

## Prep Standard - Chemical Standard Summary

**Order ID :** P5259

**Test :** Metals CLP MS FULL

**Prepbatch ID :** PB165819,

**Sequence ID/Qc Batch ID:** LB134096, LB134112,

**Standard ID :**

MP82128, MP83498, MP83619, MP83620, MP83621, MP83622, MP83623, MP83625, MP83626, MP83627, MP83628, MP83629, MP83630, MP83631, MP83632, MP83633, MP83634, MP83635, MP83636, MP83669, MP83671, MP83714, MP83716, MP83723, MP83764, MP83784,

**Chemical ID :**

M5288, M5289, M5295, M5304, M5390, M5476, M5498, M5513, M5515, M5516, M5519, M5658, M5698, M5739, M5751, M5768, M5769, M5798, M5799, M5800, M5801, M5802, M5806, M5815, M5816, M5817, M5818, M5819, M5820, M5873, M5874, M5961, M5962, M5976, M5978, M5981, M5983, M5993, M5999, M6021, M6023, M6025, M6028, M6030, M6033, M6040, M6055, M6121, M6126, W3112,

## Metals STANDARD PREPARATION LOG

| <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> |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|------------------|----------------------|
| 641              | 1:4 HCL     | <a href="#">MP82128</a> | 09/03/2024       | 02/08/2025             | Janvi Patel        | None           | None             | Sarabjit Jaswal      |
|                  |             |                         |                  |                        |                    |                |                  | 09/03/2024           |

**FROM** 1500.00000ml of W3112 + 500.00000ml of M6040 = Final Quantity: 2000.000 ml

| <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> |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|------------------|----------------------|
| 169              | 1:1HNO3     | <a href="#">MP83498</a> | 12/09/2024       | 01/03/2025             | Janvi Patel        | None           | None             | Sarabjit Jaswal      |
|                  |             |                         |                  |                        |                    |                |                  | 12/09/2024           |

**FROM** 1250.00000ml of M6126 + 1250.00000ml of W3112 = Final Quantity: 2500.000 ml

## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|----------------------------------|-------------------------|------------------|------------------------|--------------------|----------------|--------------------------|--------------------------|
| 1122             | ICPMS CALIB<br>BLANK(S0/ICB/CCB) | <a href="#">MP83619</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIP<br>ETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 25.00000ml of M6121 + 4925.00000ml of W3112 + 50.00000ml of M6126 = Final Quantity: 5000.000 ml

| <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>     |
|------------------|---------------------|-------------------------|------------------|------------------------|--------------------|----------------|--------------------------|--------------------------|
| 3947             | S7(SFAM,6020,200.8) | <a href="#">MP83620</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIP<br>ETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.10000ml of M5476 + 1.00000ml of M5799 + 1.00000ml of M5818 + 1.00000ml of M5981 + 1.00000ml of M5983 + 1.90000ml of M6033 + 10.00000ml of M6126 + 2.00000ml of M5815 + 2.00000ml of M5817 + 4.00000ml of M5390 + 4.00000ml of M6025 + 4.90000ml of M5515 + 4.90000ml of M5519 + 5.00000ml of M6121 + 50.00000ml of M5304 + 832.50000ml of W3112 + 9.00000ml of M5698 + 9.00000ml of M5751 + 9.00000ml of M5819 + 9.00000ml of M5976 + 9.00000ml of M5978 + 9.90000ml of M5498 + 9.90000ml of M5769 + 9.90000ml of M5806 = Final Quantity: 1000.000 ml

## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|---------------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3948             | S6(SFAM,6020,200.8) | <a href="#">MP83621</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.50000ml of M6121 + 1.00000ml of M6126 + 48.50000ml of W3112 + 50.00000ml of MP83620 = Final Quantity: 100.000 ml

| <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>     |
|------------------|---------------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3949             | S5(SFAM,6020,200.8) | <a href="#">MP83622</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.50000ml of M6121 + 1.00000ml of M6126 + 73.50000ml of W3112 + 25.00000ml of MP83620 = Final Quantity: 100.000 ml



## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|---------------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3954             | S4(SFAM,6020,200.8) | <a href="#">MP83623</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.50000ml of M6121 + 1.00000ml of M6126 + 86.00000ml of W3112 + 12.50000ml of MP83620 = Final Quantity: 100.000 ml

| <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>     |
|------------------|----------------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3951             | S3(SFAM, 6020,200.8) | <a href="#">MP83625</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.50000ml of M6121 + 1.00000ml of M6126 + 88.50000ml of W3112 + 10.00000ml of MP83621 = Final Quantity: 100.000 ml

## Metals STANDARD PREPARATION LOG

| <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> |
|------------------|-------------------------|-------------------------|------------------|------------------------|--------------------|----------------|------------------|----------------------|
| 3955             | S2CONC(SFAM,6020,200.8) | <a href="#">MP83626</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | None             | Mohan Bera           |
|                  |                         |                         |                  |                        |                    |                |                  | 12/17/2024           |

**FROM** 0.05000ml of M5476 + 0.05000ml of M5698 + 0.05000ml of M5798 + 0.05000ml of M5800 + 0.05000ml of M5801 + 0.05000ml of M5961 + 0.05000ml of M5981 + 0.05000ml of M5983 + 0.05000ml of M6023 + 0.05000ml of M6025 + 0.05000ml of M6028 + 0.05000ml of M6030 + 0.10000ml of M5658 + 0.10000ml of M5751 + 0.10000ml of M5802 + 0.10000ml of M6033 + 0.25000ml of M5515 + 0.25000ml of M5799 + 0.25000ml of M5819 + 0.25000ml of M5962 + 0.25000ml of M5976 + 0.25000ml of M5978 + 0.25000ml of M6021 + 0.50000ml of M5390 + 0.50000ml of M5818 + 1.25000ml of M5815 + 1.25000ml of M5817 + 2.50000ml of M5498 + 2.50000ml of M5519 + 2.50000ml of M5769 + 2.50000ml of M5806 + 2.50000ml of M6121 + 226.25000ml of W3112 + 5.00000ml of M6126 = Final Quantity: 250.000 ml

| <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> |
|------------------|---------------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|----------------------|
| 3956             | S2(SFAM,6020,200.8) | <a href="#">MP83627</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera           |
|                  |                     |                         |                  |                        |                    |                |                      | 12/17/2024           |

**FROM** 0.50000ml of M6121 + 1.00000ml of M6126 + 98.00000ml of W3112 + 0.50000ml of MP83626 = Final Quantity: 100.000 ml

## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|---------------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3957             | S1(SFAM,6020,200.8) | <a href="#">MP83628</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.50000ml of M6121 + 1.00000ml of M6126 + 88.50000ml of W3112 + 10.00000ml of MP83627 = Final Quantity: 100.000 ml

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3958             | ICV(SFAM)   | <a href="#">MP83629</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 2.00000ml of M5295 + 98.00000ml of MP83619 = Final Quantity: 100.000 ml

## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 1142             | ICSA ICPMS  | <a href="#">MP83630</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 10.00000ml of M5873 + 90.00000ml of MP83619 = Final Quantity: 100.000 ml

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 1143             | ICSAB ICPMS | <a href="#">MP83631</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 10.00000ml of M5873 + 10.00000ml of M5874 + 80.00000ml of MP83619 = Final Quantity: 100.000 ml

## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3961             | CCV         | <a href="#">MP83632</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.20000ml of M5513 + 0.50000ml of M5476 + 0.50000ml of M5799 + 0.50000ml of M5818 + 0.50000ml of M5981 + 0.50000ml of M5983 + 1.00000ml of M5815 + 1.00000ml of M5817 + 10.00000ml of M6126 + 12.45000ml of M5515 + 12.45000ml of M5519 + 2.00000ml of M5390 + 24.95000ml of M5498 + 24.95000ml of M5516 + 24.95000ml of M5769 + 25.00000ml of M5304 + 4.50000ml of M5698 + 4.50000ml of M5751 + 4.50000ml of M5819 + 4.50000ml of M5976 + 4.50000ml of M5978 + 4.95000ml of M6033 + 5.00000ml of M6121 + 826.10000ml of W3112 = Final Quantity: 1000.000 ml

| <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>     |
|------------------|-------------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3962             | MG 10PPM FOR TUNE | <a href="#">MP83633</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.01000ml of M5769 + 9.99000ml of MP83619 = Final Quantity: 100.000 ml

## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3894             | TUNE 200PPB | <a href="#">MP83634</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 2.00000ml of M6055 + 2.00000ml of MP83633 + 96.00000ml of MP83619 = Final Quantity: 100.000 ml

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 3903             | ISS 3PPM    | <a href="#">MP83635</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 5.00000ml of M6126 + 75.00000ml of M5739 + 170.00000ml of MP83619 = Final Quantity: 250.000 ml

## Metals STANDARD PREPARATION LOG

| <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>     |
|---|-------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 2902  | S8 ICPMS    | <a href="#">MP83636</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |
| <b><u>FROM</u></b> 1.00000ml of M6033 + 2.50000ml of M5288 + 2.50000ml of M5515 + 5.00000ml of M5498 + 5.00000ml of M5516 + 5.00000ml of M5769 + 79.00000ml of MP83619 = Final Quantity: 100.000 ml |             |                         |                  |                        |                    |                |                      |                          |

[illegible]

## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|-------------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 870              | ICPMS SPIKE SOL.B | <a href="#">MP83671</a> | 12/13/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/17/2024 |

**FROM** 0.45000ml of M5962 + 5.00000ml of M5993 + 5.00000ml of M5999 + 39.55000ml of MP83619 = Final Quantity: 50.000 ml

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|------------------|--------------------------|
| 1027             | SB 1PPM     | <a href="#">MP83714</a> | 12/19/2024       | 01/07/2025             | Janvi Patel        | None           | None             | Mohan Bera<br>12/20/2024 |

**FROM** 0.01000ml of M5802 + 9.99000ml of MP83619 = Final Quantity: 10.000 ml



## Metals STANDARD PREPARATION LOG

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|----------------------|--------------------------|
| 1051             | TL 1PPM     | <a href="#">MP83716</a> | 12/19/2024       | 01/07/2025             | Janvi Patel        | None           | METALS_PIPETTE_3 (A) | Mohan Bera<br>12/20/2024 |

**FROM** 0.01000ml of M6023 + 9.99000ml of MP83619 = Final Quantity: 10.000 ml

| <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>     |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|------------------|--------------------------|
| 1883             | SE 10PPM    | <a href="#">MP83723</a> | 12/19/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | None             | Mohan Bera<br>12/20/2024 |

**FROM** 0.10000ml of M5962 + 9.90000ml of MP83619 = Final Quantity: 10.000 ml

## Metals STANDARD PREPARATION LOG

| <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> |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|------------------|----------------------|
| 1417             | AS 10PPM    | <a href="#">MP83764</a> | 12/23/2024       | 01/07/2025             | Sarabjit Jaswal    | None           | None             | Mohan Bera           |
|                  |             |                         |                  |                        |                    |                |                  | 12/25/2024           |

**FROM** 0.10000ml of M5801 + 9.90000ml of MP83619 = Final Quantity: 10.000 ml

| <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> |
|------------------|-------------|-------------------------|------------------|------------------------|--------------------|----------------|------------------|----------------------|
| 1036             | CD 1PPM     | <a href="#">MP83784</a> | 12/26/2024       | 01/07/2025             | Janvi Patel        | None           | None             | Mohan Bera           |
|                  |             |                         |                  |                        |                    |                |                  | 12/26/2024           |

**FROM** 0.01000ml of M6028 + 9.99000ml of MP83619 = Final Quantity: 10.000 ml

## CHEMICAL RECEIPT LOG BOOK

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58119 / K, 10000 PPM, 500 ml | 071122 | 07/11/2025      | 09/01/2022 / jaswal     | 07/21/2022 / jaswal         | M5288          |

| Supplier                 | ItemCode / ItemName             | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|---------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58113 / Aluminum (Al) 10,000PPM | 070622 | 07/06/2025      | 09/02/2022 / jaswal     | 07/12/2022 / jaswal         | M5289          |

| Supplier | ItemCode / ItemName                  | Lot #    | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|----------|--------------------------------------|----------|-----------------|-------------------------|-----------------------------|----------------|
| EPA      | ICV-1 / ICV ( ICP/ICPMS ) STOCK SOLN | ICV-1014 | 02/05/2025      | 08/07/2024 / jaswal     | 04/20/2021 / bin            | M5295          |

| Supplier           | ItemCode / ItemName                          | Lot #        | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|--|--------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | 6020CAL-1 / Calibration Standard Method 6020 | S2-MEB711244 | 10/20/2026      | 08/07/2024 / jaswal     | 04/01/2022 / jaswal         | M5304          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57056 / Ba, 1000 PPM, 125 ml | 072122 | 07/21/2025      | 08/07/2024 / jaswal     | 09/18/2022 / bin            | M5390          |

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57138 / Sr, 10000 PPM, 125 ml | 082922 | 08/29/2025      | 07/29/2024 / jaswal     | 03/16/2023 / jaswal         | M5476          |

## CHEMICAL RECEIPT LOG BOOK

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58120 / Ca, 10000 PPM, 500 ml | 031523 | 03/15/2026      | 08/15/2023 / jaswal     | 03/17/2023 / bin            | M5498          |

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57182 / Pb, 10000 PPM, 125 ml | 061522 | 06/15/2025      | 03/19/2023 / bin        | 03/17/2023 / bin            | M5513          |

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58126 / Fe, 10000 PPM, 500 ml | 092122 | 09/21/2025      | 08/01/2024 / Jaswal     | 03/17/2023 / bin            | M5515          |

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58111 / Na, 10000 PPM, 500 ml | 022123 | 11/06/2025      | 11/06/2024 / kareem     | 03/17/2023 / bin            | M5516          |

| Supplier                 | ItemCode / ItemName             | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|---------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57119 / Potassium (K) 10,000PPM | 120822 | 12/08/2025      | 01/08/2024 / bin        | 03/17/2023 / bin            | M5519          |

| Supplier                 | ItemCode / ItemName                    | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|--|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58024 / Chromium, Cr, 500 ml, 1000 PPM | 060523 | 06/05/2026      | 08/28/2023 / jaswal     | 08/25/2023 / jaswal         | M5658          |

## CHEMICAL RECEIPT LOG BOOK

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58025 / Mn, 1000 PPM, 500 ml | 102623 | 10/26/2026      | 04/18/2024 / jaswal     | 10/27/2023 / jaswal         | M5698          |

| Supplier           | ItemCode / ItemName   | Lot #        | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|---|--------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | 6020ISS / 6020ISS, 10 ug/ml, Bi, Ho, In, 6Li, Rh, Sc, TB, Y | T2-MEB709511 | 09/03/2026      | 08/07/2024 / jaswal     | 04/11/2022 / jaswal         | M5739          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58029 / Cu, 1000 PPM, 500 ml | 071723 | 07/17/2026      | 10/01/2024 / Jaswal     | 08/25/2023 / jaswal         | M5751          |

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58112 / Mg, 10000 PPM, 500 ml | 091823 | 09/18/2026      | 01/08/2024 / bin        | 01/03/2024 / bin            | M5768          |

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58112 / Mg, 10000 PPM, 500 ml | 091823 | 09/18/2026      | 05/24/2024 / Jaswal     | 01/03/2024 / bin            | M5769          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57004 / Be, 1000 PPM, 125 ml | 102523 | 10/25/2026      | 02/09/2024 / bin        | 02/09/2024 / bin            | M5798          |

## CHEMICAL RECEIPT LOG BOOK

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57050 / Sn, 1000 PPM, 125 ml | 071123 | 07/11/2026      | 02/09/2024 / bin        | 02/09/2024 / bin            | M5799          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57027 / CO, 1000 PPM, 125 ml | 091923 | 09/19/2026      | 05/31/2024 / bin        | 02/09/2024 / bin            | M5800          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57033 / As, 1000 PPM, 125 ml | 111323 | 11/13/2026      | 02/09/2024 / bin        | 02/09/2024 / bin            | M5801          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57051 / Sb, 1000 PPM, 125 ml | 120523 | 12/05/2026      | 08/07/2024 / jaswal     | 01/03/2024 / jaswal         | M5802          |

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58111 / Na, 10000 PPM, 500 ml | 122223 | 12/22/2026      | 08/01/2024 / Jaswal     | 01/03/2024 / jaswal         | M5806          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57115 / P, 10000 PPM, 125 ml | 041723 | 04/17/2026      | 05/21/2024 / Jaswal     | 02/09/2024 / jaswal         | M5815          |

## CHEMICAL RECEIPT LOG BOOK

| Supplier                 | ItemCode / ItemName         | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-----------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57016 / S, 1000 PPM, 125 ml | 122923 | 12/29/2026      | 05/20/2024 / Jaswal     | 02/09/2024 / jaswal         | M5816          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57116 / S, 10000 PPM, 125 ml | 071123 | 07/11/2026      | 03/01/2024 / jaswal     | 02/09/2024 / jaswal         | M5817          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57014 / Si, 1000 PPM, 125 ml | 122023 | 12/20/2026      | 03/06/2024 / jaswal     | 02/09/2024 / jaswal         | M5818          |

| Supplier                 | ItemCode / ItemName                | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58030 / Zinc, Zn, 500 ml, 1000 PPM | 111623 | 11/16/2026      | 03/20/2024 / jaswal     | 02/09/2024 / jaswal         | M5819          |

| Supplier                 | ItemCode / ItemName         | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-----------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57015 / P, 1000 PPM, 125 ml | 091123 | 09/11/2026      | 05/01/2024 / jaswal     | 02/09/2024 / jaswal         | M5820          |

| Supplier | ItemCode / ItemName                | Lot #           | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|----------|------------------------------------|-----------------|-----------------|-------------------------|-----------------------------|----------------|
| EPA      | PART A / ICSA ( ICPMS ) STOCK SOLN | CP-MS ICSA-0803 | 04/30/2025      | 04/17/2024 / jaswal     | 07/14/2022 / jaswal         | M5873          |

## CHEMICAL RECEIPT LOG BOOK

| Supplier | ItemCode / ItemName                     | Lot #           | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|----------|---|-----------------|-----------------|-------------------------|-----------------------------|----------------|
| EPA      | PART B / ICSB (ICPMS)<br>STOCK SOLUTION | CP-MS ICSB-0803 | 04/30/2025      | 04/17/2024 /<br>jaswal  | 07/14/2022 /<br>jaswal      | M5874          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57028 / Ni, 1000 PPM, 125 ml | 041124 | 04/11/2027      | 07/02/2024 /<br>Jaswal  | 06/11/2024 /<br>Jaswal      | M5961          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57034 / Se, 1000 PPM, 125 ml | 060624 | 06/06/2027      | 07/02/2024 /<br>Jaswal  | 06/14/2024 /<br>Jaswal      | M5962          |

| Supplier           | ItemCode / ItemName                        | Lot #       | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|--|-------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | CGMO1-1 /<br>MOLYBDENUM 125mL<br>1000ug/mL | T2-MO720876 | 07/17/2027      | 08/07/2024 /<br>jaswal  | 02/22/2024 /<br>Jaswal      | M5976          |

| Supplier           | ItemCode / ItemName                   | Lot #       | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|---------------------------------------|-------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | CGT11-1 / TITANIUM<br>125mL 1000ug/mL | T2-TI719972 | 06/17/2027      | 08/07/2024 /<br>jaswal  | 02/22/2024 /<br>Jaswal      | M5978          |

| Supplier                 | ItemCode / ItemName         | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-----------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57092 / U, 1000 PPM, 125 ml | 060724 | 06/07/2027      | 07/29/2024 /<br>Jaswal  | 06/11/2024 /<br>Jaswal      | M5981          |



## CHEMICAL RECEIPT LOG BOOK

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57040 / Zr, 1000 PPM, 125 ml | 071423 | 07/14/2026      | 07/29/2024 / Jaswal     | 06/11/2024 / Jaswal         | M5983          |

| Supplier           | ItemCode / ItemName                         | Lot #        | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|---|--------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | CLPP-SPK-4 / SOIL/WATER SPIKE SOLN 4, 125mL | V2-MEB742036 | 03/12/2029      | 10/04/2024 / Jaswal     | 02/22/2024 / Jaswal         | M5993          |

| Supplier           | ItemCode / ItemName                         | Lot #        | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|---|--------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | CLPP-SPK-1 / SOIL/WATER SPIKE SOLN 1, 125mL | T2-MEB721963 | 07/27/2027      | 09/04/2024 / Jaswal     | 02/22/2024 / kareem         | M5999          |

| Supplier                 | ItemCode / ItemName         | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-----------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57023 / V, 1000 PPM, 125 ml | 062424 | 06/24/2027      | 09/28/2024 / jaswal     | 08/05/2024 / Jaswal         | M6021          |

| Supplier                 | ItemCode / ItemName          | Lot #   | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|---------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57081 / TI, 1000 PPM, 125 ml | 0624724 | 06/27/2027      | 08/05/2024 / kareem     | 08/05/2024 / Jaswal         | M6023          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57082 / Pb, 1000 PPM, 125 ml | 061224 | 11/09/2026      | 08/05/2024 / Jaswal     | 08/05/2024 / Jaswal         | M6025          |

## CHEMICAL RECEIPT LOG BOOK

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57048 / Cd, 1000 PPM, 125 ml | 070124 | 07/01/2027      | 08/05/2024 / kareem     | 08/05/2024 / Jaswal         | M6028          |

| Supplier                 | ItemCode / ItemName          | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 57047 / Ag, 1000 PPM, 125 ml | 122823 | 12/28/2026      | 08/05/2024 / kareem     | 08/05/2024 / Jaswal         | M6030          |

| Supplier                 | ItemCode / ItemName           | Lot #  | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------------|-------------------------------|--------|-----------------|-------------------------|-----------------------------|----------------|
| Absolute Standards, Inc. | 58113 / Al, 10000 PPM, 500 ml | 011623 | 01/16/2026      | 08/07/2024 / Jaswal     | 01/03/2024 / Jaswal         | M6033          |

| 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) | 24D1562005 | 02/08/2025      | 08/09/2024 / jaswal     | 08/01/2024 / Janvi          | M6040          |

| Supplier           | ItemCode / ItemName                         | Lot #        | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--------------------|---|--------------|-----------------|-------------------------|-----------------------------|----------------|
| Inorganic Ventures | IV-STOCK-12 / ICP-MS TUNING SOLUTION, 125mL | U2-MEB734294 | 06/21/2028      | 08/21/2024 / Jaswal     | 08/19/2024 / Jaswal         | M6055          |

| 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) | 0000275677 | 05/13/2025      | 11/13/2024 / Eman       | 10/13/2024 / Eman           | M6121          |

## CHEMICAL RECEIPT LOG BOOK

| 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 | 06/03/2025      | 12/03/2024 / Janvi      | 11/12/2024 / Janvi          | M6126          |

| 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          |



Refine your results. Redefine your industry.

300 Technology Drive  
Christiansburg, VA 24073 USA  
inorganicventures.com

# Certificate of Analysis

R: 02/22/24 M5991 M5992 M5993 M5994 M5995

P: 800-669-6799/540-585-3030

F: 540-585-3012

info@inorganicventures.com

## 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: CLPP-SPK-4  
Lot Number: V2-MEB742036  
Matrix: 3% (v/v) HNO<sub>3</sub>  
Value / Analyte(s):  
100 µg/mL ea:  
Antimony,  
50 µg/mL ea:  
Cadmium, Thallium,  
40 µg/mL ea:  
Arsenic,  
20 µg/mL ea:  
Lead,  
10 µg/mL ea:  
Selenium

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE      | CERTIFIED VALUE    | ANALYTE      | CERTIFIED VALUE    |
|--------------|--------------------|--------------|--------------------|
| Antimony, Sb | 100.0 ± 0.7 µg/mL  | Arsenic, As  | 40.00 ± 0.26 µg/mL |
| Cadmium, Cd  | 50.00 ± 0.22 µg/mL | Lead, Pb     | 20.00 ± 0.09 µg/mL |
| Selenium, Se | 10.00 ± 0.04 µg/mL | Thallium, Tl | 50.00 ± 0.22 µg/mL |

Density: 1.016 g/mL (measured at 20 ± 4 °C)

Assay Information:

| ANALYTE | METHOD     | NIST SRM# | SRM LOT#     |
|---------|------------|-----------|--------------|
| As      | ICP Assay  | 3103a     | 100818       |
| Cd      | ICP Assay  | 3108      | 130116       |
| Cd      | EDTA       | 928       | 928          |
| Cd      | Calculated |           | See Sec. 4.2 |
| Pb      | ICP Assay  | 3128      | 101026       |
| Pb      | EDTA       | 928       | 928          |
| Pb      | Calculated |           | See Sec. 4.2 |
| Sb      | ICP Assay  | 3102a     | 140911       |
| Se      | ICP Assay  | 3149      | 100901       |
| Se      | Calculated |           | See Sec. 4.2 |
| Tl      | ICP Assay  | 3158      | 151215       |
| Tl      | Calculated |           | See Sec. 4.2 |

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)

## **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; [inorganicventures.com](http://inorganicventures.com); [Info@inorganicventures.com](mailto:Info@inorganicventures.com)

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

### 11.1 Certification Issue Date

March 12, 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

- **March 12, 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 Approved By:

Joseph Burns  
Custom VS Manager



### Certifying Officer:

Paul Gaines  
Chairman / Senior Technical Director





**CERTIFIED WEIGHT REPORT:**

**Part Number:**  
**Lot Number:**  
**Description:**

57048  
070124  
Cadmium (Cd)

**Solvent:** 24002546 Nitric Acid

*R: 815/24*

**Lot #**

**2%** 40.0 Nitric Acid (mL)

**Expiration Date:** 070127

**Recommended Storage:** Ambient (20 °C)

**Nominal Concentration (µg/mL):** 1000

**NIST Test Number:** 6UTB

SE-05 Balance Uncertainty

**Weight shown below was diluted to (mL):** 2000.07 0.100 Flask Uncertainty

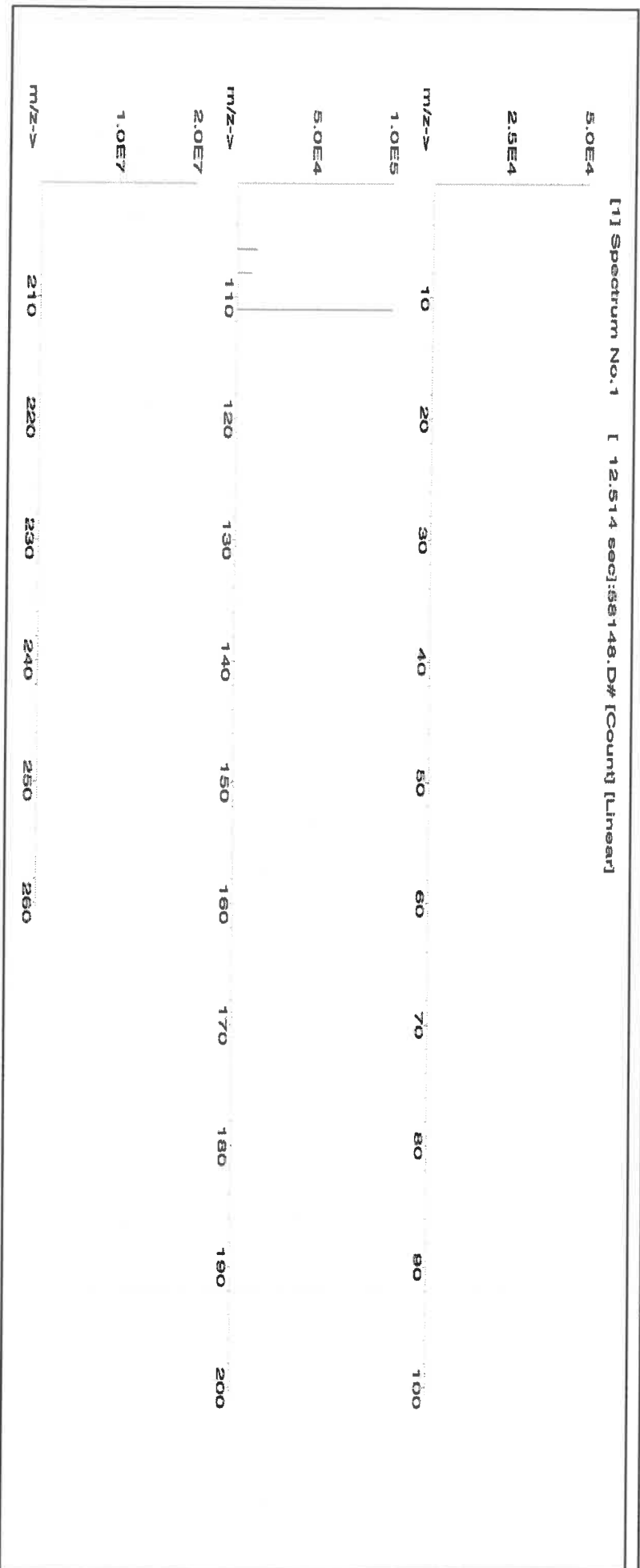
|                        |                 |
|------------------------|-----------------|
| <i>Aleah O'Brady</i>   |                 |
| Formulated By:         | Aleah O'Brady   |
|                        | 070124          |
| <i>Pedro L. Rentas</i> |                 |
| Reviewed By:           | Pedro L. Rentas |
|                        | 070124          |

