



Australian Government

Department of Education, Employment and Workplace Relations

NWP707A Analyse and review water treatment plant technology

Revision Number: 2

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Modification History

NWP707A Release 2: Layout adjusted. No changes to content.

NWP707A Release 1: Primary release.

Unit Descriptor

This unit of competency describes the outcomes required to understand water quality and sustainability technology, and provide high-level advice on meeting legislative and regulatory requirements. A detailed understanding is required of the planning, design, testing and operation of advanced processes, incorporating new or novel technologies, together with the ability to identify problems and suggest viable cost-effective solutions within the constraints of legislation and regulations.

Application of the Unit

This unit supports the attainment of skills and knowledge required for senior managers, water treatment and resource planners and related senior staff.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit of competency contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where ***bold italicised*** text is used, further information is detailed in the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Analyse fundamentals of water science	1.1 Analyse natural and engineered water cycles to establish their <i>components</i>, <i>features</i> and <i>variables</i>. 1.2 Carry out <i>water testing</i> according to procedures in order to determine water and wastewater parameters, including nitrogen, phosphorus and microbiological indicators. 1.3 Identify <i>substances commonly found in natural water sources</i> and analyse their <i>interactions</i>. 1.4 Identify <i>substances commonly found in range of wastewater sources</i> and analyse their <i>environmental</i> and <i>epidemiological effects</i>. 1.5 Identify <i>microbial species</i> found in water and wastewater and determine their activities and effects as <i>agents of disease</i> or <i>agents for removing organic matter</i>.
2 Determine design features of water treatment plants	2.1 Determine purpose of <i>water treatment</i> and quality standards required in providing water for human consumption, industry, agriculture and aquaculture. 2.2 Analyse fundamentals of <i>separation processes</i> to determine their role in water treatment. 2.3 Research microbial metabolism systems and determine their role in removing organic and inorganic constituents of water. 2.4 Analyse <i>input and output parameters</i> of water and wastewater treatment systems. 2.5 Determine <i>fundamental features</i> of water and wastewater <i>reticulation systems</i> to establish their role and function in water treatment.
3 Analyse application of government legislation and policies to water industry	3.1 Research <i>legislation and regulations</i> for Australian water industry to identify evolutionary framework and <i>forces of change</i>. 3.2 Identify key principles and provisions of water-related legislation and regulations and analyse them for their impact on current practice. 3.3 Analyse the Environment Protection Agency conditions for water and wastewater treatment plant licences, and Australian drinking water quality parameters to identify operational standards required. 3.4 Identify changes required to meet legislative and regulatory requirements and communicate to relevant stakeholders.
4 Prepare strategic advice	4.1 Synthesise and evaluate design, operation and management of water treatment plants and processes. 4.2 Consult relevant personnel to inform the framing of policy

ELEMENT**PERFORMANCE CRITERIA**

advice for the water organisation.

4.3 Prepare and present strategic advice on current and potential policies and procedures and the design, operation and management of water treatment plants and processes.

Required Skills and Knowledge

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- perform complex research
- analyse technical information
- use technology, including the internet, to access current legislative and regulatory requirements for water industry
- identify potential or actual operational problems
- undertake evidence-based short, medium and long-range planning
- communicate with employees, senior management, external industry experts and other stakeholders
- prepare complex reports
- use communication systems
- give and receive instructions.

Required knowledge:

- fundamental aspects of physics, chemistry, biology and microbiology relevant to water and wastewater treatment and requisite laboratory skills
- water sources and resources relevant to water and wastewater treatment
- substances in natural water sources and their interactions
- environmental and epidemiological effects of substances found in wastewater sources
- microbial species and effects
- purposes of water treatment
- fundamentals of separation processes and disinfection
- microbial metabolism
- input and output parameters of treatment systems
- reticulation systems and hydraulic modelling
- legislative and regulatory framework for water industry
- Environment Protection Authority requirements for treatment plant licenses and drinking water
- OHS legislation, risk management and procedures
- relevant water treatment policies and procedures
- communication systems
- relevant Australian standards, international guidelines and best practice systems applicable to water treatment plants and plant technologies.

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

The candidate should demonstrate the ability to understand water quality and sustainability technology, and provide high-level advice on meeting legislative and regulator requirements including:

- analysing and applying principles of water science
- analysing and applying principles associated with design of water treatment plants and processes
- reviewing and refining current practices associated with water treatment plant technologies
- preparing clear and accurate reports
- contributing to development of water treatment planning within organisation.

Context of and specific resources for assessment

Access to the workplace and resources including:

- documentation that should normally be available in a water industry organisation
- relevant codes, standards and government regulations.

Where applicable, physical resources should include equipment modified for people with disabilities.

Access must be provided to appropriate learning and assessment support when required.

Assessment processes and techniques must be culturally appropriate, and appropriate to the language and literacy capacity of the candidate and the work being performed.

