

Prep Standard - Chemical Standard Summary

| Order ID : | Q1292 |
|----------------|-----------------|
| Test : | TCLP ICP Metals |
| | |
| Prepbatch ID : | PB166667, |

Sequence ID/Qc Batch ID: LB134744,

Standard ID :

MP83500,MP84041,MP84063,MP84070,MP84204,MP84218,MP84219,MP84230,MP84231,MP84297,MP84381,MP84382,MP84384,MP84385,MP84386,MP84387,MP84388,MP84392,MP84446,

Chemical ID :

M4884,M5130,M5218,M5223,M5289,M5298,M5393,M5429,M5467,M5472,M5476,M5496,M5497,M5498,M5513,M5519,M5565,M5658,M5697,M5798,M5799,M5800,M5801,M5802,M5806,M5811,M5815,M5817,M5819,M5875,M5942,M5959,M5961,M5962,M5970,M5976,M5977,M5978,M5985,M5990,M6021,M6023,M6025,M6028,M6030,M6032,M6077,M612 1,M6126,M6127,M6128,M6144,M6145,M6146,M6150,W3112,



| Recipe ID 902 | NAME ICP AES CAL BLK (SO/ICB/CCB) | <u>NO.</u> MP83500 | Prep Date 12/06/2024 | Expiration Date 01/24/2025 | Prepared By Kareem Khairalla | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal 12/09/2024 |
|---------------------|---------------------------------------|-----------------------|-------------------------|----------------------------------|---------------------------------------|------------------------|--------------------------|----------------------------|
| FROM | 125.00000ml of M6121 + 2350.0000 | Dml of W311 | 2 + 25.00000 | ml of M6126 = | Final Quantity: | 2500.000 ml | | |

| Recipe ID 169 | NAME 1:1HNO3 | <u>NO.</u> <u>MP84041</u> | Prep Date 01/14/2025 | | Prepared By Eman Mughal | <u>ScaleID</u> None | PipetteID None | Sarabjit Jaswal |
|---------------------|-----------------------------------|------------------------------|-------------------------|-----------------|-------------------------------|------------------------|-------------------|-----------------|
| FROM | 1250.00000ml of M6126 + 1250.0000 | DOMI of W31 | 112 = Final Q | uantity: 2500.0 | 00 ml | | | |



| Recipe ID 994 | NAME ICPAES ISM01.2 S1 (CONC.) | <u>NO.</u> MP84063 | Prep Date 01/14/2025 | Expiration Date 02/14/2025 | Prepared By Kareem Khairalla | <u>ScaleID</u> None | PipetteID None | Sarabjit Jaswal |
|---------------------|--|---|--|---|--|--|--|-----------------|
| FROM | 0.02000ml of M5815 + 0.03000ml of of M5298 + 0.20000ml of M5476 + 0. 0.20000ml of M6025 + 0.20000ml of of M6023 + 0.70000ml of M5962 + 0. 1.20000ml of M5819 + 10.00000ml o 2.00000ml of M5942 + 4.00000ml of | 20000ml of M6030 + 0. 80000ml of f M5497 + 1 | M5658 + 0.20 30000ml of M M5961 + 1.00 0.00000ml of | 0000ml of M580 6128 + 0.40000 0000ml of M580 M5519 + 10.00 | 01 + 0.20000ml 0ml of M5496 + 00 + 1.00000ml 0000ml of M580 | of M5817 + 0.2 0.50000ml of M of M6021 + 1.2 6 + 10.00000ml | 0000ml of M59 15697 + 0.5000 0000ml of M58 | 976 + 90ml |
| Desina | | | | Funination | Duo u o uo d | | | Currentia ed Du |

| Recipe | | | | Expiration | Prepared | | | Supervised By |
|-----------|-----------------------------------|----------------|---------------|--------------|----------------|----------------|-----------------|-----------------|
| <u>ID</u> | NAME | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | PipettelD | Sarabjit Jaswal |
| 921 | ICPAES SPIKE SOL#6 | <u>MP84070</u> | 01/14/2025 | 02/14/2025 | Kareem | None | None | |
| | | | | | Khairalla | | | 01/16/2025 |
| FROM | 2.50000ml of M5962 + 50.00000ml o | f M5565 + 5 | 50.00000ml of | M5990 + 147. | 50000ml of MP8 | 3500 = Final C | uantity: 250.00 | 00 ml |
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Metals STANDARD PREPARATION LOG

| Recipe ID 902 | NAME ICP AES CAL BLK (SO/ICB/CCB) | <u>NO.</u> MP84204 | Prep Date 01/24/2025 | | <u>Prepared</u> <u>By</u> Kareem Khairalla | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|---------------------|---------------------------------------|-----------------------|-------------------------|---------------|---|------------------------|--------------------------|-----------------|
| FROM | 125.00000ml of M6121 + 2350.0000 | 0ml of W311 | 2 + 25.00000 | ml of M6126 = | Final Quantity: | 2500.000 ml | | |

| Recipe | | | | Expiration | Prepared | | | Supervised By |
|---------------|-----------------------------------|----------------|-------------|-------------------|-----------------|----------------|-----------------|-----------------|
| <u>ID</u> | NAME | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | PipettelD | Sarabjit Jaswal |
| 919 | ICP AES INTERNAL STD | <u>MP84218</u> | 01/24/2025 | 02/24/2025 | Kareem | None | None | |
| | | | | | Khairalla | | | 01/27/2025 |
| FROM | 1.00000ml of M5959 + 10.00000ml o | f M5985 + 1 | 969.00000ml | of W3112 + 20 | .00000ml of M6 | 126 = Final Qu | antity: 2000.00 | 00 ml |
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| Recipe ID 903 | NAME ICP AES RINSE SOLN | <u>NO.</u> MP84219 | Prep Date 01/24/2025 | Expiration Date 02/24/2025 | Prepared By Kareem Khairalla | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|---------------------|----------------------------------|-----------------------|-------------------------|----------------------------------|---------------------------------------|------------------------|--------------------------|-----------------|
| <u>FROM</u> | 200.00000ml of M6126 + 9800.0000 | Oml of W311 | 2 = Final Qu | antity: 10000.00 | 00 ml | | | |
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| Recipe | | | | Expiration | Prepared | | | Supervised By |
|---------------|----------------------------------|----------------|---------------|-------------------|-----------------|----------------|-----------|-----------------|
| ID | NAME | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | PipetteID | Sarabjit Jaswal |
| 904 | ICP AES ICSA SOLN | <u>MP84230</u> | 01/24/2025 | 02/24/2025 | Kareem | None | None | - |
| | | | | | Khairalla | | | 01/28/2025 |
| FROM | 25.00000ml of M5130 + 225.00000m | l of MP8420 |)4 = Final Qu | antity: 250.000 | ml | | | |
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| Recipe ID 3494 | NAME ICP AES ICSAB SOLN-1 | <u>NO.</u> MP84231 | Prep Date 01/24/2025 | Expiration Date 02/24/2025 | Prepared By Kareem Khairalla | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|----------------------|---|-----------------------|-------------------------|----------------------------------|---------------------------------------|------------------------|--------------------------|-----------------|
| FROM | 0.01000ml of M5815 + 0.01000ml of of M5130 + 10.00000ml of M5223 + 1 | | | | | 0.10000ml of M | 6077 + 10.000 | l00ml |

| <u>Recipe</u> <u>ID</u> 170 | NAME 1:1HCL | <u>NO.</u> <u>MP84297</u> | Prep Date 01/31/2025 | | Prepared By Eman Mughal | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|-----------------------------------|-----------------------------------|------------------------------|-------------------------|-----------------|-------------------------------|------------------------|--------------------------|-----------------|
| FROM | 1250.00000ml of M6121 + 1250.0000 | 00ml of W31 | I I12 = Final Q | uantity: 2500.0 | ı <u> </u> | | | |
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| Recipe ID 2480 FROM | NAME ICP AES STD 6 ISM01.3 4.00000ml of M5289 + 4.00000ml of of MP84204 = Final Quantity: 50.000 | | Prep Date 01/27/2025 00000ml of M | Expiration Date 02/24/2025 5811 + 4.00000 | Prepared By Kareem Khairalla | <u>ScaleID</u> None 4.00000ml of M | <u>PipettelD</u> None 6144 + 30.000 | Sarabjit Jaswal 02/10/2025 000ml |
|------------------------------|---|---------------------------|---|--|---------------------------------------|--|---|--|
| Recipe ID 1004 | NAME ICPAES ISM01.2 (S5) | <u>NO.</u> MP84382 | Prep Date 01/27/2025 | Expiration Date 02/24/2025 | Prepared By Kareem Khairalla | <u>ScaleID</u> None | PipettelD None | Sarabjit Jaswal |
| <u>FROM</u> | 0.25000ml of M5798 + 0.50000ml of of M5519 + 12.50000ml of M6128 + M5658 + 14.50000ml of M5811 + 2.0 + 5.00000ml of M5393 + 5.00000ml of Final Quantity: 500.000 ml | 12.50000ml 0000ml of N | of M6144 + 1 //5513 + 22.50 | 3.75000ml of M 0000ml of M549 | 15697 + 14.5000 97 + 22.50000m | 00ml of M5496 l of M6127 + 5.0 | + 14.50000ml 00000ml of M4 | of 884 |



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| Recipe ID 1005 | NAME ICPAES ISM01.2(S4) | <u>NO.</u> MP84384 | Prep Date 01/27/2025 | Expiration Date 02/24/2025 | <u>Prepared</u> <u>By</u> Kareem Khairalla | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|----------------------|----------------------------------|-----------------------|-------------------------|----------------------------------|---|------------------------|--------------------------|-----------------|
| <u>FROM</u> | 250.00000ml of MP84204 + 250.000 | 00ml of MP8 | 34382 = Final | Quantity: 500. | 000 ml | | | |
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| Recipe | | | | Expiration | Prepared | | | Supervised By |
|--------|----------------------------------|----------------|---------------|-----------------|-----------|----------------|-----------|-----------------|
| ID | NAME | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | PipettelD | Sarabjit Jaswal |
| 1007 | ICPAES ISM01.2(S3) | <u>MP84385</u> | 01/27/2025 | 02/24/2025 | Kareem | None | None | |
| | | | | | Khairalla | | | 02/10/2025 |
| FROM | 25.00000ml of MP84382 + 75.00000 | ml of MP842 | 204 = Final Q | uantity: 100.00 | 0 ml | | | |
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| Recipe ID 1008 FROM | NAME ICPAES ISM01.2(S2) 12.50000ml of MP84382 + 87.50000 | <u>NO.</u> <u>MP84386</u> ml of MP842 | Prep Date 01/27/2025 204 = Final Q | Expiration Date 02/24/2025 muantity: 100.00 | Prepared By Kareem Khairalla | <u>ScaleID</u> None | PipetteID None | Sarabjit Jaswal 02/10/2025 |
|------------------------------|--|---|--|--|---------------------------------------|------------------------|-------------------|-------------------------------|
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| Recipe ID 994 | NAME ICPAES ISM01.2 S1 (CONC.) | <u>NO.</u> MP84387 | Prep Date 01/27/2025 | Expiration Date 02/24/2025 | Prepared By Kareem Khairalla | <u>ScaleID</u> None | PipetteID None | Sarabjit Jaswal |
| FROM | FROM 0.02000ml of M5815 + 0.03000ml of M5429 + 0.10000ml of M5798 + 0.10000ml of M6028 + 0.14000ml of M5799 + 0.20000ml of M5476 + 0.20000ml of M5658 + 0.20000ml of M5801 + 0.20000ml of M5811 + 0.20000ml of M5817 + 0.20000ml of M5977 + 0.20000ml of M6025 + 0.20000ml of M6030 + 0.30000ml of M6128 + 0.40000ml of M5496 + 0.50000ml of M5697 + 0.50000ml | | | | | | | |

0.20000ml of M6025 + 0.20000ml of M6030 + 0.30000ml of M6128 + 0.40000ml of M5496 + 0.50000ml of M5697 + 0.50000ml of M6023 + 0.70000ml of M5962 + 0.80000ml of M5961 + 1.00000ml of M5800 + 1.00000ml of M6021 + 1.20000ml of M6145 +

1.20000ml of M6146 + 10.00000ml of M4884 + 10.00000ml of M5498 + 10.00000ml of M5519 + 10.00000ml of M6127 + 10.00000ml of M6144 + 2.00000ml of M5978 + 4.00000ml of M6032 + 34.24000ml of MP84204 = Final Quantity: 100.000 ml



| Recipe ID 1003 | NAME ICPAES ISM01.2 S1 | <u>NO.</u> MP84388 | Prep Date 01/27/2025 | Expiration Date 02/24/2025 | <u>Prepared</u> <u>By</u> Kareem Khairalla | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|----------------------|----------------------------------|-----------------------|-------------------------|----------------------------------|---|------------------------|--------------------------|-----------------|
| FROM | 0.50000ml of MP84387 + 99.50000m | nl of MP8420 | 04 = Final Qu | antity: 100.000 | ml | | | |

| <u>Recipe</u> <u>ID</u> 1119 | NAME ICPAES ISM01.2(CCV) | <u>NO.</u> MP84392 | Prep Date 01/27/2025 | Expiration Date 02/24/2025 | <u>Prepared</u> <u>By</u> Kareem Khairalla | <u>ScaleID</u> None | <u>PipetteID</u> None | Sarabjit Jaswal |
|------------------------------------|---|-----------------------|--------------------------------|----------------------------------|---|------------------------|--------------------------|-----------------|
| <u>FROM</u> | 0.75000ml of M5498 + 0.75000ml of of MP84204 + 25.00000ml of MP843 | | | |)ml of M5811 + | 1.25000ml of M | 6144 + 19.775 | 00ml |
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| Recipe ID 912 | NAME ICP AES ICV SOLN | <u>NO.</u> MP84446 | Prep Date 01/27/2025 | <u>Prepared</u> <u>By</u> Kareem Khairalla | <u>ScaleID</u> None | PipetteID None | Supervised By Janvi Patel 02/12/2025 |
|---------------------|---|-----------------------|-------------------------|---|------------------------|-------------------|--|
| FROM | 0.02500ml of M5429 + 0.02500ml of of M5472 + 10.00000ml of M6150 + 8 | | | | 0.25000ml of M | 5218 + 0.2500 |)0ml |



| 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 | 030921 | 03/09/2025 | 08/06/2021 / jaswal | 08/05/2021 / jaswal | M4884 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| EPA | PART A / ICSA (ICP) STOCK SOLN | ICSA-1211 | 01/31/2025 | 05/20/2024 / jaswal | 04/20/2021 / bin | M5130 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | CHEM-QC-4 / CHEM-QC-4, Second Source, 1000 ug/ml, B, Mo, Si, Sn, Ti | S2-MEB711674 | 11/02/2026 | 07/01/2022 / bin | 09/10/2021 / bin | M5218 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| EPA | PART B / ICSAB (ICP) STOCK SOLN | ICSB-0710 | 01/31/2025 | 05/20/2024 / jaswal | 04/20/2021 / bin | M5223 |
| 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 # |
| Absolute Standards, Inc. | 58126 / Fe, 10000 PPM, 500 ml | 020422 | 02/04/2025 | 05/02/2023 / jaswal | 06/15/2022 / jaswal | M5298 |



| Ventures SOLUTION #3, 125mL bin bin | Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|---|----------|---------------------|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| Supplier ItemCode / ItemName Lot # Date Opened By Received By Lot Absolute Standards, Inc. 57103 / Li, 10000 PPM, 125 ml 07/06/2025 01/30/2023 / bin 01/26/2023 / bin 03/01/2023 / bin M546 | - | | T2-MEB714159 | 01/13/2027 | | | M5393 |
| Standards, Inc. 125 ml ItemCode / ItemName Lot # Expiration Date Date Opened / Opened By Received Date / Received By Chemt Lot Absolute Standards, Inc. 57058 / Cerium, 1000PPM, 100ML 020623 02/06/2026 03/06/2023 / bin 03/01/2023 / bin 03/01/2023 / bin 04546 | Supplier | ItemCode / ItemName | Lot # | | - | | Chemtech Lot # |
| Supplier ItemCode / ItemName Lot # Date Opened By Received By Lot Absolute Standards, Inc. 57058 / Cerium, 1000PPM, 100ML 020623 02/06/2026 03/06/2023 / bin 03/01/2023 / bin 03/01/2023 / bin M546 Supplier ItemCode / ItemName Lot # Expiration Date Opened / Received Date / Chemt | | | 070622 | 07/06/2025 | | | M5429 |
| Standards, Inc. 1000PPM, 100ML bin bin M546 Supplier ItemCode / ItemName Lot # Expiration Date Opened / Received Date / Chemt | Supplier | ItemCode / ItemName | Lot # | - | | | Chemtech Lot # |
| Supplier I ItemCode / ItemName I Lot # I I I I I I I I I I I I I I I I I I | | | 020623 | 02/06/2026 | | | M5467 |
| Supplier I ItemCode / ItemName I I of # I ' I I ' I I ' I I I I I I I I I I I | | | | Expiration | Date Opened / | Received Date / | Chemtech |
| | Supplier | ItemCode / ItemName | Lot # | - | - | Received By | Lot # |

| Supplier | ItemCode / ItemName | LOT # | Date | Opened By | Received By | Lot # |
|-----------------------------|---------------------------------|--------|------------|------------------------|------------------------|-------|
| Absolute Standards, Inc. | 57038 / Sr, 1000 PPM, 125 ml | 082922 | 08/29/2025 | 01/14/2025 / Jaswal | 03/16/2023 / jaswal | M5472 |

| 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 |
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| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|----------------------------------|--------|--------------------|----------------------------|--------------------------------|-------------------|
| Absolute Standards, Inc. | 58113 / AI, 10000 PPM, 500 ml | 011623 | 01/16/2026 | 08/15/2023 / jaswal | 03/17/2023 / bin | M5496 |



| 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 | 03/18/2023 / bin | 03/17/2023 / bin | M5497 |
| 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. | 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 # |
| Inorganic Ventures | CLPP-SPK-1 / SOIL/WATER SPIKE SOLN 1, 125mL | T2-MEB721963 | 07/27/2027 | 05/30/2023 / jaswal | 05/26/2023 / jaswal | M5565 |
| 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 |



| 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 | 102523 | 10/25/2026 | 04/03/2024 / jaswal | 10/27/2023 / jaswal | M5697 |
| 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 |
| 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 Opened / | Received Date / | Chemtech |

| 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 |



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CHEMICAL RECEIPT LOG BOOK

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| 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. | 58126 / Fe, 10000 PPM, 500 ml | 051523 | 05/15/2026 | 02/06/2025 / kareem | 01/03/2024 / jaswal | M5811 |
| 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 |
| 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. | 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 # |
| Inorganic Ventures | CLPP-CAL-1 / CLP CAL SOLUTION #1, 125mL | T2-MEB714417 | 01/27/2027 | 04/19/2024 / jaswal | 02/22/2024 / jaswal | M5875 |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|--|-------------|--------------------|----------------------------|--------------------------------|-------------------|
| Inorganic Ventures | CGTI1-1 / TITANIUM 125mL 1000ug/mL | T2-TI719972 | 06/17/2027 | 06/18/2024 / Jaswal | 02/22/2024 / Jaswal | M5942 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | CGY10-1 / YTTRIUM 125mL 10,000ug/mL | V2-Y740548 | 02/20/2029 | 07/01/2024 / Jaswal | 06/14/2024 / Jaswal | M5959 |
| 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 / Jaswal | 06/11/2024 / 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 / Jaswal | 06/14/2024 / Jaswal | M5962 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 57003 / Li, 1000 PPM, 125 ml | 061224 | 06/21/2027 | 07/01/2024 / Jaswal | 07/01/2024 / Jaswal | M5970 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |

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



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|--|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| Inorganic Ventures | CGMO1-1 / MOLYBDENUM 125mL 1000ug/mL | T2-MO720876 | 07/17/2027 | 01/16/2025 / JANVI | 02/22/2024 / Jaswal | M5977 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | CGTI1-1 / TITANIUM 125mL 1000ug/mL | T2-TI719972 | 06/17/2027 | 08/07/2024 / jaswal | 02/22/2024 / Jaswal | M5978 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | CGIN10-5 / INDIUM 1 x 500 ml | U2-IN729349 | 02/21/2028 | 10/08/2024 / Jaswal | 06/14/2024 / Jaswal | M5985 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | CLPP-SPK-5 / CLP Spike Standard 5 | V2-MEB742037 | 03/12/2029 | 10/04/2024 / Jaswal | 02/22/2024 / Jaswal | M5990 |
| 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 |
| | | | l | | | |

| 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 |
| 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. | 57056 / Ba, 1000 PPM, 125 ml | 010924 | 01/09/2027 | 01/14/2025 / Jaswal | 08/05/2024 / Jaswal | M6032 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Inorganic Ventures | Z9651Q / CHEM-CLP-4/.25L | V2-MEB746762 | 09/06/2029 | 01/23/2025 / kareem | 09/19/2024 / kareem | M6077 |

| 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 |
| | | | | | | |



| 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 # |
| Absolute Standards, Inc. | 58112 / Mg, 10000 PPM, 500 ml | 112124 | 11/21/2027 | 01/13/2025 / kareem | 01/13/2025 / kareem | M6127 |
| 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 | 101124 | 10/11/2027 | 01/13/2025 / kareem | 01/13/2025 / kareem | M6128 |
| 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 | 072424 | 07/24/2027 | 01/23/2025 / kareem | 01/13/2025 / Jaswal | M6144 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received Bv | Chemtech Lot # |

| Supplier | ItemCode / ItemName | Lot # | Date | Opened By | Received Date / Received By | Lot # |
|-----------------------------|---------------------------------------|--------|------------|------------------------|--------------------------------|-------|
| Absolute Standards, Inc. | 58030 / Zinc, Zn, 500 ml, 1000 PPM | 121724 | 12/17/2027 | 02/04/2025 / jaswal | 01/13/2025 / Jaswal | M6145 |
| | | | | | | |

| 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 | 071724 | 07/17/2027 | 01/31/2025 / kareem | 10/18/2024 / kareem | M6146 |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|----------|---------------------------------------|-----------|--------------------|----------------------------|--------------------------------|-------------------|
| EPA | ICV-1 / ICV (ICP/ICPMS) STOCK SOLN | ICV1-1014 | 07/07/2025 | 02/07/2025 / JANVI | 04/20/2021 / JANVI | M6150 |
| Supplier | ItemCode / ItemName | Lot # | Expiration | Date Opened / | Received Date / | Chemtech |
| | Romoode / Romanie | LOI # | Date | Opened By | Received By | Lot # |



Certificate of Analysis ME986 ME987 MEGRA R: 02 22 24

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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).