**Compound**

| Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Cadmium nitrate tetrahydrate (Cd) IN024 CDM09221A1 1000 99.999 0.10 36.5 5.4797 5.4804 1000.1 2.0 10022-68-1 0.01 mg/m3 or-rat 60.2mg/kg 3108

[1] Spectrum No.1 [12.514 sec]:\$8148.D# [Count] [Linear]







**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.2  | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Ba | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Cd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pr | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**Certified Reference Material CRM**

Lot #

R: 815/24

M6025



**CERTIFIED WEIGHT REPORT:**

Part Number: **57182**  
Lot Number: **110923**  
Description: **Lead (Pb)**

Solvent: **24002546 Nitric Acid**

Expiration Date: **110926**  
Recommended Storage: **Ambient (20 °C)**  
Nominal Concentration (µg/mL): **10000**  
NIST Test Number: **6UTB**

2% **40.0** **Nitric Acid**  
(mL)

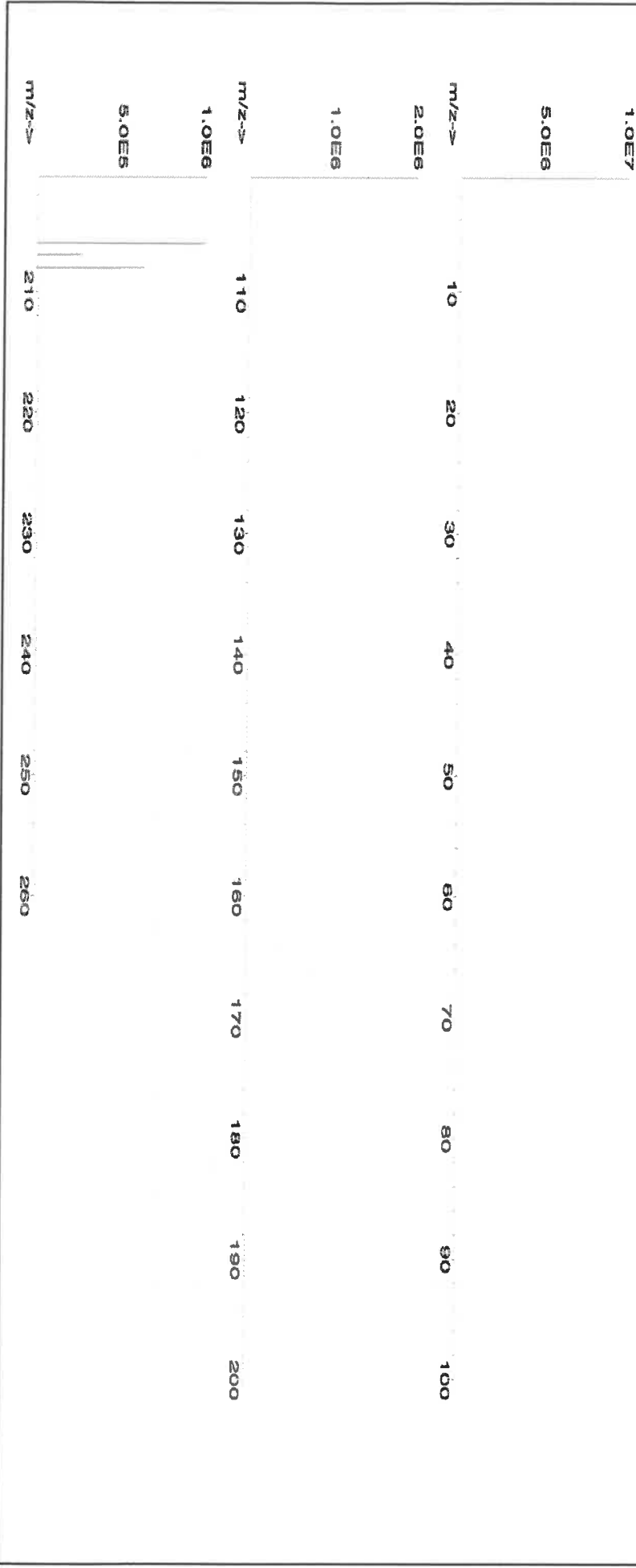
Weight shown below was diluted to (mL): **2000.02** **5E-05** Balance Uncertainty  
**0.058** Flask Uncertainty

|                |                 |
|----------------|-----------------|
|                |                 |
| Formulated By: | Lawrence Barry  |
|                |                 |
| Reviewed By:   | Pedro L. Rentas |
| 110923         |                 |

| Compound | SDS Information |            |                       |            |                        |           |                   |                   |                      |                                  |
|----------|-----------------|------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|
|          | RM#             | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) |

1. Lead(II) nitrate (Pb) IN029 PED122016A1 10000 99.999 0.10 62.5 32.0006 32.0040 10001.1 20.0 10099-74-8 0.05 mg/m3 Inverse rat 83 mg/kg 3128

[1] Spectrum No.1 [ 17.284 sec]:58182.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS ( $\mu\text{g/mL}$ )**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | T     | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

**Physical Characterization:**

(T)= Target analyte

Certified by:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**Certified Reference Material CRM**



ANAB ISO 17034 Accredited  
AR-1539 Certificate Number  
<https://AbsoluteStandards.com>

**CERTIFIED WEIGHT REPORT:**

**Part Number:** 58119  
**Lot Number:** 071122

**Solvent:** 20510011 Nitric Acid

**Lot #**

**Description:** Potassium (K)

**Expiration Date:** 071125

**2% 40.0 (mL) Nitric Acid**

**Recommended Storage:** Ambient (20 °C)

**Nominal Concentration (µg/mL):** 10000

**NIST Test Number:** 6UTB

**Weight shown below was diluted to (mL):** 2000.02

5E-05 Balance Uncertainty  
0.058 Flask Uncertainty

|                |                 |
|----------------|-----------------|
|                |                 |
| Formulated By: | Lawrence Barry  |
|                | 071122          |
|                |                 |
| Reviewed By:   | Pedro L. Rentas |
|                | 071122          |

**Compound**

**Lot Number**

**Nominal Conc. (µg/mL)**

**Purity (%)**

**Uncertainty Purity (%)**

**Assay (%)**

**Target Weight (g)**

**Actual Weight (g)**

**Actual Conc. (µg/mL)**

**Expanded Uncertainty +/- (µg/mL)**

**CAS#**

**OSHA PEL (TWA)**

**LD50**

**NIST SRM**

**SDS Information**

(Solvent Safety Info. On Attached pg.)

1. Potassium nitrate (K)

IN034 KD022021A1

10000

99.999

0.10

37.6

53.1925

53.1934

10000.2

20.0

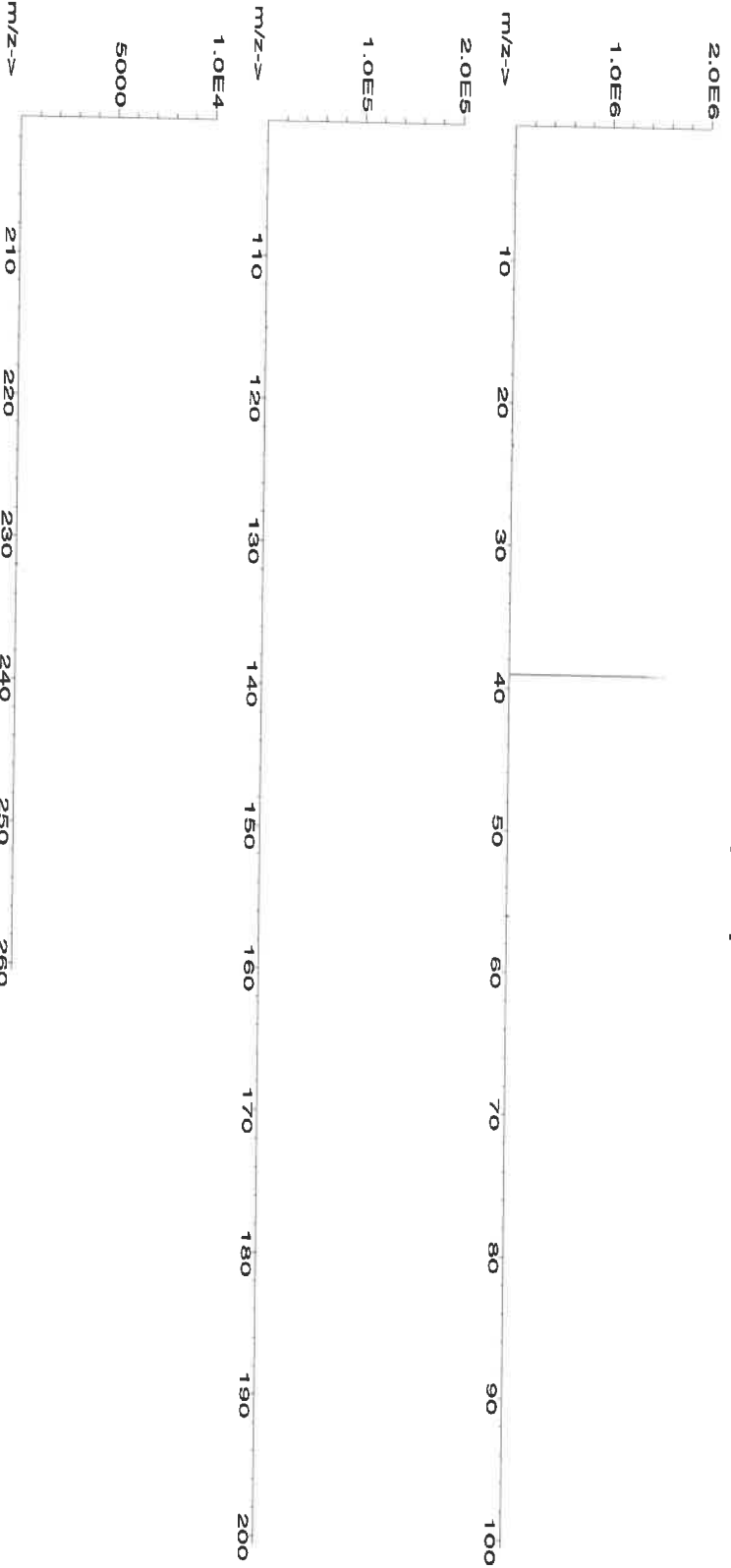
7757-79-1

5 mg/m3

oral rat 3015 mg/kg

3141a

[1] Spectrum No. 1 [ 35.763 sec]:58119.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Bu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | T     | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

**Physical Characterization:**

(T) = Target analyte

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



M5289 R: 07/12/22  
Certified Reference Material CRM

(34)



ANAB ISO 17034 Accredited  
AR-1539 Certificate Number  
https://AbsoluteStandards.com

**CERTIFIED WEIGHT REPORT:**

**Part Number:** 58113  
**Lot Number:** 070622  
**Description:** Aluminum (Al)

**Lot #**  
**Solvent:** 20370011 Nitric Acid

**Expiration Date:** 070625  
**Recommended Storage:** Ambient (20 °C)  
**Nominal Concentration (µg/mL):** 10000  
**NIST Test Number:** 6UTB  
**Weight shown below was diluted to (mL):** 2000.02  
**5E-05 Balance Uncertainty**  
**0.058 Flask Uncertainty**

|                |                   |
|----------------|-------------------|
|                |                   |
| Formulated By: | Lawrence Barry    |
| 070622         |                   |
|                |                   |
| Reviewed By:   | Pedro L. Renteria |
| 070622         |                   |

| SDS Information |          |        |               |        |             |       |            |            |               |             |  |                |      |
|-----------------|----------|--------|---------------|--------|-------------|-------|------------|------------|---------------|-------------|--|----------------|------|
| Compound        | Expanded |        |               |        |             |       |            |            |               |             |  |                |      |
|                 | Lot      |        | Nominal       | Purity | Uncertainty | Assay | Target     | Actual     | Actual        | Uncertainty | (Solvent Safety Info. On Attached pg.) |                |      |
|                 | RM#      | Number | Conc. (µg/mL) | (%)    | Purity (%)  | (%)   | Weight (g) | Weight (g) | Conc. (µg/mL) | +/- (µg/mL) | CAS#                                   | OSHA PEL (TWA) | LD50 |

1. Aluminum nitrate nonahydrate (Al) IN022 ALD012021A1 10000 99.999 0.10 7.10 281.6956 281.6977 10000.1 20.0 7784-27-2 2 mg/m3 or-tal 3671 mg/kg 3101a





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | T     | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Ru | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Sr | <0.02 | S  | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | Ta | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ti | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

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- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
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R: 4/20/21

Instructions for QATS Reference Material: *Inorganic ICV Solutions*

QATS LABORATORY INORGANIC REFERENCE MATERIAL  
INITIAL CALIBRATION VERIFICATION SOLUTIONS  
(ICV1, ICV5, AND ICV6)

**NOTE:** These instructions are for advisory purposes only. If any apparent conflict exists between these instructions and the analytical protocol or your contract, disregard these instructions.

**APPLICATION:** For use with the CLP SFAM01.0 SOW and revisions.

**CAUTION:** Read instructions carefully before opening bottle(s) and proceeding with the analyses.

Contains Metals in Dilute Acidic or  
Cyanide in Basic Aqueous Solutions  
**HAZARDOUS MATERIAL**

Safety Data Sheets  
Available Upon Request

M5291  
M15292  
M15293  
M15294  
M15295

**(A) SAMPLE DESCRIPTION**

Enclosed is a set of one (1) or more Aqueous Inorganic Reference Materials containing various analyte concentrations. ICV1 and ICV5 are in a matrix of dilute nitric acid. ICV6 is in a matrix of dilute basic solution. **For the reference material source in reporting ICVs use "USEPA". For the reference material lot number for the ICV1, ICV5, and ICV6 solutions use "ICV1-1014", "ICV5-0415", and "ICV6-0400", respectively.**

**(B) BREAKAGE OR MISSING ITEMS**

Check the contents of the shipment carefully for any broken, leaking, or missing items. Check that the seal is intact on each bottle. Refer to the enclosed chain of custody record. Report any problems to Mr. Keith Strout, APTIM Federal Services, LLC, at (702) 895-8722. If requested, return the chain-of-custody record with appropriate annotations and signatures to the address provided below.

QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY  
APTIM Federal Services, LLC  
2700 Chandler Avenue - Building C  
Las Vegas, NV 89120

**(C) ANALYSIS OF SAMPLES**

The Initial Calibration Verification Solutions (ICVs) are to be used to evaluate the accuracy of the initial calibrations of ICP, AA, and Cyanide colorimetric instruments, and are to be used with the CLP SOWs and revisions. The values for each element in the ICVs are listed below in µg/L (ppb) for the resulting solution(s) after the dilution of the concentrate(s) according to the following instructions. Use Class 'A' glassware to prepare the solution(s).

**ICV1-1014** For ICP-AES analysis, use a 10-fold dilution by pipetting 10 mL of the ICV1 concentrate into a 100 mL volumetric flask and dilute to volume with 2% (v/v) nitric acid.







**QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY**  
**"An ISO 9001:2015 Certified Program"**

**Instructions for QATS Reference Material: *Inorganic ICV Solutions***

- ICV1-1014** For ICP-MS analysis, use a 50-fold dilution by pipetting 2 mL of the ICV1 concentrate into a 100 mL volumetric flask and dilute to volume with 1% (v/v) nitric acid.
- ICV5-0415** For the cold vapor analysis of mercury by AA, use a 100-fold dilution by pipetting 1 mL of the ICV5 concentrate into a 100 mL volumetric flask and dilute to volume with 2% (v/v) nitric acid. The ICV5 concentrate is prepared in 0.05% (w/v)  $K_2Cr_2O_7$  and 5% (v/v) nitric acid.
- ICV6-0400** For the analysis of cyanide, use a 100-fold dilution by pipetting 1 mL of the ICV6 concentrate into a 100 mL volumetric flask and dilute to volume with Type II water. Distill this solution along with the samples before analysis. The cyanide concentrate is prepared from  $K_3Fe(CN)_6$ , Type II water, and 0.1 % sodium hydroxide, and will decompose rapidly if exposed to light.

**NOTE:** USE TYPE II WATER AND HIGH-PURITY ACIDS FOR ALL DILUTIONS.

**(D) CERTIFIED CONCENTRATIONS OF QATS ICV1, ICV5, AND ICV6 SOLUTIONS**

| ICV1-1014 |  |  |
|-----------|--|--|
| Element   | Concentration (µg/L)<br>(after 10-fold dilution) | Concentration (µg/L)<br>(after 50-fold dilution) |
| Al        | 2500   | 500  |
| Sb        | 1000   | 200  |
| As        | 1000   | 200  |
| Ba        | 520  | 100  |
| Be        | 510  | 100  |
| Cd        | 510  | 100  |
| Ca        | 10000  | 2000   |
| Cr        | 520  | 100  |
| Co        | 520  | 100  |
| Cu        | 510  | 100  |
| Fe        | 10000  | 2000   |
| Pb        | 1000   | 200  |
| Mg        | 6000   | 1200   |
| Mn        | 520  | 100  |
| Ni        | 530  | 110  |
| K         | 9900   | 2000   |
| Se        | 1000   | 200  |
| Ag        | 250  | 50   |
| Na        | 10000  | 2000   |
| Tl        | 1000   | 210  |
| V         | 500  | 100  |
| Zn        | 1000   | 200  |

| ICV5-0415 |   | ICV6-0400       |   |
|-----------|---|-----------------|---|
| Element   | Concentration (µg/L)<br>(after 100-fold dilution) | Analyte         | Concentration (µg/L)<br>(after 100-fold dilution) |
| Hg        | 4.0   | CN <sup>-</sup> | 99  |



Refine your results. Redefine your industry.

# Certificate of Analysis

300 Technology Drive  
Christiansburg, VA 24073 USA  
inorganicventures.com

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

## 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: 6020CAL-1  
Lot Number: S2-MEB711244  
Matrix: 5% (v/v) HNO<sub>3</sub>  
tr. HF  
Value / Analyte(s): 20 µg/mL ea:  
Silver, Aluminum,  
Arsenic, Barium,  
Beryllium, Calcium,  
Cadmium, Cobalt,  
Chromium, Copper,  
Iron, Potassium,  
Magnesium, Manganese,  
Sodium, Nickel,  
Lead, Antimony,  
Selenium, Thallium,  
Vanadium, Zinc

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE       | CERTIFIED VALUE    | ANALYTE       | CERTIFIED VALUE    |
|---------------|--------------------|---------------|--------------------|
| Aluminum, Al  | 20.01 ± 0.08 µg/mL | Antimony, Sb  | 20.01 ± 0.12 µg/mL |
| Arsenic, As   | 20.01 ± 0.18 µg/mL | Barium, Ba    | 20.01 ± 0.11 µg/mL |
| Beryllium, Be | 20.01 ± 0.14 µg/mL | Cadmium, Cd   | 20.01 ± 0.11 µg/mL |
| Calcium, Ca   | 20.01 ± 0.10 µg/mL | Chromium, Cr  | 20.01 ± 0.16 µg/mL |
| Cobalt, Co    | 20.01 ± 0.11 µg/mL | Copper, Cu    | 20.01 ± 0.10 µg/mL |
| Iron, Fe      | 20.01 ± 0.09 µg/mL | Lead, Pb      | 20.01 ± 0.11 µg/mL |
| Magnesium, Mg | 19.99 ± 0.10 µg/mL | Manganese, Mn | 20.01 ± 0.10 µg/mL |
| Nickel, Ni    | 20.01 ± 0.11 µg/mL | Potassium, K  | 20.01 ± 0.10 µg/mL |
| Selenium, Se  | 20.02 ± 0.14 µg/mL | Silver, Ag    | 20.02 ± 0.09 µg/mL |
| Sodium, Na    | 20.01 ± 0.10 µg/mL | Thallium, Tl  | 20.01 ± 0.13 µg/mL |
| Vanadium, V   | 20.01 ± 0.11 µg/mL | Zinc, Zn      | 20.01 ± 0.11 µg/mL |

**Density:** 1.026 g/mL (measured at 20 ± 4 °C)

**Assay Information:**

| <b>ANALYTE</b> | <b>METHOD</b> | <b>NIST SRM#</b> | <b>SRM LOT#</b> |
|----------------|---------------|------------------|-----------------|
| Ag             | ICP Assay     | 3151             | 160729          |
| Ag             | Volhard       | 999c             | 999c            |
| Al             | ICP Assay     | 3101a            | 140903          |
| Al             | EDTA          | 928              | 928             |
| As             | ICP Assay     | 3103a            | 100818          |
| 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             |
| Co             | ICP Assay     | 3113             | 190630          |
| Co             | EDTA          | 928              | 928             |
| Cr             | ICP Assay     | 3112a            | 170630          |
| Cu             | ICP Assay     | 3114             | 121207          |
| Cu             | EDTA          | 928              | 928             |
| Fe             | ICP Assay     | 3126a            | 140812          |
| Fe             | EDTA          | 928              | 928             |
| Fe             | Calculated    |                  | See Sec. 4.2    |
| K              | ICP Assay     | 3141a            | 140813          |
| K              | 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            | 120715          |
| Na             | Gravimetric   |                  | See Sec. 4.2    |
| Ni             | ICP Assay     | 3136             | 120619          |
| Ni             | EDTA          | 928              | 928             |
| Pb             | ICP Assay     | 3128             | 101026          |
| Pb             | EDTA          | 928              | 928             |
| Se             | ICP Assay     | 3149             | 100901          |
| Se             | Calculated    |                  | See Sec. 4.2    |
| Tl             | ICP Assay     | 3158             | 151215          |
| Tl             | Calculated    |                  | See Sec. 4.2    |
| 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

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

## 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.

**Low Silver Note:** This solution contains "LOW" levels of Silver. Please store this entire bottle inside a sealed glass jar.

## 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; inorganicventures.com; info@inorganicventures.com

## 11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

### 11.1 Certification Issue Date

October 20, 2021

- 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

- **October 20, 2026**

- 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 Approved By:

Michael Booth  
Director, Quality Control



### Certifying Officer:

Paul Gaines  
Chairman / Senior Technical Director





*R-09/18/22* **(B1)**

**Certified Reference Material CRM**

**CERTIFIED WEIGHT REPORT:**

**Part Number:** 57056  
**Lot Number:** 072122  
**Description:** Barium (Ba)

**Solvent:** 20510011 Nitric Acid

**Lot #**

**Expiration Date:** 072125  
**Recommended Storage:** Ambient (20 °C)  
**Nominal Concentration (µg/mL):** 1000  
**NIST Test Number:** 6UTB  
**Weight shown below was diluted to (mL):** 2000.02  
**5E-05 Balance Uncertainty**  
**0.058 Flask Uncertainty**

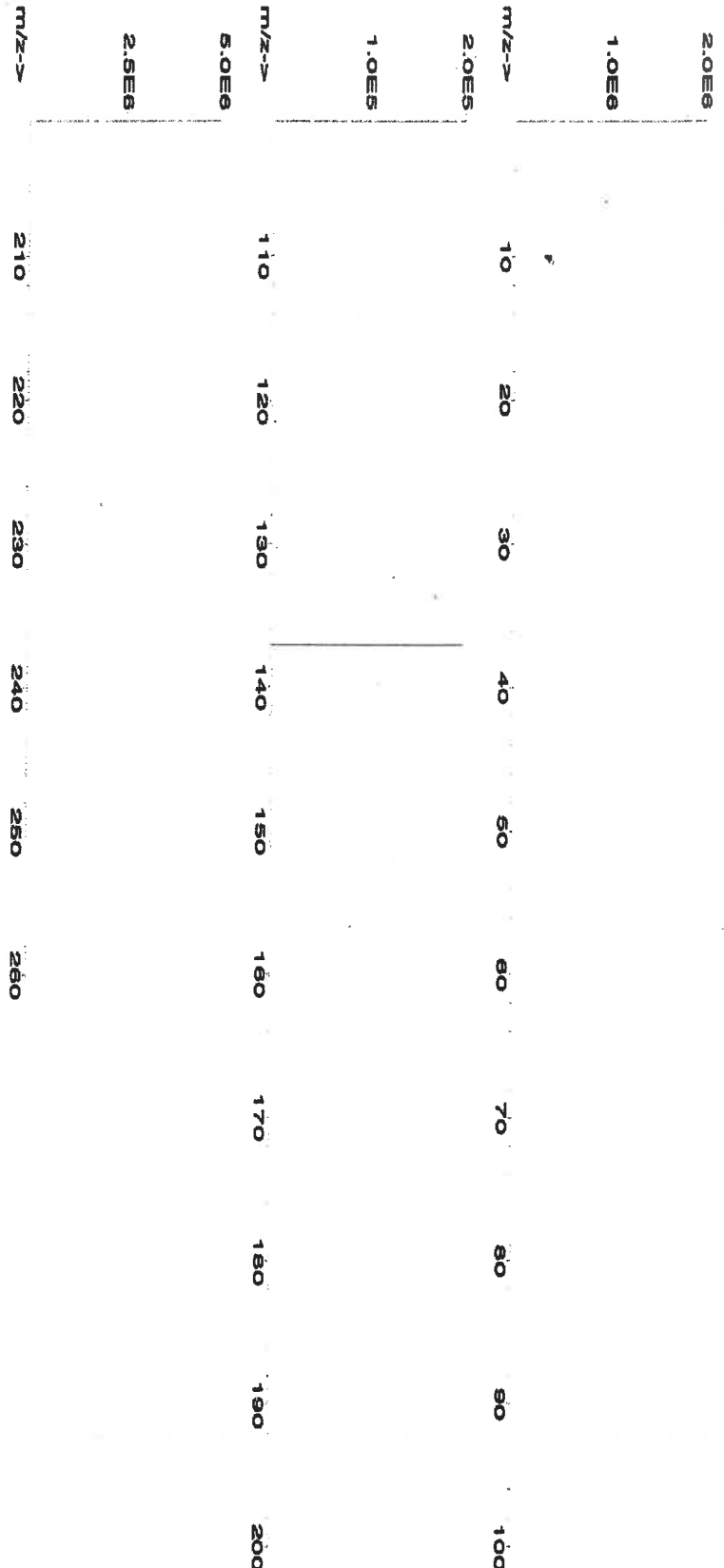
**2% 40.0 (mL) Nitric Acid**

|                          |                        |
|--------------------------|------------------------|
| <i>Giovanni Esposito</i> |                        |
| Formulated By:           | Giovanni Esposito      |
| Reviewed By:             | <i>Pedro L. Rentes</i> |
|                          | 072122                 |

| SDS Information        |                  |                       |            |                 |           |                   |                   |                      |                                  |
|------------------------|------------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|
| Compound               | Lot Number       | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) |
| 1. Barium nitrate (Ba) | IN023 BA022019A1 | 1000                  | 99.899     | 0.10            | 52.3      | 3.82417           | 3.82426           | 1000.0               | 2.0                              |

1. Barium nitrate (Ba) IN023 BA022019A1 1000 99.899 0.10 52.3 3.82417 3.82426 1000.0 2.0 10022-31-8 0.5 mg/m3 or-ral 355 mg/kg 31046

[1] Spectrum No. 1 [ 12.514 sec]:58156.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

| Trace Metals Verification by ICP-MS (µg/mL) |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|---|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al  | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.02 | Tb | <0.02 |
| Sb  | <0.02 | Ca | <0.2  | Er | <0.2  | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 |
| As  | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.02 | Os | <0.01 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 |
| Ba  | T     | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.02 | Th | <0.02 |
| Be  | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.02 | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 |
| Bi  | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 |
| B   | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 |
|   |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       | W  | <0.02 |
|   |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       | U  | <0.02 |
|   |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       | V  | <0.02 |
|   |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       | Yb | <0.02 |
|   |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       | Y  | <0.02 |
|   |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       | Zn | <0.02 |
|   |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       | Zr | <0.02 |

(T)= Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).







# Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

## Trace Metals Verification by ICP-MS (µg/mL)

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | T     | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Tc | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Ti | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.2  | Fe | <0.02 | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Tl | <0.02 | Zr | <0.02 |

(T) = Target analyte

## Physical Characterization:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

**CERTIFIED WEIGHT REPORT:**

**Part Number:**  
**Lot Number:**  
**Description:**

**57182**  
**061522**  
**Lead (Pb)**

**Expiration Date:**  
**Recommended Storage:**  
**Nominal Concentration (µg/mL):**  
**NIST Test Number:**

**061525**  
**Ambient (20 °C)**  
**10000**  
**6UTB**

**Weight shown below was diluted to (mL):**

**2000.02**

**5E-05 Balance Uncertainty**

**0.058 Flask Uncertainty**

**Solvent:**

**20510011 Nitric Acid**

**2% 40.0 Nitric Acid**

**(mL)**

**Lot #**

**20510011**

**Nitric Acid**

**Formulated By:**

**Giovanni Esposito**

**Reviewed By:**

**Pedro L. Rentas**

**061522**

**061522**

**Expanded**

**Uncertainty**

**+/- (µg/mL)**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**

**32.0041**

**10001.1**

**20.0**

**10098-74-8**

**0.05 mg/m3**

**inhalant 88 mg/kg**

**3128**

**NIST**

**SRM**

**LD50**

**OSHA PEL (TWA)**

**(Solvent Safety Info. On Attached pg.)**

**SDS Information**

**Actual**

**Weight (g)**



# Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

## Trace Metals Verification by ICP-MS (µg/mL)

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.2  | Fe | <0.02 | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pr | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T)= Target analyte

## Physical Characterization:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

*M5514, M5515*  
*R: 03/12/23*

Lot #

**Part Number:**

**Solvent:**

**Lot Number:**

**Nitric Acid**

**Description:**

**Nitric Acid**

**Expiration Date:**

**7.0%**

**Recommended Storage:**

**350.0**

**Nominal Concentration (µg/mL):**

**(mL)**

**NIST Test Number:**

**Nitric Acid**

**Weight shown below was diluted to (mL):**

**5E-05 Balance Uncertainty**

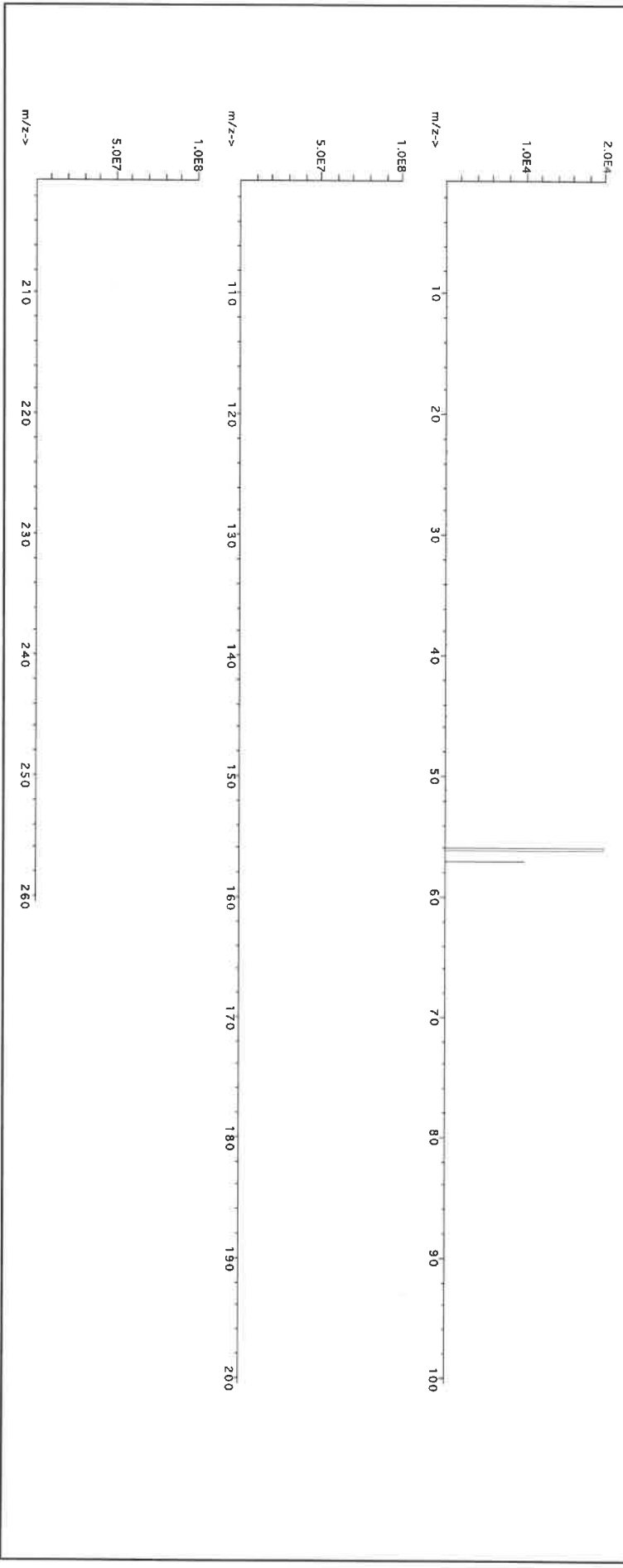
|                          |                   |
|--------------------------|-------------------|
| <i>Giovanni Caporaso</i> |                   |
| Formulated By:           | Giovanni Esposito |
| Reviewed By:             | Pedro L. Rentas   |
|                          | 092122            |

**Compound**

| Lot    | Nominal       | Purity | Uncertainty | Assay | Target     | Actual     | Actual        | Expanded    | (Solvent Safety Info. On Attached pg.) | NIST |
|--------|---------------|--------|-------------|-------|------------|------------|---------------|-------------|--|------|
| Number | Conc. (µg/mL) | (%)    | Purity (%)  | (%)   | Weight (g) | Weight (g) | Conc. (µg/mL) | +/- (µg/mL) | CAS#                                   | SRM  |

|              |       |             |       |        |      |       |         |         |         |      |           |         |                  |       |
|--------------|-------|-------------|-------|--------|------|-------|---------|---------|---------|------|-----------|---------|------------------|-------|
| 1. Iron (Fe) | IN346 | 2224912-500 | 10000 | 99.995 | 0.10 | 100.0 | 50.0034 | 50.0111 | 10001.5 | 20.0 | 7439-89-6 | 5 mg/mL | or-Ir-17500mg/kg | 3126a |
|--------------|-------|-------------|-------|--------|------|-------|---------|---------|---------|------|-----------|---------|------------------|-------|

[1] Spectrum No.1 [30.763 sec] 58126.D# [Count] [Linear]





# Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

## Trace Metals Verification by ICP-MS (µg/mL)

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.10 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | La | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.02 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.05 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.10 | Ge | <0.10 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.05 |
| B  | <0.02 | Cu | <0.10 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T)= Target analyte

## Physical Characterization:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

*Ben P. Galt*

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**Certified Reference Material CRM**



M586 M587 R:03/17/22

**CERTIFIED WEIGHT REPORT:**

**Part Number:** 58111  
**Lot Number:** 022123  
**Description:** Sodium (Na)

**Solvent:** 21110221 Nitric Acid

**Expiration Date:** 022126  
**Recommended Storage:** Ambient (20 °C)  
**Nominal Concentration (µg/mL):** 10000  
**NIST Test Number:** 6UTB

Weight shown below was diluted to (mL): 3000.41

2% 60.0 Nitric Acid (mL)

5E-05 Balance Uncertainty  
0.06 Flask Uncertainty

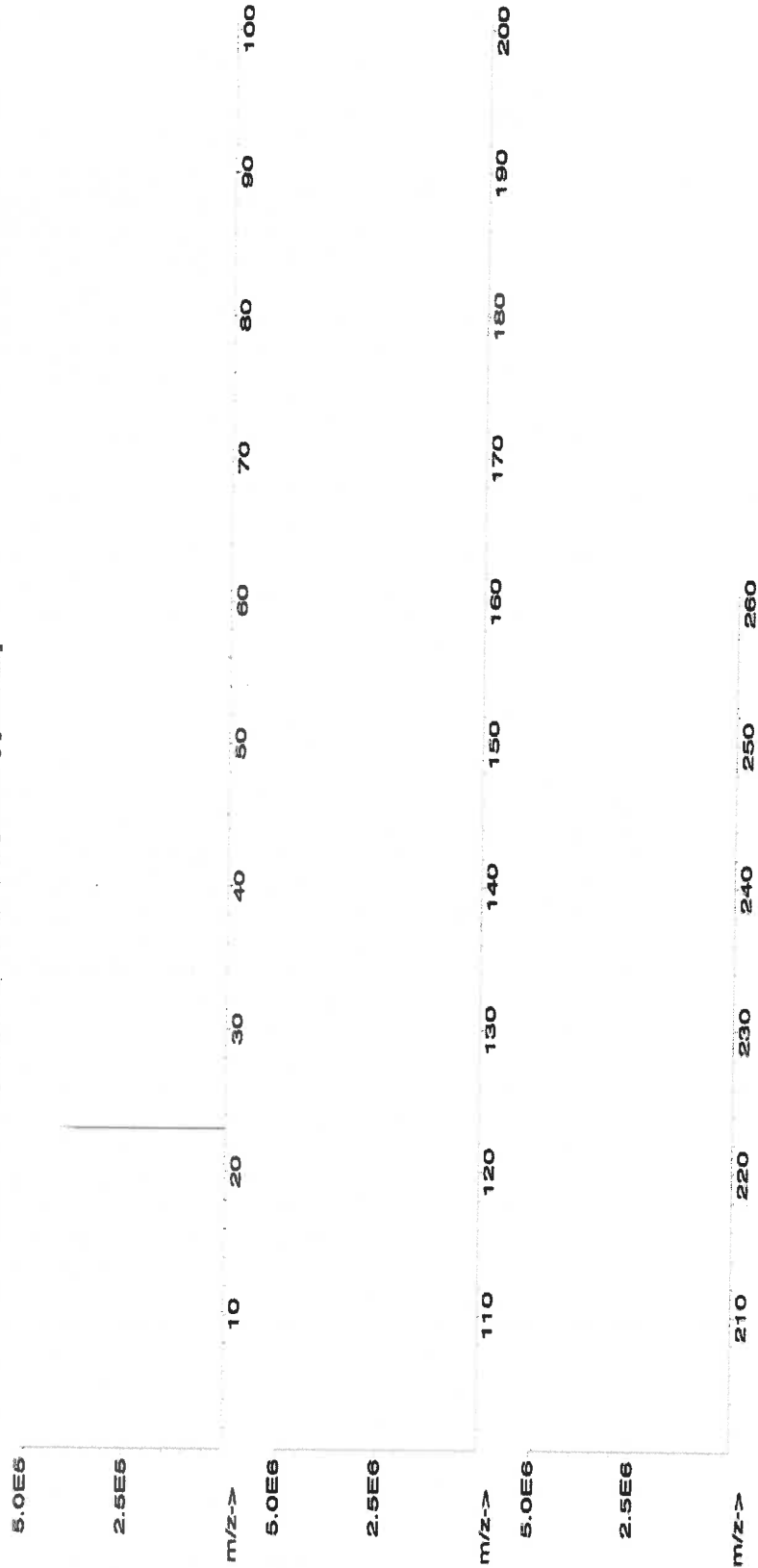
|                |                        |
|----------------|------------------------|
|                |                        |
| Formulated By: | Lawrence Barry 022123  |
|                |                        |
| Reviewed By:   | Pedro L. Rentas 022123 |

**SDS Information**

Expanded Uncertainty (Solvent Safety Info. On Attached pg.) NIST SRM  
+/- (µg/mL) CAS# OSHA PEL (TWA) LD50

|                        |                   |     |                       |            |                        |           |                   |                   |                      |                                  |           |                |      |                          |
|------------------------|-------------------|-----|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|-----------|----------------|------|--------------------------|
| Compound               | Lot               | RM# | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS#      | OSHA PEL (TWA) | LD50 | NIST SRM                 |
| 1. Sodium nitrate (Na) | IN036 NAV01201511 |     | 10000                 | 99.998     | 0.10                   | 26.9      | 111.5406          | 111.5410          | 10000.0              | 20.0                             | 7631-99-4 | 5 mg/m3        |      | ori-rat 3430 mg/kg 3152a |

[1] Spectrum No.1 [ 8.935 sec]:58111.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.02 | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Tc | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.02 | Os | <0.01 | Rh | <0.02 | Ag | <0.02 | Ti | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.02 | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.02 | Hg | <0.2  | P  | <0.2  | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

**Certified by:**

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
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- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**Certified Reference Material CRM**

**CERTIFIED WEIGHT REPORT:**

Part Number: **58119**  
Lot Number: **120822**  
Description: **Potassium (K)**

Solvent: 20510011 Nitric Acid

Lot #

Expiration Date: 120825  
Recommended Storage: Ambient (20 °C)  
Nominal Concentration (µg/mL): 10000  
NIST Test Number: 6UTB

2% 60.0 (mL) Nitric Acid

Weight shown below was diluted to (mL): 3000.4

5E-05 Balance Uncertainty  
0.06 Flask Uncertainty

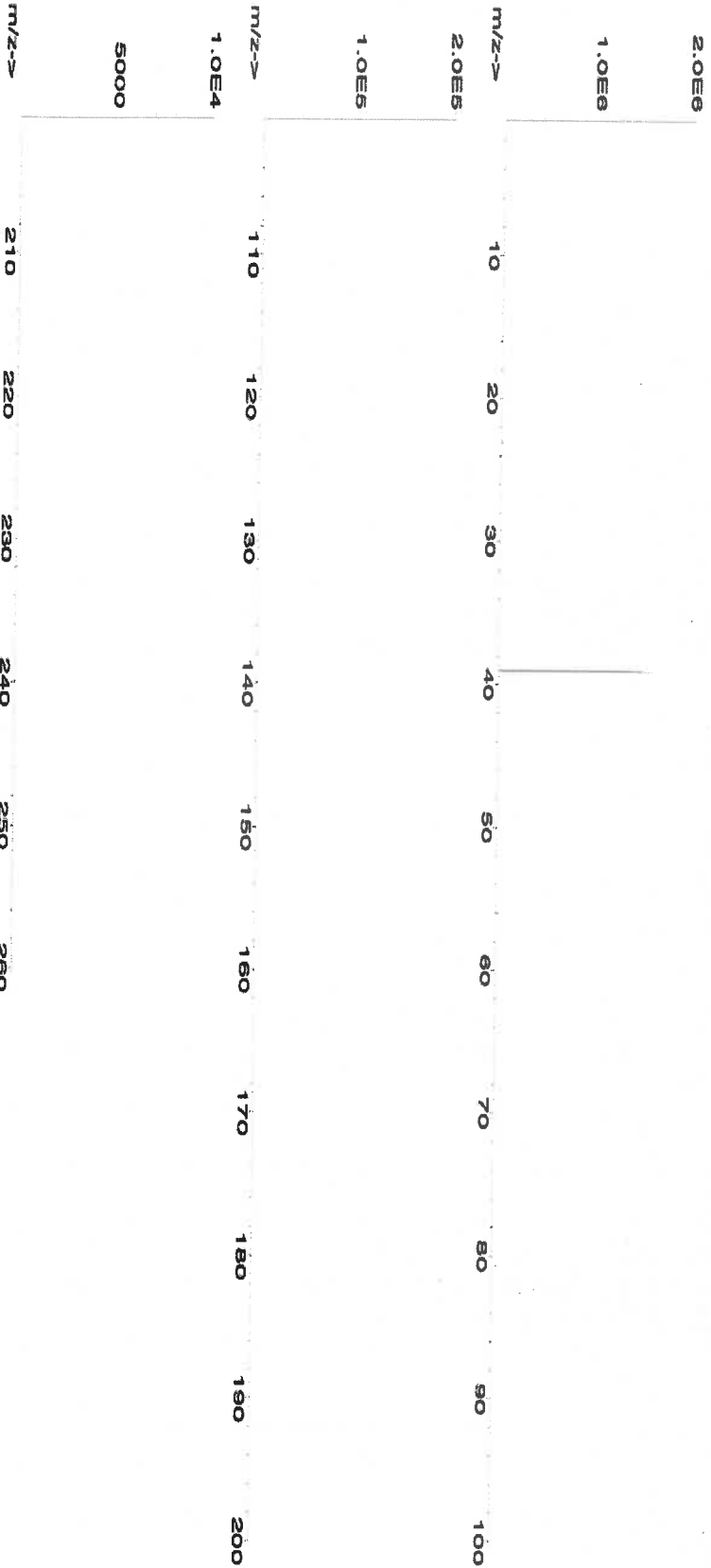
|                          |                          |
|--------------------------|--------------------------|
| <i>Giovanni Esposito</i> |                          |
| Formulated By:           | Giovanni Esposito        |
| Reviewed By:             | <i>Pedro L. Renteria</i> |
|                          | 120822                   |

**Compound**

| Lot | Nominal | Purity        | Uncertainty | Assay      | Target | Actual     | Actual     | Expanded      | SDS Information | NIST                                   |
|-----|---------|---------------|-------------|------------|--------|------------|------------|---------------|-----------------|--|
| RM# | Number  | Conc. (µg/mL) | (%)         | Purity (%) | (%)    | Weight (g) | Weight (g) | Conc. (µg/mL) | Uncertainty     | (Solvent Safety Info. On Attached pg.) |
|     |         |               |             |            |        |            |            | +/- (µg/mL)   | CAS#            | OSHA PEL (TWA)                         |

1. Potassium nitrate (K) IN034 KD022021A1 10000 99.989 0.10 37.6 79.7990 79.8075 10001.1 20.0 7757-79-1 5 mg/m3 crtat 3015 mg/kg 3141a

[1] Spectrum No.1 [ 35.763 sec]:58119.D# [Count] [Linear]







**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | Pb | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 |    |       | Nd | <0.02 | K  |       | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

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**CERTIFIED WEIGHT REPORT:**

**Part Number:** 58024  
**Lot Number:** 060523  
**Description:** Chromium (Cr)

**Lot #** 21110221 **Solvent:** Nitric Acid

2.0%

40.0 (mL) Nitric Acid

|                |                |
|----------------|----------------|
|                |                |
| Formulated By: | Lawrence Barry |
|                | 060523         |

**Expiration Date:** 060526  
**Recommended Storage:** Ambient (20 °C)

**Nominal Concentration (µg/mL):** 1000

**NIST Test Number:** 6UTB

5E-05 Balance Uncertainty

**Volume shown below was diluted to (mL):** 2000.02 0.058 Flask Uncertainty

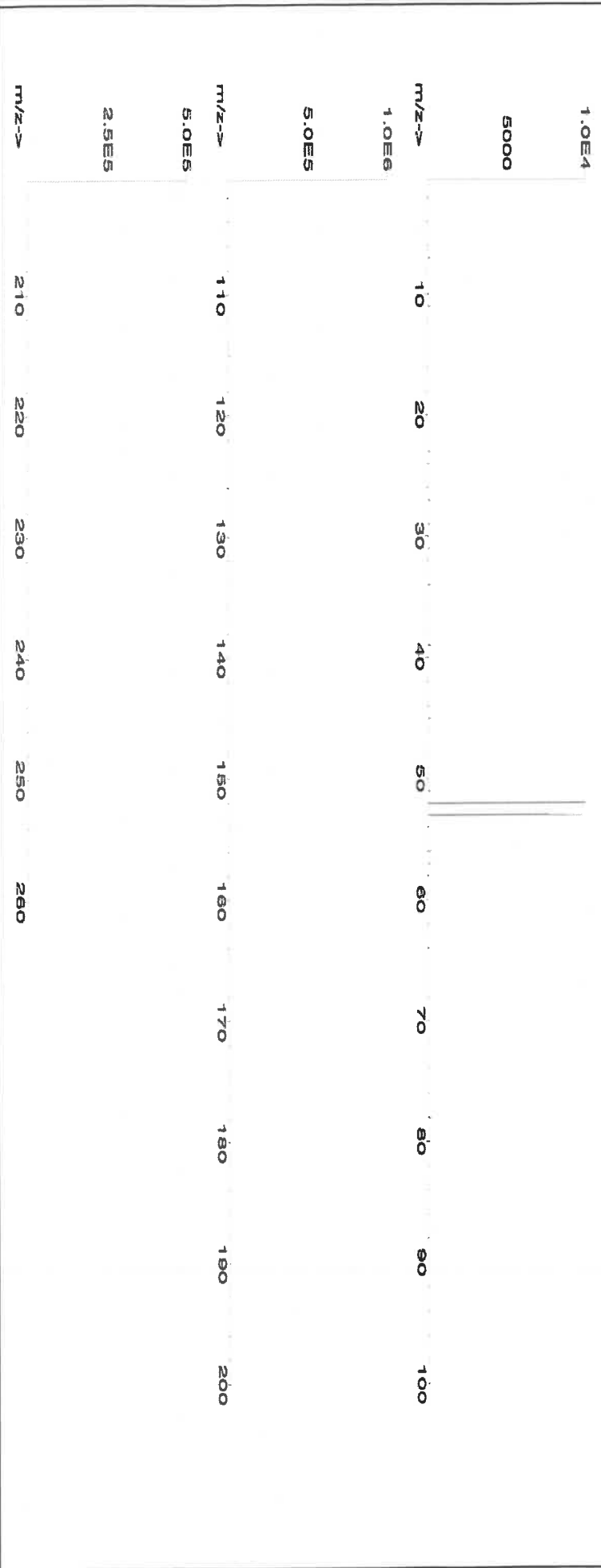
|              |                 |
|--------------|-----------------|
|              |                 |
| Reviewed By: | Pedro L. Ruelas |
|              | 060523          |

**SDS Information**

| Compound | Part Number | Lot Number | Dilution Factor | Initial Vol. (mL) | Uncertainty (mL) | Nominal Conc. (µg/mL) | Initial Conc. (µg/mL) | Final Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|-------------|------------|-----------------|-------------------|------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|
|----------|-------------|------------|-----------------|-------------------|------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|

1. Chromium(III) nitrate nonahydrate (Cr) 58124 071122 0.1000 200.0 0.084 1000 10000.1 1000.0 2.2 7789-02-8 0.5 mg(Cr)/m3 or rat 3250 mg/kg 3112a

[1] Spectrum No.1 [31.393 sec]:57024.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | T     | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
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**CERTIFIED WEIGHT REPORT:**

**Part Number:**  
**Lot Number:**  
**Description:**

**58025**  
**102623**  
**Manganese (Mn)**

**Lot #**  
**Solvent:**

**24002546**  
**Nitric Acid**

**Expiration Date:**

**102626**

**Recommended Storage:**

**Ambient (20 °C)**

**Nominal Concentration (µg/mL):**

**1000**

**NIST Test Number:**

**6UTB**

**Volume shown below was diluted to (mL):**

**3000.41**

**5E-05**  
**Balance Uncertainty**

**0.058**  
**Flask Uncertainty**

|                |                 |        |
|----------------|-----------------|--------|
| Formulated By: | Benson Chan     | 102623 |
| Reviewed By:   | Pedro L. Ruelas | 102623 |

**SDS Information**

| Compound | Part Number | Lot Number | Dilution Factor | Initial Vol. (mL) | Uncertainty Pipette (mL) | Nominal Conc. (µg/mL) | Initial Conc. (µg/mL) | Final Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|-------------|------------|-----------------|-------------------|--------------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|
|----------|-------------|------------|-----------------|-------------------|--------------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|

1. Manganese(II) nitrate tetrahydrate (Mn) 58125 071123 0.1000 300.0 0.084 1000 10000.1 1000.0 2.1 20694-39-7 5 mg/m3 or-rel>300mg/kg 3132

[1] Spectrum No.1 [34.243 sec]:57025.D# [Count] [Linear]

|        |     |     |     |     |     |     |    |    |    |     |
|--------|-----|-----|-----|-----|-----|-----|----|----|----|-----|
| 5.0E6  | 10  | 20  | 30  | 40  | 50  | 60  | 70 | 80 | 90 | 100 |
| 2.5E6  | 10  | 20  | 30  | 40  | 50  | 60  | 70 | 80 | 90 | 100 |
| 1.0E6  | 10  | 20  | 30  | 40  | 50  | 60  | 70 | 80 | 90 | 100 |
| 5.0E7  | 10  | 20  | 30  | 40  | 50  | 60  | 70 | 80 | 90 | 100 |
| 1.0E6  | 10  | 20  | 30  | 40  | 50  | 60  | 70 | 80 | 90 | 100 |
| 5.0E7  | 10  | 20  | 30  | 40  | 50  | 60  | 70 | 80 | 90 | 100 |
| m/z--> | 210 | 220 | 230 | 240 | 250 | 260 |    |    |    |     |



## Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

## Trace Metals Verification by ICP-MS (µg/mL)

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | T     | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

## Physical Characterization:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**Certified Reference Material CRM**



**CERTIFIED WEIGHT REPORT:**

Part Number: **58029**  
Lot Number: **071723**  
Description: **Copper (Cu)**

Lot #: **2110221**  
Solvent: **Nitric Acid**

2.0%

40.0 (mL)  
Nitric Acid

|                |                 |        |
|----------------|-----------------|--------|
| Formulated By: | Benson Chan     | 071723 |
| Reviewed By:   | Pedro L. Ruelas | 071723 |

Expiration Date: **071726**  
Recommended Storage: **Ambient (20 °C)**  
Nominal Concentration (µg/mL): **1000**

NIST Test Number: **6L7B**

Volume shown below was diluted to (mL): **2000.02**  
Balance Uncertainty: **5E-05**  
Flask Uncertainty: **0.058**

**SDS Information**

| Compound | Part Number | Lot Number | Dilution Factor | Initial Vol. (mL) | Uncertainty (mL) | Nominal Conc. (µg/mL) | Initial Conc. (µg/mL) | Final Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|-------------|------------|-----------------|-------------------|------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|
|----------|-------------|------------|-----------------|-------------------|------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|

1. Copper(II) nitrate trihydrate (Cu) 58129 022723 0.1000 200.0 0.084 1000 10000.5 1000.0 2.2 10031-43-3 1 mg/m3 or rat 794 mg/kg 3114

[1] Spectrum No.1 [33.422 sec]:58029.D# [Count] [Linear]

|       |        |     |     |     |     |     |     |     |     |     |     |
|-------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1.0E6 | m/z--> | 10  | 20  | 30  | 40  | 50  | 60  | 70  | 80  | 90  | 100 |
| 5.0E5 |        |     |     |     |     |     |     |     |     |     |     |
| 5.0E7 | m/z--> | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |
| 2.5E7 |        |     |     |     |     |     |     |     |     |     |     |
| 1.0E7 | m/z--> | 210 | 220 | 230 | 240 | 250 | 260 |     |     |     |     |



**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Bu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Ru | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | La | <0.2  | Hg | <0.2  | P  | <0.02 | Sr | <0.02 | S  | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | Pb | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | Ta | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | T     | Au | <0.02 |    |       | Nd | <0.02 | K  | <0.2  | Sc | <0.02 |    |       | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



M5768 M5769  
Certified Reference Material CRM  
R: 1/13/24



ANAB ISO 17034 Accredited  
AR-1539 Certificate Number  
https://AbsoluteStandards.com

**CERTIFIED WEIGHT REPORT:**

Part Number: 58112  
Lot Number: 091823  
Description: Magnesium (Mg)

Solvent: 24002546 Nitric Acid

Lot #

Expiration Date: 091826  
Recommended Storage: Ambient (20 °C)  
Nominal Concentration (µg/mL): 10000  
NIST Test Number: 6UTB  
Weight shown below was diluted to (mL): 2000.02 0.058 Flask Uncertainty

