

## SET UP RECIRCULATING AQUACULTURE SYSTEM (RAS)

**UNIT CODE:** AQ/OS/AT/CR/07/6/B

### UNIT DESCRIPTION

This unit specifies the competencies required to set up recirculating aquaculture system. It involves conducting RAS food safety risk assessment, developing RAS food safety risk management plan, designing a small-scale Recirculating Aquaculture System (RAS), supervising construction of RAS facility, setting up bio-security measures, maintaining RAS facility, evaluating RAS set up, and exiting project site.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
<p>These describe the key outcomes which make up workplace function.</p>	<p>These are assessable statements which specify the required level of performance for each of the elements.</p> <p><i><b>Bold and italicized terms are elaborated in the Range</b></i></p>
<p>1. Conduct RAS Food safety risk assessment</p>	<p>1.1 Food safety <i><b>Hazards</b></i> in RAS are identified and documented.</p> <p>1.2 Possible <i><b>sources</b></i> of physical, chemical and microbial contamination in RAS are identified based on the hazards</p> <p>1.3 Level of risk in the RAS is assessed and established as per manual standard operating standards</p>
<p>2. Develop RAS food safety risk management plan</p>	<p>2.1 <i><b>Preventive measures</b></i> for RAS hazards are established as per identified source of contamination and manual standard operating standards</p> <p>2.2 <i><b>Corrective measures</b></i> for RAS hazards are established as per identified source of contamination and manual standard operating standards</p> <p>2.3 Standard operating procedures for correcting and preventing RAS risks are developed based on the identified risks.</p> <p>2.4 RAS food safety status is evaluated based on statutory requirements and standards</p> <p>2.5 Risk is communicated as per policies for internal and external communication</p> <p>2.6 Approval and certification of RAS is sought from relevant certification bodies based on <i><b>statutory requirements</b></i> and standards</p>
<p>3. Design a small-scale Recirculating Aquaculture</p>	<p>3.1 Proposed site is assessed to establish availability of basic <i><b>amenities</b></i> and infrastructure in relation to client expectations</p> <p>3.2 Size of facility is determined based on number of fish to be cultured and budget ceiling</p>

System (RAS)	<p>3.3 Components and supporting systems of the RAS system are determined based on available amenities and infrastructure</p> <p>3.4 Layout of specific <b>components of RAS</b> is determined in accordance with human movement and surrounding land gradient</p> <p>3.5 Mechanical and biological filter systems are designed based on water flow rates and fish stocking densities</p> <p>3.6 Waste disposal system is designed in accordance with environmental regulations and identified food safety risks</p> <p>3.7 Bills of Quantities are prepared according to system requirements and available budget</p>
4. Supervise construction of RAS facility	<p>4.1 <b>PPEs</b> are identified and gathered as per task requirements</p> <p>4.2 <b>Tools, equipment, food grade materials</b> and <b>supplies</b> are identified and gathered based on task requirements.</p> <p>4.3 <b>Skilled manpower</b> is identified and engaged based on the nature of works to be undertaken</p> <p>4.4 Site is secured and cleared of unwanted vegetation and debris</p> <p>4.5 RAS shed is constructed following design specifications</p> <p>4.6 Fixed components, <b>ancillary units</b> and <b>plumbing works</b> are set up based on facility designs</p> <p>4.7 <b>Portable components</b> are installed and pipe connections carried out following designed layout</p> <p>4.8 Waste disposal system is set up in compliance with environmental regulations</p> <p>4.9 <b>Basic civil works</b> are undertaken in accordance with design specifications</p> <p>4.10 Specific components of the RAS system are singly and collectively tested, to check for functionality</p> <p>4.11 Defects are rectified using standard procedures</p>
5. Set up bio-security measures	<p>5.1 Footbaths are installed at hatchery entrances and other strategic points</p> <p>5.2 Quarantine facilities are constructed at safe distance as outlined in the hatchery designs</p> <p>5.3 Filtration systems for the incoming water are installed</p> <p>5.4 Perimeter fence is constructed around the facility</p> <p>5.5 <b>Intruder control facilities and devices</b> are installed at strategic points</p> <p>5.6 Visitors, equipment and materials entering the facility are screened in accordance with farm biosecurity procedures.</p>
6. Maintain RAS facility	<p>6.1 <b>Maintenance tools, equipment and materials</b> are assembled as per the task requirements</p>