M5989-M5990

2.0 **PRODUCT DESCRIPTION**

| Product Code: | Multi Analyte Custor | n Grade Solution | |
|---------------------|---------------------------------------|------------------|-----------|
| Catalog Number: | CLPP-SPK-5 | | |
| Lot Number: | V2-MEB742037 | | |
| Matrix: | 5% (v/v) HNO3 | | |
| Value / Analyte(s): | 100 μg/mL ea: Antimony, | | |
| | 50 µg/mL ea: Selenium, Cadmium, | | Thallium, |
| | 40 µg/mL ea: Arsenic, | | |
| | 20 µg/mL ea: Lead | | |
| CERTIFIED VALUES | AND UNCERTAINTIES | 3 | |
| | | ANALNEE | 055 |

| ANALYTE | CERTIFIED VALUE | ANALYTE | CERTIFIED VALUE |
|--------------|------------------------|--------------------|------------------------|
| Antimony, Sb | 100.0 ± 0.7 µg/mL | Arsenic, As | 40.00 ± 0.26 μg/mL |
| Cadmium, Cd | 49.99 ± 0.22 μg/mL | Lead, Pb | 19.99 ± 0.09 µg/mL |
| Selenium, Se | 50.00 ± 0.23 µg/mL | Thailium, Ti | 50.00 ± 0.22 µg/mL |
| | | | |
| Density: | 1.025 g/mL (meas | ured at 20 ± 4 °C) | |

3.0

Assay Information:

Page 1 of 4

| 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 |
| ТІ | ICP Assay | 3158 | 151215 |
| ті | 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_{CRMRM}, where two or more methods of characterization are used is the weighted mean of the results:

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

Xi = mean of Assay Method i with standard uncertainty uchar i wi = the weighting factors for each method calculated using the inverse square of the variance:

 $w_{i} = (1/u_{char\,i})^{2} / (\Sigma(1/(u_{char\,i})^{2})$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 + u_{bb}^2 + u_{1b}^2 + u_{1b}^2)^{1/2}$

k = coverage factor = 2

 $u_{char} \simeq [\Sigma((w_i)^2 (u_{char})^2)]^{\frac{1}{2}}$ where u_{char} are the errors from each characterization method ubb = bottle to bottle homogeneity standard uncertainty

ults = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty

4.0 **TRACEABILITY TO NIST**

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})

Xa = mean of Assay Method A with uchar a = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = U_{CRM/RM} = k (u²chara + u²bb + u²ts + u²ts)^{1/2} k = coverage factor = 2

uchar a = the errors from characterization ubb = bottle to bottle homogeneity standard uncertainty uits = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty

- 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

INTENDED USE 6.0

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 <u>Terms and Conditions of Sale</u>. <u>https://www.inorganicventures.com/terms-and-conditions-sale</u>. 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 $20^\circ \pm 4^\circ$ 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

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

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**

Paul R Laine

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

| m/z-> | N. 5 11 0 | m/≥-≫ 5.0⊑6 | m/z-> 2.0回5 1.0回5 | 2.0 同の の | 1. Barium nitrate (Ba) | Compound | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa | CERTIFIED WEIGHT REPORT: Part A Lot A Desc | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
|--------|--------------------|----------------|-------------------------|---------------------------------------|------------------------|---|--|---|--|
| N | | 110 | 10 | [1] Spectrum No.1 | IN02 | RM# | Expiration Date:010927Recommended Storage:Ambient (Il Concentration (µg/mL):1000NIST Test Number:6UTBWeight shown below was diluted to (mL): | <u>PORT:</u> Part Number: Lot Number: Description: | om om |
| 0 0 | | 120 | N O | | IN023 BAD022019A1 1 | Lot Number | 20 | <u>57056</u> 010924 Barium (Ba) | |
|). | | 130 | Q O | 12.514 sec]:58156.D# [Count] [Linear] | 1000 99.999 | Nominal Purity Unc Conc. (µg/mL) (%) Pu | 5E-05 00.02 | | R1815 |
| 240 | | 140 | 4 0 | 56. D# [Cour | 0.10 52.3 3 | Uncertainty Assay Purity (%) (%) W | 2% Balance Uncertainty Flask Uncertainty | | ertified Refere १२-५ |
| | | 150 160 | 0 0 0 | t] [Linear] | 3.82417 3.82441 | Target Actual Weight (g) Weight (g) | 40.0 Nitric Acid (mL) | 46 | Certified Reference Material CRM 1/2-4 |
| 1 | | 0 170 | 70 | | 1 1000.1 | Actual Conc. (µg/mL) | | | :RM М6032 |
| | | 180 | 8- 0 | | 2.0 10022-31-8 | Expanded Uncertainty (So +/- (µg/mL) CAS# | Formulated By: | Hiovanni | - |
| | | 190 Varianti | 9 O | | 0.5 mg/m3 | SDS Information (Solvent Safety Info. On Attached pg.) COSHA PEL (TWA) LD51 | Giovanni Esposito | | AI Al |
| | | 200 | 100 | | orl-rat 355 mg/kg | n Attached pg.)) LD50 | 010924 | (P) | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
| | | | | | g 3104a | NIST | <u>2</u> [2] | <u> </u> | Accredited Ite Number Idards.com |

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Certified Reference Material CRM



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

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

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Physical Characterization:

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

In P. S.

Certified by:

* Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. 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 certifed (+/-) 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).

Part # 57056 Lot # 010924

| m/z-> | 1.067 | m/z-> 2.0€7 | 5.014 | m/z-> 1.0E5 | 2.5 E 4 | 5. 0 114 | 1. Cadmium nitrate tetrahydrate (Cd) | Compound | Weight shov | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): | | CERTIFIED WEIGHT REPORT: | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
|-------|-------|----------------|-------|----------------|----------------|---------------------------------------|--------------------------------------|--|--|--|---|--------------------------|--|
| | | | | 0 0 | | [1] Spectrum No.1 | | RM# | Weight shown below was dliuted to (mL): | Expiration Date: nended Storage: ntration (µg/mL): | Part Number: Lot Number: Description: | PORT: | 15, Inc. om |
| | | 120 | | 20 | | - | IN024 CDM092021A1 | Lot Number | 6UTB uted to (mL): | 070127 Ambient (20 °C) 1000 | <u>57048</u> <u>070124</u> Cadmium (Cd) | | |
| | | 130 | | 30 | | 12.514 800 | 1000 99. | Nominal Pu Conc. (µg/mL) (1 | 2000.07 0.1 | | (Cd) | | R |
| 200 | | 140 | | \$ | | 12.514 sec]:58148.D# [Count] [Linear] | 99.999 0.10 36.5 | Purity Uncertainty Assay (%) Purity (%) (%) | 5E-05 Balance Uncertainty 0.100 Flask Uncertainty | | Solvent: 2% | | Certified R |
| | | 1 () () | | ő | | Count] [Line | .5 5.4797 | say Target 6) Weight (g) | ţ | | ent: 24002546 2% 40.0 | Lot # | Certified Reference Material CRM 3 15 12 4 |
| | | 160 | | 0 O | | ar] | 5.4804 | Actual Actual Weight (g) Conc. (µg/mL) | | | Nitric Acid | | terial CRM |
| | | 170 | | 70 | | | 1000.1 | 11 | Re | 5 | 5 | | M6028 |
| | | -1 2 C | | BO | | | 10022-68-1 | Expanded Uncertainty (Solvent +/- (µg/mL) CAS# 0 | Reviewed By: Ped | \$ | Alloch & B | | - |
| | | 190 200 | | 90 100 | | | | SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD51 | Pedro L. Rentas | ento | Brack | | ANAB IS AR-153 https://Ab |
| | | | | - | | | orl-rat 60.2mg/kg 3108 | ned pg.) NIST LD50 SRM | 070124 | | 070194 | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |

1 of 2

Part # 57048

Lot # 070124

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

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

| | F | ₽ | B | DC | | Ŗ | AS | | Sb | A | | - | |
|----------------------|----------|----------|-------|-------|----------|-------|---------------|-------|-------|--------------|---|---------|----------|
| | 10.04 | 200 | <0.02 | <0.01 | | 3 | 202 | | 40.02 | <0.02 | 200 | | |
| | <u>_</u> | 2 | ଚ | 5 | <u>ې</u> | ç | ŝ | | ç | ğ | | | |
| | 70.02 | 3 | 40.02 | <0.02 | 10.02 | 33 | 20.02 | | 3 | Т | ALC: NOT THE REAL OF THE REAL | | |
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| | 20.02 | 20.02 | 55 | <0.2 | 20.02 | 3 | A).02 | 20.02 | 3 | 40.02 | And a subscription | Ŀ | N OUK |
| | Nd | UTAT | Ş | Hg | MIN | | Mg | Ę | | E | C. NTALITY | | Aptalo |
| (T) = Target analyte | <0.02 | 20.02 | 3 | 40 i2 | <0.02 | 2 | 40 .01 | 70.05 | 5 | <0.02 | ALC: NO ALC: NO | | Varifics |
| yet anal | × | 2 | 2 | ٣ | Pd | ! | õ | NO | , | Ŋ | The second | | tion |
| vte | 40 2 | 20.02 | 5 | A0.02 | <0.02 | | <0.02 | <0.02 | | <0.02 | 一般的なより | | |
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Physical Characterization:

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

In P. S.

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 certifed (+/-) 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).

e24



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

3.0

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 So | lution |
|---------------------|---|-----------------------|
| Catalog Number: | CLPP-CAL-1 | |
| Lot Number: | T2-MEB714417 | |
| Matrix: | 5% (v/v) HNO3 | |
| Value / Analyte(s): | 5 000 μg/mL ea: Calcium, Magnesium, | Potassium, Sodium, |
| | 2 000 μg/mL ea: Aluminum, | Barium, |
| | 1 000 μg/mL ea: Iron, | |
| | 500 μg/mL ea: Nickel, Zinc, Manganese, | Vanadium, Cobalt, |
| | 250 μg/mL ea: Silver, | Copper, |
| | 200 μg/mL ea: Chromium, | |
| | 50 μg/mL ea: Beryllium | |
| CERTIFIED VALUE | S AND UNCERTAINTIES | |

| ANALYTE Aluminum, Al | CERTIFIED VALUE 2 000 ± 7 μg/mL | ANALYTE Barium, Ba | CERTIFIED VALUE 2 000 ± 9 μg/mL |
|-------------------------|------------------------------------|-----------------------|------------------------------------|
| Beryllium, Be | 50.00 ± 0.26 μg/mL | Calcium, Ca | 5 000 ± 22 μg/mL |
| Chromium, Cr | 200.0 ± 1.0 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 |
| Magnesium, Mg | 5 000 ± 20 μg/mL | Manganese, Mn | 500.0 ± 2.0 μg/mL |
| Nickel, Ni | 500.0 ± 2.2 μg/mL | Potassium, K | 5 000 ± 19 μg/mL |
| Silver, Ag | 250.0 ± 1.1 μg/mL | Sodium, Na | 5 000 ± 18 μg/mL |
| Vanadium, V | 499.7 ± 2.2 μg/mL | Zinc, Zn | 500.0 ± 2.2 μg/mL |

Density:

1.118 g/mL (measured at 20 ± 4 °C)

Assay Information:

| ANALYTE Ag | METHOD ICP Assay | NIST SRM# 3151 | SRM LOT# 160729 |
|---------------|---------------------|-------------------|--------------------|
| Ag | Volhard | 999c | 999c |
| AI | ICP Assay | 3101a | 140903 |
| AI | EDTA | 928 | 928 |
| Ва | ICP Assay | 3104a | 140909 |
| Ва | Gravimetric | | See Sec. 4.2 |
| Ве | ICP Assay | 3105a | 090514 |
| Ве | Calculated | | See Sec. 4.2 |
| Са | ICP Assay | 3109a | 130213 |
| Са | EDTA | 928 | 928 |
| Со | ICP Assay | 3113 | 190630 |
| Со | EDTA | 928 | 928 |
| Cr | ICP Assay | 3112a | 170630 |
| Cr | Calculated | | See Sec. 4.2 |
| Cu | ICP Assay | 3114 | 121207 |
| Cu | EDTA | 928 | 928 |
| Fe | ICP Assay | 3126a | 140812 |
| Fe | EDTA | 928 | 928 |
| К | ICP Assay | 3141a | 140813 |
| К | 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 |
| 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 _{CRM/RM} , where two or more methods of characterization are | Characterization of CRM/RM by One Method Certified Value, X _{CRM/RM} , where one method of characterization |
|--|---|
| used is the weighted mean of the results: | is used is the mean of individual results: |
| $X_{CRM/RM} = \Sigma(w_i) (X_i)$ | X _{CRM/RM} = (X _a) (u _{char a}) |
| X _i = mean of Assay Method i with standard uncertainty u _{char i} | X _a = mean of Assay Method A with |
| w_i = the weighting factors for each method calculated using the inverse square of the variance: $w_i = (1/u_{chari})^2 / (\Sigma(1/(u_{chari})^2)$ | $\mathbf{u}_{char \ a}$ = the standard uncertainty of characterization Method A |
| CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k (u ² _{char} + u ² _{bb} + u ² _{lts} + u ² _{ts}) ^{1/2} | CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{chara}^2 + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ |
| k = coverage factor = 2 | k = coverage factor = 2 |
| $\mathbf{u_{char}} = \left[\sum ((\mathbf{w_i})^2 (\mathbf{u_{char}})^2)\right]^{\frac{1}{2}}$ where $\mathbf{u_{char}}$ are the errors from each characterization method | u _{char a} = the errors from characterization |
| ubb = bottle to bottle homogeneity standard uncertainty | ubb = bottle to bottle homogeneity standard uncertainty |
| u _{lts} = long term stability standard uncertainty (storage) | ults = long term stability standard uncertainty (storage) |
| u _{te} = transport stability standard uncertainty | ute = transport stability standard uncertainty |

- 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

4.0

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° \pm 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

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; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 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

- January 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

SD978Ci Paul R Saines



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 Soluti | on |
|---------------------|--|--------------------|
| Catalog Number: | CLPP-CAL-3 | |
| Lot Number: | T2-MEB714159 | |
| Matrix: | 7% (v/v) HNO3 | |
| Value / Analyte(s): | 1 000 μg/mL ea: Arsenic, Selenium, | Lead, Thallium, |
| | 500 μg/mL ea: Cadmium | |

3.0 CERTIFIED VALUES AND UNCERTAINTIES

| ANALYTE Arsenic, As | CERTIFIED VALUE 1 000 ± 8 µg/mL | ANALYTE Cadmium, Cd | CERTIFIED VALUE 500.0 ± 2.1 μg/mL |
|------------------------|------------------------------------|------------------------|--------------------------------------|
| Lead, Pb | 1 000 ± 5 μg/mL | Selenium, Se | 1 000 ± 8 μg/mL |
| Thallium, Tl | 1 000 ± 7 μg/mL | | |

Density:

1.043 g/mL (measured at 20 \pm 4 °C)

Assay Information:

| ANALYTE | METHOD | NIST SRM# | SRM LOT# |
|---------|-----------|-----------|----------|
| As | ICP Assay | 3103a | 100818 |
| Cd | ICP Assay | 3108 | 130116 |
| Cd | EDTA | 928 | 928 |
| Pb | ICP Assay | 3128 | 101026 |
| Pb | EDTA | 928 | 928 |
| Se | ICP Assay | 3149 | 100901 |
| ТІ | ICP Assay | 3158 | 151215 |
| | | | |

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 | Characterization of CRM/RM by One Method Certified Value, X _{CRM/RM} , where one method of characterization |
|--|---|
| used is the weighted mean of the results: | is used is the mean of individual results: |
| $X_{CRM/RM} = \Sigma(w_i) (X_i)$ | X _{CRM/RM} = (X _a) (u _{char a}) |
| X _i = mean of Assay Method i with standard uncertainty u _{char i} | X _a = mean of Assay Method A with |
| w_i = the weighting factors for each method calculated using the inverse square of the variance: $w_i = (1/u_{chari})^2 / (\Sigma(1/(u_{chari})^2)$ | $\mathbf{u}_{char \ a}$ = the standard uncertainty of characterization Method A |
| CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k (u ² _{char} + u ² _{bb} + u ² _{lts} + u ² _{ts}) ^{1/2} | CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{chara}^2 + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ |
| k = coverage factor = 2 | k = coverage factor = 2 |
| $\mathbf{u_{char}} = \left[\sum ((\mathbf{w_i})^2 (\mathbf{u_{char}})^2)\right]^{\frac{1}{2}}$ where $\mathbf{u_{char}}$ are the errors from each characterization method | u _{char a} = the errors from characterization |
| ubb = bottle to bottle homogeneity standard uncertainty | ubb = bottle to bottle homogeneity standard uncertainty |
| u _{lts} = long term stability standard uncertainty (storage) | ults = long term stability standard uncertainty (storage) |
| u _{te} = transport stability standard uncertainty | ute = transport stability standard uncertainty |

- 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

4.0

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 $4^{\circ} - 24^{\circ}$ C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ 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

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

January 13, 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

- January 13, 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

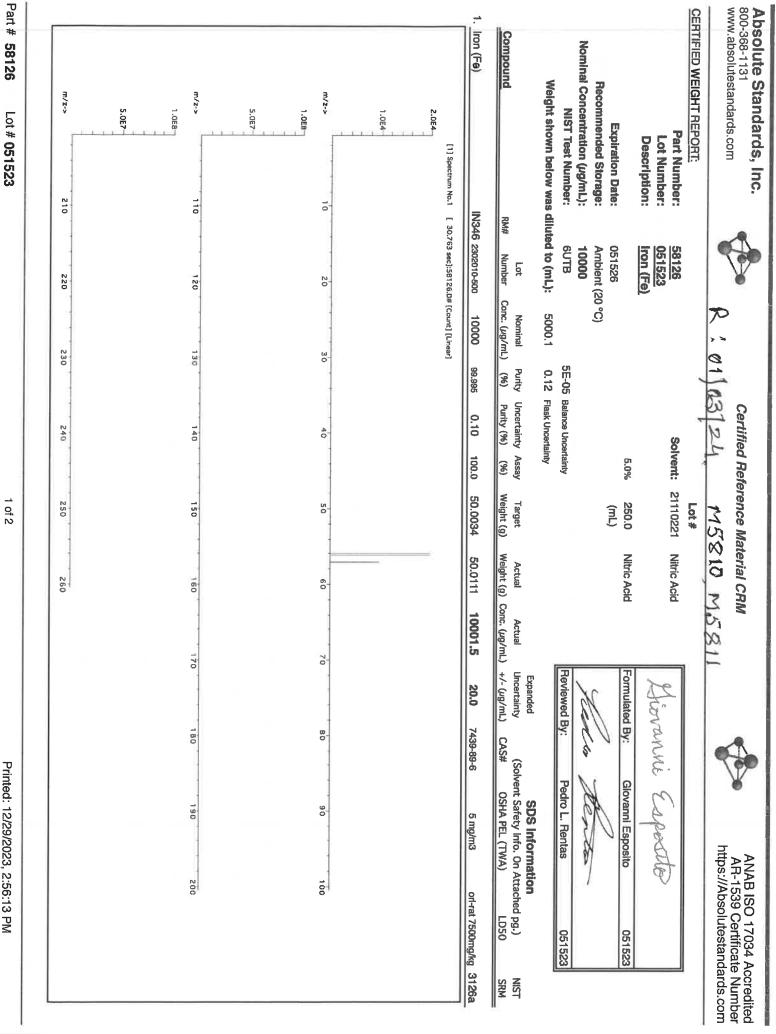
Certificate Approved By:

Thomas Kozikowski Manager, Quality Control

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

SD978Ci Paul R Saines



1 of 2

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| 11. 2015 BT 70000 an | 4002 C: 4002 Fe 4 | | Trace Metals Verification by ICP-MS (µg/mL) | Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | Description Descring <thdescring< th=""> Descring <thd< th=""><th></th></thd<></thdescring<> | |
|----------------------|---|----------------------|---|--|--|---|
| | (T) = Target analyte | (T) = Target analyte | (T) = Target analyte | Is Verification by ICP-MS (µg/mL) 4002 Ni 40.0 Pi Mi Mi Mi Mi | etrometry (ICP-MS): Is Verification by ICP-MS (μ g/mL) $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | trified Reference Material CRMCtrometry (ICP-MS):Is Verification by ICP-MS (µg/mL) 4002 Ni 402 Ni 402 4002 Ni 402 Re 402 32 4002 Re 402 32 32 402 402 Re 402 32 32 402 402 Re 402 32 32 402 402 Re 402 32 32 402 1 402 32 32 33 402 1 402 32 32 32 33 402 1 402 32 32 33 402 1 402 32 32 33 402 1 402 32 32 33 402 1 402 32 32 33 402 1 402 32 33 402 1 402 32 33 402 1 402 32 33 402 1 402 32 33 402 1 402 32 33 402 1 402 32 33 402 1 402 32 33 402 1 402 |

2 of 2

| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | - | Certified Reference Material CRM R : ষ্টি বিশ্ব M6025 | CRM ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
|--|---|---|---|
| CERTIFIED WEIGHT REPORT: Part Number: | 57182 | Lot # Solvent: 24002546 Nitric | Acid |
| Description: | Lead (Pb) | 2% 40.0 Nitric | Acid Formulated By: Lawence Barry |
| Expiration Date: Recommended Storage: Nominal Concentration (µq/mL): | 110926 Ambient (20 °C) 10000 | (mL) | Here ten |
| NIST Test Number: | 6UTB | 5E-05 Balance Uncertainty | Reviewed By: Pedro L. Rentas |
| Weight shown below was diluted to (mL): | | 2000.02 0.058 Flask Uncertainty | |
| | Lot | Nominal Purity Uncertainty Assay Target Actual | SDS Information sal Actual Uncertainty (Solvent Safety Info. On Attached pg.) |
| Compound | RM# Number Con | Purity (%) (%) Weight (g) W | (g) Conc. (µg/mL) +/- (µg/mL) CASi |
| 1. Lead(II) nitrate (Pb) | IN029 PBD122016A1 | 10000 93.999 0.10 62.5 32.0006 32.0040 | 040 10001.1 20.0 10099-74-8 0.05 mg/m3 |
| [1] Spectrum No.1 1.0E7 | - | 17.284 sec]:58182.D# [Count] [Linear] | |
| 5. ດ ຄ | | | |
| m/z-> 10 | 2 0 | 30 40 50 | 0 70 80 90 |
| | | | |
| 1.006 | | | |
| m/z-> 110 | 120 | 130 140 150 16 | 160 170 180 190 |
| | | | |
| | | | |
| | h | A30 K40 K50 20 | 260 |
| Part # 57182 Lot # 110923 | | 1 of 2 | Printed: 8/1/2024, 2:13:36 PM |

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https://Absolutestandards.com ANAB ISO 17034 Accreditec AR-1539 Certificate Number

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

| | | | and the second second | | | | TI acci ilio | Cais | VCITICA | | | C IA | HALLIN' | | | | | | |
|----|---------------|--------|-----------------------|-----|-------|----|--------------|------|---------|----|-------|------|---------|----|---------------|-----|-------|----|----------|
| AI | Am | 3 | AB | 7 | 3 | цг | 33 | : | 3 | NE | 2 | | 200 | 2 | | | | | |
| 3 | | 1 | | 1 | | | | ţ | 10.02 | 3 | 10.02 | 1.1 | 20.02 | ő | 70> | 01 | 20.02 | ¥ | <0.02 |
| S | 4 0.02 | ß | <0.2 | ц, | <0.02 | Но | 40.02 | E | <0.02 | Å | <0.02 | Re | <0.02 | Si | A0.02 | P | <0.02 | 9 | 40.02 |
| As | 4 0.2 | ĉ | <0.02 | E | <0.02 | 6 | <0.02 | Mg | <0.01 | õ | <0.02 | R | <0.02 | Ag | 40.02 | H | 40.02 | < | 20.02 |
| Ba | 40.02 | S | 40.02 | ନ୍ଥ | <0.02 | 7 | 40.02 | 5 | 30 | ¥ | 3 | Ŗ | 3 | ξ, | 5 | 7 | 5 | \$ | |
| 5 | 2 | 2 | | 2 | | | | | | 1 | | | | | 10.00 | *** | 70.02 | 77 | 10.02 |
| Be | 10.05 | ۵ ۵ | <0.02 | Ga | <0.02 | F | 40,2 | ЯH | 40.2 | ٩ | <0.02 | Ru | <0.02 | ş | ⊲ 0.02 | F | <0.02 | ~ | A0.02 |
| B | A0.02 | S | <0.02 | ନ୍ନ | <0.02 | 5 | <0.02 | Mo | <0.02 | 7 | <0.02 | Sm | <0.02 | 60 | 40.02 | 5 | <0.02 | Zn | Ang N |
| ₿ | <0.02 | Q | 4 0.02 | Au | <0.02 | \$ | т | M | <0.02 | ĸ | <0.2 | Sc | <0.02 | Ţ | 40,02 | 3 | 40.02 | 2 | 20.02 |

Physical Characterization:

(T)= Target analyte

Certified by:

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

Son P. Shirt

* 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 certifed (+/-) 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).

www.absolutestandards.com Absolute Standards, Inc. 800-368-1131 CERTIFIED WEIGHT REPORT: Ammonium hexafluorosilicate (Si) Compound Nominal Concentration (µg/mL): m/z-> m/z-> m/z-> **Recommended Storage:** 1.0E6 1.0E6 5.0E5 2.0 E6 2500 5000 Volume shown below was diluted to (mL): **NIST Test Number:** Expiration Date: Part Number: Lot Number: Description: [1] Spectrum No.1 010 110 0 58114 Number Part <u>57014</u> 030921 Silicon (Si) 6UTB 030924 1000 Ambient (20 °C) 070120 Number Бţ N 20 0 120 N_ 0 [31.393 sec]:58014.D# [Count] [Linear] 3000.41 0.1000 Dilution Factor 130 N3-0 β Vol. (mL) Pipette (mL) Conc. (µg/mL) 0.058 5E-05 300.0 Initial **Certified Reference Material CRM** Flask Uncertainty Balance Uncertainty Uncertainty N40 0.084 40 19410105 Nominal 2.0% Lot # 1000 250 (J 0 Conc. (µg/mL) Conc. (µg/mL) Nitric Acid Solvent: 10000.0 Initial 60.0 (mL) 260 160 0<u>0</u> Nitric Acid 1000.0 Final 170 0 Formulated By: Reviewed By: +/- (µg/mL) Uncertainty Expanded 2 deronce 180 00 O 16919-19-0 CAS# (Solvent Safety Info. On Attached pg.) OSHA PEL (TWA) Pedro L. Rentas e de Lawrence Barry 190 00 2.50 mg/m3 SDS Information 2 https://Absolutestandards.com ANAB ISO 17034 Accredited AR-1539 Certificate Number N00 100 orl-rat 70 mg/kg LD50 030921 030921 NIST SRM NA

Part # 57014

Lot # 030921

1 of 2

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

| | | | | | | | I race M | letais | Verifica | tion r | DY ICP-N | <u>) ()</u> S | J/mL) | | | | | | |
|----|-------|----|---------|----|-------|-----|----------|--------|----------|--------|----------|---------------|-------|----|-------|-----|-------|----|-------|
| 2 | 50 D2 | L7 | ~ n n n | ר | 50 M | 11f | 20.02 | 1: | 000 | NI: | ~ n n n | P . | 2002 | e2 | 2 | ŢŢ, | 2002 | W | 20.02 |
| A | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | N: | <0.02 | Pr | <0.02 | Se | <0.2 | Тъ | <0.02 | W | <0.02 |
| Sp | <0.02 | Ca | <0.2 | Er | <0.02 | Ho | <0.02 | Lu | <0.02 | Nb | <0.02 | Re | <0.02 | Si | Т | 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 |
| Ва | <0.02 | Cs | <0.02 | Gd | <0.02 | ŀr | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2 | Th | <0.02 | Уb | <0.02 |
| Be | <0.01 | Ω | <0.02 | Ga | <0.02 | Fe | <0.2 | Hg | <0.2 | Р | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | Y | <0.02 |
| B: | <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 |
| в | <0.02 | Cu | <0.02 | Au | <0.02 | Рь | <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.

