



LBMA



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The LBMA: Proactive Monitoring Programme

The Role of the Supervisor

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Precious Metals Manager for Stewart Group





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Stewart Group and P.A.M.

- **This presentation will give an overview of the Pro Active Monitoring (“P.A.M.”) process, including:**
 - Requirements of the refiner
 - Supervisor notification, appointment & logistics
 - Coordination of equipment
 - Methods of sampling (Silver and Gold), Packaging & Distribution
 - Refinery debriefing
 - Final report
 - Observations since the inception of the P.A.M. Programme in 2004
- **Stewart Group is one of the officially appointed LBMA Supervisors to the Good Delivery System.**
- **Stewart Group is the world’s largest privately owned independent supervision and assaying company. With our head office based in Liverpool, UK, we have a global network of offices and laboratories .**



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P.A.M. Schedule

- **Frequency of Testing**
 - Refiners can expect to be monitored a minimum of once every 3 years
 - Monitoring rounds began in 2004
 - We are currently in the 3rd round of testing for the refiners tested at the start of the P.A.M. programme .
- **Purpose for P.A.M Testing**
 - The LBMA operates a system of monitoring the quality of the production and assaying ability of refiners on the Good Delivery List. This involves refiners providing on request a dip sample from a normal production melt which will be check-assayed by one of the LBMA's referees.
 - The ongoing monitoring on a regular basis of the refiners refining and assaying ability is helping to ensure that the stringent initial requirements for joining the Good Delivery List continue to be met.
- **Geographical Areas**
 - Generally 3-4 rounds per year are arranged
 - Each round is dedicated to a geographical area



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Supervisor Notification & Appointment

- **Refiner will appoint a Supervision Company**
 - Appointment will be confirmed by fax or email, giving a document trail
- **Refiner and supervisor then agree on an inspection date**
 - Range of attendance dates provided by refinery
 - Supervisor confirms a mutually suitable date and schedule for the monitoring.





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Format for the P.A.M. Inspection

- **LBMA Notification to the Refiner**

- Nomination for testing is advised directly by the LBMA
- The Refiner has approximately one month to carry out the testing
- Flexibility of the deadline is negotiable if this is during scheduled or forced shutdowns or holiday periods for example
- If a refiner produces both gold and silver, it can be tested for both metals at the same time.

- **Four nines (999.9) producers**

The LBMA considers that all refiners on the Good Delivery Gold List must be able to assay across the full range of Good Delivery alloys, (namely a fineness range from 995.0 to 999.9) most of which can only be accurately assayed using the corrected fire assay method.

- At the higher end of this range spectrographic methods can provide assays of the necessary precision and accuracy without requiring the use of fire assaying.
- However, spectrographic procedures cannot be used to demonstrate that the refiner is able to assay over the full range of Good Delivery alloys.
- For Refiners where their production technology and products marketed involves only gold with a fineness of 999.9 and above, the LBMA recognizes the difficulties that may be encountered if they were required to produce a special low gold content alloy for the sole purposes of LBMA monitoring.



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Format for the P.A.M. Inspection

- **Four nines (999.9) producers (cont'd)**
 - Therefore, the “four-nines” Refiners which, for the reasons described above, are unable to provide a gold dip sample with a fineness of less than 999.0, may instead elect to have a different form of monitoring whereby they will be sent a set of 6 reference samples (ranging in fineness from 995.0 to 999.9) for them to assay using the corrected fire assay method.
 - These reference samples will be provided by the LBMA and will have been produced and cross checked to the highest standards by the panel of Good Delivery Referees.
 - On receipt of the samples, the refiner must submit to the LBMA within six working days a report showing the mean assay of each sample to five significant figures.



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Coordination of Equipment

- **Supervision company will hold a supply of LBMA Gold and Silver moulds**
 - The supervision company will forward the relevant mould(s) to the local office or supervisor (representative) or alternatively directly to the Refiner.
 - Occasionally, moulds are forwarded directly to a refinery representative, whereupon the Refinery will assume responsibility of the mould(s) and must confirm receipt
 - Moulds should be returned to the Supervision Company upon completion of monitoring
 - Delivery of the moulds must be assured – preferably 3 days in advance latest
 - If the Refinery wishes to perform some trials using the moulds prior to the date of performing the PAM inspection, this is acceptable .





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Method of Sampling

- The actual method of taking and casting the dip sample can be either of the following:
 - a) The Refiner can use a standard LBMA mould.
 - b) The Refiner can use its normal method of dip sampling with alternative moulds, (provided that this will produce the required acceptable samples).
- The Refiner should ensure that the mould is preheated and properly dressed as required, before the dip sampling is carried out.

