



Australian Government

Department of Education, Employment and Workplace Relations

SFIAQUA219B Operate and maintain high technology water treatment components

Release: 1

SFIAQUA219B Operate and maintain high technology water treatment components

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit of competency involves operating, monitoring and manipulating a range of high technology water treatment components to keep water quality and environmental conditions within specified ranges for cultured or held stock. Tasks are undertaken under the direct instructions of a supervisor. The unit also involves carrying out routine maintenance and minor repairs on these components, including non-scheduled (emergency) maintenance or repairs. It covers interpreting instructions for operating equipment appropriately, and recording and communicating results and observations to supervisors. The operation of other equipment and infrastructure, and feeding, health management, handling, harvesting and post-harvest activities, including chemical adjustments for pH (acid/alkaline balance) control, are covered in other aquaculture, seafood processing and seafood sales and distribution units of competency. 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	This unit has application to recirculating aquaculture systems (RAS) which have high technology water treatment components as are used in the seafood industry and within an aquascape or holding tank in the ornamental or pet sector. All enterprise or workplace procedures and activities are carried out according to 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. Equipment operation, maintenance, repairs and
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	calibrations are undertaken in a safe manner that conforms to manufacturer instructions. Appropriate <i>personal protective equipment (PPE)</i> is selected, checked, used and maintained.
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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. Prepare to operate high technology water treatment components	1.1. High technology water treatment components of a recirculating aquaculture system (RAS) and other aquaculture equipment and infrastructure are identified and confirmed against a work plan or schedule or other workplace instructions. 1.2. Designated tasks at the work site are prioritised and instructions are confirmed with supervisor. 1.3. Routine pre-operational checks and calibrations of components are carried out according to manufacturer specifications. 1.4. Faulty components are identified, safety tagged, if they cannot be fixed or replaced, and reported to supervisor. 1.5. Abnormal or non-standard conditions within the culture or holding structures or systems are reported following pre-operational checks. 1.6. Changes in environmental parameters or water quality parameters associated with the operation and maintenance of components are identified, assessed and reported to supervisor.
2. Operate and monitor high technology water treatment components	2.1. Automatic or mechanised equipment is operated and maintained. 2.2. Critical flow rates and other water quality parameters are measured and recorded for performance and efficiency. 2.3. Adjustments to operating components are undertaken under supervision to optimise conditions for the culture or holding species. 2.4. Backup components are checked and tested for operational capacity. 2.5. Abnormal or non-standard conditions and other risks are reported.
3. Maintain and repair high technology water treatment components	3.1. Work plan or schedule of required maintenance and repairs is confirmed with supervisor. 3.2. Potential risks to stock are identified and contingency plans confirmed with supervisor. 3.3. Basic tools and equipment and spare parts and repair materials are collected, assessed as serviceable, and taken to worksite. 3.4. Components are serviced under supervision according to manufacturer guidelines. 3.5. Worn or damaged parts or areas are replaced or repaired as instructed using repair techniques and

ELEMENT	PERFORMANCE CRITERIA
	spare parts and repair materials appropriate for the task. 3.6. Components and water supply and disposal systems are returned to working order. 3.7. System is checked for serviceability and performance, and problems are rectified or reported to supervisor.

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 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 monitoring and maintenance, and recommendations made for improvements. 4.4. Feedback on own work performance is sought from supervisor and opportunities to improve identified.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

- assisting with biofilter start-up, shock-loading and maintenance
- carrying out routine cleaning and hygiene maintenance programs
- cleaning premises to meet hygiene and product quality and food safety maintenance requirements
- collecting and recording appropriate data, such as growth, mortalities and food fed, and carrying out basic analysis of data on paper or electronically
- communicating with supervisor about the operation and maintenance of components, supplier and/or manufacturer instructions or advice
- communicating ideas on possible improvements
- maintain basic inventory list
- performing repair or maintenance using wood, plastics, PVC, fibreglass, glass, concrete, steel or aluminium
- providing oral reports to supervisor on effectiveness of monitoring and maintenance
- receiving, storing, using and stocktaking culture stock, feeds, chemicals, spare parts and other inputs and equipment
- undertaking basic plumbing and working with pipes and pumps (licences will be required for gas plumbing, town water supply plumbing, and electrical and welding work)
- using, storing and disposing of chemicals and biological agents.

