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## CERTIFICATE OF ANALYSIS FOR

# Pegmatite Li Ore

## (Bynoe Pegmatite Field, Northern Territory, Australia)

## CERTIFIED REFERENCE MATERIAL

# OREAS 752

**Summary Statistics for Key Analytes.**

| Constituent | Certified Value | 1SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Peroxide Fusion ICP** | | | | | | |
| Li, Lithium (wt.%) | 0.707 | 0.021 | 0.697 | 0.716 | 0.693 | 0.720 |
| $Li_2O$, Lithium oxide (wt.%) | 1.52 | 0.045 | 1.50 | 1.54 | 1.49 | 1.55 |
| **4-Acid Digestion** | | | | | | |
| Li, Lithium (wt.%) | 0.695 | 0.024 | 0.684 | 0.705 | 0.680 | 0.709 |
| $Li_2O$, Lithium oxide (wt.%) | 1.50 | 0.052 | 1.47 | 1.52 | 1.46 | 1.53 |

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note: intervals may appear asymmetric due to rounding.

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| Constituent | Certified Value | SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Peroxide Fusion ICP** | | | | | | |
| Al, Aluminium (wt.%) | 8.51 | 0.382 | 8.31 | 8.71 | 8.37 | 8.65 |
| As, Arsenic (ppm) | 14.1 | 2.4 | 12.1 | 16.1 | IND | IND |
| Ba, Barium (ppm) | 57 | 4.3 | 54 | 60 | 54 | 60 |
| Be, Beryllium (ppm) | 154 | 7 | 150 | 158 | 150 | 159 |
| Bi, Bismuth (ppm) | 2.55 | 0.29 | 2.32 | 2.78 | 2.38 | 2.72 |
| Ca, Calcium (wt.%) | 0.215 | 0.042 | 0.191 | 0.238 | 0.200 | 0.229 |
| Cd, Cadmium (ppm) | 1.57 | 0.43 | 1.29 | 1.86 | IND | IND |
| Ce, Cerium (ppm) | 3.48 | 0.255 | 3.28 | 3.69 | 3.28 | 3.69 |
| Co, Cobalt (ppm) | 1.28 | 0.16 | 1.18 | 1.38 | IND | IND |
| Cs, Cesium (ppm) | 66 | 3.8 | 64 | 68 | 64 | 68 |
| Cu, Copper (ppm) | 38.1 | 8.3 | 33.8 | 42.4 | 35.7 | 40.6 |
| Dy, Dysprosium (ppm) | 0.36 | 0.04 | 0.34 | 0.38 | 0.33 | 0.39 |
| Er, Erbium (ppm) | 0.14 | 0.03 | 0.11 | 0.17 | IND | IND |
| Fe, Iron (wt.%) | 0.865 | 0.037 | 0.849 | 0.880 | 0.844 | 0.886 |
| Ga, Gallium (ppm) | 17.8 | 1.00 | 17.0 | 18.6 | 16.7 | 18.9 |
| Gd, Gadolinium (ppm) | 0.36 | 0.05 | 0.33 | 0.38 | 0.33 | 0.39 |
| Ge, Germanium (ppm) | 6.37 | 0.492 | 6.02 | 6.71 | 5.71 | 7.03 |
| Ho, Holmium (ppm) | 0.054 | 0.011 | 0.051 | 0.057 | IND | IND |
| K, Potassium (wt.%) | 2.10 | 0.097 | 2.06 | 2.14 | 2.05 | 2.15 |
| La, Lanthanum (ppm) | 1.88 | 0.30 | 1.66 | 2.09 | 1.74 | 2.01 |
| Li, Lithium (wt.%) | 0.707 | 0.021 | 0.697 | 0.716 | 0.693 | 0.720 |
| $Li_2O$, Lithium oxide (wt.%) | 1.52 | 0.045 | 1.50 | 1.54 | 1.49 | 1.55 |
| Mg, Magnesium (wt.%) | 0.047 | 0.006 | 0.045 | 0.049 | 0.044 | 0.050 |
| Mn, Manganese (wt.%) | 0.081 | 0.003 | 0.080 | 0.082 | 0.079 | 0.084 |
| Mo, Molybdenum (ppm) | 3.38 | 0.46 | 3.11 | 3.65 | IND | IND |
| Nb, Niobium (ppm) | 54 | 6 | 51 | 58 | 52 | 57 |
| Nd, Neodymium (ppm) | 1.49 | 0.098 | 1.43 | 1.55 | 1.21 | 1.77 |
| P, Phosphorus (wt.%) | 0.135 | 0.011 | 0.127 | 0.142 | 0.130 | 0.139 |
| Pr, Praseodymium (ppm) | 0.43 | 0.08 | 0.35 | 0.50 | 0.39 | 0.46 |
| Rb, Rubidium (ppm) | 659 | 20 | 646 | 671 | 638 | 679 |
| Si, Silicon (wt.%) | 34.18 | 0.640 | 33.72 | 34.63 | 33.59 | 34.76 |
| Sm, Samarium (ppm) | 0.40 | 0.07 | 0.35 | 0.44 | IND | IND |
| Sn, Tin (ppm) | 238 | 11 | 232 | 245 | 228 | 249 |
| Sr, Strontium (ppm) | 43.4 | 4.6 | 40.8 | 46.1 | 40.2 | 46.6 |
| Ta, Tantalum (ppm) | 41.0 | 1.80 | 39.5 | 42.6 | 39.5 | 42.5 |
| Tb, Terbium (ppm) | 0.078 | 0.018 | 0.063 | 0.093 | IND | IND |

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note 1: intervals may appear asymmetric due to rounding.
Note 2: the number of decimal places quoted does not imply accuracy of the certified value to this level but are given to minimise rounding errors when calculating 2SD and 3SD windows.

