



**Australian Government**

# **MSS025007 Perform sampling and testing of soils**

**Release: 1**

# MSS025007 Perform sampling and testing of soils

## Modification History

Release 1. Supersedes and is equivalent to MSS025007A Perform sampling and testing of soils

## Application

This unit of competency covers the ability to collect soil samples in accordance with a defined sampling plan, prepare the samples for testing, conduct in-field and laboratory testing of the samples and report the results. Personnel are required to check the validity and reliability of data, recognise atypical test data, and troubleshoot common test procedures and equipment problems.

This unit of competency is applicable to environmental technicians in a range of industry sectors, such as geotechnical services and civil engineering; site remediation or rehabilitation; solid and hazardous waste management; natural resource management; management of contaminated sites; environmental services (e.g. sampling and monitoring of air quality, water and soil); environmental compliance, auditing and inspection; groundwater and clean water (e.g. catchments, supply and environmental flows).

While no specific licensing or certification requirements apply to this unit at the time of publication, environmental monitoring and management activities are governed by relevant legislation, regulations and/or external accreditation requirements. Local requirements should be checked.

## Pre-requisite Unit

MSS024008                      Recognise common geological landforms and samples

## Competency Field

Sampling and testing

## Unit Sector

Environmental

## Elements and Performance Criteria

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

|                       |                                                                |
|-----------------------|----------------------------------------------------------------|
| 1 <b>Confirm soil</b> | 1.1      Review available site information, such as site plan, |
|-----------------------|----------------------------------------------------------------|

|   |                                                          |     |                                                                                                                                                        |
|---|----------------------------------------------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <b>sampling and testing requirements with supervisor</b> |     | sampling/testing locations and history of sampling/testing.                                                                                            |
|   |                                                          | 1.2 | Confirm the sampling locations, numbers and types of samples, timing and frequency of sampling from workplace or client's sampling plan.               |
|   |                                                          | 1.3 | Check that all sampling/testing procedures are in accordance with client or workplace requirements, relevant standards and guidelines.                 |
| 2 | <b>Prepare for soil sampling</b>                         | 2.1 | Identify site and sampling hazards and review workplace safety procedures.                                                                             |
|   |                                                          | 2.2 | Liaise with relevant personnel to arrange site access and obtain all clearances and/or permits, as necessary.                                          |
|   |                                                          | 2.3 | Select sampling equipment and conditions to achieve representative samples and to preserve sample integrity during collection, storage and transit.    |
|   |                                                          | 2.4 | Select field test equipment/instruments and check operation and calibration, as required, in accordance with procedures and manufacturer instructions. |
|   |                                                          | 2.5 | Assemble and check all sampling equipment, field test equipment, materials, containers and safety equipment.                                           |
|   |                                                          | 2.6 | Arrange suitable transport to, from and around site, as required.                                                                                      |
| 3 | <b>Conduct sampling and log soil samples</b>             | 3.1 | Locate sampling points and any services at the site.                                                                                                   |
|   |                                                          | 3.2 | Work effectively with other site personnel during drilling and excavation operations to collect and log reliable samples, as necessary.                |
|   |                                                          | 3.3 | Conduct representative sampling in accordance with sampling plan and defined procedures for field and/or laboratory testing, as required.              |
|   |                                                          | 3.4 | Record all information and label samples in accordance with traceability requirements.                                                                 |
|   |                                                          | 3.5 | Record environment and any conditions or atypical observations made during sampling that may impact on                                                 |

