

### Prep Standard - Chemical Standard Summary

**Order ID :** Q2904

**Test :** Metals Group 10

**Prepbatch ID :** PB169324,

**Sequence ID/Qc Batch ID:** LB136940, LB136940,

**Standard ID :**  
MP85156,

**Chemical ID :**  
M6151, M6158, M6180, M6181, W3112,



| <u>Recipe ID</u>                                                                               | <u>NAME</u> | <u>NO.</u>              | <u>Prep Date</u> | <u>Expiration Date</u> | <u>Prepared By</u>  | <u>ScaleID</u> | <u>PipetteID</u> | <u>Supervised By</u>              |
|------------------------------------------------------------------------------------------------|-------------|-------------------------|------------------|------------------------|---------------------|----------------|------------------|-----------------------------------|
| 170                                                                                            | 1:1HCL      | <a href="#">MP85156</a> | 04/07/2025       | 09/06/2025             | Kareem<br>Khairalla | None           | None             | Sarabjit Jaswal<br><br>04/07/2025 |
| <b><u>FROM</u></b> 1250.00000ml of M6151 + 1250.00000ml of W3112 = Final Quantity: 2500.000 ml |             |                         |                  |                        |                     |                |                  |                                   |

## CHEMICAL RECEIPT LOG BOOK

| Supplier         | ItemCode / ItemName                                         | Lot #      | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------|-------------------------------------------------------------|------------|-----------------|-------------------------|-----------------------------|----------------|
| Seidler Chemical | BA-9530-33 / Hydrochloric Acid, Instra-Analyzed (cs/6x2.5L) | 22G2862015 | 02/17/2026      | 02/18/2025 / Sagar      | 01/15/2025 / Sagar          | M6151          |

| Supplier         | ItemCode / ItemName                                   | Lot #      | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------|-------------------------------------------------------|------------|-----------------|-------------------------|-----------------------------|----------------|
| Seidler Chemical | BA-9598-34 / Nitric Acid, Instra-Analyzed (cs/4x2.5L) | 24D1062002 | 09/09/2025      | 03/10/2025 / Eman       | 02/02/2025 / Sagar          | M6158          |

| Supplier           | ItemCode / ItemName                                      | Lot #        | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|----------------------------------------------------------|--------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | WW-LFS-1 / Laboratory Fortified Stock Solution 1, 125 ml | W2-MEB752149 | 02/05/2026      | 08/06/2025 / Janvi      | 07/22/2025 / Janvi          | M6180          |

| Supplier           | ItemCode / ItemName                                      | Lot #         | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|----------------------------------------------------------|---------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | WW-LFS-2 / Laboratory Fortified Stock Solution 2, 125 ml | V2-MEB7433480 | 02/05/2026      | 08/06/2025 / Janvi      | 07/22/2025 / Janvi          | M6181          |

| Supplier         | ItemCode / ItemName | Lot #               | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------|---------------------|---------------------|-----------------|-------------------------|-----------------------------|----------------|
| Seidler Chemical | DIW / DI Water      | Daily Lab-Certified | 07/03/2029      | 07/03/2024 / Iwona      | 07/03/2024 / Iwona          | W3112          |

Hydrochloric Acid, 36.5–38.0%  
BAKER INSTRA-ANALYZED® Reagent  
For Trace Metal Analysis

 **avantors™**



M6151

R → 11/15/25

Material No.: 9530-33  
Batch No.: 22G2862015  
Manufactured Date: 2022-06-15  
Retest Date: 2027-06-14  
Revision No.: 0

