



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **MSL977011A Contribute to the selection, commissioning and maintenance of analytical instruments**

**Release: 1**

## **MSL977011A Contribute to the selection, commissioning and maintenance of analytical instruments**

### **Modification History**

Not applicable.

### **Unit Descriptor**

<b>Unit descriptor</b>	This unit of competency covers the ability to identify appropriate instrumentation to meet specific analytical needs, determine the suitability of available instruments, commission instruments, develop maintenance schedules, maintain relevant records and train staff to operate instruments correctly.
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### **Application of the Unit**

<b>Application of the unit</b>	<p>This unit of competency is applicable to experienced laboratory technical officers/technicians, laboratory supervisors and technical specialists who conduct instrumental analysis in laboratories providing consultancy, research and development and quality assurance services. These services may be provided for a wide range of industry sectors, such as forensic science, environmental monitoring, chemical, biomedical, mineral, food and manufacturing testing.</p> <p>Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting, at the end of this unit of competency under the section 'This competency in practice'.</p>
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### **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## 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 required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Recommend a suitable instrument	<ul style="list-style-type: none"> <li>1.1. Confirm the scope of analysis for which instrumentation is required</li> <li>1.2. Research information about the specifications and features of instruments that may be suitable and their suppliers</li> <li>1.3. Research information about the environmental operating conditions and services that instruments require</li> <li>1.4. Liaise with suppliers and/or conduct tests to compare the stated performance of available instruments against enterprise specifications</li> <li>1.5. Seek advice/assistance with evaluating instruments if beyond own technical competence</li> <li>1.6. Assist senior staff to select the most suitable instrument</li> <li>1.7. Develop a thorough understanding of the selected instrument's operation, installation requirements, routine instrument checks and maintenance requirements</li> </ul>
2. Establish a suitable operating environment for an instrument	<ul style="list-style-type: none"> <li>2.1. Select a suitable instrument location</li> <li>2.2. Confirm required services for instrument using the supplier's specifications</li> <li>2.3. Arrange for necessary connection of services</li> </ul>
3. Commission a new instrument	<ul style="list-style-type: none"> <li>3.1. Liaise with supplier to arrange delivery and installation as appropriate</li> <li>3.2. Ensure that the supplier fully explains the instrument's operation and maintenance requirements during installation</li> <li>3.3. Ensure that full qualification of the instrument's performance is completed prior to instrument handover</li> <li>3.4. Conduct in-house checks of accessories and test measurements to confirm instrument performance for the full scope of intended use</li> <li>3.5. Liaise with supplier to resolve any performance issues, clarify aspects of instrument operation or provide additional training</li> <li>3.6. Enter all required information about the new instrument into the enterprise information management system</li> <li>3.7. Assess any new risks to instrument operators, other laboratory personnel and the environment</li> <li>3.8. Develop and document clear procedures for safely</li> </ul>

ELEMENT	PERFORMANCE CRITERIA
	operating and maintaining the instrument and recording its use
4. Train, or arrange training for, instrument operators	4.1. Identify the knowledge and skills required to operate the instrument safely and reliably in the workplace and to evaluate the data obtained 4.2. Develop, or access, an appropriate training program for instrument operators 4.3. Ensure that each operator can use the instrument competently for the required analytical methods 4.4. Record all training outcomes in accordance with the enterprise procedures 4.5. Audit operator's use of instruments at regular intervals to ensure their ongoing competence

## Required Skills and Knowledge

### Required skills

Required skills include:

- establishing enterprise requirements for a specific analytical instrument from a consideration of client test requests, routine and non-routine samples, applicable test methods and cost/benefits
- locating, interpreting and comparing information about analytical instruments used by the enterprise
- recommending suitable instruments by analysing factors such as:
  - scope of intended use (fixed/portable and laboratory/field) and robustness
  - range of appropriate analytes and test methods, and limitations
  - detection method, detection limit, accuracy, precision/reproducibility, sensitivity, linearity and response time
  - software applications
  - ease of use
  - purchase price, operating costs and level of supplier support
  - facility to upgrade and add accessories
  - generation of waste
- conducting pre-use and calibration checks, troubleshooting common faults, conducting basic repairs and maintaining analytical instruments used in job role
- safely operating analytical instruments used in job role to obtain reliable data
- processing and analysing measurement data, quantifying analytes and applying established corrections
- interpreting manuals and writing operating instructions for analytical instruments used in enterprise
- seeking advice and further directions when faced with unforeseen circumstances or situations that may require decisions or response actions beyond technical competence

### Required knowledge

Required knowledge includes:

- concepts and principles such as:
  - absorption, reflection, emission, fluorescence, reflectance, scattering, refraction, polarisation, diffraction, dispersion and spectra
  - ionisation, re-combination, photoelectric effect, and interaction of ions with electric and magnetic fields
  - electromagnetic induction, and generation of electromagnetic radiation and plasmas
  - common instrument layout (sample introduction, energy source, single/multi-beam, dispersive/analyte separation components and path, detection, signal conditioning, computer control, data processing and display, power supply,

## Required skills

- vacuum and pump systems)
  - terms and concepts, such as operating voltage, accuracy, response time, sensitivity, detection limit, linearity, resolution and spectral bandwidth
- characteristics, capabilities, advantages/limitations, function of key components and operating principles for analytical instruments used in enterprise such as:
  - gas chromatographs (GC, GC-MS)
  - liquid chromatographs (LC, LC-MS)
  - instruments using inductively coupled plasma (ICP) linked to atomic (AES) or optical (OES) emission spectrometers or mass spectrometers (MS)
  - fourier transform infra red spectrophotometers (IR/FTIR) and attachments (e.g. microscope and reflectance)
  - ultraviolet/visible/near infra red spectrophotometers (UV/VIS/NIR) and attachments (e.g. microscope and reflectance)
  - atomic absorption spectrometers (AAS) including vapour generation and electrothermal atomisation accessories
- role and importance of regular calibration and pre-use checks and maintenance
- common instrument faults, troubleshooting, recommended remedial actions and repairs
- common instrument operator errors
- guidelines and safety procedures for working with (non) ionising radiation, high voltages, radio frequency (RF) fields, hazardous samples, chemicals and waste
- health, safety and workplace emergency response procedures relevant to job role

## Evidence Guide

### 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.

#### Overview of assessment

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

Assessors should ensure that candidates can:

- select analytical instruments that will satisfy enterprise needs and specifications
- confirm that an analytical instrument is performing to specification
- develop operating procedures, usage logs and maintenance schedules for analytical instruments
- keep accurate and complete records relevant to job role

#### Context of and specific resources for assessment

This unit of competency is to be assessed in the workplace or simulated workplace environment. Resources may include:

- laboratory with specialised analytical instruments
- laboratory reagents and equipment
- SOPs and test methods.

#### Method of assessment

The following assessment methods are suggested:

- oral/written tests and calculations involving analytical quantities, setup, calibration, operation and basic maintenance of analytical instruments
- review of records of instrument selection, use and maintenance generated by the candidate
- review of instrument training materials/records generated by the candidate
- observation of the candidate checking, using and maintaining analytical instruments.

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.

Access must be provided to appropriate learning and/or

## EVIDENCE GUIDE

	<p>assessment support when required.</p> <p>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.</p>
<b>This competency in practice</b>	<p>Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting.</p> <p><b>Laboratory operations</b></p> <p>A technician has been requested by the laboratory manager to help develop the laboratory's capability to conduct testing for trace metals in water samples. He/she searches for relevant Australian standards, technical publications and supplier's brochures on the Internet and identifies two techniques that appear to suit the laboratory's testing requirements and constraints. The two techniques involve inductively coupled plasma mass spectrometry (ICP-MS) and anodic stripping voltammetry (ASV). The technician carefully assesses of the performance of each type of instrument, the services and operating environment required, the purchase price and operating costs and the level of support that each supplier is prepared to provide. The technician decides that the ASV instrument is probably the most appropriate choice. He/she then provides a boiler water sample to several suppliers for analysis by ASV and discusses the results obtained in each case with his/her manager. The manager agrees with the technician's recommendation and notes that the ASV instrument will provide a much more favourable return on investment than the ICP-MS. The technician then contacts the supplier to confirm the purchase and arranges for the utilities, services and accommodation arrangements to be completed prior to instrument delivery.</p>

## Range Statement

### 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.

#### 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

#### Standards, codes, procedures and/or enterprise requirements

Standards, codes, procedures and/or enterprise requirements may include:

- Australian and international standards, such as:
  - AS ISO 17025-2005 General requirements for the competence of testing and calibration laboratories
  - AS/NZS 2243 Set:2006 Safety in laboratories set
  - AS/NZS ISO 9000 Set:2008 Quality management systems set
  - AS 2830.1 Good laboratory practice - Chemical analysis
  - ISO/IEC Guide 98-3:2008 Uncertainty of measurement - Part 3 Guide to the expression of uncertainty in measurement (GUM)
- Eurachem/CITAC Guide CG4 Quantifying uncertainty in analytical measurement
- Australian code of good manufacturing practice (GMP)
- principles of good laboratory practice (GLP)
- material safety data sheets (MSDS)
- national measurement regulations and guidelines
- enterprise procedures, standard operating procedures (SOPs) and operating manuals
- quality manuals, equipment and procedure manuals
- equipment startup, operation and shutdown procedures