**Table 1 continued.**

| Constituent | Certified Value | SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Peroxide Fusion ICP continued** | | | | | | |
| Th, Thorium (ppm) | 0.97 | 0.080 | 0.93 | 1.01 | IND | IND |
| Tl, Thallium (ppm) | 3.84 | 0.235 | 3.67 | 4.01 | 3.66 | 4.03 |
| U, Uranium (ppm) | 8.44 | 0.784 | 7.83 | 9.04 | 8.17 | 8.70 |
| W, Tungsten (ppm) | 5.11 | 0.57 | 4.69 | 5.53 | 4.85 | 5.38 |
| Y, Yttrium (ppm) | 1.90 | 0.167 | 1.80 | 2.01 | IND | IND |
| Zn, Zinc (ppm) | 98 | 5.4 | 95 | 101 | 93 | 103 |
| Zr, Zirconium (ppm) | 29.6 | 3.6 | 25.9 | 33.3 | 28.0 | 31.2 |
| **Borate Fusion XRF** | | | | | | |
| $Al_2O_3$, Aluminium(III) oxide (wt.%) | 16.30 | 0.087 | 16.27 | 16.34 | 16.20 | 16.41 |
| CaO, Calcium oxide (wt.%) | 0.287 | 0.006 | 0.284 | 0.289 | 0.281 | 0.293 |
| $Fe_2O_3$, Iron(III) oxide (wt.%) | 1.25 | 0.011 | 1.24 | 1.25 | 1.23 | 1.26 |
| $K_2O$, Potassium oxide (wt.%) | 2.54 | 0.030 | 2.53 | 2.56 | 2.52 | 2.56 |
| MgO, Magnesium oxide (wt.%) | 0.087 | 0.013 | 0.081 | 0.093 | 0.082 | 0.093 |
| MnO, Manganese oxide (wt.%) | 0.107 | 0.004 | 0.105 | 0.108 | 0.104 | 0.109 |
| $Na_2O$, Sodium oxide (wt.%) | 3.75 | 0.044 | 3.73 | 3.77 | 3.72 | 3.78 |
| $P_2O_5$, Phosphorus(V) oxide (wt.%) | 0.320 | 0.005 | 0.318 | 0.321 | 0.315 | 0.325 |
| $SiO_2$, Silicon dioxide (wt.%) | 73.01 | 0.346 | 72.87 | 73.14 | 72.77 | 73.25 |
| $SO_3$, Sulphur trioxide (wt.%) | 0.101 | 0.008 | 0.095 | 0.106 | 0.094 | 0.107 |
| | | | | | | |
| $LOI^{1000}$, Loss on ignition @1000°C (wt.%) | 0.681 | 0.097 | 0.633 | 0.730 | 0.623 | 0.740 |
| **4-Acid Digestion** | | | | | | |
| Al, Aluminium (wt.%) | 7.94 | 0.485 | 7.76 | 8.13 | 7.73 | 8.16 |
| As, Arsenic (ppm) | 13.7 | 1.4 | 13.1 | 14.4 | 12.6 | 14.8 |
| Ba, Barium (ppm) | 58 | 2.8 | 57 | 60 | 56 | 61 |
| Be, Beryllium (ppm) | 154 | 11 | 148 | 159 | 147 | 160 |
| Bi, Bismuth (ppm) | 2.47 | 0.158 | 2.40 | 2.54 | 2.39 | 2.55 |
| Ca, Calcium (wt.%) | 0.199 | 0.011 | 0.196 | 0.203 | 0.192 | 0.207 |
| Cd, Cadmium (ppm) | 1.57 | 0.111 | 1.53 | 1.61 | 1.44 | 1.69 |
| Ce, Cerium (ppm) | 3.00 | 0.56 | 2.73 | 3.27 | 2.78 | 3.22 |
| Co, Cobalt (ppm) | 1.22 | 0.120 | 1.16 | 1.28 | 1.15 | 1.30 |
| Cs, Cesium (ppm) | 70 | 3.5 | 68 | 71 | 68 | 71 |
| Cu, Copper (ppm) | 36.4 | 2.79 | 35.2 | 37.6 | 35.1 | 37.6 |
| Dy, Dysprosium (ppm) | 0.34 | 0.04 | 0.30 | 0.38 | 0.29 | 0.40 |
| Er, Erbium (ppm) | 0.13 | 0.03 | 0.11 | 0.16 | IND | IND |
| Fe, Iron (wt.%) | 0.835 | 0.033 | 0.822 | 0.848 | 0.812 | 0.858 |
| Ga, Gallium (ppm) | 17.8 | 1.16 | 17.3 | 18.2 | 17.2 | 18.4 |

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note 1: intervals may appear asymmetric due to rounding.
Note 2: the number of decimal places quoted does not imply accuracy of the certified value to this level but are given to minimise rounding errors when calculating 2SD and 3SD windows.

Table 1 continued.

| Constituent | Certified Value | SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **4-Acid Digestion continued** | | | | | | |
| Hf, Hafnium (ppm) | 2.05 | 0.116 | 2.00 | 2.09 | 1.95 | 2.15 |
| Ho, Holmium (ppm) | 0.050 | 0.006 | 0.048 | 0.052 | IND | IND |
| K, Potassium (wt.%) | 2.08 | 0.074 | 2.05 | 2.11 | 2.04 | 2.13 |
| La, Lanthanum (ppm) | 1.50 | 0.41 | 1.32 | 1.68 | 1.39 | 1.60 |
| Li, Lithium (wt.%) | 0.695 | 0.024 | 0.684 | 0.705 | 0.680 | 0.709 |
| $Li_2O$, Lithium oxide (wt.%) | 1.50 | 0.052 | 1.47 | 1.52 | 1.46 | 1.53 |
| Mg, Magnesium (wt.%) | 0.044 | 0.005 | 0.042 | 0.045 | 0.042 | 0.045 |
| Mn, Manganese (wt.%) | 0.079 | 0.003 | 0.078 | 0.080 | 0.077 | 0.081 |
| Mo, Molybdenum (ppm) | 3.12 | 0.170 | 3.05 | 3.19 | 2.95 | 3.29 |
| Na, Sodium (wt.%) | 2.70 | 0.123 | 2.65 | 2.75 | 2.64 | 2.77 |
| Nb, Niobium (ppm) | 53 | 4.7 | 51 | 55 | 51 | 55 |
| Nd, Neodymium (ppm) | 1.42 | 0.25 | 1.27 | 1.58 | 1.34 | 1.51 |
| Ni, Nickel (ppm) | 10.4 | 0.64 | 10.1 | 10.6 | 10.0 | 10.8 |
| P, Phosphorus (wt.%) | 0.140 | 0.004 | 0.139 | 0.142 | 0.137 | 0.144 |
| Pb, Lead (ppm) | 16.2 | 1.24 | 15.7 | 16.8 | 15.5 | 17.0 |
| Pr, Praseodymium (ppm) | 0.38 | 0.05 | 0.33 | 0.44 | 0.36 | 0.41 |
| Rb, Rubidium (ppm) | 652 | 52 | 628 | 676 | 637 | 668 |
| S, Sulphur (wt.%) | 0.042 | 0.004 | 0.040 | 0.044 | 0.041 | 0.043 |
| Sb, Antimony (ppm) | 0.71 | 0.062 | 0.68 | 0.74 | 0.67 | 0.74 |
| Sc, Scandium (ppm) | 0.50 | 0.07 | 0.47 | 0.54 | 0.44 | 0.57 |
| Sm, Samarium (ppm) | 0.37 | 0.06 | 0.33 | 0.41 | IND | IND |
| Sn, Tin (ppm) | 79 | 9 | 75 | 83 | 76 | 82 |
| Sr, Strontium (ppm) | 36.3 | 2.76 | 35.1 | 37.5 | 34.5 | 38.1 |
| Ta, Tantalum (ppm) | 41.5 | 2.40 | 40.4 | 42.6 | 39.9 | 43.0 |
| Tb, Terbium (ppm) | 0.063 | 0.009 | 0.057 | 0.069 | IND | IND |
| Th, Thorium (ppm) | 0.95 | 0.11 | 0.91 | 1.00 | 0.87 | 1.03 |
| Ti, Titanium (wt.%) | 0.016 | 0.001 | 0.016 | 0.017 | 0.016 | 0.017 |
| Tl, Thallium (ppm) | 3.86 | 0.154 | 3.79 | 3.93 | 3.75 | 3.96 |
| U, Uranium (ppm) | 7.90 | 0.556 | 7.65 | 8.15 | 7.62 | 8.18 |
| V, Vanadium (ppm) | 3.94 | 0.193 | 3.84 | 4.04 | 3.50 | 4.38 |
| W, Tungsten (ppm) | 5.26 | 0.276 | 5.13 | 5.39 | 5.10 | 5.42 |
| Y, Yttrium (ppm) | 1.52 | 0.21 | 1.44 | 1.60 | 1.35 | 1.69 |
| Zn, Zinc (ppm) | 98 | 3.3 | 96 | 99 | 94 | 101 |
| Zr, Zirconium (ppm) | 24.5 | 2.5 | 23.4 | 25.6 | 23.0 | 26.1 |

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note 1: intervals may appear asymmetric due to rounding.
Note 2: the number of decimal places quoted does not imply accuracy of the certified value to this level but are given to minimise rounding errors when calculating 2SD and 3SD windows.