## Certificate of Analysis

| Test                                      | Specification | Result      |
|-------------------------------------------|---------------|-------------|
| ACS – Assay (as HCl) (by acid–base titrn) | 36.5 – 38.0 % | 37.9 %      |
| ACS – Color (APHA)                        | ≤ 10          | 5           |
| ACS – Residue after Ignition              | ≤ 3 ppm       | < 1 ppm     |
| ACS – Specific Gravity at 60°/60°F        | 1.185 – 1.192 | 1.191       |
| ACS – Bromide (Br)                        | ≤ 0.005 %     | < 0.005 %   |
| ACS – Extractable Organic Substances      | ≤ 5 ppm       | < 1 ppm     |
| ACS – Free Chlorine (as Cl <sub>2</sub> ) | ≤ 0.5 ppm     | < 0.5 ppm   |
| Phosphate (PO <sub>4</sub> )              | ≤ 0.05 ppm    | < 0.03 ppm  |
| Sulfate (SO <sub>4</sub> )                | ≤ 0.5 ppm     | < 0.3 ppm   |
| Sulfite (SO <sub>3</sub> )                | ≤ 0.8 ppm     | 0.3 ppm     |
| Ammonium (NH <sub>4</sub> )               | ≤ 3 ppm       | < 1 ppm     |
| Trace Impurities – Arsenic (As)           | ≤ 0.010 ppm   | < 0.003 ppm |
| Trace Impurities – Aluminum (Al)          | ≤ 10.0 ppb    | 1.3 ppb     |
| Arsenic and Antimony (as As)              | ≤ 5.0 ppb     | < 3.0 ppb   |
| Trace Impurities – Barium (Ba)            | ≤ 1.0 ppb     | 0.2 ppb     |
| Trace Impurities – Beryllium (Be)         | ≤ 1.0 ppb     | < 0.2 ppb   |
| Trace Impurities – Bismuth (Bi)           | ≤ 10.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Boron (B)              | ≤ 20.0 ppb    | < 5.0 ppb   |
| Trace Impurities – Cadmium (Cd)           | ≤ 1.0 ppb     | < 0.3 ppb   |
| Trace Impurities – Calcium (Ca)           | ≤ 50.0 ppb    | 163.0 ppb   |
| Trace Impurities – Chromium (Cr)          | ≤ 1.0 ppb     | 0.7 ppb     |
| Trace Impurities – Cobalt (Co)            | ≤ 1.0 ppb     | < 0.3 ppb   |
| Trace Impurities – Copper (Cu)            | ≤ 1.0 ppb     | < 0.1 ppb   |
| Trace Impurities – Gallium (Ga)           | ≤ 1.0 ppb     | < 0.2 ppb   |
| Trace Impurities – Germanium (Ge)         | ≤ 3.0 ppb     | < 2.0 ppb   |
| Trace Impurities – Gold (Au)              | ≤ 4.0 ppb     | 0.6 ppb     |
| Heavy Metals (as Pb)                      | ≤ 100 ppb     | < 50 ppb    |
| Trace Impurities – Iron (Fe)              | ≤ 15 ppb      | 6 ppb       |

>>> Continued on page 2 >>>

Hydrochloric Acid, 36.5–38.0%  
BAKER INSTRA-ANALYZED® Reagent  
For Trace Metal Analysis

 **avantorsm**



Material No.: 9530-33  
Batch No.: 22G2862015

| Test                                                   | Specification | Result     |
|--------------------------------------------------------|---------------|------------|
| Trace Impurities – Lead (Pb)                           | ≤ 1.0 ppb     | < 0.5 ppb  |
| Trace Impurities – Lithium (Li)                        | ≤ 1.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Magnesium (Mg)                      | ≤ 10.0 ppb    | 2.9 ppb    |
| Trace Impurities – Manganese (Mn)                      | ≤ 1.0 ppb     | < 0.4 ppb  |
| Trace Impurities – Mercury (Hg)                        | ≤ 0.5 ppb     | 0.1 ppb    |
| Trace Impurities – Molybdenum (Mo)                     | ≤ 10.0 ppb    | < 3.0 ppb  |
| Trace Impurities – Nickel (Ni)                         | ≤ 4.0 ppb     | < 0.3 ppb  |
| Trace Impurities – Niobium (Nb)                        | ≤ 1.0 ppb     | 0.8 ppb    |
| Trace Impurities – Potassium (K)                       | ≤ 9.0 ppb     | < 2.0 ppb  |
| Trace Impurities – Selenium (Se), For Information Only |               | < 1.0 ppb  |
| Trace Impurities – Silicon (Si)                        | ≤ 100.0 ppb   | < 10.0 ppb |
| Trace Impurities – Silver (Ag)                         | ≤ 1.0 ppb     | 0.5 ppb    |
| Trace Impurities – Sodium (Na)                         | ≤ 100.0 ppb   | 2.3 ppb    |
| Trace Impurities – Strontium (Sr)                      | ≤ 1.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Tantalum (Ta)                       | ≤ 1.0 ppb     | 1.6 ppb    |
| Trace Impurities – Thallium (Tl)                       | ≤ 5.0 ppb     | < 2.0 ppb  |
| Trace Impurities – Tin (Sn)                            | ≤ 5.0 ppb     | 4.0 ppb    |
| Trace Impurities – Titanium (Ti)                       | ≤ 1.0 ppb     | 1.5 ppb    |
| Trace Impurities – Vanadium (V)                        | ≤ 1.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Zinc (Zn)                           | ≤ 5.0 ppb     | 0.8 ppb    |
| Trace Impurities – Zirconium (Zr)                      | ≤ 1.0 ppb     | 0.3 ppb    |