REQUIRED SKILLS AND KNOWLEDGE**Literacy skills used for:**

- interpreting documentation relating to the environmental and biological requirements of the culture or holding species
- interpreting material safety data sheet (MSDS) labels
- interpreting operating manuals and manufacturer instructions
- recording operational information.

Numeracy skills used for:

- analysing basic data, including basic calculations, estimations and graphing
- estimating or calculating volumes and quantities of inputs and outputs of liquids, gases and solids.

Required knowledge

- basic relationship of inputs (stock, feed, energy, water and labour) to outputs (wastes, product and water quality)
- biological and environmental requirements of cultured or held stock
- complexity of system and interrelationship of components
- fouling and other conditions likely to impact on water flow
- how to interpret manufacturer recommendations and instructions
- normal and abnormal or non-standard stock behaviour, and the role of stress on the health and performance of stock
- OHS risks associated with water and electricity, closed spaces, high pressure pumps and moving parts of equipment, such as rotating drums
- OHS risks associated with working with compressed oxygen, carbon dioxide, ozone, ultraviolet (UV) lights, oils and greases, and chemicals, including chlorine, acids and alkaloids
- operation and maintenance of automatic or mechanised equipment
- operation of pumps, cleaning equipment, water quality monitoring and other basic equipment and tools
- reasons for wear and tear of components and the subsequent need for availability of spares and backups, and for routine repairs
- variations in biofiltration and other filtration processes over a 24 hour day and 7 day week
- water quality, optimal and critical limits for various parameters and non-standard conditions.

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

- carry out maintenance and repairs according to work plan or schedule
- carry out routine monitoring and checks of equipment, flow rates and water quality and report non-standard conditions to supervisor
- operate and monitor automated water treatment components
- report problems and potential risks to supervisor.

Assessment must confirm knowledge of:

- biological and environmental requirements of the culture or holding species
- OHS risks associated with operation and maintenance
- operation and maintenance 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:

- basic tools and equipment to complete repairs and maintenance
- other equipment as needed to operate the system and maintain water quality
- RAS with high technology waste treatment components
- spare parts and repair materials
- templates for recording data
- water monitoring equipment
- work plan or work instructions for the RAS operation

EVIDENCE GUIDE

and maintenance.

EVIDENCE GUIDE	
Method of assessment	The following assessment methods are suggested: • demonstration • data records • written or oral questions.
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>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>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

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- food safety/Hazard Analysis Critical Control Points (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.

RANGE STATEMENT***OHS guidelines*** 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 and 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.

Food safety and hygiene regulations and procedures may include:

- Australian Shellfish Sanitation program
- equipment design, use, cleaning and maintenance
- exporting requirements, including 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,

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	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.
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<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, and 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

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two or more different types):

- 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, such as pH and alkalinity, adjustments are also made, sometimes in a separate area to the chemical filter
- 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)
- 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
- ventilation systems, fans, blowers and humidifiers/ dehumidifiers
- water treatment devices, such as those that maintain pH (acid/alkaline) balance.

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<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 generally some form of water treatment with equipment or structures, particularly aeration or oxygenation and processing of nitrogenous wastes, is undertaken • where a water exchange (replacement) rate of 5-10% per day is used to assist in maintaining water quality (particularly nitrate control).
<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: • airlift • axial • centrifugal • hydraulic ram or helical drive • magnetic drive • mechanical • peristaltic or dosing • piston • pressure • powered by:

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- battery
- cable
- diesel or petrol
- electricity (single or 3-phase)
- hydraulics
- pneumatic or air driven
- solar
- wind
- regenerative turbine
- screw pump
- self-priming or non-priming
- sludge or surge
- submersible
- venturi
- washing, disinfecting and sterilising equipment, such as autoclaves
- water quality test equipment, including pH, dissolved oxygen, temperature and salinity.