**Table 2. Indicative Values for OREAS 752.**

| Constituent | Unit | Value | Constituent | Unit | Value | Constituent | Unit | Value |
|---|---|---|---|---|---|---|---|---|
| **Peroxide Fusion ICP** | | | | | | | | |
| Ag | ppm | < 1 | Na | wt.% | 2.37 | Se | ppm | < 3 |
| B | ppm | 30.9 | Ni | ppm | 13.1 | Te | ppm | 0.76 |
| Cr | ppm | 48.4 | Pb | ppm | 17.5 | Ti | wt.% | 0.017 |
| Eu | ppm | 0.054 | Re | ppm | < 0.01 | Tm | ppm | 0.028 |
| Hf | ppm | 2.09 | S | wt.% | 0.045 | V | ppm | < 5 |
| In | ppm | < 0.2 | Sb | ppm | 0.70 | Yb | ppm | 0.13 |
| Lu | ppm | < 0.05 | Sc | ppm | < 5 | | | |
| **Borate Fusion XRF** | | | | | | | | |
| $As_2O_3$ | ppm | 14.2 | $Nb_2O_5$ | ppm | 134 | $TiO_2$ | wt.% | 0.027 |
| BaO | ppm | 112 | NiO | ppm | 14.0 | $V_2O_5$ | ppm | < 100 |
| Cl | ppm | 127 | PbO | ppm | 27.0 | $WO_3$ | ppm | < 10 |
| CoO | ppm | < 10 | $Sb_2O_3$ | ppm | < 10 | ZnO | ppm | 122 |
| $Cr_2O_3$ | ppm | < 100 | $SnO_2$ | ppm | 269 | $ZrO_2$ | ppm | 64 |
| CuO | ppm | 45.0 | SrO | ppm | 86 | | | |
| $MoO_3$ | ppm | < 10 | $Ta_2O_5$ | ppm | 56 | | | |
| **Thermogravimetry** | | | | | | | | |
| $H_2O$- | wt.% | 0.219 | | | | | | |
| **4-Acid Digestion** | | | | | | | | |
| Ag | ppm | 0.172 | Ge | ppm | 0.11 | Se | ppm | 0.51 |
| B | ppm | 7.17 | Hg | ppm | < 2 | Si | wt.% | 34.42 |
| Cr | ppm | 20.4 | In | ppm | 0.022 | Te | ppm | 0.11 |
| Eu | ppm | 0.046 | Lu | ppm | 0.020 | Tm | ppm | < 0.05 |
| Gd | ppm | 0.33 | Re | ppm | < 0.002 | Yb | ppm | 0.12 |

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note: the number of significant figures reported is not a reflection of the level of certainty of stated values. They are instead an artefact of ORE's in-house CRM-specific LIMS.

## INTRODUCTION

OREAS reference materials are intended to provide a low cost method of evaluating and improving the quality of analysis of geological samples. To the geologist they provide a means of implementing quality control in analytical data sets generated in exploration from the grass roots level through to prospect evaluation, and in grade control at mining operations. To the analyst they provide an effective means of calibrating analytical equipment, assessing new techniques and routinely monitoring in-house procedures.

OREAS reference materials enable users to successfully achieve process control of these tasks because the observed variance from repeated analysis has its origin almost exclusively in the analytical process rather than the reference material itself.

## SOURCE MATERIAL

OREAS 752 has been prepared from RC drill chip samples supplied from Core Lithium's Finniss Lithium Project located in the Northern Territory, Australia. The project area contains the Grants lithium pegmatite deposit, within the Bynoe Pegmatite Field. Lithium-Caesium-Tantalum (LCT) Type pegmatites in the Finniss area intrude Palaeoproterozoic metasediments of the Burrell Creek Formation. Lithium mineralisation typically occurs as coarse spodumene and accessory amblygonite with muscovite, quartz, albite and k-feldspar gangue.

## COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 752 was prepared in the following manner:

- Drying to constant mass at 105°C;
- Milling 100% minus 30 microns;
- Homogenisation;
- Packaging in 10g units in laminated foil pouches and 500g units in plastic wide-mouth jars.

## ANALYTICAL PROGRAM

Twenty-four commercial analytical laboratories participated in the program to characterise the elements reported in Table 1. The following methods were employed:

- Sodium peroxide fusion with full suite elemental package by ICP-OES and/or MS finish (20 laboratories);
- Lithium borate fusion whole rock analysis package by X-ray fluorescence (19 laboratories);
- Thermogravimetry: Moisture at 105°C (2 laboratories as a part of their fusion package) and Loss on Ignition (LOI) at 1000°C (8 laboratories used a thermogravimetric analyser, 4 laboratories used conventional muffle furnace and 9 laboratories included LOI with their fusion package);
- 4-acid digestion for full suite elemental package by ICP-OES and MS finish (up to 24 laboratories depending on the element).

For the round robin program twelve 200g test units were taken at predetermined intervals during the bagging stage, immediately following homogenisation and are considered representative of the entire prepared batch. The six samples received by each laboratory were obtained by taking two 10g scoop splits from each of three separate 200g test units. This format enabled nested ANOVA treatment of the results to evaluate homogeneity, i.e. to ascertain whether between-unit variance is greater than within-unit variance.

Table 1 presents the 103 certified values (including Li in both elemental and oxide form for peroxide fusion and 4-acid digestion) together with their associated 1SD's, 95% confidence and tolerance limits, Table 2 shows 55 indicative values and Table 3 provides performance gate intervals for the certified values based on their pooled 1SD's. Tabulated results of all elements together with uncorrected means, medians, standard deviations, relative standard deviations and per cent deviation of lab means from the corrected mean of means (PDM[3]) are presented in the detailed certification data for this CRM (**OREAS 752 DataPack-1.0.190208_103543.xlsx**).

Results are also presented in scatter plots for $Li_2O$ (wt.%) by peroxide fusion ICP and 4-acid digestion in Figure 1 and 2 respectively, together with ±3SD (magenta) and ±5% (yellow) control lines and certified value (green line). Accepted individual results are coloured blue and individual and dataset outliers are identified in red and violet, respectively.

## STATISTICAL ANALYSIS

**Certified Values, Standard Deviations, Confidence and Tolerance Limits** have been determined for each analytical method following removal of individual and laboratory outliers (Table 1). Certified Values are the mean of means after outlier filtering. The 95% Confidence Limit is a measure of the reliability of the certified value, i.e. the narrower the Confidence Interval the greater the certainty in the Certified Value. It should not be used as a control limit for laboratory performance.

**95% Confidence Limits** are inversely proportional to the number of participating laboratories and inter-laboratory agreement. It is a measure of the reliability of the certified value. A 95% confidence interval indicates a 95% probability that the true value of the analyte under consideration lies between the upper and lower limits. *95% Confidence Limits should not be used as control limits for laboratory performance.*

**Indicative (uncertified) values** (Table 2) are provided where i) the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification; ii) interlaboratory consensus is poor; or iii) a significant proportion of results are outlying or reported as less than detection limits.

**Standard Deviation** values (1SDs) are reported in Table 1. They provide an indication of a level of performance that might reasonably be expected from a laboratory being monitored by this CRM in a QA/QC program. They take into account errors attributable to measurement uncertainty and CRM variability. For an effective CRM the contribution of the latter should be negligible in comparison to measurement errors. The Standard Deviation values include all sources of measurement uncertainty: between-lab variance, within-run variance (precision errors) and CRM variability.

The SD for each analyte's certified value is calculated from the same filtered data set used to determine the certified value, i.e. after removal of all individual, lab dataset (batch) and 3SD outliers (single iteration). These outliers can only be removed after the absolute homogeneity of the CRM has been independently established, i.e. the outliers must be confidently deemed to be analytical rather than arising from inhomogeneity of the CRM. **The standard deviation is then calculated for each analyte from the pooled accepted analyses generated from the certification program.**

In the application of SD's in monitoring performance it is important to note that not all laboratories function at the same level of proficiency and that different methods in use at a particular laboratory have differing levels of precision. Each laboratory has its own inherent SD (for a specific concentration level and analyte-method pair) based on the analytical process and this SD is not directly related to the round robin program.

The majority of data generated in the round robin program was produced by a selection of world class laboratories. The SD's thus generated are more constrained than those that would be produced across a randomly selected group of laboratories. To produce more generally achievable SD's the 'pooled' SD's provided in this report include inter-lab bias. This 'one size fits all' approach may require revision at the discretion of the QC manager concerned following careful scrutiny of QC control charts.