>>> Continued on page 3 >>>

Hydrochloric Acid, 36.5–38.0%  
BAKER INSTRA–ANALYZED® Reagent  
For Trace Metal Analysis



Material No.: 9530-33  
Batch No.: 22G2862015

| Test | Specification | Result |
|------|---------------|--------|
|------|---------------|--------|

For Laboratory, Research, or Manufacturing Use  
Product Information (not specifications):  
Appearance (clear, fuming liquid)  
Meets ACS Specifications  
Storage Condition: Store below 25 °C.

Country of Origin: USA  
Packaging Site: Phillipsburg Mfg Ctr & DC

A handwritten signature in cursive script that reads 'Jamie Ethier'.  
Jamie Ethier  
Vice President Global Quality

Nitric Acid 69%  
CMOS

avantor™



R- 0210212025

m - 6158

Material No.: 9606-03  
Batch No.: 24D1062002  
Manufactured Date: 2024-03-26  
Retest Date: 2029-03-25  
Revision No.: 0

## Certificate of Analysis

| Test                              | Specification | Result      |
|-----------------------------------|---------------|-------------|
| Assay (HNO <sub>3</sub> )         | 69.0 – 70.0 % | 69.7 %      |
| Appearance                        | Passes Test   | Passes Test |
| Color (APHA)                      | ≤ 10          | 5           |
| Residue after Ignition            | ≤ 2 ppm       | 1 ppm       |
| Chloride (Cl)                     | ≤ 0.08 ppm    | < 0.03 ppm  |
| Phosphate (PO <sub>4</sub> )      | ≤ 0.10 ppm    | < 0.03 ppm  |
| Sulfate (SO <sub>4</sub> )        | ≤ 0.2 ppm     | < 0.2 ppm   |
| Trace Impurities – Aluminum (Al)  | ≤ 40.0 ppb    | < 1.0 ppb   |
| Arsenic and Antimony (as As)      | ≤ 5.0 ppb     | < 2.0 ppb   |
| Trace Impurities – Barium (Ba)    | ≤ 10.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Beryllium (Be) | ≤ 10.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Bismuth (Bi)   | ≤ 20.0 ppb    | < 10.0 ppb  |
| Trace Impurities – Boron (B)      | ≤ 10.0 ppb    | < 5.0 ppb   |
| Trace Impurities – Cadmium (Cd)   | ≤ 50 ppb      | < 1 ppb     |
| Trace Impurities – Calcium (Ca)   | ≤ 50.0 ppb    | 2.3 ppb     |
| Trace Impurities – Chromium (Cr)  | ≤ 30.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Cobalt (Co)    | ≤ 10.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Copper (Cu)    | ≤ 10.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Gallium (Ga)   | ≤ 10.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Germanium (Ge) | ≤ 20 ppb      | < 10 ppb    |
| Trace Impurities – Gold (Au)      | ≤ 20 ppb      | < 5 ppb     |
| Heavy Metals (as Pb)              | ≤ 100 ppb     | 100 ppb     |
| Trace Impurities – Iron (Fe)      | ≤ 40.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Lead (Pb)      | ≤ 20.0 ppb    | < 10.0 ppb  |
| Trace Impurities – Lithium (Li)   | ≤ 10.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Magnesium (Mg) | ≤ 20 ppb      | < 1 ppb     |
| Trace Impurities – Manganese (Mn) | ≤ 10.0 ppb    | < 1.0 ppb   |
| Trace Impurities – Nickel (Ni)    | ≤ 20.0 ppb    | < 5.0 ppb   |

