



Australian Government

MSL975041 Perform fire assay techniques

Release: 1

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Modification History

Release	Comments
Release 1	This version was released in <i>MSL Laboratory Operations Training Package Release 2.0</i>. Supersedes and equivalent to MSL975010 Perform fire assay techniques. Conditional/optional prerequisite removed – code retained. Foundation skill information added. Range of conditions removed. Assessment requirements amended.

Application

This unit of competency describes the skills and knowledge to safely extract a range of precious metals from their host matrices in readiness for analysis. The unit also covers the ability to select and/or modify laboratory methods to suit particular ores and to ensure total recovery.

This unit applies to laboratory personnel working in the mineral assay industry sector.

No licensing or certification requirements exist at the time of publication. However, regulations and/or external accreditation requirements for laboratory operations exist, so local requirements should be checked. Relevant legislation, industry standards and codes of practice within Australia must also be applied.

Pre-requisite Unit

MSL973023 Perform fire pouring techniques

Competency Field

Testing

Elements and Performance Criteria

Elements describe the essential outcomes.

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

1 **Classify ore samples and**

1.1 Review client request to identify sample/analysis requirements, preparation methods and equipment

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	select fluxing method		involved
		1.2	Inspect samples, compare with specifications, record and report any discrepancies
		1.3	Conduct visual and simple chemical tests to identify the type of sample and sulphide concentrations
		1.4	Review client sample/analysis history and identify possible chemical interferences
		1.5	Decide whether non-standard fluxing is required
		1.6	Select sample weight and flux to optimise precious metal recovery and purity
2	Prepare for precious metal recovery	2.1	Identify hazards and workplace safety procedures associated with the sample, preparation methods, reagents and equipment
		2.2	Examine the recommended preparation method to identify the critical steps that will affect the quality of analytical results
		2.3	Plan parallel work sequences to optimise the throughput of multiple sets of samples
		2.4	Assemble all required equipment, materials, reagents and check they are fit for purpose
3	Recover precious metals from ore sample	3.1	Weigh required amounts of sample and flux components to achieve an acceptable button and fluid slag
		3.2	Select the type and size of pot to suit sample method and client requirements
		3.3	Mix charge to ensure homogeneity and optimal collection of precious metal
		3.4	Set and monitor furnace temperature/time to ensure complete fusion
		3.5	Separate slag and button with minimal loss of lead

Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
		collector	
		3.6	Maintain sequencing in order to track samples, buttons and prills throughout the recovery process
		3.7	Separate lead collector from the required precious metal and check for contamination, losses and evidence of other precious metals
		3.8	Minimise personal exposure to hazards and the release of collectors to the work environment
		3.9	Collate laboratory documentation and the prepared sample and present for analysis
4	Troubleshoot and correct failed recovery	4.1	Monitor all stages of recovery for indicators of potential loss
		4.2	Recognise undesirable recovery conditions and decide whether the process requires correction
		4.3	Choose an appropriate corrective action and re-start the process
		4.4	Document any adjustments made to standard methods and re-sequencing of samples
		4.5	Seek advice when problems are beyond scope of responsibility or knowledge
5	Perform daily maintenance of assay equipment	5.1	Segregate and dispose of waste in accordance with workplace requirements
		5.2	Grade and inspect pots using established criteria prior to storage for re-use
		5.3	Inspect furnaces for cracks, unserviceable components and remove slag
		5.4	Inspect and clean extractive systems
		5.5	Report defective equipment and consumable requirements to appropriate personnel

Foundation Skills

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

- Problem solving skills to:
 - identify indicators of poor recovery and contamination
 - apply knowledge of mineral chemistry and fire assay techniques to solve recovery and contamination problems.

Other foundation skills essential to performance are explicit in the performance criteria of this unit.

Unit Mapping Information

Equivalent to MSL975010 Perform fire assay techniques, Release 1.

