



**Australian Government**

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

# **MSS025016A Perform sampling and testing of stationary emissions**

**Release: 1**

## **MSS025016A Perform sampling and testing of stationary emissions**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the ability to collect and test gaseous and particulate components in air pollution emissions from stationary sources. Personnel work in pairs with a senior stack tester or air pollution engineer and use specified sampling points and sampling/test methods. They continually monitor hazards and risks in the work area, apply specified safe working procedures and use prescribed safety equipment. Note that this unit does not cover laboratory analysis of samples (e.g. gravimetric, moisture content and gas analysis) which is addressed in units such as *MSL974003A Perform chemical tests and procedures* and *MSL975020A Apply routine spectrometric techniques*. Sampling and testing of source odours is addressed in the unit *MSS025010A Assist with odour source assessment*.

### **Application of the Unit**

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

- environmental services (e.g. sampling and monitoring of air, odour, and air quality consultancy)
- environmental compliance, auditing and inspection
- management of pollution in chemical, food and by-product, mineral process manufacturing and energy production.
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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 | Confirm stack sampling/testing requirements with supervisor | 1.1 | Confirm the site location, scope and purpose of stack sampling/testing, relevant standards and data requirements                                                     |
|   |                                                             | 1.2 | Review available information about the site, its industrial processes, details of sampling/testing locations and any previous sampling/testing results for emissions |
|   |                                                             | 1.3 | Select possible sampling/analyser train configurations to suit type and likely concentration of particulate matter, plant/stack conditions and/or gases of interest  |
|   |                                                             | 1.4 | Check that selected sampling/test methods are in accordance with statutory, client or enterprise requirements, relevant standards and guidelines                     |
| 2 | Assist with site liaison                                    | 2.1 | Liaise with site controller to access site                                                                                                                           |
|   |                                                             | 2.2 | Arrange for induction training, clearances and/or permits, as necessary                                                                                              |
|   |                                                             | 2.3 | Clarify site health and safety hazards/risks, safe work procedures/methods and availability of safe work platform                                                    |
|   |                                                             | 2.4 | Negotiate access to stack during suitable process operating conditions for sampling/testing and to minimise impact on normal operations                              |
|   |                                                             | 2.5 | Negotiate access to site equipment, services, materials and support personnel, as necessary                                                                          |
|   |                                                             | 2.6 | Confirm schedule for stack sampling/testing activities                                                                                                               |

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| 3 | Prepare for stack sampling/testing                | 3.1 | Review site hazards, risks, specified safe work methods                                                                                                           |
|   |                                                   | 3.2 | Review approved health and safety plan covering site sampling/testing activities                                                                                  |
|   |                                                   | 3.3 | Review sampling/testing procedures and methods and equipment configurations with close attention to the sequence of steps and details for each                    |
|   |                                                   | 3.4 | Select sampling equipment and test instruments and check their operation/calibration in accordance with relevant methods, standards and manufacturer instructions |
|   |                                                   | 3.5 | Ensure all conditioning reagents, solutions and calibration gases, as appropriate, are obtained and ready for field use                                           |
|   |                                                   | 3.6 | Prepare and store filters appropriate for the likely physical and chemical nature of the gases and particulates and in accordance with sampling/test method       |
|   |                                                   | 3.7 | Assemble and safely stow all sampling equipment, test instruments, materials, containers and safety equipment                                                     |
|   |                                                   | 3.8 | Arrange suitable transport to, from and around site as required                                                                                                   |
| 4 | Assist with site inspection and preliminary tests | 4.1 | Locate the site controller and re-confirm access and suitability of stack conditions                                                                              |
|   |                                                   | 4.2 | Inspect work platform and check for safe access to existing sampling access holes and electrical services                                                         |
|   |                                                   | 4.3 | Transport all required equipment and materials to work platform, check they are fit for purpose and rectify, as necessary                                         |
|   |                                                   | 4.4 | Record the dimensions of the stack and conduct preliminary determinations of temperature, velocity, pressure and moisture content values using relevant methods   |