>>> Continued on page 2 >>>

Nitric Acid 69%  
CMOS

 **avantors<sup>TM</sup>**



Material No.: 9606-03  
Batch No.: 24D1062002

| Test                                | Specification | Result     |
|-------------------------------------|---------------|------------|
| Trace Impurities – Niobium (Nb)     | ≤ 50.0 ppb    | < 1.0 ppb  |
| Trace Impurities – Potassium (K)    | ≤ 50 ppb      | 16 ppb     |
| Trace Impurities – Silicon (Si)     | ≤ 50 ppb      | < 10 ppb   |
| Trace Impurities – Silver (Ag)      | ≤ 20.0 ppb    | < 1.0 ppb  |
| Trace Impurities – Sodium (Na)      | ≤ 150.0 ppb   | < 5.0 ppb  |
| Trace Impurities – Strontium (Sr)   | ≤ 30.0 ppb    | < 1.0 ppb  |
| Trace Impurities – Tantalum (Ta)    | ≤ 10.0 ppb    | < 5.0 ppb  |
| Trace Impurities – Thallium (Tl)    | ≤ 10.0 ppb    | < 5.0 ppb  |
| Trace Impurities – Tin (Sn)         | ≤ 20.0 ppb    | < 10.0 ppb |
| Trace Impurities – Titanium (Ti)    | ≤ 10.0 ppb    | < 1.0 ppb  |
| Trace Impurities – Vanadium (V)     | ≤ 10.0 ppb    | < 1.0 ppb  |
| Trace Impurities – Zinc (Zn)        | ≤ 20.0 ppb    | < 1.0 ppb  |
| Trace Impurities – Zirconium (Zr)   | ≤ 10.0 ppb    | < 1.0 ppb  |
| Particle Count – 0.5 µm and greater | ≤ 60 par/ml   | 10 par/ml  |
| Particle Count – 1.0 µm and greater | ≤ 10 par/ml   | 3 par/ml   |

>>> Continued on page 3 >>>

Nitric Acid 69%  
CMOS

 **avantor™**



Material No.: 9606-03  
Batch No.: 24D1062002

| Test | Specification | Result |
|------|---------------|--------|
|------|---------------|--------|

For Microelectronic Use

Country of Origin: USA  
Packaging Site: Phillipsburg Mfg Ctr & DC



Jamie Croak  
Director Quality Operations, Bioscience Production

# Certificate of Analysis

300 Technology Drive  
Christiansburg, VA 24073 USA  
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F: 540-585-3012  
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## 1.0 ACCREDITATION / REGISTRATION

**INORGANIC VENTURES** is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).



## 2.0 PRODUCT DESCRIPTION

|                 |                                     |
|-----------------|-------------------------------------|
| Product Code:   | Multi Analyte Custom Grade Solution |
| Catalog Number: | WW-LFS-1                            |
| Lot Number:     | W2-MEB752149                        |
| Matrix:         | 5% (v/v) HNO <sub>3</sub>           |

