



Australian Government

Department of Education, Employment and Workplace Relations

SFIAQUA313B Oversee operations of high technology water treatment components

Release: 1

SFIAQUA313B Oversee operations of high technology water treatment components

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit of competency involves coordinating the operation and maintenance of a range of high technology water treatment components to optimise conditions for stock breeding and growth, or holding environment. The unit covers interpreting and conveying instructions, overseeing operations, monitoring the operation of components, data entry and analysis, and conveying information. Processes will include those for ensuring the use and updating of established procedures and techniques. Skills to coordinate staff are covered by RTE3704A Coordinate worksite activities. Licensing, legislative, regulatory or certification requirements may apply to this unit. Therefore it will be necessary to check with the relevant state or territory regulators for current licensing, legislative or regulatory requirements before undertaking this unit.
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Application of the Unit

Application of the unit	The unit will have application to <i>recirculating aquaculture systems (RAS)</i>, aquaria or other holding facility that has high technology water treatment components. The unit has application for those workers who have responsibility for a specific area of work or who lead a work group or team. The operation and maintenance of other equipment and infrastructure; chemical adjustments for controlling pH (acid/alkaline) balance; stock husbandry, such as feeding, health management and handling (e.g. adjusting stocking densities and grading); and harvesting and post-harvest activities are covered in other aquaculture, seafood processing and seafood sales and distribution units of competency. All enterprise or workplace procedures and activities are carried out according to <i>relevant government regulations, licensing and other compliance requirements, including occupational health and safety (OHS) guidelines, food safety and hygiene regulations and procedures, and ecologically sustainable development (ESD) principles</i>. Equipment operation, maintenance, repairs and calibrations are undertaken in a safe manner that conforms to manufacturer instructions. Appropriate <i>personal protective equipment (PPE)</i> is selected, checked, used and
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Licensing/Regulatory Information

Refer to Unit Descriptor

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan for the operation and maintenance of high technology water treatment components	1.1. Work plan or schedule is interpreted and confirmed with senior personnel. 1.2. Labour and resource requirements are confirmed with senior personnel and arranged. 1.3. Optimal ranges for basic environmental parameters, advanced environmental parameters and water quality parameters affecting cultured or held stock are identified from enterprise procedures. 1.4. Staff members undertaking basic operations and routine maintenance or repairs are briefed on responsibilities according to work plan or schedule. 1.5. Contingency plans are confirmed and related to staff.
2. Optimise operations of high technology water treatment components	2.1. Appropriate components for operations are identified and prepared. 2.2. Routine pre-operational checks and calibrations are made and recorded. 2.3. Operation of components and other aquaculture equipment and infrastructure, including culture or holding structures or systems, are monitored and abnormal or non-standard conditions are reported or adjustments to operating components made as planned. 2.4. Operation or production schedule is altered to compensate for factors affecting cultured or held stock during operations, or contingency plans are implemented. 2.5. Data on the performance and efficiency of components or system operation is collated and analysed and steps are taken to optimise activities. 2.6. Work team progress and outcomes are monitored against the work plan or schedule, with support given as required.
3. Oversee maintenance and repair of high technology water treatment components	3.1. Maintenance schedule is confirmed with staff. 3.2. Repairs and maintenance for pre-operation, standard operation and post-operation are supervised. 3.3. Repairs and maintenance activities are altered to compensate for factors affecting cultured or held stock. 3.4. Backup or auxiliary systems are installed and used as needed in line with enterprise requirements. 3.5. Worn or damaged parts or areas, or malfunctioning components and water supply or disposal systems are

ELEMENT	PERFORMANCE CRITERIA
	identified for repair on site or sent to manufacturer or specialist. 3.6. Operation of components is checked following maintenance and optimal operation is confirmed. 3.7. Work team progress and outcomes are monitored against the repairs and maintenance schedule, with support given as required.

