



**Australian Government**

# **MSL973023 Perform fire pouring techniques**

**Release: 1**

# MSL973023 Perform fire pouring techniques

## Modification History

| Release   | Comments                                                                                                                                                                                                                                                                            |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Release 1 | <p>This version was released in <i>MSL Laboratory Operations Training Package Release 2.0</i>.</p> <p>Supersedes and equivalent to MSL973011 Perform fire pouring techniques. Foundation skill information added. Range of conditions removed. Assessment requirements amended.</p> |

## Application

This unit of competency describes the skills and knowledge to follow standard procedures for extracting precious metals from their host matrices in readiness for analysis. Fire pourers are expected to handle routine samples, recognise common sample preparation and cupellation problems and make standard adjustments to fluxes and firings. They are expected to seek advice from their supervisor when non-routine problems arise.

This unit of competency 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

Nil

## 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 | <b>Plan work for shift</b> | 1.1 | Review job requests to identify the samples, preparation methods required for each, and shift priorities |
|---|----------------------------|-----|----------------------------------------------------------------------------------------------------------|

- 1.2 Identify hazards, safety equipment/procedures associated with samples, preparation methods, reagents and equipment
  - 1.3 Plan parallel work sequences to optimise the throughput of multiple sets of samples during shift
  - 1.4 Assemble all required equipment, materials, reagents and check they are fit for purpose
  - 1.5 Check pots and cupels and discard those with faults and/or a record of high gold values
  - 1.6 Check that fusion and muffle furnaces are operating at the specified temperatures
- 2 **Prepare sample racks for fusion**
  - 2.1 Check samples against accompanying documentation and record/report any discrepancies
  - 2.2 Conduct simple visual/chemical tests for each sample to assess the adequacy of prior sample preparation and possible presence of sulphides or other mineralogy
  - 2.3 Weigh out the recommended amount of sample and add specified identifier to maintain orientation, as necessary
  - 2.4 Weigh out flux components, mix thoroughly with the sample charge and transfer to recommended type and size of pot without loss of material
  - 2.5 Place pots in racks
  - 2.6 Record all required details of sample preparation to ensure traceability of samples
  - 2.7 Seek advice to deal with any situation beyond scope of responsibility or knowledge
- 3 **Obtain acceptable buttons and prills**
  - 3.1 Maintain sequencing in order to track samples, buttons and prills throughout the recovery process
  - 3.2 Monitor furnace temperature/time to ensure complete sample fusion
  - 3.3 Remove fused samples from furnace and pour into

- moulds with minimal loss of material
- 3.4 Recognise the need for repeat firings due to lead shotting and/or poor fusions
  - 3.5 Separate slag and button with minimal loss of collector
  - 3.6 Inspect buttons for matte, brittleness, size and malformed shape
  - 3.7 Place acceptable buttons in muffle furnace using cupels that have been previously loaded and preheated
  - 3.8 Regularly monitor furnace temperature/time/air flow to ensure efficient cupellation
  - 3.9 Recover prills, check identifiers and inspect for contamination, losses and evidence of other precious metals (e.g. high gold, Platinum and Palladium)
  - 3.10 Complete and collate sample records before presenting prills for analysis
- 4    **Troubleshoot and correct common recovery failures**
- 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 Apply an established corrective action and restart 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 Grade and inspect pots using established criteria prior to storage for re-use
  - 5.2 Report defective equipment and consumable requirements to appropriate personnel

|   |                                         |     |                                                                                                               |
|---|-----------------------------------------|-----|---------------------------------------------------------------------------------------------------------------|
| 6 | <b>Maintain a safe work environment</b> | 6.1 | Use safe work procedures and personal protective equipment (PPE) to ensure personal safety and that of others |
|   |                                         | 6.2 | Minimise the release of collectors to the work environment                                                    |
|   |                                         | 6.3 | Segregate and dispose of waste in accordance with workplace requirements                                      |

## Foundation Skills

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

- Learning skills to:
  - minimising re-work, waste and environmental impacts and disposing of all waste responsibly
  - manually handling heavy and hot items of equipment safely
- Numeracy skills to:
  - recognise the presence of highly oxidised ores, such as haematite or magnetite, and adjusting the charge weight and flux components to suit
  - accurately weighing samples and flux components
  - maintaining sequential control of samples through all recovery stages
  - 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
    - visual appearance of samples, buttons and prills
    - corrective actions for specific samples
  - planning work flow to ensure efficient sample throughput

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

## Unit Mapping Information

Equivalent to MSL973011 Perform fire pouring techniques, Release 1.

## Links

MSL Laboratory Operations Companion Volume Implementation Guide is available from VETNet -

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

## Assessment Requirements for MSL973023 Perform fire pouring 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 and effectively extracted precious metals from the host matrices in readiness for analysis on at least 3 occasions, including:
  - maintaining close attention to technical and safety requirements in a physically demanding, hazardous environment
  - recognising common sample preparation and cupellation problems and making standard adjustments to fluxes and firings
  - recognising non-acceptable characteristics of received and fused samples, buttons and prills
  - recognising indicators of poor recovery and applying established corrective actions.

### Knowledge Evidence

There must be evidence the candidate has knowledge of:

- workplace procedures and/or standard methods for:
  - fusion of common mineral ore samples
  - cupellation of buttons
  - digestion/parting of prills
  - specific samples, sites and clients (labelling, preparation, storage, transport and disposal)
  - published preparation methods
  - recording and reporting
  - waste minimisation and safe disposal
- common samples:

- 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
- sequencing of pots in a rack:
  - addition of silver wire or silver nitrate ( $\text{AgNO}_3$ ) mix
  - addition of coloured salts (e.g. copper sulphate  $\text{CuSO}_4$ )
- separation of collectors:
  - cupellation; digestion; and/or parting, annealing and weighing for a gravimetric finish
- function, operation and maintenance of assay equipment used in job role
- typical hazards
- criteria for an 'acceptable' button, including:
  - one piece, mass >20 g and <50 g
  - malleable
  - separates cleanly from slag
  - free of undecomposed ore, matte and speiss
- causes of contamination and losses, 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 action, including:
  - viscous slag (check furnace temperature, adjust flux and lower charge weight)
  - lead shotting – (adjust flux, lower charge weight to compensate for high oxides, silicates and chromites)
  - sulphides (adjust fusion time, 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 three parts silver (Ag) to prill, wrap in lead foil and re-cupel)
- workplace and legal traceability requirements
- 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.

## 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:
  - a variety of precious metal ore samples and associated fire assay methods, fire assay materials and reagents
  - client requests and documentation: client profile, sample identification, sample receipt, storage and analyses, required preparation method and service charges
  - assay equipment, such as:
    - mixing equipment and balances
    - fusion and muffle furnaces and associated spares
    - temperature sensors and hotplates
    - compressed air service, extraction systems and fuel supply lines
    - cupels, pouring equipment, pot loader, trolleys, moulds, tongs and hammers
    - pots, including ceramic, acidic/basic, alumina, zirconia and graphite
  - collectors, including litharge or lead (II) oxide (PbO) for pot fusion and silver (AGNO3) for the cupellation
  - fluxes
  - non-standard flux additives
  - safety equipment and safe work procedures.

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

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