Australian Government

Department of Education, Employment and Workplace Relations

NWP411A Select treatment requirements for waterborne microorganisms

Revision Number: 2

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Modification History

NWP411A Release 2: Layout adjusted. No changes to content.
NWP411A Release 1: Primary release.

Unit Descriptor

This unit of competency describes the outcomes required to identify microorganisms and assess the appropriate potable water or water reuse treatment processes for inactivation or removal.

Application of the Unit

This unit covers generic competency for water treatment operators responsible for water quality in a range of technical and process applications in water and wastewater treatment.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

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 range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Investigate waterborne microorganisms.	1.1 Identify the samples of ***waterborne microorganisms*** found in water sources. 1.2 Identify the ***general characteristics*** of different types of microorganisms. 1.3 Identify ***water quality or treatment problems*** caused by microorganisms. 1.4 Identify ***microorganisms causing problems*** specific to water treatment processes. 1.5 Identify the ***characteristics of***, ***and diseases caused by***, ***pathogenic microorganisms***.
2 Identify processes to remove microorganisms.	2.1 Assess the effectiveness of a range of ***filtration processes*** for physically removing pathogenic microorganisms according to ***organisational and legislative requirements***. 2.2 Assess the effectiveness of a range of disinfection processes for inactivating pathogenic microorganisms according to organisational and legislative requirements. 2.3 Identify and assess the implications of by-product formation resulting from disinfection processes. 2.4 Assess the effectiveness of various pre- or post-treatment processes for removing microorganisms, or their metabolites, causing nuisance and toxicity problem.
3 Determine appropriate water treatment processes.	3.1 Identify optimum treatment processes for the range of microorganisms found in water sources. 3.2 Report on effective treatment processes and associated sampling and testing requirements required to maintain water quality.

Required Skills and Knowledge

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

Required skills:

- interpret a range of complex and technical documents, including relevant:
  - regulatory, legislative, licensing and organisational requirements
  - codes and standards
  - specifications
  - organisational policies
- communicate effectively with a range of relevant parties using clear and direct communication to identify and confirm requirements
- articulate complex ideas clearly
- produce reports on treatment requirements for management
- analyse and evaluate reports and reference materials
- work collaboratively with relevant stakeholders
- analyse problems and apply appropriate remedial solutions
- perform various calculations to provide data for the analysis and development of options and solutions
- identify hazards and develop appropriate responses to control and mitigate risks in accordance with regulations and legislation
- identify opportunities for improved water management
- participate in the provision of appropriate information to inform workplace processes
- understand capabilities and limitations of plant, equipment and tools
- manage work priorities
- use information effectively to improve work performance

Required knowledge:

- organisational and legislative requirements relevant to water quality and treatment
- types, lifecycle, characteristics of waterborne microorganisms
- nuisance problems caused by waterborne microorganisms
- toxicity and pathogenic problems caused by waterborne microorganisms
- relevant legislation, standards and workplace policies and procedures related directly to the control and treatment of waterborne microorganisms
- principles of water or reuse treatment processes
- Ct concept
- log reduction
- properties and modes of action of disinfectants

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.

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

The candidate should demonstrate the ability to identify microorganisms and assess the appropriate potable water or water reuse treatment processes for inactivation or removal including:

- identifying a range of waterborne microorganisms,
- analysing their general characteristics and the types of problems caused
- identifying pathogenic microorganisms and the diseases caused
- assessing and selecting water or reuse treatment processes for physically removing or inactivating pathogenic microorganisms, including disinfection by-product issues
- assessing and selecting pre- or post-treatment processes for removing the causes of nuisance and toxicity problems
- preparing reports on the optimum treatment for a range of microorganisms including measures to ensure validity

Context of and specific resources for assessment

Access to the workplace and resources, including:

- documentation that should normally be available in a water treatment 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 only taken at the point 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

In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. 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. 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.

Waterborne microorganisms may include:

- viruses
- bacteria
- protozoa
- algae
- cyanobacteria
- helminths

General characteristics of microorganisms may include:

- evolutionary development
- source
- structure
- life cycle
- growth rates and requirements

Water quality or treatment problems may include:

- nuisance problems
- taste and odour
- filter clogging
- colour
- corrosion
- toxicity problems
- pathogenic problems

Microorganisms causing problems may include:

- diatoms
- sulphur bacteria
- cyanobacteria including:
  - Microcystis aeruginosa
  - Anabaena circinalis
- Pathogenic microorganisms including:
  - viruses:
    - Enterovirus,
    - Hepatitis A,
    - Hepatitis E,
    - Rotavirus
  - bacteria:
    - Campyllobacter
    - Salmonella
    - Escherichia coli

	• protozoa species:
	  • Giardia
	  • Cryptosporidium
	  • Nagleria
	• Helminths such as Ascaris lumbricoides

Characteristics of pathogenic microorganisms may include:	• pathogenicity • virulence • resistance to disinfectants (Ct, log reduction) • opportunistic infection capability
Diseases caused by pathogenic microorganisms may include:	• typhoid • cholera • ascariasis • hepatitis • giardiasis • cryptosporidiosis • gastroenteritis • tuberculosis
Filtration processes may include:	• slow sand filter • granular media filters • membrane filters
Organisational and legislative requirements may include:	• federal, state and local environmental and water quality legislation and guidelines • organisational policies • standard operating procedures • communication and reporting protocols • quality assurance
Disinfection processes may include:	• chlorination • chloramination • UV • chlorine dioxide • ozone
Pre- or post-treatment processes may include:	• micro-straining • algicides • activated carbon • ozone-biologically activated carbon (BAC)

Unit Sector(s)

Not applicable.

Competency field

Treatment.