2% 40.0 (mL) Nitric Acid

M5768 M5769

R: 1/13/24

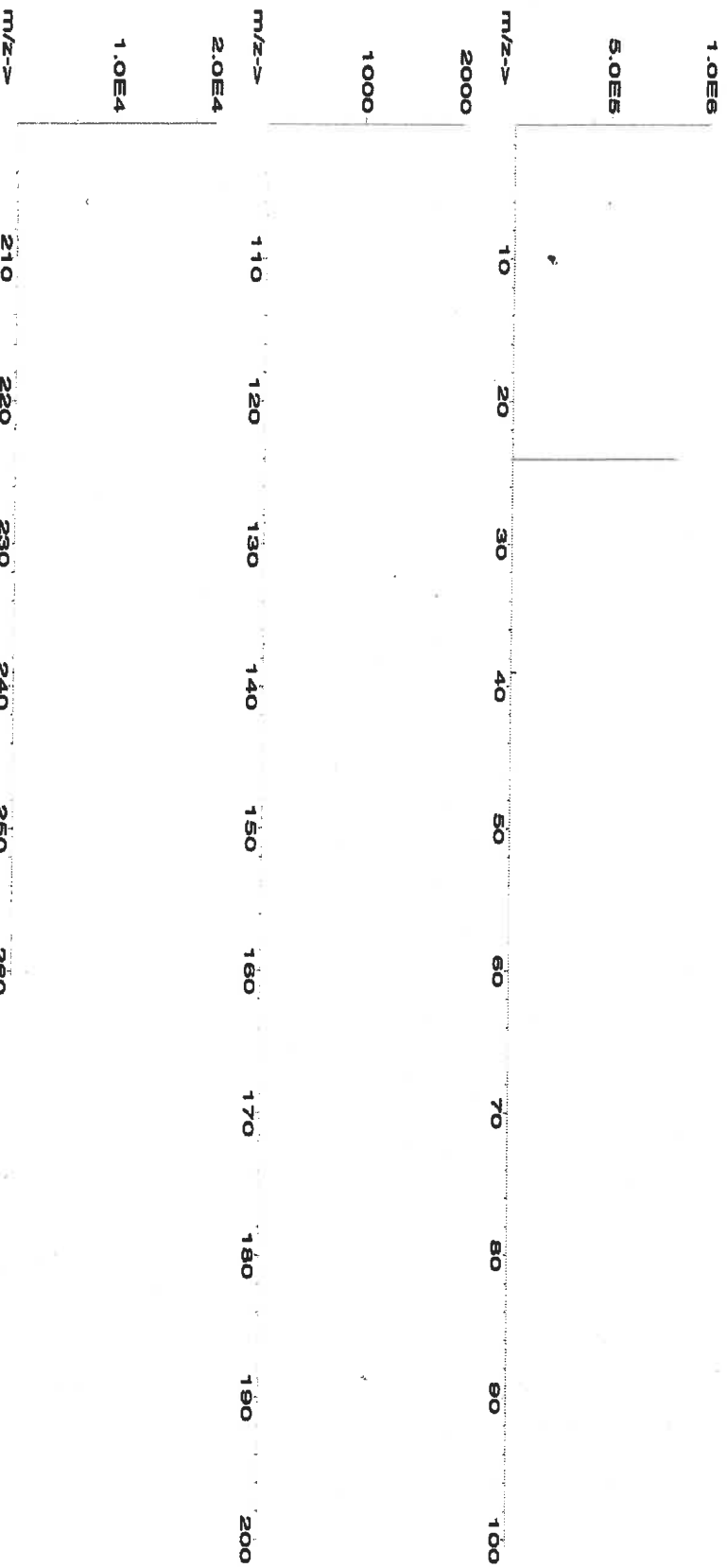
|                                      |  |        |
|--------------------------------------|--|--------|
| Formulated By: <i>Lawrence Barry</i> |  | 091823 |
| Reviewed By: <i>Pedro L. Rentas</i>  |  | 091823 |

**Compound**

| SDS Information                        |                       |            |                        |                  |                   |                   |                      |             |             |           |  |  |
|--|-----------------------|------------|------------------------|------------------|-------------------|-------------------|----------------------|-------------|-------------|-----------|--|--|
| Lot Number                             | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay Purity (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded    |             | NIIST SRM |  |  |
|  |                       |            |                        |                  |                   |                   |                      | Uncertainty | +/- (µg/mL) |           |  |  |
| (Solvent Safety Info. On Attached pg.) |                       |            |                        |                  |                   |                   |                      |             |             |           |  |  |
| CAS#                                   | OSHA PEL (TWA)        | LD50       |                        |                  |                   |                   |                      |             |             |           |  |  |

1. Magnesium nitrate hexahydrate (Mg) IN030 M500222A1 10000 99.999 0.10 8.51 234.9118 234.9126 10000.0 20.0 13446-18-9 NA or-rat 5440 mg/kg 3131a

[1] Spectrum No. 1 [ 19.923 sec]: 58112.D# [Count] [Linear]







**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | T     | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



M5768 M5769  
Certified Reference Material CRM  
R: 1/13/24



**CERTIFIED WEIGHT REPORT:**

Part Number: 58112  
Lot Number: 091823  
Description: Magnesium (Mg)

Solvent: 24002546 Nitric Acid

Lot #

Expiration Date: 091826

Recommended Storage: Ambient (20 °C)

Nominal Concentration (µg/mL): 10000

NIST Test Number: 6UTB

Weight shown below was diluted to (mL): 2000.02

2% 40.0 (mL) Nitric Acid

M5768 M5769  
BP R: 1/13/24

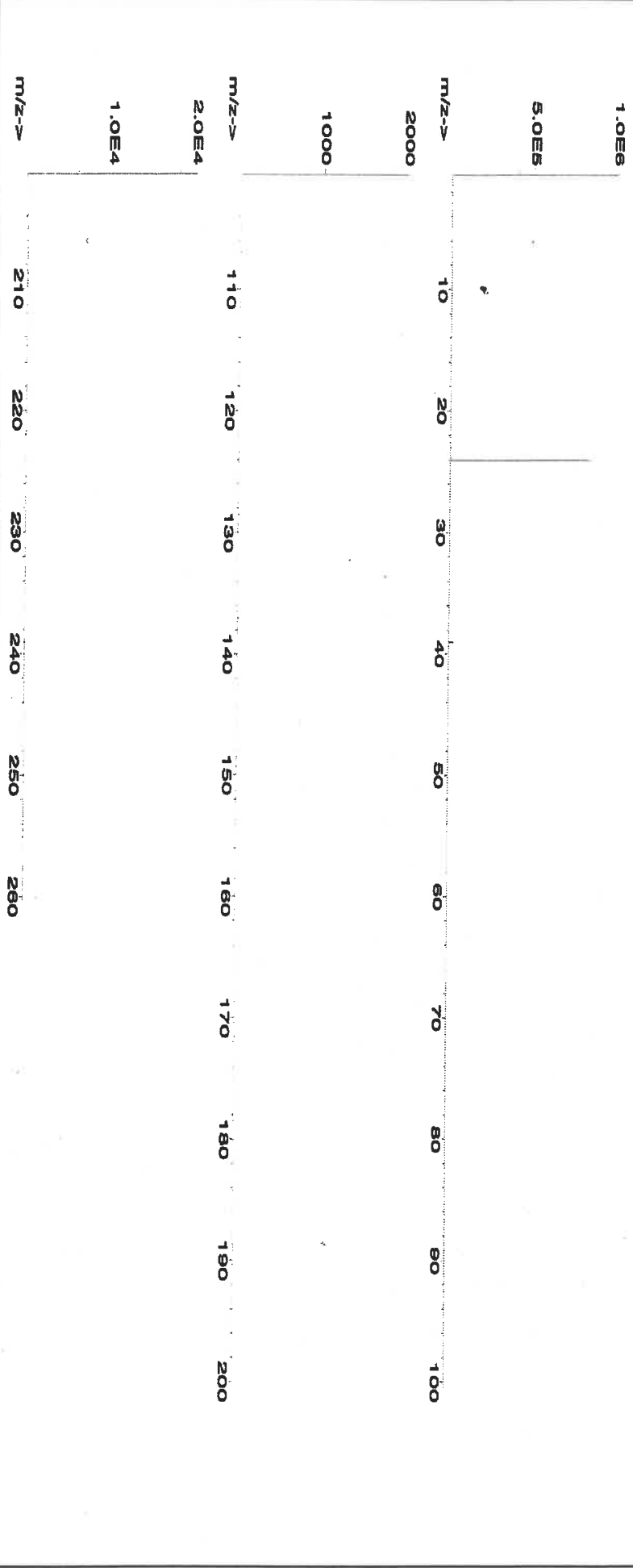
|                                      |  |        |
|--------------------------------------|--|--------|
| Formulated By: <i>Lawrence Barry</i> |  | 091823 |
| Reviewed By: <i>Pedro L. Rentas</i>  |  | 091823 |

**Compound**

| Lot | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|-----|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|-----|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Magnesium nitrate hexahydrate (Mg) IN030 M500222A1 10000 99.999 0.10 8.51 234.9118 234.9126 10000.0 20.0 13446-18-9 NA or-rat 5440 mg/kg 3131a

[1] Spectrum No. 1 [ 19.923 sec]: 58112.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | T     | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
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- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

**Part Number:** 57004  
**Lot Number:** 102523  
**Description:** Beryllium (Be)

**Lot #** 24002546  
**Solvent:** Nitric Acid

**Expiration Date:**

102526

2.0%

40.0 (mL)

Nitric Acid

**Recommended Storage:**

Ambient (20 °C)

**Nominal Concentration (µg/mL):**

1000

**NIST Test Number:**

6UTB

**Volume shown below was diluted to (mL):** 2000.02

5E-05 Balance Uncertainty

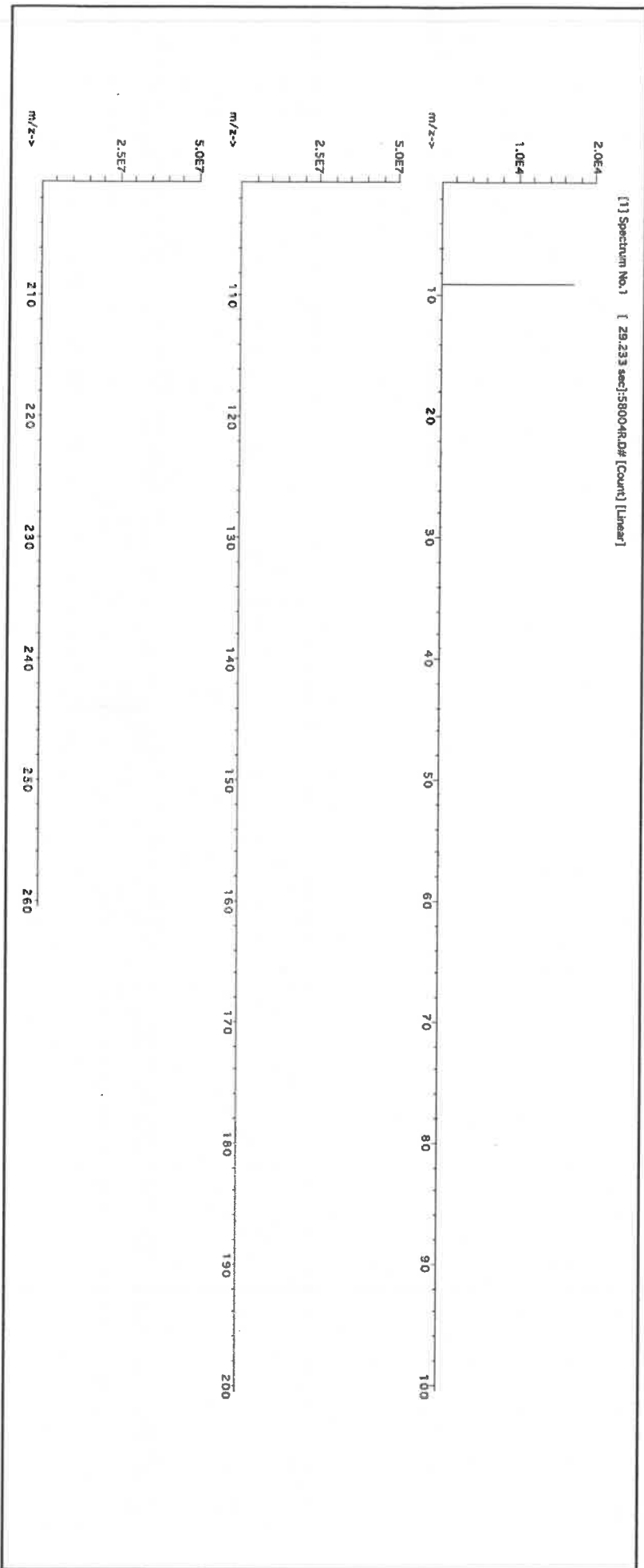
0.058 Flask Uncertainty

|                |                 |        |
|----------------|-----------------|--------|
| Formulated By: | Benson Chan     | 102523 |
| Reviewed By:   | Pedro L. Rentas | 102523 |

**SDS Information**

| Compound | Part Number | Lot | Dilution Factor | Initial Vol. (mL) | Uncertainty Pipette (mL) | Nominal Conc. (µg/mL) | Initial Conc. (µg/mL) | Final Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|-------------|-----|-----------------|-------------------|--------------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|
|----------|-------------|-----|-----------------|-------------------|--------------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|

|                           |       |        |        |       |       |      |         |        |     |            |          |                        |    |
|---------------------------|-------|--------|--------|-------|-------|------|---------|--------|-----|------------|----------|------------------------|----|
| 1. Beryllium nitrate (Be) | 58104 | 091423 | 0.1000 | 200.0 | 0.084 | 1000 | 10001.5 | 1000.0 | 2.2 | 13597-99-4 | 0.2µg/m3 | intrinsc-rat 3.16mg/kg | NA |
|---------------------------|-------|--------|--------|-------|-------|------|---------|--------|-----|------------|----------|------------------------|----|





## Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

Trace Metals Verification by ICP-MS ( $\mu\text{g/mL}$ )

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Tc | <0.02 | U  | <0.02 |
| As | <0.02 | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Ti | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | T     | Cr | <0.02 | Ga | <0.02 | Fe | <0.02 | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Ta | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.02 | Sc | <0.02 | Ta | <0.02 | Tl | <0.02 | Zr | <0.02 |

(T) = Target analyte

## Physical Characterization:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

\* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.  
 \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.

\* All standard containers are meticulously cleaned prior to use.

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 \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.

\* All Standards should be stored with caps tight and under appropriate laboratory conditions.

\* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**Certified Reference Material CRM**

**CERTIFIED WEIGHT REPORT:**

Part Number: 57050  
Lot Number: 071123  
Description: Tin (Sn)

Solvents: 21110221 Nitric Acid  
22D0562008 Hydrochloric acid

Lot #

R-02509124

M599



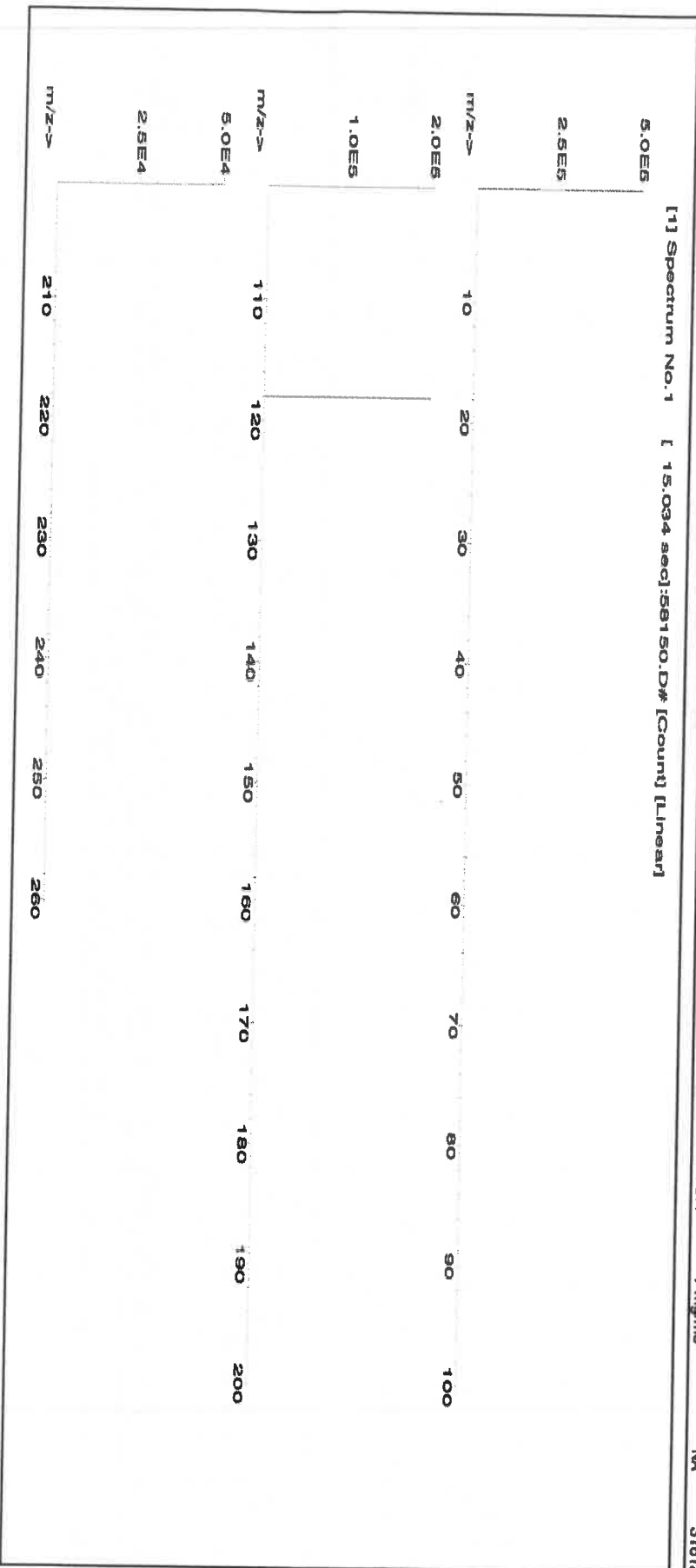
Expiration Date: 071126  
Recommended Storage: Ambient (20 °C)  
Nominal Concentration (µg/mL): 1000  
NIST Test Number: 6UTB  
Weight shown below was diluted to (mL): 499.93  
5E-05 Balance Uncertainty  
0.058 Flask Uncertainty

|                               |  |
|-------------------------------|--|
| Formulated By: Benson Chan    |  |
| 071123                        |  |
| Reviewed By: Pedro L. Rientas |  |
| 071123                        |  |

| SDS Information |        |                       |            |                 |           |                   |                   |                      |                          |  |  |  |
|-----------------|--------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|--------------------------|--|--|--|
| Compound        | Lot    | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty (%) | NIST                                   |  |  |
|                 |        |                       |            |                 |           |                   |                   |                      |                          | (Solvent Safety Info. On Attached pg.) |  |  |
| RM#             | Number |                       |            |                 |           |                   |                   |                      |                          |  |  |  |

1. Ammonium hexafluoroantimonate(V) (Sn) IN010 SMD042023A1 1000 99.999 0.10 44.2 1.13107 1.13286 1001.6 2.0 16919-24-7 7 mg/m3 NA 3161a

[1] Spectrum No. 1 [ 15.034 sec]:56150.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Ti | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <500  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Ta | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



R: 02/09/24 115800 (54)

CERTIFIED WEIGHT REPORT:

Part Number: 57027  
Lot Number: 091923  
Description: Cobalt (Co)

Expiration Date: 091926  
Recommended Storage: Ambient (20 °C)  
Nominal Concentration (µg/mL): 1000  
NIST Test Number: 6UTB

Volume shown below was diluted to (mL): 2000.02

5E-05 Balance Uncertainty  
0.058 Flask Uncertainty

Lot # 24002546  
Solvent: Nitric Acid

2.0% Nitric Acid  
40.0 (mL)

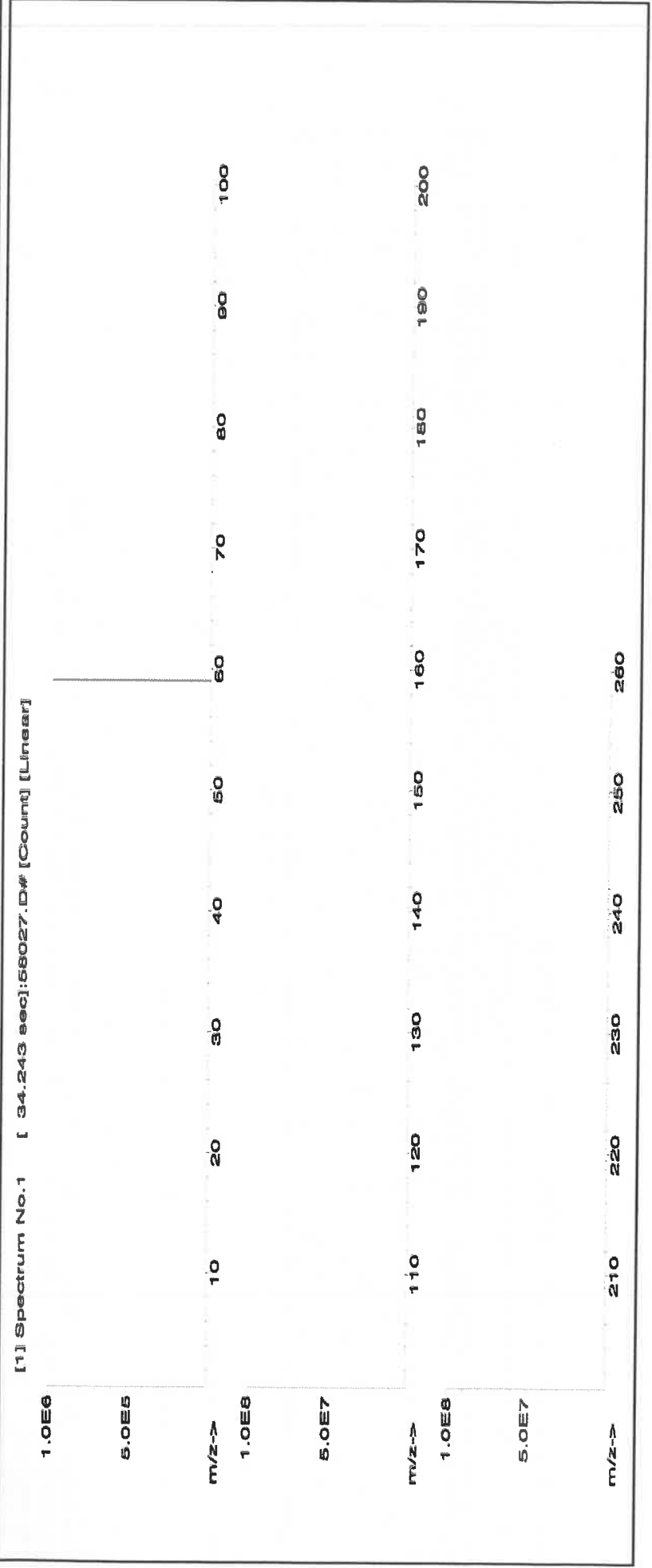
|                |                 |
|----------------|-----------------|
|                |                 |
| Formulated By: | Lawrence Barry  |
|                |                 |
| Reviewed By:   | Pedro L. Rentas |

SDS Information

Expanded Uncertainty +/- (µg/mL)  
Final Conc. (µg/mL)  
Initial Conc. (µg/mL)  
Nominal Conc. (µg/mL)  
Pipette (mL)  
Initial Vol. (mL)  
Dilution Factor  
Part Number  
Lot Number

(Solvent Safety Info. On Attached pg.)  
CAS#  
OSHA PEL (TWA)  
LD50  
NIST  
SRM

1. Cobalt(II) nitrate hexahydrate (Co) 58127 050923 0.1000 200.0 0.084 1000 10000.0 1000.0 2.2 10026-22-9 0.02 mg/m3 orl-rat 691 mg/kg 3113







**Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.02 | Os | <0.01 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.2  | Na | <0.02 | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | T     | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T)= Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

**Certified by:**

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

**Part Number:**  
**Lot Number:**  
**Description:**

**57033**  
**111323**  
**Arsenic (As)**

**Lot #**  
**Solvent:**

**24002546**  
**Nitric Acid**

**Expiration Date:**

**111326**

**2.0%**  
**80.0 (mL)**

**Nitric Acid**

**Recommended Storage:**

**Ambient (20 °C)**

**Nominal Concentration (µg/mL):**

**1000**

**NIST Test Number:**

**6UTB**

**Volume shown below was diluted to (mL):**

**4000.0**

**5E-05 Balance Uncertainty**  
**0.06 Flask Uncertainty**

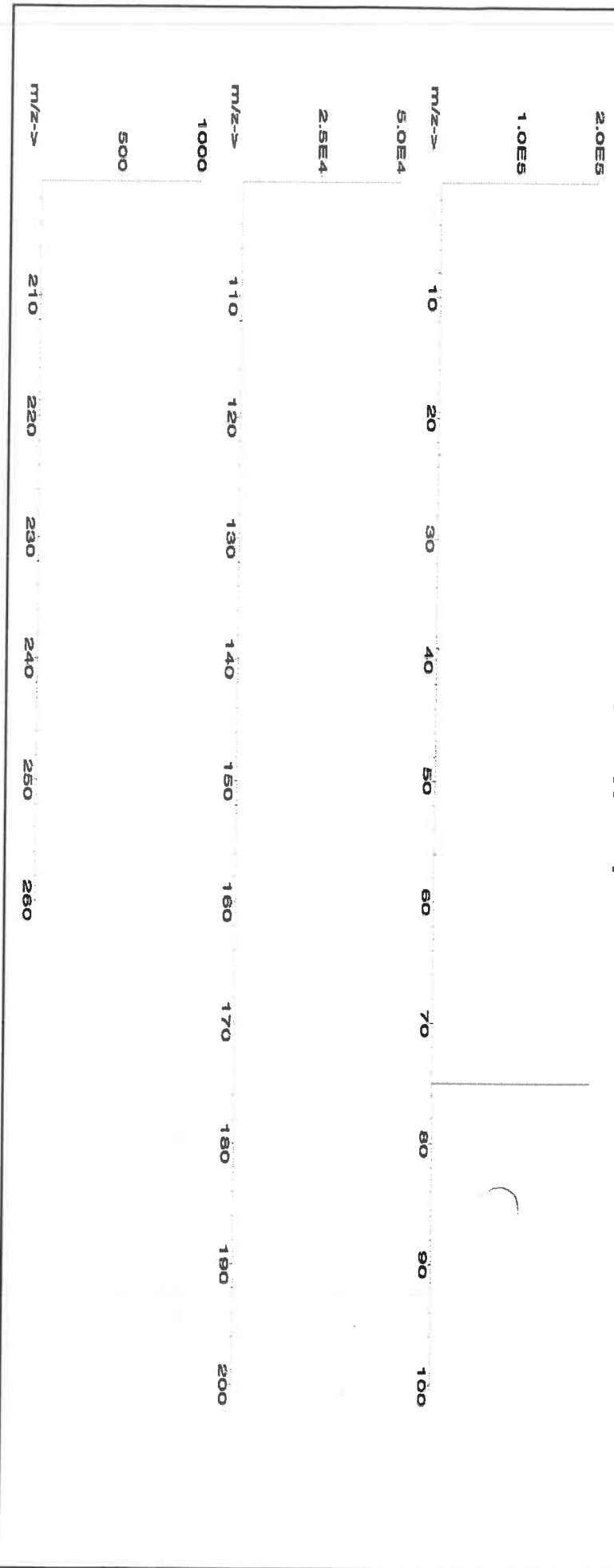
|                       |                        |
|-----------------------|------------------------|
|                       |                        |
| <b>Formulated By:</b> | <b>Lawrence Barry</b>  |
| <b>Reviewed By:</b>   |                        |
|                       | <b>Pedro L. Rendas</b> |
|                       | <b>111323</b>          |

**Compound**

| Part Number | Lot Number | Dilution Factor | Initial Vol. (mL) | Uncertainty Pipette (mL) | Nominal Conc. (µg/mL) | Initial Conc. (µg/mL) | Final Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | SDS Information (Solvent Safety Info. On Attached pg.) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|-------------|------------|-----------------|-------------------|--------------------------|-----------------------|-----------------------|---------------------|----------------------------------|--|------|----------------|------|----------|
|-------------|------------|-----------------|-------------------|--------------------------|-----------------------|-----------------------|---------------------|----------------------------------|--|------|----------------|------|----------|

1. Arsenic (As) 58133 020522 0.1000 400.0 0.084 1000 10001.0 1000.0 2.0 7440-38-2 0.5 mg/m3 or-lat 500 mg/kg 3103a

[1] Spectrum No.1 [34.433 sec]:57033.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |     |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|-----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy  | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er  | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Tc | <0.02 | U  | <0.02 |
| As | T     | Ce | <0.02 | Eu  | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Ti | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd  | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga  | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge* | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sa | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au  | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Tl | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

**Certified by:**

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

**Part Number:** 57115  
**Lot Number:** 041723  
**Description:** Phosphorous (P)

**Solvent:** 21110221 Nitric Acid

**Lot #**

R102109124 M5815

**Expiration Date:** 041726  
**Recommended Storage:** Ambient (20 °C)  
**Nominal Concentration (µg/mL):** 10000  
**NIST Test Number:** 6UTB