En P. Stal

Certified by:

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

- 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 certifed (+/-) 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).

Part # 57014 Lot # 030921



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

Instructions for QATS Reference Material: ICP-AES ICS

QATS LABORATORY INORGANIC REFERENCE MATERIAL INTERFERENCE CHECK SAMPLE SET FOR ICP-AES (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.
 - **<u>CAUTION</u>**: 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 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-1211" and for the ICSAB mixture use "ICSA-1211+ICSB-0710".

<u>CAUTION:</u> 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 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 interference check sample set is to be used to verify inter-element and background correction factors of inductively-coupled plasma (ICP) spectrometers. This reference material set consists of two (2) concentrated solutions. The ICSA solution contains the four (4) interferent elements: AI, Ca, Fe, and Mg. The ICSB solution contains the analytes: Ag, As, Sb, Ba, Be,

RM ICP-AES ICSA-1211 B-0710 SFAM.docx

Page 1 of 2

QATS Form 20-007F189R01, 01-17-2023



The Quality Assurance Technical Support (QATS) contract is operated by APTIM Federal Services, LLC.



ICSA

M5126

M5127

M5128

M5129

M5130

Instructions for QATS Reference Material: ICP-AES ICS

Cd, Co, Cr, Cu, Mn, Ni, Pb, Tl, Se, V, and Zn. This instruction sheet provides the nominal values for ICP-AES 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-1211, Interferents: Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 2% v/v HNO₃. Analyze this ICSA solution by ICP-AES.

ICSB-0710, Analytes, mixed with ICSA-1211, 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 2% v/v HNO₃. Analyze this ICSAB solution by ICP-AES.

(D) "CERTIFIED VALUE" CONCENTRATIONS OF QATS ICP-AES 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. | "CERTIFIE | | | ERENCE CH | IECK SAMPL CSB-0710 | E ICP-AES IO | CSA-1211, |
|----------|-----------|------------------|------------------------|-------------------------|-----------------------------|------------------------|-------------------------|
| Element | CRQL | Part A (µg/L) | Low Limit (µg/L) | High Limit (µg/L) | Part A +Part B (µg/L) | Low Limit (µg/L) | High Limit (µg/L) |
| AI | 200 | 255000 | 216000 | 294000 | 247000 | 209000 | 285000 |
| Sb | 60 | (0.0) | -60.0 | 60.0 | 618 | 525 | 711 |
| As | 10 | (0.0) | -10.0 | 10.0 | 104 | 88.4 | 120 |
| Ва | 200 | (6.0) | -194 | 206 | (537) | 337 | 737 |
| Be | 5.0 | (0.0) | -5.0 | 5.0 | 495 | 420 | 570 |
| Cd | 5.0 | (1.0) | -4.0 | 6.0 | 972 | 826 | 1120 |
| Са | 5000 | 245000 | 208000 | 282000 | 235000 | 199000 | 271000 |
| Cr | 10 | (52.0) | 42.0 | 62.0 | 542 | 460 | 624 |
| Со | 50 | (0.0) | -50.0 | 50.0 | 476 | 404 | 548 |
| Cu | 25 | (2.0) | -23.0 | 27.0 | 511 | 434 | 588 |
| Fe | 100 | 101000 | 85600 | 116500 | 99300 | 84400 | 114500 |
| Pb | 10 | (0.0) | -10.0 | 10.0 | (49.0) | 39.0 | 59.0 |
| Mg | 5000 | 255000 | 216000 | 294000 | 248000 | 210000 | 286000 |
| Mn | 15 | (7.0) | -8.0 | 22.0 | 507 | 430 | 584 |
| Ni | 40 | (2.0) | -38.0 | 42.0 | 954 | 810 | 1100 |
| Se | 35 | (0.0) | -35.0 | 35.0 | (46.0) | 11.0 | 81.0 |
| Ag | 10 | (0.0) | -10.0 | 10.0 | 201 | 170 | 232 |
| TI | 25 | (0.0) | -25.0 | 25.0 | (108) | 83.0 | 133 |
| V | 50 | (0.0) | -50.0 | 50.0 | 491 | 417 | 565 |
| Zn | 60 | (0.0) | -60.0 | 60.0 | 952 | 809 | 1095 |

The acceptance ranges for all analytes in parentheses in the above table were determined using the listed certified value \pm 1 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.



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

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1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Ti

| Product Code: | Multi Analyte Custom Grade Solution | on |
|---------------------|---|---------------------|
| Catalog Number: | CHEM-QC-4 | |
| Lot Number: | S2-MEB711674 | |
| Matrix: | 3% (v/v) HNO3 3% (v/v) HF | |
| Value / Analyte(s): | 1 000 μg/mL ea: Boron, Silicon, Titanium | Molybdenum, Tin, |

Second Source: Whenever possible, this solution was manufactured from a second set of concentrates in our manufacturing facility.

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ICP Assay

| ANALYTE Boron, B | CERTIFIED VALUE 1 000 ± 7 μg/mL | ANALYTE Molybdenum, Mo | CERTIFIED VALUE 1 000 ± 5 μg/mL | |
|---------------------|------------------------------------|---------------------------|------------------------------------|----------|
| Silicon, Si | 1 000 ± 7 μg/mL | Tin, Sn | 1 000 ± 5 μg/mL | |
| Titanium, Ti | 1 001 ± 6 μg/mL | | | |
| Density: | 1.032 g/mL (meas | sured at 20 ± 4 °C) | | |
| Assay Information | ו: | | | |
| ANALYTE | METHOD | NIST SRM# | | SRM LOT# |
| В | ICP Assay | 3107 | | 110830 |
| Мо | ICP Assay | 3134 | | 130418 |
| Si | ICP Assay | 3150 | | 130912 |
| Sn | ICP Assay | 3161a | | 140917 |

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.

3162a

| Characterization of CRM/RM by Two or More Methods Certified Value, X _{CRM/RM} , where two or more methods of characterization are | Characterization of CRM/RM by One Method Certified Value, X _{CRM/RM} , where one method of characterization |
|--|---|
| used is the weighted mean of the results: | is used is the mean of individual results: |
| $X_{CRM/RM} = \Sigma(w_i) (X_i)$ | X _{CRM/RM} = (X _a) (u _{char a}) |
| X _i = mean of Assay Method i with standard uncertainty u _{char i} | X _a = mean of Assay Method A with |
| w_i = the weighting factors for each method calculated using the inverse square of the variance: $w_i = (1/u_{chari})^2 / (\Sigma(1/(u_{chari})^2)$ | u _{char} a = the standard uncertainty of characterization Method A |
| CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k (u ² _{char} + u ² _{bb} + u ² _{lts} + u ² _{ts}) ^{1/2} | CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k (u ² char a + u ² bb + u ² lts + u ² ts) ¹ |
| k = coverage factor = 2 | k = coverage factor = 2 |
| $\mathbf{u_{char}} = \left[\sum ((\mathbf{w_i})^2 (\mathbf{u_{char}})^2)\right]^{\frac{1}{2}}$ where $\mathbf{u_{char}}$ are the errors from each characterization method | u _{char a} = the errors from characterization |
| ubb = bottle to bottle homogeneity standard uncertainty | u _{bb} = bottle to bottle homogeneity standard uncertainty |
| u _{lts} = long term stability standard uncertainty (storage) | ults = long term stability standard uncertainty (storage) |
| u _{te} = transport stability standard uncertainty | ute = transport stability standard uncertainty |

- 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

4.0

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 $4^{\circ} - 24^{\circ}$ C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ 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

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

November 02, 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

- November 02, 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

Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Paul R Line



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

Instructions for QATS Reference Material: ICP-AES ICS

QATS LABORATORY INORGANIC REFERENCE MATERIAL INTERFERENCE CHECK SAMPLE SET FOR ICP-AES (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.
 - **<u>CAUTION</u>**: 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 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-1211" and for the ICSAB mixture use "ICSA-1211+ICSB-0710".

<u>CAUTION:</u> 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 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 interference check sample set is to be used to verify inter-element and background correction factors of inductively-coupled plasma (ICP) spectrometers. This reference material set consists of two (2) concentrated solutions. The ICSA solution contains the four (4) interferent elements: AI, Ca, Fe, and Mg. The ICSB solution contains the analytes: Ag, As, Sb, Ba, Be,

RM ICP-AES ICSA-1211 B-0710 SFAM.docx

Page 1 of 2

QATS Form 20-007F189R01, 01-17-2023



The Quality Assurance Technical Support (QATS) contract is operated by APTIM Federal Services, LLC.



ICSA

M5126

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M5130

Instructions for QATS Reference Material: ICP-AES ICS

Cd, Co, Cr, Cu, Mn, Ni, Pb, Tl, Se, V, and Zn. This instruction sheet provides the nominal values for ICP-AES 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-1211, Interferents: Pipet 10 mL of the ICSA solution into a 100 mL volumetric flask and dilute to volume with 2% v/v HNO₃. Analyze this ICSA solution by ICP-AES.

ICSB-0710, Analytes, mixed with ICSA-1211, 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 2% v/v HNO₃. Analyze this ICSAB solution by ICP-AES.

(D) "CERTIFIED VALUE" CONCENTRATIONS OF QATS ICP-AES 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. | "CERTIFIE | | | ERENCE CH | IECK SAMPL CSB-0710 | E ICP-AES IO | CSA-1211, |
|----------|-----------|------------------|------------------------|-------------------------|-----------------------------|------------------------|-------------------------|
| Element | CRQL | Part A (µg/L) | Low Limit (µg/L) | High Limit (µg/L) | Part A +Part B (µg/L) | Low Limit (µg/L) | High Limit (µg/L) |
| AI | 200 | 255000 | 216000 | 294000 | 247000 | 209000 | 285000 |
| Sb | 60 | (0.0) | -60.0 | 60.0 | 618 | 525 | 711 |
| As | 10 | (0.0) | -10.0 | 10.0 | 104 | 88.4 | 120 |
| Ва | 200 | (6.0) | -194 | 206 | (537) | 337 | 737 |
| Be | 5.0 | (0.0) | -5.0 | 5.0 | 495 | 420 | 570 |
| Cd | 5.0 | (1.0) | -4.0 | 6.0 | 972 | 826 | 1120 |
| Са | 5000 | 245000 | 208000 | 282000 | 235000 | 199000 | 271000 |
| Cr | 10 | (52.0) | 42.0 | 62.0 | 542 | 460 | 624 |
| Со | 50 | (0.0) | -50.0 | 50.0 | 476 | 404 | 548 |
| Cu | 25 | (2.0) | -23.0 | 27.0 | 511 | 434 | 588 |
| Fe | 100 | 101000 | 85600 | 116500 | 99300 | 84400 | 114500 |
| Pb | 10 | (0.0) | -10.0 | 10.0 | (49.0) | 39.0 | 59.0 |
| Mg | 5000 | 255000 | 216000 | 294000 | 248000 | 210000 | 286000 |
| Mn | 15 | (7.0) | -8.0 | 22.0 | 507 | 430 | 584 |
| Ni | 40 | (2.0) | -38.0 | 42.0 | 954 | 810 | 1100 |
| Se | 35 | (0.0) | -35.0 | 35.0 | (46.0) | 11.0 | 81.0 |
| Ag | 10 | (0.0) | -10.0 | 10.0 | 201 | 170 | 232 |
| TI | 25 | (0.0) | -25.0 | 25.0 | (108) | 83.0 | 133 |
| V | 50 | (0.0) | -50.0 | 50.0 | 491 | 417 | 565 |
| Zn | 60 | (0.0) | -60.0 | 60.0 | 952 | 809 | 1095 |

The acceptance ranges for all analytes in parentheses in the above table were determined using the listed certified value \pm 1 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.



1 of 2

Printed: 7/29/2022, 11:20:08 PM

| 800-368-1131 | Absolute Standards, II |
|--------------|------------------------|
| | Inc. |
| | 800-368-1131 |



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

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

| | | | | | | | race Me | etais | Verifica | ation | by ICP- | MC (| hg/mr) | | | | | | |
|----|-------|----------------|-------|----|-------|----|---------|-------|----------|----------------|---------|------|--------|----|-------|----|-------|----------------|-------------|
| | | | | | | | -01110- | | | | | | | | | | | | |
| Al | Т | G | <0.02 | Dy | <0.02 | Hf | <0.02 | Li | <0.02 | Ni | <0.02 | 77 | <0.02 | Se | <0.2 | Ъ | <0.02 | W | <u>6</u> .0 |
| Sр | <0.02 | ß | <0.2 | 막 | <0.02 | Но | <0.02 | Ŀ | <0.02 | Nb | <0.02 | Re | <0.02 | ŝ | <0.02 | Te | 40.02 | | <0.02 |
| As | <0.2 | င့ | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | ^S 0 | <0.02 | Rh | <0.02 | Ag | <0.02 | | 40.02 | V | 4 |
| Ba | <0.02 | ß | <0.02 | Gd | <0.02 | ١r | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2 | Þ | <0.02 | Υ γ | 4 |
| Be | <0.01 | Ω | <0.02 | Ga | <0.02 | Fe | <0.2 | Hg | <0.2 | P | <0.02 | Ru | <0.02 | ş | 40.02 | Jm | 40.02 | ¥ | |
| B: | <0.02 | S | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | ₽ | <0.02 | Sm | <0.02 | s | <0.02 | 2 | <0.02 | 7 | 4 |
| B | <0.02 | С ¹ | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | × | <0.2 | Ş | <0.02 | Ta | <0.02 | Ţ. | <0.02 | 27 | A) |

Physical Characterization:

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

(T)= Target analyte

Certified by:

In P. Mr.

* 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

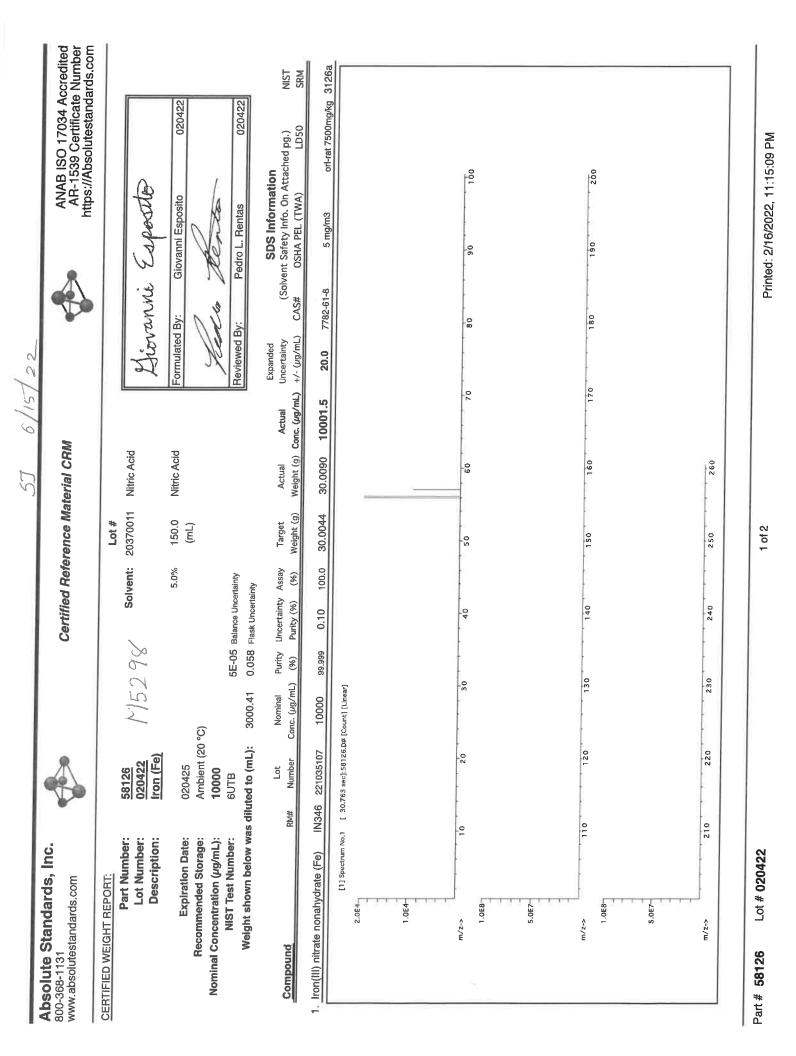
the preparation of all standards.

* 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 certifed (+/-) 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).



Absolute Standards, Inc. www.absolutestandards.com 800-368-1131





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

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

| 000 | 20 | 00.00 | | | | | | | | | ALC: NO | LI LI LI LI LI LI | | The state of the | | | | |
|-------|----|-------|----|-------|----|-------|------|-------|----------|-------|---------|-------------------|----------|------------------|----|-------|--------|-------|
| 70.07 | 3 | 20.02 | ĥ | <0.02 | Ħ | <0.02 | := | <0.02 | ïŻ | <0.10 | Å | 000- | 0 | 00 | Ē | | | |
| <0.02 | S | <0.2 | ц, | 2002 | ЦО | 000 | F | | ; ; | | * * | 70.02 | b o | 2.0> | 11 | <0.02 | > | <0.0× |
| 507 | c | 0.00 | i, | 10.04 | 2 | 70.02 | T'I | <0.02 | ٩Ż | <0.02 | Re | <0.02 | 55 | <0.02 | ť | 2007 | 11 | 001 |
| 7.02 | ŋ | <0.02 | 립 | <0.02 | In | <0.02 | Mo | /0.01 | ć | 000 | ē | | | | 2 | 10.02 | > | 20.02 |
| <0.02 | ڒ | 20.02 | 2 | 000 | | | 9 | 10.04 | ŝ | 70.02 | 2 | <0.02 | Ag | <0.02 | Ħ | ≤0.02 | > | <0.0> |
| | 3 | 70.04 | 3 | <0.UZ | 4 | <0.02 | Mn | <0.10 | Ρd | <0.02 | Rh | <0.02 | ٩Ŋ | 102 | É | 200 | | |
| <0.01 | გ | <0.5 | g | <0.02 | Ц. | C 02 | 'n, | | ¢ | | 1 | 1000 | PLT | 7.02 | 97 | <0.02 | Υb | <0.0≻ |
| <0.07 | ξ | 010 | ç | | , | 7.02 | 2112 | 7.02 | <u>ب</u> | <0.02 | 2 | <0.02 | S | <0.02 | Tm | <0.02 | > | 100 |
| 70.02 | 3 | 01.02 | 35 | <0.10 | ę | <0.02 | мо | <0.02 | Ł | <0.02 | mS. | 2007 | U | 200 | 5 | | ' । | 20.00 |
| <0.02 | õ | <0.10 | Υn | <0.02 | fd | <0.02 | NA | 20.02 | 1 | | 5 | 70.02 | 2 | 20.02 | Ч | <0.02 | Z Z | ×0.0 |
| | | | | | | | DLT | 20,02 | 4 | 202 | 22 | <0.02 | <u>e</u> | 000 | ï | 2007 | 1 | òç |

Physical Characterization:

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

Certified by:

Sur P

- * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. 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 certifed (+/-) 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).

| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | By: Lawrence Barr By: Lawrence Barr Jy: Pedro L. Renta SDS Info. (Solvent Safety Info. | 7790-69-4 | | Printed: 1/18/2023, 4:01:43 PM |
|--|--|------------------------------|--|--------------------------------|
| A | Formulated Formulated Reviewed E Actual Uncertainty | -H - H | ۶ <u>۲</u> | |
| aterial CRM | Nitric Acid Nitric Acid Actual Actual | | ar] 160 280 | |
| leference M | 20510011 20.0 (mL) (mL) Target | 100.0134 | 0 0 0 0 220 0 220 0 220 0 220 0 220 | 1 of 2 |
| Certified Reference Material CRW | Solvent: Solvent: Solvent: 2% 5E-05 Balance Uncertainty 0.058 Rask Uncertainty Purity Uncertainty Assay (%) Purity (%) (%) | 10.0 | 8103:D#[C 240 240 240 240 | |
| | C) C) 5E-05 B 1000.12 0.058 F Nominal Purity t no. (ug/mL) (%) | 88.999 | 9.619 sec]:58103: 30 130 14 230 24 14 | |
| | | | | |
| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Lot Number: Description: Expiration Date: Thilum (070622 Recommended Storage: Nominal Concentration (µg/mL): Nominal Concentration (µg/mL): Neight shown below was diluted to (mL): Compound RM# Number | 1. Lithium nitrate (Li) IN01 | [1] Spectrum No.1 1.0E6 5.0E5 m/z-> 10 500 500 500 10 10 10 10 10 10 10 10 10 | |

Absolute Standards, Inc. www.absolutestandards.com 800-368-1131



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

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

| | | | | | | | | | | | | and the second se | and | | The state of the s | | | | |
|----|-------|----|-------|----|-------|------|-------|---------|-------|----|-------|---|---|-----|--|--------|-------|------------|-------|
| - | <0.02 | 3 | <0.02 | Dy | <0.02 | Hf | <0.02 | E | Ŧ | N | <0.02 | 占 | <0.02 | Se | ₫02 | e. | <0.02 | M | 000> |
| Sb | <0.02 | లి | ⊲0.2 | Ъ | <0.02 | Ho | <0.02 | La L | ≤0.0> | ź | ≤0:0> | Re | <0.0> | 3 | €0.02 | e H | <0.02 | Þ | 4002 |
| S | ₫2 | ථ | <0.02 | 围 | <0.02 | H | 0.02 | Mg | 10.0> | ő | <0.02 | Rh | <0.02 | Ag | <0.02 | F | <0.02 | > | |
| | <0.02 | ర | <0.02 | 3 | <0.02 | h | 40.02 | Wa | <0.02 | Pd | <0.02 | Rb. | 40.02 | Z | 202 | Ē | CU CU | 5 | |
| ė | ≤0.01 | ර | <0.02 | පී | <0.02 | £ | <02 | He | <02 | Δ. | <0,00 | Ru | 89 | 3 | 200 | Ę | 200 | 2 > | 70.00 |
| | <0.02 | ථ | <0.02 | ප | <0.02 | el | A002 | Ň | 20.02 | Å | 200 | , e | 200 | 5 0 | 100 | 1 5 | | - 1 - 1 | 70105 |
| 6 | <0.02 | õ | <0.02 | Au | <0.02 | i de | 0.02 | PN | <0.02 | × | <02 | 3 | | ρĘ | | i F | | 5 4 | |

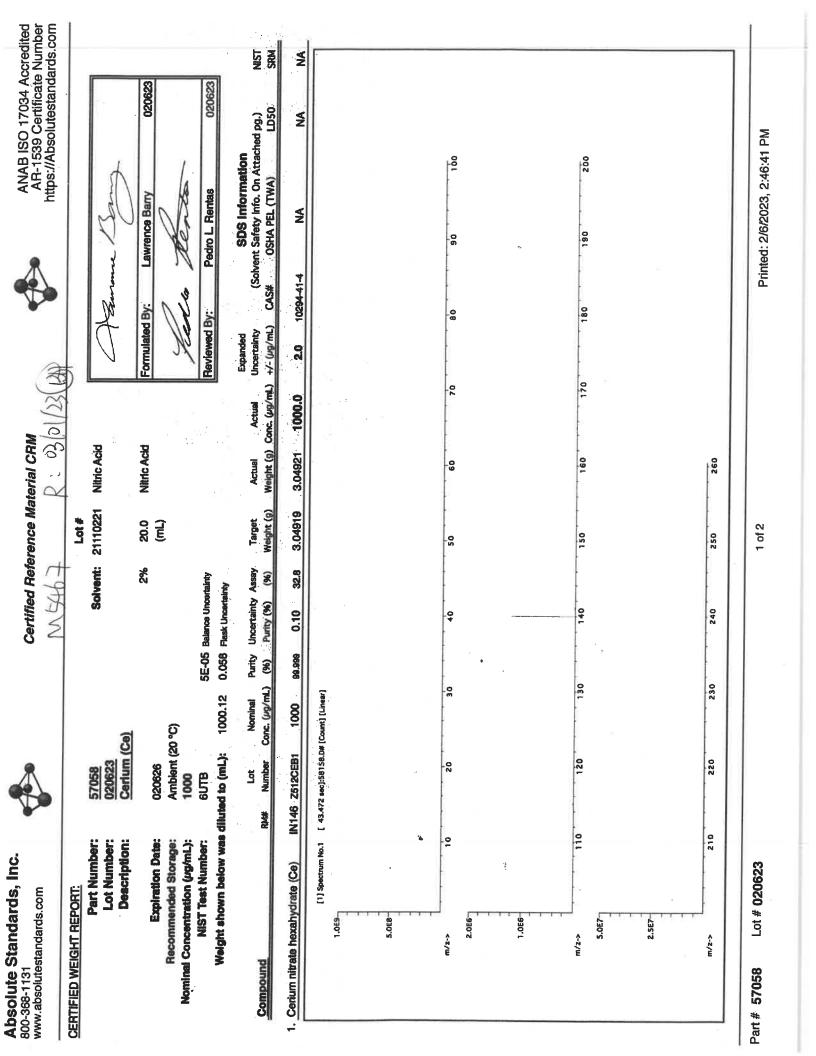
Physical Characterization:

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 certifed (+/-) 0.5% of the stated value, unless otherwise stated.
- * 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). All Standards should be stored with caps tight and under appropriate laboratory conditions.