Validity and sufficiency of evidence requires that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice
- a decision of competence should only be made when the assessor has complete confidence in the person's competence over time and in various contexts
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence

- where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
- assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.

Questioning will be undertaken in a manner appropriate to the skill levels of the operator and cultural issues that may affect responses to the questions, and will reflect the requirements of the competency and the work being performed.

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. Add any 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.

- Components*** may include:
- natural water cycles, including:
 - rivers and lakes
 - artesian and aquifers
 - brackish and salt water
 - stormwater
 - engineered water cycles, including:
 - reticulation systems
 - dams
 - collection systems
 - bores and wells

- Features*** may include:
- natural water cycles:
 - rainfall patterns
 - size and protection
 - retention time in catchment
 - evaporation rate
 - types of source:
 - bore
 - river
 - dam
 - engineered water cycles
 - type of user:
 - domestic
 - industrial
 - aquaculture
 - agriculture
 - type of water or wastewater treatment system:
 - urban
 - non-urban
 - length and volume of collection and reticulation system

- Variables*** may include:
- natural water cycles, including:
 - rainfall

- temperature
- pH, hardness and alkalinity
- taste, odour, colour and turbidity
- nature and quantity of total dissolved and suspended matter
- dissolved oxygen
- engineered water cycles, including:
 - flow rates
 - industrial and agricultural uses and inputs
 - input and output parameters
 - availability and uses of recycling

Water testing may include:

- pH, chlorine, suspended solids and dissolved oxygen
- alkalinity and volatile acids
- mixed liquor suspended solids
- mixed liquor volatile suspended solids
- colour, turbidity and conductivity
- biological oxygen demand (BOD) and chemical oxygen demand (COD), total organic carbon (TOC), phosphorus (P), nitrogen (N), other ions and organic compounds
- identification and enumeration of bacteria, cyanobacteria and protozoa.

Substances commonly found in natural water sources may include:

- metal ions
- salts
- N and P
- microorganisms and algae
- organic and inorganic compounds producing colour, turbidity, odour or taste
- radiation emitters.

Interactions may include:

- oxidation of metal ions
- settling of suspended matter
- ultraviolet destruction of microorganisms
- growth of nuisance organisms, such as cyanobacteria

Substances commonly found in range of wastewater sources may include:

- toxins
- metals
- domestic or industrial organic matter
- other dissolved and suspended solids
- toxic, flammable and asphyxiating gases
- disinfection by-products

Range of wastewater sources may include:

- domestic
- industry
- aquaculture

- agriculture
 - stormwater
 - serious:
 - material environmental harm to air, water or land
 - nuisance environmental harm
- Environmental effects*** may include:
- faecal-oral route of infection
 - infection and transmission of infectious agents
 - effects of biological, chemical or physical toxins on animals and plants
- Epidemiological effects*** may include:
- E. Coli
 - salmonella
 - campylobacter
 - Shigella
 - Yersinia
 - protozoa
 - adenovirus
 - enterovirus
 - hepatitis virus
- Microbial species*** may include:
- bacteria
 - viruses
 - protozoa
 - microbial toxins
 - chemical toxins
- Agents of disease*** may include:
- aerobic bacteria
 - facultative bacteria
 - anaerobic bacteria
- Agents for removing organic matter*** may include:
- coagulation
 - flocculation
 - sedimentation
 - filtration
 - disinfection
 - natural systems
 - designed wetlands
 - lagoons
 - Imhoff tanks
 - small septic tanks
 - bio-filters
 - contactors
 - activated sludge processes
 - special treatment processes
- Water treatment*** may include:
- filtration
- Separation processes*** may

include:

- presses
- centrifuges
- sedimentation
- gravity settling
- flocculation
- chemically assisted processes

Input and output

parameters may include:

- Biological Oxygen Demand and Chemical Oxygen Demand
- suspended solids
- biomass as mixed liquor suspended solids (MLSS) or mixed liquor volatile suspended solids (MLVSS)
- pH
- dissolved oxygen (DO)
- N, P and other chemical species
- toxins
- chlorine
- faecal coliforms, such as E. Coli
- colour
- turbidity

Fundamental features may include:

- pipe networks
- gravity and pressure systems
- pumps and pump wells
- reservoirs
- residual disinfection
- oxygenation
- hydraulic modelling
- leak detection
- leak prevention

Reticulation systems may include:

- sewage collection systems
- water distribution systems

Legislation and regulations relevant to the State or Territory may include:

- Environmental Protection and Biodiversity Conservation Act 1999
- relevant state and territory environmental protection legislation
- relevant water legislation and regulations
- Australian Drinking Water Guidelines
- Water recycling guidelines
- Water quality guidelines
- National Water Quality Management Strategy

Forces of change may include:

- community expectations
- availability of technology
- climatic change

- diminishing fresh water sources

Unit Sector(s)

Not applicable.

Competency field

Leadership.