**2% 40.0 (mL) Nitric Acid**

**Weight shown below was diluted to (mL):** 2000.02 0.058 Balance Uncertainty Flask Uncertainty

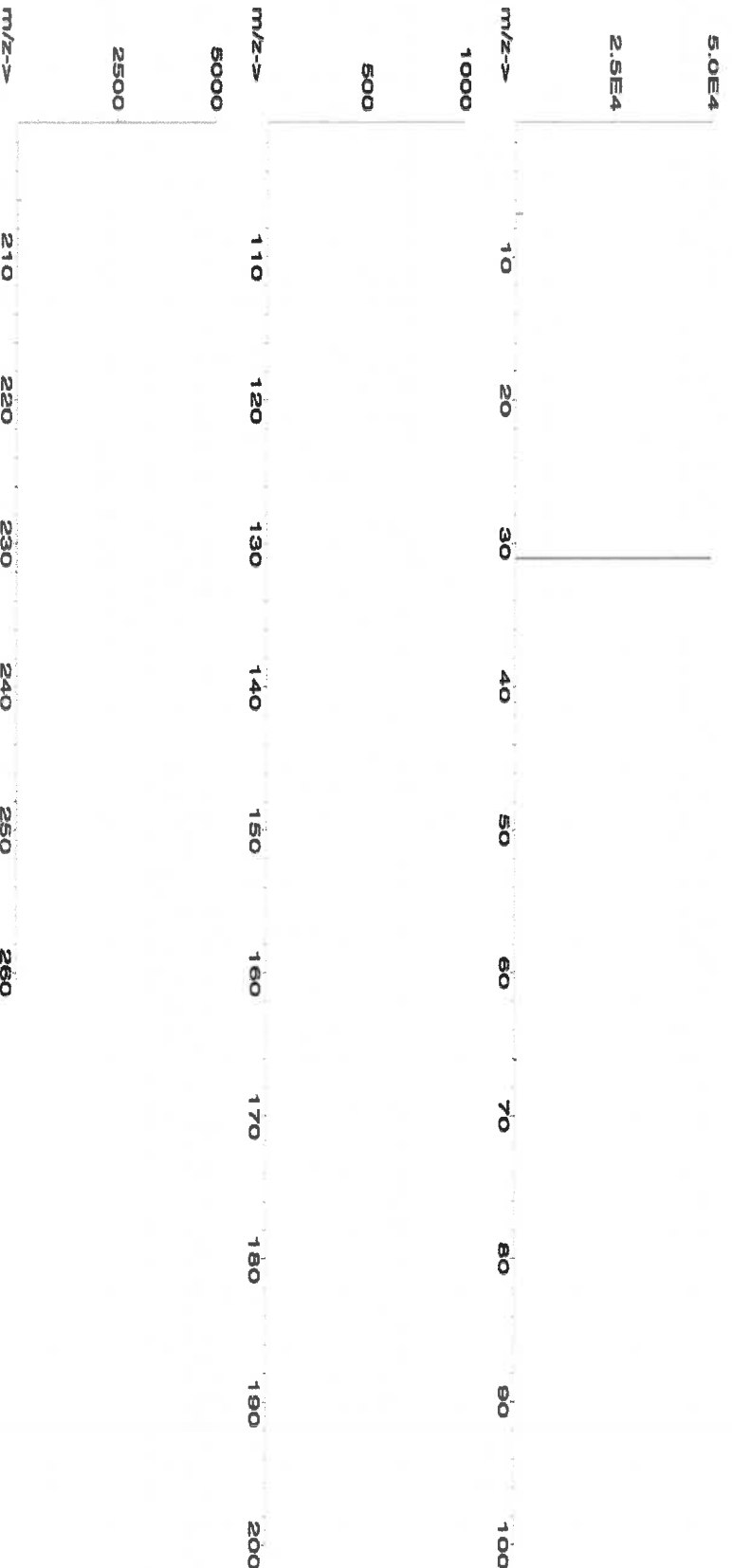
|                                      |               |
|--------------------------------------|---------------|
|                                      |               |
| <b>Formulated By:</b> Lawrence Barry | <b>041723</b> |
|                                      |               |
| <b>Reviewed By:</b> Pedro L. Rentas  | <b>041723</b> |

**SDS Information**

| Compound | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|------------|-----------------------|------------|-----------------------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|----------|------------|-----------------------|------------|-----------------------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Ammonium dihydrogen phosphate (P) IN008 P082019A1 10000 99.999 0.10 27.5 72.7287 72.7289 10000.0 20.0 7722-76-1 5 mg/m3 or-hal->2000mg/kg 3186

[1] Spectrum No.1 [ 12.074 sec]:58115.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | T     | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

**Certified by:**

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

Part Number:  
Lot Number:  
Description:

57016  
122923  
Sulfur (S)

Lot #

ASTM Type 1 Water

|                |                 |
|----------------|-----------------|
|                |                 |
| Formulated By: | Benson Chan     |
| Reviewed By:   | Pedro L. Rentas |
| 122923         |                 |

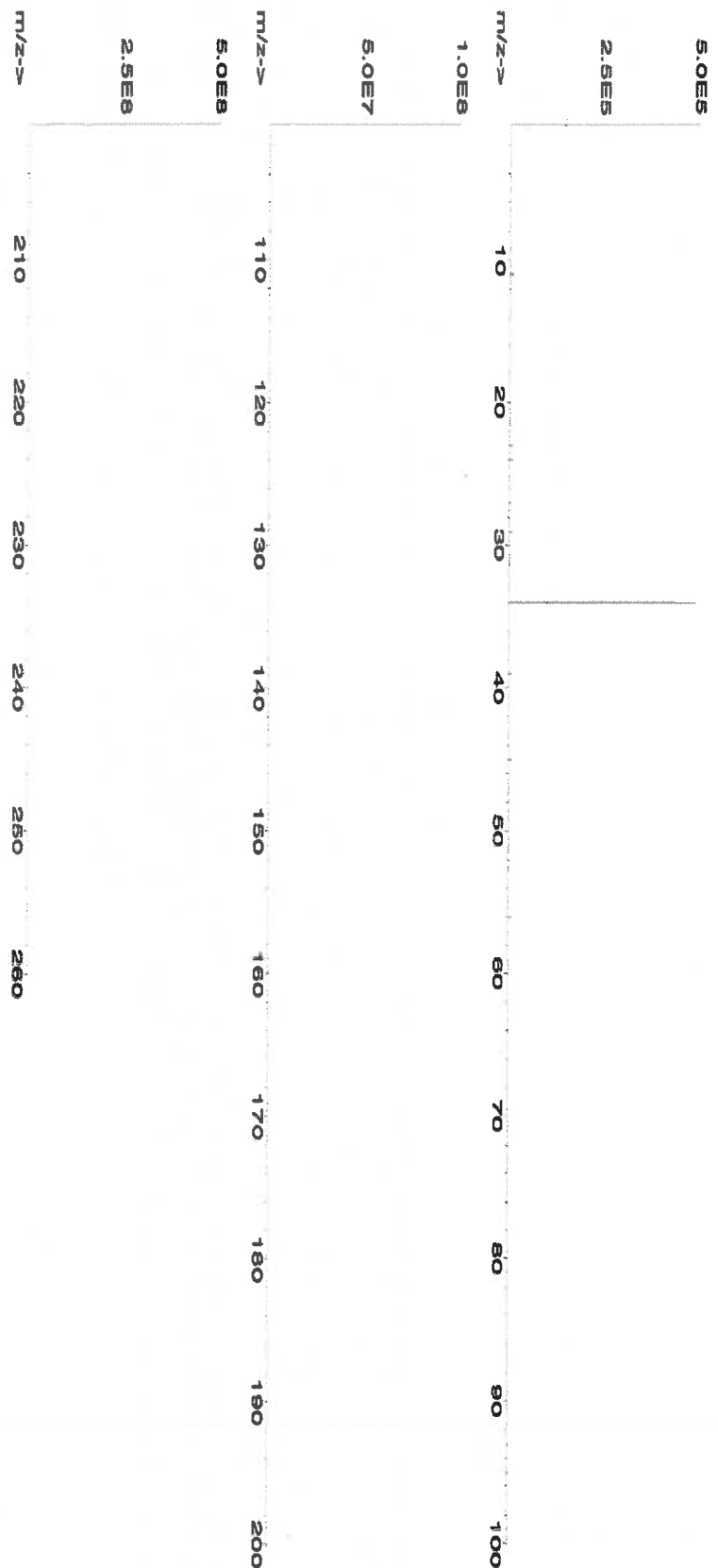
Expiration Date: 122926  
Recommended Storage: Ambient (20 °C)  
Nominal Concentration (µg/mL): 1000  
NIST Test Number: 6L7B  
Weight shown below was diluted to (mL): 4000.0  
SE-05 Balance Uncertainty  
0.06 Flask Uncertainty

**Compound**

| RM# | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|-----|------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|-----|------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Ammonium sulfate (S) IN117 SLBR725V 1000 99.9 0.10 24.3 16.4979 16.4980 1000.0 2.0 7783-20-2 NA 0.01-0.02 4250mg/kg 3181

[1] Spectrum No. 1 [33.603 sec]:57016.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Ba | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Ru | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | S  | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | Ta | <0.02 | Ti | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
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- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

Part Number:  
Lot Number:  
Description:

57116  
071123  
Sulfur (S)

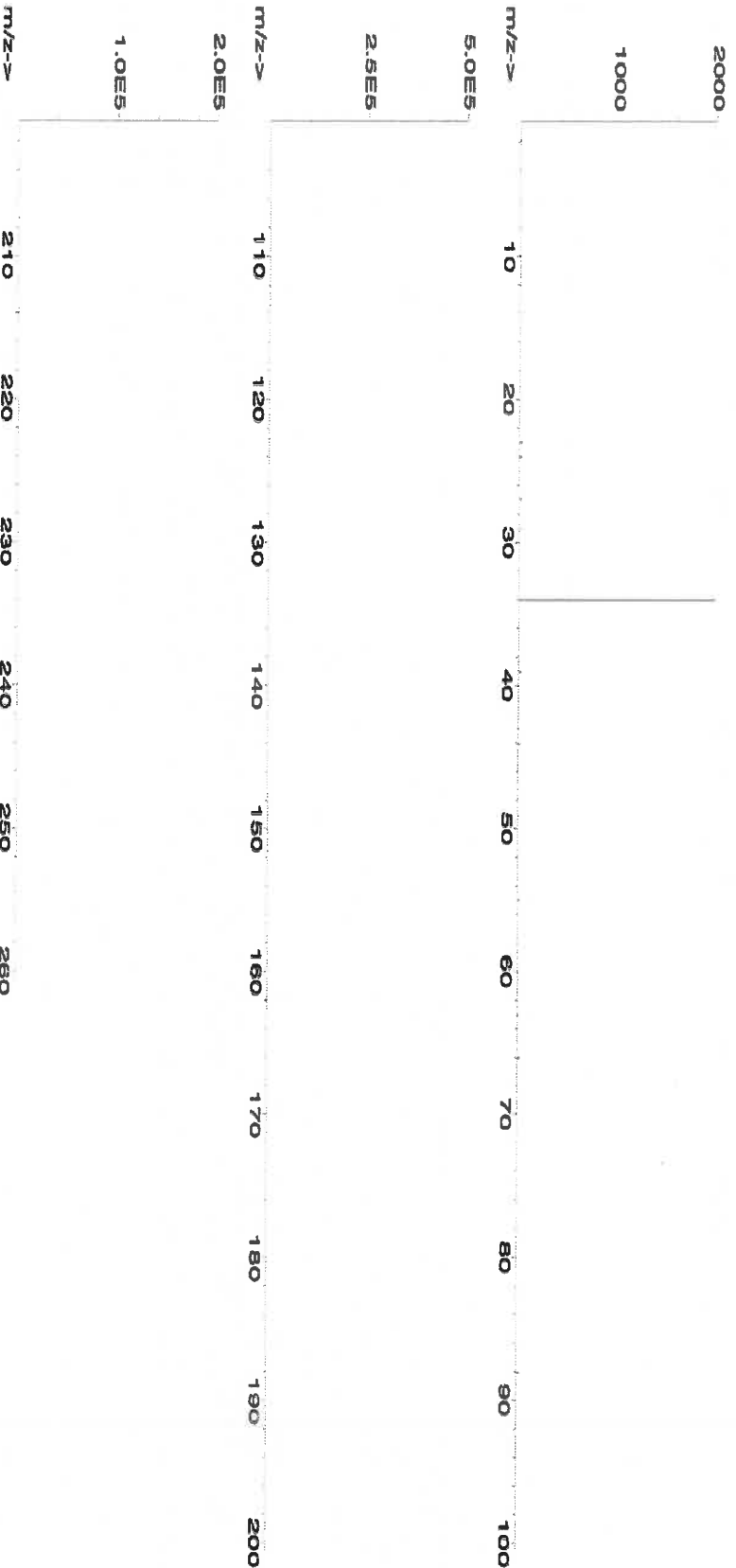
Lot #  
Solvent: 071123  
ASTM Type 1 Water

|                |                 |
|----------------|-----------------|
|                |                 |
| Formulated By: | Lawrence Barry  |
|                | 071123          |
|                |                 |
| Reviewed By:   | Pedro L. Rentas |
|                | 071123          |

Expiration Date: 071126  
Recommended Storage: Ambient (20 °C)  
Nominal Concentration (µg/mL): 10000  
NIST Test Number: 6UTB  
Weight shown below was diluted to (mL): 1999.48  
5E-05 Balance Uncertainty  
0.058 Flask Uncertainty

| SDS Information      |                 |                       |            |                        |           |                   |                   |                      |                                  |
|----------------------|-----------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|
| Compound             | Lot Number      | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) |
| Ammonium sulfate (S) | IN117 SLBR7225V | 10000                 | 99.9       | 0.10                   | 24.3      | 82.4675           | 82.4692           | 10000.1              | 20.0                             |
|                      |                 |                       |            |                        |           | 7763-20-2         | NA                |                      |                                  |
|                      |                 |                       |            |                        |           |                   | oral 4250mg/kg    | 3181                 |                                  |

[1] Spectrum No. 1 [ 24.004 sec]:58116.D# [Count] [Linear]







**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Ti | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | T     | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

**Physical Characterization:**

(T)= Target analyte

Certified by:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
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- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

Part Number: **57014**  
Lot Number: **122023**  
Description: **Silicon (Si)**

Solvent: **24002546 Nitric Acid**

Lot #

*R: 02/09/24 M5818*

Expiration Date: **122026**

2% 40.0 (mL) Nitric Acid

Recommended Storage: **Ambient (20 °C)**

Nominal Concentration (µg/mL): **1000**

NIST Test Number: **6UTB**

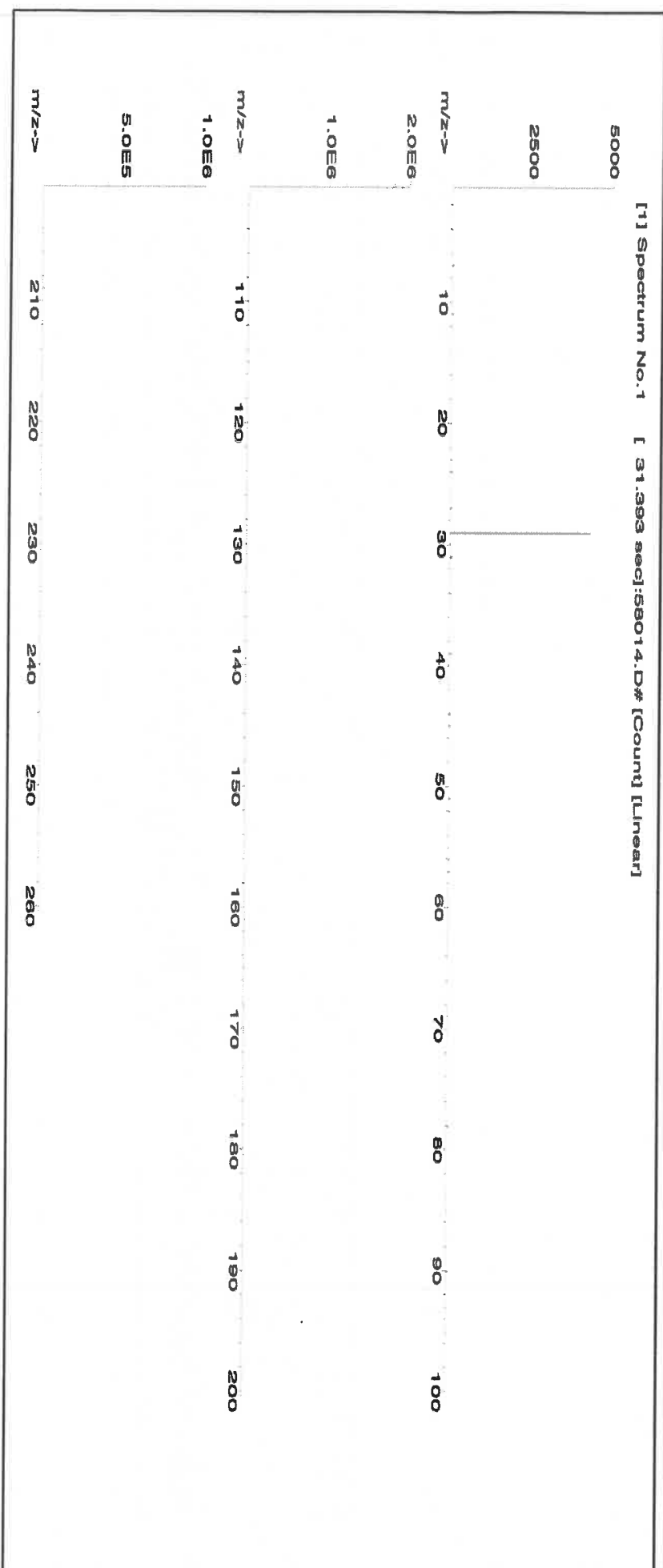
|                      |                 |
|----------------------|-----------------|
| <i>Aleah O Brady</i> |                 |
| Formulated By:       | Aleah O Brady   |
| Reviewed By:         | Pedro L. Rentas |
|                      | 122023          |

Weight shown below was diluted to (mL): **1999.48** 0.058 Balance Uncertainty  
0.058 Flask Uncertainty

**SDS Information**

| Compound                         | Lot Number       | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS#       | OSHA PEL (TWA) | LD50             | NIST SRM |
|----------------------------------|------------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------------|----------------|------------------|----------|
| Ammonium hexafluorosilicate (Si) | IN009 S1D08022A1 | 1000                  | 99.999     | 0.10            | 14.4      | 13.8854           | 13.8855           | 1000.0               | 2.0                              | 18919-19-0 | 2.5 mg/m3      | off-mus 70 mg/kg | NA       |

[1] Spectrum No. 1 [ 31.393 sec; 158014.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS ( $\mu\text{g/mL}$ )**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | T     | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Bu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Ru | <0.02 | Ag | <0.02 | Ti | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Tl | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Certified by:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

**Part Number:** 58030  
**Lot Number:** 111623  
**Description:** Zinc (Zn)

**Solvent:** 24002546 Nitric Acid

**2%** 60.0 (mL) Nitric Acid

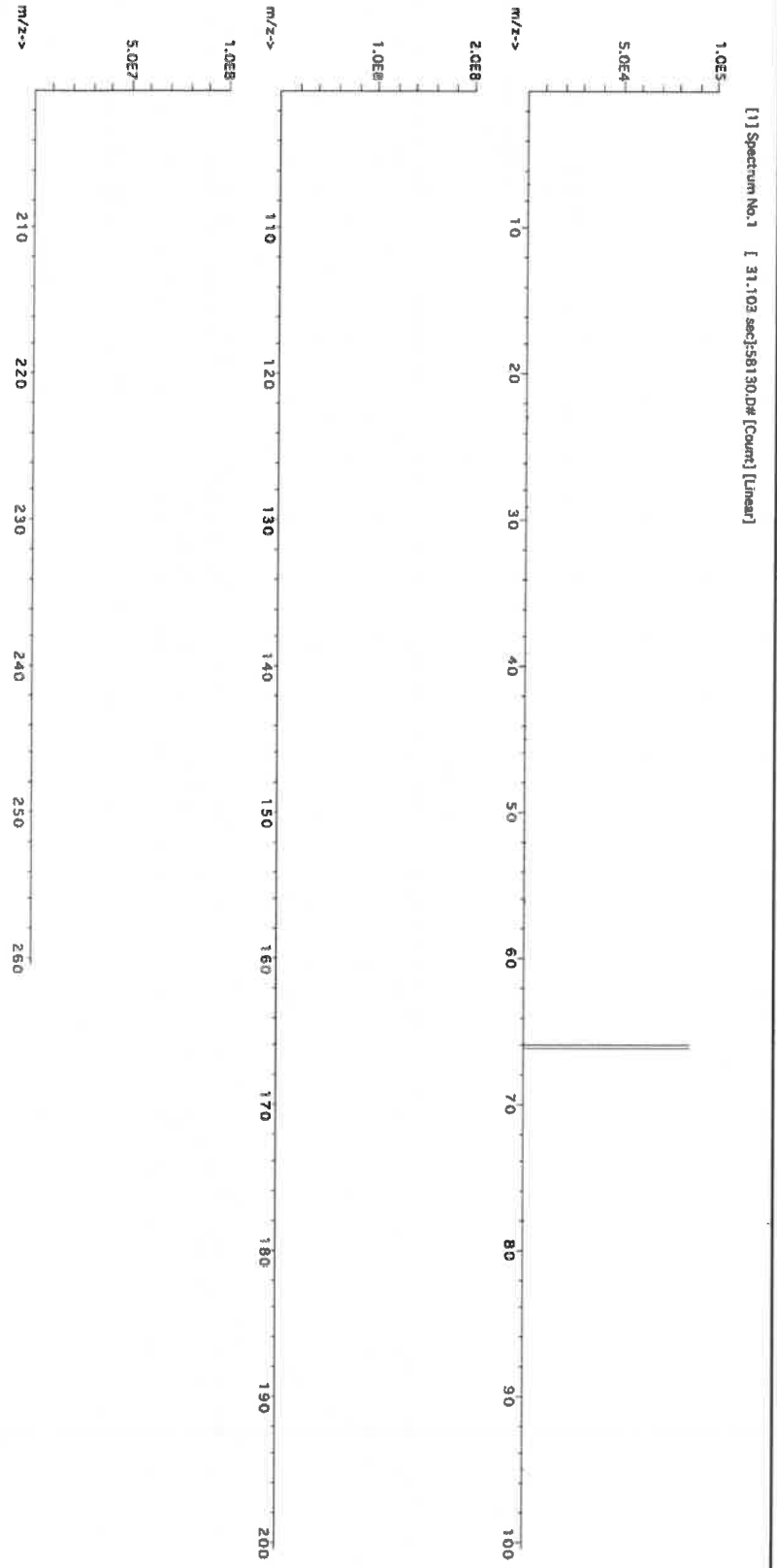
**Expiration Date:** 111626  
**Recommended Storage:** Ambient (20 °C)  
**Nominal Concentration (µg/mL):** 1000  
**NIST Test Number:** 6UTB

|                |                   |
|----------------|-------------------|
|                |                   |
| Formulated By: | Benson Chan       |
|                |                   |
| Reviewed By:   | Pedro L. Reintias |
| 111623         |                   |

**Weight shown below was diluted to (mL):** 3000.4 0.06 Balance Uncertainty Flask Uncertainty

| Compound | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LDSO | NIST SRM |
|----------|------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|----------|------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Zinc nitrate hexahydrate (Zn) IN016 ZNE03021A1 1000 99.999 0.10 24.3 12.3475 12.3502 1000.2 2.0 10196-16-6 1 mg/mL 3168 or-rat 1190mg/kg





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Bu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

Part Number: **57015**  
Lot Number: **091123**  
Description: **Phosphorous (P)**

Solvent: **24002546 Nitric Acid**

Lot #

R: 02109124 M5820

Expiration Date: **091126**  
Recommended Storage: **Ambient (20 °C)**  
Nominal Concentration (µg/mL): **1000**  
NIST Test Number: **6LJB**

2% **40.0** **Nitric Acid**  
(mL)

Weight shown below was diluted to (mL): **2000.02** **5E-05** Balance Uncertainty  
**0.058** Flask Uncertainty

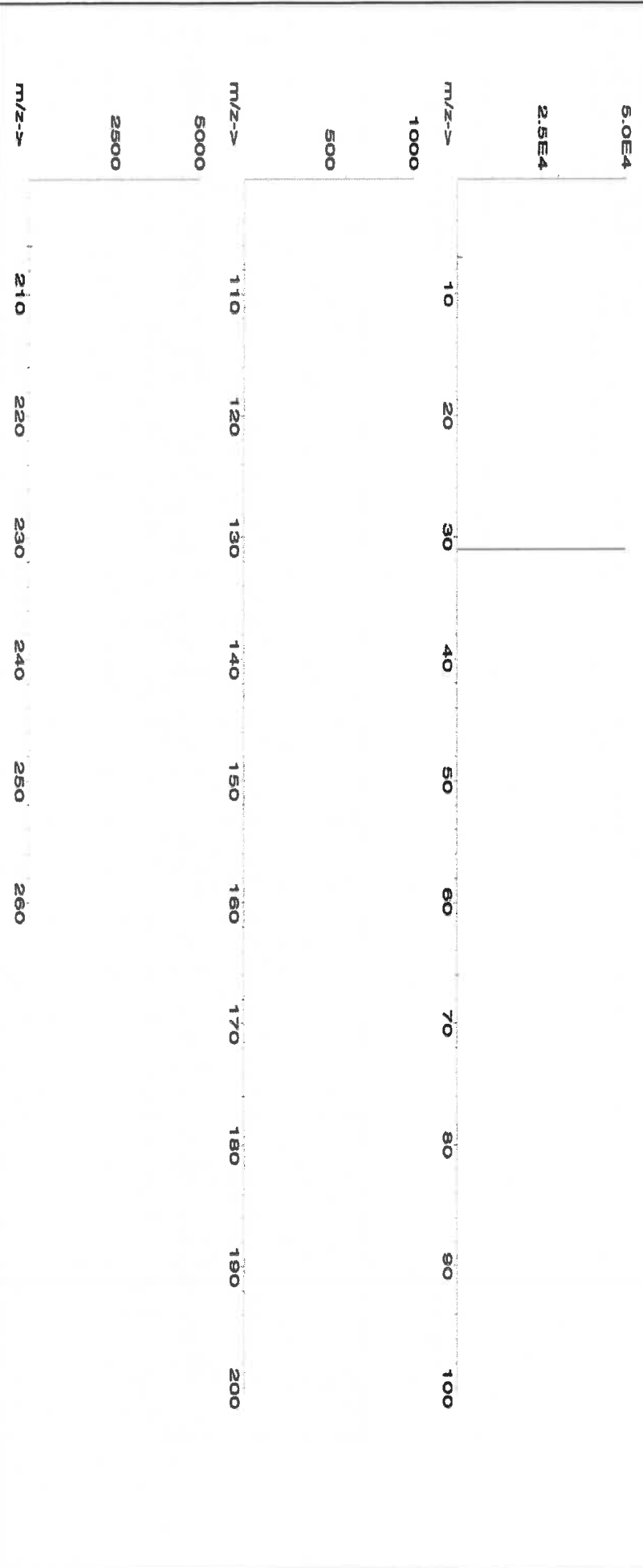
|                |                 |
|----------------|-----------------|
|                |                 |
| Formulated By: | Lawrence Barry  |
|                |                 |
| Reviewed By:   | Pedro L. Rentas |
| 091123         |                 |

**Compound**

| RM# | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|-----|------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|-----|------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Ammonium dihydrogen phosphate (P) IN008 PY062019A1 1000 99.999 0.10 27.5 7.2729 7.2730 1000.0 2.0 7722-76-1 5 mg/m3 xH-rat >2000mg/kg 3186

[1] Spectrum No.1 [ 12.074 sec]:58115.D# [Count] [Linear]





## Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

Trace Metals Verification by ICP-MS ( $\mu\text{g/mL}$ )

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Tc | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | T     | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sa | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