- sample representativeness or integrity.
- 3.6 Transport all samples back to base according to workplace procedures and relevant codes.
- 4 **Prepare soil samples for testing**
- 4.1 Prepare sub-samples and back-up sub-samples that are representative of the source.
- 4.2 Label all sub-samples to ensure traceability and store in accordance with workplace procedures.
- 4.3 Follow defined preparation and safety procedures to limit hazards or contamination to samples, self, work area and environment.
- 4.4 Distribute sub-samples to required destinations for testing, maintaining sample integrity, traceability and chain of custody requirements.
- 5 **Conduct physical and chemical soil tests in the field**
- 5.1 Obtain sample or sub-sample for designated field test.
- 5.2 Check that all equipment, instruments and reagents are fit for purpose.
- 5.3 Set up and calibrate instruments, as necessary, to ensure safe operation and valid results.
- 5.4 Operate equipment/instruments in accordance with test method requirements.
- 5.5 Perform tests/procedures/observations on all samples and standards, if appropriate, in accordance with specified methods
- 5.6 Record all field observations and results and ensure that they are accurately transferred to workplace information management system.
- 6 **Conduct physical and chemical soil tests in the laboratory**
- 6.1 Obtain sample or sub-sample for designated laboratory test.
- 6.2 Check that all equipment, instruments and reagents are fit for purpose.

- |   |                                                                         |                                                                                                                       |
|---|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|   | 6.3                                                                     | Set up and calibrate instruments, as necessary, to ensure safe operation and valid results.                           |
|   | 6.4                                                                     | Operate equipment/instruments in accordance with test method requirements.                                            |
|   | 6.5                                                                     | Perform tests/procedures on all samples, blanks and standards, if appropriate, in accordance with specified methods.. |
|   | 6.6                                                                     | Record test data noting atypical observations                                                                         |
|   | 6.7                                                                     | Process the data for samples, standards and blanks in accordance with workplace procedures.                           |
|   | 6.8                                                                     | Enter approved information into workplace information management system.                                              |
| 7 | <b>Review results and assess soil suitability for specific purposes</b> |                                                                                                                       |
|   | 7.1                                                                     | Review results in relation to legislative and/or client requirements.                                                 |
|   | 7.2                                                                     | Compare data with required/established/desired parameters to establish suitability for purpose.                       |
|   | 7.3                                                                     | Determine need for remedial action and report to client.                                                              |
| 8 | <b>Maintain a safe work environment</b>                                 |                                                                                                                       |
|   | 8.1                                                                     | Rehabilitate sampling site to render it safe and to minimise environmental impact.                                    |
|   | 8.2                                                                     | Clean all equipment, containers, work area and vehicles according to workplace procedures.                            |
|   | 8.3                                                                     | Check serviceability of all equipment before storage.                                                                 |
|   | 8.4                                                                     | Use defined safe work practices and personal protective equipment (PPE) to ensure personal safety and that of others. |
|   | 8.5                                                                     | Minimise the generation of wastes and environment impacts.                                                            |
|   | 8.6                                                                     | Ensure the safe collection of all hazardous wastes for appropriate disposal.                                          |

## Foundation Skills

This section describes those required skills (language, literacy and numeracy) that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

## Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

**Legislation, regulations, standards, codes, workplace procedures and requirements include the latest version of one or more of:**

- federal legislation, such as the Environment Protection and Biodiversity Conservation Act, and National Environmental Protection Measures
- state/territory government legislation and local government by-laws, policies, regulations and plans dealing with land use, acquisition, planning and protection; environmental protection; soil conservation; pollution and contaminated sites
- legislation, standards and codes of practice for work health and safety (WHS)
- Australian and international standards covering: soil sampling (e.g. AS 1199 Sampling procedures for inspection by attributes series, and AS 4433.2-1997 Guide to the sampling of particulate materials - Preparation of samples); soils testing (e.g. HB 160-2006 Soils testing, and AS 1289 Methods of testing soils for engineering purposes series); geotechnical site investigations (e.g. AS 1726-1993 Geotechnical site investigations); and transport of dangerous goods/emergency procedures (AS 1678 Emergency procedure guide series)
- registration/licensing and/or accreditation requirements
- site plans, maps and specifications; methods and procedures for sampling and in-field testing to meet workplace, client and/or regulatory/certifying body requirements; client sampling schemes and sampling plans
- workplace documents, such as standard operating procedures (SOPs); work schedules; recording and reporting procedures; equipment manuals and warranties; supplier catalogue and handbooks; safety data sheets (SDS) and safety procedures; waste minimisation, containment, processing and safe disposal procedures.

**Materials sampled include one or more**

- solid samples, such as soil and sediments
- natural, agricultural and engineered soils

- of:**
- solid wastes
  - soil water
  - soil gas/vapour.

