediately if any issues arise and investigate the cause.
- Stopping the pump (if needed):
 - Use the stop button on the local panel or SCADA system.
 - Close valves if required to prevent backflow or water hammer effects.

Element 4. Operate and monitor equipment

Assessment Task: Operate and monitor equipment

Scenario:

You are a process plant operator on a lithium (spodumene) mine site in Western Australia. Your supervisor has assigned your duties for the shift. They include:

- Treat process water by dosing reagents in the coagulation and flocculation stage, monitoring sedimentation, and taking samples to check pH and turbidity.
- Pump treated water to storage by transferring it from the settling or thickening stage to the holding tanks or reservoirs, ensuring flow rates are within operating limits.

You are required to carry out your tasks according to workplace policies and procedures, equipment operating instructions and relevant environmental and WHS legislation.

Assessment Instructions:

4.1. Read and interpret data from equipment indicators and maintain flow rates:

- Monitor flow meters, pressure gauges, and level indicators to confirm water movement and maintain operational flow rates.
- Check electrical current readings to assess power draw and detect abnormal pump loads.
- Observe storage tank levels to prevent overfilling or dry running.
- Listen for unusual noises or vibrations that may indicate mechanical issues.
- Use SCADA or local control panels to monitor and adjust flow conditions as required.

4.2. Continuously inspect plant and identify defects and potential problems:

- Conduct routine walk-through inspections to check pumps, pipes, and storage tanks for leaks, corrosion, or structural weaknesses.
- Identify cavitation signs such as high-pitched noises or excessive vibration in pumps.
- Check for overheating in motors and pump casings.
- Look for signs of wear or damage in valves, joints, and seals.
- Inspect strainers and filters for blockages or accumulation of debris.

4.3. Adjust equipment to approved operating parameters and optimise performance, maintain efficient water treatment systems and meet water quality targets:

- Modify pump speeds and valve positions to maintain required pressure and flow rates.
- Adjust chemical dosing rates to achieve correct pH levels and effective coagulation.
- Perform filter backwashing or cleaning to restore system efficiency.
- Regulate pressure to prevent strain on pipelines and membranes.
- Adjust recirculation rates to optimise water recovery and minimise waste.

4.4. Control feed to equipment:

- Adjust pump operation to regulate water feed into treatment units.
- Open or close valves to control flow direction, rate, and pressure.
- Use SCADA or manual controls to modify feed rates based on system requirements.

- Monitor flow meters and sensors to ensure consistent feed rates.
- Verify that storage tanks maintain adequate levels to prevent underfeeding or overflow.

Assessment Criteria:

- 4.1. Read and interpreted data from equipment indicators and maintained flow rates.
- 4.2. Continuously inspected plant and identified defects and potential problems.
- 4.3. Adjusted equipment to approved operating parameters, optimised performance, maintained efficient water treatment systems, and met water quality targets.
- 4.4. Controlled feed to equipment.

Evidence:

Assessor Evidence Guide. Evidence should demonstrate the candidate can perform the key skills of the following:

4.1. Read and interpret data from equipment indicators and maintain flow rates

Monitoring flow rates, pressure, levels, and mechanical conditions of pumps and pipelines is carried out to keep flow rates within required limits and prevent inefficiencies, equipment damage, or process disruptions. The operator monitors equipment indicators from control rooms, local pump stations, or near the equipment itself, depending on the system setup:

- Readings from flow meters, pressure sensors, and level indicators can be displayed on SCADA panels or digital control interface in the control room.
- Some equipment requires the operator to remain at the control panel installed near the pumps and pipelines.
- Physical inspections include checking flow meters, pressure gauges, and storage levels directly and listening for unusual noises, feeling for vibrations, or visually inspecting leaks and discharge points require being close to the equipment.

The monitoring location depends on the type of system, level of automation, and whether adjustments are made remotely or manually.