## Physical Characterization:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

MS961 R-1 6/11/24

Lot #

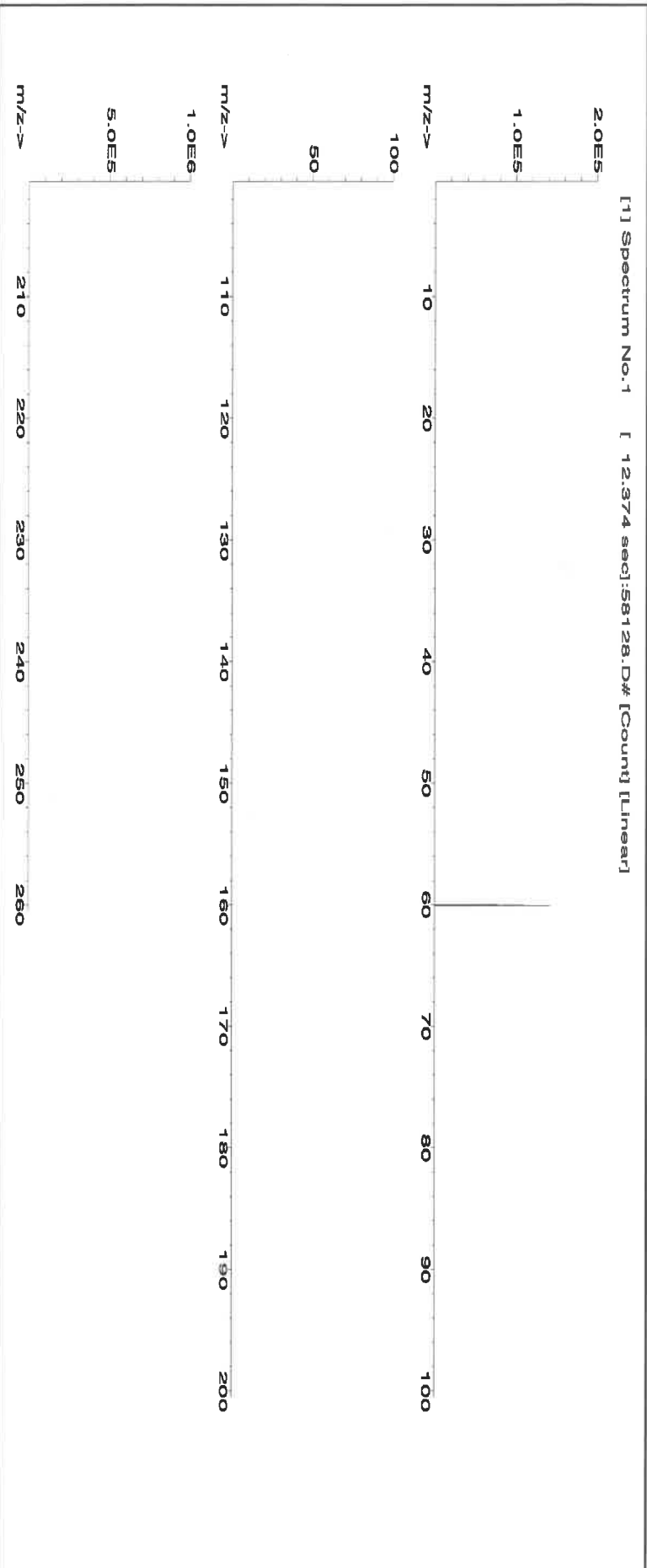
**Part Number:** 57028  
**Lot Number:** 041124  
**Description:** Nickel (NI)  
**Solvent:** 24002546 Nitric Acid  
**Expiration Date:** 041127  
**Recommended Storage:** Ambient (20 °C)  
**Nominal Concentration (µg/mL):** 1000  
**NIST Test Number:** 6UTB  
**Weight shown below was diluted to (mL):** 249.85  
**5E-05 Balance Uncertainty**  
**0.002 Flask Uncertainty**  
**2% 5.0 (mL) Nitric Acid**

|                |                 |        |
|----------------|-----------------|--------|
| Formulated By: | Brian Geddes    | 041124 |
| Reviewed By:   | Pedro L. Rentas | 041124 |

**SDS Information**

| Compound | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | SRM |
|----------|------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|-----|
|----------|------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|-----|

1. Nickel(II) nitrate hexahydrate (NI) IN033 NIM052023A1 1000 99.999 0.10 20.2 1.2369 1.2369 1000.0 2.0 13478-00-7 1 mg/m3 or-rat 1620 mg/kg 3136







**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | T     | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Ba | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Bc | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
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- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
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**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.02 | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Bu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Ru | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Sr | <0.02 | S  | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | Ta | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 |    |       | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

**Certified by:**

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
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- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

# Certificate of Analysis

M5976, M5977

R: 02/22/24

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

## 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: Single Analyte Custom Grade Solution  
Catalog Number: CGMO1  
Lot Number: T2-MO720876  
Matrix: H2O  
tr. NH4OH  
Value / Analyte(s): 1 000 µg/mL ea:  
Molybdenum  
Starting Material: Ammonium Molybdate  
Starting Material Lot#: 2361  
Starting Material Purity: 99.9893%

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 998 ± 7 µg/mL  
Density: 1.000 g/mL (measured at 20 ± 4 °C)  
Assay Information:

Assay Method #1 998 ± 4 µg/mL  
ICP Assay NIST SRM 3134 Lot Number: 130418

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

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

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

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

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

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

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

$k$  = coverage factor = 2

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

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

$u_{lts}$  = long term stability standard uncertainty (storage)

$u_{ts}$  = transport stability standard uncertainty

### Characterization of CRM/RM by One Method

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

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

$X_a$  = mean of Assay Method A with

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

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

$k$  = coverage factor = 2

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

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

$u_{lts}$  = long term stability standard uncertainty (storage)

$u_{ts}$  = 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)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

|   |    |   |          |   |    |   |          |   |    |   |          |   |    |   |          |   |    |   |          |
|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| M | Ag | < | 0.000590 | M | Eu | < | 0.000300 | M | Na |   | 0.000879 | M | Se | < | 0.008000 | M | Zn |   | 0.000598 |
| M | Al |   | 0.000563 | M | Fe | < | 0.006500 | M | Nb | < | 0.029000 | i | Si | < |          | M | Zr | < | 0.001800 |
| M | As | < | 0.002100 | M | Ga | < | 0.000300 | i | Nd | < |          | M | Sm | < | 0.000300 |   |    |   |          |
| M | Au | < | 0.000300 | M | Gd | < | 0.000300 | M | Ni | < | 0.008000 | M | Sn | < | 0.008900 |   |    |   |          |
| M | B  | < | 0.003300 | M | Ge | < | 0.000300 | M | Os | < | 0.000590 | M | Sr |   | 0.000175 |   |    |   |          |
| M | Ba |   | 0.001689 | M | Hf | < | 0.001800 | i | P  | < |          | M | Ta | < | 0.004200 |   |    |   |          |
| M | Be | < | 0.000890 | M | Hg | < | 0.003300 | M | Pb | < | 0.000300 | M | Tb | < | 0.000300 |   |    |   |          |
| M | Bi | < | 0.000890 | M | Ho | < | 0.000300 | M | Pd | < | 0.001800 | M | Te | < | 0.021000 |   |    |   |          |
| O | Ca |   | 0.006334 | M | In | < | 0.032000 | M | Pr | < | 0.013000 | M | Th | < | 0.000300 |   |    |   |          |
| O | Cd | < | 0.026000 | M | Ir | < | 0.000300 | M | Pt | < | 0.000300 | O | Tl | < | 0.032000 |   |    |   |          |
| M | Ce | < | 0.008300 | M | K  |   | 0.130213 | M | Rb |   | 0.004575 | M | Tl |   | 0.001266 |   |    |   |          |
| M | Co |   | 0.000598 | M | La | < | 0.000300 | M | Re | < | 0.000300 | M | Tm | < | 0.000300 |   |    |   |          |
| M | Cr |   | 0.000527 | O | Li |   | 0.000059 | M | Rh | < | 0.000300 | M | U  | < | 0.005300 |   |    |   |          |
| M | Cs |   | 0.000527 | M | Lu | < | 0.000300 | M | Ru | < | 0.079000 | M | V  | < | 0.000890 |   |    |   |          |
| M | Cu |   | 0.002252 | M | Mg |   | 0.000563 | i | S  | < |          | M | W  |   | 0.087982 |   |    |   |          |
| M | Dy | < | 0.000300 | M | Mn | < | 0.005900 | M | Sb |   | 0.001513 | M | Y  | < | 0.000300 |   |    |   |          |
| M | Er | < | 0.000300 | s | Mo | < |          | M | Sc | < | 0.001200 | M | Yb | < | 0.000300 |   |    |   |          |

M - Checked by ICP-MS    O - Checked by ICP-OES    i - Spectral Interference  
n - Not Checked For    s - Solution Standard Element

#### 6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

#### 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)

**Atomic Weight; Valence; Coordination Number; Chemical Form in Solution** - 95.94 +6 6,7,8,9

[MoO4]-2(chemical form as received)

**Chemical Compatibility** -Mo is received in a NH4OH matrix giving the operator the option of using HCl or HF to stabilize acidic solutions. The [MoO4]-2 is soluble in concentrated HCl [MoOCl5]-2, dilute HF / HNO3 [MoOF5]-2 and basic media [MoO4]-2. Stable at ppm levels with some metals provided it is fluorinated. Do not mix with Alkaline or Rare Earths when HF is present. Stable with most inorganic anions provided it is in the [MoO4]-2 chemical form.

**Stability** - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the [MoOF5]-2 for months in 1% HNO3 / LDPE container. 1-10,000 ppm single element solutions as the [MoO4]-2 chemically stable for years in 1% NH4OH in a LDPE container.

**Mo Containing Samples (Preparation and Solution)** -Metal (Soluble in HF / HNO3 or hot dilute HCl); Oxide (soluble in HF or NH4OH) ; Organic Matrices (Dry ash at 450EC in Pt0 and dissolve oxide with HF or HCl ).

**Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):**

| Technique/Line     | Estimated D.L.       | Order | Interferences (underlined indicates severe) |
|--------------------|----------------------|-------|---|
| ICP-MS 95 amu      | 3 ppt                | n/a   | 40Ar39K16O,79Br16O,190Os2+,190Pt2+          |
| ICP-OES 202.030 nm | 0.008 / 0.0002 µg/mL | 1     | Os, Hf                                      |
| ICP-OES 203.844 nm | 0.012 / 0.002 µg/mL  | 1     |   |
| ICP-OES 204.598 nm | 0.012 / 0.001 µg/mL  | 1     | Ir, Ta                                      |

## 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: 800.569.6799; 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

July 17, 2022

- 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

- July 17, 2027

- 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:

Uyen Truong  
Supervisor, Product Documentation



### Certificate Approved By:

Michael Booth  
Director, Technical



### Certifying Officer:

Paul Gaines  
Chairman / Senior Technical Director



# Certificate of Analysis

MS978, MS979



Refine your results. Redefine your industry.

300 Technology Drive  
Christiansburg, VA 24073 USA  
inorganicventures.com

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

## 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: Single Analyte Custom Grade Solution

Catalog Number: CGT1

Lot Number: T2-T1719972

Matrix: 2% (v/v) HNO<sub>3</sub>

Value / Analyte(s): tr. HF

Starting Material: 1 000 µg/mL ea.

Starting Material: Titanium

Starting Material: Ti Metal

Starting Material Lot#: 2094

Starting Material Purity: 99.9975%

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 1002 ± 5 µg/mL

Density: 1.012 g/mL (measured at 20 ± 4 °C)

## Assay Method #1

1002 ± 4 µg/mL

ICP Assay NIST SRM 3162a Lot Number: 130925

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

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

$X_{CRM/RM} = (X_p) / (U_{char} \cdot k)$

$X_p$  = mean of Assay Method A with

$U_{char} \cdot k$  = the standard uncertainty of characterization Method A

$U_{char} = (U_{CRM/RM}^2 / (2 \cdot (U_{CRM/RM}^2)^2))^{1/2}$

$U_{CRM/RM} = 2(w) (U_p)$

$X_1$  = mean of Assay Method 1 with standard uncertainty  $U_{CRM/RM}$

$U_{CRM/RM} = (U_{CRM/RM}^2 / (2 \cdot (U_{CRM/RM}^2)^2))^{1/2}$

$U_{CRM/RM} = (U_{CRM/RM}^2 / (2 \cdot (U_{CRM/RM}^2)^2))^{1/2}$

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$U_{CRM/RM} = (U_{CRM/RM}^2 / (2 \cdot (U_{CRM/RM}^2)^2))^{1/2}$



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)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an UHPA-filtered Clean Room. An UHPA-filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

|      |   |          |      |   |          |      |   |          |      |   |          |      |   |          |
|------|---|----------|------|---|----------|------|---|----------|------|---|----------|------|---|----------|
| M Ag | < | 0.000536 | M Eu | < | 0.000268 | O Na | < | 0.032670 | M Se | < | 0.001204 | O Zn | < | 0.003267 |
| O Al | < | 0.000872 | O Fe | < | 0.003225 | O Nb | < | 0.043560 | O Si | < | 0.004735 | O Zr | < | 0.043560 |
| M As | < | 0.008586 | M Ga | < | 0.000268 | M Nd | < | 0.000268 | M Sm | < | 0.000268 |      |   |          |
| M Au | < | 0.004577 | M Gd | < | 0.000268 | O Ni | < | 0.010890 | M Sn | < | 0.000986 |      |   |          |
| O B  | < | 0.008929 | M Ge | < | 0.002146 | M Os | < | 0.000269 | O Sr | < | 0.000986 |      |   |          |
| M Ba | < | 0.002683 | M Hf | < | 0.002161 | O P  | < | 0.054450 | M Ta | < | 0.010560 |      |   |          |
| M Be | < | 0.005366 | M Hg | < | 0.003231 | M Pb | < | 0.001073 | M Tb | < | 0.000268 |      |   |          |
| M Bi | < | 0.001609 | M Ho | < | 0.000268 | M Pd | < | 0.000268 | M Th | < | 0.001341 |      |   |          |
| O Ca | < | 0.000676 | M In | < | 0.002683 | M Pr | < | 0.000268 | M Tl | < | 0.053663 |      |   |          |
| M Cd | < | 0.000268 | M Ir | < | 0.000269 | M Pt | < | 0.000536 | S Tl | < |          |      |   |          |
| M Co | < | 0.000268 | M K  | < | 0.001172 | M Rb | < | 0.000268 | M Ti | < | 0.000268 |      |   |          |
| M Cr | < | 0.000752 | O Li | < | 0.000268 | M Re | < | 0.000268 | M Tm | < | 0.000268 |      |   |          |
| M Cs | < | 0.000268 | M Lu | < | 0.000268 | M Rh | < | 0.000268 | M U  | < | 0.000268 |      |   |          |
| O Cu | < | 0.010890 | O Mg | < | 0.005445 | I S  | < | 0.006976 | M Y  | < | 0.002146 |      |   |          |
| M Dy | < | 0.000268 | O Mn | < | 0.003267 | M Sb | < | 0.004900 | M Yb | < | 0.000536 |      |   |          |
| M Er | < | 0.000268 | M Mo | < | 0.000774 | O Sc | < |          |      |   |          |      |   |          |

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

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)

**Atomic Weight; Valence; Coordination Number; Chemical Form in Solution** - 47.87 ± 4.6 Ti(F)<sub>6</sub>-2 media. Unstable at ppm levels with metals that would pull F- away (i.e. Do not mix with Alkaline or Rare Earths or high levels of transition elements unless they are fluorinated). Stable with most inorganic anions with a tendency to hydrolyze forming the hydrated oxide in all dilute acids except HF.

**Stability** - 2-100 ppb levels stable (Alone or mixed with all other metals) as the Ti(F)<sub>6</sub>-2 for months in 1% HNO<sub>3</sub> / LDPE container. 1-10,000 ppm single element solutions as the Ti(F)<sub>6</sub>-2 chemically stable for years in 2-5% HNO<sub>3</sub> / trace HF in an LDPE container.

**TI Containing Samples (Preparation and Solution)** - Metal (Soluble in H<sub>2</sub>O / HF caution - powder reacts violently). Oxide - low temperature history anatase or rutile (Dissolved by heating in 1:1:1 H<sub>2</sub>O / HF / H<sub>2</sub>SO<sub>4</sub>); K<sub>2</sub>SiO<sub>7</sub> - no KF if silica not present); Organic Matrices (Dry ash at 450EC in P10 and dissolve by heating with 1:1:1 H<sub>2</sub>O / HF / H<sub>2</sub>SO<sub>4</sub> or fuse ash with pyrosulfate if oxide is as plastic pigment and likely in brookite crystaline form).

**Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):**

| Technique/Line     | Estimated D.L.         | Order | Interferences (underlined indicates severe) |
|--------------------|------------------------|-------|---|
| ICP-MS 48 amu      | 14 ppt                 | N/A   | 32S16O, 32S14N,                             |
| ICP-OES 323.452 nm | 0.0054 / 0.00092 µg/mL | 1     | 14N17N2, 36Ar12C,                           |
| ICP-OES 334.941 nm | 0.0038 / 0.00028 µg/mL | 1     | 48Ca, 196X=2                                |
| ICP-OES 336.121 nm | 0.0053 / 0.00034 µg/mL | 1     | W, Mo, Co                                   |
|                    |                        |       | Nb, Ta, Cr, U                               |
|                    |                        |       | Ce, Ar, Ni                                  |
|                    |                        |       | Ru  |
|                    |                        |       | (where X = Zr, Mo,                          |

## HAZARDOUS INFORMATION

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

## 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.

## 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: 800.868.6786; 540.565.3030; Fax: 540.565.3030; Email: info@inorganicventures.com

11.0

CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

June 17, 2022

- 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

- June 17, 2027

- 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 Approved By:

Thomas Kozlikowski  
Manager, Quality Control

*TD9784*

Certifying Officer:

Paul Gaines  
Chairman / Senior Technical Director

*Paul Gaines*



MS981

R:6/11/24



CERTIFIED WEIGHT REPORT:

Part Number:  
Lot Number:  
Description:

57092  
060724  
Uranium (U)

Expiration Date:  
Recommended Storage:  
Nominal Concentration (µg/mL):  
NIST Test Number:

060727  
Ambient (20 °C)  
1000  
6UTB

Volume shown below was diluted to (mL): 2000.07

5E-05 Balance Uncertainty  
0.100 Flask Uncertainty

Lot # Solvent:  
24002546 Nitric Acid

2.0% Nitric Acid  
40.0 (mL)

|                          |                   |
|--------------------------|-------------------|
| <i>Giovanni Esposito</i> |                   |
| Formulated By:           | Giovanni Esposito |
| <i>Pedro L. Rentas</i>   |                   |
| Reviewed By:             | Pedro L. Rentas   |

SDS Information

| Compound | Part Number | Lot Number | Dilution Factor | Initial Vol. (mL) | Uncertainty Pipette (mL) | Nominal Conc. (µg/mL) | Initial Conc. (µg/mL) | Final Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | (Solvent Safety Info. On Attached pg.) | CAS# | LD50 | NIST SRM |
|----------|-------------|------------|-----------------|-------------------|--------------------------|-----------------------|-----------------------|---------------------|----------------------------------|--|------|------|----------|
|----------|-------------|------------|-----------------|-------------------|--------------------------|-----------------------|-----------------------|---------------------|----------------------------------|--|------|------|----------|

1. Uranyl nitrate hexahydrate (U) 58192 041524 0.1000 200.0 0.084 1000 10001.5 1000.0 2.2 13620-83-7 0.05 mg/m3 orl-rat 1040 mg/kg 3164

[1] Spectrum No.1 [ 23.264 sec]:57092.D# [Count] [Linear]





Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

| Trace Metals Verification by ICP-MS ( $\mu\text{g/mL}$ ) |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|--|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al   | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb   | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As   | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.02 | Os | <0.01 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba   | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be   | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.02 | Hg | <0.2  | P  | <0.2  | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi   | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.02 | Sc | <0.2  | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

Physical Characterization:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

7236 673 3.67



45983 R: 6/11/24

CERTIFIED WEIGHT REPORT:

Part Number:  
Lot Number:  
Description:

57040  
071423  
Zirconium (Zr)

Expiration Date:  
Recommended Storage:  
Nominal Concentration (µg/mL):  
NIST Test Number:

071426  
Ambient (20 °C)  
1000  
6UTB  
5E-05 Balance Uncertainty  
0.058 Flask Uncertainty

Volume shown below was diluted to (mL): 2000.02

Lot # Solvent:  
21110221 Nitric Acid

2.0% Nitric Acid  
40.0 (mL)

|                |                 |
|----------------|-----------------|
|                |                 |
| Formulated By: | Benson Chan     |
|                |                 |
| Reviewed By:   | Pedro L. Rentas |

Expanded  
Uncertainty  
+/- (µg/mL)

Final  
Conc. (µg/mL)

Nominal  
Conc. (µg/mL)

Initial  
Vol. (mL)

Dilution  
Factor

Part  
Number

Lot  
Number

Compound

|                                       |       |        |        |       |       |      |         |        |     |            |    |    |    |
|---------------------------------------|-------|--------|--------|-------|-------|------|---------|--------|-----|------------|----|----|----|
| 1. Zirconyl chloride octahydrate (Zr) | 58140 | 070621 | 0.1000 | 200.0 | 0.084 | 1000 | 10000.3 | 1000.0 | 2.2 | 13520-92-8 | NA | NA | NA |
|---------------------------------------|-------|--------|--------|-------|-------|------|---------|--------|-----|------------|----|----|----|

[1] Spectrum No.1 [ 41.153 sec]:57040.D# [Count] [Linear]

1.OE6

5.OE5

m/z-->

1.OE8

5.OE7

m/z-->

1.OE8

5.OE7

m/z-->



Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

Trace Metals Verification by ICP-MS ( $\mu\text{g/mL}$ )

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.02 | Os | <0.01 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.2  | Fe | <0.02 | Hg | <0.2  | P  | <0.2  | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.02 | Sc | <0.2  | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |
|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    | T     |

(T) = Target analyte

Physical Characterization:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

*[Signature]*

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified ( $\pm$ ) 0.5% of the stated value, unless otherwise stated.
- \* All standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



# Certificate of Analysis

300 Technology Drive  
Christiansburg, VA 24073 USA  
inorganicventures.com

*R: 2/22/2024*  
*M5999*

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

## 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: CLPP-SPK-1  
Lot Number: T2-MEB721963  
Matrix: 7% (v/v) HNO<sub>3</sub>  
Value / Analyte(s):  
2 000 µg/mL ea: Aluminum, Barium,  
1 000 µg/mL ea: Iron,  
500 µg/mL ea: Manganese, Nickel,  
Vanadium, Zinc,  
Cobalt,  
250 µg/mL ea: Copper,  
200 µg/mL ea: Chromium,  
50 µg/mL ea: Beryllium, Silver

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE       | CERTIFIED VALUE    | ANALYTE       | CERTIFIED VALUE    |
|---------------|--------------------|---------------|--------------------|
| Aluminum, Al  | 2 000 ± 7 µg/mL    | Barium, Ba    | 2 000 ± 9 µg/mL    |
| Beryllium, Be | 50.00 ± 0.26 µg/mL | Chromium, Cr  | 200.0 ± 1.1 µg/mL  |
| Cobalt, Co    | 500.0 ± 2.4 µg/mL  | Copper, Cu    | 250.0 ± 1.0 µg/mL  |
| Iron, Fe      | 1 000 ± 4 µg/mL    | Manganese, Mn | 500.0 ± 2.0 µg/mL  |
| Nickel, Ni    | 500.0 ± 2.2 µg/mL  | Silver, Ag    | 50.00 ± 0.22 µg/mL |
| Vanadium, V   | 500.0 ± 2.2 µg/mL  | Zinc, Zn      | 500.0 ± 2.2 µg/mL  |

Density: 1.070 g/mL (measured at 20 ± 4 °C)

Assay Information:



| ANALYTE | METHOD      | NIST SRM# | SRM LOT#     |
|---------|-------------|-----------|--------------|
| Ag      | ICP Assay   | 3151      | 160729       |
| Ag      | Volhard     | 999c      | 999c         |
| Ag      | Calculated  |           | See Sec. 4.2 |
| Al      | ICP Assay   | 3101a     | 140903       |
| Al      | EDTA        | 928       | 928          |
| Ba      | ICP Assay   | 3104a     | 140909       |
| Ba      | Gravimetric |           | See Sec. 4.2 |
| Be      | ICP Assay   | 3105a     | 090514       |
| Be      | Calculated  |           | See Sec. 4.2 |
| Co      | ICP Assay   | 3113      | 190630       |
| Co      | EDTA        | 928       | 928          |
| Cr      | ICP Assay   | 3112a     | 170630       |
| Cu      | ICP Assay   | 3114      | 121207       |
| Cu      | EDTA        | 928       | 928          |
| Fe      | ICP Assay   | 3126a     | 140812       |
| Fe      | EDTA        | 928       | 928          |
| Mn      | ICP Assay   | 3132      | 050429       |
| Mn      | EDTA        | 928       | 928          |
| Ni      | ICP Assay   | 3136      | 120619       |
| Ni      | EDTA        | 928       | 928          |
| V       | IC 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:

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

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

$k$  = 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

$u_{\text{tts}}$  = 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

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

$k$  = coverage factor = 2

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

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

$u_{\text{tts}}$  = 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**

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

### **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)

**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; [inorganicventures.com](http://inorganicventures.com); [info@inorganicventures.com](mailto:info@inorganicventures.com)

## 11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

### 11.1 Certification Issue Date

July 27, 2022

- 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

- July 27, 2027

- 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 Approved By:

Thomas Kozikowski  
Manager, Quality Control



### Certifying Officer:

Paul Gaines  
Chairman / Senior Technical Director





**Certified Reference Material CRM**  
R: 01/03/24 M6033



ANAB ISO 17034 Accredited  
AR-1539 Certificate Number  
https://AbsoluteStandards.com

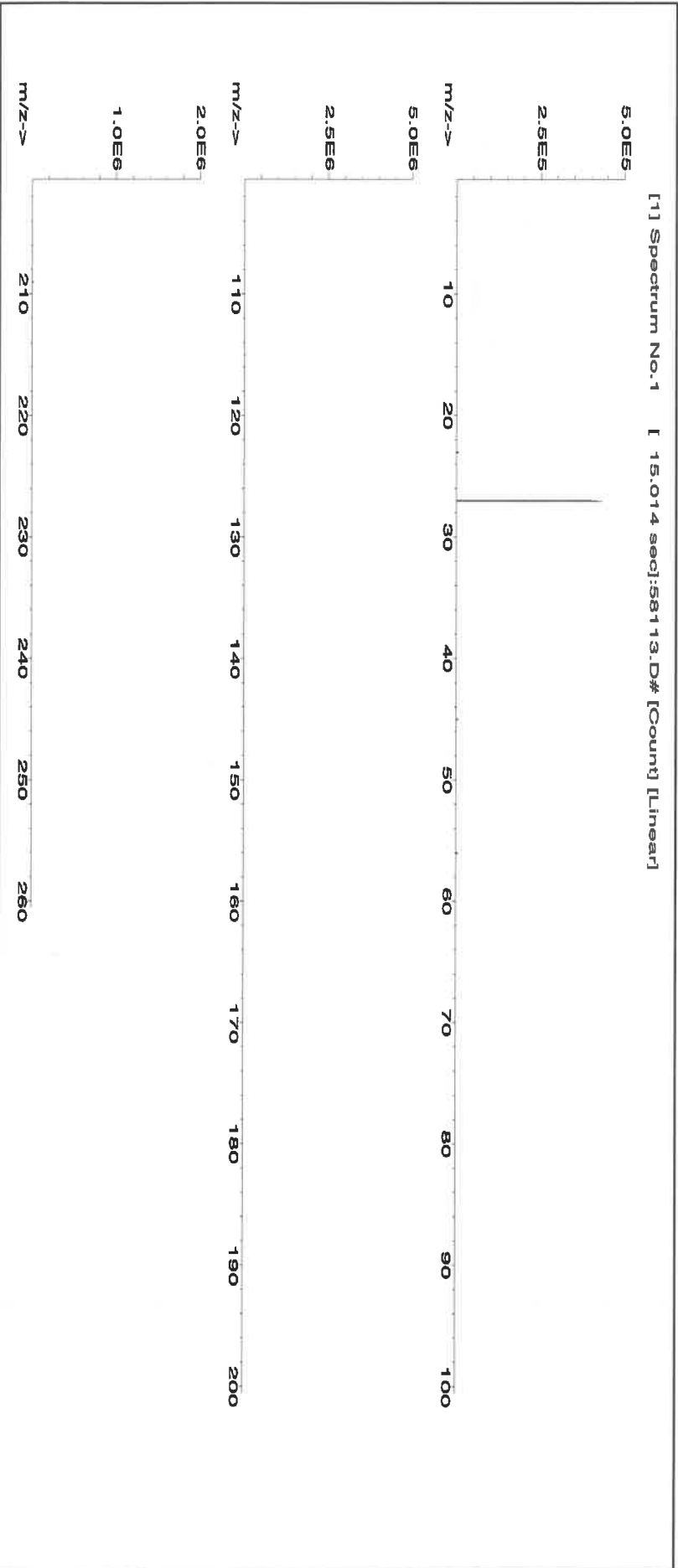
**CERTIFIED WEIGHT REPORT:**

**Part Number:** 58113  
**Lot Number:** 011623  
**Description:** Aluminum (Al)  
**Expiration Date:** 011626  
**Recommended Storage:** Ambient (20 °C)  
**Nominal Concentration (µg/mL):** 10000  
**NIST Test Number:** 6LUTB  
**Weight shown below was diluted to (mL):** 2000.02  
**Solvent:** 20510011 Nitric Acid  
**Lot #**  
**2%** 40.0 (mL) Nitric Acid  
**5E-05** Balance Uncertainty  
**0.058** Flask Uncertainty

|                          |                        |
|--------------------------|------------------------|
| <i>Giovanni Esposito</i> |                        |
| Formulated By:           | Giovanni Esposito      |
| Reviewed By:             | <i>Pedro L. Rentas</i> |
|                          | Pedro L. Rentas        |
|                          | 011623                 |

| Compound | RM# | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|-----|------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|----------|-----|------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Aluminum nitrate nonahydrate (Al) IN022 ALUM12021A1 10000 99.999 0.10 7.30 273.9779 274.0078 10001.1 20.0 7784-27-2 2 mg/m3 or rat 3671 mg/kg 3101a



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

 **avantor™**



Material No.: 9530–33  
Batch No.: 24D1562005  
Manufactured Date: 2024–03–18  
Retest Date: 2029–03–17  
Revision No.: 0