After pouring the dip sample, the metal can then be cast into bars or grain as per the Refiner's normal production process.

If the bars are cleaned, weighed and stamped during the inspection, these marks will be recorded by the representative. However, based on our experience at the majority of locations, these operations are invariably not carried out immediately and therefore this information will not be recorded on the Supervisors report.



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Witnessing of Dip Sampling Operations

- **Witness a Normal Production Melt**

- The purpose of taking the dip sample is to provide sufficient homogeneous material to provide the samples to be assayed by the refiner and the LBMA's referees, together with enough spare samples in case of various eventualities.
- The dip sample melt should have a fineness of :
 - Au 995.0 to 999.0
 - Ag 999 or above
- Sample should be taken from a normal production melt
- It is not necessary for Supervisor to witness the charging of the metal
- All operations following charging should be witnessed
- Supervisor should be confident about Homogeneity of the melt
- Melt may have been homogenised by induction melting or manual stirring
- The dip sample is taken from final stage of melting, preceding casting



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Witnessing of Dip Sampling Operations

- **Examples of equipment required**
 - LBMA Certified Mould,(alternative moulds can be used providing these produce a suitable sample.
 - Ladle
 - G Clamp
 - Guillotine/Shears





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Preparation, Weighing and Distribution

- A total of 8 final samples will be prepared.
- The 8 samples should be individually weighed and the weights recorded on both the numbered outer sample envelopes and the sampling report.
- Weighing of the samples should be carried out on a balance weighing to a minimum of 0.10 gram.
- The samples will be packaged in the Supervisors official sampling envelopes and sealed by the Supervisor.
- Two of these samples will be sent directly by the Supervisor to the LBMA, via courier as soon as possible after the monitoring operation. On receipt of the two samples by the LBMA, one sample will be sent according to a rota to one of the LBMA's referees who will be asked to assay the sample to five significant figures. It should be noted that the referee will not be aware of the identity of the refiner that provided the sample
- The Proforma invoice accompanying the 2 samples for the LBMA should have the narrative "Analytical Sample of No Commercial Value" and the value shown should be a nominal amount.
- One sample will be allocated for the Refiner for assaying purposes. and the remaining five sealed samples will be retained at the Refinery.



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Refinery de-briefing

- Supervisors will forward a standard operational monitoring report to LBMA, this will include :
 - Description of the material being monitored
 - Full description of the melting and dip sampling operations
 - Debriefing with the Refinery Manager
 - Weights, measures and bar numbers (where available)
 - Additional comments.



Official LBMA Report

- The Supervisor will report to the LBMA using a standardised format (right)
 - This report will be submitted to the LBMA within 4 days of completing the dip sampling completion
 - The report is not issued to the Refinery



Appendix 4 – Form of Supervisor’s Report on Dip Sampling Operations

Please return to: _____
 The Chief Executive
 London Bullion Market Association
 13/14 Basinghall Street, London EC2V 5BQ
 T: +44 (0) 20 7796 3067 F: +44 (0) 20 7796 2112

Supervising Company _____

Supervisor's Representative _____

Date of Monitoring Operation _____

Refiner (Company Name) _____

Refiner Location _____

Refinery Manager or Representative _____
 (Position _____)

Metal being monitored _____

Description of commercial melting _____
 Operation witnessed _____
 (purpose, target assay, raw materials, _____
 Melting method, homogenisation time) _____

Description of dip sampling _____
 Method of dip sampling used _____
 Type of ladle used (e.g. new graphite) _____
 Mould used (LBMA or refinery) _____
 Cats Dip sample weight n (g) _____
 Method of subdivision of dip samples _____
 Weights of individual samples _____
 Method of sealing dates _____
 Description of samples left at refinery _____
 Method and date of despatch two samples to the LBMA (including weights) _____