Equipment indicators will show data relating to key parameters relating to flow rate. Examples of indicators and the data they provide, as well as how this information can be interpreted to maintain flow rates are detailed below:

- Current:
 - Electrical current readings on control panels indicate the power draw of pumps and motors.
 - A higher-than-normal current may suggest excessive load, blockages, or pump inefficiencies, while a lower-than-expected reading may indicate reduced performance or mechanical failure.
- Flow:
 - Flow meters measure the volume of water moving through pipes.
 - Low flow may signal blockages, airlocks, or pump wear, while excessive flow can indicate valve malfunctions or uncontrolled discharge.

- Level:
 - Storage tank or pond levels are displayed on gauges, sight glasses, or automated sensors.
 - Sudden drops may indicate leaks, pump malfunctions, or excessive withdrawal rates, while high levels may require adjustments to avoid overflows.
- Pressure:
 - Pressure gauges and sensors display readings at different points in the system.
 - A drop in pressure may suggest pipeline leaks, pump failures, or airlocks.
 - Excessive pressure may indicate obstructions, closed valves, or pump overloading.
- Unusual noises (e.g., cavitation):
 - Loud noises, rattling, or high-pitched whistling sounds may indicate cavitation, where vapour bubbles form and collapse inside the pump.
 - Cavitation can cause severe internal damage and is usually caused by low suction pressure, excessive pump speed, or restrictions in the suction line.
- Vibrations:
 - Excessive vibration in pumps, motors, or pipelines may indicate misalignment, loose components, or bearing wear.

4.2. Continuously inspect plant and identify defects and potential problems

Routine checks during operation can detect developing issues before they cause failures or process disruptions. You should monitor the system operation by walking through the plant, listening for unusual noises, feeling for vibrations, and checking for leaks or temperature changes, which can reveal problems that may not be obvious from control panels alone.

Plant that should be inspected and monitored should include the following as a minimum, but it is a good idea to remain alert to any signs or sounds that may suggest current or emerging mechanical or other issues:

- Fixed pumps.
- Lines, such as:
 - Pipeline systems for transporting water, chemicals, or slurry between processing units.
 - Chemical dosing lines.
 - Return lines that carry treated water back to storage tanks or treatment units.
 - Wastewater discharge lines.
 - Slurry transport lines to locations for further processing or disposal.
- Storage tanks/dams.

The types of defects and potential problems that visual and physical inspections can identify include:

- Signs of cavitation in pumps such as high-pitched noises or vibration.
- Seal leaks where fluid is escaping from pump seals.
- Overheating indicated by excessive pump casing temperature.
- Excessive vibration in the pump housing, pipes, or motor mounts.
- Inconsistent flow or pressure fluctuations shown on flow meters and pressure gauges.
- Electrical faults such as irregular power draw, motor overheating, or damaged wiring and connections.
- Leaks or seepage at pipe joints, welds, or cracks, indicated by damp areas, mineral deposits, or pressure loss.
- Blockages or restricted flow detected through pressure changes, reduced flow rates, or unexpected turbulence.
- Pressure drops shown on gauges, indicating possible internal damage, leaks, or pump failure.
- Corrosion or wear seen as rust, pitting, or thinning of pipe walls.
- Valve malfunctions such as sticking, failure to open or close, or leaking at valve seats and seals.
- Pipe misalignment at joints, flanges, and stress points, causing bending or shifting.
- Cracks or structural weaknesses in storage tanks and dams, seen as fractures, seepage, or material displacement.
- Liner damage in the form of punctures, tears, or areas of detachment causing leaks.
- Overflow risks due to high water levels exceeding spillway or discharge limits.
- Sediment buildup observed as sludge accumulation at the bottom of tanks or reduced water capacity.

- Contamination indicated by changes in water appearance, odour, or unexpected deposits.
- Unstable embankments or erosion with signs of soil displacement, cracks, or water seepage along dam walls.