Table 3 shows **Performance Gates** calculated for two and three standard deviations. As a guide these intervals may be regarded as warning or rejection for multiple 2SD outliers, or rejection for individual 3SD outliers in QC monitoring, although their precise application should be at the discretion of the QC manager concerned. A second method utilises a 5%

window calculated directly from the certified value. Standard deviation is also shown in relative percent for one, two and three relative standard deviations (1RSD, 2RSD and 3RSD) to facilitate an appreciation of the magnitude of these numbers and a comparison with the 5% window. Caution should be exercised when concentration levels approach lower limits of detection of the analytical methods employed as performance gates calculated from standard deviations tend to be excessively wide whereas those determined by the 5% method are too narrow. One approach used at commercial laboratories is to set the acceptance criteria at twice the detection level (DL) ± 10%.

*i.e. Certified Value ± 10% ± 2DL (adapted from Govett, 1983)*

**Table 3. Performance Gates for OREAS 752.**

| Constituent | Certified Value | Absolute Standard Deviations | | | | | Relative Standard Deviations | | | 5% window | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1SD | 2SD Low | 2SD High | 3SD Low | 3SD High | 1RSD | 2RSD | 3RSD | Low | High |
| **Peroxide Fusion ICP** | | | | | | | | | | | |
| Al, wt.% | 8.51 | 0.382 | 7.75 | 9.27 | 7.36 | 9.66 | 4.49% | 8.99% | 13.48% | 8.08 | 8.94 |
| As, ppm | 14.1 | 2.4 | 9.3 | 18.9 | 6.9 | 21.4 | 17.12% | 34.24% | 51.36% | 13.4 | 14.8 |
| Ba, ppm | 57 | 4.3 | 49 | 66 | 44 | 70 | 7.44% | 14.89% | 22.33% | 54 | 60 |
| Be, ppm | 154 | 7 | 141 | 168 | 134 | 174 | 4.34% | 8.68% | 13.02% | 147 | 162 |
| Bi, ppm | 2.55 | 0.29 | 1.98 | 3.12 | 1.69 | 3.41 | 11.22% | 22.45% | 33.67% | 2.42 | 2.68 |
| Ca, wt.% | 0.215 | 0.042 | 0.131 | 0.298 | 0.089 | 0.340 | 19.45% | 38.90% | 58.36% | 0.204 | 0.225 |
| Cd, ppm | 1.57 | 0.43 | 0.71 | 2.43 | 0.28 | 2.86 | 27.34% | 54.67% | 82.01% | 1.49 | 1.65 |
| Ce, ppm | 3.48 | 0.255 | 2.97 | 3.99 | 2.72 | 4.25 | 7.32% | 14.64% | 21.96% | 3.31 | 3.66 |
| Co, ppm | 1.28 | 0.16 | 0.95 | 1.61 | 0.79 | 1.77 | 12.73% | 25.46% | 38.19% | 1.22 | 1.35 |
| Cs, ppm | 66 | 3.8 | 59 | 74 | 55 | 77 | 5.70% | 11.39% | 17.09% | 63 | 69 |
| Cu, ppm | 38.1 | 8.3 | 21.5 | 54.8 | 13.2 | 63.1 | 21.80% | 43.61% | 65.41% | 36.2 | 40.0 |
| Dy, ppm | 0.36 | 0.04 | 0.29 | 0.43 | 0.25 | 0.47 | 10.19% | 20.39% | 30.58% | 0.34 | 0.38 |
| Er, ppm | 0.14 | 0.03 | 0.08 | 0.20 | 0.05 | 0.23 | 20.55% | 41.11% | 61.66% | 0.13 | 0.15 |
| Fe, wt.% | 0.865 | 0.037 | 0.791 | 0.939 | 0.754 | 0.976 | 4.29% | 8.57% | 12.86% | 0.822 | 0.908 |
| Ga, ppm | 17.8 | 1.00 | 15.8 | 19.8 | 14.8 | 20.8 | 5.64% | 11.28% | 16.92% | 16.9 | 18.7 |
| Gd, ppm | 0.36 | 0.05 | 0.25 | 0.47 | 0.20 | 0.52 | 14.98% | 29.97% | 44.95% | 0.34 | 0.38 |
| Ge, ppm | 6.37 | 0.492 | 5.39 | 7.35 | 4.89 | 7.84 | 7.72% | 15.44% | 23.15% | 6.05 | 6.69 |
| Ho, ppm | 0.054 | 0.011 | 0.032 | 0.076 | 0.021 | 0.087 | 20.48% | 40.95% | 61.43% | 0.051 | 0.057 |
| K, wt.% | 2.10 | 0.097 | 1.91 | 2.30 | 1.81 | 2.39 | 4.61% | 9.21% | 13.82% | 2.00 | 2.21 |
| La, ppm | 1.88 | 0.30 | 1.27 | 2.48 | 0.97 | 2.79 | 16.14% | 32.29% | 48.43% | 1.78 | 1.97 |
| Li, wt.% | 0.707 | 0.021 | 0.664 | 0.749 | 0.643 | 0.770 | 2.98% | 5.97% | 8.95% | 0.671 | 0.742 |
| $Li_2O$, wt.% | 1.52 | 0.045 | 1.43 | 1.61 | 1.39 | 1.66 | 2.98% | 5.97% | 8.95% | 1.45 | 1.60 |
| Mg, wt.% | 0.047 | 0.006 | 0.036 | 0.059 | 0.030 | 0.064 | 12.07% | 24.14% | 36.21% | 0.045 | 0.050 |
| Mn, wt.% | 0.081 | 0.003 | 0.076 | 0.086 | 0.074 | 0.089 | 3.14% | 6.28% | 9.42% | 0.077 | 0.085 |
| Mo, ppm | 3.38 | 0.46 | 2.46 | 4.31 | 1.99 | 4.77 | 13.67% | 27.34% | 41.01% | 3.21 | 3.55 |
| Nb, ppm | 54 | 6 | 43 | 66 | 37 | 71 | 10.34% | 20.69% | 31.03% | 52 | 57 |
| Nd, ppm | 1.49 | 0.098 | 1.29 | 1.69 | 1.19 | 1.79 | 6.61% | 13.21% | 19.82% | 1.42 | 1.56 |
| P, wt.% | 0.135 | 0.011 | 0.112 | 0.157 | 0.101 | 0.168 | 8.27% | 16.54% | 24.82% | 0.128 | 0.141 |
| Pr, ppm | 0.43 | 0.08 | 0.26 | 0.59 | 0.18 | 0.67 | 19.50% | 39.00% | 58.50% | 0.40 | 0.45 |
| Rb, ppm | 659 | 20 | 619 | 698 | 599 | 718 | 3.01% | 6.03% | 9.04% | 626 | 692 |

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note 1: intervals may appear asymmetric due to rounding.
Note 2: the number of decimal places quoted does not imply accuracy of the certified value to this level but are given to minimise rounding errors when calculating 2SD and 3SD windows.