Supervisor or post s sampling _____
interview Comments (if any) _____

Signed by Supervisors Representative _____ on _____



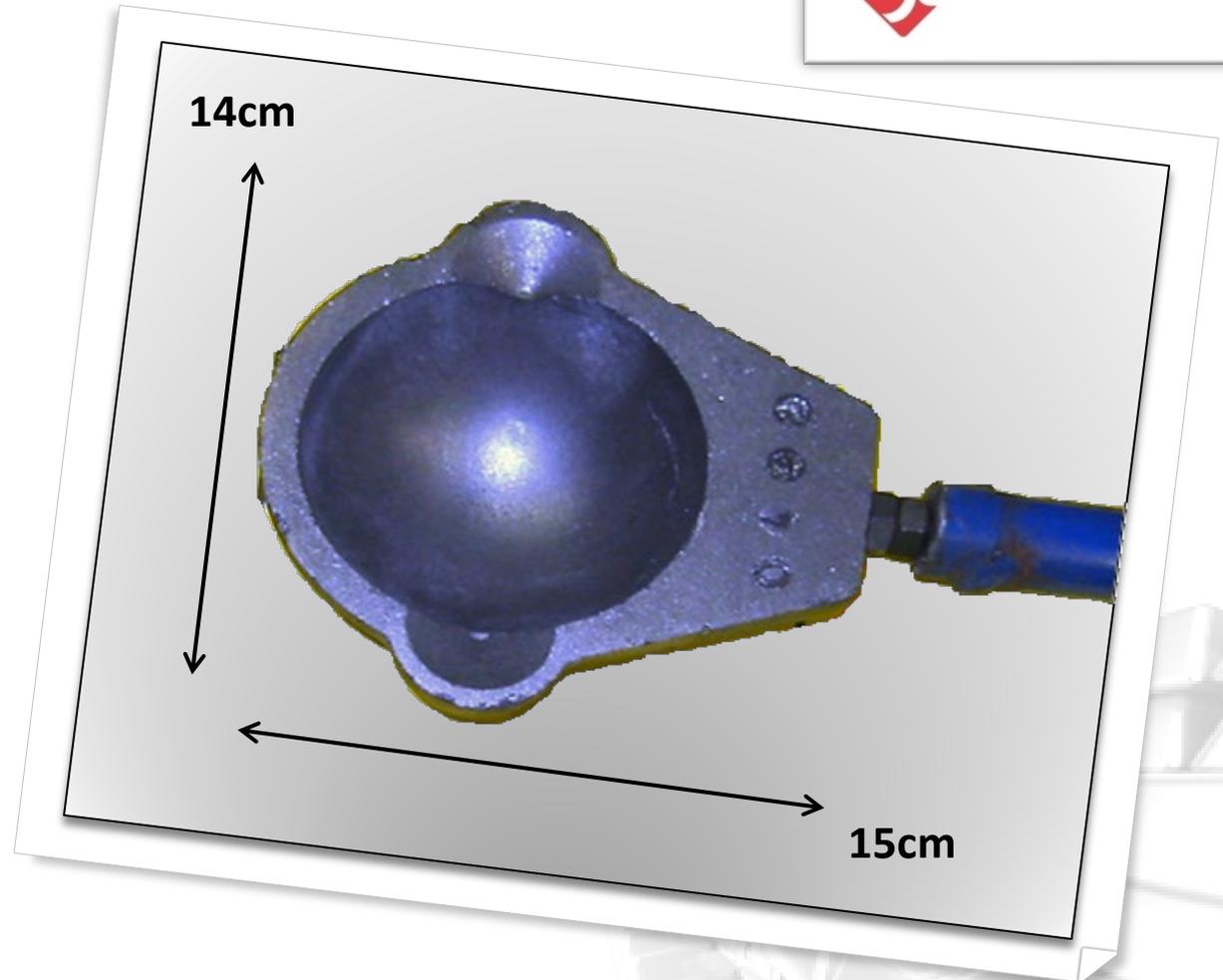
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Example of Equipment

Example of Ladle





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Example of Equipment

G Clamp





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Example of Equipment Required

Guillotine / Shears





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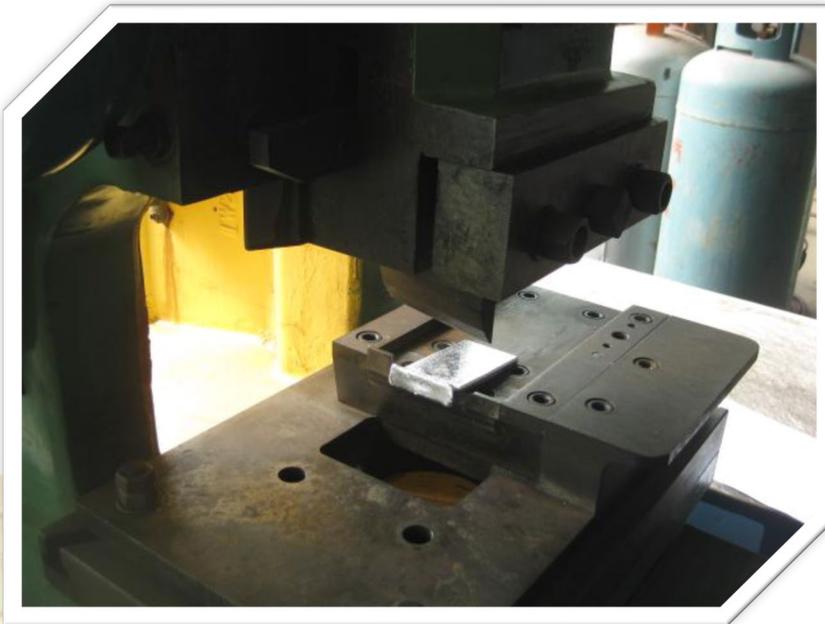