- Types of samples include one or more of:**
- discrete samples
  - composite samples
  - quality control samples
  - research or one-off samples
  - environmental or survey samples.

- Sampling tools and equipment include one or more of:**
- maps, global positioning system (GPS) unit and compass
  - shovels and crow bars
  - metal-free scoop and cleaning brush
  - folding rulers and tape measures
  - hand and power augers, pry bars and files (auger maintenance)
  - push tubes, sampling tubes, dip tubes, spears and syringes
  - front-end loader, backhoe, excavator and drill rig
  - sample bottles or containers, plastic bags/containers and disposable buckets
  - sample splitters, graters and mills, mortar and pestles
  - lysimeters, soil gas probes.

- Testing equipment and instruments include one or more of:**
- digital camera, hand lenses and microscopes
  - sieves and sieve shakers
  - Munsell soil colour chart
  - pH meter and soil pH test kit
  - conductivity meter
  - tensiometer (moisture measurements)
  - ultraviolet/visible (UV/Vis) spectrophotometer
  - atomic absorption spectrophotometer
  - gas chromatographs (GC) and GC-MS
  - infrared spectrophotometer
  - diffuse reflectance accessories
  - inductively coupled plasma (ICP) spectrometers and ICP-MS
  - X-ray fluorescence (XRF) spectrometers
  - radiation monitor (e.g. Geiger-Muller counter).

- Site and sampling hazards include one**
- solar radiation, dust and noise
  - wildlife such as snakes, spiders and domestic animals
  - biohazards such as microorganisms and agents associated with

**or more of:**

soil

- chemicals such as acids and hydrocarbons
- manual handling of heavy sample bags and containers
- crushing, entanglement and cuts associated with moving machinery and hand tools
- vehicular and pedestrian traffic.

**Chemical soil tests include one or more of:**

- electrical conductivity
- pH
- alkalinity
- cation exchange capacity
- organic carbon
- available phosphorus
- nutrients and micronutrients
- sulfate
- carbonate
- nitrate and total nitrogen
- metals, including heavy metals
- organics, including pesticides and other hazardous chemicals.

**Physical soil tests include one or more of:**

- soil profile description
- particle size analysis, soil colour (Munsell), soil texture and water repellence
- infiltration
- soil moisture content
- liquid limit, plastic limit (plasticity index), Atterberg limits, volume expansion and linear shrinkage
- compaction, standard penetration test, cone penetration test
- dispersibility (Emerson class number)
- soil resistivity
- radioactivity.

**WHS and environmental management requirements include:**

- compliance with relevant federal/state/territory WHS legislation at all times
- assuming that samples are potentially hazardous and applying standard precautions
- accessing and applying current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and state/territory Departments of Health, where relevant.

## Unit Mapping Information

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## Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=5b04f318-804f-4dc0-9463-c3fb9a3fe998>

# Assessment Requirements for MSS025007 Perform sampling and testing of soils

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## Performance Evidence

Evidence of competence in this unit must satisfy all of the requirements of the elements and performance criteria, and include demonstration of:

- collecting, preserving and labelling a set of representative soil samples for at least one (1) site in accordance with a given sampling plan
- preparing soil samples and conducting at least one (1) chemical test and one (1) physical test in the field using given test methods
- preparing soil samples and conducting at least one (1) chemical test and one (1) physical test in a laboratory using given test methods
- planning field and laboratory activities
- selecting and checking all required field equipment, instruments and materials
- using sampling equipment to obtain reliable, representative soil samples in accordance with sampling plan and paying close attention to any pre-treatment, containers, preservation, storage, labelling and traceability requirements
- identifying atypical materials and samples and taking appropriate action
- setting-up, calibrating and operating field/laboratory test instruments to obtain valid and reliable data in accordance with test methods
- accurately recording site features, environmental conditions and any observations that may impact on reliability of field data
- interpreting gross features of data, identifying atypical results as out-of-normal range or an artefact and making relevant conclusions
- identifying and rectifying basic instrument faults
- calculating results using appropriate units and precision and/or preparing calibration graphs
- checking the acceptability of environmental data using specified quality tests or procedures
- using established soil parameters/criteria to make valid conclusions about soil suitability
- providing accurate, complete records of sampling and testing, site observations and data
- presenting and reporting results in accordance with workplace procedures
- seeking advice when issues/problems are beyond scope of competence/responsibility
- safely transporting, cleaning, maintaining and storing field equipment in accordance with workplace procedures
- working safely and following relevant legislative requirements for the disposal of waste and the preservation of the environment.