4.3. Adjust equipment to approved operating parameters and optimise performance, maintain efficient water treatment systems and meet water quality targets

Variations in system performance, water quality, or mechanical function may indicate the need for operational adjustments:

- Sudden drops or surges in flow, unexpected pressure fluctuations, or irregular storage levels can signal inefficiencies or potential equipment strain.
- Shifts in water composition, such as increased solids, changes in pH, or higher contaminant loads, may affect treatment effectiveness and require corrective action.
- Mechanical irregularities, including unusual noises, vibration, or temperature increases in equipment, can point to wear, blockages, or strain that could lead to failure if not addressed.
- External factors, such as seasonal changes, raw water variability, or increased process demands, may also disrupt system balance and require operational adjustments to maintain stability.

Depending on the conditions identified, adjustments could include:

- Pump speed adjustments to control flow rates and maintain required pressure.
- Valve position changes to regulate water distribution, prevent overflows, or redirect flow.
- Chemical dosing modifications to correct pH, improve coagulation, or optimise flocculation.
- Filter backwashing or cleaning to remove buildup and restore efficiency.
- Pressure regulation to balance system operation and prevent strain on pipelines and membranes.
- Recirculation rate adjustments to maximise water recovery and minimise waste.
- Membrane flushing or cleaning cycles to remove fouling and restore filtration performance.

4.4. Control feed to equipment

Water feed to equipment is controlled through pumps, valves, and automated systems that regulate flow rates, pressure, and distribution across the treatment process. The control points depend on the system design, with adjustments made either locally at equipment sites or remotely from control rooms. Flow must be managed to match processing demands, prevent overloading or underfeeding, and maintain stable operating conditions.

Control can be manual or automated, depending on the plant setup. Manual control requires operators to physically adjust pump speeds, open or close valves, or change flow settings at individual units. Automated control uses sensors, flow meters, and SCADA systems to adjust feed rates dynamically based on water levels, pressure readings, and process requirements. Automated systems are preferable as they provide more consistent regulation and faster response to changes in demand or system conditions.

Methods for controlling water feed depend on system design, equipment type, and process requirements. Gravity-fed systems may use manual valves for flow control, while pressurised systems use pumps with automated sensors. Filtration units, clarifiers, and reverse osmosis systems each require specific adjustments to maintain efficiency. Flow rates, pressure limits, and operational sequences vary, making it necessary to use SOPs and equipment instructions. Checking control panels, instrumentation, and mechanical components against documented procedures confirms correct settings. SOPs provide guidance to keep adjustments within process requirements, prevent equipment damage, and maintain water quality standards for treatment and reuse.

Methods to control feed to equipment, depending on the system and equipment include:

- Adjust pump speed to regulate the volume of water delivered to equipment.
- Open or close valves to control flow direction, rate, and pressure.
- Monitor flow meters and sensors to track water movement and make adjustments as needed.
- Check tank or reservoir levels and regulate inflow to prevent overflow or underfeeding.
- Adjust pump operation or valve settings in response to pressure changes to maintain stable flow.
- Use automated SCADA systems to manage water feed remotely through programmed control sequences.
- Operate manual control panels to start, stop, or adjust water feed settings directly at the equipment.

Element 5. Clean up

Assessment Task: Clean up

Scenario:

You are a process plant operator on a lithium (spodumene) mine site in Western Australia. Your supervisor has assigned your duties for the shift. They include:

- Treat process water by dosing reagents in the coagulation and flocculation stage, monitoring sedimentation, and taking samples to check pH and turbidity.
- Pump treated water to storage by transferring it from the settling or thickening stage to the holding tanks or reservoirs, ensuring flow rates are within operating limits.

You are required to carry out your tasks according to workplace policies and procedures, equipment operating instructions and relevant environmental and WHS legislation.

