



Australian Government

Department of Education, Employment and Workplace Relations

MSS024010A Perform environmental biological techniques

Release: 1

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Modification History

Not applicable.

Unit Descriptor

This unit of competency covers the ability to collect and examine biological samples using microscopes, keys and biochemical tests to identify and enumerate environmentally significant organisms. Personnel are expected to prepare aseptic media and solutions, set up equipment for microbiological testing and identify basic microorganisms of environmental significance.

Application of the Unit

This unit of competency is applicable to environmental technicians working in a range of industry sectors, such as:

- environmental services (e.g. sampling and monitoring of air quality, water and soil)
- clean water (e.g. catchments, supply and environmental flows)
- water treatment, storm and wastewater management
- natural resource management.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

Not applicable.

Elements and Performance Criteria Pre-Content

Not applicable.

Elements and Performance Criteria

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| 1 | Obtain biological samples | 1.1 | Locate and review background information for site/project |
| | | 1.2 | Review work request to identify required samples and the procedures, materials and equipment involved |
| | | 1.3 | Identify hazards and enterprise control measures associated with collecting the sample, preparation methods, reagents and/or equipment |
| | | 1.4 | Assemble required materials, reagents and equipment and check that they are fit for purpose |
| | | 1.5 | Collect samples in accordance with relevant legislative requirements, codes of practice and enterprise procedures |
| | | 1.6 | Log samples using enterprise procedures |
| | | 1.7 | Record sample description, compare with specification and note and report discrepancies |
| | | 1.8 | Ensure traceability from receipt of sample to reporting of results |
| 2 | Perform basic biological techniques associated with the examination of microorganisms | 2.1 | Use aseptic techniques to prepare media for microbiological analysis |
| | | 2.2 | Obtain samples aseptically for microbiological analysis |
| | | 2.3 | Identify possible contamination pathways for both samples and media |
| | | 2.4 | Perform simple chemical tests to identify morphology of environmentally significant bacteria |
| | | 2.5 | Use aseptic techniques to manipulate samples and bacterial cultures |
| | | 2.6 | Use standard techniques to grow cultures of environmentally significant microorganisms |
| | | 2.7 | Use disinfection and sterilisation to control the |

growth of microorganisms

3	Prepare microscope for use	3.1	Select appropriate microscope and attachments for examination and measurements
		3.2	Check that all microscope components are clean and fit for purpose
		3.3	Mount sample in accordance with specified method
		3.4	Adjust settings and alignment of optical and mechanical components to optimise performance
4	Perform microscopic examination in accordance with test methods	4.1	Identify microorganisms, cell structures and components of animal/plant tissues in environmental samples
		4.2	Measure organisms and structures
		4.3	Enumerate microorganisms in environmental samples
5	Classify organisms	5.1	Classify organisms into hierarchical structures using appropriate keys
		5.2	Record all observations and measurements used to determine classifications
6	Relate cell structures and their functions to environmental adaptation	6.1	Identify cell structures from examination of biological specimens
		6.2	Associate biological functions with cell structures
		6.3	Associate cell physiology and enzyme cycles to environmental adaptation
		6.4	Identify important biochemical pathways associated with environmentally significant organisms

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| 7 | Maintain a safe work environment | 7.1 | Ensure safety and minimise cross-contamination through the use of personal protective clothing and safety equipment |
| | | 7.2 | Handle all samples and equipment in accordance with enterprise safety procedures |
| | | 7.3 | Clean up spills using appropriate techniques to protect personnel, work area and environment |
| | | 7.4 | Minimise generation of waste and environmental impacts |
| | | 7.5 | Collect and dispose of all wastes safely |
| | | 7.6 | Report hazards and incidents to designated personnel using enterprise procedures |
| 8 | Maintain enterprise records | 8.1 | Record approved data into enterprise system |
| | | 8.2 | Maintain confidentiality and security of enterprise information and data |

Required Skills and Knowledge

Required skills

Required skills include:

- interpreting instructions, manuals and applying enterprise procedures
- logging and tracking samples from collecting or receiving a sample through to completion of a procedure and reporting
- performing tasks associated with the culture and isolation of microorganisms
- setting up, cleaning and using a light microscope to achieve optimum resolution of the specimen
- identifying artefacts or image aberrations attributable to misalignment or obstruction of light paths or condensers used in bright field, dark ground, and phase contrast microscopy, or with other steps in microscopic examinations
- performing basic microscopic examination of materials to enumerate and identify microorganisms, and identify important components of plant and animal tissues
- interpreting and recording test results, including simple calculations/estimations
- using personal protective clothing and other safety equipment correctly
- preventing contaminating of oneself, other people, the work area, equipment or the samples under test
- sterilising materials, disinfecting spillage, and safely disposing of all contaminated waste
- decontaminating the work area upon completion of work
- storing/disposing of samples and cleaning/storing equipment
- seeking advice when issues/problems are beyond scope of competence/responsibility
- working safely for the protection of self and others

Required knowledge

Required knowledge includes:

- principles and terminology used in elementary microbiological testing, organism classification, microscopic examination and cell structure
- hazards, risks and controls associated with handling microorganisms
- common sampling techniques for air, water, soil in a range of terrestrial and aquatic habitats
- the relationship between sterile practices, hygiene procedures and the ability to obtain growth of microorganisms free of contamination
- importance of pure culture techniques and aseptic transfer to successful microbiological investigation and correct interpretation of results
- growth requirements of microorganism cultures (e.g. bacteria, fungi and yeasts)
- principles of infection control related to occupational health and safety (OHS), sampling and transfer of materials in microbiological investigations

- disinfection and sterilisation procedures used in the collection, processing and safe disposal of samples and materials
- cleaning and sanitising requirements of equipment and work area and effects of physical and chemical agents on microbial growth and death
- parts and functions of common microscopes, set-up procedures and common causes/solutions for sub-optimal performance (e.g. fringing)
- basic structure and function of cells and organelles
- basic classes and classification of organisms
- cell physiology and processes, such as simple and facilitated diffusion, plasmolysis, osmosis, tonicity, active transport, energy production, mitosis, motility, phagocytosis and pinocytosis
- purposes and mechanisms of staining (e.g. Gram +ve and -ve)
- enterprise and/or legal traceability requirements
- relevant safety procedures

Evidence Guide

Overview of assessment	Competency must be demonstrated in the ability to perform consistently at the required standard.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include: • collecting and handling biological samples • using aseptic techniques to obtain/manipulate samples and prepare media • using standard techniques to grow cultures of environmentally significant microorganisms • setting up and optimising the performance of light microscopes • conducting tests and microscopic examination of samples to identify and enumerate environmentally significant (micro)organisms and important components of plant/animal tissues • demonstrating safe sterilisation, disinfection, cleaning and waste disposal techniques • preparing documentation that is concise, accurate and meets enterprise requirements • working safely.

Context of and specific resources for assessment	This unit of competency is to be assessed in the workplace or a simulated workplace environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace. This unit of competency may be assessed with: • <i>MSL952001A Collect routine site samples</i> • <i>MSS024006A Perform sampling and testing of water</i> • environmental monitoring units, such as: • <i>MSS024009A Assist with assessing and monitoring stormwater systems</i> • <i>MSS025013A Assist with assessing and monitoring wetlands.</i> The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. Resources may include: • relevant sampling equipment and materials • standard microbiology laboratory with relevant equipment, materials and reagents • enterprise procedures, test methods and equipment manuals. Under duty of care requirements, off-the-job training providers will only use biological samples and organisms of a risk category that is compatible with their laboratory as defined in <i>AS/NZS 2243.3:2010 Safety in laboratories - Microbiological aspects and containment facilities</i>.
Method of assessment	The following assessment methods are suggested: • inspection of samples and review of data, results and records prepared by the candidate • feedback from peers and supervisors that the candidate consistently follows enterprise procedures and works safely • oral/written questioning associated with sampling, safe handling, culturing, testing and examination of microorganisms, and their identification • observation of the candidate handling samples/cultures, optimising a light microscope for identified samples, classifying organisms or performing basic environmental microbiological testing. In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those

	aspects of competency which are difficult to assess directly. Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work-like environment.
Guidance information for assessment	