<b>RANGE STATEMENT</b>	
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|  | <ul style="list-style-type: none"><li>• calibration and maintenance schedules</li><li>• cleaning, hygiene and personal hygiene requirements</li><li>• data quality procedures</li><li>• enterprise recording and reporting procedures</li><li>• material, production and product specifications</li><li>• production and laboratory schedules</li><li>• quality system and continued improvement processes</li><li>• safety requirements for equipment, materials or products</li><li>• sampling procedures (labelling, preparation, storage, transport and disposal)</li><li>• schematics, work flows and laboratory layouts</li><li>• statutory and enterprise occupational health and safety (OHS) requirements</li><li>• stock records and inventory</li><li>• test procedures (validated and authorised)</li><li>• waste minimisation, containment, processing and disposal procedures</li></ul> |
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<b>RANGE STATEMENT</b>	
<b>Analytical instruments</b>	<p>Analytical instruments may include:</p> <ul style="list-style-type: none"> <li>• gas chromatographs, specialised sampling devices and detectors</li> <li>• liquid chromatographs, specialised sampling devices and detectors</li> <li>• inductively coupled plasma spectrometers ICP-AES/OES or ICP-MS</li> <li>• UV-VIS spectrophotometers and accessories</li> <li>• IR/FTIR spectrophotometers and accessories</li> <li>• fluorimeters</li> <li>• Raman spectrometers</li> <li>• atomic absorption spectrometers, specialised sampling devices (graphite furnace) and detectors</li> <li>• X-ray fluorescence (XRF) and diffraction (XRD)</li> <li>• electrometric instruments (e.g. anodic stripping voltammetry)</li> </ul>
<b>Specifications and features of instruments</b>	<p>Specifications and features of instruments may include:</p> <ul style="list-style-type: none"> <li>• suitability for analytes of interest and sample requirements</li> <li>• suitability for specific test methods</li> <li>• working/dynamic range, sensitivity and detection limits</li> <li>• response time</li> <li>• linearity and estimated uncertainty for each range</li> <li>• single or multi-species analysis</li> <li>• interfacing with data loggers and computers</li> <li>• power and battery requirements</li> <li>• size and weight</li> <li>• use under environmental conditions (thermal/mechanical stress and magnetic/electrostatic fields)</li> <li>• use of consumables</li> <li>• generation of wastes</li> <li>• hazards</li> <li>• ease of use</li> <li>• run time and throughput of samples</li> <li>• purchase price and operating costs</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Hazards</b>	<p>Hazards may include:</p> <ul style="list-style-type: none"> <li>• electric shock</li> <li>• biohazards, such as microbiological organisms and agents associated with soil, air, water, blood and blood products, and human or animal tissue and fluids</li> <li>• corrosive chemicals</li> <li>• sharps and broken glassware</li> <li>• flammable liquids and gases</li> <li>• fluids under pressure and sources of ignition</li> <li>• disturbance or interruption of services</li> <li>• toxic fumes</li> <li>• ionising (X-ray, neutron) non-ionising radiation (UV, radio frequency (RF) and laser)</li> </ul>
<b>Addressing hazards</b>	<p>Addressing hazards may include:</p> <ul style="list-style-type: none"> <li>• use of MSDS</li> <li>• accurate labelling of samples, reagents, aliquoted samples and hazardous materials</li> <li>• personal protective equipment such as gloves, safety glasses and coveralls</li> <li>• use of fumehoods, direct extraction of vapours and gases</li> <li>• use of appropriate equipment such as biohazard containers, laminar flow cabinets, Class I, II and III biohazard cabinets</li> <li>• handling and storage of all hazardous materials and equipment in accordance with labelling, MSDS and manufacturer's instructions</li> </ul>
<b>Occupational health and safety (OHS) and environmental management requirements</b>	<p>OHS and environmental management requirements:</p> <ul style="list-style-type: none"> <li>• 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</li> <li>• all operations assume the potentially hazardous nature of samples and require standard precautions to be applied</li> <li>• where relevant, users should access and apply current industry understanding of infection</li> </ul>

## RANGE STATEMENT

	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)

Unit sector	Testing
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## Competency field

Competency field	
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## Co-requisite units

Co-requisite units		