Lot # 070622 Part # 57103



Absolute Standards, Inc. www.absolutestandards.com 800-368-1131



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

| | 42 Hr 488 W | | <0.02 Te <0.02 U | Ag <0.02 T1 <0.02 V <0.02 | <02 Th <0.02 Yb | <0.02 Tm <0.02 Y | <0.02 Sn <0.02 Zn | <0.02 Ti <0.02 Zr |
|------------------|-------------|-------|------------------|---------------------------|-----------------|------------------|-------------------|-------------------|
| (mL) | 002 | 70.05 | 20.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| igu, | đ | 1 | ž | Rh | Rb | Ru | Sm | ŝ |
| V ILP-MS | 00 | | 20.05 | <0.02 | <0.02 | <0.02 | <0.02 | <02 |
| | in in | | 2 | °s | РД | <u>a</u> , | Ł | Х |
| ventication by I | 002 | 1000 | 70'02 | €0.01 | <0.02 | <02 | <0.02 | <0.02 |
| Metals | | ٩, | 3 | Mg | Mn | Hg | Mo | PN |
| I race me | 002 | 4000 | 20,02 | <0.02 | <0.02 | 40 2 | <0.02 | <0.02 |
| | Hf | | 윤 | ų | Ц | Fe | La | £ |
| | 4002 | | 20102 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | M | 5 1 | 뉙 | 圕 | З | e B | 3 | Au |
| | 400 | | 2.02 | L | <0.02 | <0.02 | <0.02 | <0.02 |
| | 5 | \$, | 3 | ප | ర | 5 | 8 | ð |
| | 000 | 20.0 | 20:02 | 4 0.2 | <0.02 | €0.01 | <0.02 | <0.02 |
| | AI | | 2 | As | Ba | Be | 盗 | P |

(T)= Target analyte

Physical Characterization:

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

Certified by:

Ser P

* 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).

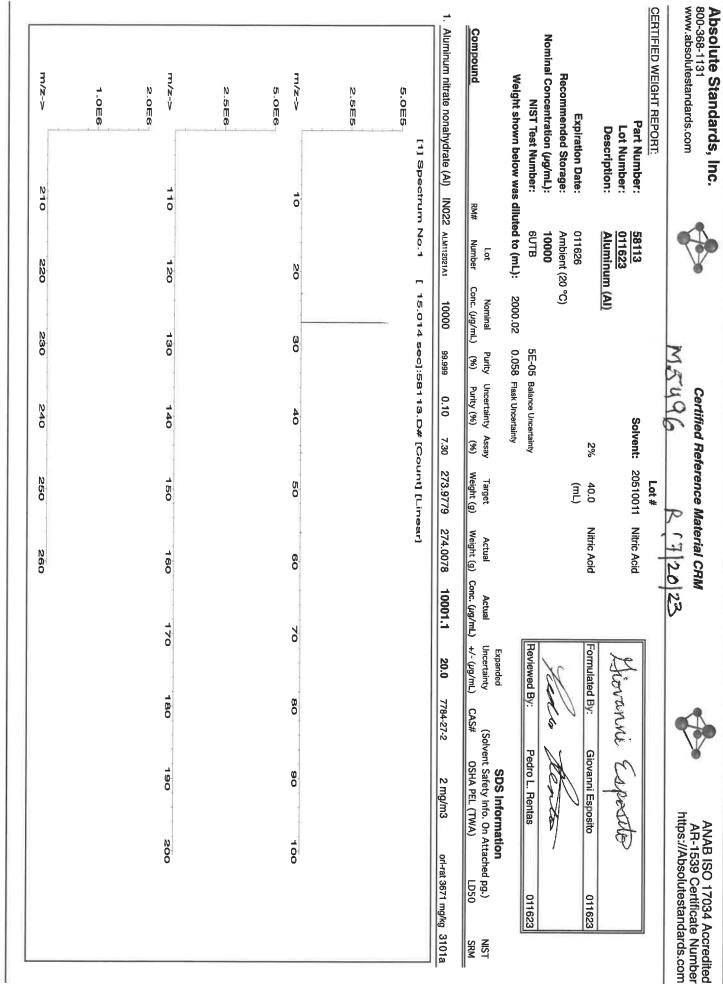
Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated.

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| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | 031523 | on ttached pg.) NIST LD50 SRM ont-rat >2000mo/kg 3109a | Ő | O O N |
|--|--|--|---|--|
| ARA | Ped X Gio | SDS Information (Solvent Safety Info. On Attached pg.) COSHA PEL (TWA) LD5(COSHA PEL (TWA) onl-rat >2000 | -0 0 | 190 |
| MUXCITI | Formulated By: Reviewed By: | Expanded Uncertainty +/- (µg/mL) CAS: 20.0 471-34 | Q R | 170 |
| 170 | | Actual Actual Weight (g) Conc. (ug/mL) 75.2093 10001.4 | So | 1900 1900 1900 |
| Certified Reference Material CRM | Lot # Solvent: 21110221 2% 60.0 (mL) Uncertainty sentainty | Uncertainty Assay Target Purity (%) (%) Weight (g) 0.10 38.9 75.1990 | 0.D# [Count] [Line | 140 150 240 250 |
| NV5497 | 5E-05 Balance 00.41 0.058 Flask Un | Nominal Purity Uncertainty Conc. (<i>ug/m</i> L) (%) Purity (%) 10000 99.999 0.10 | 30 30 | - 30 5 7 30 7 30 |
| | 58120 031523 031526 031526 Ambient (20 10000 6UTB 6UTB 6UTB | Lot A RM# Number Con | 10 To 1 12 | 220 |
| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | CERTIFIED WEIGHT REPORT: Part Number: 58120 Lot Number: 031523 Description: 031526 Expiration Date: 031526 Recommended Storage: Ambient (2 Nominal Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was diluted to (mL): | Compound 1. Calcium carbonate (Ca) | 2.0E4 1.0E4 3.0E4 5.0E4 2.5E4 | T.OES 1.0ES 5.0E4 m/2-> 2 m/2-> 2 Part # 58120 Lot # 031523 |

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Absolute Standards, inc. 800-368-1131 www.absolutestandards.com

Certified Reference Material CRM



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

| | <0.02 | 3 | <0.02 | ĥ | <0.02 | Hf | <0.02 | Ц | <0.02 | z | <0.02 | Ł | <0.02 | ŝ | <0.2 | £ | <0.02 | × | <0.02 |
|---|--------------|----|--------------|----|--------------|----|-------|----|--------------|----|---------------|----|-------|----|-------|----|-------|---|-------|
| _ | <0.02 | లి | ٣ | 固 | 40.02 | Bo | 40.02 | 3 | <u>60.05</u> | ź | <0.02 | Se | <0.02 | ŝ | <0.02 | Te | <0.02 | Þ | 40.02 |
| | 40 12 | ථ | 40.02 | a | 40.02 | h | <0.02 | Mg | ±0.01 | ő | <u>60</u> .02 | 2 | <0.02 | Ag | <0.02 | F | <0.02 | > | <0.02 |
| _ | €0.05 | ඊ | <0.02 | 3 | 40.02 | 놰 | <0.02 | Å | €0.02 | æ | <0.02 | å | <0.02 | Na | <0.2 | Ę | <0.02 | ይ | 40.02 |
| | <0.01 | q | <0.02 | ß | 40.02 | Ę | 402 | Hg | <0.2 | ۵. | <0.02 | Ru | <0.02 | S | €0.02 | Ę | <0.02 | × | <0.02 |
| | ≤0.02 | გ | <u>60.02</u> | ප් | 40.02 | 3 | 0.02 | Mo | <0.02 | æ | <0.02 | Sn | <0.02 | S | <0.02 | Sn | <0.02 | Ŋ | <0.02 |
| | ≤0.02 | ð | <u>60.05</u> | Au | 000 | £ | <0.02 | PN | <u>40.02</u> | Å | 40.2 | ŝ | <0.02 | T. | ≤0.02 | Ę | <0.02 | 2 | 2002 |

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.

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Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).

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Part # 58120 Lot # 031523

| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | 031523 | on ttached pg.) NIST LD50 SRM ont-rat >2000mo/kg 3109a | Ő | O O N |
|--|--|--|---|--|
| ARA | Ped X Gio | SDS Information (Solvent Safety Info. On Attached pg.) COSHA PEL (TWA) LD5(COSHA PEL (TWA) onl-rat >2000 | -0 0 | 190 |
| MUXCITI | Formulated By: Reviewed By: | Expanded Uncertainty +/- (µg/mL) CAS: 20.0 471-34 | Q R | 170 |
| 170 | | Actual Actual Weight (g) Conc. (ug/mL) 75.2093 10001.4 | So | 1900 1900 1900 |
| Certified Reference Material CRM | Lot # Solvent: 21110221 2% 60.0 (mL) Uncertainty sentainty | Uncertainty Assay Target Purity (%) (%) Weight (g) 0.10 38.9 75.1990 | 0.D# [Count] [Line | 140 150 240 250 |
| NV5497 | 5E-05 Balance 00.41 0.058 Flask Un | Nominal Purity Uncertainty Conc. (<i>ug/m</i> L) (%) Purity (%) 10000 99.999 0.10 | 30 30 | - 30 5 7 30 7 30 |
| | 58120 031523 031526 031526 Ambient (20 10000 6UTB 6UTB 6UTB | Lot A RM# Number Con | 10 To 1 12 | 220 |
| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | CERTIFIED WEIGHT REPORT: Part Number: 58120 Lot Number: 031523 Description: 031526 Expiration Date: 031526 Recommended Storage: Ambient (2 Nominal Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was diluted to (mL): | Compound 1. Calcium carbonate (Ca) | 2.0E4 1.0E4 3.0E4 5.0E4 2.5E4 | T.OES 1.0ES 5.0E4 m/2-> 2 m/2-> 2 Part # 58120 Lot # 031523 |

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Absolute Standards, inc. 800-368-1131 www.absolutestandards.com

Certified Reference Material CRM



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

| | <0.02 | 3 | <0.02 | ĥ | <0.02 | Hf | <0.02 | Ц | <0.02 | z | <0.02 | Ł | <0.02 | ŝ | <0.2 | £ | <0.02 | × | <0.02 |
|---|--------------|----|--------------|----|--------------|----|-------|----|--------------|----|---------------|----|-------|----|-------|----|-------|---|-------|
| _ | <0.02 | లి | ٣ | 固 | 40.02 | Bo | 40.02 | 3 | <u>60.05</u> | ź | <0.02 | Se | <0.02 | ŝ | <0.02 | Te | <0.02 | Þ | 40.02 |
| | 40 12 | ථ | 40.02 | a | 40.02 | h | <0.02 | Mg | ±0.01 | ő | <u>60</u> .02 | 2 | <0.02 | Ag | <0.02 | F | <0.02 | > | <0.02 |
| _ | €0.05 | ඊ | <0.02 | 3 | 40.02 | 놰 | <0.02 | Å | €0.02 | æ | <0.02 | å | <0.02 | Na | <0.2 | Ę | <0.02 | ያ | 40.02 |
| | <0.01 | q | <0.02 | g | 40.02 | Ę | 402 | Hg | <0.2 | ۵. | <0.02 | Ru | <0.02 | S | €0.02 | Ę | <0.02 | × | <0.02 |
| | ≤0.02 | გ | <u>60.02</u> | ප් | 40.02 | 3 | 0.02 | Mo | <0.02 | æ | <0.02 | Sn | <0.02 | S | <0.02 | Sn | <0.02 | Ŋ | <0.02 |
| | ≤0.02 | ð | <u>60.05</u> | Au | 000 | £ | <0.02 | PN | <u>40.02</u> | Å | 40.2 | ŝ | <0.02 | T. | ≤0.02 | Ę | <0.02 | 2 | 2002 |

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.

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Part # 58120 Lot # 031523

| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | | | | Certified R | Certified Reference Material CRM | aterial CRI | R 103/17 | H/2 | | AN AF https | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | Accredited ate Number ndards.com |
|--|--|--------------------------|--------------------|--|---------------------------------------|----------------------|-------------------------|--|----------------------|---|--|--|
| CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description: | r: <u>57182</u> rr: <u>061522</u> n: <u>Lead (Pb</u>) | - | | Solvent: | Lot # It: 20510011 | Nitric Acid | | Lievannie | / nui E | apertite | | |
| Expiration Date:061525Recommended Storage:Ambient (2)Nominal Concentration (ug/mL):10000NIST Test Number:6UTBWeight shown below was diluted to (mL): | e: 061525 e: Ambient (20 °C)): 10000 n: 6UTB rs diluted to (mL): 20 | 0 °C) 2000.02 | 5E-05 B 0.058 F | 2% 5E-05 Balance Uncertainty 0.058 Flask Uncertainty | 2% 40.0 mty (mL) | Nitric Acid | | Formulated By: | | Giovanní Esposito | 061522 | য় য |
| Compound | Lot RM# : Number | Nominal Conc. (µg/mL) | Purity (%) | Uncertainty Assay Purity (%) (%) | ay Target) Weight (g) | Actual Weight (g) | Actual Conc. (µg/mL) | Expanded Uncertainty +/- (µg/mL) C | Solvent S CAS# 0S | SDS information (Solvent Safety Info. On Attached pg.) COHA PEL (TWA) | tion Attached pg.) LD50 | NIST |
| 1. Lead(II) nitrate (Pb) | IN029 PBD122016A1 | 10000 | 99,999 | 0.10 62.5 | 5 32.0006 | | 10001.1 | | φ | 0.05 ma/m3 | introne | |
| [1] Speci | [1] Spectrum No.1 [| 17.284 s | 90]:58 | 85.D# | 17.284 sec]:58182.D# [Count] [Linear] | (upe | | | | | | 11 |
| ສ ອ ອ | | | | | | | | | | | | |
| 2.0E6 | 20 | O. | | 40 | 80 | Co | 20 | Ö Ø | 0 | * | 100 | |
| 1.056 | | | | | | | | | | | | |
| rn/z-> | 110 | 130 | | 140 | 150 | 160 | 170 | 180 | | 0 | 002 | |
| ы С. С. Ш. С. | | | | | | | | | | | | |
| R A E | 210 220 | 530 | | N 0 | 250 | 260 | | | | | | |
| Part # 57182 Lot # 061522 | | | | | 1 of 2 | | | | Printed: 3 | Printed: 3/16/2023, 1:45:32 PM | 45:32 PM | |

-

Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com



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

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

| F | | | | | | | | | | | | | | | | | |
|-----------|---------|-------|-------|----|---|-----|-------|------------|--------------|-----|--------------|----|--------------|-----|--------|----|-------|
| | d <0.02 | Ŋ | <0.02 | Hf | <0.02 | Li | <0.02 | in in | <0.02 | đ | 4000 | 3 | C.04 | 14 | WWV | - | 000 |
| | | d | 000 | 14 | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | | 1 | | : | | 2 | 10 | 10 | 70.02 | * | ZULUS |
| _ | | đ | 20.02 | 2 | | 3 | <0.02 | q | <0.02 | g | 40.02 | ŝ | <u>60.05</u> | Te | \$0.02 | Ŋ | ≤0.02 |
| 02 ₹07 | ` | đ | <0.02 | 9 | 0.02 | Mg | <0.01 | ő | <0.02 | 4a | <0.02 | Åø | 2007 | F | 200 | 1 | Ş |
| _ | _ | 5 | 2007 | 1 | 200 | 1 | 000 | i | | | | 9 | | 17 | 70.02 | > | 70702 |
| | | 3 | 70.70 | 4 | | UIW | 20'02 | P2 | <0.02 | 2 | 40.02 | Ra | 5 9 9 | đ | ≤0.02 | \$ | 20.02 |
| | _ | g | 0.02 | Ъ. | €02 | Нg | <0.2 | 9 | 2002 | n d | 2007 | 2 | 2007 | e | 000 | | |
| | _ | Ċ | | , | | | | • | | | 70.00 | 5 | 70.02 | 111 | 70.02 | H | 20102 |
| | | 5 | | ġ | <0.02 | Wo | <0.02 | Z . | <u>6</u> .62 | SB | 40.02 | s | <0.02 | Sn | <000> | Zn | 2007 |
| | | Au Au | <0.02 | £ | F | 72 | 2007 | 2 | 500 | 0 | ~~~~ | ŧ | | | | 1 | 10.01 |
| | | | | | | | 70.00 | 4 | 10 | 20 | 20.02 | 13 | | q | 8.U2 | 3 | 808 |

Physical Characterization:

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

In P M.

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 certifed (+/-) 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).

Part # 57182 Lot # 061522

| m/z-> | 5 0 0 0 | m/z-> 1.0⋿4 | 1.065 | m/z-> 2.065 | 1.000 | N.OE | 1. Potassium nitrate (K) | Compound | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa | CERTIFIED WEIGHT REPORT: Part I Lot I Des | 800-368-1131 www.absolutestandards.com |
|-------------|------------------|----------------|-------|----------------|-------|---------------------------------------|--------------------------|--|---|---|--|
| 210 220 | | 110 120 | | 10 | | [1] Spectrum No.1 [| IN034 KD022021A1 | RM# Number | Expiration Date:120825Recommended Storage:Ambient (20 °C)Il Concentration (µg/mL):10000NIST Test Number:6UTBWeight shown below was diluted to (mL):30 | <u>PORT:</u> Part Number: <u>58119</u> Lot Number: <u>120822</u> Description: <u>Potassium (K)</u> | om |
| 230 | | 130 | | ۵ O | | | 10000 . 9 | Nominal P Conc. (µg/mL) | 20 °C) 3000.4 | am (K) | |
| 240 | | 140 | | 4. 0. | | 35.763 sec]:58119.D# [Count] [Linear] | 99.999 0.10 37.6 | Purity Uncertainty Assay (%) Purity (%) (%) | 29 5E-05 Balance Uncertainty 0.06 Flask Uncertainty | Solvent: | Certified R |
| N U U | | 150 | | ທ. ດ | | čount] [Line | .6 79.7990 | ay Target 5) Weight (g) | 2% 60.0 (mL) | Lot # nt: 20510011 | Certified Reference Material CRM |
| N 20 | | 160 | | 0 | | er) | | Actual / Weight (g) Conc | Nitric Acid | Nitric Acid | terial CRM |
| | | 170 | | 70 | | | 10001.1 20.0 | Expanded Actual Uncertainty Conc. (µg/mL) +/- (µg/mL) | Revie | re | R R: 0 |
| | | 180 | | 8 O | | | .0 7757-79-1 | CAS | Formulated By: | tovanni | RINA |
| | | 190 | | 8 0 | | | 5 mg/m3 | SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD5(| Giovanni Esposito | Especito | THE S |
| | | 200 | | 10.00 | | · | orl-rat 3015 mg/kg | mation On Attached pg.) (A) LD50 | 120822 | Ğ | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
| | | | | | | | lei I | NIST | | | 4 Accredite cate Numb andards.co |

Part # 58119 Lot # 120822

1 of 2

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| M | Printed: 3/16/2023, 1:45:22 PM | Printed: 3 | | | | | | 2 of 2 | | | | | | | 0822 | Lot # 120822 | | rt # 58119 | Part # |
|--|--|-----------------|---|----------------------|---|--|---|-----------------------------------|---|---|--|---|---|--|--|---|---|--|-------------|
| | | | - · | above) of NIS | to NIST (see above). 9 Uncertainty of NIST 9.C. (1994). | the U | Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). Standards are certifed (+/-) 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). | weight 1. and E: fice, W | ated with ise stated laborator valuating rinting Of | e calibr otherw opriate es for E ment P | in to use. is that arrive, unless inder appr "Guidelin S. Govern | ed prio ed valu t and ui t, C.E., 297, U. | lly using the stat and Kuya Il Note 1: | netrica).5% of d with of r, B.N. | Standards are prepared gravimetrically using balances that are calibrated with weights trace Standards are certifed (+/-) 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 Expressi Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washing | prepa certifi should eferenu Result | dards an dards an tandards ar tandards surement | * Star * All s Mea | |
| | | | tated. sed in | erwise s Is are u | s unless otherwise stated. raw materials are used in | nts un nty rav | The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. Purified acids, 18.2 megohim deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards. | etric m I the hi | nd volum sware and | netric a A glas | om gravir Ited Class | ated fr calibra | ion calcu ed water | xentrat deioniz ds. | The certified value is the concert Purified acids, 18.2 megohim deic the preparation of all standards. All the preparation of all standards. | value is 18.2 j on of a | certified red acids preparati | * The * Purit the | |
| | 1 | | | | | | | | | | | | | | | | | | |
| | | | | | | · | : | : > | | | | | ÷ | | | | | | |
| | in P. M. | 1 | | | | | | | | idard. | of this stan | paration | l in the pre | observe | Homogeneity: No heterogeneity was observed in the preparation of this standard. | heterog | ;eneity: No | Homog | |
| | Certified by: | | | | | | | | | | | | | | ation: | acteriz | Physical Characterization: | Physi | |
| | | | | | . 5 | | liyte | (T) = Target analyte | (T) = Ta | | | | | | æ | | | | |
| 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | 40,02 40,02 40,02 40,02 40,02 7 5 40,02 7 5 40,02 7 5 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | I S 클 I I I I I | 4444 888 828 828 828 828 828 828 828 828 | Ta Sr Ag Si Se | 444444 888888888 | Sc S | - & & & & & & & & & & & & & & & & & & & | x y v y o y y | 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | Ng H Mg L L | 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8 | 34 日 4 日 5 五 | 88888888 88888888 | <u> </u> | 40.020 | 5 S S S S S S S | 400 400 200 200 200 200 200 200 200 200 | Al As Ba Bi Bi | |
| | | | | Ň | (µg/mL) | S | Verification by ICP-M | ation | Verific | Metals | Trace N | | | | | | | | |
| | | | | | | | (S): | ICP-N | ometry (| Spectr | ma Mass | ed Plas | y Couple | uctivel | Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | Analys | umental. | Instr | |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | ANAB IS AR-1539 https://Abs | | | | | CRM | Certified Reference Material CRM | rence | fied Refe | Certi | | | V | | , Inc. | dards.con | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | Absolute : 800-368-1131 www.absolute | ₹8 2 |

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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 Cu | stom Grade Solut | lion |
|---------------------|--|----------------------------|------------------------|
| Catalog Number: | CLPP-SPK-1 | | |
| Lot Number: | T2-MEB721963 | | |
| Matrix: | 7% (v/v) HNO3 | | |
| Value / Analyte(s): | 2 000 µg/mL ea: Aluminum, | | Barium, |
| | 1 000 μg/mL ea: Iron, | | |
| | 500 μg/mL ea: Manganese, Vanadium, Cobalt, | | Nickel, Zinc, |
| | 250 μg/mL ea: Copper, | | |
| | 200 µg/mL ea: Chromium, | | |
| | 50 µg/mL ea: Beryllium, ES AND UNCERTAI | NTIES | Silver |
| | | ANALYTE | CERTIFIED VALUE |
| Aluminum, Al | 2 000 ± 7 µg/mL | Barlum, Ba | 2 000 ± 9 µg/mL |
| Beryilium, 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 |
| lron, Fe | 1 000 ± 4 μg/mL | Mangan ese , 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:

3.0

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 |
| AI | 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 |
| Со | 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_{CRMRM}, where two or more methods of characterization are used is the weighted mean of the results:

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

- $X_i =$ mean of Assay Method i with standard uncertainty u_{char} i $w_i \approx$ the weighting factors for each method calculated using the inverse square of the variance:
 - $w_{i} = (1/u_{char\,i})^{2} / (\Sigma(1/(u_{char\,i})^{2})$

CRM/RM Expanded Uncertainty (2) = U_{CRM/RM} = k $(u^2_{char} + u^2_{bb} + u^2_{ta} + u^2_{ta})^{ta}$

k = coverage factor = 2

- $u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{\frac{1}{2}}$ where u_{char} are the errors from each characterization method ubb = bottle to bottle homogeneity standard uncertainty
- uits = long term stability standard uncertainty (storage)
- uts = transport stability standard uncertainty

4.0 **TRACEABILITY TO NIST**

Characterization of CRM/RM by One Method Certified Value, $\mathbf{X}_{\text{CRM/RM}}$, where one method of characterization is used is the mean of individual results:

 $X_{CRM/RM} = (X_a) (u_{char a})$ Xa = mean of Assay Method A with Uchar a = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (2) = U_{CRM/RM} = k $(u^2_{chara} + u^2_{bb} + u^2_{lb} + u^2_{cb})^{\frac{1}{2}}$ k = coverage factor = 2 uchar a = the errors from characterization

ubb = bottle to bottle homogeneity standard uncertainty

- uite = long term stability standard uncertainty (storage)
- uts = transport stability standard uncertainty

- 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 $20^\circ \pm 4^\circ$ 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

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; into@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 CRWRM 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

DOJ781.