Received! — 08/01/2024  
pater  
m6039  
m6040

## Certificate of Analysis

| Test                                      | Specification | Result      |
|---|---------------|-------------|
| ACS – Assay (as HCl) (by acid–base titrn) | 36.5 – 38.0 % | 37.6 %      |
| ACS – Color (APHA)                        | ≤ 10          | 5           |
| ACS – Residue after Ignition              | ≤ 3 ppm       | < 1 ppm     |
| ACS – Specific Gravity at 60°/60°F        | 1.185 – 1.192 | 1.192       |
| 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    | < 5.0 ppb   |
| Arsenic and Antimony (as As)              | ≤ 5.0 ppb     | < 3.0 ppb   |
| Trace Impurities – Barium (Ba)            | ≤ 1.0 ppb     | < 1.0 ppb   |
| Trace Impurities – Beryllium (Be)         | ≤ 1.0 ppb     | < 1.0 ppb   |
| Trace Impurities – Bismuth (Bi)           | ≤ 10.0 ppb    | < 10.0 ppb  |
| Trace Impurities – Boron (B)              | ≤ 20.0 ppb    | 2.2 ppb     |
| Trace Impurities – Cadmium (Cd)           | ≤ 1.0 ppb     | < 1.0 ppb   |
| Trace Impurities – Calcium (Ca)           | ≤ 50.0 ppb    | 31.0 ppb    |
| Trace Impurities – Chromium (Cr)          | ≤ 1.0 ppb     | 0.5 ppb     |
| Trace Impurities – Cobalt (Co)            | ≤ 1.0 ppb     | 0.2 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     | < 0.2 ppb   |
| Heavy Metals (as Pb)                      | ≤ 100 ppb     | < 50 ppb    |
| Trace Impurities – Iron (Fe)              | ≤ 15 ppb      | 3 ppb       |

>>> Continued on page 2 >>>

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

 **avantor™**



Material No.: 9530-33  
Batch No.: 24D1562005

| Test   | Specification | Result     |
|--|---------------|------------|
| Trace Impurities – Lead (Pb)                           | ≤ 1.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Lithium (Li)                        | ≤ 1.0 ppb     | < 0.1 ppb  |
| Trace Impurities – Magnesium (Mg)                      | ≤ 10.0 ppb    | 2.2 ppb    |
| Trace Impurities – Manganese (Mn)                      | ≤ 1.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Mercury (Hg)                        | ≤ 0.5 ppb     | < 0.1 ppb  |
| Trace Impurities – Molybdenum (Mo)                     | ≤ 10.0 ppb    | < 5.0 ppb  |
| Trace Impurities – Nickel (Ni)                         | ≤ 4.0 ppb     | 0.2 ppb    |
| Trace Impurities – Niobium (Nb)                        | ≤ 1.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Potassium (K)                       | ≤ 9.0 ppb     | < 1.0 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     | < 0.3 ppb  |
| Trace Impurities – Sodium (Na)                         | ≤ 100.0 ppb   | 2.0 ppb    |
| Trace Impurities – Strontium (Sr)                      | ≤ 1.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Tantalum (Ta)                       | ≤ 1.0 ppb     | < 0.9 ppb  |
| Trace Impurities – Thallium (Tl)                       | ≤ 5.0 ppb     | < 2.0 ppb  |
| Trace Impurities – Tin (Sn)                            | ≤ 5.0 ppb     | < 0.4 ppb  |
| Trace Impurities – Titanium (Ti)                       | ≤ 1.0 ppb     | 0.2 ppb    |
| Trace Impurities – Vanadium (V)                        | ≤ 1.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Zinc (Zn)                           | ≤ 5.0 ppb     | < 0.2 ppb  |
| Trace Impurities – Zirconium (Zr)                      | ≤ 1.0 ppb     | < 0.1 ppb  |

>>> Continued on page 3 >>>

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

 **avantor™**



Material No.: 9530-33  
Batch No.: 24D1562005

| 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



Jamie Croak  
Director Quality Operations, Bioscience Production

*18/19/24, M6055*

300 Technology Drive  
Christiansburg, VA 24073 USA  
inorganicventures.com

P: 800-669-6799/540-585-3030

F: 540-585-3012

[info@inorganicventures.com](mailto:info@inorganicventures.com)

## 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: IV-STOCK-12  
Lot Number: U2-MEB734294  
Matrix: 5% (v/v) HNO<sub>3</sub>  
Value / Analyte(s): 10 µg/mL ea:  
Barium, Beryllium,  
Bismuth, Cerium,  
Cobalt, Indium,  
Lithium, Nickel,  
Lead, Uranium

## 3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE     | CERTIFIED VALUE    | ANALYTE       | CERTIFIED VALUE    |
|-------------|--------------------|---------------|--------------------|
| Barium, Ba  | 10.01 ± 0.04 µg/mL | Beryllium, Be | 10.01 ± 0.05 µg/mL |
| Bismuth, Bi | 10.01 ± 0.06 µg/mL | Cerium, Ce    | 10.01 ± 0.04 µg/mL |
| Cobalt, Co  | 10.01 ± 0.05 µg/mL | Indium, In    | 10.01 ± 0.04 µg/mL |
| Lead, Pb    | 10.00 ± 0.04 µg/mL | Lithium, Li   | 10.01 ± 0.04 µg/mL |
| Nickel, Ni  | 10.01 ± 0.04 µg/mL | Uranium, U    | 10.01 ± 0.05 µg/mL |

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

Assay Information:



| ANALYTE | METHOD      | NIST SRM#         | SRM LOT#     |
|---------|-------------|-------------------|--------------|
| Ba      | ICP Assay   | 3104a             | 140909       |
| Ba      | Calculated  |                   | See Sec. 4.2 |
| Ba      | Gravimetric |                   | See Sec. 4.2 |
| Be      | ICP Assay   | 3105a             | 090514       |
| Be      | Calculated  |                   | See Sec. 4.2 |
| Bi      | ICP Assay   | 3106              | 180815       |
| Ce      | ICP Assay   | 3110              | 160830       |
| Ce      | EDTA        | 928               | 928          |
| Ce      | Calculated  |                   | See Sec. 4.2 |
| Co      | ICP Assay   | 3113              | 190630       |
| Co      | EDTA        | 928               | 928          |
| Co      | Calculated  |                   | See Sec. 4.2 |
| In      | ICP Assay   | 3124a             | 110516       |
| In      | EDTA        | 928               | 928          |
| In      | Calculated  |                   | See Sec. 4.2 |
| Li      | ICP Assay   | 3129a             | 100714       |
| Li      | Calculated  |                   | See Sec. 4.2 |
| Li      | Gravimetric |                   | See Sec. 4.2 |
| Ni      | ICP Assay   | 3136              | 120619       |
| Ni      | EDTA        | 928               | 928          |
| Ni      | Calculated  |                   | See Sec. 4.2 |
| Pb      | ICP Assay   | 3128              | 101026       |
| Pb      | EDTA        | 928               | 928          |
| Pb      | Calculated  |                   | See Sec. 4.2 |
| U       | ICP Assay   | traceable to 3164 | R2-U689597   |
| U       | Calculated  |                   | See Sec. 4.2 |

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:

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

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

$k$  = 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

$u_{\text{ts}}$  = 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

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

$k$  = coverage factor = 2

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

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

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

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

#### Certified Abundance:

##### IV's Certified Abundance

| Isotope      | Atom %      |
|--------------|-------------|
| Uranium 238U | 99.8 ± 0.1  |
| Uranium 235U | 0.19 ± 0.05 |

#### 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)

### **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; inorganicventures.com; info@inorganicventures.com

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

**11.1 Certification Issue Date**

June 21, 2023

- 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**

- June 21, 2028

- 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 Approved By:**

Thomas Kozikowski  
Manager, Quality Control



**Certifying Officer:**

Paul Gaines  
Chairman / Senior Technical Director



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

avantor™



R → 16/13/24  
Met dig

M 6121

Material No.: 9530-33  
Batch No.: 0000275677  
Manufactured Date: 2020/12/16  
Retest Date: 2025/12/15  
Revision No: 1

## Certificate of Analysis

| Test                                      | Specification | Result  |
|---|---------------|---------|
| ACS - Assay (as HCl) (by acid-base titrn) | 36.5 - 38.0 % | 37.6    |
| ACS - Color (APHA)                        | <= 10         | 5       |
| ACS - Residue after Ignition              | <= 3 ppm      | 1       |
| ACS - Specific Gravity at 60°/60°F        | 1.185 - 1.192 | 1.190   |
| ACS - Bromide (Br)                        | <= 0.005 %    | < 0.005 |
| ACS - Extractable Organic Substances      | <= 5 ppm      | 1       |
| ACS - Free Chlorine (as Cl <sub>2</sub> ) | <= 0.5 ppm    | < 0.5   |
| Phosphate (PO <sub>4</sub> )              | <= 0.05 ppm   | < 0.03  |
| Sulfate (SO <sub>4</sub> )                | <= 0.5 ppm    | < 0.3   |
| Sulfite (SO <sub>3</sub> )                | <= 0.8 ppm    | 0.3     |
| Ammonium (NH <sub>4</sub> )               | <= 3 ppm      | < 1     |
| Trace Impurities - Arsenic (As)           | <= 0.010 ppm  | < 0.003 |
| Trace Impurities - Aluminum (Al)          | <= 10.0 ppb   | < 0.2   |
| Arsenic and Antimony (as As)              | <= 5 ppb      | < 3     |
| Trace Impurities - Barium (Ba)            | <= 1.0 ppb    | < 0.2   |
| Trace Impurities - Beryllium (Be)         | <= 1.0 ppb    | < 0.2   |
| Trace Impurities - Bismuth (Bi)           | <= 10.0 ppb   | < 1.0   |
| Trace Impurities - Boron (B)              | <= 20.0 ppb   | < 5.0   |
| Trace Impurities - Cadmium (Cd)           | <= 1.0 ppb    | < 0.3   |
| Trace Impurities - Calcium (Ca)           | <= 50.0 ppb   | 29.7    |
| Trace Impurities - Chromium (Cr)          | <= 1.0 ppb    | < 0.4   |
| Trace Impurities - Cobalt (Co)            | <= 1.0 ppb    | < 0.3   |
| Trace Impurities - Copper (Cu)            | <= 1.0 ppb    | < 0.1   |
| Trace Impurities - Gallium (Ga)           | <= 1.0 ppb    | < 0.2   |

For questions on this Certificate of Analysis please contact Technical Services at 855.282.6867 or +1.610.386.1700

Avantor Performance Materials, LLC

100 Matsonford Rd, Suite 200, Radnor, PA 19087. U.S.A. Phone: 610.386.1700

| Test   | Specification | Result |
|--|---------------|--------|
| Trace Impurities – Germanium (Ge)                      | <= 3.0 ppb    | < 2.0  |
| Trace Impurities – Gold (Au)                           | <= 4.0 ppb    | < 0.2  |
| Heavy Metals (as Pb)                                   | <= 100 ppb    | < 50   |
| Trace Impurities – Iron (Fe)                           | <= 15.0 ppb   | < 1    |
| Trace Impurities – Lead (Pb)                           | <= 1.0 ppb    | < 0.5  |
| Trace Impurities – Lithium (Li)                        | <= 1.0 ppb    | 0.2    |
| Trace Impurities – Magnesium (Mg)                      | <= 10.0 ppb   | 0.4    |
| Trace Impurities – Manganese (Mn)                      | <= 1.0 ppb    | < 0.4  |
| Trace Impurities – Mercury (Hg)                        | <= 0.5 ppb    | 0.1    |
| Trace Impurities – Molybdenum (Mo)                     | <= 10.0 ppb   | < 5.0  |
| Trace Impurities – Nickel (Ni)                         | <= 4.0 ppb    | < 0.3  |
| Trace Impurities – Niobium (Nb)                        | <= 1.0 ppb    | < 0.2  |
| Trace Impurities – Potassium (K)                       | <= 9.0 ppb    | < 2.0  |
| Trace Impurities – Selenium (Se), For Information Only | ppb           | 1.0    |
| Trace Impurities – Silicon (Si)                        | <= 100.0 ppb  | < 10.0 |
| Trace Impurities – Silver (Ag)                         | <= 1.0 ppb    | < 0.3  |
| Trace Impurities – Sodium (Na)                         | <= 100.0 ppb  | < 5.0  |
| Trace Impurities – Strontium (Sr)                      | <= 1.0 ppb    | < 0.2  |
| Trace Impurities – Tantalum (Ta)                       | <= 1.0 ppb    | < 0.9  |
| Trace Impurities – Thallium (Tl)                       | <= 5.0 ppb    | < 2.0  |
| Trace Impurities – Tin (Sn)                            | <= 5.0 ppb    | < 0.8  |
| Trace Impurities – Titanium (Ti)                       | <= 1.0 ppb    | 0.2    |
| Trace Impurities – Vanadium (V)                        | <= 1.0 ppb    | < 0.2  |
| Trace Impurities – Zinc (Zn)                           | <= 5.0 ppb    | 0.3    |
| Trace Impurities – Zirconium (Zr)                      | <= 1.0 ppb    | < 0.1  |

For Laboratory, Research or Manufacturing Use  
Product Information (not specifications):  
Appearance (clear, fuming liquid)  
Meets ACS Specifications

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

  
Jamie Ethier  
Vice President Global Quality

For questions on this Certificate of Analysis please contact Technical Services at 855.282.6867 or +1.610.386.1700

Avantor Performance Materials, LLC  
100 Matsonford Rd, Suite 200, Radnor, PA 19087. U.S.A. Phone: 610.386.1700

Nitric Acid 69%  
CMOS



R → 11/12/24

M6126

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

 **avantor**<sup>TM</sup>



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



**CERTIFIED WEIGHT REPORT:**

**Part Number:** 58111  
**Lot Number:** 122223  
**Description:** Sodium (Na)

**Solvent:** 24002546 Nitric Acid

**Lot #**

**Expiration Date:** 122226

**Recommended Storage:** Ambient (20 °C)

**Nominal Concentration (µg/mL):** 10000

**NIST Test Number:** 6UTB

**Weight shown below was diluted to (mL):** 3000.4 0.06 Flask Uncertainty

|                      |                 |
|----------------------|-----------------|
| <i>Aleah O Brady</i> |                 |
| Formulated By:       | Aleah O Brady   |
| Reviewed By:         | Pedro L. Rentas |
|                      | 122223          |

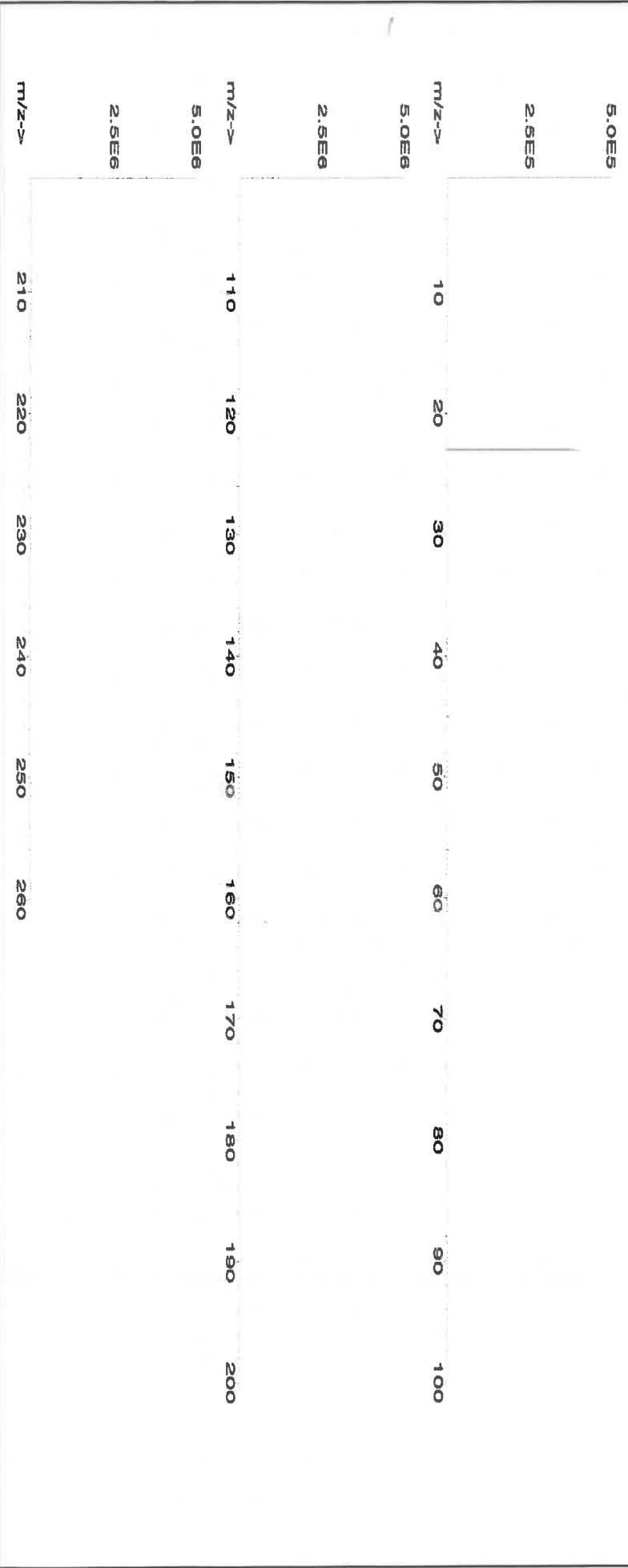
**Expanded**

**SDS Information**

| Compound | Lot | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|-----|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|----------|-----|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Sodium nitrate (Na) IN036 NAV01201511 10000 99.999 0.10 26.9 111.5406 111.5479 10000.7 20.0 7631-99-4 5 mg/m3 or-trat 3430 mg/kg 3152a

[1] Spectrum No.1 [ 8.935 sec]:58111.D# [Count] [Linear]







**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.02 | Tm | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Ti | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

**Certified by:**

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



Refine your results. Redefine your industry.

300 Technology Drive  
Christiansburg, VA 24073 USA  
inorganicventures.com

A: 4/11/22  
**Certificate of Analysis**  
M5738 M5739 M5740 M5741 M5742  
M5743

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

### 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: 6020ISS  
Lot Number: S2-MEB709511  
Matrix: 7% (v/v) HNO<sub>3</sub>  
Value / Analyte(s): 10 µg/mL ea:  
Bismuth, Holmium,  
Indium, 6-Lithium,  
Rhodium, Scandium,  
Terbium, Yttrium

### 3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE        | CERTIFIED VALUE    | ANALYTE      | CERTIFIED VALUE    |
|----------------|--------------------|--------------|--------------------|
| 6-Lithium, Li6 | 10.00 ± 0.03 µg/mL | Bismuth, Bi  | 10.00 ± 0.05 µg/mL |
| Holmium, Ho    | 10.00 ± 0.05 µg/mL | Indium, In   | 10.00 ± 0.04 µg/mL |
| Rhodium, Rh    | 10.00 ± 0.07 µg/mL | Scandium, Sc | 10.00 ± 0.04 µg/mL |
| Terbium, Tb    | 10.00 ± 0.04 µg/mL | Yttrium, Y   | 10.00 ± 0.04 µg/mL |

Density: 1.035 g/mL (measured at 20 ± 4 °C)

Assay Information:

| ANALYTE | METHOD      | NIST SRM# | SRM LOT#     |
|---------|-------------|-----------|--------------|
| Bi      | ICP Assay   | 3106      | 180815       |
| Bi      | Calculated  |           | See Sec. 4.2 |
| Ho      | ICP Assay   | 3123a     | 090408       |
| Ho      | EDTA        | 928       | 928          |
| In      | ICP Assay   | 3124a     | 110516       |
| In      | EDTA        | 928       | 928          |
| In      | Calculated  |           | See Sec. 4.2 |
| Li6     | Gravimetric |           | See Sec. 4.2 |
| Rh      | ICP Assay   | 3144      | 070619       |
| Sc      | ICP Assay   | 3148a     | 100701       |
| Sc      | EDTA        | 928       | 928          |
| Tb      | ICP Assay   | 3157a     | 100518       |
| Tb      | EDTA        | 928       | 928          |
| Tb      | Calculated  |           | See Sec. 4.2 |
| Y       | ICP Assay   | 3167a     | 120314       |
| Y       | EDTA        | 928       | 928          |
| Y       | Calculated  |           | See Sec. 4.2 |

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

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

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

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

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

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

$k$  = coverage factor = 2

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

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

$u_{lts}$  = long term stability standard uncertainty (storage)

$u_{ts}$  = transport stability standard uncertainty

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

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

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

$X_a$  = mean of Assay Method A with

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

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

$k$  = coverage factor = 2

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

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

$u_{lts}$  = long term stability standard uncertainty (storage)

$u_{ts}$  = transport stability standard uncertainty

#### Certified Abundance:

##### IV's Certified Abundance

| Isotope     | Atom %     |
|-------------|------------|
| Lithium Li6 | 95.6 ± 0.3 |
| Lithium Li7 | 4.4 ± 0.1  |

## 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**

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

**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)

**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; [inorganicventures.com](http://inorganicventures.com); [info@inorganicventures.com](mailto:info@inorganicventures.com)

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

### 11.1 Certification Issue Date

September 03, 2021

- 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

- **September 03, 2026**

- 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 Approved By:

Michael Booth  
Director, Quality Control



### Certifying Officer:

Paul Gaines  
Chairman / Senior Technical Director





**QATS LABORATORY INORGANIC REFERENCE MATERIAL  
 INTERFERENCE CHECK SAMPLE SET FOR ICP-MS (ICSA WITH ICSB)**

**NOTE:** These instructions are for advisory purposes only. If any apparent conflict exists between these instructions and the analytical protocol or your contract, disregard these instructions.

**APPLICATION:** For use with the CLP SFAM01.0 SOW and revisions.

**CAUTION:** Read instructions carefully before opening bottle(s) and proceeding with the analyses.

Contains Heavy Metals  
**HAZARDOUS MATERIAL**

Safety Data Sheets  
 Available Upon Request

**(A) SAMPLE DESCRIPTION**

Enclosed is a set of one (1) or more bottles of an Aqueous Reference Material, each composed of metals at various concentrations and prepared with nitrate salts and oxy-acids of the respective elements in a 5% nitric acid matrix. **For the reference material source in reporting ICSA and ICSAB mixture use "USEPA". For the reference material lot number for the ICSA use "ICSA-0803" and for the ICSAB mixture use "ICSA-0803+ICSB-0803".**

**CAUTION:** The bottle(s) should be protected from light during storage to ensure the stability of silver which is contained in the ICSB solution. The bottle(s) should be stored at room temperature. **Do not allow the solution(s) to freeze.**

**(B) BREAKAGE OR MISSING ITEMS**

Check the contents of the shipment carefully for any broken, leaking, or missing items. Check that the seal is intact on each bottle. Refer to the enclosed chain of custody record. Report any problems to the Contracting Officer, Ross Miller at [miller.ross@epa.gov](mailto:miller.ross@epa.gov). If directed by Ross Miller, return the chain of custody record with appropriate annotations and signatures to the address provided below.

QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY  
 APTIM Federal Services, LLC  
 2700 Chandler Avenue - Building C  
 Las Vegas, NV 89120

**(C) ANALYSIS OF SAMPLES**

This interference check sample set is to be used to verify elemental isobaric correction factors of inductively coupled plasma-mass spectrometers (ICP-MS). This reference material set consists of two (2) concentrated solutions. The ICSA solution contains several interferent elements and species; for a complete listing refer to the CLP SOW. The ICSB solution contains the analytes: Ag, As, Sb, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, Tl, Se, V, and Zn. This instruction sheet provides the nominal values for the ICP-MS ICS Part A and Part B target analytes when diluted as directed.

Using Class "A" glassware, preparation and analysis must be performed according to the following instructions:

**ICSA-0803, Interferents:** Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 1% v/v HNO<sub>3</sub>. Analyze this solution by ICP-MS.

**ICSB-0803, Analytes, mixed with ICSA-0803, Interferents:** Pipet 10 mL of the ICSA solution and 10 mL of the ICSB solution into a 100 mL volumetric flask and dilute to volume with 1% v/v HNO<sub>3</sub>. Analyze this ICSAB solution by ICP-MS.

**(D) "CERTIFIED VALUE" CONCENTRATIONS OF QATS ICP-MS ICS SOLUTION(S)**

The "Certified Value" concentrations of the elements, listed in Table 1 below, were derived from statistically pooled analysis results from the following sources, if available: QATS Laboratory, CLP laboratories, Quarterly Blind (QB)/Proficiency Testing (PT) events, CLP pre-award events, and external referee laboratories.

| Table 1. "CERTIFIED VALUES" FOR INTERFERENCE CHECK SAMPLE ICP-MS<br>ICSA-0803, AND ICSA-0803 MIXED WITH ICSB-0803 |      |                  |                          |                          |                             |                          |                          |
|---|------|------------------|--------------------------|--------------------------|-----------------------------|--------------------------|--------------------------|
| Element   | CRQL | Part A<br>(µg/L) | Lower<br>Limit<br>(µg/L) | Upper<br>Limit<br>(µg/L) | Part A<br>+Part B<br>(µg/L) | Lower<br>Limit<br>(µg/L) | Upper<br>Limit<br>(µg/L) |
| Al  | 20.0 | [100000]         |                          |                          | [100000]                    |                          |                          |
| Sb  | 2.0  | (1.5)            | -2.5                     | 5.5                      | (22.0)                      | 18.0                     | 26.0                     |
| As  | 1.0  | (0.1)            | -1.9                     | 2.1                      | 19.0                        | 16.2                     | 21.9                     |
| Ba  | 10.0 | (1.2)            | -18.8                    | 21.2                     | (22.0)                      | 2.0                      | 42.0                     |
| Be  | 1.0  | (0)              | -2.0                     | 2.0                      | 19.0                        | 16.2                     | 21.9                     |
| Cd  | 1.0  | (0.7)            | -1.3                     | 2.7                      | 20.0                        | 17.0                     | 23.0                     |
| Ca  | 500  | [100000]         |                          |                          | [100000]                    |                          |                          |
| C   |      | [200000]         |                          |                          | [200000]                    |                          |                          |
| Cl  |      | [1000000]        |                          |                          | [1000000]                   |                          |                          |
| Cr  | 2.0  | (21.0)           | 17.0                     | 25.0                     | 40.0                        | 34.0                     | 46.0                     |
| Co  | 1.0  | (1.0)            | -1.0                     | 3.0                      | 20.0                        | 17.0                     | 23.0                     |
| Cu  | 2.0  | (8.0)            | 4.0                      | 12.0                     | (25.0)                      | 21.0                     | 29.0                     |
| Fe  | 200  | [100000]         |                          |                          | [100000]                    |                          |                          |
| Pb  | 1.0  | (4.0)            | 2.0                      | 6.0                      | 25.0                        | 21.3                     | 28.8                     |
| Mg  | 500  | [100000]         |                          |                          | [100000]                    |                          |                          |
| Mn  | 1.0  | (7.0)            | 5.0                      | 9.0                      | 27.0                        | 23.0                     | 31.1                     |
| Mo  |      | [2000]           |                          |                          | [2000]                      |                          |                          |
| Ni  | 1.0  | (6.0)            | 4.0                      | 8.0                      | 24.0                        | 20.4                     | 27.6                     |
| P   |      | [100000]         |                          |                          | [100000]                    |                          |                          |
| K   | 500  | [100000]         |                          |                          | [100000]                    |                          |                          |
| Se  | 5.0  | (0.3)            | -9.7                     | 10.3                     | (19.0)                      | 9.0                      | 29.0                     |
| Ag  | 1.0  | (0)              | -2.0                     | 2.0                      | 18.0                        | 15.3                     | 20.7                     |
| Na  | 500  | [100000]         |                          |                          | [100000]                    |                          |                          |
| S   |      | [100000]         |                          |                          | [100000]                    |                          |                          |
| Tl  | 1.0  | (0)              | -2.0                     | 2.0                      | 21.0                        | 17.9                     | 24.2                     |
| Ti  |      | [2000]           |                          |                          | [2000]                      |                          |                          |
| V   | 5.0  | (0.5)            | -9.5                     | 10.5                     | (19.0)                      | 9.0                      | 29.0                     |
| Zn  | 5.0  | (11.0)           | 1.0                      | 21.0                     | (29.0)                      | 19.0                     | 39.0                     |

[ ] Indicates analytes that do not require ICP-MS determination in the ICS.

The acceptance ranges for all analytes in parentheses in the above table were determined using the listed certified value  $\pm 2$  times the associated CLP SOW CRQL. The acceptance ranges for all other analytes were determined using the certified value  $\pm 15$  percent of the listed certified value.



**QATS LABORATORY INORGANIC REFERENCE MATERIAL  
 INTERFERENCE CHECK SAMPLE SET FOR ICP-MS (ICSA WITH ICSB)**

**NOTE:** These instructions are for advisory purposes only. If any apparent conflict exists between these instructions and the analytical protocol or your contract, disregard these instructions.