	<p>6.2 Water flow rate into tanks or ponds is regulated based on species cultured, stage of development and water quality</p> <p>6.3 RAS facility is cleaned and disinfected as per the standard sanitary operating procedures</p> <p>6.4 Water quality parameter ranges are maintained within optimum levels</p> <p>6.5 Maintenance and repairs of RAS components are carried out based on identified faults</p> <p>6.6 Wastes from the RAS system are disposed of according to environmental regulations and identified food safety risks</p>
7. Evaluate RAS set up	<p>7.1 Set up is evaluated based on food safety standards</p> <p>7.2 RAS set up is approved for compliance to statutory requirements by relevant authorities</p>
8. Exit project site	<p>8.3 Recyclable materials and supplies are stored based on manufacturer's instructions.</p> <p>8.4 Non-recyclable materials are disposed of in regard to environmental protection regulations.</p> <p>8.5 Tools and equipment are cleaned and stored as per workplace procedures.</p> <p>8.6 Project completion report is prepared and disseminated as per workplace procedures.</p> <p>8.7 Completed structures are handed over to the client</p>

## RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Hazards may include but not limited to:	<ul style="list-style-type: none"> <li>• Physical</li> <li>• Chemical <ul style="list-style-type: none"> <li>○ Accumulation of nitrogenous compounds</li> <li>○ Heavy metals</li> </ul> </li> <li>• Microbial <ul style="list-style-type: none"> <li>○ Sick fish</li> <li>○ Parasites</li> <li>○ Viruses</li> <li>○ Bacteria</li> </ul> </li> </ul>
2. Sources of hazards may include but not limited to:	<ul style="list-style-type: none"> <li>• Poor feeding</li> <li>• Poor feed quality</li> <li>• Poor water quality</li> <li>• Poor personnel hygiene and health</li> <li>• Cleaning agents</li> </ul>

<p>3. Preventive measures may include but not limited to:</p>	<ul style="list-style-type: none"> <li>• Flushing process</li> <li>• Cleaning of sedimentation units</li> <li>• Good water quality</li> <li>• Sanitary measures</li> <li>• Disease management</li> <li>• Parasite control</li> <li>• Use of quality feed</li> <li>• Good hygienic practices</li> <li>• Biosecurity measures</li> <li>• Probiotics</li> </ul>
<p>4. Corrective measures may include but not limited to:</p>	<ul style="list-style-type: none"> <li>• Disposal of contaminated fish</li> <li>• Fish disease treatment</li> <li>• Water flow management</li> <li>• Sterilization of RAS</li> <li>• Control feeding process</li> </ul>
<p>5. Statutory requirements may include but not limited to:</p>	<ul style="list-style-type: none"> <li>• Compliance to standards and regulations</li> <li>• Kenya Fisheries Service</li> <li>• County Government</li> <li>• The Fisheries Management and Development Act No.35 of 2016.</li> <li>• The Codex Alimentarius Food Hygiene Basic Texts;</li> <li>• The Food Drugs and Chemical Substances Act Cap. 254 of the Laws of the Kenya;</li> <li>• The Pest Control Products Act, Cap. 346 of the Laws of Kenya;</li> <li>• The Public Health Act, Cap. 242 of the Laws of Kenya;</li> <li>• The Environmental Management and Co-ordination Act, 1999.</li> </ul>
<p>6. Amenities may include but not limited to:</p>	<ul style="list-style-type: none"> <li>• Power supply</li> <li>• Piped water</li> <li>• Road network</li> <li>• Internet connectivity</li> </ul>
<p>7. Components of RAS may include but not limited to</p>	<ul style="list-style-type: none"> <li>• Fish growing tanks, Filtration system, Water circulation pump, Water heating system, Quarantine tanks, aeration and accessories, Water storage tanks, intake structure, fish culture tanks, lighting systems, aeration system, filtration system, drainage, water flow control structures, biosecurity installations</li> </ul>