- 4.5 Assess suitability/compliance of sampling plane
  - 4.6 Assess whether the operating environment will impact on safety or reliability of sampling/testing and make modifications or alternative arrangements as directed
  - 4.7 Confirm numbers of samples, sampling positions and times, sampling/test methods and equipment configurations for sampling and in-situ measurements
- 5 Conduct sampling and in-situ tests
  - 5.1 Set up sampling/analyser train with appropriate sensors, probes, nozzle, conditioning components and detectors in accordance with method
  - 5.2 Allow sufficient time for the system to stabilise
  - 5.3 Calibrate analyser in accordance with test method
  - 5.4 Operate equipment with close attention to each method step and to maintaining the isokinetic or required sampling/test conditions for each sampling point
  - 5.5 Conduct regular leak checks, purging and system performance tests in accordance with method to ensure reliable results
  - 5.6 Carefully collect, label and store each sample to minimise loss or contamination and ensure traceability
  - 5.7 Accurately record measurements, environmental conditions and any atypical observations that may impact on validity/integrity of samples or test results
- 6 Finalise stack sampling/testing
  - 6.1 Safely disassemble, clean/decontaminate and restow all equipment and materials for transport to base
  - 6.2 Transport all samples back to base as soon as practicable and in accordance with enterprise procedures, test methods or relevant standards

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|   |                                  | 6.3 | Ensure all field observations, calibration data, measurements, calculations and results are accurately transferred to enterprise information database |
|   |                                  | 6.4 | Distribute samples for laboratory analysis within specified holding times, if required                                                                |
| 7 | Process and interpret data       | 7.1 | Review test data noting atypical observations                                                                                                         |
|   |                                  | 7.2 | Calculate required quantities using relevant test method and ensure values are consistent with expectations                                           |
|   |                                  | 7.3 | Estimate and document uncertainty of measurement in accordance with enterprise procedures, if required                                                |
|   |                                  | 7.4 | Record processed results in accordance with enterprise procedures                                                                                     |
|   |                                  | 7.5 | Interpret trends in data and/or results and report atypical results promptly to appropriate personnel                                                 |
|   |                                  | 7.6 | Determine if obvious procedure or equipment problems have led to atypical data or results                                                             |
|   |                                  | 7.7 | Compare results with established air quality standards, statutory environmental quality concentration limits or similar, if relevant                  |
|   |                                  | 7.8 | Finalise reporting of results in accordance with enterprise requirement                                                                               |
| 8 | Maintain a safe work environment | 8.1 | Clean all equipment, containers, work area and vehicles according to enterprise procedures                                                            |
|   |                                  | 8.2 | Check serviceability of all equipment before storage                                                                                                  |
|   |                                  | 8.3 | Use defined safe work practices and personal protective equipment to ensure personal safety and that of others                                        |
|   |                                  | 8.4 | Minimise the generation of wastes and                                                                                                                 |

environment impacts

- 8.5 Ensure the safe collection of all hazardous wastes for appropriate disposal

## Required Skills and Knowledge

### Required skills

Required skills include:

- planning and preparing for field activities
- communicating effectively with site personnel, and negotiating access and support
- observational and descriptive skills
- recognising hazards, assessing risks and using appropriate safe work methods/equipment
- collecting representative samples of stationary source emissions in accordance with a sampling plan/procedures, standards or instructions
- using appropriate techniques to preserve the integrity of samples and transport them safely
- demonstrating correct and safe use of stack sampling equipment and analysers, including set-up, pre-use checks, calibration and performance checks
- using stack testing equipment/analysers to obtain reliable, quantitative results
- identifying and rectifying basic instrument faults
- identifying atypical data and samples and taking appropriate action
- solving technical problems and responding effectively to changed/unforeseen circumstances
- seeking advice when issues/problems are beyond scope of competence/responsibility
- maintaining, cleaning, decontaminating sampling equipment
- completing accurate records of sampling, test data and results
- writing/compiling concise and accurate reports
- following requirements for the disposal of waste and the preservation of the environment
- working safely