M6180  
R-37/22/23

|                     |                 |            |
|---------------------|-----------------|------------|
| Value / Analyte(s): | 1 000 µg/mL ea: |            |
|                     | Potassium,      |            |
|                     | 600 µg/mL ea:   |            |
|                     | Phosphorus,     |            |
|                     | 300 µg/mL ea:   |            |
|                     | Sodium,         | Iron,      |
|                     | 200 µg/mL ea:   |            |
|                     | Magnesium,      | Aluminum,  |
|                     | Cerium,         | Selenium,  |
|                     | Thallium,       |            |
|                     | 100 µg/mL ea:   |            |
|                     | Lead,           | Calcium,   |
|                     | 80 µg/mL ea:    |            |
|                     | Arsenic,        |            |
|                     | 70 µg/mL ea:    |            |
|                     | Mercury,        |            |
|                     | 50 µg/mL ea:    |            |
|                     | Nickel,         |            |
|                     | 40 µg/mL ea:    |            |
|                     | Chromium,       |            |
|                     | 30 µg/mL ea:    |            |
|                     | Copper,         | Boron,     |
|                     | Vanadium,       |            |
|                     | 20 µg/mL ea:    |            |
|                     | Zinc,           | Strontium, |
|                     | Barium,         | Beryllium, |
|                     | Cadmium,        | Cobalt,    |
|                     | Manganese,      | Lithium,   |
|                     | 7.5 µg/mL ea:   |            |
|                     | Silver          |            |

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE       | CERTIFIED VALUE    | ANALYTE       | CERTIFIED VALUE    |
|---------------|--------------------|---------------|--------------------|
| Aluminum, Al  | 200.2 ± 0.7 µg/mL  | Arsenic, As   | 80.1 ± 0.5 µg/mL   |
| Barium, Ba    | 20.02 ± 0.12 µg/mL | Beryllium, Be | 20.02 ± 0.11 µg/mL |
| Boron, B      | 30.02 ± 0.15 µg/mL | Cadmium, Cd   | 20.04 ± 0.09 µg/mL |
| Calcium, Ca   | 100.1 ± 0.3 µg/mL  | Cerium, Ce    | 200.2 ± 1.0 µg/mL  |
| Chromium, Cr  | 40.02 ± 0.26 µg/mL | Cobalt, Co    | 20.03 ± 0.09 µg/mL |
| Copper, Cu    | 30.03 ± 0.13 µg/mL | Iron, Fe      | 300.3 ± 1.3 µg/mL  |
| Lead, Pb      | 100.1 ± 0.5 µg/mL  | Lithium, Li   | 20.03 ± 0.09 µg/mL |
| Magnesium, Mg | 200.2 ± 0.9 µg/mL  | Manganese, Mn | 19.99 ± 0.09 µg/mL |
| Mercury, Hg   | 70.0 ± 0.3 µg/mL   | Nickel, Ni    | 50.05 ± 0.22 µg/mL |
| Phosphorus, P | 600.5 ± 2.9 µg/mL  | Potassium, K  | 1 001 ± 4 µg/mL    |
| Selenium, Se  | 200.2 ± 1.1 µg/mL  | Silver, Ag    | 7.52 ± 0.03 µg/mL  |
| Sodium, Na    | 300.3 ± 1.3 µg/mL  | Strontium, Sr | 20.02 ± 0.10 µg/mL |
| Thallium, Tl  | 200.2 ± 1.0 µg/mL  | Vanadium, V   | 30.02 ± 0.13 µg/mL |
| Zinc, Zn      | 20.05 ± 0.09 µg/mL |               |                    |

Density: 1.037 g/mL (measured at 20 ± 5 °C)

Assay Information:

| ANALYTE | METHOD      | NIST SRM#          | SRM LOT#     |
|---------|-------------|--------------------|--------------|
| Ag      | ICP Assay   | 3151               | 160729       |
| Ag      | Volhard     | 999c               | 999c         |
| Al      | ICP Assay   | 3101a              | 140903       |
| Al      | EDTA        | 928                | 928          |
| As      | ICP Assay   | 3103a              | 100818       |
| B       | ICP Assay   | 3107               | 190605       |
| B       | Calculated  |                    | See Sec. 4.2 |
| Ba      | ICP Assay   | 3104a              | 140909       |
| Ba      | Gravimetric |                    | See Sec. 4.2 |
| Be      | ICP Assay   | 3105a              | 090514       |
| Ca      | ICP Assay   | 3109a              | 130213       |
| Ca      | EDTA        | 928                | 928          |
| Cd      | ICP Assay   | 3108               | 130116       |
| Cd      | EDTA        | 928                | 928          |
| Ce      | ICP Assay   | 3110               | 160830       |
| Ce      | EDTA        | 928                | 928          |
| Co      | ICP Assay   | 3113               | 190630       |
| Co      | EDTA        | 928                | 928          |
| Cr      | ICP Assay   | 3112a              | 170630       |
| Cu      | ICP Assay   | 3114               | 120618       |
| Cu      | EDTA        | 928                | 928          |
| Fe      | ICP Assay   | 3126a              | 140812       |
| Fe      | EDTA        | 928                | 928          |
| Hg      | ICP Assay   | 3133               | 160921       |
| Hg      | EDTA        | 928                | 928          |
| K       | ICP Assay   | 3141a              | 140813       |
| K       | Gravimetric |                    | See Sec. 4.2 |
| Li      | ICP Assay   | 3129a              | 100714       |
| Li      | Gravimetric |                    | See Sec. 4.2 |
| Mg      | ICP Assay   | 3131a              | 140110       |
| Mg      | EDTA        | 928                | 928          |
| Mn      | ICP Assay   | 3132               | 050429       |
| Mn      | EDTA        | 928                | 928          |
| Na      | ICP Assay   | 3152a              | 200413       |
| Na      | Gravimetric |                    | See Sec. 4.2 |
| Ni      | ICP Assay   | 3136               | 120619       |
| Ni      | EDTA        | 928                | 928          |
| P       | ICP Assay   | 3139a              | 060717       |
| P       | Acidimetric | 84L                | 84L          |
| Pb      | ICP Assay   | 3128               | 101026       |
| Pb      | EDTA        | 928                | 928          |
| Se      | ICP Assay   | 3149               | 100901       |
| Sr      | EDTA        | 928                | 928          |
| Sr      | ICP Assay   | Traceable to 3153a | K2-SR650985  |
| Tl      | ICP Assay   | 3158               | 151215       |
| V       | ICP Assay   | 3165               | 160906       |
| V       | EDTA        | 928                | 928          |
| Zn      | ICP Assay   | 3168a              | 120629       |
| Zn      | EDTA        | 928                | 928          |

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

#### Characterization of CRM/RM by Two or More Methods

Certified Value,  $X_{\text{CRM/RM}}$ , where two or more methods of characterization are used is the weighted mean of the results:

$$X_{\text{CRM/RM}} = \sum (w_i) (X_i)$$

$X_i$  = mean of Assay Method  $i$  with standard uncertainty  $u_{\text{char } i}$

$w_i$  = the weighting factors for each method calculated using the inverse square of the variance:

$$w_i = (1/u_{\text{char } i}^2) / (\sum (1/u_{\text{char } i}^2))$$

$$\text{CRM/RM Expanded Uncertainty } (\pm) = U_{\text{CRM/RM}} = k (u_{\text{char}}^2 + u_{\text{bb}}^2 + u_{\text{its}}^2 + u_{\text{ts}}^2)^{1/2}$$

$k$  = coverage factor = 2

$u_{\text{char}} = [\sum (w_i)^2 (u_{\text{char } i}^2)]^{1/2}$  where  $u_{\text{char } i}$  are the errors from each characterization method

$u_{\text{bb}}$  = bottle to bottle homogeneity standard uncertainty

$u_{\text{its}}$  = long term stability standard uncertainty (storage)

$u_{\text{ts}}$  = transport stability standard uncertainty

#### Characterization of CRM/RM by One Method

Certified Value,  $X_{\text{CRM/RM}}$ , where one method of characterization is used is the mean of individual results:

$$X_{\text{CRM/RM}} = (X_a) (u_{\text{char } a})$$

$X_a$  = mean of Assay Method A with

$u_{\text{char } a}$  = the standard uncertainty of characterization Method A

$$\text{CRM/RM Expanded Uncertainty } (\pm) = U_{\text{CRM/RM}} = k (u_{\text{char } a}^2 + u_{\text{bb}}^2 + u_{\text{its}}^2 + u_{\text{ts}}^2)^{1/2}$$

$k$  = coverage factor = 2

$u_{\text{char } a}$  = the errors from characterization

$u_{\text{bb}}$  = bottle to bottle homogeneity standard uncertainty

$u_{\text{its}}$  = long term stability standard uncertainty (storage)

$u_{\text{ts}}$  = transport stability standard uncertainty

## 4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

### 4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

### 4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

### 4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

## 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

N/A

## 6.0 INTENDED USE

6.1 This standard is intended for the calibration of analytical instruments and validation of analytical methods as appropriate. This CRM may be used in connection with EPA Methods 6010, 6020 (all versions), Standard Methods 3120 B and USP <232> / ICH Q3D.

