



Australian Government

Department of Education, Employment and Workplace Relations

MSS025012A Perform environmental microbiological tests

Release: 1

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Modification History

Not applicable.

Unit Descriptor

This unit of competency covers the ability to receive and prepare samples, identify and quantitate examples of microorganisms of environmental significance. Personnel will also be able to apply an understanding of the role of microorganisms in bioremediation, agriculture and industrial processes.

Application of the Unit

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

- environmental monitoring, sampling and field testing (e.g. air, water, groundwater and soil)
- natural resource management
- occupational hygiene monitoring (e.g. air)
- groundwater and clean water (e.g. catchments, supply and environmental flows)
- water treatment, storm and wastewater management
- site remediation or rehabilitation.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

MSS024010A Perform environmental biological techniques

Employability Skills Information

Not applicable.

Elements and Performance Criteria Pre-Content

Not applicable.

Elements and Performance Criteria

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| 1 | Receive microbiological samples | 1.1 | Check samples and accompanying documentation in accordance with enterprise procedures |
| | | 1.2 | Log samples and record sufficient details to enable accurate tracking and chain of custody |
| | | 1.3 | Distribute samples for local testing or dispatch samples to other testing facilities, as necessary |
| | | 1.4 | Store samples appropriately where testing or transport is to be delayed |
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| 2 | Prepare for safe microbiological work and aseptic applications | 2.1 | Select work area and equipment required for the safe handling of materials that may contain microorganisms of specified risk groups |
| | | 2.2 | Wear protective clothing, replacing it when contamination is suspected |
| | | 2.3 | Apply correct disinfection procedures to work areas before and after use |
| | | 2.4 | Locate relevant emergency equipment for timely response to microbiological accidents |
| | | 2.5 | Apply standard precautions when handling biological materials |
| | | 2.6 | Minimise the production and release of aerosols, using biological safety cabinets, where necessary |
| | | 2.7 | Clean up spills, and report all spills and suspected incidents to supervisor |
| | | 2.8 | Wash hands before and after laboratory work and when contamination is suspected |
| | | 2.9 | Ensure the safe collection and disposal of biohazardous materials and other laboratory wastes in accordance with enterprise procedures |

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| 3 | Process samples for direct examination | 3.1 | Prepare thin smears of samples for subsequent staining to enable microscopic identification of cells |
| | | 3.2 | Prepare liquid films of specimens for direct observation of cell structure |
| | | 3.3 | Prepare samples to concentrate material for subsequent staining or microscopy |
| 4 | Prepare pure cultures for microbiological work and aseptic applications | 4.1 | Select culture media to maximise growth of microorganisms and cells |
| | | 4.2 | Inoculate media aseptically, applying techniques suitable for purpose of culture |
| | | 4.3 | Incubate inoculated media in conditions to optimise growth of organisms and cells |
| | | 4.4 | Subculture on suitable media to optimise production of pure cultures |
| 5 | Perform environmental microbiological analyses | 5.1 | Identify major microorganisms and groups of microorganisms in air, water and soil samples |
| | | 5.2 | Count cells in undiluted samples to indicate the dilution necessary to reliably count organisms in culture |
| | | 5.3 | Prepare serial dilutions of samples aseptically for culture and colony counting |
| | | 5.4 | Count colonies for calculating number of viable organisms per unit volume |
| | | 5.5 | Count microorganisms in samples and cultures using spectrometric and electronic methodologies, where relevant |
| | | 5.6 | Estimate and document uncertainty of measurement in accordance with enterprise procedures, where relevant |
| | | 5.7 | Use rapid detection techniques to monitor the presence of microorganisms in water |