### Required knowledge

Required knowledge includes:

- specific legislation, policies, standards and codes of practice related to air quality/pollution and monitoring of stationary source emissions
- terminology for atmospheric science, sampling and testing of stationary source emissions
- properties of air pollutants, such as:
  - particulates (e.g. inorganics and organics, and metals)
  - inorganic gases (e.g. CO, CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>, ammonia, acid rain and halogens)
  - volatile organics
- localised meteorology and dispersion of air pollutants
- ideal gas behaviour, principles of fluid flow through ducts, and effects of bends and orifices
- principles of stationary source emissions sampling (particles, common gases and compounds) and associated sampling equipment

- stack dimensions, source parameters and the selection of sampling planes, number and location of sampling points
- isokinetic conditions, and effect of fluctuations in source parameters on results
- principles of emission monitoring (particles and common gases) and associated analysers
- function of key components, operating principles of common stack sampling/analyser trains
- common procedure/equipment problems leading to atypical data/results
- common process problems leading to atypical test results (e.g. high oxygen readings may indicate a hole in the stack)
- labelling and traceability of samples and management of large volumes of data
- hazards and risks associated with stationary source emissions
- safe work methods and equipment, requirements for safe work platforms and services (e.g. *AS 1657:1992 Fixed platforms, walkways, stairways and ladders - Design, construction and installation*), personal protective equipment, relevant health, safety and environment requirements and procedures

## Evidence Guide

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| 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 | <p>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:</p> <ul style="list-style-type: none"> <li>• demonstrating an understanding of the legislative and regulatory framework for air quality</li> <li>• using accurate terminology to describe air quality parameters and stack sampling/testing</li> <li>• interpreting and applying stack sampling/monitoring plans, sampling/test methods and standards</li> <li>• operating, maintaining and/or calibrating stack sampling and testing equipment to obtain representative stack samples and produce consistently valid and accurate results</li> <li>• interpreting gross features of data, identifying atypical results and making relevant conclusions</li> <li>• calculating results using appropriate units/precision</li> <li>• providing accurate, complete records of sampling and testing observations, data and results</li> <li>• working safely and follow relevant legislative</li> </ul> |

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|  | requirements for the disposal of waste and the preservation of the environment. |
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| Context of and specific resources for assessment | <p>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:</p> <ul style="list-style-type: none"> <li>• <i>MSL974003A Perform chemical tests and procedures</i></li> <li>• <i>MSS025009A Perform sampling and testing of air.</i></li> </ul> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Resources may include:</p> <ul style="list-style-type: none"> <li>• Vehicles, stack sampling/test equipment, analysers, reagents, gases, safety equipment, camera, consumables, logbooks and data loggers, and computers</li> <li>• safety procedures, sampling/test methods, standards and equipment manuals.</li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
| Method of assessment                             | <p>The following assessment methods are suggested:</p> <ul style="list-style-type: none"> <li>• inspection of stack samples collected by the candidate</li> <li>• review of stack measurements, test results, calculations and observations produced by the candidate</li> <li>• review of sampling/testing records and reports completed by the candidate</li> <li>• feedback from supervisor about the candidate's ability to consistently apply enterprise procedures and work safely</li> <li>• oral and written questioning to check the candidate's understanding of the principles of stack sampling/testing, operation of stack sampling equipment, test instruments/analysers and processing of data</li> <li>• observation of the candidate performing a range of stack sampling and testing tasks.</li> </ul> <p>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.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>The language, literacy and numeracy demands of</p> |

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|  | assessment should not be greater than those required to undertake the unit of competency in a work-like environment. |
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| Guidance information for assessment |  |
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## Range Statement