## Table 3. Performance Gates continued.

| Constituent | Certified Value | Absolute Standard Deviations | | | | | Relative Standard Deviations | | | 5% window | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1SD | 2SD Low | 2SD High | 3SD Low | 3SD High | 1RSD | 2RSD | 3RSD | Low | High |
| **Peroxide Fusion ICP continued** | | | | | | | | | | | |
| Si, wt.% | 34.18 | 0.640 | 32.90 | 35.45 | 32.26 | 36.09 | 1.87% | 3.74% | 5.61% | 32.47 | 35.88 |
| Sm, ppm | 0.40 | 0.07 | 0.26 | 0.53 | 0.20 | 0.59 | 16.68% | 33.37% | 50.05% | 0.38 | 0.42 |
| Sn, ppm | 238 | 11 | 217 | 260 | 207 | 270 | 4.42% | 8.84% | 13.26% | 227 | 250 |
| Sr, ppm | 43.4 | 4.6 | 34.3 | 52.6 | 29.7 | 57.1 | 10.52% | 21.03% | 31.55% | 41.3 | 45.6 |
| Ta, ppm | 41.0 | 1.80 | 37.4 | 44.6 | 35.6 | 46.4 | 4.39% | 8.78% | 13.18% | 39.0 | 43.1 |
| Tb, ppm | 0.078 | 0.018 | 0.042 | 0.114 | 0.024 | 0.132 | 23.14% | 46.27% | 69.41% | 0.074 | 0.082 |
| Th, ppm | 0.97 | 0.080 | 0.81 | 1.13 | 0.73 | 1.21 | 8.22% | 16.43% | 24.65% | 0.93 | 1.02 |
| Tl, ppm | 3.84 | 0.235 | 3.37 | 4.31 | 3.14 | 4.55 | 6.12% | 12.24% | 18.36% | 3.65 | 4.03 |
| U, ppm | 8.44 | 0.784 | 6.87 | 10.01 | 6.09 | 10.79 | 9.29% | 18.59% | 27.88% | 8.02 | 8.86 |
| W, ppm | 5.11 | 0.57 | 3.97 | 6.25 | 3.40 | 6.82 | 11.13% | 22.26% | 33.39% | 4.85 | 5.37 |
| Y, ppm | 1.90 | 0.167 | 1.57 | 2.24 | 1.40 | 2.40 | 8.76% | 17.53% | 26.29% | 1.81 | 2.00 |
| Zn, ppm | 98 | 5.4 | 87 | 109 | 82 | 114 | 5.53% | 11.06% | 16.59% | 93 | 103 |
| Zr, ppm | 29.6 | 3.6 | 22.4 | 36.9 | 18.7 | 40.5 | 12.24% | 24.49% | 36.73% | 28.1 | 31.1 |
| **Borate Fusion XRF** | | | | | | | | | | | |
| $Al_2O_3$, wt.% | 16.30 | 0.087 | 16.13 | 16.48 | 16.04 | 16.57 | 0.53% | 1.07% | 1.60% | 15.49 | 17.12 |
| CaO, wt.% | 0.287 | 0.006 | 0.275 | 0.299 | 0.269 | 0.305 | 2.07% | 4.15% | 6.22% | 0.273 | 0.301 |
| $Fe_2O_3$, wt.% | 1.25 | 0.011 | 1.23 | 1.27 | 1.22 | 1.28 | 0.84% | 1.68% | 2.53% | 1.18 | 1.31 |
| $K_2O$, wt.% | 2.54 | 0.030 | 2.48 | 2.60 | 2.45 | 2.63 | 1.17% | 2.33% | 3.50% | 2.42 | 2.67 |
| MgO, wt.% | 0.087 | 0.013 | 0.062 | 0.113 | 0.049 | 0.125 | 14.60% | 29.19% | 43.79% | 0.083 | 0.092 |
| MnO, wt.% | 0.107 | 0.004 | 0.099 | 0.115 | 0.094 | 0.119 | 3.80% | 7.60% | 11.40% | 0.101 | 0.112 |
| $Na_2O$, wt.% | 3.75 | 0.044 | 3.66 | 3.84 | 3.62 | 3.88 | 1.16% | 2.33% | 3.49% | 3.56 | 3.94 |
| $P_2O_5$, wt.% | 0.320 | 0.005 | 0.310 | 0.329 | 0.306 | 0.334 | 1.46% | 2.92% | 4.38% | 0.304 | 0.336 |
| $SiO_2$, wt.% | 73.01 | 0.346 | 72.32 | 73.70 | 71.97 | 74.05 | 0.47% | 0.95% | 1.42% | 69.36 | 76.66 |
| $SO_3$, wt.% | 0.101 | 0.008 | 0.086 | 0.116 | 0.078 | 0.123 | 7.46% | 14.91% | 22.37% | 0.096 | 0.106 |
| **Thermogravimetry** | | | | | | | | | | | |
| $LOI^{1000}$, wt.% | 0.681 | 0.097 | 0.486 | 0.876 | 0.389 | 0.973 | 14.29% | 28.59% | 42.88% | 0.647 | 0.715 |
| **4-Acid Digestion** | | | | | | | | | | | |
| Al, wt.% | 7.94 | 0.485 | 6.97 | 8.91 | 6.49 | 9.40 | 6.11% | 12.21% | 18.32% | 7.55 | 8.34 |
| As, ppm | 13.7 | 1.4 | 11.0 | 16.5 | 9.6 | 17.9 | 10.06% | 20.13% | 30.19% | 13.0 | 14.4 |
| Ba, ppm | 58 | 2.8 | 53 | 64 | 50 | 67 | 4.89% | 9.79% | 14.68% | 55 | 61 |
| Be, ppm | 154 | 11 | 132 | 175 | 121 | 186 | 7.11% | 14.21% | 21.32% | 146 | 161 |
| Bi, ppm | 2.47 | 0.158 | 2.15 | 2.78 | 1.99 | 2.94 | 6.40% | 12.80% | 19.20% | 2.34 | 2.59 |
| Ca, wt.% | 0.199 | 0.011 | 0.178 | 0.221 | 0.167 | 0.231 | 5.35% | 10.69% | 16.04% | 0.189 | 0.209 |
| Cd, ppm | 1.57 | 0.111 | 1.34 | 1.79 | 1.23 | 1.90 | 7.09% | 14.18% | 21.27% | 1.49 | 1.65 |
| Ce, ppm | 3.00 | 0.56 | 1.89 | 4.11 | 1.33 | 4.67 | 18.52% | 37.04% | 55.56% | 2.85 | 3.15 |
| Co, ppm | 1.22 | 0.120 | 0.98 | 1.46 | 0.87 | 1.58 | 9.77% | 19.53% | 29.30% | 1.16 | 1.28 |
| Cs, ppm | 70 | 3.5 | 63 | 77 | 59 | 80 | 4.96% | 9.92% | 14.89% | 66 | 73 |
| Cu, ppm | 36.4 | 2.79 | 30.8 | 41.9 | 28.0 | 44.7 | 7.67% | 15.34% | 23.01% | 34.5 | 38.2 |
| Dy, ppm | 0.34 | 0.04 | 0.26 | 0.42 | 0.22 | 0.46 | 11.58% | 23.16% | 34.74% | 0.32 | 0.36 |
| Er, ppm | 0.13 | 0.03 | 0.08 | 0.19 | 0.05 | 0.21 | 19.75% | 39.49% | 59.24% | 0.13 | 0.14 |
| Fe, wt.% | 0.835 | 0.033 | 0.769 | 0.900 | 0.736 | 0.933 | 3.92% | 7.84% | 11.77% | 0.793 | 0.876 |

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note 1: intervals may appear asymmetric due to rounding.
Note 2: the number of decimal places quoted does not imply accuracy of the certified value to this level but are given to minimise rounding errors when calculating 2SD and 3SD windows.