Links

Training Package Companion Volumes -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=5c63a03b-4a6b-4ae5-9560-1e3c5f462baa>

Assessment Requirements for MSL975041 Perform fire assay techniques

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Performance Evidence

There must be evidence the candidate has completed the tasks outlined in the elements and performance criteria of this unit, and:

- safely performed fire assay techniques to extract a range of precious metals from 3 different host matrices in readiness for analysis, including:
 - maintaining sequential control of samples through all recovery stages
 - optimising work flow to ensure efficiency of recovery for multiple client samples
 - recognising and identifying the cause of non-acceptable received and fused samples, buttons and prills
 - keeping accurate and complete records, including:
 - pour sheets (date, time, client, pour number and preparation method)
 - number of pots, positions of sample, blank and check in rack
 - adjustments made to standard preparation methods for specific samples
 - analytical method
 - assay data.

Knowledge Evidence

There must be evidence the candidate has knowledge of:

- chemical and physical principles relating to:
 - fusion of mineral ores
 - cupellation
 - parting and digestion processes
- expected physical and chemical properties of materials at each recovery stage
- standard methods for the fire assay of a range of precious metal ores relevant to job role

- criteria for an ‘acceptable’ button, including:
 - one piece, mass >20g and <50g
 - malleable
 - separates cleanly from slag
 - free of undecomposed ore, matte and speiss
- causes of contamination, including:
 - poorly made cupels
 - base metals (copper (Cu), nickel (Ni), zinc (Zn) and bismuth (Bi))
 - arsenic (As), sulphur (S), antimony (Sb), selenium (Se), tellurium (Te) and chromium (Cr)
 - scoria
 - sprouting
- indicators of potential loss and the corrective actions, including:
 - viscous slag (check furnace temperature, adjust flux and lower charge weight)
 - lead shotting (adjust flux and lower charge weight to compensate for high oxides, silicates and chromites)
 - sulphides (adjust fusion time and adjust sample weight and/or flux)
 - matte, speiss (adjust sample weight and flux)
 - incomplete fusion (adjust sample weight and/or flux)
 - unacceptable button (adjust sample weight and/or flux)
 - inquartation (add 3 parts silver (Ag) to prill, wrap in lead foil and re-cupel)
- typical samples:
 - solids, such as rocks, minerals, soils, sands and stream sediments
 - core and other drill samples, such as rotary air blast (RAB), reverse circulation (RC) and aircore
 - slurries, powder concentrates and metallurgical solutions
 - dump samples and grab samples
- common fluxes:
 - bulk fluxes containing PbO, borax, soda ash, silica, silver nitrate and flour
 - non-standard flux additives such as:
 - flour (oxidising samples)
 - nitre (reducing samples, sulphides)
 - silica (basic ores)
 - PbO (siliceous ores)
 - exotic additives, such as calcium fluoride (CaF₂) (refractory ores)
 - nickel sulphide (NiS), nickel carbonate (NiCO₃), sulphur, borax and soda ash)
- methods to sequence pots in a rack:
 - addition of silver wire
 - addition of coloured salts, such as copper (Cu)
 - position of reagent blanks, standards and check samples

- common waste produced through recovery
- principles and purpose of test methods implemented (why they are used and what they demonstrate)
- technological advances that include automation
- awareness of environmental sustainability issues as they relate to the work task
- legal, ethical and work health and safety (WHS) requirements specific to the work task including traceability, confidentiality and security requirements of all client information, and laboratory data and records.

Assessment Conditions

Skills must have been demonstrated in the workplace or in a simulated environment that reflects workplace conditions and contingencies. The following conditions must be met for this unit:

- use of suitable facilities, equipment and resources, including:
 - client requests/documentation, including client profile, sample identification, sample receipt, storage and analyses, and required preparation method
 - a variety of precious metal ore samples
 - fire assay methods, examples of assay records, equipment, materials and reagents
 - assay equipment, including:
 - mixing equipment and balances
 - fusion and muffle furnaces and associated spares
 - temperature sensors and hotplates
 - compressed air service, extraction systems and fuel supply lines
 - pots, cupels, pouring equipment, pot loader, trolleys, moulds, tongs and hammers
 - safety equipment and workplace safety procedures.

Assessors must satisfy the NVR/AQTF mandatory competency requirements for assessors.

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