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Example of Equipment Required

Mechanical Shear

Mechanical Shear





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Example of Equipment Required

Official LBMA Gold Mould





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Example of Equipment Required

Official Silver LBMA
Mould





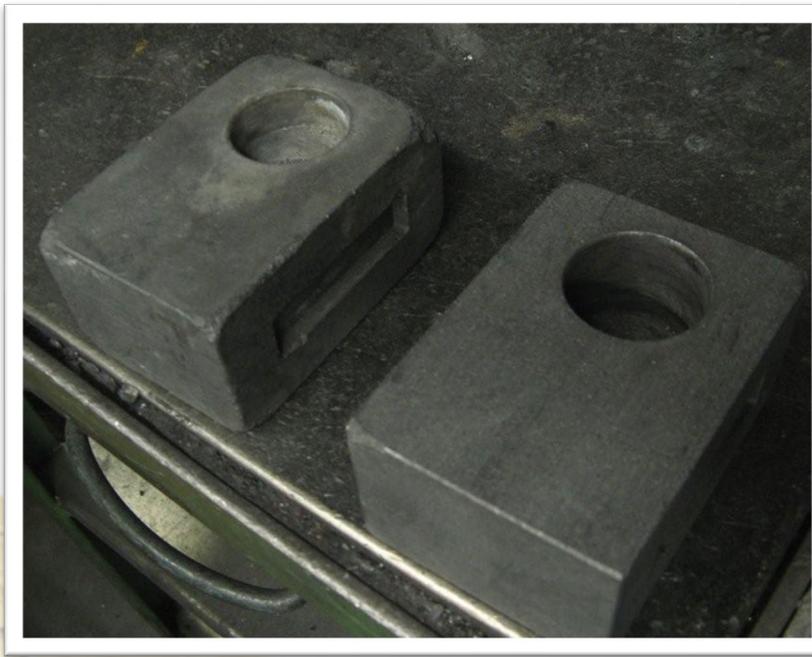
LBMA



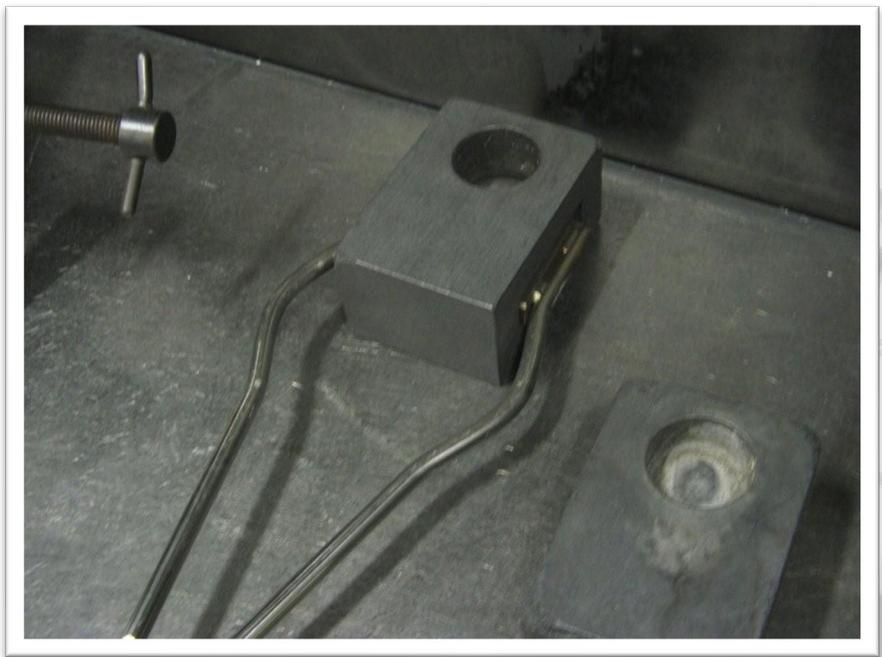
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Example of Equipment Required

Alternative Mould



Alternative Mould (and Clamp)





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Method of casting the sample