Assessment Instructions:

5.1. Clean plant and equipment:

- Remove dust, dirt, and debris from plant and equipment using water, cleaning agents, or hosing as per site procedures.
- Conduct descaling to eliminate mineral deposits and residue buildup inside pumps, pipelines, and storage areas.
- Flush internal components with clean water or chemical solutions to remove contaminants.
- Inspect equipment for remaining contamination and repeat cleaning if necessary.
- Dispose of cleaning waste according to site procedures.

5.2. Clean and store auxiliary equipment:

- Flush discharge lines, hoses, and strainers to remove sediment, scale, or chemical residues.
- Wipe down generators, power tools, and level indicators using lint-free cloths and appropriate cleaning agents.
- Scrub strainers, sampling equipment, and level indicators with non-abrasive brushes to remove fine particles.
- Conduct chemical cleaning where needed, following manufacturer guidelines.
- Inspect cleaned equipment for wear or damage and tag any faulty items out of service.
- Store auxiliary equipment in designated areas, protecting it from contamination or mechanical damage.

5.3. Complete documentation clearly, concisely, and on time:

- Record cleaning activities, including descaling operations, reagent usage, and equipment inspections.
- Update maintenance logs, noting any defects or irregularities identified during cleaning.
- Submit completed records through digital systems or paper-based reporting, following site procedures.
- Ensure documentation is accurate, legible, and submitted within the required timeframe.

5.4. Complete end-of-shift reports and records:

- Fill out shift handover reports detailing completed work, outstanding tasks, and any identified issues.
- Update records such as water quality logs, reagent usage sheets, and equipment maintenance reports.
- Report faults, defects, or incidents by completing hazard or incident reports as required.
- Submit documentation to the designated location or personnel.

Assessment Criteria:

- 5.1. Cleaned plant and equipment.
- 5.2. Cleaned and stored auxiliary equipment.
- 5.3. Completed documentation clearly, concisely, and on time.
- 5.4. Completed end of shift reports and records.

Evidence:

Assessor Evidence Guide. Evidence should demonstrate the candidate can perform the key skills of the following:

5.1. Clean plant and equipment

On completion of the task, all plant and equipment must be cleaned so that it is ready for the next use. Cleaning must be carried out in accordance with the manufacturer's manual for equipment if there is one, or the relevant SOP. The plant and equipment can be cleaned of dust, dirt, debris, spilt reagents, and general contamination using water and cleaning agents or by hosing down as per site procedures.

Due to contaminated water passing through equipment, the majority of the contamination will be on the inside or area where water has sat still. This build-up of contaminants and residues is known as 'scale'. The process used to clean scale is called 'descaling'. Descaling is carried out to remove mineral deposits, scale buildup, and residue that accumulate on plant and equipment used in the water treatment of mine process water. Scale builds up in areas where water flow is restricted, turbulent, or experiences temperature changes, leading to the precipitation of dissolved minerals. Deposits can form on internal surfaces of pumps, pipelines, and storage infrastructure where water is repeatedly cycled, concentrated, or exposed to chemical treatments. Scale accumulates on pump impellers, casings, and seals, affecting performance. Inside pipelines, mineral buildup reduces flow capacity and increases pressure resistance, leading to blockages and excessive wear. Deposits can develop along walls, inlet and outlet points, and submerged structures in storage tanks and dams, where minerals settle over time, creating hardened layers that reduce storage capacity and interfere with water treatment processes.

The method depends on the equipment type, scale composition, and operational requirements.

Preparation for descaling:

- Identify and assess the type and severity of scaling in plant and equipment, such as calcium carbonate, iron deposits, or silica scaling, to determine the most effective descaling method.
- Drain and isolate equipment, including pipes, pumps, heat exchangers, and membranes, before descaling.
- Choose a descaling method based on the scale composition and equipment material, using mechanical, chemical, or high-pressure cleaning techniques.

