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# Certificate of Analysis

**Reference Material: AUOA-1**

| | 95% Confidence Interval | | Standard Deviation |
|---|---|---|---|
| **Recommended Value** | **Lower Limit** | **Upper Limit** | |
| 6.2725 | 6.1585 | 6.3866 | 0.2060 |

**Table 1 Recommended Values and 95% Confidence Intervals of Gold Concentration (in ppm, or µg/g). Based on the results of 15 laboratories.**

## 1. Date of Certification

September 2007

## 2. Certificate Status

Original

## 3. Supplier of Reference Material

Western Mineral Standards
54 Helen Street
Bellevue 6056 Western Australia

## 4. Prepared and Certified by

Dr John Henstridge
Principal Consultant Statistician
Data Analysis Australia
97 Broadway
Nedlands, WA, 6009

Dr John Henstridge

## 5. Available Packaging

This reference material is packed in 2kg PE screw cap jars, labelled with the identification code, the expected value and standard deviation of the gold concentration, health warning and the manufacturer's contact details. They are also available in cartons of six jars, and each carton will include this certificate of analysis.

## 6. Origin of Reference Material

This reference material is an oxide gold ore from west of Cue, Western Australia.

The reference material has been well mixed. The entire batch was tested to ensure that the gold was evenly distributed throughout the material.

## 7. Intended Use

Gold Assay standards provided with associated geochemistry data.

## 8. Instructions for Use

Weigh out the usual quantity used in the analysis for total gold by the normal procedure. Homogeneity testing has shown that consistent results can be obtained for gold when using samples of 30 to 40 grams.

## 9. Method of Test Material Preparation

Gold was added to the ore matrix material to give the required grade. The appropriate amount of 99.99% fine gold at <10μm particle size was added to 1kg of matrix material and mixed for 24 hours in a jar mixer. This 1kg was then added to one tonne of the bulk matrix material in three lots, with continuous mixing. The bulk material continued to be mixed for a total of 24 hours. The material was then riffle split seven times and remixed for an additional 24 hours.

Following mixing, the reference material was discharged from a homogenous mixer through a vibrasonic sieve into large bags. A one-kilogram sample was taken after every 200 kilograms of the material was discharged. These one-kilogram samples were numbered in order of being discharged, then divided into six subsamples of between 125 and 250 grams. An additional five one-kilogram samples were taken randomly from the bags into which the material was discharged and these were each divided into four subsamples of approximately 250 grams. This sampling process ensured enough subsamples were available for the reference material to be analysed in conjunction with other reference materials, which were prepared in two tonne batches.

The subsamples were placed into zip lock bags, and then labelled with random identifiers. To ensure laboratory confidentiality, the labelling was done by staff from Data Analysis Australia.

The laboratories participating in this certification process were sent either two or three of the subsamples. In addition, two laboratories were sent an extra subsample from each of the five ordered one-kilogram samples. The laboratories were also sent a number of subsamples from seven other reference materials that were being analysed for certification. An indication of the expected gold concentration was given in broad terms, with a range of four parts per million.

## 10. Homogeneity Tests

The homogeneity test was incorporated into the methodology by ensuring that two laboratories received subsamples from each ordered sample of the reference material (see Analytical Methodology). There was no evidence that this reference material was non-homogenous across the one-kilogram samples.

## 11. Analytical Methodology

This reference material was analysed for certification along with seven other reference materials, which allows the use of more powerful statistical techniques in the certification. Performing the certification in this manner also provides the following advantages:

- "Blinding" of the laboratories, in that they did not know which reference material each sample corresponded to, so the laboratory did not have prior knowledge as to what result they should obtain. The inclusion of the expected range of the gold concentration was to assist the laboratories in their analysis, and did not provide enough information for the laboratories to know which reference material was in each sample.
- Improved ability to detect bias between laboratories, such as if one laboratory gives results that are consistently higher/lower than other laboratories for all standards; and
- Ability to detect bias in the results between laboratories for each standard separately.

Sixteen laboratories were randomly allocated an identifying letter from A to P. The set of subsamples was designed in such a way that each laboratory received at least two subsamples of each reference material. These subsamples were taken from different ordered samples in such a way to eliminate the confounding of laboratory against the order of the sample. Table 2 shows the set of subsamples received by each laboratory, where AUOA-1 has been labelled as reference material F.

The subsamples were labelled with random identifiers so the laboratories were unaware of the reference material and one-kilogram sample that the subsample came from. This provided a means of determining whether a laboratory had an overall bias or a problem of precision.