Gold Sample

Silver Sample





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Samples after pouring using G-Clamp

Gold Sample

Silver Sample





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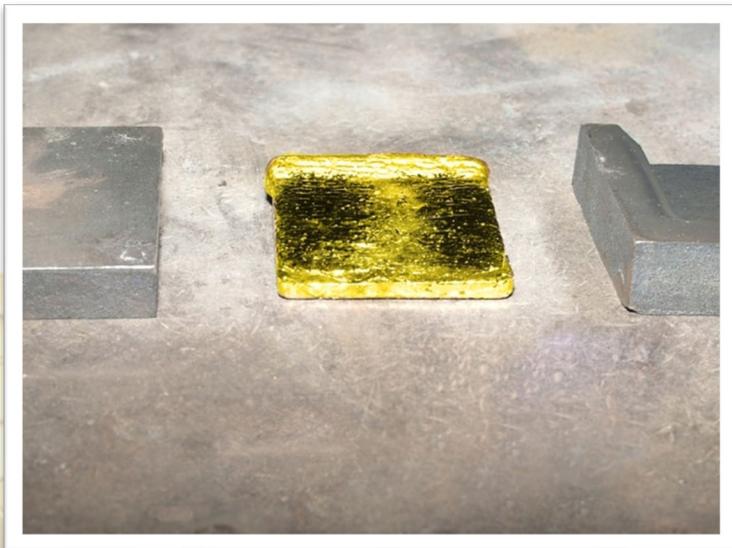


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Samples Produced

Gold Mould

- Two Part, Cast Iron
- Internal: 50 x 60 x 6 mm
- Top funnel: 20 mm
- Approx weight: 350 gms-450 gms



Silver Mould

- Two Part, Cast Iron
- Internal: 100 x 60 x 6 mm
- Top funnel: 20 mm
- Approx weight: 350-450 gms





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Melting Procedure

Preheating Moulds

Charcoal added to Silver Melt





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Melting Procedure

Melting Silver Grain

Stirring Silver Grain





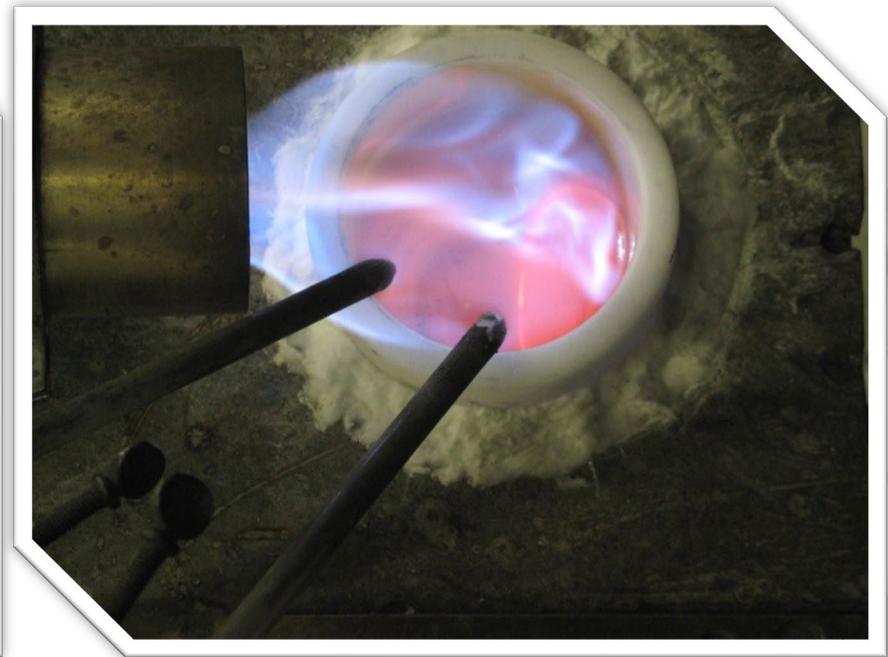
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Melting Procedure