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| | | 5.8 | Use indicator organisms to estimate the likely presence of other pathogenic species |
| 6 | Examine test data for legislative compliance | 6.1 | Confirm data are the result of valid measurements |
| | | 6.2 | Report details of sampling/testing procedures and quality assurance in accordance with legislative requirements |
| | | 6.3 | Report data in the required format with the appropriate accuracy, precision, statistic type and units |
| | | 6.4 | Compare data with specified assessment criteria |
| | | 6.5 | Comment on any significant data trends and identify the possible causes or implications |
| | | 6.6 | Identify atypical or out-of-range results and the risk and/or instances of potential/actual non-compliance |
| | | 6.7 | Confirm all unexpected findings with supervisor |
| 7 | Maintain records | 7.1 | Enter approved data and results into enterprise information management system |
| | | 7.2 | Maintain instrument logs as required by accreditation checklists |
| | | 7.3 | Maintain security and confidentiality of all client information, data, test results and records |

Required Skills and Knowledge

Required skills

Required skills include:

- interpreting sampling/testing procedures, manuals and guidelines
- using protective clothing and biological safety cabinets
- setting up, using and maintaining sampling/testing equipment
- performing tasks for the culture, isolation, identification and use of microorganisms
- preventing contamination of oneself, other people, the work area, equipment or the samples and materials under test
- preventing contamination of media or reagents during manipulations/transfer of cultures
- identifying artefacts or image aberrations attributable to misalignment or obstruction of light paths or condensers used in bright field, dark ground, phase and fluorescent microscopy, or with other steps in microscopic examinations
- identifying Gram reactions
- describing bacterial colony forms on common media used in environmental investigations
- using numeracy skills for enumerating microorganisms
- preparing documentation that is accurate, concise and in accordance with enterprise and/or legislative requirements
- seeking advice when issues/problems are beyond scope of competence/responsibility
- reporting incidents or accidents
- disinfecting spillage and safely disposing of all contaminated materials
- decontaminating the work area upon completion of work
- working safely

Required knowledge

Required knowledge includes:

- relevant microbiological terminology in the areas of bacteriology, parasitology and mycology
- cell biology and chemistry related to laboratory phenomena, such as growth and isolation of organisms for identification
- microbial genetics
- microbial diversity
- microorganisms of importance in assessment of the natural environment
- diseases associated with air, water, and soil-borne microorganisms
- transmission and infection mechanisms and vectors
- population growth curves for microorganisms

- anti-microbial agents and their suitability/efficacy in a variety of situations
- relevant disinfection and sterilisation procedures
- rationale for sample dilution when preparing materials for enumerating organisms and other pure culture work (e.g. most probable number (MPN) technique)
- need for accurate identification of sample source (e.g. field location)
- sampling procedures for the microbiological testing of drinking water which should conform to the guidelines published by the National Health and Medical Research Council (NHMRC), the Australian Water Resources Council
- testing procedures for the microbiological content of air, water and soil which should be guided by advice of relevant national and state/territory environment protection agencies
- identification of indicator microorganisms to assist in determining the cause, time or nature of pollution
- use of microorganisms in wastewater treatment
- use of microorganisms in toxic spill recovery
- use of microorganisms in site remediation
- collection and disposal of waste, waste minimisation principles
- relevant health, safety and environment requirements

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: • safely performing tasks for the culture, isolation, identification, enumeration and use of microorganisms • not contaminating self, other people, the work area, equipment or the samples or materials under test, or media or reagents during manipulations involving transfer of cultures • identifying artefacts or image aberrations attributable to misalignment or obstruction of light paths or condensers used in bright field, dark ground, phase and fluorescent microscopy, or with other steps in microscopic examinations • identifying Gram reactions accurately