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

| m/z-> | N.5 6 | m/z-> 5.0E5 | 5.0 5 5 | m/z-> 1.0≣6 | 5000 | 1.064 | 1. Chromium(III) nitrate nonahydrate (Cr) | Compound | Volume sho | Expiration Date: Recommended Storage: Nominal Concentration (ug/mL): | Par De | CERTIFIED WEIGHT REPORT: | www.absolutestandards.com |
|---------|----------|----------------|---------------|----------------|------|---------------------------------------|---|---|---|--|---|--------------------------|---|
| N 10 | | 140 | | 1 | | [1] Spectrum No.1 | | Pa | Volume shown below was diluted to (mL): | Expiration Date: nended Storage: ntration (µg/mL): | Part Number: Lot Number: Description: | | 3 |
| 220 | | 120 | | N. O | | - | 58124 071122 | Part Lot Number Number | filuted to (mL): | 060526 Ambient (20 °C) 1000 | <u>58024</u> 060523 Chromium (Cr) | | A |
| 230 | | 130 | | ů. O | | 31,393 80 | 0.1000 | Dilution Factor | 2000.02 | | | | MS |
| 240 | | 140 | | | | c]:57024. | 200.0 0.084 | Initial Uncertainty Vol. (mL) Pipette (mL) | 0.058 Flask U | | | | MS658 |
| | | | | ð. | | 31,393 sec]:57024.D# [Count] [Línear] | 084 1000 | Uncertainty Nominal Pipetta (mL) Conc. (µg/mL) | Flask Uncertainty | | 21110221 2.0% | Lot # |) B |
| N 50 | | ۲ O | | S | | t] [Linear] | 10 10000.1 | nal Initial g/mL) Conc. (µg/mL) | | (mL) | 221 Nitric Acid % 40.0 | # Solvent: | |
| 200 | | 180 | | 0 | | ş | 0.1 1000.0 | al Final rg/mL) Conc. (µg/mL) | | Ľ | .0 Nitric Acid | ent: | 123 |
| | | 170 | | 70 | | | 0.0 2.2 | Expanded al Uncertainty ig/mL) +/- (µg/mL) | neviewed by. | X | Acid Formulated By: | | 1 |
| | | 180 | | 8- 0- | | 1 | 7789-02-8 |) CAS | su by. | a la | Horney: | | |
| | | 180 | | Ŷ | | | | olvent OS | reulo L. noillas | ten | Lawrence Barry | | Y |
| | | N O O | | 100 | | | 0.5 mg(Cr)/m3 orl- | SDS Information nt Safety Info. On Attac OSHA PEL (TWA) | | Ø | nce Barry | | AH-15: https://Ab |
| | | 0 | | o | | | ort-rat 3250 mg/kg | ched pg.) LDS0 | 000050 | 00050 | 060523 | | AH-1539 Certificate Number https://Absolutestandards.com |
| | | | | | | | g 3112a | NIST | ل | 0 | [ω] | IJ | te Numbei Jards.com |

Part # 58024 Lot # 060523

1 of 2

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| Absolute 800-368-1131 www.absolute | Absolute Standards, Inc. Certified Reference 800-368-1131 www.absolutestandards.com www.absolutestandards.com instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | י, Inc. | ctively | V Coupled | Plasm | na Mass S | Ce Ce | rtified Ru | eferer CP-Mi | Certified Reference Material Ci trometry (ICP-MS): | rial C | RM | | | | | | https | AB ISO 170 I-1539 Cert ://Absolute | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
|---|--|--|---|---|--|---|---|--|---|---|---------------------------|--|--|----------------|---|-----|---------------|------------|--|--|
| | | | | | | Trace N | Metals | Verification | | by ICP-MS | | /g/mL) | | | | | | | | |
| A | -0.02 Cd | 40.02 | Dy | 40.02 | Hf | 40.02 | | 40.02 | Ŋ | -0.02 | | A).02 | - Se | ð | | 7 | A 33 | W | CUL | |
| | | 40.02 | E Dy | <0.02 | Ho | 4).02 (0).02 | 달드 | 4 4 22 | Ş 3 | A 0.02 | R P | 40.02 | Si Se | 4 A A | - | ъ р | A 0.02 | u W | <0.02 | |
| | | 40.02 |) 달 | -40.02 | 5 | <0.02 | Mg | <0.01 | , õ | 40.02 | Rh | 40.02 | Ag | <0.02 | | 브 | 40.02 | v (| <0.02 | |
| R Ba | | -T T | ନ୍ଦୁ ହ | A 0.02 | 1) H | 4. 6. B | F. M | A. 0.02 | P Pd | A A 3 8 | R RB | A 4.02 | e Na | 202 | | 1 2 | 8 8 8 | \$ \$ | A0.02 | |
| | | 40.02 | ନ ଜୁ | 40.02 | 8 L : | a a 3 | Nd S | 8 8 8 8 8 | × 7 · | A 40 12 | Sm | A) 02 | Tas | 402 | | | | 22- | | |
| | | | | | | | | (T)=1 | (T)= Target analyte | nalyte | | | | | | | | | | |
| Physical | Physical Characterization: | tion: | | | | | | | | | | | | | | | Certified by: | led by: | | a |
| Homogen | Homogeneity: No heterogeneity was observed in the preparation of this standard. | neity was o | bserved | l in the prepa | ration c | of this stands | ard. | | | | | | | | | | LA . | J. | | ľ |
| * The ce * Purifiec * All star * Standa * Standa * All star Measu | 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). | the conce standard rs are me rs are me ed gravim d (+/-) 0. d (+/-) 0. ce stored ce stored se stored " NIST Te | eionize s. s. etriculou etrical with c with c chnica | on calculat ed water, c usly cleaned ly using ba the stated aps tight <i>a</i> and Kuyat, and Kuyat, | ed fro alibrat d prior lances 1 value C.E., 1 C.E., 1 C.E., 1 | ed Class <i>A</i> ed Class <i>A</i> to use. that are i that are i that approp Guidelines Governm | A glass A glass calibra therwia s for En hent Pr | ware and ware and ware and ware and with ware stated. Se stated aboratory valuating a valuating official section of the sectio | tric me the hig veights ce, Wa | asuremen yhest purit traceable tions. pressing tl ashington, | y raw to NII D.C. (| ess otherwise stated. materials are used in ST (see above). ST (see NIST rertainty of NIST 1994). | vise st are us bove). of NIST | ated. ed in | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |

Part # 58024 Lot # 060523

| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | CERTIFIED WEIGHT REPORT: | | Ex | Recommended Storage: Nominal Concentration (µg/mL): | NIST | Volume s | Compound | 1. Copper(II) nitrate trihydrate (Cu) | 1.0E8 | 5.0E5 | m/z-> | 2.5E7 | m/z-≻ 2.0€7 | 1.0€7 | m/z-> |
|--|--------------------------|---|------------------|--|--------------------------|---|---|---------------------------------------|-------|---|----------------------|-------|----------------|-------|-------|
| om as, Inc. | | Part Number: Lot Number: Description: | Expiration Date: | Recommended Storage: Concentration (µg/mL): | NIST Test Number: | Volume shown below was diluted to (mL): | z | | | | 10 | | 110 | | 2 |
| - | | 58029 102523 Copper (Cu) | 102526 | Ambient (20 °C) 1000 | 6UTB | t diluted to (mL) | Part Lot Number Number | 58129 100223 | | | N | | 120 | | |
| | | (Cu) | | 20 °C) | | 2000.02 | Dilution Factor | 0.1000 | | | 30 | | 130 | | |
| Certif | | | | | 5E-05 Balance | 0.058 Flask U | Initial Uncertainty Vol. (mL) Pipette (mL) | 200.0 0.084 | | | 4° | | 140 | | |
| ified Referen M569子 | Lot # | 24002546 | 2.0% | | Balance Uncertainty | Flask Uncertainty | Initial Uncertainty Nominal Vol. (mL) Pipette (mL) Conc. (µg/mL) | 84 1000 | | | 50 | | 150 | | |
| Certified Reference Material CRM M 56 G子 R いり0/2 | Solve | 46 Nitric Acid | 40.0 (mL) | | | | Initial nL) Conc. (µg/mL) | 10000.1 | | | 80 | | 0 160 | | |
| 1 CRM 10 27 23 | | L | Nitric Acid | | | | Final L) Conc. (µg/mL) | 1000.0 | 894 | tinna an | palantarijo da daren | | 0 170 | | |
| | | | Formulated By: | Mg . | Reviewed By: | | cxpanoed Uncertainty +/- (µg/mL) | 2.2 | | | 70 | | | | |
| - | | and and a second | | to the | -70 | | (Solven CAS# C | 10031-43-3 | | | 8 0 | | 180 | | |
| http: | | | Benson Chan | and a | Pedro L. Rentas | | (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD50 | 1 mg/m3 | | | 90 | | 190 | | |
| ANAB ISO 17034 Accreditec AR-1539 Certificate Number https://Absolutestandards.com | | | 102523 | , | 102523 | | Attached pg.) | ori-rat 794 mg/kg | | | 100 | | N 0 | | |
| Accredite ate Numbe Idards.com | 4 | | 23 | | ដ្រ | | NIST | 3114 | | | | | | | |

www.absolutestandards.com 300-368-1131 Absolute Standards, Inc.



Certified Reference Material CRM



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

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

| Γ | | | | | | | Trace M | etals | ; Verifica | ition | by ICP-N | r) SI | g/mL) | | | | | | |
|----|-------|---|-------|-----|-------|----|---------|----------------|------------|----------|--------------------|-------|----------------------|-------|--------------------------|----|-------|----|-------------------|
| | 3 | 2 | 22 | 7 | 2 | | 2 | and the second | | Sale Con | Constraint for the | | Sector Sector Sector | March | Contraction of the other | | | | The second second |
| A | 40.02 | 8 | 20,02 | Dy | <0.02 | Hf | <0.02 | 5 | <0.02 | N | <0.02 | Pr | <0.02 | Se. | <0.2 | 5 | <0.02 | W | <0.02 |
| SB | 40.02 | ß | <0.2 | Ę | <0.02 | Ho | <0.02 | Ŀ | <0.02 | ß | <0.02 | Re | <0.02 | 2 | <0.02 | ī | <0.02 | c | <0.02 |
| As | 40.2 | ů | <0.02 | F | <0.02 | F | <0.02 | Mg | <0.01 | õ | A0.02 | Rb | A0.02 | Ag | 40.02 | 3 | 40.02 | < | 4002 |
| Ba | <0.02 | S | <0.02 | ନ୍ଥ | <0.02 | 5 | 40.02 | Mb | <0.02 | Pd | <0.02 | Rb | A).02 | Na | 40 i2 | J | <0.02 | \$ | 40.02 |
| Be | <0.01 | ዮ | <0.02 | Ga | <0.02 | Fe | <0.2 | Hg | <0.2 | 'n | <0.02 | Ru | <0.02 | Sr | 40.02 | j | <0.02 | ĸ | 40.02 |
| Bi | <0.02 | S | <0.02 | ĉ | <0.02 | La | 40.02 | Mo | <0.02 | ¥ | <0.02 | Sm | <0.02 | s | <0.02 | Sn | <0.02 | 2 | 40.02 |
| œ | <0,02 | ß | -1 | Au | <0.02 | 3 | <0.02 | Nd | <0.02 | ĸ | <0.2 | 8 | <0.02 | Ta | <0.02 | H | <0.02 | 2 | 40.02 |

(T) = Target analyte

Physical Characterization:

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

in politic

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 certifed (+/-) 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).

urt # 58029 Lot # 102523



1 of 2

Absolute Standards, Inc. www.absolutestandards.com 800-368-1131

Certified Reference Material CRM



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



| | | | | | | | Trace M | letals | Verification | Ition | by ICP-MS | | (ng/mL) | | | | | | | _ |
|----|-------|---|---|----|-------|----|---------|-------------|----------------|--|---|------------|---------|----|------------------------------|-----|--------------|----|---|----|
| | | and the second se | A CONTRACTOR OF A CONTRACTOR | | | | | All and the | TANK ALL STATE | The second s | ALL DESCRIPTION OF THE OWNER OF T | Nonese and | | | and the second second second | | | | A COLUMN TO A C | 10 |
| A | <0.02 | 3 | <0.02 | à | <0.02 | Hf | <0.02 | ГI | <0.02 | N | <0.02 | Ł | <0.02 | Se | <0.2 | Trb | <0.02 | M | <0.02 | - |
| Sb | <0.02 | J | 40.2 | 固 | <0.02 | Ho | ≤0.02 | 2 | <0.02 | £ | <0.02 | Re | <0.02 | S | <0.02 | Ę | 40.02 | D | <0.02 | _ |
| As | <02 | ඊ | <0.02 | Eu | 40.02 | ч | 40.02 | Mg | 10.0> | ő | <0.02 | Rh | <0.02 | Ag | <0.02 | F | ≤0.02 | > | <0.02 | - |
| Ba | <0.02 | ű | <0.02 | 3 | 40.02 | Ц | <0.02 | Mn | <0.02 | P | €0.02 | £ | <0.02 | Ra | 40 12 | đ | <0.02 | \$ | <0.02 | - |
| Be | T | Ċ | 0.02 | G | <0.02 | e. | <02 | Hg | <02 | ۵. | <0.02 | Ru | ≤0.02 | 2 | <0.02 | μ | <0.02 | 7 | <0.02 | - |
| Ä | <0.02 | රී | <0.0≥ | පී | <0.02 | r. | <0.02 | Mo | <0.02 | đ, | 40.02 | Sm | ≤0.02 | s | <0.02 | Sn | <0.02 | Za | <0.02 | - |
| æ | <0.02 | ð | <0.02 | Au | <0.02 | £ | 40.02 | PN | <0.02 | М | <0.2 | ŝ | <0.02 | Ta | <0.02 | F | <0.02 | 2 | 40.02 | _ |
| | | | | | | | | | (T) = Tarr | get analy | yte | | | | | | | | | 1 |
| | | | | | | | | | | | | | | | | | | | | |

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 certifed ($\frac{1}{4}$) 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).

| Part # 57050 Lot # | m/z-> | N.01 M.4 | m/2->- | 1.0E5 | 171/2-> 2.0E5 | N G M G | 8. 0 11 15 | 1. Ammonium hexatluorostannate(IV) (Sn) | Compound | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below w | <u>CERTIFIED WEIGHT REPORT</u> Part N Lot N Desc | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
|--------------------|------------|-------------|---------|-------|------------------|------------------|---------------------------------------|---|--|---|--|--|
| Lot # 071123 | 210 | | 110 120 | | 0 No | | [1] Spectrum No.1 | (W) (Sn) INO10 SND042023A1 | Lot RM# Number | Expiration Date: 071126 Pecommended Storage: Ambient (20 °C) Concentration (µg/mL): 1000 NIST Test Number: 6UTB Weight shown below was diluted to (mL): | <u>PORT:</u> Part Number: <u>57050</u> Lot Number: <u>071123</u> Description: <u>Tin (Sn)</u> | s.com |
| | 230 | | 130 | | e e | | [15.034 sec]: | 1000 | Nominal Conc. (µg/mL) | 0 °C) 499.93 | 2 | V |
| | 20 | | 140 | | ð | | 15.034 sec]:58150.D# [Count] [Linear] | 99.999 0.10 44.2 | Purity Uncertainty Assay (%) Purity (%) (%) | 5E-05 Balance Uncertainty 0.058 Flask Uncertainty | Solvents: | Certifi |
| | N30 260 | | 150 160 | | 8 | | unt) [Linear] | 1.13107 | r Target Actual Weight (g) Weight (g) | (mL) | Lot # 21110221 22D0562008 | Certified Reference Material |
| | | | 170 | | 70 | | | 1001.6 | Actual Conc. (µg/mL) | ric acid | ric acid | CRM |
| | | | 180 | | 80 | | | 16919- | Expanded Uncertainty (Solv +/- (µg/mL) CAS# | Formulated By: | | PPGP M |
| | | | 190 200 | | 90 100 | | | 7 mg/m3 | SDS Information (Solvent Safety Info. On Attached pg.))# OSHA PEL (TWA) LD50 | Benson Chan | | R |
| | | | 0 | | ŏ | | | ω | on tached pg.) NIST LD50 SRM | 071123 - 071123 | | ANAB ISC AR-1539 (https://Abso |
| | | | | | | | | | | | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |

| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | • | Cei | Certified Reference Material CRM | ial CRM | | ANAB ISO 17034 Accredited |
|---|--|---|---|---|---------------------------|---|
| www.absolutestandards.com | 5 | | | | V | AR-1539 Certificate Number https://Absolutestandards.com |
| Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | ductively Coupled | Plasma Mass Spec | trometry (ICP-MS): | | | |
| | | Trace Metals | Is Verification by ICP-MS | P-MS (µg/mL) | | |
| AI <0.02 Cd <0.02 | Dy <0.02 | 4003 | | | | |
| A)2 C C | | 2 2 2 2 2 2 2 | 40.02 Ni | | Se <0.2 Tb Si <0.02 Te | 40.02 W 40.02 |
| 2 2 2 2 2 2 2 2 | | | <0.01 Os <0.02 Pd | Rb Rb | | \$ < c |
| | Ge 40.02 | Fe 40.2 Hg | 40.2 P 40.02 Pt | Ru Sm | | _ |
| | | | (T) = Target | 4 | ZITAS | <0.02 Zr <0.02 |
| Physical Characterization: | | | | | | Certified by: |
| Homogeneity: No heterogeneity was observed in the preparation of this standard. | observed in the prepa | ration of this standard. | | | | // |
| ŝ | 9 | | | | | mr P All |
| | | | | | | |
| | | 9 4 | | | 20 | |
| | | | | | ÷ | |
| * 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 politoriated with using balances. | centration calculat deionized water, ca ds. eticulously cleaned | d from gravimetric librated Class A gla prior to use. | and volumetric measurer ssware and the highest p | nents unless otherwise stated. writy raw materials are used in | ie stated. 'e used in | |

Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
 Standards are certifed (+/-) 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).

Part # 57050 Lot # 071123

2 of 2

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| redited Jumber ds.com | NIST SRM | 3113 | | |
|--|--|---|---|--------------------------------------|
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | Formulated By: Lawrence Barry 091923 Formulated By: Lawrence Barry 091923 Reviewed By: Pedro L. Rentas 091923 Expanded SDS Information Uncertainty (Solvent Safety Info. On Attached pg.) N +/- (ug/mL) CAS# 0SHA PEL (TWA) LD50 S | ng/kg | 180 B0 190 200 200 200 | Printed: 2/8/2024, 5:01:14 PM |
| AM I'U (fru (| Nitric Acid | 1000.0 | | |
| Certified Reference Material CRM 02109124 | Solvent: Nttric Acid 40.0 (mL) httal bittal Conc. (ug/mL) | 10000.0 | | |
| artified Réference l 0 2 0 9 1 2 4 | Lot # C 24002546 2.0% 2.0% Nominat Nominat Conc. (rg/mL) | 1000 | 34.243 eec]:58027.D# [Count] [Linear] 30 40 50 130 140 150 230 240 250 | 1 of 2 |
| Certified F | | 0.084 | 240 240 240 | |
| Å | 5E-05 0.058 on Initial or Vol. (mL) | 00 200.0 | 3 eec]:55 230 30 23 130 | |
| | 57027 091923 Cobait (Co) 091926 Ambient (20 °C) 1000 6UTB 6UTB 6UTB d to (mL): 2000.02 Lot Dilution Lot Dilution | 23 0.1000 | | |
| | 57027 091923 Cobalt (Cobalt (Ambient Ambient 1000 6UTB ss diluted to (mL Part Lot | 58127 050923 | | |
| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description: Cobait (C Cobait (C Cobait (C 091926 Recommended Storage: Nominal Concentration (µg/mL): Nominal Concentration (µg/mL): Nominal Concentration (µg/mL): NIST Test Number: COTB NIST Test Number: COTB CODAIT (C) CODAIT (C) C) CODAIT (C) C) C) C) C) C) C) C) C) C) | 1. Cobatt(II) nitrate hexahydrate (Co) 58 | | <pre>Part # 57027 Lot # 091923</pre> |

Absolute Standards, Inc. www.absolutestandards.com 800-368-1131

Certified Reference Material CRM



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

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

| L | 200 | 10 | 2 Contraction | 4 | 2000 | | 400 | | | - | | 4 | | | | | | | |
|---|-------|----|---------------|----|---------------|----|--------------|----|-------------------|----|--------------|----|--------------|----|--------------|----|-------|----|--------------|
| | 20.05 | 3 | 20.05 | 5 | 20.02 | Ħ | 40.02 | 3 | <0.02 | ż | 40.02 | £ | 40.02 | 8 | 40.2 | f | ₫.02 | M | 40.02 |
| _ | 40.02 | లి | 4 02 | 山 | €0.02 | Ho | 40.02 | 5 | <0.02 | Ż | <u>40.02</u> | Re | <0.02 | 3 | ≤0.02 | Te | €0.02 | D | <0.02 |
| _ | 402 | ථ | €0.05 | 圕 | 40.02 | Ч | 40.02 | Mg | 10 ⁰ ⊳ | ő | ≤0.02 | 붭 | <0.02 | Ag | 40.02 | F | <0.02 | Ż | <0.02 |
| _ | 40.02 | చి | ≤0.02 | ઝ | 600 | ы | <0.02 | Mn | <0.02 | P | 40,02 | ßb | <0.02 | Na | 40.2 | đ | <0.02 | Ŗ | <0.02 |
| _ | 10.05 | ບັ | ≤0.02 | g | 20.0 2 | ङ | 402 | Hg | 40.2 | ۵. | €0:02 | Ru | <0.02 | ي. | ≪0.02 | Ta | ≤0.02 | Y | €0.02 |
| _ | <0.02 | ථ | £- | ö | 40.02 | Ľ | 0 02 | Mo | <u>60.02</u> | æ, | <0.02 | Sm | <0.02 | S | <0.02 | Sn | <0.02 | 2 | 6 .02 |
| _ | 40.02 | ට් | <0.02 | Au | 40.02 | £ | 40.02 | PN | 40.02 | м | 4 02 | 8 | 40.02 | £ | 40.02 | Ë | 40.02 | 72 | 2002 |

Physical Characterization:

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

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Standards are certifed (+/-) 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 by:

| Printed: 2/8/2024, 5:01:04 PM | 1 of 2 | Part # 57033 Lot # 111323 |
|---|---------------------------------------|---|
| ő | 230 240 250 26 | m/z-> 210 220 2 |
| | | 0 0 0 |
| 160 170 180 190 200 | 130 140 150 1 | m/≥-> 110 120 1 |
| | | N m 4 |
| 80 70 80 100 | 90 40 50 | 5.0E4 |
| | | - 1 0 0 0 0 |
| | 34.433 seo]:57033.D# [Count] [Linear] | [1] Spectrum No.1 [34.433 2.0E5 |
| 1000.0 2.0 7440-38-2 0.5 mg/m3 orl-rat | 400.0 0.084 1000 | 1. Arsenic (As) 58133 020522 0.1000 |
| Expanded SDS Information Final Uncertainty (Solvent Safety Info. On Attached pg.) <u>nL) Conc. (ug/mL) +/- (ug/mL) CAS</u> # OSHA PEL (TWA) LD50 | 11 | Part Lot Dilution Compound Number Number Factor |
| Reviewed By: Pedro L. Rentas 111323 | 0.06 Flask Uncertainty | Volume shown below was diluted to (mL): 4000.0 |
| Hedre Fenter | | |
| Id Acid Formulated By: Lawrence Barry 111992 | 24002546 Nitric Acid 2.0% 80.0 | Description: <u>Arsenic (As)</u> |
| п (| Lot # Solvent: | |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | Certified Reference Material CRM | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |

< 00 **N**



Certified Reference Material CRM



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

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

(T) = Target analyte

Physical Characterization:

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

Low P. S.