Preheating prior to taking Dip Samples





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Melting Procedure

Pouring the Silver Sample

Recording Melt Temperature





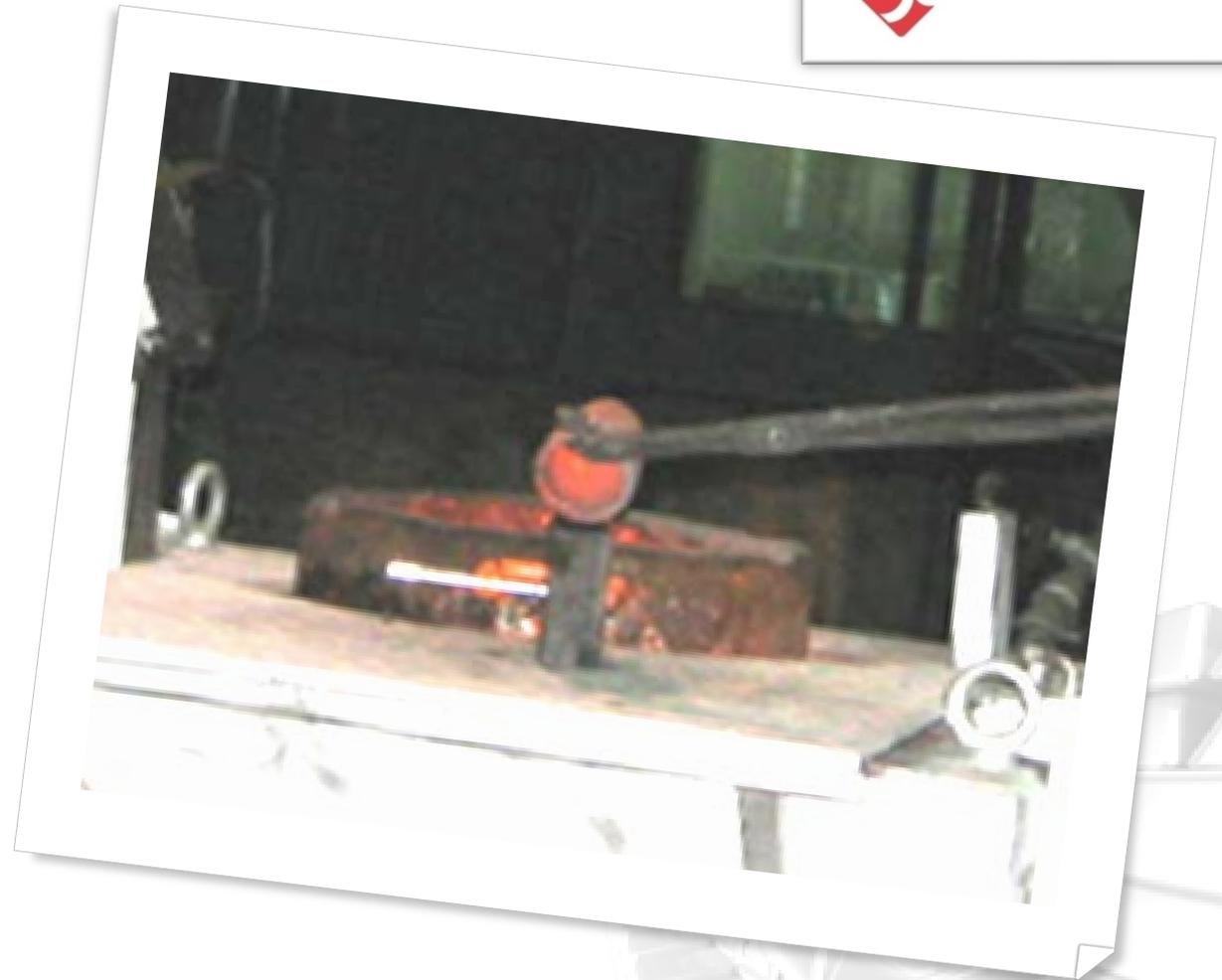
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Sampling Procedure

Pouring the Silver
sample from a
sample crucible





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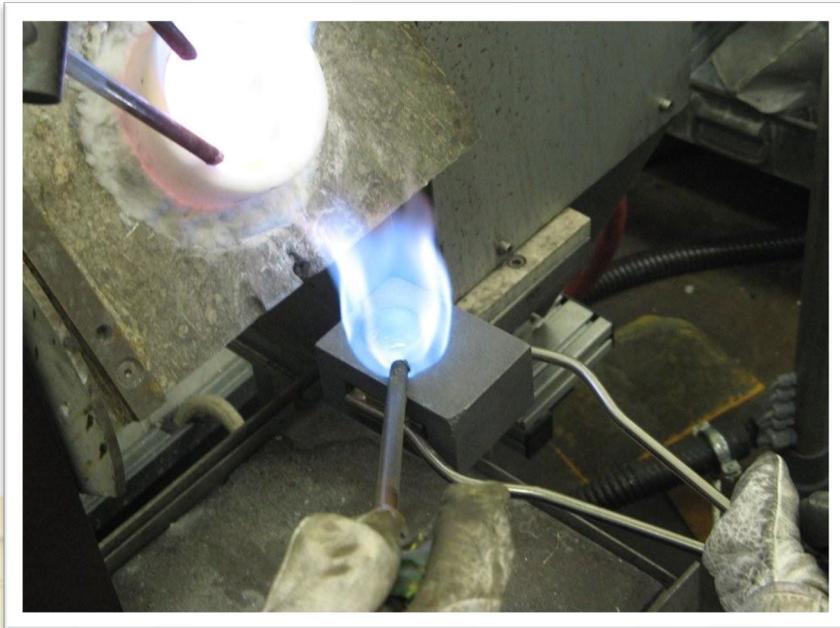