8. PPE's may include but not limited to	<ul style="list-style-type: none"> <li>• Gum boots, helmets, goggles, gloves, overalls, first aid kits</li> </ul>
9. Tools, equipment, materials and supplies may include but not limited to:	<ul style="list-style-type: none"> <li>• Tools-tape measure, spirit level, jembes, spades, pangas, plumbing tools, masonry</li> <li>• Equipment-plate compactors and rollers, wheelbarrows, aeration equipment, filtration</li> <li>• Materials and supplies-ropes, liners, pegs, plumbing materials, lime, cement, sand, roofing materials, fencing wire, fittings, assorted screens,</li> </ul>
10. Skilled manpower may include but not limited to	<ul style="list-style-type: none"> <li>• Masons</li> <li>• Plumbers</li> <li>• Electricians</li> <li>• Painter</li> <li>• Carpenter</li> <li>• Welders and fabricators</li> </ul>
11. Ancillary units may include but not limited to	<ul style="list-style-type: none"> <li>• Back-up power supply,</li> <li>• Fish feed Stores</li> <li>• Office</li> <li>• Water storage tanks</li> <li>• Filtration facilities</li> <li>• Pump house</li> <li>• Generator room</li> <li>• Staff houses</li> <li>• Equipment stores</li> </ul>
12. Portable components may include but not limited to	<ul style="list-style-type: none"> <li>• Plastic tanks</li> <li>• Aeration equipment</li> <li>• Filters</li> <li>• Water pumps</li> <li>• Water heaters</li> </ul>
13. Basic civil works may include but limited to	<ul style="list-style-type: none"> <li>• Landscaping</li> <li>• Walkways</li> <li>• Gate installation</li> <li>• Parking area</li> <li>• Perimeter fencing</li> <li>• Access roads</li> </ul>

## REQUIRED SKILLS AND KNOWLEDGE

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

### Required Skills

The individual needs to demonstrate the following skills:

- Food safety risk assessment
- communication
- Training
- Use of tools and equipment
- Measurement
- Drawing and sketching
- Communication
- Basic first aid
- Interpretation of simple hatchery design
- Masonry
- Basic plumbing
- Budgeting
- Plumbing

### Required Knowledge

The individual needs to demonstrate knowledge of:

- Food safety Standards
- Hazard Analysis Critical Control Points (HACCP)
- Regulatory bodies/ Competent authorities
- Food Safety Hazards in Aquaculture
- Good aquaculture practices
- Good hygiene practices
- Safety precautions
- Principles of food hygiene
- National legislations and regulations
- National legislations and regulations
- Types of tools, equipment and PPEs
- Budgeting
- Microbiology
- Basic chemistry
- Water quality
- Water filtration mechanisms
- Disease causing pathogens
- RAS design, layout and construction

### EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Developed RAS food safety risk management plan</p> <p>1.2 Identified a suitable location for the RAS facility</p>
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	<ul style="list-style-type: none"> <li>1.3 Determined the required components and supporting systems of the RAS system</li> <li>1.4 Designed a functional layout of the RAS facility</li> <li>1.5 Designed a workable filtration and waste disposal system</li> <li>1.6 Prepared Bills of Quantities and worked out RAS cost estimates</li> <li>1.7 Supervised construction of RAS facility and installation of functional parts</li> <li>1.8 Set up an environmentally friendly waste disposal system</li> <li>1.9 Installed biosecurity structures</li> <li>1.10 Tested RAS system components singly and collectively for defects and rectified accordingly.</li> <li>1.11 Cleaned and disinfected RAS facility as per the standard sanitary operating procedures</li> <li>1.12 Disposed of wastes from the RAS system according to NEMA regulations</li> <li>1.13 Screened visitors, equipment and materials entering the RAS facility.</li> </ul>
2. Resource Implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> <li>2.1 Workplace or assessment location</li> <li>2.2 PPEs</li> <li>2.3 Tools, equipment and materials</li> <li>2.4 Pond construction materials</li> <li>2.5 Building materials</li> <li>2.6 Writing materials</li> </ul>
3. Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Observation</li> <li>3.2 Oral questioning</li> <li>3.3 Projects</li> <li>3.4 Written tests</li> <li>3.5 Portfolio of Evidence</li> <li>3.6 Interview</li> <li>3.7 Third party report</li> </ul>
4. Context of Assessment	<p>Competency may be assessed:</p> <ul style="list-style-type: none"> <li>4. 1 On-the-job</li> <li>4. 2 Off-the –job</li> <li>4. 3 During Industrial attachment</li> </ul>

5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.
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