6.2 For products attaining traceability through Inorganic Ventures' Primary Certified Reference Materials (PCRM™) see the Limited License to Use PCRM™ in the Inorganic Ventures Terms and Conditions of Sale. <https://www.inorganicventures.com/terms-and-conditions-sale>. The Terms and Conditions contain information on the use of materials traceable to PCRM™ certified reference materials. This Limited License agreement is especially pertinent for laboratories accredited under ISO:17034.

## 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

### 7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 25° C to minimize the effects of transpiration. Use at 20° ± 5° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit [www.inorganicventures.com/TCT](http://www.inorganicventures.com/TCT)

**Note:** This solution contains Silver (Ag), please refer to our Sample Preparation Guide for more information (<https://www.inorganicventures.com/sample-preparation-guide/samples-containing-silver>)

## **8.0 HAZARDOUS INFORMATION**

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

## **9.0 HOMOGENEITY**

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

## **10.0 QUALITY STANDARD DOCUMENTATION**

### **10.1 ISO 9001 Quality Management System Registration**

- QSR Certificate Number QSR-1034

### **10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"**

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

### **10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"**

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; [Info@inorganicventures.com](mailto:Info@inorganicventures.com);

## **11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY**

### **11.1 Certification Issue Date**

April 08, 2025

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

### **11.2 Lot Expiration Date**

- **April 08, 2029**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

### 11.3 Period of Validity

- Sealed TCT Bag Open Date: \_\_\_\_\_

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

### 12.0

#### NAMES AND SIGNATURES OF CERTIFYING OFFICERS

##### Certificate Prepared By:

Justin Dirico  
Stock Processing Supervisor



##### Certificate Approved By:

Jodie Wall  
Stock VSM Coordinator



##### Certifying Officer:

Paul Gaines  
Chairman / Senior Technical Director



300 Technology Drive  
Christiansburg, VA 24073 USA  
inorganicventures.com

# Certificate of Analysis

P: 800-669-6799/540-585-3030  
F: 540-585-3012  
info@inorganicventures.com

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## 1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).



## 2.0 PRODUCT DESCRIPTION

Product Code: Multi Analyte Custom Grade Solution  
Catalog Number: WW-LFS-2  
Lot Number: V2-MEB743480  
Matrix: 5% (v/v) HNO<sub>3</sub>  
tr. HF  
Value / Analyte(s):  
200 µg/mL ea:  
Silica,  
80 µg/mL ea:  
Antimony,  
70 µg/mL ea:  
Tin,  
40 µg/mL ea:  
Molybdenum,  
20 µg/mL ea:  
Titanium

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE                  | CERTIFIED VALUE    | ANALYTE        | CERTIFIED VALUE    |
|--------------------------|--------------------|----------------|--------------------|
| Antimony, Sb             | 80.1 ± 0.5 µg/mL   | Molybdenum, Mo | 40.05 ± 0.22 µg/mL |
| Silica, SiO <sub>2</sub> | 200.3 ± 1.4 µg/mL  | Tin, Sn        | 70.1 ± 0.4 µg/mL   |
| Titanium, Ti             | 20.03 ± 0.12 µg/mL |                |                    |

Density: 1.025 g/mL (measured at 20 ± 4 °C)

### Assay Information:

| ANALYTE          | METHOD     | NIST SRM#          | SRM LOT#     |
|------------------|------------|--------------------|--------------|
| Mo               | ICP Assay  | 3134               | 130418       |
| Sb               | ICP Assay  | 3102a              | 140911       |
| SiO <sub>2</sub> | Calculated |                    | See Sec. 4.2 |
| Sn               | ICP Assay  | 3161a              | 140917       |
| Ti               | ICP Assay  | traceable to 3162a | T2-TI725816  |