The descaling method will vary based on the type of scale, location and manufacturer's recommendations for the plant or equipment:

- Circulate acidic solutions, such as hydrochloric acid, citric acid, or sulphamic acid, through the system to dissolve mineral deposits. Use neutralising agents if required after treatment.
- Use scrapers, brushes, or abrasive tools to physically remove scale from surfaces such as pipe walls, heat exchangers, or tank linings.
- Direct high-pressure water jets at scale-covered surfaces to break down and flush out mineral buildup.
- Apply ultrasonic or hydrosonic cleaning to create vibrations and cavitation forces that loosen deposits from internal surfaces of pipes and membranes.
- Flush the system with clean water after descaling to remove any residual chemicals or loosened particles.
- Inspect the equipment visually and check flow rates, pressure, or chemical compatibility before returning it to service.

5.2. Clean and store auxiliary equipment

Just as fixed plant and equipment require cleaning after use, so too does auxiliary and sampling/testing equipment such as:

- Discharge lines.
- Generators.
- Hand and power tools.
- Hoses (water and air).
- Level indicators.
- Pump system.
- Strainers.
- Sampling and testing equipment.

Cleaning must be carried out in accordance with the manufacturer's manual for equipment if there is one, or the relevant SOP. The plant and equipment can be cleaned of dust, dirt debris, spilt reagents, and general contamination using water and cleaning agents or by hosing down as per site procedures.

Cleaning auxiliary equipment can be carried out as follows.

- Flush discharge lines, hoses, and strainers with clean water or an appropriate cleaning solution to remove sediment, scale, or chemical residues. High-pressure water or air purging may be required for stubborn deposits.
- Wipe down generators, power tools, and level indicators using lint-free cloths and appropriate degreasers or cleaning agents to remove dust, oil, and grease buildup.
- Scrub strainers, sampling equipment, and level indicators manually with non-abrasive brushes to remove fine particles or biological growth.
- Use chemical cleaning if equipment has been exposed to scaling, chemical fouling, or microbial contamination. Descaling agents, disinfectants, or neutralising solutions may be required, but you need to check the SOP and manual for compatibility with residual materials before using them.
- Clean generators, electrical components, and enclosed systems using compressed air or vacuum systems to remove dust and loose debris.

You should inspect all equipment during cleaning to check for wear, corrosion, or blockages, and act accordingly to either fix the issue or tag it out of service and report it to your supervisor.

All equipment should be returned to its designated storage location, which may be a store room or sea container in or near the process plant or water treatment infrastructure, or it may be coiled or hung on hooks or racking close to where it is used. Hand and power tools and sensitive equipment should be stored in a place where it is free from contamination or damage by water, sunlight or other tools and equipment being placed on them. This also may be in a site store, office (for smaller equipment such as testing equipment), or in a tool bag or box if used regularly.

5.3. Complete documentation clearly, concisely and on time

You may be required to complete documentation prior to, during, and following completion of water treatment tasks.

Some documentation may need to be filled out during work tasks in pen in a notebook, e.g., sampling results or a specific form such as a pre-start inspection or hazard report, while others can be entered into an application on a phone or tablet. Depending on the systems used, some records are captured automatically by equipment data logging systems, e.g., records of automatic dosing, or flow rates.

However they are captured, records and reports must be legible and accurate and submitted to the right person in the right format within the correct time limit. This may require you to transcribe information from notebooks into spreadsheets or data logging systems or enter it into the site's information management system. Reports should be typed in the correct format and submitted by hand (but backed up) or via email.

5.4. Complete end of shift reports and records

The types of end of shift reports and records that should be completed will vary according to the tasks completed, if incidents or equipment faults have occurred and if any hazards or issues were identified during the task or shift.

The purpose of these records and reports is to capture information from the shift either for reporting and tracking purposes or to be used during handover or end of shift meetings.

Examples of end of shift reports and records that are applicable to a range of tasks include:

- Job Hazard Analysis (JHA).
- Take 5 forms.
- Hazard reports.
- Pre-start checklists.
- Shift handover reports.
- Reagent usage records.
- Water quality sampling logs.
- Flow monitoring records.
- Pump operation logs.
- Equipment maintenance records.
- Incident and fault reports.