ELEMENT	PERFORMANCE CRITERIA
4. Finalise operation, monitoring and maintenance activities	4.1. Clean up of work area, including repairs and storage of equipment, is supervised and condition report prepared. 4.2. Relevant operation, monitoring and maintenance data, observations or information are recorded legibly and accurately, and any out of range or unusual records checked. 4.3. Compliance and other required reports are prepared and conveyed to senior personnel advising of the effectiveness of operation, monitoring and maintenance, and recommendations made for improvements. 4.4. Options for improving efficiency through mechanisation or automation of process or activity, and use of specialised contract staff are researched and presented to senior personnel as potential improvements. 4.5. Staff are given feedback on their work performance.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

- accurately recording and analysing results, using computers and technology, where applicable
- adjusting systems to optimise water quality or support stock density
- analysing problems, devising solutions and reflecting on approaches taken
- applying risk assessment processes and putting controls in place to mitigate risk and minimise impact
- choosing options for mechanisation or automation of process or activity, including the use of specialised contract services
- cleaning and maintaining equipment to hygiene, product quality and food safety standards
- communicating information about optimising the operation and maintenance of the components to the work group
- consulting with the work group on improvements in operations and maintenance
- coordinating operations and work group
- establishing key performance indicators (KPIs), comparisons and benchmarking to

REQUIRED SKILLS AND KNOWLEDGE

- monitor enterprise performance
- identifying potential improvements
- implementing emergency procedures, and crisis or disaster management
- following disease management procedures:
 - disposing of mortalities
 - following ESD principles
 - implementing quarantine procedures
 - using cause diagnosis techniques
- operating and shutting down equipment in a safe manner
- operating within a budget
- ordering, storing and monitoring usage rates, quantities and types of feeds, chemicals, spare parts and other inputs and equipment
- organising staff
- providing feedback to staff
- repairing and replacing components, undertaking basic plumbing and work with pipes and pumps
- reporting orally and in writing on effectiveness of operation, monitoring and maintenance
- researching options for improvement
- using, storing and disposing of chemicals and biological agents.

Literacy skills used for:

- interpreting documentation relating to optimising the operation and maintenance of the components
- interpreting workplace documentation such as operating manuals and manufacturer instructions, operational and maintenance schedules, stocking densities and harvest outputs.

Numeracy skills used for:

- assessing efficiencies of conversion of inputs to outputs
- calculating dosage rates for medications and treatments, and determining withholding periods
- calculating KPIs
- calculating volumes and quantities of inputs and outputs of liquids, gases and solids
- reading and interpreting material safety data sheet (MSDS) labels
- recording information.

Required knowledge

- calculation and analysis of KPIs to demonstrate effectiveness of operations

REQUIRED SKILLS AND KNOWLEDGE

- effective management of staff, time and resources
- federal, state, territory and local government laws and regulations relating to:
 - environmental sustainability, particularly strategies and regulations/license conditions for waste and effluent minimisation, and methods of disposal
 - forward planning and risk management for events, such as blackouts, brownouts and equipment breakdowns
 - OHS for staff, management, contractors and visitors
 - withholding periods when using chemicals or medications
 - translocation of exotic or introduced species and biosecurity issues
- impacts of inputs on systems and component operation, such as maximum stocking, feeding and waste loads
- methods of customisation and retrofitting of components
- role of quarantine, hygiene and cleaning programs in disease prevention and control
- standards, guidelines and approaches to the operation of high technology water treatment components, such as:
 - association between water hydraulics, water chemistry and oxygenation, super saturation and gas exchange
 - biology of stock and environmental and husbandry requirements within RAS to achieve growth targets
 - importance of optimised production to achieve sound economic outcomes
 - monitoring of basic and advanced environmental and water quality parameters
 - nitrification and other bacterial processes and requirements, including biofilter start-up, shock-loading and maintenance
 - operation and maintenance of water treatment components, including back-flushing filters, cleaning (pigging) of water supply and disposal lines, and routine dry outs
 - optimal and critical levels for water quality parameters, such as temperature, pH (acid/alkaline balance), dissolved oxygen, nitrogenous wastes and carbon dioxide
- uses for wastes, recycled water and by-products.
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Evidence Guide