**Table 3. Performance Gates continued.**

| Constituent | Certified Value | Absolute Standard Deviations | | | | | Relative Standard Deviations | | | 5% window | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1SD | 2SD Low | 2SD High | 3SD Low | 3SD High | 1RSD | 2RSD | 3RSD | Low | High |
| **4-Acid Digestion continued** | | | | | | | | | | | |
| Ga, ppm | 17.8 | 1.16 | 15.5 | 20.1 | 14.3 | 21.3 | 6.54% | 13.07% | 19.61% | 16.9 | 18.7 |
| Hf, ppm | 2.05 | 0.116 | 1.82 | 2.28 | 1.70 | 2.39 | 5.65% | 11.29% | 16.94% | 1.94 | 2.15 |
| Ho, ppm | 0.050 | 0.006 | 0.037 | 0.063 | 0.031 | 0.069 | 12.66% | 25.31% | 37.97% | 0.048 | 0.053 |
| K, wt.% | 2.08 | 0.074 | 1.93 | 2.23 | 1.86 | 2.31 | 3.57% | 7.14% | 10.70% | 1.98 | 2.19 |
| La, ppm | 1.50 | 0.41 | 0.68 | 2.31 | 0.27 | 2.72 | 27.25% | 54.49% | 81.74% | 1.42 | 1.57 |
| Li, wt.% | 0.695 | 0.024 | 0.646 | 0.743 | 0.622 | 0.768 | 3.51% | 7.01% | 10.52% | 0.660 | 0.729 |
| $Li_2O$, wt.% | 1.50 | 0.052 | 1.39 | 1.60 | 1.34 | 1.65 | 3.51% | 7.01% | 10.52% | 1.42 | 1.57 |
| Mg, wt.% | 0.044 | 0.005 | 0.034 | 0.053 | 0.029 | 0.058 | 11.01% | 22.01% | 33.02% | 0.041 | 0.046 |
| Mn, wt.% | 0.079 | 0.003 | 0.072 | 0.086 | 0.069 | 0.089 | 4.23% | 8.45% | 12.68% | 0.075 | 0.083 |
| Mo, ppm | 3.12 | 0.170 | 2.78 | 3.46 | 2.61 | 3.63 | 5.44% | 10.89% | 16.33% | 2.97 | 3.28 |
| Na, wt.% | 2.70 | 0.123 | 2.46 | 2.95 | 2.33 | 3.07 | 4.55% | 9.09% | 13.64% | 2.57 | 2.84 |
| Nb, ppm | 53 | 4.7 | 44 | 62 | 39 | 67 | 8.81% | 17.61% | 26.42% | 50 | 56 |
| Nd, ppm | 1.42 | 0.25 | 0.92 | 1.92 | 0.68 | 2.17 | 17.51% | 35.02% | 52.52% | 1.35 | 1.49 |
| Ni, ppm | 10.4 | 0.64 | 9.1 | 11.7 | 8.5 | 12.3 | 6.14% | 12.29% | 18.43% | 9.9 | 10.9 |
| P, wt.% | 0.140 | 0.004 | 0.133 | 0.148 | 0.129 | 0.151 | 2.60% | 5.19% | 7.79% | 0.133 | 0.147 |
| Pb, ppm | 16.2 | 1.24 | 13.7 | 18.7 | 12.5 | 20.0 | 7.65% | 15.29% | 22.94% | 15.4 | 17.0 |
| Pr, ppm | 0.38 | 0.05 | 0.28 | 0.48 | 0.23 | 0.53 | 13.04% | 26.08% | 39.11% | 0.36 | 0.40 |
| Rb, ppm | 652 | 52 | 548 | 756 | 496 | 809 | 7.99% | 15.99% | 23.98% | 620 | 685 |
| S, wt.% | 0.042 | 0.004 | 0.035 | 0.049 | 0.031 | 0.053 | 8.48% | 16.96% | 25.44% | 0.040 | 0.044 |
| Sb, ppm | 0.71 | 0.062 | 0.58 | 0.83 | 0.52 | 0.89 | 8.74% | 17.49% | 26.23% | 0.67 | 0.74 |
| Sc, ppm | 0.50 | 0.07 | 0.37 | 0.64 | 0.30 | 0.70 | 13.23% | 26.47% | 39.70% | 0.48 | 0.53 |
| Sm, ppm | 0.37 | 0.06 | 0.26 | 0.49 | 0.20 | 0.54 | 15.56% | 31.11% | 46.67% | 0.35 | 0.39 |
| Sn, ppm | 79 | 9 | 62 | 97 | 53 | 106 | 11.14% | 22.29% | 33.43% | 75 | 83 |
| Sr, ppm | 36.3 | 2.76 | 30.8 | 41.8 | 28.0 | 44.5 | 7.60% | 15.19% | 22.79% | 34.5 | 38.1 |
| Ta, ppm | 41.5 | 2.40 | 36.7 | 46.3 | 34.3 | 48.7 | 5.79% | 11.58% | 17.37% | 39.4 | 43.5 |
| Tb, ppm | 0.063 | 0.009 | 0.046 | 0.080 | 0.037 | 0.089 | 13.60% | 27.19% | 40.79% | 0.060 | 0.066 |
| Th, ppm | 0.95 | 0.11 | 0.72 | 1.18 | 0.61 | 1.30 | 12.07% | 24.14% | 36.22% | 0.90 | 1.00 |
| Ti, wt.% | 0.016 | 0.001 | 0.014 | 0.019 | 0.012 | 0.020 | 8.23% | 16.47% | 24.70% | 0.016 | 0.017 |
| Tl, ppm | 3.86 | 0.154 | 3.55 | 4.17 | 3.40 | 4.32 | 3.99% | 7.99% | 11.98% | 3.67 | 4.05 |
| U, ppm | 7.90 | 0.556 | 6.79 | 9.01 | 6.23 | 9.57 | 7.04% | 14.08% | 21.11% | 7.51 | 8.30 |
| V, ppm | 3.94 | 0.193 | 3.55 | 4.33 | 3.36 | 4.52 | 4.90% | 9.80% | 14.70% | 3.74 | 4.14 |
| W, ppm | 5.26 | 0.276 | 4.71 | 5.81 | 4.43 | 6.09 | 5.24% | 10.48% | 15.72% | 5.00 | 5.52 |
| Y, ppm | 1.52 | 0.21 | 1.11 | 1.93 | 0.91 | 2.14 | 13.48% | 26.96% | 40.43% | 1.45 | 1.60 |
| Zn, ppm | 98 | 3.3 | 91 | 104 | 88 | 107 | 3.36% | 6.71% | 10.07% | 93 | 102 |
| Zr, ppm | 24.5 | 2.5 | 19.6 | 29.4 | 17.2 | 31.9 | 10.00% | 20.01% | 30.01% | 23.3 | 25.7 |

SI unit equivalents: ppm, parts per million ≡ mg/kg ≡ µg/g ≡ 0.0001 wt.% ≡ 1000 ppb, parts per billion.
Note 1: intervals may appear asymmetric due to rounding.
Note 2: the number of decimal places quoted does not imply accuracy of the certified value to this level but are given to minimise rounding errors when calculating 2SD and 3SD windows.

