

ASSAY

| Element: Calcium | | | SPECTROGRAPHIC ANALYSIS | | | |
|--|----------------|----------------------|-------------------------|--------------|---------------------------|--------------|
| Symbol: Ca | | | Element: ppm | Element: ppm | Element: ppm | Element: ppm |
| Isotope: 40 | | | Ag: <1 | I: | Rh: | Tc: |
| Series: JW | | | Al: 128.32 | In: <1 | Ru: | Te: |
| Batch: 118740 | | | As: <1 | Ir: | S: <1 | Th: <1 |
| ISOTOPIC ANALYSIS | | | Au: | K: <1 | Sb: | Ti: <1 |
| Isotope | Atomic Percent | Precision plus/minus | B: <1 | Li: <1 | Sc: | Tl: <1 |
| 40 | 99.9650 | 0.01000 | Ba: <1 | Mg: 55.18 | Se: <1 | U: <1 |
| 42 | 0.0090 | 0.00300 | Be: <1 | Mn: 10.81 | Si: <1 | V: <1 |
| 43 | 0.0020 | 0.00100 | Bi: | Mo: <1 | Sn: <1 | W: <1 |
| 44 | 0.0220 | 0.00300 | Br: | N: | Sr: 140.21 | Zn: <1 |
| 46 | <.001 | 0.00000 | C: | Na: 18.12 | Ta: <1 | Zr: <1 |
| 48 | 0.0020 | 0.00100 | Ca: M | Nb: | LANTHANIDES and ACTINIDES | |
| The limits quoted above are an expression of the precision of this measurement only. The error is estimated at less than 1% from known sources of systematic errors. | | | Cd: <1 | Ni: <1 | Am: | La: |
| | | | Cl: | O: | Bk: | Lu: |
| | | | Co: <1 | Os: | Ce: | Md: |
| | | | Cr: <1 | P: <1 | Cf: | Nd: |
| | | | Cs: | Pa: | Cm: | Np: |
| | | | Cu: 161.21 | Pb: <1 | Dy: <1 | Pr: |
| | | | F: | Pd: | Er: <1 | Pu: |
| | | | Fe: 93.5 | Pm: | Es: | Sm: <1 |
| | | | Ga: <1 | Po: | Eu: <1 | Tb: |
| | | | Ge: | Pt: | Fm: | Y: <1 |
| | | | Hf: | Ra: | Gd: <1 | Yb: |
| | | | Hg: | Rb: | Ho: | Tm: |
| | | | | Re: | | |

- * Request No. 19829; Requisition No. B-3869; Resample ASSIG-0180 impurities
- * The spectrographic results reported herein are semi-quantitative estimates valid to one significant figure.
- * Elements listed above without values were not detected or would calculate less than 10 ppm.
- * This analysis reflects enrichment and impurity levels prior to conversion/fabrication (if applicable).
- * Symbols: M - major; T - trace; I - interference; < - less than; <= - less than/equal to; ~ - approximately; nd - not detected; no analyses made in all other cases.

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Chemical Science Division
 Nuclear Analytical Chemistry and Isotopic Laboratories
 One Bethel Valley Road, MS
 6415 Oak Ridge, TN 37830



Trace Metal Impurity Report

| | | | |
|----------------|--------------------------------------|-------------------------------|----------------|
| CUSTOMER NAME: | Eva Hickman | CUSTOMER ID: Ca-40, 118740 | CHARGE NUMBER: |
| Analysis Date | 01/25/2019 | | |
| Analyzed by | Dr. Ben Manard <i>[Signature]</i> | | |
| Approved by | Dr. Cole R. Hexel <i>[Signature]</i> | | |

