Australian Government

Department of Education, Employment and Workplace Relations

MSL954002A Prepare mineral samples for analysis

Revision Number: 1

MSL954002A Prepare mineral samples for analysis

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	The unit of competency covers the ability to reduce given mineral samples to representative client samples and analytical portions that meet client requirements for analysis. Personnel are also required to recognise problems and invalid preparation steps and take appropriate corrective actions.

Application of the Unit

Application of the unit	This unit of competency is applicable to technical assistants working in the mineral assay and construction materials testing sectors. 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. These are found at the end of this unit of competency under the section 'This competency in practice'.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.

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.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Interpret and schedule client requirements	1.1. Review client request to identify sample/analysis requirements, preparation methods and equipment involved 1.2. Inspect samples, compare with specifications, record and report any discrepancies 1.3. Liaise with client when samples and/or request forms do not comply with enterprise procedures 1.4. Identify hazards and enterprise controls associated with the sample, preparation methods, reagents and equipment 1.5. Plan parallel work sequences to optimise throughput of multiple sets of samples 1.6. Assemble all required equipment materials, reagents and check they are fit for purpose
2. Prepare client samples for analysis	2.1. Estimate safe times for the preparation of required sample proportions 2.2. Split samples to obtain representative sub-samples as required 2.3. Safely operate comminution equipment 2.4. Monitor texture of the samples as an indicator of particle size and adjust milling times accordingly 2.5. Monitor sample compaction and build up of residues on equipment and rectify as necessary 2.6. Record preparation difficulties that may impact on quality or cause additional client costs 2.7. Report any departure from preparation methods or client specifications 2.8. Label client samples and record chain of custody information 2.9. Store all client samples in accordance with enterprise procedures
3. Use non-destructive methods to prepare laboratory portions for analysis	3.1. Examine the recommended preparation method to identify critical steps that will affect the quality of analytical results 3.2. Closely follow each preparation step with particular attention to safety, precision and minimisation of cross-contamination of samples 3.3. Monitor parameters that indicate completion or failure of each preparation step 3.4. Analyse and record invalid preparation steps and

ELEMENT	PERFORMANCE CRITERIA
	take corrective action before repeating the procedure 3.5. Present laboratory portions for analysis in appropriate containers with all required chain of custody documentation
4. Maintain a safe work environment	4.1. Apply established safe work practices and use protective equipment to ensure personal safety and that of other laboratory personnel 4.2. Minimise the generation of waste and environmental impacts 4.3. Ensure the safe disposal of all hazardous waste and spent/surplus samples 4.4. Clean, care for and store equipment and reagents as required

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- using preparation equipment
- recognising hazards and working safely at all times
- interpreting and following preparation methods
- recognising problems and implementing corrective actions
- recognising limitations and seeking timely advice
- minimising rework, waste and environmental impact

Required knowledge

Required knowledge includes:

- geological properties of common samples, such as sulphides, oxides and silicates
- terminology, such as homogeneous, heterogeneous, integrity and segregation
- distribution of common analytes in a matrix
- chemical reactions associated with common preparation methods
- effects of reagents on the element of interest
- reaction and recovery rates, solubility and equilibria
- tracking analytes of interest during changes of state
- safety information, such as material safety data sheets MSDS
- function of key equipment components and principles of operation
- calculation steps in preparation methods (for example, serial dilution)
- non-SI units (ppm, ppb) and SI units, and conversions
- enterprise and/or legal traceability requirements
- relevant health, safety and environmental requirements

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: • recognise hazards and work safely at all times • interpret and closely follow preparation methods • prepare a range of samples that consistently meet client requirements (that is, representative, free of contamination, specified quantity and particle size and ready for analysis) • recognise problems, atypical preparation stages and implement corrective actions • achieve required sample throughput • recognise limitations and seek timely advice • minimise rework, waste and environmental impact • dispose of all waste, surplus and spent samples responsibly.
Context of and specific resources for assessment	This unit of competency is to be assessed in the workplace or simulated workplace environment. This unit of competency may be assessed with: • *MSL924001A Record and present data* • *MSL943002A Participate in laboratory/field workplace safety*. Resources may include: • a variety of mineral samples • mineral preparation methods • standard operating procedures (SOPs) • mineral preparation equipment, materials and reagents • safety equipment.
Method of assessment	The following assessment methods are suggested: • sizing checks and grind performance for samples prepared by candidate • review of preparation and production documentation prepared by the candidate

EVIDENCE GUIDE	
	• review of quality control performance and analytical results traceable to samples prepared by the candidate • written/oral questioning about preparation methods, critical steps, typical problems and corrective actions • feedback from peers clients and supervisors. 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 assessment support when required. 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.
This competency in practice	Industry representatives have provided the case study below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. **Mineral processing** A mining company provides a drill-core sample to a laboratory to determine its gold content as part of the company's resource estimation. A technician receives the sample and registers the details from the client specification sheet. He/she confirms that a 100g (75 micron) analytical portion is required with the coarse split to be retained for possible future testing. Noting from the sheet that the sample is likely to contain high levels of free gold, the technician carefully segregates it from all other samples. After drying and crushing the sample, the technician splits the coarse material and pulverises a sub-sample to the required particle size. He/she places it in a labelled packet and presents it to the assay section. The technician carefully cleans all the equipment used during processing the sample to prevent cross-contamination of samples.