EVIDENCE GUIDE	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
Overview of assessment	
Critical aspects for assessment evidence required to demonstrate competence in this unit	Assessment must confirm ability to • coordinate work team activities to ensure the operation and maintenance of high technology water treatment components • forward plan for efficiency and contingencies • optimise conditions for stock breeding and growth, or holding environment • report on effectiveness of operation, monitoring and maintenance. Assessment must confirm knowledge of: • biological and environmental requirements of the culture or holding species • ESD principles • OHS risks associated with staff, management, contractors and visitors • procedures for data collection, recording, analysis and reporting • standards, guidelines and approaches to the operation of high technology waste treatment components • water quality, optimal and critical limits for various parameters and non-standard conditions.
Context of and specific resources for assessment	Assessment is to be conducted at the workplace or in a simulated work environment. It should cover the operation of a RAS typically used in aquaculture, holding or ornamental facilities in the region. Resources may include: • enterprise requirements for basic and advanced environmental parameters, and water quality parameters for culture or holding stock • RAS with high technology waste treatment components • other equipment as needed to operate the system and

EVIDENCE GUIDE

maintain water quality

- spare parts and repair materials
- operational staff to coordinate
- templates for recording data
- water monitoring equipment
- work plan or work instructions for the RAS operation and maintenance.

EVIDENCE GUIDE	
Method of assessment	The following assessment methods are suggested: • case studies, simulation or drills • journal which may include work diary notes, photographs or videos • portfolio of workplace documents, including work procedures, benchmarks, checklists and data sheets showing improved practices in the operation and maintenance of high technology water treatment components • reporting of activities of work group in relation to the operation and maintenance of high technology water treatment components • third-party reports.
Guidance information for assessment	This unit may be assessed holistically with other units within a qualification.

Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<i>A recirculating aquaculture system (RAS)</i> is:	• a system in which at least some of the water is recycled one or more times back into the system after some form of treatment • also called a closed system (which is the opposite to a flow-through or open system where there is little residence time for the culture water) • where a water exchange (replacement) rate of 5-10% per day is used to assist in maintaining water quality (particularly nitrate control) • where generally some form of water treatment with equipment or structures, particularly aeration or oxygenation and processing of nitrogenous wastes, is undertaken.

RANGE STATEMENT	
<i>Relevant government regulations, licensing and other compliance requirements</i> may include:	• biodiversity and genetically modified organisms • biosecurity, translocation and quarantine • business or workplace operations, policies and practices • environmental hazard identification, risk assessment and control • food safety/Hazard Analysis Critical Control Point (HACCP), hygiene and temperature control along chain of custody, and Australian Quarantine Inspection Service (AQIS) Export Control (Fish) orders • health and welfare of aquatic animals • OHS hazard identification, risk assessment and control.
<i>OHS guidelines</i> may include:	• appropriate workplace provision of first aid kits and fire extinguishers • clean, uncluttered, hygienic workplace • codes of practice, regulations and/or guidance notes which may apply in a jurisdiction or industry sector • enterprise-specific OHS procedures, policies or standards • hazard and risk assessment of workplace, maintenance activities and control measures • induction or training of staff, contractors and visitors in relevant OHS procedures and/or requirements to allow them to carry out their duties in a safe manner • OHS training register • safe lifting, carrying and handling techniques, including manual handling, and the handling and storage of hazardous substances • safe systems and procedures for outdoor work, including protection from solar radiation, fall protection, confined space entry and the protection of people in the workplace • systems and procedures for the safe maintenance of property, machinery and equipment, including hydraulics and exposed moving parts • the appropriate use, maintenance and storage of PPE.
<i>Food safety and hygiene regulations and procedures</i> may	• Australian Shellfish Sanitation program • equipment design, use, cleaning and