| Element | Value (ug/g) | Uncertainty (2σ) | Element | Value (ug/g) | Uncertainty (2σ) | Element | Value (ug/g) | Uncertainty (2σ) |
|---------|--------------|------------------|---------|--------------|------------------|---------|--------------|------------------|
| Ag | <1 | | Ga | <1 | | Si | <1 | |
| Al | 128.32 | 0.8 | Gd | <1 | | Sm | <1 | |
| As | <1 | | In | <1 | | Sn | <1 | |
| B | <1 | | K | <1 | | Sr | 140.21 | 0.65 |
| Ba | <1 | | Li | <1 | | Ta | <1 | |
| Be | <1 | | Mg | 55.18 | 0.13 | Th | <1 | |
| Ca | Matrix | | Mn | 10.81 | 0.11 | Ti | <1 | |
| Cd | <1 | | Mo | <1 | | Tl | <1 | |
| Co | <1 | | Na | 18.12 | 0.16 | U | <1 | |
| Cr | <1 | | Ni | <1 | | V | <1 | |
| Cu | 161.21 | 0.69 | P | <1 | | W | <1 | |
| Dy | <1 | | Pb | <1 | | Y | <1 | |
| Er | <1 | | S | <1 | | Zn | <1 | |
| Eu | >1 | <i><1/A</i> | Se | <1 | | Zr | <1 | |
| Fe | 93.5 | 0.38 | | | | | | |

| |
|--------|
| Purity |
| 99.93% |

ASSAY

| Element: Calcium Symbol: Ca Isotope: 48 Series: LO Batch: 140042 | | | SPECTROGRAPHIC ANALYSIS | | | | | | | | | | | | | | | | | | | | | | | | |
|--|------------------|---------|--------------------------------|-----------------------|----------------------------------|---------------------|--------|---------|----|--------|---------|----|------|---------|----|--------|---------|----|-------|---------|----|---------|---------|------------------|------------|-----------------|------------------|
| | | | Element: ppm | Element: ppm | Element: ppm | Element: ppm | | | | | | | | | | | | | | | | | | | | | |
| ISOTOPIC ANALYSIS | | | Ag: <1 | I: | Rh: | Tc: | | | | | | | | | | | | | | | | | | | | | |
| | | | Al: 4.17 | In: <1 | Ru: | Te: | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Isotope</th> <th>Atomic Percent</th> <th>Precision plus/minus</th> </tr> </thead> <tbody> <tr><td>40</td><td>3.8400</td><td>0.02000</td></tr> <tr><td>42</td><td>0.0500</td><td>0.01000</td></tr> <tr><td>43</td><td><.01</td><td>0.00000</td></tr> <tr><td>44</td><td>0.1100</td><td>0.01000</td></tr> <tr><td>46</td><td><0.01</td><td>0.00000</td></tr> <tr><td>48</td><td>95.9900</td><td>0.02000</td></tr> </tbody> </table> | | | Isotope | Atomic Percent | Precision plus/minus | 40 | 3.8400 | 0.02000 | 42 | 0.0500 | 0.01000 | 43 | <.01 | 0.00000 | 44 | 0.1100 | 0.01000 | 46 | <0.01 | 0.00000 | 48 | 95.9900 | 0.02000 | As: <1 | Ir: | S: <1 | Th: <1 |
| | | | Isotope | Atomic Percent | Precision plus/minus | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 3.8400 | 0.02000 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42 | 0.0500 | 0.01000 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 43 | <.01 | 0.00000 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 44 | 0.1100 | 0.01000 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 46 | <0.01 | 0.00000 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 48 | 95.9900 | 0.02000 | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The limits quoted above are an expression of the precision of this measurement only. The error is estimated at less than 1% from known sources of systematic errors.</p> | | | Au: | K: <1 | Sb: | Ti: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | B: <1 | Li: <1 | Sc: | Tl: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | Ba: <1 | Mg: 44.38 | Se: <1 | U: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | Be: <1 | Mn: 47.68 | Si: <1 | V: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | Bi: | Mo: <1 | Sn: <1 | W: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | Br: | N: | Sr: 734.16 | Zn: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | C: | Na: 6.09 | Ta: <1 | Zr: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | Ca: M | Nb: | LANTHANIDES and ACTINIDES | | | | | | | | | | | | | | | | | | | | | | |
| Cd: <1 | Ni: <1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Cl: | O: | Am: | La: | | | | | | | | | | | | | | | | | | | | | |
| | | | Co: <1 | Os: | Bk: | Lu: | | | | | | | | | | | | | | | | | | | | | |
| | | | Cr: <1 | P: <1 | Ce: | Md: | | | | | | | | | | | | | | | | | | | | | |
| | | | Cs: | Pa: | Cf: | Nd: | | | | | | | | | | | | | | | | | | | | | |
| | | | Cu: 2.91 | Pb: <1 | Cm: | Np: | | | | | | | | | | | | | | | | | | | | | |
| | | | F: | Pd: | Dy: <1 | Pr: | | | | | | | | | | | | | | | | | | | | | |
| | | | Fe: 49.48 | Pm: | Er: <1 | Pu: | | | | | | | | | | | | | | | | | | | | | |
| | | | Ga: <1 | Po: | Es: | Sm: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | Ge: | Pt: | Eu: <1 | Tb: | | | | | | | | | | | | | | | | | | | | | |
| | | | Hf: | Ra: | Fm: | Y: <1 | | | | | | | | | | | | | | | | | | | | | |
| | | | Hg: | Rb: | Gd: <1 | Yb: | | | | | | | | | | | | | | | | | | | | | |
| | | | | Re: | Ho: | Tm: | | | | | | | | | | | | | | | | | | | | | |