Certified by:

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

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 * Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1994).

Part # 57033 Lot # 111323

| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | m/z-> | 2500 | m/z-> | 500 | m/z->- | 2.5 114 | 5.OE4 | 1. Ammonium dihydrogen phosphate (P) | Compound | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa | CERTIFIED WEIGHT REPORT: Par Lo De | www.absolutestandards.com |
|--|--------|------|-------|-----|----------|------------|---------------|--------------------------------------|---|--|---|-----------------------------|
| R I D 2 M 4 C 1 M 52 15 Interview Lat* Solvent: 2111021 Nitric Acid Provide (P) 2% 40.0 Nitric Acid 2000/2 0.058 Failure inventienty Environmenty 2000/2 0.058 Failure inventienty Environmenty Environmenty Nominia Party Uncertainty Assay Target Actual Actual Commutated By: Perford L Ren 10000 ease 0.10 27.5 72.7287 72.7287 72.7284 10000.0 30.0 772.78-1 5mg/r 12.074 aeoc)15891 15. D/r County (Linear) Ease Solvent Safety M 13.0 40 sio eo 70 sio sio sio 130 14.0 150 150 150 150 150 150 150 150 | N O | | 110 | | 10 | | [1] Spectrum | | | Expiration Date: Recommended Storage: I Concentration (µg/mL): NIST Test Number: Weight shown below was d | DRT: Part Number: Lot Number: Description: | om |
| RICZINGLA MITELS Bolvent: 21110221 Nitric Acid IDP 2% 40.0 Nitric Acid SEC5 Balance locentary (mL) Nitric Acid Formulated Br. Formulated Br. SEC5 Balance locentary (mL) Nitric Acid Formulated Br. Lawrence Balance (mL) Formulated Br. Lawrence Balance (mL) Formulated Br. Lawrence Balance (mL) Source It Mitels Acid Formulated Br. Lawrence Balance (ML) Source It Mitels Acid Formulated Br. Lawrence Balance (ML) Source It Mitels Acid Formulated Br. Formulated Br | 2220 | | 120 | | N. O | | | | Lot Number | 041726 Ambient (20 10000 6UTB 6UTB | 57115 041723 Phosphore | 5 |
| Hric Acid Iric Acid Iric Acid Iric Acid Iric Acid Actual Actual Actual Expanded Expanded Expanded SDS Inf Expanded SDS Inf Solvent Safety Inf eight (g) Conc. (ug/mL) · (AS# OSHA PEL) 2.7289 10000.0 20.0 7722-76-1 5 mg/m 2.7289 10000.0 20.0 7722-76-1 5 mg/m 150 170 180 190 190 190 | 230 | | 130 | | ຜ. ວ | | 2.074 sec]:58 | | | 00.02 | us (P) | R |
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| Formulated By: Lawrence Ba Formulated By: Lawrence Ba Reviewed By: Pedro L. Ren Conc. (ug/m), -/- (ug/m), CAS# OSHA PEL 10000.0 20.0 7722-76-1 5 mg/m 10000.0 20.0 7722-76-1 5 mg/m 10000.0 eio eio | 250 | | 150 | | S O | | ınt] [Linear] | | | | | |
| Formulated By: Lawrence Ba Formulated By: Pedro L. Ren Expanded SDS Inf Uncertainty (Solvent Safety Inf +/- (ug/mL) CAS# OSHA PEL (20.0 7722-76-1 5 mg/m 20.0 7722-76-1 5 mg/m 20.0 190 90 | 260 | | | | | | | 2.7289 10000. | Actual Actual sight (g) Conc. (µg/1 | rric Acid | tric Acid | 15815 |
| 22-76-1 5 mg/m | | | | | 1 | | | 20.0 | | Formulated B | Q | |
| o 200 | | | 4 | | | | | | SC (Solvent Saf CAS# OSH/ | Ped | Gerence / | |
| .hed pg.) LbS0 LbS0 | | | | | | | | | DS Information fety Info. On Attac A PEL (TWA) | L. Rentas | Jan | https://At |
| g 3186 SRM | | | 9 | | J | | | | 0 | 041723 041723 | | tps://Absolutestandards.com |

| Abs | Absolute (800-368-1131 www.absolute | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | lards , ds.com | Inc. | - | | | | ĉ | rtified Re | eren | Certified Reference Material CRM | ial CR | M | | | | | https AF | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | 4 Accredited cate Number andards.com |
|------------|---|---|---|---|---|---|---|--|---|--|------------------------------------|---|--------------------------------|---|---------------------|------------------------|-------------|-------------------------------|---------------|--|--|
| - | nstrum | iental A | nalysi | s by Indi | uctive | ły Coupl | ed Pla | Instrumental Analysis by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS); | s Spec | troscopy | (ICP | -MS): | | | | | | | | | |
| _ | | | | | | | | Trace Metals | etals | Verifica | Ition | Verification by ICP-MS | 1.00 | (µg/mL) | | | | | | | |
| - | A | 40.02 | 8 | 40,02 | Ą | 40.02 | H | 40.02 | E | A0.02 | Z | A)22 | 7 | A).02 | Se | A 2 | ŧ | AB | W | | |
| | | A.22 | 2 G | A0.2 | ម្មា | 40.02 | Но | 40.02 | Ŀ | 40.02 | NB | <0.02 | Re | 40.02 | ŝ | 40.02 | Te | 40.02 | c : | 40.02 | |
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| | | 10.0> | ព្ | 40,02 | ណ្ឌ | <0.02 | 장 | <0.2 | Hg | 40.2 | שי | T | R Q | 40.02 | K 2 | 8.8 2 | | <0.02 | 4 'B | 60.02 20.02 | |
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| hand | hysical | Physical Characterization: | cteriza | ution: | | | | | | | | | | | | | | Cer | Certified by: | y: | |
| - | Iomogen | eity: No I | heteroge | neity was | observ | ed in the pr | eparati | Homogeneity: No heterogeneity was observed in the preparation of this standard. | ındard. | | | | | | | | (| h | J. | Ŵ | |
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| * * * * * | All star Standa Standa All Star Uncerta Measur | ndard co rds are rds are ndards s ainty Re rement | ntaine prepare certife hould I ference Result, | rs are me ad gravin d (+/-) 0 es storec e: Taylor " NIST Te | eticulo netrica).5% o d with r, B.N. echnic | ally using the stat caps tigh and Kuya al Note 1; | hed pri balanc iced val it and it, C.E. 297, L | * 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 certifed (+/-) 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). | e calit other ropriat nes for nment | brated wit wise stat te laborat Evaluatir Printing (| h weig ed. ory co Office, |)hts trace onditions. Expressir Washingt | able to og the l on, D.(| to NIST (see above). e Uncertainty of NIST D.C. (1994). | e abov ty of N | e). IIST | | | | | |
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| Part # | 57115 | | Lot # 041723 | 1723 | | | | | | | 2 of 2 | of 2 | | | | | Print | Printed: 2/8/2024, 5:01:22 PM | 24, 5:0 |)1:22 PM | |

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| | | ear) | ount] [Lin | 24.004 sec];58116,D# [Count] [Linear] | ¢ sec];58 | [24.00 | | [1] Spectrum No.1 | 2000 |
| 20.0 7763-20-2 NA orf-rat 4250mg/kg 3181 | 10000.1 | 82,4682 | 82.4675 | 0.10 24.3 | 99,9 | 10000 | IN117 SLBR7225V | IN11 | 1. Ammonium sulfate (S) |
| Expanded SDS Information Uncertainty (Solvent Safety Info. On Attached pg.) NIST +/- (ug/mL) CAS# OSHA PEL (TWA) LDSO SRM | (g) Conc. (µg/mL) | Actual Weight (g) | Target Weight (g) | Uncertainty Assay Purity (%) (%) | Purity (%) | Nominal Conc. (µg/mL) | Lot. Number | RM# | Compound |
| i By: Ped | [F | | | Balance Uncertainty Flask Uncertainty | 0.058 | 1999.48 | led to (mL): | Weight shown below was diluted to (mL): | Weight show |
| Lawrence barry | 1 1 | | | | | 20 °C) | 071126 Ambient (20 °C) 10000 Sum | Expiration Date: nended Storage: htration (µg/mL): %T Test Number: | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Teet Number |
| around Bring | Type 1 Water | ASTM Ty | Lot# 071123 | Solvent: | | E) | 57116 071123 Sulfur (S) | <u>PORT:</u> Part Number: Lot Number: Description: | CERTIFIED WEIGHT REPORT: Part N Lot N Desc |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | CRM | | ference M | Certified Reference Material | R a | | | om | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
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| 800-368-1131 www.absolutestandards.com | | 0 | Certified Reference Material CRM | nce Material C | RM | | | • | ANAB ISO 1: AR-1539 Ce https://Absolut | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
|---|--|---|--|---|---|-------------------------|-----------|------------|--|--|
| Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | ictively Coupled | Plasma Mass Sp | ectrometry (IC | P-MS): | | | | | | |
| | | Trace Metals | | Verification by ICP-MS | IS (µg/mL) | | | | | |
| AI <0.02 Cd <0.02 | Dv 40.02 | A M | -12 | | | a dista div. | ALL MERCY | | A STREET STREET STREET | |
| 40.02 Ca | | 40.02 | 40.02 40.02 | Ni <0.02 Nb <0.02 | Pr <0.02 Re <0.02 | Si Se | | | | A 6.3 |
| 200 200 | Gd <0.02 | In <0.02 N | Mg <0.01 C | | | | | | < 0 | <0.02 |
| 40.02 | Ga 40.02 | Fe <0.2 Hg | A A 3 12 | 8 8 | | | 12 1 | | 40.02 Y 40.02 | 40.02 20.02 |
| B (UUZ CI 40,02 | Au <0.02 | <0.02 | <0.02 | | Sc <0.02 | Ta o | <0.02 | | 40.02 21 21 40 | 40.02 |
| Physical Characterization: | | | (T)= Target analyte | alyte | | | | ۲ ۲ | Certified by: | |
| Homogeneity: No heterogeneity was observed in the preparation of this standard. | oserved in the prepa | ation of this standard | | | | | | | | 1 |
| | | | | | | | (| the second | P.S. | |
| * The certified value is the concentration calculated from gravimetric and volumetric measurements * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity in the preparation of all standards. * All standard containers are meticulously cleaned prior to use the preparation of the preparation of all standards. | ntration calculate ionized water, ca | d from gravimetri librated Class A g | c and volumetric lassware and the | c measurement highest purity | s unless otherwise stated. raw materials are used in | ise state are used i | 5.6 | | | |
| * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). * Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. | trically using bala % of the stated | value, unless othe | brated with weighwise stated. | phts traceable : | to NIST (see ab | ove). | | | | |
| * Uncertainty Reference: Taylor, Measurement Result," NIST Tec | vith caps tight ar B.N. and Kuyat, (hnical Note 1297 | id under appropria 2.E., "Guidelines fc , U.S. Governmen | ite laboratory co r Evaluating and t Printing Office, | I Expressing the Washington, D | ⁹ Uncertainty of NIST).C. (1994). | F NIST | | | | |
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| * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to * Standards are certifed (+/-) 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 Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D. | itrically using bail trically using bail is of the stated with caps tight ar B.N. and Kuyat, (hnical Note 1297 | prior to use. ances that are cali value, unless othe d under appropria 2.E., "Guidelines fo , U.S. Governmen | brated with weig rwise stated. re laboratory co or Evaluating and t Printing Office, t Printing Office, | ghts traceable . onditions. I Expressing the Washington, D | to NiST (see ab 3 Uncertainty o).C. (1994). | ove). F NIST | | | | |

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Certified Reference Material CRM



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

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

| Al 40.02 Sb 40.02 As 40.02 Ba 40.02 Ba 40.02 Be 40.01 Bi 40.02 B 40.02 | |
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(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 certifed (+/-) 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).

Part # 58030 Lot # 111623



Certificate of Analysis

R: 02/22/24 M.5942

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: | CGTI1 |
| Lot Number: | T2-TI719972 |
| Matrix: | 2% (v/v) HNO3 tr. HF |
| Value / Analyte(s): | 1 000 μg/mL ea: Titanium |
| Starting Material: | Ti Metal |
| Starting Material Lot#: | 2094 |
| Starting Material Purity: | 99.9975% |
| CERTIFIED VALUES | AND UNCERTAINTIES |

| Certified Value: | 1002 ± 5 μg/mL |
|------------------|------------------------------------|
| Density: | 1.012 g/mL (measured at 20 ± 4 °C) |

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Assay Information:

3.0

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 | Characterization of CRM/RM by One Method |
|---|---|
| Certified Value, $X_{\mbox{CRM/RM}}$, where two or more methods of characterization are used is the weighted mean of the results: | Certified Value, X _{CRMRM} , where one method of characterization is used is the mean of individual results: |
| $\begin{split} & \textbf{X}_{CRM/RM} = \Sigma(w_i) \; (\textbf{X}_i) \\ & \textbf{X}_i = \text{mean of Assay Method } i \; \text{with standard uncertainty } \textbf{u}_{char \; i} \\ & \textbf{w}_i = \text{the weighting factors for each method calculated using the inverse square of the variance:} \\ & \textbf{w}_i = (1/u_{char \; i})^2 / (\Sigma(1/(u_{char \; i})^2) \end{split}$ | $X_{CRM/RM} = (X_n) (u_{char a})$ $X_n = mean of Assay Method A withu_{char a} = the standard uncertainty of characterization Method A$ |
| CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k ($u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts}$) ^{Y₂} k = coverage factor = 2 $u_{char} = [\Sigma((w_i)^2 (u_{char}_i)^2)]^{Y_2}$ where u_{char} is the errors from each characterization method u_{bb} = bottle to bottle homogeneity standard uncertainty u_{tts} = long term stability standard uncertainty (storage) u_{tts} = transport slability standard uncertainty | CRMRM Expanded Uncertainty (±) = U _{CRMRM} = k ($u^2_{char e} + u^2_{bb} + u^2_{lts} + u^2_{ts}$) ^{1/2} k = coverage factor = 2 uchar e = 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 |

Page 1 of 4

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.

| М | Ag | < | 0.000536 | Μ | Eu | < | 0.000268 | 0 | Na | < | 0.032670 | Μ | Se | | 0.001204 | 0 | Zn | < | 0.003267 | |
|---|----|---|----------|---|------|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|
| 0 | AI | | 0.000872 | 0 | Fe | | 0.003225 | 0 | Nb | < | 0.043560 | 0 | Si | | 0.004735 | 0 | Zr | < | 0.043560 | ŧ |
| М | As | < | 0.008586 | М | Ga | < | 0.000268 | Μ | Nd | < | 0.000268 | Μ | Sm | < | 0.000268 | | | | | |
| Μ | Au | < | 0.004577 | Μ | Gd | < | 0.000268 | 0 | Ni | < | 0.010890 | М | Sn | | 0.000096 | | | | | |
| 0 | В | < | 0.008929 | М | Ge | < | 0.002146 | M | Os | < | 0.000269 | 0 | Sr | | 0.000096 | | | | | |
| М | Ba | < | 0.002683 | Μ | Hf | | 0.002161 | 0 | P | < | 0.054450 | М | Та | | 0.010560 | | | | | |
| M | Be | < | 0.005366 | Μ | Hg | < | 0.003231 | Μ | Pb | < | 0.001073 | Μ | Тb | < | 0.000268 | | | | | |
| М | Bi | < | 0.001609 | М | Но | < | 0.000268 | М | Pd | < | 0.000268 | Μ | Те | < | 0.001341 | | | | | |
| 0 | Ca | | 0.000676 | Μ | In | < | 0.002683 | Μ | Pr | < | 0.000268 | M | Th | < | 0.053663 | | | | | |
| М | Cd | < | 0.000268 | Μ | lr – | < | 0.000269 | М | Pt | < | 0.000536 | S | Tī | < | | | | | | |
| М | Се | < | 0.000268 | Μ | κ | | 0.001172 | М | Rb | < | 0.000268 | Μ | TI | < | 0.000268 | | | | | |
| М | Co | < | 0.004293 | Μ | La | < | 0.000268 | М | Re | < | 0.000268 | Μ | Tm | < | 0.000268 | | | | | |
| М | Cr | | 0.000752 | 0 | Li | < | 0.027225 | M | Rh | < | 0.000268 | M | U | < | 0.000268 | | | | | |
| М | Cs | < | 0.000268 | М | Lu | < | 0.000268 | Μ | Ru | < | 0.000269 | M | V | < | 0.019855 | | | | | |
| 0 | Cu | < | 0.010890 | 0 | Mg | < | 0.005445 | i | S | < | | Μ | W | | 0.000473 | | | | | |
| M | Dy | < | 0.000268 | 0 | Mn | < | 0.003267 | M | Sb | < | 0.006976 | Μ | Y | < | 0.002146 | | | | | |
| Μ | Er | < | 0.000268 | Μ | Мо | | 0.000774 | 0 | Sc | < | 0.004900 | М | Yb | < | 0.000536 | | | | | |
| | | | | | | | | | | | | | | | | | | | | |

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 $20^{\circ} \pm 4^{\circ}$ 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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 47.87 +4 6 Ti(F)6-2 Chemical Compatibility - Soluble in concentrated HCl, HF, H3PO4 H2SO4 and HNO3. Avoid neutral to basic 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)6-2 for months in 1% HNO3 / LDPE container. 1-10,000 ppm single element solutions as the Ti(F)6-2 chemically stable for years in 2-5% HNO3 / trace HF in an LDPE container.

Ti Containing Samples (Preparation and Solution) - Metal (Soluble in H2O / HF caution -powder reacts violently); Oxide - low temperature history anatase or rutile (Dissolved by heating in 1:1:1 H2O / HF / H2SO4); Oxide - high temperature history (~800EC) brookite (fuse in Pt0 with K2S2O7); Ores (fuse in Pt0 with KF + K2S2O7 - no KF if silica not present); Organic Matrices (Dry ash at 450EC in Pt0 and dissolve by heating with 1:1:1 H2O / HF / H2SO4 or fuse ash with pyrosulfate if oxide is as plastic pigment and likely in brookite crystalline 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, |
| | | | 14N16O18O, |
| | | | 14N17N2, 36Ar12C, |
| | | | 48Ca, [96X=2 |
| | | | (where X = Zr, Mo, |
| | | | Ru)] |
| ICP-OES 323.452 nm | 0.0054 / 0.00092 µg/mL | 1 | Ce, Ar, Ni |
| ICP-OES 334.941 nm | 0.0038 / 0.000028 µg/mL | 1 | Nb, Ta, Cr, U |
| ICP-OES 336.121 nm | 0.0053 / 0.000034 µg/mL | 1 | W, Mo, Co |

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

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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 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 Kozikowski Manager, Quality Control

DD978ti

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA

inorganicventures.com

3.0

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: | CGY10 |
| Lot Number: | V2-Y740548 |
| Matrix: | 2% (v/v) HNO3 |
| Value / Analyte(s): | 10 000 μg/mL ea: Yttrium |
| Starting Material: | Yttrium Oxide |
| Starting Material Lot#: | 2661 and 06230520YL |
| Starting Material Purity: | 99.9984% |
| CERTIFIED VALUES AI | ND UNCERTAINTIES |

| Certified Value: | 10000 ± 30 µg/mL |
|------------------|--|
| Density: | 1.032 g/mL (measured at 20 \pm 4 °C) |

Assay Information:

| Assay Method #1 | 10011 ± 25 µg/mL EDTA NIST SRM 928 Lot Number: 928 |
|-----------------|---|
| Assay Method #2 | 9997 ± 50 μg/mL ICP Assay NIST SRM 3167a Lot Number: 190730 |
| Assay Method #3 | 9984 ± 31 µg/mL Calculated NIST SRM Lot Number: See Sec. 4.2 |

- 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_{CRWRM}, where two or more methods of characterization are used is the weighted mean of the results:

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

- 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:
 - $w_i = (1/u_{char\,i})^2 \, / \, (\Sigma(1/(u_{char\,i})^2)$

CRM/RM Expanded Uncertainty (±) = U_{CRM/RM} = k $(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{\frac{1}{2}}$ k = coverage factor = 2

- $u_{char} = [\Sigma((w_j)^2 (u_{char})^2)]^{\frac{1}{2}}$ where u_{char} are the errors from each characterization method
- ubb = bottle to bottle homogeneity standard uncertainty
- ults = long term stability standard uncertainty (storage)
- uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

Characterization of CRM/RM by One Method

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

 $\begin{array}{l} X_{CRM/RM}=(X_{\alpha}) \; (u_{char \; \alpha}) \\ X_{\alpha}= mean \; of Assay \; \mbox{Method} \; A \; \mbox{with} \\ u_{ohar \; \alpha}= \mbox{the standard uncertainty of characterization} \; \mbox{Method} \; A \end{array}$

CRM/RM Expanded Uncertainty (\pm) = U_{CRM/RM} = k ($u^2_{char a} + u^2_{bb} + u^2_{tts} + u^2_{bs}$)^{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

- 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 Callbration

- 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.

| м | Ag | < | 0.004600 | м | Eu | | 0.009037 | м | Na | | 0.086360 | M | Se | < | 0.005200 | м | Zn | | 0.030125 |
|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| | - | - | | | | | | | | | | | | - | | | | | |
| М | AI | | 0.014862 | 0 | Fe | | 0.002410 | M | Nb | < | 0.000570 | U | Si | | 0.024100 | 0 | Zr | < | 0.002600 |
| М | As | < | 0.003500 | М | Ga | < | 0.000570 | М | Nd | | 0.000923 | M | Sm | | 0.000461 | | | | |
| М | Au | < | 0.001700 | М | Gd | < | 0.003500 | М | Ni | < | 0.005700 | М | Sn | < | 0.002300 | | | | |
| 0 | в | | 0.002209 | М | Ge | < | 0.005200 | М | Os | < | 0.001200 | М | Sr | < | 0.004600 | | | | |
| 0 | Ва | < | 0.002500 | М | Hf | < | 0.000570 | n | Ρ | < | | М | Та | < | 0.000570 | | | | |
| 0 | Ве | < | 0.001400 | М | Hg | < | 0.000570 | М | Pb | | 0.005020 | М | Tb | | 0.001044 | | | | |
| М | Bi | < | 0.003500 | М | Но | | 0.009037 | М | Pd | < | 0.005100 | М | Те | < | 0.002300 | | | | |
| 0 | Са | | 0.009841 | М | In | < | 0.002300 | М | Pr | < | 0.002300 | М | Th | < | 0.000570 | | | | |
| М | Cd | < | 0.000570 | М | Ir | < | 0.000570 | М | Pt | < | 0.000570 | М | Ti | < | 0.003500 | | | | |
| М | Се | < | 0.002300 | 0 | к | | 0.018677 | М | Rb | < | 0.000570 | М | TI | < | 0.000570 | | | | |
| М | Co | < | 0.000570 | Μ | La | | 0.000461 | М | Re | < | 0.000570 | М | Tm | < | 0.003500 | | | | |
| М | Cr | < | 0.004000 | 0 | Li | < | 0.009300 | М | Rh | < | 0.008000 | М | U | < | 0.000570 | | | | |
| М | Cs | < | 0.000570 | M | Lu | | 0.000582 | М | Ru | < | 0.000570 | Μ | v | | 0.001265 | | | | |
| М | Сц | | 0.002610 | 0 | Mg | | 0.001486 | n | S | < | | М | W | < | 0.002300 | | | | |
| М | Dy | | 0.003815 | M | Мп | | 0.000582 | М | Sb | | 0.005422 | s | Y | < | | | | | |
| М | Er | | 0.003615 | М | Мо | < | 0.005700 | М | Sc | < | 0.001200 | Μ | Yb | | 0.001827 | | | | |
| | | | | | | | | | | | | | | | | | | | |

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

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 <u>Terms and Conditions of Sale</u>. <u>https://www.inorganicventures.com/terms-and-conditions-sale</u>. 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 $4^\circ - 24^\circ$ C to minimize the effects of transpiration. Use at $20^\circ \pm 4^\circ$ 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

Atomic Welght; Valence; Coordination Number; Chemical Form in Solution - 88.91 +3 6 Y(OH)(H2O)x+2 Chemical Compatibility -Soluble in HCI, H2SO4 and HNO3. Avoid HF, H3PO4 and neutral to basic media. Stable with most metals and inorganic anions forming an insoluble carbonate, oxide, oxalate, and fluoride. Avoid mixing with elements / solutions containing moderate amounts of fluoride.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO3 / LDPE container.