## Knowledge Evidence

Must provide evidence that demonstrates knowledge of:

- scientific terminology used in job role covering soil sampling and testing
- fundamentals of soil morphology, such as soil profiles, horizons, structure and texture, and mineralogy
- (Australian) soil classification system
- fundamentals of soil formation
- land use and soil systems (interactions and impacts), such as plant-soil interactions, soil fertility, soil contamination and remediation
- fundamentals of geomorphology, such as erosion and mass wasting; transportation and deposition, sedimentation; fluvial, aeolian, hillslope and weathering processes
- fundamentals of soil chemistry, soil salinity
- physical/engineering soil properties, such as:
  - colour (Munsell chart)
  - liquid and plastic limits
  - linear shrinkage
  - soil particle density
  - particle size distribution
  - dispersion and Emerson class number
- fundamentals of sampling, such as:
  - sampling plans and site selection
  - principles of representative samples
  - principles and procedures for random, systematic, stratified and composite sampling; consistency of sampling procedures
  - preservation of the integrity of samples
  - maintaining identification of samples relative to their source, workplace and/or legal traceability requirements
  - cost-effectiveness of sampling
- characteristics of soils to be sampled and likely contaminants
- links between quality control, quality assurance, quality management systems and sampling procedures
- workplace procedures dealing with legislative requirements for the handling, labelling and transport of hazardous goods
- common site hazards, links between safe work procedures and personal and environmental safety, particularly at high risk sites.

## Assessment Conditions

- Judgement of competence must be based on holistic assessment of the evidence. Assessment methods must confirm consistency of performance over time, rather than a single assessment event.

- This unit of competency is to be assessed in the workplace, or a simulated workplace environment. A simulated workplace environment must reflect realistic operational workplace conditions that cover all aspects of workplace performance, including the environment, task skills, task management skills, contingency management skills and job role environment skills.
- Foundation skills are integral to competent performance of the unit and should not be assessed separately.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
- Knowledge evidence may be collected concurrently with performance evidence or through an independent process such as workbooks, written assessments or interviews (provided a record is kept in each case).
- Holistic assessment methods include:
  - inspection of soil samples collected by the candidate
  - review of field and laboratory chemical/physical soil test results, calculations and site observations produced by the candidate, including assessment of soil suitability
  - review of sampling/testing records completed by the candidate
  - feedback from supervisors about the candidate's ability to apply workplace procedures and soil sampling/test methods consistently, work safely and produce results within the agreed timeframe
  - oral and/or written questions to check the candidate's knowledge of soil sampling and testing procedures, set-up and use of equipment, normal ranges, and troubleshooting of common sampling and testing problems.
- Access is required to all instruments, equipment, materials, workplace documentation, procedures, and specifications associated with this unit including, but not limited to:
  - vehicles, soil sampling equipment, field test equipment, digital camera, containers and reagents/consumables
  - equipment/instruments for laboratory based soils testing
  - safe work procedures and safety equipment
  - workplace procedures, work program, maps, site plans, site sampling plans and test methods, and equipment manuals.
- Assessors must satisfy the assessor competency requirements that are in place at the time of the assessment as set by the VET regulator.
- The assessor must demonstrate both technical competency and currency.
- Technical competence can be demonstrated through:
  - relevant VET or other qualification/Statement of Attainment AND/OR
  - relevant workplace experience
- Currency can be demonstrated through:
  - performing the competency being assessed as part of current employment OR
  - having consulted with an organisation providing environmental monitoring, management or technology related services about performing the competency being assessed within the last twelve months.

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