* Request No. 32571; Requisition No. B-12639; Resample ASSIG-0181 impurities

* The spectrographic results reported herein are semi-quantitative estimates valid to one significant figure.

* Elements listed above without values were not detected or would calculate less than 10 ppm.

* This analysis reflects enrichment and impurity levels prior to conversion/fabrication (if applicable).

* Symbols: M - major; T - trace; I - interference; < - less than; <= - less than/equal to; ~ - approximately; nd - not detected; no analyses made in all other cases.

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Trace Metal Impurity Report

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|----------------|-------------------|-------------------------------|----------------|
| CUSTOMER NAME: | Eva Hickman | CUSTOMER ID: Ca-40, 140042 | CHARGE NUMBER: |
| Analysis Date | 01/25/2019 | | |
| Analyzed by | Dr. Ben Manard | | |
| Approved by | Dr. Cole R. Hexel | | |

| Element | Value (ug/g) | Uncertainty (2σ) | Element | Value (ug/g) | Uncertainty (2σ) | Element | Value (ug/g) | Uncertainty (2σ) |
|---------|--------------|------------------|---------|--------------|------------------|---------|--------------|------------------|
| Ag | <1 | | Ga | <1 | | Si | <1 | |
| Al | 4.17 | 1.59 | Gd | <1 | | Sm | <1 | |
| As | <1 | | In | <1 | | Sn | <1 | |
| B | <1 | | K | <1 | | Sr | 734.16 | 4.14 |
| Ba | <1 | | Li | <1 | | Ta | <1 | |
| Be | <1 | | Mg | 44.38 | 0.21 | Th | <1 | |
| Ca | Matrix | | Mn | 47.68 | 0.22 | Ti | <1 | |
| Cd | <1 | | Mo | <1 | | Tl | <1 | |
| Co | <1 | | Na | 6.09 | 0.07 | U | <1 | |
| Cr | <1 | | Ni | <1 | | V | <1 | |
| Cu | 2.91 | 0.38 | P | <1 | | W | <1 | |
| Dy | <1 | | Pb | <1 | | Y | <1 | |
| Er | <1 | | S | <1 | | Zn | <1 | |
| Eu | <1 | | Se | <1 | | Zr | <1 | |
| Fe | 49.48 | 0.38 | | | | | | |

| |
|--------|
| Purity |
| 99.91% |