RANGE STATEMENT

include:

maintenance

- exporting requirements and AQIS Export Control (Fish) orders
- HACCP, food safety program, and other risk minimisation and quality assurance systems
- location, construction and servicing of seafood premises
- people, product and place hygiene and sanitation requirements
- Primary Products Standard and the Australian Seafood Standard (voluntary)
- product labelling, tracing and recall
- receipt, storage and transportation of food, including seafood and aquatic products
- requirements set out in Australian and New Zealand Food Authority (ANZFA) Food Standards Code and state and territory food regulations
- temperature and contamination control along chain of custody.

RANGE STATEMENT	
<i>ESD principles</i> may include:	• applying animal welfare ethics and procedures • control of effluents, chemical residues, contaminants, wastes and pollution • control of weeds, pests, predators and diseases, stock health maintenance • improving energy efficiency • increasing use of renewable, recyclable and recoverable resources • minimising noise, dust, light or odour emissions • preventing live cultured or held organisms from escaping into environment • reducing emissions of greenhouse gases • reducing energy use • reducing use of non-renewable resources • undertaking environmental hazard identification, risk assessment and control • undertaking facility quarantine, biosecurity and translocation of livestock and genetic material • using and recycling water, and maintaining water quality.
<i>PPE</i> may include:	• hard hat or protective head covering • hearing protection (e.g. ear plugs and ear muffs) • non-slip and waterproof boots (gumboots) or other safety footwear • protective eyewear, glasses and face mask • protective hair, beard and boot covers • uniforms, overalls or protective clothing (e.g. mesh and waterproof aprons).
<i>High technology water treatment components</i> may include:	• aeration or oxygenation equipment, such as aerators, aspirators, airlifts and fans • components that regulate environmental and climate control factors, such as temperature, photoperiod and light intensity • degassing systems for removing carbon dioxide and ozone, including the use of specialised air filters • facilities and processes designed for health management such as quarantine area, sterilising using ultraviolet (UV) light and ozone, and pasteurising using heat or steam • mechanical/physical/solid, chemical and biological filtration devices (or a combination of

RANGE STATEMENT

two or more different types):

- biological filter:
 - is part of an RAS where dissolved metabolic by-products are converted to less toxic forms by microbial action from a range of different bacteria, fungi and other microorganisms
 - the most important function is the oxidation of ammonia to nitrite, and nitrite to nitrate (often called nitrification)
- chemical filter:
 - examples include activated carbon, zeolites and other ion-exchange mediums
 - is where a variety of chemical substances are used to treat water passing through them
 - ozone and chemical (e.g. pH and alkalinity) adjustments are also made, sometimes in a separate area to the chemical filter
- mechanical/physical/solid filter:
 - includes swirl separators, hydrocones, protein skimmers or foam fractionators, drum filters, belt filters, bead and other suspended media filters and screen filters
 - is important to ensure organic loads going into biofilters are as low as possible to prevent the more competitive heterotrophic bacteria from taking over and reducing nitrification capacity
 - is part of an RAS that removes solid organic matter and other wastes
 - reduces the biological oxygen demand (BOD) for the system
 - some degassing or carbon dioxide stripping can also take place
- water treatment devices, such as those that maintain pH (acid/alkaline) balance
- ventilation systems, fans, blowers and humidifiers/ dehumidifiers.