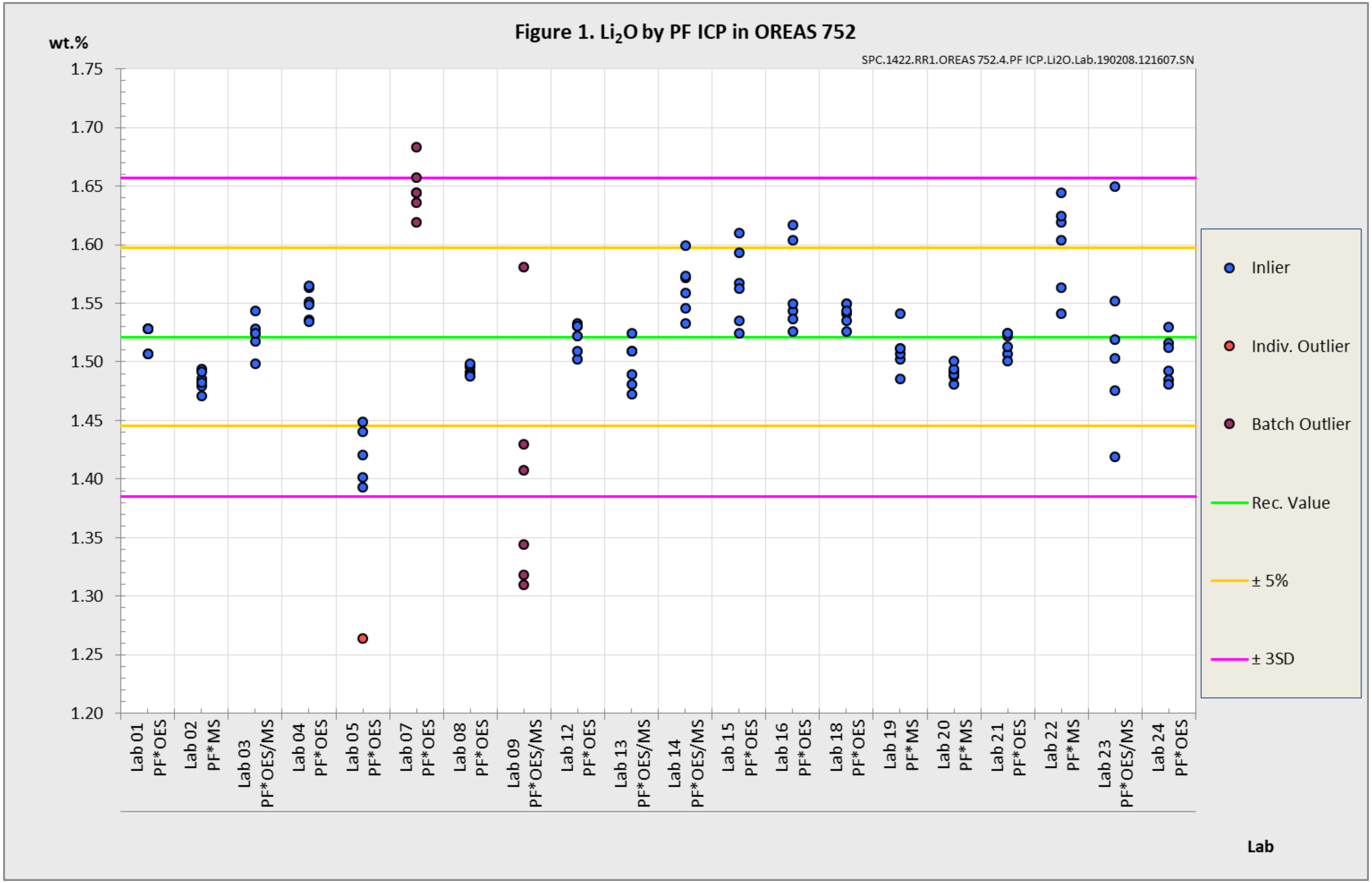
Figure 1. Li2O by PF ICP in OREAS 752
wt.%
SPC.1422.RR1.OREAS 752.4.PF ICP.Li2O.Lab.190208.121607.SN
1.75
1.70
1.65
1.60
1.55
1.50
1.45
1.40
1.35
1.30
1.25
1.20
Lab 01 PF*OES
Lab 02 PF*MS
Lab 03 PF*OES/MS
Lab 04 PF*OES
Lab 05 PF*OES
Lab 07 PF*OES
Lab 08 PF*OES
Lab 09 PF*OES/MS
Lab 12 PF*OES
Lab 13 PF*OES/MS
Lab 14 PF*OES/MS
Lab 15 PF*OES
Lab 16 PF*OES
Lab 18 PF*OES
Lab 19 PF*MS
Lab 20 PF*MS
Lab 21 PF*OES
Lab 22 PF*MS
Lab 23 PF*OES/MS
Lab 24 PF*OES
Inlier
Indiv. Outlier
Batch Outlier
Rec. Value
± 5%
± 3SD
Lab

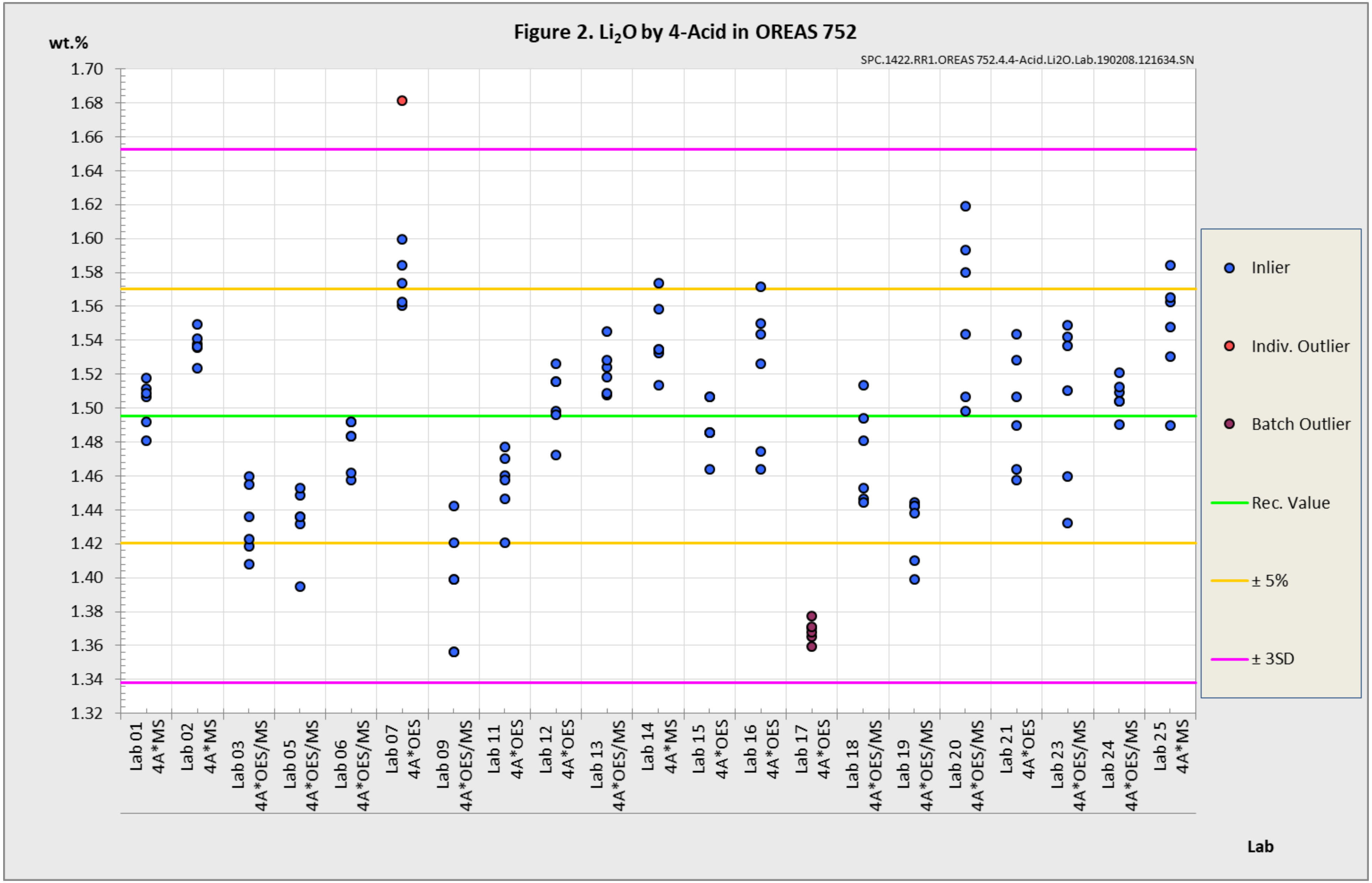
Figure 2. $Li_2O$ by 4-Acid in OREAS 752
wt.%
SPC.1422.RR1.OREAS 752.4.4-Acid.Li2O.Lab.190208.121634.SN
1.70
1.68
1.66
1.64
1.62
1.60
1.58
1.56
1.54
1.52
1.50
1.48
1.46
1.44
1.42
1.40
1.38
1.36
1.34
1.32
Lab 01 4A*MS
Lab 02 4A*MS
Lab 03 4A*OES/MS
Lab 05 4A*OES/MS
Lab 06 4A*OES/MS
Lab 07 4A*OES
Lab 09 4A*OES/MS
Lab 11 4A*OES
Lab 12 4A*OES
Lab 13 4A*OES/MS
Lab 14 4A*MS
Lab 15 4A*OES
Lab 16 4A*OES
Lab 17 4A*OES
Lab 18 4A*OES/MS
Lab 19 4A*OES/MS
Lab 20 4A*OES/MS
Lab 21 4A*OES
Lab 23 4A*OES/MS
Lab 24 4A*OES/MS
Lab 25 4A*MS
Lab
Inlier
Indiv. Outlier
Batch Outlier
Rec. Value
± 5%
± 3SD