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Sampling Procedure Using an Alternative Mould

Casting dip sample

Button samples produced





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Cutting Samples

Gold Samples



Silver Samples





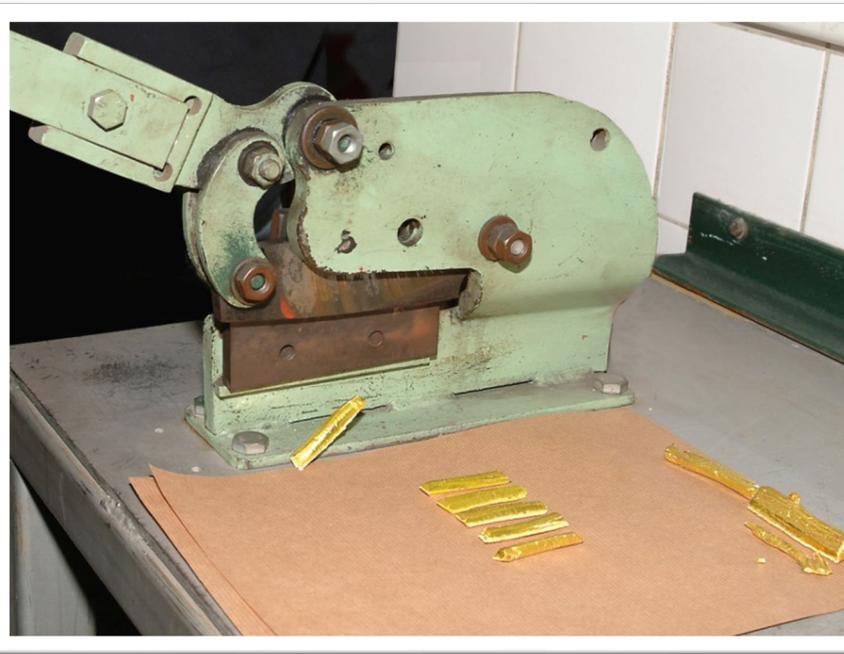
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Cutting Samples

Gold Samples



Silver Samples





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Cutting Samples

Gold Samples



Silver Samples





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Weighing Samples

Gold Samples



Silver Samples





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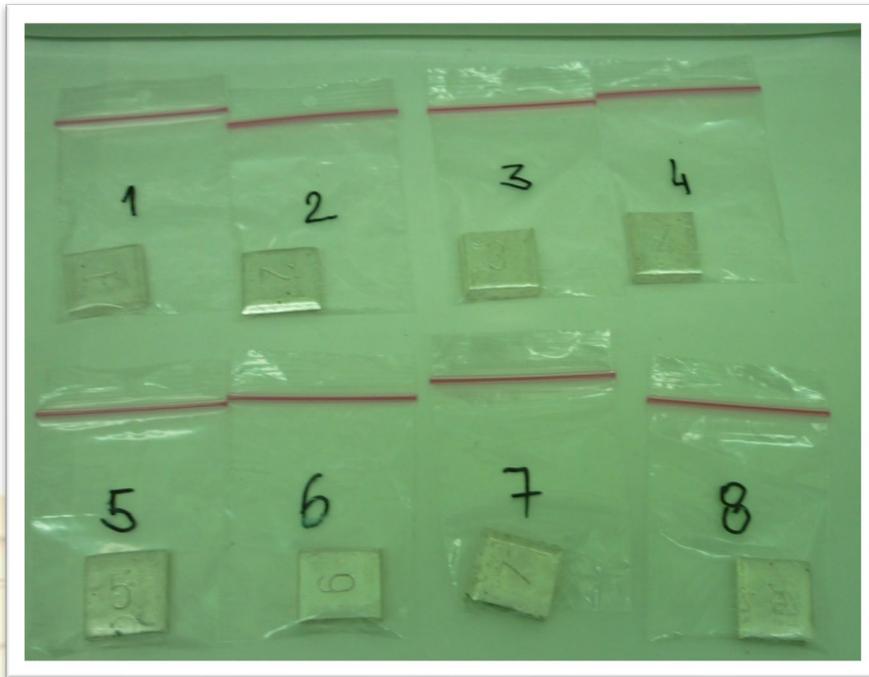