Processing records and reports must be done in accordance with site procedures and may require you to:

- Enter information into a software application.
- Scan and email forms and documents.
- Hand hard copies to your supervisor or place them in a tray, e.g., shift sheets, work reports, pre-start checklists, and hazard reports.

Performance Criteria Assessment Outcome

Unit of Competency	Outcome	Feedback
RIIWVG302D - Reclaim and treat water	Satisfactory <input type="checkbox"/> Not Yet Satisfactory <input type="checkbox"/>	

Elements and Performance Criteria

Practical Assessment.

Example Scenario. RTO to confirm suitability in context of Assessment Conditions and Learners.

Assessment Task: Reclaim and treat water

Scenario:

You are a process plant operator on a lithium (spodumene) mine site in Western Australia. Your supervisor has assigned your duties for the shift. They include:

- Treat process water by dosing reagents in the coagulation and flocculation stage, monitoring sedimentation, and taking samples to check pH and turbidity.
- Pump treated water to storage by transferring it from the settling or thickening stage to the holding tanks or reservoirs, ensuring flow rates are within operating limits.

You are required to carry out your tasks according to workplace policies and procedures, equipment operating instructions and relevant environmental and WHS legislation.

Note: You must carry out the following on more than one occasion.

Assessment Instructions:

- 1.1. Access, interpret and apply water reclaiming and treating documentation and ensure the work activity is compliant
- 1.2. Obtain, read, interpret, clarify and confirm work requirements
- 1.3. Use appropriate communication methods
- 1.4. Select and wear personal protective equipment appropriate for work activities
- 1.5. Select appropriate reagents
- 1.6. Carry out equipment pre-start checks
- 1.7. Identify and address potential risks, hazards and environmental issues, and implement control measures
- 1.8. Obtain and interpret emergency procedures, and be prepared for fire/accident/emergency
- 2.1. Dose reagents at approved levels
- 2.2. Take sample and test
- 2.3. Monitor water storage levels and reject and/or permeate flows
- 3.1. Pump water to storage
- 4.1. Read and interpret data from equipment indicators and maintain flow rates
- 4.2. Continuously inspect plant and identify defects and potential problems
- 4.3. Adjust equipment to approved operating parameters and optimise performance, maintain efficient water treatment systems and meet water quality targets
- 4.4. Control feed to equipment
- 5.1. Clean plant and equipment
- 5.2. Clean and store auxiliary equipment
- 5.3. Complete documentation clearly, concisely and on time
- 5.4. Complete end of shift reports and records.

Observation Checklist

Assessor Evidence Guide. Evidence should demonstrate the candidate can perform the following.

Performance Criteria	Assessment Evidence Gathered or Observed	Satisfactory	Not Yet Satisfactory
1.1. Access, interpret and apply water reclaiming and treating documentation and ensure the work activity is compliant		<input type="checkbox"/>	<input type="checkbox"/>
1.2. Obtain, read, interpret, clarify and confirm work requirements		<input type="checkbox"/>	<input type="checkbox"/>
1.3. Use appropriate communication methods		<input type="checkbox"/>	<input type="checkbox"/>
1.4. Select and wear personal protective equipment appropriate for work activities		<input type="checkbox"/>	<input type="checkbox"/>
1.5. Select appropriate reagents		<input type="checkbox"/>	<input type="checkbox"/>
1.6. Carry out equipment pre-start checks		<input type="checkbox"/>	<input type="checkbox"/>
1.7. Identify and address potential risks, hazards and environmental issues, and implement control measures		<input type="checkbox"/>	<input type="checkbox"/>
1.8. Obtain and interpret emergency procedures, and be prepared for fire/accident/emergency		<input type="checkbox"/>	<input type="checkbox"/>
2.1. Dose reagents at approved levels		<input type="checkbox"/>	<input type="checkbox"/>
2.2. Take sample and test		<input type="checkbox"/>	<input type="checkbox"/>
2.3. Monitor water storage levels and reject and/or permeate flows		<input type="checkbox"/>	<input type="checkbox"/>
3.1. Pump water to storage		<input type="checkbox"/>	<input type="checkbox"/>
4.1. Read and interpret data from equipment indicators and maintain flow rates		<input type="checkbox"/>	<input type="checkbox"/>
4.2. Continuously inspect plant and identify defects and potential problems		<input type="checkbox"/>	<input type="checkbox"/>
4.3. Adjust equipment to approved operating parameters and optimise performance, maintain efficient water treatment systems and meet water quality targets		<input type="checkbox"/>	<input type="checkbox"/>
4.4. Control feed to equipment		<input type="checkbox"/>	<input type="checkbox"/>
5.1. Clean plant and equipment		<input type="checkbox"/>	<input type="checkbox"/>
5.2. Clean and store auxiliary equipment		<input type="checkbox"/>	<input type="checkbox"/>