RANGE STATEMENT	
<i>Work plan or schedule</i> may include information on:	• contingencies for responding to partial or full system shutdown, stock stress or mortalities • contingency plan to address staffing and equipment supply problems • costs and budget details • date and time tasks are to be undertaken • designated jobs tasks, directions or designs • environmental impact control measures • expected time required to complete activities • hazard identification, risk assessment and risk control measures • local, state, territory and federal government regulations • location • maintenance schedule for particular items of equipment • manufacturer guidelines or instructions • materials, supplies, tools, equipment or other resources required • monitoring and reporting requirements and procedures, including logs or checklists • non-conformance or incident/fault reporting procedures • OHS procedures, including PPE requirements • order of activities • other members of work team and their roles, responsibilities and skills • person in charge • pre- and post-operational and safety checks • preferred supplier list and resources required by external workers and tradespeople • routine maintenance procedures • specific structures or components • standard for completed activities.
<i>Basic environmental parameters</i> may include:	• activity of pests, competitors, diseases and predators • light levels • turbidity • water flow • water level or depth.
<i>Advanced environmental</i>	• changes in stocking density, size classes and

RANGE STATEMENT

parameters may include:

grades

- chemicals and biological agents
- diseases or stressful conditions
- inappropriate system design
- inefficient feeding or poor quality feeds
- intense lighting or inappropriate light regimes
- loud or intermittent noises
- source, quality and/or genetics of seed stock
- toxic micro-algae
- wastes and contaminants.

RANGE STATEMENT	
<i>Water quality parameters</i> may include:	• alkalinity • BOD • chlorine or chloramines • dissolved carbon dioxide • dissolved oxygen • general water hardness • level of nitrogenous wastes (e.g. ammonia, nitrite and nitrate), and contaminants and pollutants • pH (acid/alkaline balance) • phosphates • redox potential • salinity or conductivity • temperature • total dissolved solids.
<i>Cultured or held stock</i> may include:	• adults, broodstock (ready to breed), seedstock or stockers, eggs and sperm, fertilised eggs, larvae, post-larvae, seed, spat, hatchlings, yearlings, juveniles, fry, fingerlings, yearlings, smolt, sporophytes, seedlings and tissue cultures • finfish, crustaceans, molluscs, aquatic reptiles, amphibians, polychaete and oligochaete worms, plankton, micro-algae, seaweed, aquatic plants, live rock, sponges and other aquatic invertebrates • for human consumption (seafood), stockers for other farms, stockers for conservation or recreational fishing, display or companion animals (ornamentals), and other products, including pearls, skins, shells, eggs, chemicals and pigments • wild caught, hatchery or nursery reared.
<i>Contingency plans</i> to address:	• adverse weather conditions and acts of nature, such as flood or fire • breakdown of components • bypass of components • compromised water source • disease outbreaks • emergency procedures • non-standard water quality parameters • risks to cultured or held stock during emergency shutdowns or breakdowns

RANGE STATEMENT	
	• risks to environment • risks to infrastructure and equipment • risks to product quality and food safety.

RANGE STATEMENT	
<i>Routine pre-operational checks and calibrations</i> may include:	• appropriate use of PPE • checking and confirming equipment calibration settings and operating methods for turbo-charged engines • checking for design problems or equipment modifications • checking for wear, corrosion and incorrect use • checking fuel, oils and lubricants, electrolyte levels, wheels, tyre pressure, fan belts, leads, lines, connections, air filters, brakes, clutch, gearbox, steering, lighting and transmission • identifying and segregating unsafe or faulty equipment for repair or replacement • inspecting safety guards, power take-off (PTO) stubs and shafts, and hitch and towing points • observing and monitoring noise levels for correct operation • preparing independently powered tools, which may include cleaning, priming, tightening, and basic repairs and adjustments • pre-start and safety checks, including the service and maintenance of cooling system.
<i>Other aquaculture equipment and infrastructure</i> may include:	• alarm and monitoring systems, including loss of pressure, burglar, loss of electricity and critical parameters • counters and microscopes, pipettes and syringes, measuring cylinders and dissecting kits • effluent and waste disposal, such as sewage, septic and compost pits • heating or cooling systems, such as heat exchange equipment, geothermal, gas, hydro, electric and solar (can also include insulated buildings and greenhouses) • husbandry equipment, such as graders, feeders, fish pumps, nets, fish bins and transporters • lighting, such as skylights, fluorescent, incandescent, metal halide and mercury vapour • pipes and reticulation systems, including siphons, both for supply and disposal • pumps: • centrifugal • magnetic drive