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Work plan or schedule 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.
Worksite may include:	• depots • hatchery, nursery, grow out and holding facilities • laboratories • post-harvest or processing facilities • staff amenities • stock and quarantine treatment facilities

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	• storage areas • workshops.

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<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>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 • no reproduction or courtship • not feeding • piping, darting, flashing or whirling movement

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	• schooling activity • swimming or moving erratically • water levels too high or low in culture system.

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 systems • tanks, raceways and RAS • water supply and disposal systems for closed and semi-closed systems.
<i>Environmental parameters</i> may include:	• activity of pests, competitors and predators • light levels • turbidity • water flow • water level or depth.
<i>Water quality parameters</i> may include:	• alkalinity • chlorine or chloramines • dissolved carbon dioxide • dissolved oxygen • general water hardness • level of nitrogenous wastes, such as ammonia, nitrite and nitrate, and contaminants and pollutants • pH (acid/alkaline balance) • phosphates • salinity or conductivity • temperature • total dissolved solids.
<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 • foam fractionator or protein skimmer • heating or cooling • managing shock-loading • manual or computer controlled • UV or ozone systems

RANGE STATEMENT

- water or air flow changes.

RANGE STATEMENT	
<i>Other risks</i> may include those associated with:	• environment • food safety and product quality • infrastructure, plant and equipment • stock.
<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 culture stock during emergency shutdowns or breakdowns • risks to environment • risks to infrastructure and equipment • risks to product quality and food safety.
<i>Basic tools and equipment</i> may include:	• cleaning rags, solvents and chlorine • concreting tools, including wheelbarrow, cement mixer and trowel • electric or battery operated tools, including heat gun, drill, angle grinder, drill press, circular saw and drop saw • glue, primer, sandpaper and wire brush • hand tools, including screwdrivers, spanners or socket set, stilson, hacksaws, clamps, chisels and hammers • measuring tape, string-line, level and square • oil or grease gun • plugs or repair patches • safety equipment (e.g. goggles, mask or breathing equipment) • silicon or similar sealant • spade, shovel, pick and crowbar • thread or plumber's tape and Teflon paste • tools for working with fibreglass.
<i>Spare parts and repair materials</i> may include:	• earth, stones and fillings • fibreglass webbing, gels, flow coat and hardeners • fittings, such as joints, valves, mark boards, barrel unions and reducers

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	• glass panes, off-cuts and sealants • nylon strips, netting and wire rope • pipe lengths • pipe saddles or clamps • protection strips • PVC, polyethylene and other plastics • sand, gravel, cement, concrete, bricks and pavers • stainless steel and treated metals • wood.
<i>Worn or damaged parts or areas</i> may include:	• chemical and biological filters • depth gauges • electronic monitors • fittings, such as joints, valves and boards • flow control devices, such as taps, valves, float valves, monks, dykes, weirs and gates • mechanical components in treatment structures, such as sieves, filters and aerators • 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>Repair techniques</i> may include:	• applying plugs or patches • fibreglassing • laying and joining pipes (with or without glue or other fixatives) • metal welding • mixing, pouring and curing concrete • plastic welding • sealing or gluing glass • woodworking, screwing, nailing and gluing.
<i>Records or reports</i> may include:	• associated equipment and infrastructure • checklists, data sheets, inventory and stocktakes • culture or holding stock species • dates, times and progress against timelines of activities or events • details related to culture or holding structures or systems • electronic or hard copy

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	• Gantt chart • graphs, charts and tables • key performance indicators (KPIs) • operation and maintenance details and other outcomes achieved • personnel and subcontractor performance data • problems experienced and strategies to overcome them.
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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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