| | Ordered One Kilogram Sample* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lab** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **A** | D G | A F | B *f* | B H | A G | B E | C *f* | C E | D H | A E |
| **B** | A *f* | D H | C E | A H | B E | D G | A G | B H | B G | C F |
| **C** | C *f* | E G H H | A E | A G G H | *f* H | A D G H | B E | B D G H | C G | D G H H |
| **D** | E H | C G | B D | G H | A D | C F | *f* H | A G | A *f* | B E |
| **E** | B E | D G | D H | F H | E G | C H | A D | A C | B *f* | C G |
| **F** | D G | B F F G | A C | F F G G | C H | B E F G | E G | F F G H | E H | A D F G |
| **G** | A D | C F | C G | E G | D *f* | B G | C H | B H | A E | B F |
| **H** | C *f* | A E | B H | E F | B G | A D | D *f* | E G | D G | C H |
| **I** | C H | B E F H | B *f* | D F F H | C E | A F F H | B G | A F G H | D H | A E F H |
| **J** | B E | D H | A G | D E | A *f* | C H | C E | D F | C *f* | B G |
| **K** | B G | A D | A E | C E | B D | E H | A *f* | F H | C G | D H |
| **L** | A D | C G | *f* H | C D | E H | B G | B D | C E | B E | A F |
| **M** | A *f* | C H | D H | B D | A C | D G | E H | E G | B *f* | C G |
| **N** | C H | B F | E G | B C | D G | A F | A C | B D | A D | E H |
| **O** | E H | B G | C G | A C | B H | C F | D G | D F | A E | B F |
| **P** | B G | A E | D *f* | A B | C *f* | E H | B H | A C | C H | D G |

**Table 2 Set of subsamples by laboratory. The reference materials being tested have been labelled A through to H, with AUOA-1 labelled F.**
*Samples labelled in lowercase and italics were randomly taken from the discharge bags and are therefore not ordered.

## 12. Calculation of Certified Values

Results for Gold via Fire Assay were returned by 16 laboratories. These results were used to calculate the recommended values and 95% confidence intervals for gold concentrations in each of the materials.

The Analysis of Variance (ANOVA) technique was used to assess the homogeneity of the reference materials across the one-kilogram samples and also to identify outliers in the gold concentration. Outliers were detected and removed by comparing individual results, sample results and overall laboratory results. Once the outliers were removed and the homogeneity of the reference material was confirmed, the remaining results were used to calculate the certified values.

The results from Laboratory L showed a high level of variability across all reference materials. All results from this laboratory were therefore excluded from the analysis. For this reference material, the remaining fifteen laboratories returned a total of 95 results across 48 subsamples. One result was removed as an outlier. A summary of the results from the laboratories is given in Table 3, showing average values with and without outliers. A laboratory result marked with an asterisk signifies that some of that laboratory's results were identified and removed as outliers.

The recommended value was calculated as an average of the laboratory average gold concentrations, and the confidence interval was created using the average and standard deviation of the laboratory averages. The confidence interval is calculated using the following formula:

$$X \pm (t * s / \sqrt{n})$$

where $X$ is the average and $s$ is the standard deviation of the laboratory averages, $n$ is the number of laboratory averages used and $t$ is the 0.025 critical value of the Student's t-distribution. The recommended values and confidence limits are given in Table 1 on the first page of this certificate.

| | Average Gold Concentration (µg/g) | |
|---|---|---|
| Laboratory | Fire Assay (Outliers Removed) | Fire Assay |
| A | 5.987 | 5.987 |
| B | 6.458 | 6.458 |
| C | 6.188 | 6.188 |
| D | 6.263 | 6.263 |
| E | 6.465 | 6.465 |
| F | 6.257 | 6.257 |
| G | 6.143 | 6.143 |
| H | 6.060 | 6.060 |
| I | 6.192 | 6.192 |
| J | 6.158 | 6.158 |
| K | 6.075 | 6.075 |
| M | 6.420 | 6.420 |
| N* | 6.277 | 5.995 |
| O | 6.808 | 6.808 |
| P | 6.338 | 6.338 |

**Table 3 Average gold concentrations (µg/g) by laboratory and method. An asterisk indicates that outliers were removed.**

## 13. Notice

The reference material AUOA-1 and this certificate have been prepared with the appropriate care and attention. This certificate conforms to the requirements outlined in the ISO Guide 35, Reference materials – General and statistical principles for certification, 2006 edition. The Purchaser by receipt hereof releases and indemnifies Data Analysis Australia and Western Mineral Standards from and against all liability and costs arising from the use of this material.

## 14. Participating Laboratories

The laboratories that agreed to participate are shown in Table 4.

| Laboratory | State/Province | Country |
|---|---|---|
| Acme Analytical Laboratories Ltd | British Columbia | Canada |
| Activation Laboratories | Ontario | Canada |
| ALS Chemex Canada | British Columbia | Canada |
| ALS Chemex Perth | Western Australia | Australia |
| Amdel Adelaide | South Australia | Australia |
| Amdel Macraes | | New Zealand |
| Amdel Perth | Western Australia | Australia |
| Ammtec | Western Australia | Australia |
| Genalysis (Perth) | Western Australia | Australia |
| ITS Jakarta | Jakarta | Indonesia |
| SGS del Peru S.A.C. | San Isidro | Peru |
| SGS Kalgoorlie | Western Australia | Australia |
| SGS Townsville | Queensland | Australia |
| SGS Welshpool | Western Australia | Australia |
| SGS West Wyalong | New South Wales | Australia |
| Ultra Trace | Western Australia | Australia |

**Table 4 Participating laboratories. (Not related to the order of laboratories in other tables.)**