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| <b>Codes of practice</b>                                                        | Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Legislation, standards, codes, procedures and/or enterprise requirements</b> | <p>Legislation, standards, codes, procedures and/or enterprise requirements may include:</p> <ul style="list-style-type: none"> <li>• federal legislation, such as</li> <li>• Environment Protection and Biodiversity Conservation Act 1999</li> <li>• state/territory government legislation and regulations and local government by-laws, policies, and plans dealing with: <ul style="list-style-type: none"> <li>• land use, acquisition, planning and protection</li> <li>• environmental protection</li> <li>• pollution and contaminated sites</li> </ul> </li> <li>• Australian and international standards, such as: <ul style="list-style-type: none"> <li>• AS ISO 14050:1999 Environmental management - Vocabulary</li> <li>• AS/NZS ISO 14000 Basic Set:2007 Environmental management basic set</li> <li>• AS 4323.1:1995 Stationary source emissions - Selection of sampling positions</li> <li>• AS 4323.2:1995 Stationary source emissions - Determination of total particulate matter - Isokinetic manual sampling - Gravimetric method</li> <li>• ISO 10780:1994 Stationary source emissions - Measurement of velocity and volume flowrate of gas stream in ducts</li> <li>• US Environmental Protection Authority (EPA) methods, such as: <ul style="list-style-type: none"> <li>• Method 4 Determination of moisture content in stack gases</li> <li>• Method 7E Determination of nitrogen oxides emissions from stationary sources (instrumental analyser procedure)</li> </ul> </li> <li>• enterprise sampling and monitoring protocols</li> <li>• equipment manuals and warranties, supplier catalogue and handbooks</li> </ul> </li> </ul> |