**APPLICATION:** For use with the CLP SFAM01.0 SOW and revisions.

**CAUTION:** Read instructions carefully before opening bottle(s) and proceeding with the analyses.

Contains Heavy Metals  
**HAZARDOUS MATERIAL**

Safety Data Sheets  
 Available Upon Request

**(A) SAMPLE DESCRIPTION**

Enclosed is a set of one (1) or more bottles of an Aqueous Reference Material, each composed of metals at various concentrations and prepared with nitrate salts and oxy-acids of the respective elements in a 5% nitric acid matrix. **For the reference material source in reporting ICSA and ICSAB mixture use "USEPA". For the reference material lot number for the ICSA use "ICSA-0803" and for the ICSAB mixture use "ICSA-0803+ICSB-0803".**

**CAUTION:** The bottle(s) should be protected from light during storage to ensure the stability of silver which is contained in the ICSB solution. The bottle(s) should be stored at room temperature. **Do not allow the solution(s) to freeze.**

**(B) BREAKAGE OR MISSING ITEMS**

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QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY  
 APTIM Federal Services, LLC  
 2700 Chandler Avenue - Building C  
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**(C) ANALYSIS OF SAMPLES**

This interference check sample set is to be used to verify elemental isobaric correction factors of inductively coupled plasma-mass spectrometers (ICP-MS). This reference material set consists of two (2) concentrated solutions. The ICSA solution contains several interferent elements and species; for a complete listing refer to the CLP SOW. The ICSB solution contains the analytes: Ag, As, Sb, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, Tl, Se, V, and Zn. This instruction sheet provides the nominal values for the ICP-MS ICS Part A and Part B target analytes when diluted as directed.

Using Class "A" glassware, preparation and analysis must be performed according to the following instructions:



**ICSA-0803, Interferents:** Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 1% v/v HNO<sub>3</sub>. Analyze this solution by ICP-MS.

**ICSB-0803, Analytes, mixed with ICSA-0803, Interferents:** Pipet 10 mL of the ICSA solution and 10 mL of the ICSB solution into a 100 mL volumetric flask and dilute to volume with 1% v/v HNO<sub>3</sub>. Analyze this ICSAB solution by ICP-MS.

**(D) "CERTIFIED VALUE" CONCENTRATIONS OF QATS ICP-MS ICS SOLUTION(S)**

The "Certified Value" concentrations of the elements, listed in Table 1 below, were derived from statistically pooled analysis results from the following sources, if available: QATS Laboratory, CLP laboratories, Quarterly Blind (QB)/Proficiency Testing (PT) events, CLP pre-award events, and external referee laboratories.

| Table 1. "CERTIFIED VALUES" FOR INTERFERENCE CHECK SAMPLE ICP-MS<br>ICSA-0803, AND ICSA-0803 MIXED WITH ICSB-0803 |      |                  |                          |                          |                             |                          |                          |
|---|------|------------------|--------------------------|--------------------------|-----------------------------|--------------------------|--------------------------|
| Element   | CRQL | Part A<br>(µg/L) | Lower<br>Limit<br>(µg/L) | Upper<br>Limit<br>(µg/L) | Part A<br>+Part B<br>(µg/L) | Lower<br>Limit<br>(µg/L) | Upper<br>Limit<br>(µg/L) |
| Al  | 20.0 | [100000]         |                          |                          | [100000]                    |                          |                          |
| Sb  | 2.0  | (1.5)            | -2.5                     | 5.5                      | (22.0)                      | 18.0                     | 26.0                     |
| As  | 1.0  | (0.1)            | -1.9                     | 2.1                      | 19.0                        | 16.2                     | 21.9                     |
| Ba  | 10.0 | (1.2)            | -18.8                    | 21.2                     | (22.0)                      | 2.0                      | 42.0                     |
| Be  | 1.0  | (0)              | -2.0                     | 2.0                      | 19.0                        | 16.2                     | 21.9                     |
| Cd  | 1.0  | (0.7)            | -1.3                     | 2.7                      | 20.0                        | 17.0                     | 23.0                     |
| Ca  | 500  | [100000]         |                          |                          | [100000]                    |                          |                          |
| C   |      | [200000]         |                          |                          | [200000]                    |                          |                          |
| Cl  |      | [1000000]        |                          |                          | [1000000]                   |                          |                          |
| Cr  | 2.0  | (21.0)           | 17.0                     | 25.0                     | 40.0                        | 34.0                     | 46.0                     |
| Co  | 1.0  | (1.0)            | -1.0                     | 3.0                      | 20.0                        | 17.0                     | 23.0                     |
| Cu  | 2.0  | (8.0)            | 4.0                      | 12.0                     | (25.0)                      | 21.0                     | 29.0                     |
| Fe  | 200  | [100000]         |                          |                          | [100000]                    |                          |                          |
| Pb  | 1.0  | (4.0)            | 2.0                      | 6.0                      | 25.0                        | 21.3                     | 28.8                     |
| Mg  | 500  | [100000]         |                          |                          | [100000]                    |                          |                          |
| Mn  | 1.0  | (7.0)            | 5.0                      | 9.0                      | 27.0                        | 23.0                     | 31.1                     |
| Mo  |      | [2000]           |                          |                          | [2000]                      |                          |                          |
| Ni  | 1.0  | (6.0)            | 4.0                      | 8.0                      | 24.0                        | 20.4                     | 27.6                     |
| P   |      | [100000]         |                          |                          | [100000]                    |                          |                          |
| K   | 500  | [100000]         |                          |                          | [100000]                    |                          |                          |
| Se  | 5.0  | (0.3)            | -9.7                     | 10.3                     | (19.0)                      | 9.0                      | 29.0                     |
| Ag  | 1.0  | (0)              | -2.0                     | 2.0                      | 18.0                        | 15.3                     | 20.7                     |
| Na  | 500  | [100000]         |                          |                          | [100000]                    |                          |                          |
| S   |      | [100000]         |                          |                          | [100000]                    |                          |                          |
| Tl  | 1.0  | (0)              | -2.0                     | 2.0                      | 21.0                        | 17.9                     | 24.2                     |
| Ti  |      | [2000]           |                          |                          | [2000]                      |                          |                          |
| V   | 5.0  | (0.5)            | -9.5                     | 10.5                     | (19.0)                      | 9.0                      | 29.0                     |
| Zn  | 5.0  | (11.0)           | 1.0                      | 21.0                     | (29.0)                      | 19.0                     | 39.0                     |

[ ] Indicates analytes that do not require ICP-MS determination in the ICS.

The acceptance ranges for all analytes in parentheses in the above table were determined using the listed certified value  $\pm 2$  times the associated CLP SOW CRQL. The acceptance ranges for all other analytes were determined using the certified value  $\pm 15$  percent of the listed certified value.



**CERTIFIED WEIGHT REPORT:**

Part Number:  
Lot Number:  
Description:

57051  
120523  
**Antimony (Sb)**

Lot #  
Solvent:

24002546  
Nitric Acid

2.0%  
60.0  
Nitric Acid

(mL)

Formulated By: *Lawrence Barry*  
Lawrence Barry  
120523

Reviewed By: *Pedro L. Renteria*  
Pedro L. Renteria  
120523

Expiration Date:

120526

Recommended Storage:

Ambient (20 °C)

Nominal Concentration (µg/mL):

1000

NIST Test Number:

6U7B

Volume shown below was diluted to (mL):

3000.41

5E-05 Balance Uncertainty  
0.058 Flask Uncertainty

Expanded

Uncertainty

(Solvent Safety Info. On Attached Pg.)

SDS Information

CAS#

OSHA PEL (TWA)

LD50

NIST

Compound

Part Number

Lot Number

Dilution Factor

Initial Vol. (mL)

Uncertainty

Pipette (mL)

Nominal Conc. (µg/mL)

Initial Conc. (µg/mL)

Final Conc. (µg/mL)

Expanded Uncertainty +/- (µg/mL)

CAS#

OSHA PEL (TWA)

LD50

NIST

SRM

1. Antimony (Sb)

58151

100923

0.1000

300.0

0.084

1000

10001.4

1000.0

2.1

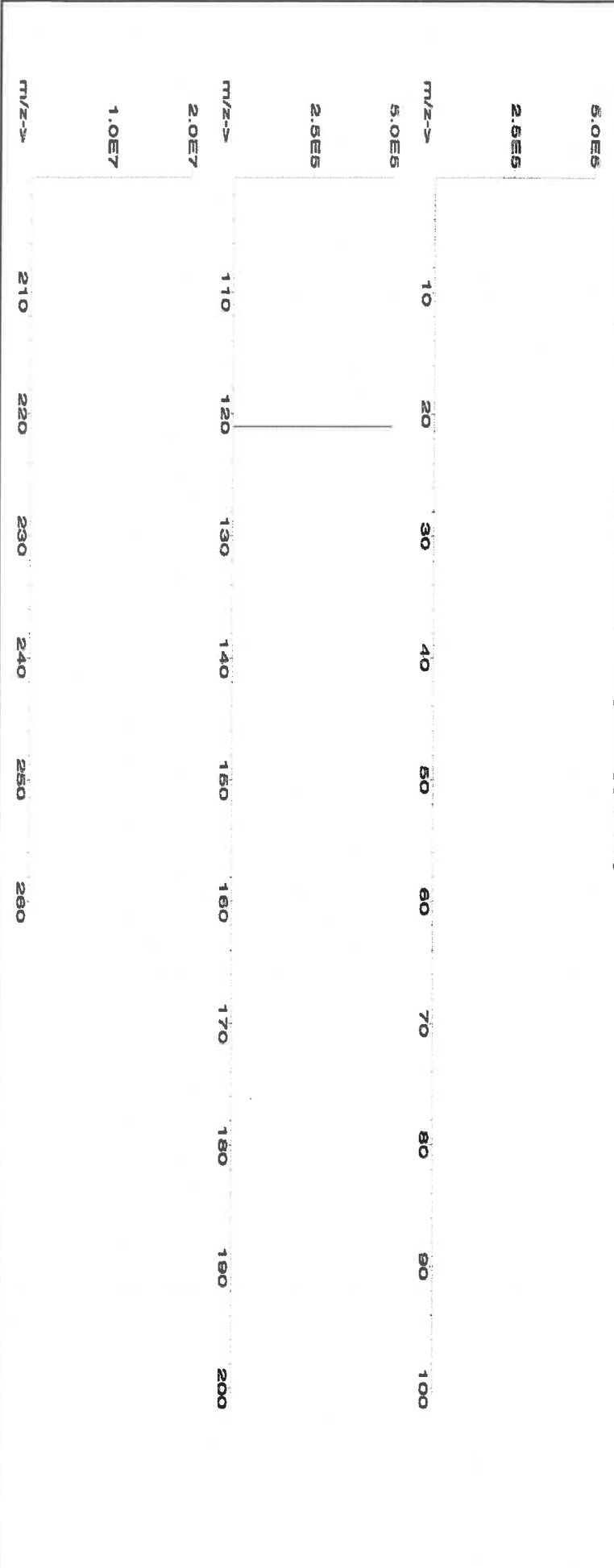
7440-36-0

0.5 mg/m3

or: rat 7000 mg/kg

3102a

[1] Spectrum No.1 [ 17.964 sec]:58051.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | T     | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

**Certified by:**

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



M6030



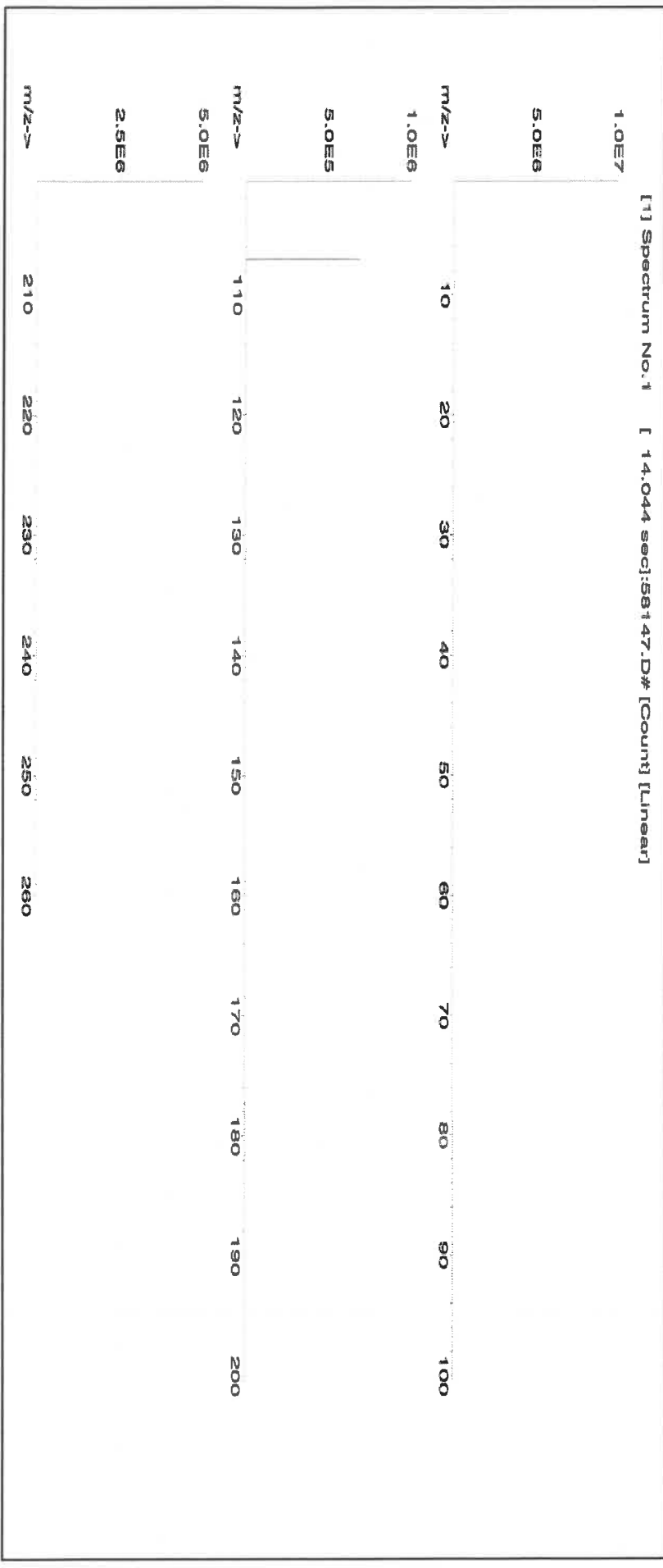
**CERTIFIED WEIGHT REPORT:**

Part Number: **57047**  
Lot Number: **122823**  
Description: **Silver (Ag)**  
Solvent: 24002546 Nitric Acid  
Lot #: **828/5/24**

Expiration Date: 122826  
Recommended Storage: Ambient (20 °C)  
Nominal Concentration (µg/mL): 1000  
NIST Test Number: 6UTB  
Weight shown below was diluted to (mL): 4000.30  
5E-05 Balance Uncertainty  
0.058 Flask Uncertainty

|                |                 |
|----------------|-----------------|
|                |                 |
| Formulated By: | Benson Chan     |
| Reviewed By:   | Pedro L. Rentas |
|                | 122823          |

| SDS Information        |       |            |                       |            |                        |           |                   |                   |                      |
|------------------------|-------|------------|-----------------------|------------|------------------------|-----------|-------------------|-------------------|----------------------|
| Compound               | RM#   | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Purity (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) |
| 1. Silver nitrate (Ag) | IN035 | J0612AGA1  | 1000.0                | 99.9996    | 0.10                   | 63.7      | 6.27992           | 6.27998           | 1000.0               |
|                        |       |            |                       |            |                        |           | 2.0               | 7761-88-8         | 10 µg/mL             |
|                        |       |            |                       |            |                        |           |                   |                   | NA                   |
|                        |       |            |                       |            |                        |           |                   |                   | 3151                 |





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | T     | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T)= Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 meghm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**Certified Reference Material CRM**

**CERTIFIED WEIGHT REPORT:**

R: 03/16/23 MS473 MS474 MS475 MS476

Lot #

Part Number:

**56138**

Solvent: 20510011

Nitric Acid

Lot Number:

**082922**

Description:

**Strontium (Sr)**

2% 20.0

Nitric Acid

Expiration Date:

082925

(mL)

Recommended Storage:

Ambient (20 °C)

Nominal Concentration (µg/mL):

**10000**

NIST Test Number:

6UTB

Weight shown below was diluted to (mL):

1000.12

0.058 Balance Uncertainty  
Flask Uncertainty

|                |                   |
|----------------|-------------------|
|                |                   |
| Formulated By: | Lawrence Barry    |
|                | 082922            |
|                |                   |
| Reviewed By:   | Pedro L. Renteria |
|                | 082922            |

**SDS Information**

**Compound**

RM#

Lot

Number

Nominal

Purity (%)

Uncertainty

Assay

Target

Actual

Actual

Conc. (µg/mL)

Expanded

Uncertainty

CAS#

OSHA PEL (TWA)

LD50

NIST

SRM

or-rat >2000mg/kg

3153a

1. Strontium nitrate (Sr)

IN017 SR2022018A1

10000

99.997

0.10

41.2

24.2756

24.2758

10000.1

20.0

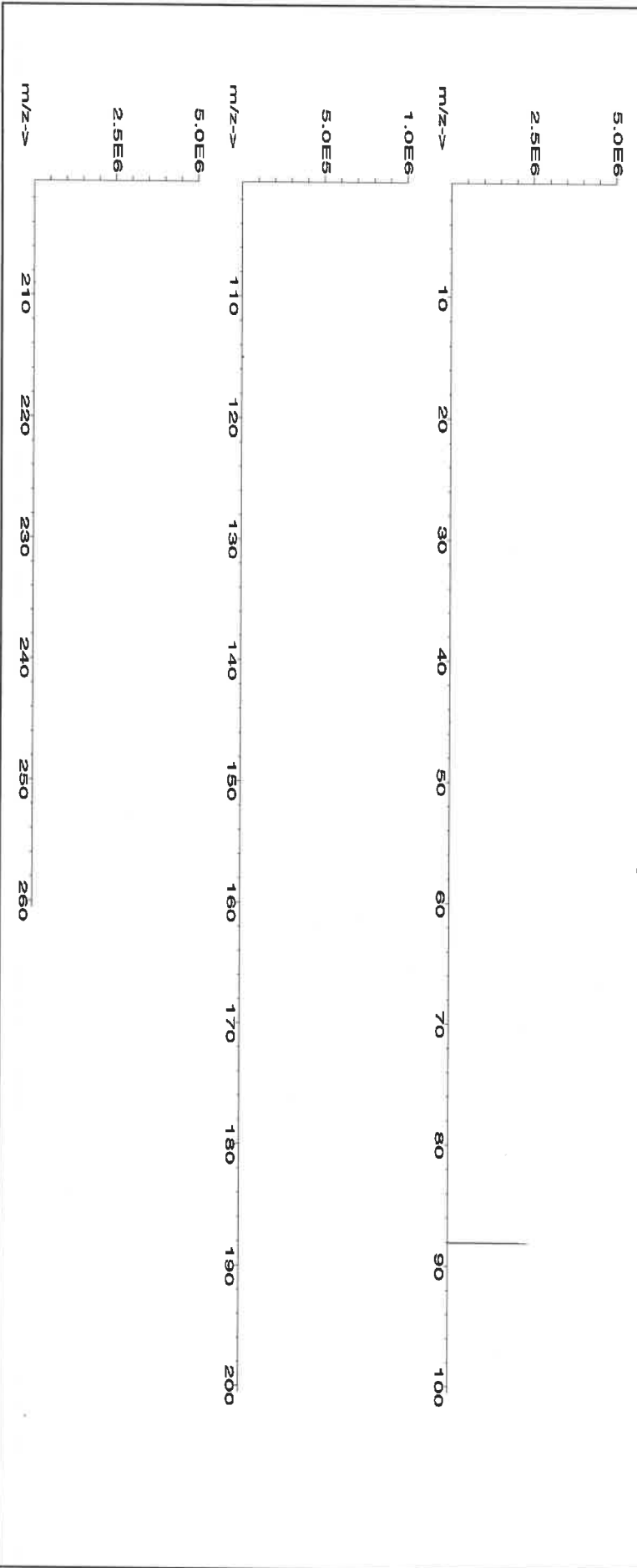
10042-76-9

NA

or-rat >2000mg/kg

3153a

[1] Spectrum No. 1 [14.495 sec]: 56138.D# [Count] [Linear]





**Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pr | <0.02 | Se | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | <0.02 | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Th | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | T     | Tm | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Sn | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Sc | <0.02 | Ta | <0.02 | Ti | <0.02 | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Homogeneity: No heterogeneity was observed in the preparation of this standard.

Certified by:

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- \* All standard containers are meticulously cleaned prior to use.
- \* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
- \* All Standards should be stored with caps tight and under appropriate laboratory conditions.
- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**CERTIFIED WEIGHT REPORT:**

**Part Number:** 57081  
**Lot Number:** 062724  
**Description:** Thallium (TI)

**Lot #**

**Solvent:** 24002546 Nitric Acid

**2%** 40.0 Nitric Acid (mL)

**Expiration Date:**

062727

**Recommended Storage:** Ambient (20 °C)

**Nominal Concentration (µg/mL):**

1000

**NIST Test Number:**

6UTB

**Weight shown below was diluted to (mL):** 2000.1

5E-05 Balance Uncertainty  
0.10 Flask Uncertainty

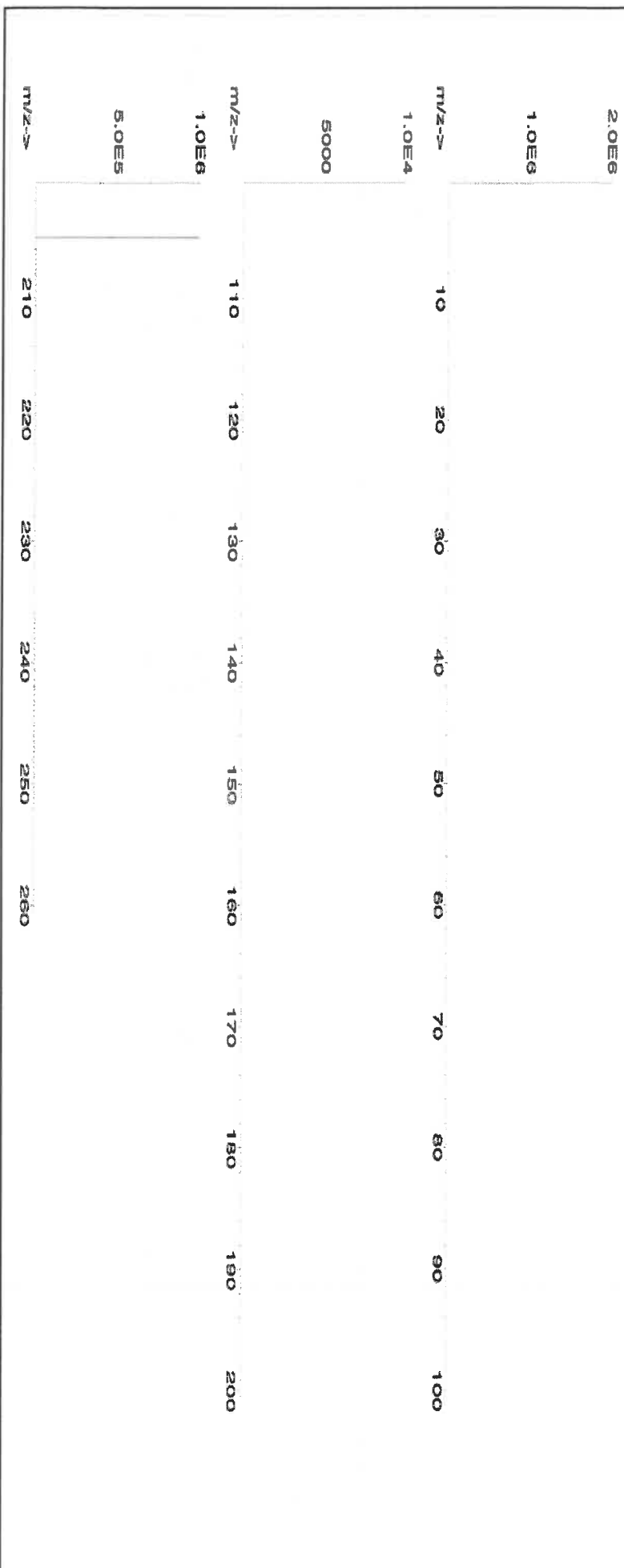
|                      |                        |
|----------------------|------------------------|
| <i>Aleah O'Brady</i> |                        |
| Formulated By:       | Aleah O'Brady          |
|                      | 062724                 |
| Reviewed By:         | <i>Pedro L. Rendas</i> |
|                      | Pedro L. Rendas        |
|                      | 062724                 |

**SDS Information**

| Compound | Lot Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty (%) | Assay (%) | Target Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|
|----------|------------|-----------------------|------------|-----------------|-----------|-------------------|-------------------|----------------------|----------------------------------|------|----------------|------|----------|

1. Thallium nitrate (TI) IN037 BCCF4399 1000 99.999 0.10 77.0 2.5975 2.5977 1000.1 2.0 10102-45-1 0.1 mg/m3 orl-mus 15mg/kg 3158

[1] Spectrum No.1 [ 14.044 sec]:57081.D# [Count] [Linear]







**Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):**

**Trace Metals Verification by ICP-MS (µg/mL)**

|    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |    |       |
|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Al | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | Pt | <0.02 | Sc | <0.2  | Tb | <0.02 | W  | <0.02 |
| Sb | <0.02 | Ca | <0.2  | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | <0.02 | Te | <0.02 | U  | <0.02 |
| As | <0.2  | Ce | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | Os | <0.02 | Rh | <0.02 | Ag | <0.02 | Tl | T     | V  | <0.02 |
| Ba | <0.02 | Cs | <0.02 | Gd | <0.02 | Ir | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2  | Tm | <0.02 | Yb | <0.02 |
| Be | <0.01 | Cr | <0.02 | Ga | <0.02 | Fe | <0.2  | Hg | <0.2  | P  | <0.02 | Ru | <0.02 | Sr | <0.02 | Sn | <0.02 | Y  | <0.02 |
| Bi | <0.02 | Co | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Pt | <0.02 | Sm | <0.02 | S  | <0.02 | Ti | <0.02 | Zn | <0.02 |
| B  | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K  | <0.2  | Se | <0.02 | Ta | <0.02 |    |       | Zr | <0.02 |

(T) = Target analyte

**Physical Characterization:**

Certified by:

Homogeneity: No heterogeneity was observed in the preparation of this standard.

- \* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
- \* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
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- \* Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated.
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- \* Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).



**Certified Reference Material CRM**

M6021



**CERTIFIED WEIGHT REPORT:**

Part Number: **57023**  
Lot Number: **062424**  
Description: **Vanadium (V)**

Lot # **24002546**  
Solvent: **Nitric Acid**

|                |                 |
|----------------|-----------------|
| Aleah O'Brady  |                 |
| Formulated By: | Aleah O'Brady   |
|                | 062424          |
| Reviewed By:   | Pedro L. Rantas |
|                | 062424          |

Expiration Date: **062427**  
Recommended Storage: **Ambient (20 °C)**  
Nominal Concentration (µg/mL): **1000**  
NIST Test Number: **6UTB**

Volume shown below was diluted to (mL): **2000.3**  
**5E-05** Balance Uncertainty  
**0.06** Flask Uncertainty

Volume shown below was diluted to (mL): **2000.3**

**5E-05** Balance Uncertainty  
**0.06** Flask Uncertainty

| Compound | Part Number | Lot Number | Dilution Factor | Initial Vol. (mL) | Uncertainty (mL) | Nominal Conc. (µg/mL) | Initial Conc. (µg/mL) | Final Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) | CAS# | OSHA PEL (TWA) | LD50 | NIST SRM |
|----------|-------------|------------|-----------------|-------------------|------------------|-----------------------|-----------------------|---------------------|----------------------------------|------|----------------|------|----------|
|          |             |            |                 |                   |                  |                       |                       |                     |                                  |      |                |      |          |

1. Ammonium metavanadate (V) 58123 021224 0.1000 200.0 0.084 1000 10000.3 10000.0 2.2 7803-55-6 0.05 mg/m3 or-at 58.1mg/kg 3165

[1] Spectrum No.1 [ 34.243 sec]:58023.D# [Count] [Linear]

|        |     |     |     |     |     |     |     |     |     |     |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 2.0E6  | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |
| 1.0E6  |     |     |     |     |     |     |     |     |     |     |
| 2.0E7  |     |     |     |     |     |     |     |     |     |     |
| 1.0E7  |     |     |     |     |     |     |     |     |     |     |
| 5.0E8  |     |     |     |     |     |     |     |     |     |     |
| 2.5E8  |     |     |     |     |     |     |     |     |     |     |
| m/z--> | 210 | 220 | 230 | 240 | 250 | 260 |     |     |     |     |