Y Containing Samples (Preparation and Solution) - Metal (Soluble in acids); Oxide (Dissolve by heating in H2O/ HNO3); Ores (Carbonate fusion in Pt0 followed by HCI dissolution); Organic Matrices (Dry ash and dissolve in 1:1 H2O / HCI or HNO3).

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

| Estimated D.L. | Order | Interferences (underlined indicates severe) |
|------------------------|--|--|
| 0.8 ppt | N/A | 73Ge16O, 178Hf+2 |
| 0.005 / 0.000036 µg/mL | 1 | Ce, Th |
| 0.004 / 0.00007 µg/mL | 1 | Ce |
| 0.005 / 0.0009 µg/mL | 1 | Ta, Th |
| | 0.8 ppt 0.005 / 0.000036 µg/mL 0.004 / 0.00007 µg/mL | 0.8 ppt N/A 0.005 / 0.000036 μg/mL 1 0.004 / 0.00007 μg/mL 1 |

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 Regulrements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

February 20, 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

- February 20, 2029

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

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

11.3 Period of Validity

- Sealed TCT Bag Open Date:

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

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS **Certificate Prepared By:**

Uyen Truong **Custom Processing Supervisor**

Certificate Approved By:

Muzzammil Khan Stock Laboratory Supervisor

Mayn Mung Mayni Kh Paul R Laina

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director



| | Ho | Ph | | B Bi B | As Ba | 2 | 1 5 | Absc 800-36 www.at |
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| calibra calibra ed prio palance and ur and ur c, C.E., c, C.E., | paration | | | Fe La | F F H | | d Plas | |
| The certified value is the concentration calculated from gravimetric and volumetric measury Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest 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 trac Standards are certifed (+/-) 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 Express Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washing | Homogeneity: No heterogeneity was observed in the preparation of this standard | | | <0.2 <0.02 | 40.02 20.02 | | Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | |
| A glass A glass calibra calibra s for E s for E s for E | lard. | | | Hg Mo Nd | Mn Mn | Metals | Spectr | Certif |
| nd volume ware and ted with se stated laborator valuating Valuating Of | | | (T) = Ta | <0.2 <0.02 | <0.02 <0.02 | Verific | ometry () | ied Refe |
| etric m I the hi weight I. y cond and Ex and Ex | | | (T) = Target analyte | х P P | Pd Os Nb | ation | ICP-M | rence |
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| | | | | | | | | 1 3 6 8 |

| | m/z-> 210 | 1.0E8 | N. O E B | m/z-≻ 110 | -1 -0 | m/z-> 10 2.0E8 | 1.0 [[] | [1] Spectrum No.1 2.0E4 | 1. Selenium (Se) | Compound | Volume shown below was diluted to (mL): | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): | Lot Number: Description: | CERTIFIED WEIGHT REPORT: | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
|-----|-----------|-------|-------------------|-----------|--------------|-------------------|------------|---------------------------------------|----------------------|--|--|--|--------------------------------|--------------------------|--|
| | 0 | | | 0 | | J | | um No | 58134 | Part Number | 6 as diluted | | | л | |
| 220 | | | | 120 | | 12 0 | | - | 071223 | Lot Number | ed to (mL): | 060627 Ambient (20 °C) 1000 | <u>060624</u> Selenium (Se) | 7024 | V |
| | N | | | 4 | | ω | | 33.702 | 0.1000 | Dilution Factor | 2000.07 | ĉ | (Se) | | |
| | 230 | | | 130 | | 80 | | 90C]:58 | 200.0 | Initial Vol. (mL) | 5E-05 0.100 | | | | |
| | 240 | | | 140 | | 4 0 | | 034.D# | 0.084 | Initial Uncertainty Vol. (mL) Pipette (mL) | Balance Uncertainty Flask Uncertainty | | | | Sertified Referen |
| | 250 | | | 150 | | . (л О | | 33.702 sec]:58034.D# [Count] [Linear] | 1000 | Nominal Conc. (µg/mL) | rtainty nty | | 2.0% | Lot # | Reference 162. |
| | 260 | | | 160 | | 60 | | inear] | 10002.5 | Initial Conc. (µg/mL) | | (mL) | 40.0 | Solvent: | Certified Reference Material CRM からすチェート・アンの |
| | | | | 170 | | 70 | | | 1000.0 | Final Conc. (ug/mL) | 11 | | Nitric Acid | | 114 |
| | | | | ŏ | | 0 | | | 2.2 | Expanded Uncertainty +/- (µg/mL) | Reviewed By: | <i>M</i> | Formulated By: | | 24 |
| | | | | 180 | | 80 | | | 7782-49-2 | 0 | × | 20 | BY | | |
| | | | | 190 | | 90 | | | 0.2 mg/m3 | SDS Information nt Safety Info. On Att: OSHA PEL (TWA) | Pedro L. Rentas | | Benson Chan | | ਤ |
| | | | | 200 | | 100 | | | 3 orl-rat 6700 mg/kg | SDS Information (Solvent Safety Info. On Attached pg.) AS# OSHA PEL (TWA) LDS0 | 1tas 060624 | , | n 060624 | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
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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. Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). Standards are certifed (+/-) 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). | The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise st. Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are us 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 certifed (+/-) 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). | rements t purity r ceable to s. s. sing the l ngton, D.0 | highes highes tra ndition: Expres Washir | volumetric re and the i with weij stated. stated. oratory cc uating and ing Office. | ric and glasswa glasswa alibratec nerwise riate lab for Evalu nt Print | * The certified value is the concentration calculated from gravimetric and volumetric measurements unlee * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw n 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 NIS * Standards are certifed (+/-) 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 Unce Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, D.C. (1 | ed fron alibrate alibrates lances l value, l value, C.E., "Q C.E., "Q C.E., "Q | The certified value is the concentration calculated from gravi Purified acids, 18.2 megohm deionized water, calibrated Class the preparation of all standards. All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that ar Standards are certifed (+/-) 0.5% of the stated value, unless All standards should be stored with caps tight and under app Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelin Measurement Result," NIST Technical Note 1297, U.S. Gover | ntratio sionized s. etrically etrically 5% of t 5% of t B.N. a B.N. a | he conce egohm de standardd s are met d gravim (+/-) 0. e stored : Taylor, NIST Tev | alue is t 1 8.2 me n of all : ntainer: orepare certifed bould bu ference ference Result," | The certified value is the concen Purified acids, 18.2 megohm dei the preparation of all standards. All standard containers are meti Standards are prepared gravime Standards are certifed (+/-) 0.5 All standards should be stored w Uncertainty Reference: Taylor, E Measurement Result," NIST Tech | * The c * Purifie the purifie * All stand * Stand * All stand Measu | |
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| | | (µg/mL) | ICP-MS | -MS): on by | metry (ICP-MS): Verification by ICP-MS | s Spectrom Metals V | Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): Trace Metals Verification by | Plasma | Coupled | ctively | by Indu | nalysis | nental A | Instru | |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | | ₽M | terial Cl | nce Ma | Certified Reference Material CRM | Certifie | | | | | Inc. | | Absolute Standards, 800-368-1131 www.absolutestandards.com | Absolute 800-368-1131 www.absolute | 800- |



| Part# 57003 Lot # 062124 | * The certified value is the concentration calculated from gravimetric and volumer * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and 1 the preparation of all standards. * All standard containers are meticulously cleaned prior to use. * Standards are prepared gravinetrically using balances that are calibrated with w * Standards are certified (+/) 0.5% of the stated value, unless otherwise stated. * All Standards should be stored with caps tight and under appropriate iaboratory * Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating of Measurement Result," NIST Technical Note 1297, U.S. Government Printing Off | Homogeneity: No heterogeneity was observed in the preparation of this standard. | Physical Characterization: | Al 40.02 Cid 40.02 Dry 40.02 Hd Sb 40.02 Cic 40.02 Eu 40.02 Hd As 40.2 Cic 40.02 Eu 40.02 In Ba 40.02 Cic 40.02 Gd 40.02 In Bi 40.02 Cic 40.02 Ge 40.02 In Bi 40.02 Cic 40.02 Ge 40.02 La | | Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS): | Absolute Standards, Inc. 800-368-1131 www.absolutiestandards.com |
|---------------------------------|---|---|----------------------------|---|-------------|---|--|
| 2 01 2 | * 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 standard. * 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 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. * Standards are certified (+/-) 0.5% of the stated value, unless otherwise stated. * All Standards broud by stoud with cases tight and under appropriate laboratory conditions. * All Standards are prepared with cases tight and under appropriate laboratory conditions. * Mucertainty 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). | this standard. | | 40/02 Li T Nh 40/02 Hr 40/02 And 40/02 Li An | -MS (µg/mL) | Mass Spectrometry (ICP-MS): | Certified Reference Material CRM |
| Printed: 6/24/2024, 11:20:08 PM | Ъ. | Sur P. S. | Certified by: | Site Gall Tite Gall U Gall Site Gall Tite Gall Site Gall Si | | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |



300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

Certificate of Analysis M5936, M5933 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-M0720876 |
| 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% |
| CEPTIEIED VALUES | |

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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

Assav 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 | Characterization of CRM/RM by One Method |
|---|--|
| Certified Value, X _{CRWRM} , where two or more methods of characterization are used is the weighted mean of the results: | Certified Value, X _{CRWRM} , where one method of characterization is used is the mean of individual results: |
| $\begin{split} & \textbf{X}_{CRM/RM} \equiv \boldsymbol{\Sigma}(\textbf{w}_i) \left(\textbf{X}_i \right) \\ & \textbf{X}_i = \text{mean of Assay Method : with standard uncertainty u_{char i} \\ & \textbf{w}_i = \text{the weightling factors for each method calculated using the inverse square of the variance.} \\ & \textbf{w}_i = (1/k_{ohar})^2 / (\boldsymbol{\Sigma}(1/(u_{char}))^2) \end{split}$ | $X_{CRM/RM} = (X_a) (u_{cher, a})$ $X_a = mean of Assay Method A withu_{cher, a} = the standard uncertainty of characterization Method A$ |
| CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k ($u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{cs}$) ^{1/5} k = coverage factor = 2 $u_{char} = [\Sigma(w_p)^2 (u_{char}; p^2)]^{1/2}$ where u_{char} are the errors from each characterization method $u_{bb} = $ bottle to bottle homogeneity standard uncertainty $u_{lts} = long term stability standard uncertainty (storage) u_{ts} = transport stability standard uncertainty$ | CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k (u ² _{char a} + u ² _{bb} + u ² _{lts} + u ² _{ts}) ^{y₅} 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 _{lts} = transport stability standard uncertainty |
| Page 1 of 4 | |

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.

| Μ | Ag | < | 0.000590 | Μ | Eu | < | 0.000300 | М | Na | | 0.000879 | М | Se | < | 0.008000 | М | Zn | | 0.000598 |
|---|----|---|----------|---|-----|---|----------|-----|----|---|----------|---|----|---|----------|---|----|---|----------|
| М | A | | 0.000563 | Μ | Fe | < | 0.006500 | М | Nb | < | 0.029000 | i | Si | < | | М | Zr | < | 0.001800 |
| М | As | < | 0.002100 | Μ | Ga | < | 0.000300 | i | Nd | < | | Μ | Sm | < | 0.000300 | | | | |
| Μ | Au | < | 0.000300 | Μ | Gd | < | 0.000300 | Μ | Ni | < | 0.008000 | M | Sn | < | 0.008900 | | | | |
| Μ | В | < | 0.003300 | М | Ge | < | 0.000300 | Μ | Os | < | 0.000590 | Μ | Sr | | 0.000175 | | | | |
| Μ | Ba | | 0.001689 | Μ | Hf | < | 0.001800 | i – | P | < | | Μ | Та | < | 0.004200 | | | | |
| Μ | Be | < | 0.000890 | Μ | Hg | < | 0.003300 | Μ | Pb | < | 0.000300 | Μ | Tb | < | 0.000300 | | | | |
| Μ | Bi | < | 0.000890 | Μ | Но | < | 0.000300 | Μ | Pd | < | 0.001800 | М | Те | < | 0.021000 | | | | |
| 0 | Ca | | 0.006334 | M | In | < | 0.032000 | Μ | Pr | < | 0.013000 | М | Th | < | 0.000300 | | | | |
| 0 | Cd | < | 0.026000 | Μ | -Ir | < | 0.000300 | Μ | Pt | < | 0.000300 | 0 | TI | < | 0.032000 | | | | |
| Μ | Се | < | 0.008300 | Μ | ĸ | | 0.130213 | М | Rb | | 0.004575 | Μ | TI | | 0.001266 | | | | |
| М | Co | | 0.000598 | М | La | < | 0.000300 | М | Re | < | 0.000300 | М | Tm | < | 0.000300 | | | | |
| Μ | Cr | | 0.000527 | 0 | Li | | 0.000059 | Μ | Rh | < | 0.000300 | M | U | < | 0.005300 | | | | |
| М | Cs | | 0.000527 | М | Lu | < | 0.000300 | М | Ru | < | 0.079000 | M | V | < | 0.000890 | | | | |
| Μ | Cu | | 0.002252 | M | Mg | | 0.000563 | i | S | < | | M | W | | 0.087982 | | | | |
| М | Dy | < | 0.000300 | Μ | Mn | < | 0.005900 | М | Sb | | 0.001513 | М | Y | < | 0.000300 | | | | |
| Μ | Er | < | 0.000300 | s | Мо | < | | Μ | Sc | < | 0.001200 | М | 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 $20^\circ \pm 4^\circ$ C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliguots to container.

- For more information, visit 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 HCI or HF to stabilize acidic solutions. The [MoO4]-2 is soluble in concentrated HCI [MoOCI5]-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 HCI); Oxide (soluble in HF or NH4OH); Organic Matrices (Dry ash at 450EC in Pt0 and dissolve oxide with HF or HCI). 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,79Br1 |
| | | | 60,1900s2+,190Pt |
| | | | 2+ |
| 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 CRWRM.

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

July 17, 2022

- The certification is valid within the measurement uncertainty specified provided the CRW/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

Michael 2 Booth

Certificate Approved By:

Michael Booth **Director**, Technical

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Paul R Laine



300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

Certificate of Analysis M5936, M5933 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-M0720876 | | | | | |
| 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% | | | | | |
| CERTIFIED VALUES AND UNCERTAINTIES | | | | | | |

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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

Assav 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 | Characterization of CRM/RM by One Method |
|---|---|
| Certified Value, X _{CRWRM} , where two or more methods of characterization are used is the weighted mean of the results: | Certified Value, X _{CRWRM} , where one method of characterization is used is the mean of individual results: |
| $\begin{split} & X_{CRM/RM} \equiv \Sigma(w_i) (X_i) \\ & X_i = \text{mean of Assay Method : with standard uncertainty u_{char i} \\ & w_i = \text{the weightling factors for each method calculated using the inverse square of the variance.} \\ & w_i = (1/k_{ohar})^2 / (\Sigma(1/(u_{char}))^2) \end{split}$ | $X_{CRM/RM} = (X_a) (u_{cher, a})$ $X_a = mean of Assay Method A withu_{cher, a} = the standard uncertainty of characterization Method A$ |
| CRM/RM Expanded Uncertainty (±) = U _{CRM/RM} = k ($u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{cs}$) ^{1/5} k = coverage factor = 2 u _{char} = $[\Sigma(w_p)^2 (u_{char}; j^2)]^{1/2}$ 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 u _{lts} = transport stability standard uncertainty | CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u^2_{chara} + u^2_{bb} + u^2_{fts} + u^2_{bs})^{y_3}$ k = coverage factor = 2 $u_{chara} =$ the errors from characterization $u_{bb} =$ bottle to bottle homogeneity standard uncertainty $u_{fts} = long term stability standard uncertainty (storage)$ $u_{fts} = transport stability standard uncertainty$ |
| Page 1 of 4 | |

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.

| Μ | Ag | < | 0.000590 | М | Eu | < | 0.000300 | М | Na | | 0.000879 | М | Se | < | 0.008000 | М | Zn | | 0.000598 |
|---|----|---|----------|---|-----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| М | A | | 0.000563 | Μ | Fe | < | 0.006500 | М | Nb | < | 0.029000 | i | Si | < | | М | Zr | < | 0.001800 |
| Μ | As | < | 0.002100 | Μ | Ga | < | 0.000300 | i | Nd | < | | Μ | Sm | < | 0.000300 | | | | |
| Μ | Au | < | 0.000300 | Μ | Gd | < | 0.000300 | Μ | Ni | < | 0.008000 | M | Sn | < | 0.008900 | | | | |
| Μ | В | < | 0.003300 | М | Ge | < | 0.000300 | Μ | Os | < | 0.000590 | Μ | Sr | | 0.000175 | | | | |
| Μ | Ba | | 0.001689 | Μ | Hf | < | 0.001800 | i | Ρ | < | | Μ | Та | < | 0.004200 | | | | |
| Μ | Be | < | 0.000890 | Μ | Hg | < | 0.003300 | Μ | Pb | < | 0.000300 | Μ | Tb | < | 0.000300 | | | | |
| М | Bi | < | 0.000890 | Μ | Но | < | 0.000300 | Μ | Pd | < | 0.001800 | М | Те | < | 0.021000 | | | | |
| 0 | Ca | | 0.006334 | M | In | < | 0.032000 | Μ | Pr | < | 0.013000 | М | Th | < | 0.000300 | | | | |
| 0 | Cd | < | 0.026000 | Μ | -Ir | < | 0.000300 | Μ | Pt | < | 0.000300 | 0 | TI | < | 0.032000 | | | | |
| Μ | Се | < | 0.008300 | Μ | ĸ | | 0.130213 | М | Rb | | 0.004575 | Μ | TI | | 0.001266 | | | | |
| М | Co | | 0.000598 | М | La | < | 0.000300 | М | Re | < | 0.000300 | М | Tm | < | 0.000300 | | | | |
| Μ | Cr | | 0.000527 | 0 | Li | | 0.000059 | Μ | Rh | < | 0.000300 | M | U | < | 0.005300 | | | | |
| М | Cs | | 0.000527 | М | Lu | < | 0.000300 | М | Ru | < | 0.079000 | M | V | < | 0.000890 | | | | |
| Μ | Cu | | 0.002252 | M | Mg | | 0.000563 | i | S | < | | M | W | | 0.087982 | | | | |
| Μ | Dy | < | 0.000300 | Μ | Mn | < | 0.005900 | М | Sb | | 0.001513 | М | Y | < | 0.000300 | | | | |
| Μ | Er | < | 0.000300 | s | Мо | < | | М | Sc | < | 0.001200 | М | 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 $20^\circ \pm 4^\circ$ C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliguots to container.

- For more information, visit 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 HCI or HF to stabilize acidic solutions. The [MoO4]-2 is soluble in concentrated HCI [MoOCI5]-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 HCI); Oxide (soluble in HF or NH4OH); Organic Matrices (Dry ash at 450EC in Pt0 and dissolve oxide with HF or HCI). 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,79Br1 |
| | | | 60,1900s2+,190Pt |
| | | | 2+ |
| 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 CRWRM.

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

July 17, 2022

- The certification is valid within the measurement uncertainty specified provided the CRW/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

Michael 2 Booth

Certificate Approved By:

Michael Booth **Director**, Technical

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Paul R Laine

Page 1 of 4

ក⁰⁸ = ក្រុងអាស់ ដែល ភ្លេង ភ្ល

Z = 1000BL = $\sup_{x \in \mathcal{A}} (\pi_x) = O_{CRM/RM} = k \left(u^2_{Char} + u^2_{T}_{bb} + u^2_{T}_{bb} + u^2_{T}_{bb} + u^2_{C}_{bb} \right)^{1/2}$ $\mathsf{M}^{i} = (1/\mathsf{n}^{\mathsf{clust}\,i})^{\Sigma} \setminus (\Sigma(1/(\mathsf{n}^{\mathsf{clust}\,i})_{\Sigma})$

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$$\begin{split} \chi_{CRM,FRM} = & (\chi_{o}) \; (u_{char, o}) \\ \chi_{a} = mean of Assay Method A with ut and a charter of the standard uncertainty of uncertainty of the standard uncertainty$$

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

Certified Value, X_{CRMMM}, where two or more methods of characterization are used is the weighted mean of the results: Characterization of CRM/RM by One Method Characterization of CRM/RM by Two or More Methods

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent to following equations are used in the calculate/K=2.

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

ICP Assay NIST SRM 3162a Lot Number: 130925 1002 ± 4 hg/mL

F# bodteM vssA

BCIOL = 3

un pepuedra w

(1x) (1w) = X(wi) (xi)

:noiternotnl ysseA

1.012 g/mL (measured at 20 ± 4 °C) Density: 1002 ± 5 µg/mL sulsV beitified

 $\chi_q = mean of Assay Method I with standard uncertainty updat 1$ w₁ = the weighting factors for each method calculated using the tothe weighting and the standard uncertainty updat 1

CERTIFIED VALUES AND UNCERTAINTIES 3.0

Starting Material Purity: 99.9975% Starting Material Lot#: 2094 Starting Material: In Metal unineti T 1 000 hg/mL ea: :(s)ətylanA \ əulsV :xinteM

tr. HF 2% (v/v) HNO3 27991717-2T Lot Number: **LITED** Catalog Number: Product Code:

Single Analyte Custom Grade Solution

PRODUCT DESCRIPTION 0.S

Number QSR-1034).

the Competence of Reference Material Producers" and ISO/IEC 17025, "Ceneral Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Vantures is also an ISO 9001 registered manufacturer (QSR Certificate Inorganic Manuel 2014) INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for



ACCREDITATION / REGISTRATION 0.r

300 Technology Drive Christiansburg, VA 24073 USA Christiansburg, VA 24073

R:2/22/24

info@inorganicventures.com E: 240-282-3015 E: 240-282-3030

Refine your results. Redefine your industry. Certificate of Analysis 6LESH' 8LESH

4.0 TRACEABILITY TO NIST

sbecueq. - This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRMRM uncertainty error and the measurement, weighing and volume dilutiton errors. In rare cases where no NIST SRMRM are available, the term "in-house std." is approximately and the term and term and term and term and term are cases where no NIST SRMRM are available, the term "in-house std." is a provided.