5.3. Complete documentation clearly, concisely and on time		<input type="checkbox"/>	<input type="checkbox"/>
5.4. Complete end of shift reports and records		<input type="checkbox"/>	<input type="checkbox"/>

Performance Criteria Assessment Outcome

Unit of Competency	Outcome	Feedback
RIIWVG302D - Reclaim and treat water	Satisfactory <input type="checkbox"/> Not Yet Satisfactory <input type="checkbox"/>	

Performance Evidence

Observation Checklist

Assessor Evidence Guide. Evidence should demonstrate the candidate can perform the following.

Performance Evidence	Assessment Evidence Gathered or Observed	Satisfactory	Not Yet Satisfactory
Evidence is required to be collected that demonstrates a candidate's competency in this unit. Evidence must be relevant to the roles within this sector's work operations and satisfy all of the requirements of the performance criteria of this unit and include evidence that the candidate:		<input type="checkbox"/>	<input type="checkbox"/>
locates and applies relevant documentation, policies and procedures		<input type="checkbox"/>	<input type="checkbox"/>
implements the requirements, procedures and techniques for the safe, effective and efficient completion of the reclaiming and treating of water including:		<input type="checkbox"/>	<input type="checkbox"/>
selecting and using the required tools and equipment		<input type="checkbox"/>	<input type="checkbox"/>
treating water		<input type="checkbox"/>	<input type="checkbox"/>
extracting water		<input type="checkbox"/>	<input type="checkbox"/>
operating and monitoring equipment		<input type="checkbox"/>	<input type="checkbox"/>
works effectively with others to undertake and complete the reclaiming and treating of water that meets all of the required outcomes including:		<input type="checkbox"/>	<input type="checkbox"/>
using a range of communication techniques to convey information to others		<input type="checkbox"/>	<input type="checkbox"/>
maintaining written and verbal reporting requirements and procedures		<input type="checkbox"/>	<input type="checkbox"/>
demonstrates completion of reclaiming and treating water that safely, effectively and efficiently meets all of the required outcomes on more than one (1) occasion including:		<input type="checkbox"/>	<input type="checkbox"/>
completing water treatment operations		<input type="checkbox"/>	<input type="checkbox"/>
completing extracting operations		<input type="checkbox"/>	<input type="checkbox"/>
reading and interpreting data from equipment indicators		<input type="checkbox"/>	<input type="checkbox"/>

inspecting, identifying defects in and adjusting equipment		<input type="checkbox"/>	<input type="checkbox"/>
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Performance Evidence Assessment Outcome

Unit of Competency	Outcome	Feedback
RIIWVG302D - Reclaim and treat water	Satisfactory <input type="checkbox"/> Not Yet Satisfactory <input type="checkbox"/>	

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit. Further information is available in the Resources and Infrastructure Industry Training Package Companion Volume.