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 1199 Sampling procedures and tables for inspection by attributes
	  • AS 1678 Emergency procedure guide -Transport
	  • AS 1940-2004 Storage and handling of flammable and combustible liquids
	  • AS 3780-2008 The storage and handling of corrosive substances
	  • AS 3988-1991 Copper, lead, zinc, gold and silver ores - Guide to sample preparation for the determination of gold
	  • AS 4433.2-1997 Guide to the sampling of particulate materials - Preparation of samples
	  • AS ISO 1000-1998 The international system of units (SI) and its application
	  • AS/NZS 4452:1997 The storage and handling of toxic substances
	• enterprise recording and reporting procedures
	• equipment startup, operation and shutdown procedures
	• MSDS
	• national measurement regulations and guidelines
	• principles of good laboratory practice (GLP)

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	• production and laboratory schedules • quality manuals, equipment and procedures manuals • standard operating procedures (SOPs) and published preparation methods
Samples	Samples may include: • solids, such as rocks, minerals, soils, sands and stream sediments • core and other drill samples (e.g. rotary air blast (RAB), reverse circulation (RC) and aircore) • slurries, powder concentrates and metallurgical solutions • dump samples and grab samples
Client requests/documentation	Client requests/documentation may include: • client profile, sample identification and sample receipt • preparation methods, storage and analyses required • service charges
Preparation methods	Preparation methods may include: • sorting, boxing and drying • sieving • primary crushing (e.g. 10 mm, 2 mm) • fine pulverising (e.g. 100 micron, 75 micron) • partial digestion requiring separation (e.g. aqua regia) • complete digestion (e.g. multi-acid digest) • non-destructive (e.g. LIF, $Li_2B_4O_7$ disks) • solvent extraction (e.g. di isobutyl ketone dibK)
Preparation equipment	Preparation equipment may include: • splitters (e.g. riffles and rotary dividers) • mills (e.g. ball, ring and rod) • bowls (e.g. chrome-steel, tungsten-carbide and zirconia) and tumblers • crushers (e.g. cone, jaw and roll), grinders and disc pulverisers • sieves

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	• ovens, muffle furnaces, hot plates and microwave ovens • ultrasonic baths • centrifuges and vacuum and pressure filtration • volumetric glassware/plastic ware and dispensers • analytical balances • auto-samplers • sample containers and labels
Hazards	Hazards may include: • asbestiform minerals, dust, silica and fibrous samples • chemicals, such as hydrofluoric acid, bromine, perchloric acid, aqua regia, cyanide, lead-based compounds, free-mercury and nickel compounds • noise and vibration • crushing, entanglement and cuts associated with moving machinery • manual handling of heavy loads, such as sample bags • heat, exhaustion, stress and fatigue
Safety equipment and hazard control measures	Safety equipment and hazard control measures may include: • ensuring assess to service shut-off points • recognising and observing hazard warnings and safety signs • labelling of samples, reagents and hazardous materials • direct extraction and fume hoods • guards for moving machinery parts • noise insulation • using personal protective equipment, such as masks, gloves, boots, goggles, coats, ear muffs and safety boots • following established manual handling procedures • regular cleaning of equipment and work areas using enterprise procedures • antidotes for specific hazards, such as

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	hydrofluoric acid and cyanide • reporting of abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/waste water, gasses, smoke, vapour, fumes, odour and particulars to appropriate personnel
Critical preparation steps that determine analytical accuracy and precision	Critical preparation steps that determine analytical accuracy and precision may include: • monitoring drying (incipient and total) • mixing to ensure homogeneity before sub-sampling • suitability of reagents for purpose (e.g. dryness) • accurate operation of dispensers and balances • critical/non-critical volumes and critical reagent quantities • temperature control during digests • loss of solution prior to/after mixing • type and acid strength in final solutions • mechanical loss of digest (sputtering, residues on glassware/plastic ware and filtering)
Occupational health and safety (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)

Unit sector	Sampling

Competency field

Competency field	

Co-requisite units

Co-requisite units		