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Weighing and Dispatch of Samples

Bagged / Numbered Samples

Example of Sample Envelope



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Fax +44 (0)151 548 0714
www.stewartgroupglobal.com

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Material LBMA GOOD DELIVERY GOLD (999)

~~Ref~~ XXXXX REFINERY LTD Wet Weight

SG ~~Ref~~ SALES ORDER # Dry Weight

Local Office Ref. PURCHASE ORDER # Moisture Content

Client Ref. _____ Sampling Date 07/03/2011

~~Ref~~ / Works XXXXX REFINERY LTD Sample Sealing Date 07/03/2011

~~Ref~~ No. LBMA PRO-ACTIVE-MONITORING (SAMPLE N^o 2 of 8)

No. of Bags / Drums x

SAMPLE WEIGHT = 15.0gms



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Review

Since the inception of the PAM Programme in 2004, Stewart Group has to date been appointed on close to 100 gold & silver PAM inspections involving refineries based in 18 countries.

We have compiled a database on the various procedures adopted by the refineries, with the following general observations:

MOULDS

- The majority of the refineries tested chose to use the dedicated LBMA gold & silver moulds. Three refineries however chose to cast the samples into their own button moulds or similar mould to the LBMA two-section moulds which also resulted in suitable samples for assaying.
- All moulds were pre-heated and generally prepared using gas black, carbon, refined kerosene and proprietary mould additives etc.
- We should also mention that with the exception of two inspections that the LBMA moulds have been very successfully deployed throughout the PAM campaigns. However it was noted that one refiner had to wash the moulds several times before usage in order to remove some fine iron particles from the mould surface.
- On another occasion the silver mould which had been used for several previous PAM inspections required replacing due to worn /pitted internal surfaces.
- The LBMA has in fact addressed this situation and ordered additional moulds with smoother surfaces to replace any worn moulds and to supplement their stock.
- It is the responsibility of the independent inspectors and the refineries to ensure beforehand that the mould/s to be used are in a satisfactory condition.



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Review (cont'd)

FURNACES:

- Medium/High Frequency Induction furnaces were most prevalent followed by gas, oil, kerosene, LPG with an oxy-acetylene torch also used by one gold refinery.

CRUCIBLES:

- Silicon carbide ,carbon, alumina/silica graphite & ceramic.

FLUXES

- This varied considerably between refiners with some refiners melting without the addition of fluxes.
- Fluxes used included charcoal, carbon, quartz sand, nitre, soda, borax, calgon, saltpeter.
- Several refiners added charcoal/carbon/wood blocks to their silver melts to reduce oxidation also the application of an argon gas flame to the metal surface was another option applied to excel extra air.

MATERIAL SAMPLED

- This varied considerably with charges generally ranging from 5 to 200Kgs for gold and from 30 to 2000 Kgs for silver.
- The melting temperatures were recorded at the majority of locations with the following average ranges of temperature noted:
 - 1100 to 1300 degrees C for Silver.
 - 1200 to 1300 degrees C for Au.



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Review (cont'd)

CLEANING OF SAMPLES

- Samples were cleaned using various methods including wire brushing, polishing, acetone/chemical cleaning also ultrasonic immersion.

CUTTING OF SAMPLES

- Options included: manual and mechanical guillotine cutting, hydraulic shears, cable cutters, milling machines, electronic cutting devices and mechanical saws.

ADDITIONAL OBSERVATIONS

- **“Four-Nines” Gold Refiners**
 - We noted that three refineries which are producers of 9999 gold added silver to their gold melt during the Pro-Active Monitoring. The reason being was to dilute the 9999 gold content to obtain suitable assay samples for analytical purposes..
 - Although not specifically stated in the current PAM Procedures and Criteria, the correct practice should be to melt and assay the refiners gold production only and therefore assay for gold only rather than determining the gold content on a binary sample.
 - There are special arrangements in place for the monitoring of gold refiners whose production technology involves only “four-nines” gold.
 - As previously mentioned, the monitoring of these refiners will involve them testing a set of 6 reference samples provided by the LBMA..



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Review (cont'd)

CONCLUDING REMARKS

- We would like to thank all the Refiners involved in our PAM inspections for their kind co-operation also the LBMA for inviting us to give this presentation at the Refining and Assaying Seminar.



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Thank you



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