Range Statement

Codes of practice	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used
Legislation, standards, codes, procedures and/or enterprise requirements	Legislation, standards, codes, procedures and/or enterprise requirements may include: • federal legislation, such as • Environment Protection and Biodiversity Conservation Act 1999 • state/territory government legislation and regulations and local government by-laws, policies, and plans dealing with issues, such as: • environmental protection • nature conservation, wildlife/plant protection, prevention of cruelty to animals and quarantine • codes of practice dealing with the care and use of animals for scientific purposes • Australian and international standards, such as: • AS/NZS 2243.3:2002 Safety in laboratories - Microbiological aspects and containment facilities • AS/NZS 4276 series Water microbiology • Australian and New Zealand Guidelines for fresh and marine water quality • American Public Health Association (APHA) Standard methods for examination of water and wastewater • cleaning, hygiene, personal hygiene requirements

	• enterprise procedures, standard operating procedures and operating manuals • incident and accident/injury reports • instructions to comply with new legislation, standards, guidelines and codes • quality system and continued improvement processes • safety requirements for equipment, materials or products and material safety data sheets (MSDS) • sampling procedures (labelling, preparation, storage, transport and disposal) • test procedures (validated and authorised) • waste minimisation, containment, processing and disposal procedures
Equipment, materials and systems	Equipment, materials and systems may include: • sampling equipment for different sample types and species, such as: • air samplers (e.g. for <i>Legionella</i>) • nets (e.g. for plankton) • sediment samplers • soli samplers (e.g. Niskin and Nansen) • protective and physical containment facilities and equipment for safe handling of microorganisms, including personal protective equipment, such as gloves, gowns, masks and safety glasses, and gloves for working with extremes of heat and cold • carbon dioxide cabinets and incubators • transfer equipment, such as inoculating loops, pipettes (quantitative and qualitative), flasks, tubes and spatulas • liquid nitrogen containers for cell storage • filtration membranes • microscopes with bright field and other relevant illumination systems and stereomicroscopes • counting chambers for micro-enumeration • colony counting devices • Bunsen burners and bench incinerators • incubators and water baths • anaerobic jars, fermentation chambers, continuous culture systems and other devices for controlling growth environments of microorganisms • laboratory information management systems (LIMS), reference databases, record and filing systems • stains, media, reagents and biological materials

	necessary for laboratory testing • laboratory glassware and measuring equipment • disinfecting and sterilising solutions and equipment, such as ultraviolet (UV) lamps • materials suitable for the safe containment, collection, processing and disposal of biological and non-biological wastes • autoclaves
Samples	Samples may include: • air • surface water, wastewater and stormwater • soils and sediments • plants and animals
Aseptic techniques	Aseptic techniques may include: • preparation of basic and enriched media • sterilisation of media • aseptic transfer of microorganisms (e.g. bacteria, fungi and yeasts) to culture media • production and identification of pure cultures on solid media • production of contaminant-free cultures in liquid media
Microscopes and microscopy techniques	Microscopes and microscopy techniques may include: • bright field microscopy • dark field microscopy techniques • Kohler illumination and its importance in producing uniform and glare-free images • phase contrast microscopy • polarised light microscopy • stereo microscopy techniques • image analysers and camera eyepieces • stage micrometers and microscopic measurement • counting chambers
Organism classification	Organism classification may include: • kingdoms • hierarchical system of species classification • dichotomous keys
Cell structure and function	Cell structure and function may include: • cell theory • eukaryotic and prokaryotic cells and their

	organisation - cell organelles and structures, including plasma membrane and cell wall, chromosomes, nucleus, cytoplasm, vacuoles and vesicles, golgi complex, endoplasmic reticulum, lysosomes, chloroplasts, ribosomes and mitochondria, cytoskeleton, cilia and flagella - biological membranes (structure and function - osmosis, diffusion, active transport cellular metabolism) - heterotrophic and autotrophic organisms
OHS and environmental management requirements	OHS and environmental management requirements: - all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these requirements must not be compromised at any time - all operations assume the potentially hazardous nature of samples and require standard precautions to be applied - where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health

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Unit Sector(s)

Environmental

Custom Content Section

Not applicable.