	• accurately describing bacterial colony forms on common media used in bacteriological investigations • comparing microbiological data with relevant assessment criteria and drawing logical conclusions • preparing data and documentation that is accurate, concise and in accordance with enterprise requirements • disinfecting any spillage and safely disposing of all contaminated materials • decontaminating the work area upon completion of work • working safely and reporting all incidents or accidents.
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>MSS025001A Assist with assessing site environmental indicators</i> • <i>MSS025002A Assess the environmental risk or impact of a project activity or process.</i> The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. Resources may include: • a standard microbiology laboratory with relevant equipment, samples and reagents • enterprise procedures, test methods and equipment manuals. Under duty of care requirements, off-the-job training providers will only use samples and organisms of a risk category 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: • review of results/data/records generated by the candidate • feedback from peers and supervisors about the candidate's ability to consistently apply enterprise procedures and work safely • oral and/or written questions associated with testing

	of environmentally significant microorganisms and record keeping integrated assessment with a case study focus, such as the isolation and identification of bacterial species in a specimen containing two or more species, by relating sample, cultural, morphological and biochemical data, and such from other relevant tests and procedures. 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: - land use, acquisition, planning and protection - environmental protection - Australian and international standards, such as: - AS/NZS 4276 series Water microbiology - AS/NZS 3896:2008 Waters - Examination for

	<i>legionellae</i> spp. including <i>Legionella pneumophila</i> • Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand 2000, Australian guidelines for water quality monitoring and reporting, National Water Quality Management Strategy No. 7, ANZECC & ARMCANZ, Canberra • AS/NZS 2031:2001 Selection of containers and preservation of water samples for microbiological analysis • AS/NZS 3666 series Air-handling and water systems of buildings - microbial control • NOHSC:1003 Adopted national exposure standards for atmospheric contaminants in the occupational environment • American Public Health Association (APHA) Handbook - Water and wastewater analysis • data quality procedures • enterprise sampling and monitoring protocols • equipment manuals and warranties, supplier catalogue and handbooks • material safety data sheets (MSDS) • occupational health and safety (OHS) national standards and codes of practice
Environmental microbiological tests	Environmental microbiological tests may include: • identification of major groups of environmentally significant organisms, such as: • bacteria, Cyanobacteria, Corynebacteria, <i>Legionella pneumophila</i>, <i>Lactobacillus</i>, <i>Rhizobia</i>, hydrocarbon utilising bacteria, and sulfite reducing bacteria • Total Coliforms, Faecal Coliforms, <i>Escherichia coli</i>, <i>Enterococci</i> and Faecal <i>Streptococci</i> • Archaea • <i>Aspergillus</i> • micro-algae, blue-green algae • anaerobic protozoa • indicator microorganisms and their role in predicting likely infectious agents • enumeration of organisms, and use of counting chambers • use of selective and enriched media and their role in identification and enumeration of microorganisms, such as:

	• MacConkey's agar (Coliforms) • BG11 (Cyanobacteria) • yeast mannitol agar (<i>Rhizobium</i>) • lactose broth • ammonium salts • nutrient agars • tryptic soy agar • biochemical tests, such as IMViC (indole, methyl red, Voges-Proskauer and citrate) • use of antibiotics, such as cycloheximide (detection of bacteria in presence of yeasts and mould) • micro-toxicity testing • microbial activity in soils
Equipment, materials and systems	Equipment, materials and systems may include: • protective and physical containment facilities and equipment for safe handling of microorganisms • 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), 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
Legislative compliance	Legislative compliance may involve: - comparison and interpretation of data in comparison with assessment criteria, limits and other regulatory requirements, such as: - exposure standards for atmospheric contaminants in the occupational environment - guidelines for drinking water - allowable pollution index for public recreation areas - discharge of sewage and allowable contamination levels - drawing conclusions about air quality, water quality, and the condition of ecosystems
Use of microorganisms in bioremediation, agriculture and industrial processes	Use of microorganisms in bioremediation, agriculture and industrial processes may include: - treatment of wastewater (especially in sewage) - sulphite reducing bacteria - remediation of oil spills using microorganisms, such as HCB, pseudomonas - production of eco-friendly fuels, such as ethanol
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

Unit Sector(s)

Environmental

Custom Content Section

Not applicable.