RANGE STATEMENT

- pressure
- submersible
- peristaltic or dosing
- airlift
- piston
- hydraulic ram or helical drive
- axial
- screw pump
- regenerative turbine
- venturi
- self-priming or non-priming
- sludge or surge
- powered by:
 - diesel or petrol
 - electricity (single or 3-phase)
 - cable
 - hydraulics
 - solar
 - wind
 - battery
 - pneumatic or air driven
- water quality test equipment, including pH, dissolved oxygen, temperature and salinity
- washing, disinfecting and sterilising equipment (e.g. autoclaves).

RANGE STATEMENT	
<i>Culture or holding structures or systems</i> may include:	• display tanks, aquaria and aquascapes (ornamental industry) • grow out facilities, hatcheries and nurseries • harvested stock holding structures, tanks, bins and cages • live holding systems • pest, predator and disease control structures • purging or depurating system • tanks, raceways and RAS • water supply and disposal systems for closed and semi-closed systems.
<i>Abnormal or non-standard conditions</i> may include:	• critical flow rates down due to obstructions or damage to lines or pipes • critical water quality parameters outside safe operating conditions • moving parts making unusual noises or movement being hampered • plant or equipment failure resulting in leaks or non-operation of system • power not on, water not flowing or aeration off • smoke, fumes or other emissions • sparks or obvious signs of electrical shorts • stock showing signs of stress, such as: • aggression or cannibalism • colour changes • gasping at surface • lesions or other signs of damage to skin • not feeding • no reproduction or courtship • piping, darting, flashing or whirling movement • schooling activity • swimming or moving erratically • water levels too high or low in culture system.
<i>Adjustments to operating components</i> may include:	• alkalinity addition • back-flushing or changing of filters • biofilter start-up and maintenance • changes in light and dark regimes • degassing • digital or analog control systems

RANGE STATEMENT

- foam fractionator or protein skimmer
- heating or cooling
- managing shock-loading
- manual or computer controlled
- UV or ozone systems
- water or air flow changes.

RANGE STATEMENT	
<i>Enterprise requirements</i> may include:	• enterprise policies and procedures, including those relevant to waste disposal, recycling and re-use guidelines • industry standards or codes of practice • MSDS • OHS procedures • operations or maintenance manuals • product labels, manufacturer specifications or guidelines • production schedules • standard operating procedures (SOPs) • supervisor oral or written instructions • work and routine maintenance plans • work notes.
<i>Worn or damaged parts or areas</i> may include:	• depth and flow gauges and electronic monitors • fittings (e.g. joints, valves and boards) • flow control devices (e.g. taps, valves, float valves, monks, dykes, weirs and gates) • mechanical components in treatment structures (e.g. sieves, filters and aerators) • mechanical, chemical and biological filters • pipes • pumps and mechanical components • sides or bottoms of earthen, concrete, fibreglass or plastic-lined supply and disposal systems or structures • wood or metal structures.
<i>Work area</i> may include:	• depots • hatchery, nursery, grow out and holding facilities • laboratories • post-harvest or processing facilities • staff amenities • stock and quarantine treatment facilities • storage areas • workshops.
<i>Operation, monitoring and maintenance data</i> may include:	• checklists, data sheets, inventory and stocktakes • dates, times and progress against timelines of activities or events • details related to culture or holding structures or systems

RANGE STATEMENT	
	- operation and maintenance details and other outcomes achieved - personnel and subcontractor performance data - problems experienced and strategies to overcome them.
Reports may include:	- electronic or hard copy - graphs and charts, including Gantt charts and tables - KPIs.

Unit Sector(s)

Unit sector	Aquaculture operations
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Co-requisite units

Co-requisite units		

Competency field

Competency field	
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