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|  | <ul style="list-style-type: none"><li>• government policy (e.g. environmental protection and impact assessment)</li><li>• material safety data sheets (MSDS)</li><li>• national environment protection measures</li><li>• occupational health and safety (OHS) national standards and codes of practice</li><li>• site-specific requirements</li></ul> |
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| <b>Information about the site, industrial activities and emissions</b> | <p>Information about the site, industrial processes and emissions may include:</p> <ul style="list-style-type: none"> <li>• location of site and nearby buildings, topography and meteorological records</li> <li>• complaints, previous stack testing at site or odour assessments in nearby locations</li> <li>• industrial process inputs/outputs, process flowchart, unit operations, batch, cyclic or continuous operation, predictable variations in process conditions, production rates, and period of operation</li> <li>• air emission control systems, such as scrubbers, bag filters, stacks and bio filters</li> <li>• parameters of emission sources, such as location, geometry, release parameters and weather interaction</li> <li>• previous emissions data, such as: <ul style="list-style-type: none"> <li>• velocity and temperature of pollutant concentration</li> <li>• moisture content</li> </ul> </li> <li>• expected gas composition and likely interfering compounds</li> <li>• high vacuum, high pressure and high temperature gas streams</li> <li>• corrosive or very reactive components</li> </ul> |
| <b>Air pollutants</b>                                                  | <p>Air pollutants may include:</p> <ul style="list-style-type: none"> <li>• inorganic gases: <ul style="list-style-type: none"> <li>• CO and CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>x</sub></li> </ul> </li> <li>• acid gases <ul style="list-style-type: none"> <li>• H<sub>2</sub>S, HCl</li> </ul> </li> <li>• ozone</li> <li>• chlorine, fluorine and fluorides</li> <li>• volatile organic liquids and compounds</li> <li>• particulates: <ul style="list-style-type: none"> <li>• deposited matter</li> <li>• suspended matter (PM<sub>10</sub>, PM<sub>2.5</sub>, and PM<sub>1</sub>)</li> <li>• particulate fluorides</li> <li>• heavy metals</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Stack tests</b>                                                     | <p>Stack tests may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• measurement of temperature, pressure, velocity and volume flowrate of gas streams</li> <li>• gas analysis for determination of molecular weight</li> <li>• determination of moisture content</li> <li>• determination of particulate matter</li> <li>• determination of concentration of specific gases in</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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|  | emissions (e.g. O <sub>2</sub> , CO <sub>2</sub> , SO <sub>2</sub> , NO and NO <sub>2</sub> ) |
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| <b>Hazards</b>                              | <p>Hazards may include:</p> <ul style="list-style-type: none"><li>• working on elevated platforms</li><li>• exposure to toxic, corrosive or hot gases</li><li>• electrical hazards</li><li>• trip hazards from cables</li><li>• noise or heat from plant equipment</li><li>• objects falling from the work platform or into the duct/stack</li><li>• flammability hazards</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Safety procedures</b>                    | <p>Safety procedures may include:</p> <ul style="list-style-type: none"><li>• preparation/approval of site health and safety plan for sampling/testing, and safe work permits/approvals</li><li>• use of safe work method statements, site safety induction, risk cards, 'step back' and safety checks</li><li>• use of personal protective equipment</li><li>• ensuring two persons are present</li><li>• monitoring of atmosphere for hazardous gases</li><li>• working upwind of known contaminants</li><li>• prohibition of eating, drinking and smoking</li><li>• separation of heavy equipment into smaller units/cases for transport</li><li>• testing and earthing of electrical services, generators, trip out devices and connectors</li><li>• shielding of hot surfaces and exhausts</li><li>• careful handling of glass containers</li><li>• reporting procedures for safety problems</li><li>• regular medical checks</li></ul> |
| <b>Safety equipment</b>                     | <p>Safety equipment may include:</p> <ul style="list-style-type: none"><li>• safety harness, personal protective equipment, such as boots, gloves, safety glasses and overalls</li><li>• gas monitors</li><li>• communication equipment (e.g. two-way radio and mobile phone)</li><li>• MSDS</li><li>• first aid equipment</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Stack sampling and testing equipment</b> | <p>Stack sampling and testing equipment may include:</p> <ul style="list-style-type: none"><li>• sampling train with in-stack or out-stack collector and components, such as:</li><li>• sampling nozzles</li><li>• probe tubes (e.g. glass and stainless steel)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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|  | <ul style="list-style-type: none"><li>• filters, impingers and desiccators for transport of dry filters</li><li>• flexible bags (e.g. Tedlar, Mylar and Teflon)</li><li>• particulate matter collectors, accessories (e.g. cyclones and filter bags)</li><li>• pre-prepared sample containers (e.g. Dioxin and furans), transport containers, eskies and ice</li><li>• instruments to measure static and differential pressure (e.g. manometer and barometer)</li><li>• sampling flow rate control devices</li><li>• pumps</li><li>• sampling flow meters</li><li>• water removal device (e.g. condenser and silica gel)</li><li>• temperature sensors in stack, duct and gas meters</li><li>• gas velocity instruments (e.g. pitot tube)</li><li>• heating/cooling elements to prevent condensation of probe tube or collectors</li><li>• gas analysers (e.g. NO<sub>x</sub>, CO, CO<sub>2</sub>, O<sub>2</sub> and N<sub>2</sub>) with components, such as:<ul style="list-style-type: none"><li>• sample gas manifolds</li><li>• analyte specific, dual range and low concentration analysers</li></ul></li><li>• data recorder, data logger and/or computer for real-time analysis</li><li>• reagents and standards (e.g. calibration gases, converter efficiency gases, interference checks and demineralised water)</li><li>• sample lines, hoses, ropes, bags and winches</li><li>• electrical extension cords</li><li>• calibrated rod for measuring stack dimensions</li><li>• balance, timers and digital camera</li><li>• tools and spare access hole plugs</li><li>• cherry picker</li></ul> |
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| <b>Sampling/measurement system performance tests</b> | <p>Sampling/measurement system performance checks may include:</p> <ul style="list-style-type: none"><li>• detecting and rectifying leaks (or reducing them to acceptable levels)</li><li>• analyser 2 or 3 point calibration tests</li><li>• NO<sub>2</sub> to NO conversion efficiency checks</li><li>• system bias checks</li><li>• system response time check</li><li>• interference checks</li><li>• post-run system bias and zero/span drift checks</li><li>• quality control (QC) runs</li></ul>                                                                                                                                                                                                 |
| <b>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 consumables, and require standard precautions to be applied</li><li>• 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</li></ul> |

## Unit Sector(s)

Environmental

## Custom Content Section

Not applicable.