**Tolerance Limits** (ISO Guide 3207) were determined using an analysis of precision errors method and are considered a conservative estimate of true homogeneity. The meaning of tolerance limits may be illustrated for lithium oxide ($Li_2O$) by peroxide fusion ICP, where 99% of the time ($1-\alpha=0.99$) at least 95% of subsamples ($\rho=0.95$) will have concentrations lying between 1.49 and 1.55 wt.%. Put more precisely, this means that if the same number of subsamples were taken and analysed in the same manner repeatedly, 99% of the tolerance intervals so constructed would cover at least 95% of the total population, and 1% of the tolerance intervals would cover less than 95% of the total population (ISO Guide 35). *Please note that tolerance limits pertain to the homogeneity of the CRM only and should not be used as control limits for laboratory performance.*

**ANOVA Study**

The homogeneity of OREAS 752 has also been evaluated in an ANOVA study for all certified analytes occurring at least 20 times the lower limit of detection. No significant *p*-values were found indicating that no evidence exists that between-unit variance is greater than within-unit variance.

It is important to note that ANOVA is not an absolute measure of homogeneity. Rather, it establishes whether or not the analytes are distributed in a similar manner throughout the packaging run of OREAS 752 and whether the variance between two subsamples from the same unit is statistically distinguishable to the variance from two subsamples taken from any two separate units. A reference material therefore, can possess poor absolute homogeneity yet still pass a relative homogeneity test if the within-unit heterogeneity is large and similar across all units.

Based on the statistical analysis of the results of the inter-laboratory certification program it can be concluded that OREAS 752 is sufficiently homogenous and is fit-for-purpose as a certified reference material (see 'Intended Use' below).

## PARTICIPATING LABORATORIES

1. AGAT Laboratories, Mississauga, Ontario, Canada
2. Alex Stewart International, Mendoza, Argentina
3. ALS, Brisbane, QLD, Australia
4. ALS, Lima, Peru
5. ALS, Loughrea, Galway, Ireland
6. ALS, Perth, WA, Australia
7. ALS, Vancouver, BC, Canada
8. American Assay Laboratories, Sparks, Nevada, USA
9. Bureau Veritas Commodities Canada Ltd, Vancouver, BC, Canada
10. Bureau Veritas Geoanalytical, Adelaide, SA, Australia
11. Bureau Veritas Geoanalytical, Perth, WA, Australia
12. Inspectorate (BV), Lima, Peru
13. Intertek Genalysis, Perth, WA, Australia
14. Intertek Testing Services Philippines, Cupang, Muntinlupa, Philippines

15. Nagrom, Perth, WA, Australia
16. Ontario Geological Survey, Sudbury, Ontario, Canada
17. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
18. Reminex Centre de Recherche, Marrakesh, Marrakesh-Safi, Morocco
19. Saskatchewan Research Council, Saskatoon, Saskatchewan, Canada
20. SGS, Randfontein, Gauteng, South Africa
21. SGS Australia Mineral Services, Perth, WA, Australia
22. SGS Canada Inc., Vancouver, BC, Canada
23. SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
24. UIS Analytical Services, Centurion , South Africa

***Please note: Above numbered alphabetical list of participating laboratories <u>does not</u> reflect the Lab ID numbering on the scatter plots above.***

## PREPARER AND SUPPLIER

Certified reference material OREAS 752 was prepared, certified and supplied by:

ORE RESEARCH & EXPLORATION

ORE Research & Exploration Pty Ltd
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It is packaged in 10g units in laminated foil packets and in 500g units in wide-mouth plastic jars.

## METROLOGICAL TRACEABILITY

The analytical samples were selected in a manner to represent the entire batch of prepared CRM. This 'representivity' was maintained in each submitted laboratory sample batch and ensures the user that the data is traceable from sample selection through to the analytical results that underlie the consensus values. Each analytical data set has been validated by its assayer through the inclusion of internal reference materials and QC checks during analysis.

The laboratories were chosen on the basis of their competence (from past performance in inter-laboratory programs undertaken by ORE Pty Ltd) for a particular analytical method, analyte or analyte suite, and sample matrix. Most of these laboratories have and maintain ISO 17025 accreditation. The certified values presented in this report are calculated from the means of accepted data following robust statistical treatment as detailed in this report.

Guide ISO/TR 16476:2016, section 5.3.1 describes metrological traceability in reference materials as it pertains to the transformation of the measurand. In this section it states, *"Although the determination of the property value itself can be made traceable to appropriate units through, for example, calibration of the measurement equipment used, steps like the transformation of the sample from one physical (chemical) state to another cannot. Such transformations may only be compared with a reference (when available), or* *among themselves. For some transformations, reference methods have been defined and may be used in certification projects to evaluate the uncertainty associated with such a transformation. In other cases,* ***only a comparison among different laboratories using the same method is possible. In this case, certification takes place on the basis of agreement among independent measurement results*** *(see ISO Guide 35:2006, Clause 10).”*

## COMMUTABILITY

The measurements of the results that underlie the certified values contained in this report were undertaken by methods involving pre-treatment (digestion/fusion) of the sample. This served to reduce the sample to a simple and well understood form permitting calibration using simple solutions of the CRM. Due to these methods being well understood and highly effective, commutability is not an issue for this CRM. All OREAS CRMs are sourced from natural ore minerals meaning they will display similar behaviour as routine ‘field’ samples in the relevant measurement process. Care should be taken to ensure ‘matrix matching’ as close as practically achievable. The matrix and mineralisation style of the CRM is described in the ‘Source Material’ section and users should select appropriate CRMs matching these attributes to their field samples.

## INTENDED USE

OREAS 752 is intended to cover all activities needed to produce a measurement result. This includes extraction, possible separation steps and the actual measurement process (the signal producing step). OREAS 752 may be used to calibrate the entire procedure by producing a pure substance CRM transformed into a calibration solution.

OREAS 752 is intended for the following uses:

- For the monitoring of laboratory performance in the analysis of analytes reported in Table 1 in geological samples;
- For the verification of analytical methods for analytes reported in Table 1;
- For the calibration of instruments used in the determination of the concentration of analytes reported in Table 1.

## STABILITY AND STORAGE INSTRUCTIONS

OREAS 752 was sourced from Li-rich pegmatite ore and is low in reactive sulphides. In its unopened state and under normal conditions of storage it has a shelf life beyond ten years. Its stability will be monitored at regular intervals and purchasers notified if any changes are observed.

## INSTRUCTIONS FOR CORRECT USE

The certified values for lithium borate fusion XRF and for LOI are on a ‘dry sample’ basis whilst all other certified values are reported on a ‘sample as received’ basis.

## HANDLING INSTRUCTIONS

Fine powders pose a risk to eyes and lungs and therefore standard precautions such as the use of safety glasses and dust masks are advised.

## LEGAL NOTICE

Ore Research & Exploration Pty Ltd has prepared and statistically evaluated the property values of this reference material to the best of its ability. The Purchaser by receipt hereof releases and indemnifies Ore Research & Exploration Pty Ltd from and against all liability and costs arising from the use of this material and information.

## DOCUMENT HISTORY

| Revision No. | Date | Changes applied |
|---|---|---|
| 2 | 22nd February 2019 | Table of content got 'QMS ACCREDITED' link added. |
| 1 | 11th February 2019 | Minor change in the Source Material section. |
| 0 | 11th February 2019 | First publication. |

## QMS ACCREDITED

ORE Pty Ltd is accredited to ISO 9001:2015 by Lloyd's Register Quality Assurance Ltd for its quality management system including development, manufacturing, certification and supply of CRMs.

## CERTIFYING OFFICER

22nd February, 2019

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