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

#### Characterization of CRM/RM by Two or More Methods

Certified Value,  $X_{\text{CRM/RM}}$ , where two or more methods of characterization are used is the weighted mean of the results:

$$X_{\text{CRM/RM}} = \sum (w_i) (X_i)$$

$X_i$  = mean of Assay Method  $i$  with standard uncertainty  $u_{\text{char } i}$

$w_i$  = the weighting factors for each method calculated using the inverse square of the variance:

$$w_i = (1/u_{\text{char } i})^2 / (\sum (1/u_{\text{char } i})^2)$$

$$\text{CRM/RM Expanded Uncertainty (z)} = U_{\text{CRM/RM}} = k (u_{\text{char}}^2 + u_{\text{bb}}^2 + u_{\text{Its}}^2 + u_{\text{ts}}^2)^{1/2}$$

$k$  = coverage factor = 2

$u_{\text{char}} = [\sum ((w_i)^2 (u_{\text{char } i})^2)]^{1/2}$  where  $u_{\text{char } i}$  are the errors from each characterization method

$u_{\text{bb}}$  = bottle to bottle homogeneity standard uncertainty

$u_{\text{Its}}$  = long term stability standard uncertainty (storage)

$u_{\text{ts}}$  = transport stability standard uncertainty

#### Characterization of CRM/RM by One Method

Certified Value,  $X_{\text{CRM/RM}}$ , where one method of characterization is used is the mean of individual results:

$$X_{\text{CRM/RM}} = (X_a) (u_{\text{char } a})$$

$X_a$  = mean of Assay Method A with

$u_{\text{char } a}$  = the standard uncertainty of characterization Method A

$$\text{CRM/RM Expanded Uncertainty (z)} = U_{\text{CRM/RM}} = k (u_{\text{char } a}^2 + u_{\text{bb}}^2 + u_{\text{Its}}^2 + u_{\text{ts}}^2)^{1/2}$$

$k$  = coverage factor = 2

$u_{\text{char } a}$  = the errors from characterization

$u_{\text{bb}}$  = bottle to bottle homogeneity standard uncertainty

$u_{\text{Its}}$  = long term stability standard uncertainty (storage)

$u_{\text{ts}}$  = transport stability standard uncertainty

## 4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

### 4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

### 4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

### 4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

## 5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

N/A

## 6.0 INTENDED USE

6.1 This standard is intended for the calibration of analytical instruments and validation of analytical methods as appropriate. This CRM may be used in connection with EPA Methods 6010, 6020 (all versions), Standard Methods 3120 B and USP <232> / ICH Q3D.

6.2 For products attaining traceability through Inorganic Ventures' Primary Certified Reference Materials (PCRM™) see the Limited License to Use PCRM™ in the Inorganic Ventures Terms and Conditions of Sale. <https://www.inorganicventures.com/terms-and-conditions-sale>. The Terms and Conditions contain information on the use of materials traceable to PCRM™ certified reference materials. This Limited License agreement is especially pertinent for laboratories accredited under ISO:17034.

## 7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

### 7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit [www.inorganicventures.com/TCT](http://www.inorganicventures.com/TCT)

**HF Note:** This standard should not be prepared or stored in glass.

## **8.0 HAZARDOUS INFORMATION**

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

## **9.0 HOMOGENEITY**

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

## **10.0 QUALITY STANDARD DOCUMENTATION**

### **10.1 ISO 9001 Quality Management System Registration**

- QSR Certificate Number QSR-1034

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## **11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY**

### **11.1 Certification Issue Date**

May 07, 2024

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

### **11.2 Lot Expiration Date**

- **May 07, 2029**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

### 11.3 Period of Validity

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### 12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

#### Certificate Prepared By:

Justin Dirico  
Stock Processing Supervisor



#### Certificate Approved By:

Thomas Kozikowski  
Stock VS Manager



#### Certifying Officer:

Paul Gaines  
Chairman / Senior Technical Director