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

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)

.my €.0 a2 M 0732£0.0 > ⊨N O 832000.0 > ⊔∃ M 8€2000.0 > ⊵A M ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to CRMRMs 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 up of the method for each element of the property effection of the method for the met

| | | | | | | | | | | | - | | | | | | | | |
|----------|---|----|------|----------|---|----|---|------------|---|----|-----|----------|---|----|---|----------|---|------------|---|
| | | | 9 | 0:000536 | > | ٩٨ | Μ | 0.004900 | > | эS | 0 | ¢77000.0 | | oM | Μ | 892000.0 | > | ΞL | Μ |
| | | | 9 | 941200.0 | > | × | Μ | 926900.0 | > | qs | Μ | 0.003267 | > | υM | 0 | 892000.0 | > | DÀ | M |
| | | | 1 | 0.000473 | | M | Μ | | > | S | - į | 0.005445 | > | БM | 0 | 068010.0 | > | ng | 0 |
| | | | 9 | 98610.0 | > | Λ | Μ | 0.000269 | > | nЯ | Μ | 0.000268 | > | nŋ | Μ | 0.000268 | > | sÖ | M |
| | | | 8 | 0.000268 | > | Π | Μ | 0.000268 | > | ЧЫ | Μ | 0.027225 | > | П | 0 | 297000.0 | | CL | M |
| | | | 8 | 0.000268 | > | шŢ | M | 89Z000.0 | > | əЯ | W | 0.000268 | > | гŋ | W | 0.004293 | > | 00 | W |
| | | | 5 | 0.000268 | > | Ш | Μ | 0.000268 | > | ЧЯ | Μ | 271100.0 | | К | W | 0.000268 | > | 9 <u>0</u> | W |
| | | | | | > | Ш | S | 0.000536 | > | Ъł | Μ | 692000.0 | > | 4 | Μ | 892000.0 | > | PO | M |
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| | | | | \$£100.0 | > | θT | Μ | 0.000268 | > | Pd | Μ | 0.000268 | > | ен | Μ | 609100.0 | > | B | M |
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| | | | | 0.01056(| | БT | Μ | 0.054450.0 | > | d | 0 | 191200.0 | | łΗ | Μ | 0.002683 | > | Вa | M |
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| | | | - | 60000.0 | | us | Μ | 068010.0 | > | !N | 0 | 0.000268 | > | ΡÐ | M | 778400.0 | > | nΨ | W |
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| 792600.0 | > | uΖ | 0 \$ | 0.00120 | | əS | Μ | 0.032670 | > | вΝ | 0 | 0.000268 | > | nΞ | Μ | 0.000536 | > | ₿¥ | M |
| | | | | | | | | | | | | | | | | | | | |

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

- For the calibration of analytical instruments and validation of analytical methods as appropriate. 9.0 INTENDED USE

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

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- Chemical Testing - Accredited / A2LA Certificate Number 883.01 "serveter of the second second and the Competence of the Competence of Testing and Calibration Laboratories."

- QSR Certificate Number QSR-1034

nottertizigeA metevs inemegeneM villsuD 100e OSI 1.01

WOITATNEMUDOD GRADNATS YTILAUD

0.01

Homogeneity data indicate that the end user should take a minimum server of 0.2 m L or 2.0 m L or 2 - This solution was more according to the superior superior of the form as the solution of the homogeneous. المستحدم المرابعة الم .viienegeneity.

Please refer to the Safety Data Sheet for information regarding this CRMRM. HOMOGENEITY 0'6

NOITAMAORNI SUOGAASAH 0.8

| ۲۹۸۱۵۵۲۹۵۵) ۱۹۸۱۶۵۶ ۲۲۵۶ (۱۹۹۵ ۲۲۵۶۶ ۲۲۵۶ ۱۹۵۱ ۱۹۵٫ ۲۶٬۵۲۱ ۱۹۵٫ ۲۶٬۵۲۱ | .sselo n r r r | 0.0054 / 0.00052 µg/mL 0.0054 / 0.00038 µg/mL 0.0053 / 0.00034 µg/mL 10 not be prepared or stored ir 10N | CP-OES 323.452 nm (CP-OES 334.941 nm (CP-OES 334.941 nm (CP-OES 336.121 nm (CP-OES 336.121 nm (CP-OES 336.121 nm (CP-OES 336.121 nm (CP-OES 336.121 nm (CP-OES 336.121 nm) (CP-OES 34.121 nm) (CP-OES 34.121 nm) (CP-OES 34.121 nm) (CP-OES 34.121 nm) |
|---|-------------------------|--|--|
| SET Interferences (underlined indicates severe) 32S160, 32S14N, | Orde A/N | 14 pt | ICP-MS 48 amu |

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

1:1:1 H2O / HF / H2SO4 or fuse ash with pyrosultate it oxide is as plastic pigment and likely in prookite Notentity: Oxde - low temperature history and sortanty - ineer (sortant in 122) in source heads Notentity: Oxde - low temperature history (-800EC) brookite (fuse in Pto with KS2207); Ores (f TI Containing Samples (Preparation and Solution) - Metal (Soluble in H2O / HF caution -powder reacts violentino: Ovide , Iour Inergene , or entile (Discoluted by Inergene) and Ferdinal Market (Soluble In 1997).

HINGS / LDPE compared from and solutions as the TI(F)6-2 chemically stable for years in the solution and the solutions as the TI(F)6-2 chemically stable for years in the solution from and solutions. 1-10,000 ppm aingle element solutions as the TI(F)6-2 chemically stable for years in the solution from and solutions are the transmission from and solutions are the transmission from and solutions are the solutions are the transmission from and solutions are the solutions are the transmission from and solutions are the transmission from and solutions are the solution from and solutions are the transmission from and solutions are the solution from an and solutions are the solution from an and solutions are the solution from an and solutions are the solutions are the solution from an and solutions are the solutions are the solutions are the solution from an an and solutions are the solutions are the solutions are the solutions are the solution from an and solutions are the solutions are the solution from an and solutions are the solutions are the solutions are the solution from an and solutions are the solutions are the solutions are the solution from an and solutions are the solutions are the solutions are the solution from an an an an an an and solutions are the solutions are the solution are the so with a fendency to hydrolyze forming the hydrafied oxide in all dilute acids except HF. **Stability -** 2-100 ppb levels stable (Alone or mixed with all other metals) as the Ti(F)6-2 for months in 1% HNO3 / LDPE container. 1-10.000 point and element solutions as the Ti(F)6-2 chemically stable for year 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 thansition elements unless they are fluorinated). Stable with more inorganic anions with a tendency to hydrolyze forming the hydrafed oxide in all dilute acids except HF. Chemical Compatibility - Soluble in concentrated HCI, HF, H3PO4 H2SO4 and HVO3. Avoid neutral to basic S-8(T)T 6 4+ 78.74 - noiluite in Solution (Chemical Form in Solution - 47.74 6 T(F)6-5-- For more information, visit www.inorganicventures.com/TCT Afomic Weinher Valence: Coordination Winnher: Chemical Equa

reported density. Do not pipette from the container. Do not return removed aliquots to container. - 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 renorted density. To not other from the container. To not return removed alternots to container.

Page some more served to the served to the served to the ordent of the ordent 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 the rescaled to the test 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. - While stored in the sealed TCT bag, transpiration of this CRAWRM is negligible. After opening the sealed TCT had transmission of the CDMMAN will occur recutification increase in the source concentration of the is

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

Page 4 of 4

Certifying Officer:

Chairman / Senior Technical Director

NOS Paulo 182

Paul Gaines

-

Thomas Kozikowski Manager, Quality Control

Certificate Approved By:

0.2r

NAMES AND SIGNATURES OF CERTIFYING OFFICERS

- 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.

- Sealed TCT Bag Open Date:

11.3 Period of Validity stability studies conducted on property stored and handled CR/WRMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

- The lot expiration date reflects the period of time that the stability of a CRMMM can be supported by long term

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

- June 17, 2027

11.2 Lot Expiration Date

The cartification is valid within the measurement uncertainty specified provided the CRWRM 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.

June 17, 2022

11.1 Certification Issue Date

CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY 0.11

norganic Ventures, 300 Technicky Drive, Christianeburg, Ve. 24073, USA; Telephone: 800,669,678; 640,585,3030, Fax: 540,562,5015; Innga

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

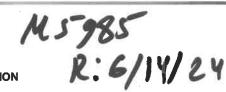
10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"



Certificate of Analysis

Refine your results. Redefine your industry.

300 Technology Drive Christiansburg, VA 24073 USA 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). P: 800-669-6799/540-585-3030 F: 540-585-3012 info@inorganicventures.com



2.0 PRODUCT DESCRIPTION

| Product Code: | Single Analyte Custom Grade Solution |
|---------------------------|--------------------------------------|
| Catalog Number: | CGIN10 |
| Lot Number: | U2-IN729349 |
| Matrix: | 5% (v/v) HNO3 |
| Value / Analyte(s): | 10 000 μg/mL ea: Indium |
| Starting Material: | Indium Metal |
| Starting Material Lot#: | 2511 |
| Starting Material Purity: | 99.9995% |
| CERTIFIED VALUES AN | ID UNCERTAINTIES |

| Certified Value: | 10022 ± 30 μg/mL |
|------------------|--|
| Density: | 1.044 g/mL (measured at 20 \pm 4 °C) |

Assay Information:

3.0

| Assay Method #1 | 10021 ± 56 μg/mL ICP Assay NIST SRM 3124a Lot Number: 110516 |
|-----------------|--|
| Assay Method #2 | 10035 ± 25 µg/mL EDTA NIST SRM 928 Lot Number: 928 |
| Assay Method #3 | 10001 ± 33 µg/mL Calculated NIST SRM Lot Number: See Sec. 4.2 |

- 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_{CRMRM}, where two or more methods of characterization are used is the weighted mean of the results:

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

- X_{i} = mean of Assay Method I with standard uncertainty $u_{char i}$
 - \mathbf{w}_{i} = the weighting factors for each method calculated using the inverse square of the variance:
 - $w_i = (1/u_{char\,i})^2 / (\Sigma (1/(u_{char\,i})^2)$

CRM/RM Expanded Uncertainty (±) = U_{CRM/RM} = k $(u^2_{char} + u^2_{bb} + u^2_{1ts} + u^2_{ts})^{1/2}$ k = coverage factor = 2 $u_{char} = [2((w_i)^2 (u_{char} i)^2)]^{1/2}$ where u_{char} i are the errors from each characterization method

- $\begin{array}{l} \text{construction} \quad \text{con$
- uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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:

$$\begin{split} \chi_{CRM/RM} = (X_n) \, (u_{cher\ n}) \\ \chi_n = mean\ of\ Assay\ Method\ A\ with \\ u_{cher\ n} = the\ standard\ uncertainty\ of\ characterization\ Method\ A \end{split}$$

CRM/RM Expanded Uncertainty (±) = U_{CRM/RM} = k (u²_{cher} a + u²_{bb} + u²_{Hs} + u²_{ks})^½ k = coverage factor = 2 u_{char} a = the errors from characterization u_{bb} = bottle to bottle homogeneity standard uncertainty u_{fts} = long term stability standard uncertainty (storage) u_{tts} = ransport stability standard uncertainty

 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.

| М | Ag | < | 0.000760 | Μ | Eu | < | 0.000760 | 0 | Na | | 0.012771 | М | Se | < | 0.023000 | М | Zn | < | 0.006100 |
|---|----|---|----------|---|------|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| М | AI | | 0.003385 | 0 | Fe | | 0.004462 | М | Nb | < | 0.000760 | 0 | Si | | 0.024619 | М | Zr | < | 0.000760 |
| М | As | < | 0.004600 | М | Ga | < | 0.000760 | М | Nd | < | 0.000760 | М | Sm | < | 0.000760 | | | | |
| М | Au | < | 0.002300 | М | Gd | < | 0.000760 | 0 | Ni | < | 0.005100 | М | Sn | < | 0.000760 | | | | |
| 0 | в | | 0.003692 | М | Ge | < | 0.001600 | м | Os | < | 0.000760 | 0 | Sr | < | 0.000610 | | | | |
| М | Ba | < | 0.001600 | М | Hf | < | 0.000760 | n | Р | < | | М | Та | < | 0.000760 | | | | |
| 0 | Be | < | 0.000130 | М | Hg | < | 0.003100 | М | Pb | | 0.001400 | М | Tb | < | 0.000760 | | | | |
| Μ | Bi | < | 0.000760 | М | Ho | < | 0.000760 | Μ | Pd | < | 0.001600 | М | Те | < | 0.000760 | | | | |
| 0 | Ca | | 0.004616 | 5 | In | < | | М | Pr | < | 0.000760 | М | Th | < | 0.000760 | | | | |
| Μ | Cd | < | 0.000760 | М | lr – | < | 0.000760 | М | Pt | < | 0.000760 | 0 | Π | < | 0.001100 | | | | |
| М | Се | < | 0.000760 | 0 | к | | 0.007078 | М | Rb | < | 0.000760 | М | TI | < | 0.000760 | | | | |
| М | Со | < | 0.000760 | М | La | < | 0.000760 | М | Re | < | 0.000760 | M | Tm | < | 0.000760 | | | | |
| 0 | Cr | < | 0.001300 | 0 | Li | < | 0.000130 | М | Rh | < | 0.000760 | м | U | < | 0.000760 | | | | |
| М | Cs | < | 0.000760 | М | Lu | < | 0.000760 | М | Ru | < | 0.000760 | М | V | < | 0.001600 | | | | |
| М | Cu | < | 0.003800 | 0 | Mg | | 0.000707 | n | s | < | | М | W | < | 0.001600 | | | | |
| М | Dy | < | 0.000760 | 0 | Mn | | 0.000149 | М | Sb | < | 0.000760 | М | Y | < | 0.000760 | | | | |
| М | Er | < | 0.000760 | М | Мо | < | 0.002300 | М | Sc | < | 0.000760 | М | Yb | < | 0.000760 | | | | |
| | | | | | | | | | | | | | | | | | | | |

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

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 <u>Terms and Conditions of Sale</u>. <u>https://www.inorganicventures.com/terms-and-conditions-sale</u>. 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 $20^\circ \pm 4^\circ$ 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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 114.82 +3 6 ln(H2O)6+3 Chemical Compatibility -Soluble in HCl, HNO3, and H2SO4. Avoid neutral and basic media. Stable with most metals and inorganic anions. The oxalate, sulfide, carbonate, hydroxide and phosphate are insoluble in water.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO3 / LDPE container.

In Containing Samples (Preparation and Solution) -Metal (Best dissolved in HCI / HNO3); Oxide (Soluble in mineral acids); Ores (Carbonate fusion in Pt0 followed by HCI dissolution); Organic Matrices (Sulfuric/peroxide digestion or dry ash and dissolution in dilute HCI).

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 115 amu | 1 ppt | n/a | 115Sn, 99Ru16O |
| ICP-OES 158.583 nm | 0.05 / 0.002 µg/mL | 1 | |
| ICP-OES 230.606 nm | 0.1 / 0.03 µg/mL | 1 | Ni, Os |
| ICP-OES 325.609 nm | 0.2 / 0.05 µg/mL | 1 | Mn, Mo, Th |

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 Callbration 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

February 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

- February 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

DJ 78

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director



Certificate of Analysis MGO 7Y

M6075 M6076

M6077

300 Technology Drive Christiansburg, VA 24073 USA 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).

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





2.0 **PRODUCT DESCRIPTION**

| Product Code: | Multi Analyte Custom Grade Solution | |
|---------------------|-------------------------------------|-------------|
| Catalog Number: | CHEM-CLP-4 | |
| Lot Number: | V2-MEB746762 | |
| Matrix: | 3% (v/v) HNO3 3% (v/v) HF | |
| Value / Analyte(s): | 1 000 µg/mL ea: | Molubdopum |
| | Boron, | Molybdenum, |
| | Silicon, | Tin, |
| | Titanium | |

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

| ANALYTE Boron, B | CERTIFIED VALUE 1 000 ± 5 µg/mL | ANALYTE Molybdenum, Mo | CERTIFIED VALUE 1 000 ± 5 µg/mL |
|---------------------|------------------------------------|---------------------------|------------------------------------|
| Silicon, Si | 1 000 ± 7 μg/mL | Tin, Sn | 1 000 ± 5 μg/mL |
| Titanium, Ti | 1 000 ± 6 µg/mL | | |
| Density: | 1.033 g/mL (measur | ed at 20 ± 4 °C) | |
| Assay Information: | | | |

NIST SRM# ANALYTE METHOD SRM LOT# в **ICP** Assay 3107 190605 в Calculated See Sec. 4.2 Mo ICP Assay traceable to 3134 U2-MO739068 Traceable to 3150 Si ICP Assay S2-SI702546 Sn ICP Assay 3161a 140917 Ti **ICP** Assav traceable to 3162a T2-TI725816

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

Characterization of CRM/RM by Two or More Methods

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

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

- X_i = mean of Assay Method i with standard uncertainty $u_{char i}$
 - w_j = the weighting factors for each method calculated using the inverse square of the variance:
 - $w_i = (1/u_{char i})^2 / (\Sigma(1/(u_{char i})^2))$

CRM/RM Expanded Uncertainty (±) = U_{CRM/RM} = k $(u^2_{cher} + u^2_{bb} + u^2_{ts} + u^2_{ts})^{1/2}$ k = coverage factor = 2

- $u_{char} = \left[\sum ((w_i)^2 (u_{char})^2) \right]^{\frac{1}{2}}$ where u_{char} i are the errors from each characterization method
- ubb = bottle to bottle homogeneity standard uncertainty
- ults = long term stability standard uncertainty (storage)
- uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

Characterization of CRM/RM by One Method

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

 $\begin{array}{l} X_{CRM/RM}=(X_{a}) \left(u_{char\,a}\right) \\ X_{a}= mean of Assay Method A with \\ u_{char\,a}= the standard uncertainty of characterization Method A \end{array}$

CRM/RM Expanded Uncertainty (±) = U_{CRM/RM} = k ($u^2_{chere} + u^2_{bb} + u^2_{ts} + u^2_{ts}$)^{1/2} k = coverage factor = 2 $u_{chara} =$ the errors from characterization $u_{bb} =$ bottle to bottle homogeneity standard uncertainty $u_{ts} = long term stability standard uncertainty (storage)$

u_{ts} = transport stability standard uncertainty

- 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 <u>Terms and Conditions of Sale</u>. <u>https://www.inorganicventures.com/terms-and-conditions-sale</u>. 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 $20^{\circ} \pm 4^{\circ}$ 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 HF Note: This standard should not be prepared or stored in glass.

8.0 HAZARDOUS INFORMATION

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

9.0 HOMOGENEITY

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

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

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

September 06, 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

- September 06, 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.

- 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.

NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

Certificate Approved By:

Joseph Burns **Custom VS Manager**

Paul R Saines

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Hydrochloric Acid, 36.5-38.0% BAKER INSTRA-ANALYZED® Reagent

For Trace Metal Analysis





R->10/13/24

Met dig

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

| Μ | 6 | ۱ | 2 | 1 |
|---|---|---|---|---|
| _ | _ | - | | |

Certificate of Analysis

| Test | Specification | Result |
|---|---------------|---------|
| ACS - Assay (as HCI) (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 Cl2) | <= 0.5 ppm | < 0.5 |
| Phosphate (PO4) | <= 0.05 ppm | < 0.03 |
| Sulfate (SO4) | <= 0.5 ppm | < 0.3 |
| Sulfite (SO3) | <= 0.8 ppm | 0.3 |
| Ammonium (NH4) | <= 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

Material No.: 9530-33 Batch No.: 0000275677

| 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 | <] |
| Trace Impurities – Lead (Pb) | <pre>>> dqq 0.1 =></pre> | < 0.5 |
| Trace Impurities – Lithium (Li) | <= 1.0 ppb | 0.2 |
| Frace Impurities – Magnesium (Mg) | <= 10.0 ppb | 0.2 |
| Frace Impurities – Manganese (Mn) | <= 1.0 ppb | < 0.4 |
| race Impurities – Mercury (Hg) | <= 0.5 ppb | 0.1 |
| race Impurities – Molybdenum (Mo) | <= 10.0 ppb | < 5.0 |
| race Impurities – Nickel (Ni) | <= 4.0 ppb | < 0.3 |
| race Impurities – Niobium (Nb) | <= 1.0 ppb | < 0.2 |
| race Impurities – Potassium (K) | <= 9.0 ppb | < 2.0 |
| race Impurities - Selenium (Se), For Information Only | ppb | 1.0 |
| race Impurities - Silicon (Si) | <= 100.0 ppb | < 10.0 |
| race Impurities – Silver (Ag) | <= 1.0 ppb | < 0.3 |
| race Impurities – Sodium (Na) | <= 100.0 ppb | < 5.0 |
| race Impurities – Strontium (Sr) | <= 1.0 ppb | < 0.2 |
| race Impurities – Tantalum (Ta) | <= 1.0 ppb | < 0.2 |
| ace Impurities - Thallium (TI) | <= 5.0 ppb | |
| ace Impurities – Tin (Sn) | <= 5.0 ppb | < 2.0 |
| ace Impurities - Titanium (Ti) | <= 1.0 ppb | < 0.8 |
| ace Impurities – Vanadium (V) | <= 1.0 ppb | 0.2 |
| ace Impurities – Zinc (Zn) | <= 5.0 ppb | < 0.2 |
| ace Impurities – Zirconium (Zr) | <= 1.0 ppb | 0.3 < 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

James Techie 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





R-> 11/12/24 TH6126

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 (HNO₃) | 69.0 – 70.0 % | 69.7 % |
| Appearance | Passes Test | Passes Test |
| Color (APHA) | ≤ 10 | 5 |
| Residue after Ignition | ≤ 2 ppm | 1 ppm |
| Chloride (CI) | ≤ 0.08 ppm | < 0.03 ppm |
| Phosphate (PO4) | ≤ 0.10 ppm | < 0.03 ppm |
| Sulfate (SO4) | ≤ 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





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

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

For Microelectronic Use

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



| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description: Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: | Setting Certified Reference Material CRM Setting National 112124 N.S. I/I/3/250/vent: 24012496 Magnesium (Mg) N.S. I/I/3/250/vent: 24012496 Nitric Acid 112127 N.G. V.Y. 2% 40.0 Nitric Acid 112127 M.G.V.Y. 2% 40.0 Nitric Acid 112127 M.G.V.Y. 2% 40.0 Nitric Acid 110000 GUTB 5E-05 Balance Uncertainty | Formulated By: |
|---|--|--|
| Weight shown below was diluted to (mL): | 2000.07 0.100 Fask Uncertainty 2000.07 0.100 Fask Uncertainty Nominal Purthy Uncertainty Assay Target Actual Conc. (ug/mL) (%) Purthy (%) (%) Weight (g) | Expanded SDS Information Actual Uncertainty Uncertainty (Solvent Safety Info. On Attached pg.) Conc. (ug/mL) +/- (ug/mL) CAS# OSHA PEL (TWA) |
| 1. Magnesium nitrate hexahydrate (Mg) IN030 Mgposzoza41 | 10000 98.999 0.10 8.51 234.9183 234.9459 | 20.0 13446-18-9 NA orf-rat |
| [1] Spectrum No.1 1.0E6 | [19.923 sec];58112.D# [Count] [Linear] | |
| g. Oeg | | |
| m/≈-> 10 2000 | 20 30 40 50 6 0 | 70 80 90 100 |
| 1000 | | |
| m/z-> 110 2.0厘4 | 120 130 140 150 160 | 170 180 190 200 |
| m/z-≫ 210 | 220 230 240 250 260 | |
| | | |

www.absolutestandards.com Absolute Standards, Inc. 800-368-1131



Certified Reference Material CRM



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

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

| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | | - | 20.02 | | 20.05 | 18 | <0.0Z | × | 40.2 | ĸ | <0.02 | Nd | <0.02 | Рb | <0.02 | Au | <0.02 | ç | <0.02 | 8 |
|--|--|-----|-----|-------|-----|-------|-----|-------|-----|-------|----|-------|----|-------|-----|-------|----------|-------|----------------|-------|----|
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 2 | 21 | 2002 | 9 8 | 0.02 | 3 6 | 10.02 | 311 | 20.02 | 2 | <0.02 | MO | 20.05 | 5 | Z0102 | ନ୍ନ | <0.02 | S | <0.02 | æ. |
| 40.02 Cd 40.02 Dy 40.02 Hf 40.02 Ni 40.02 Pr 40.02 Sc 40.2 Tb 40.02 W 40.02 Ca 40.2 Er 40.02 Hf 40.02 Li 40.02 Nb 40.02 Sc 40.2 Tb 40.02 U 40.02 Ca 40.2 Er 40.02 Ho 40.02 Lu 40.02 Re 40.02 Si 40.02 Te 40.02 U 40.02 Ca 40.02 Ir 40.02 Mg T Os 40.02 Na 40.02 Te 40.02 V 40.01 Cr 40.02 Ir 40.02 Mg T Os 40.02 Na 40.02 Th 40.02 V 40.01 Gr 40.02 Ir 40.02 Ma 40.02 Yb 40.02 Yb 40.02 Yb 40.02 Yb 40.02 | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 4 | Zn | -0.02 | 2 | 2002 | 0 | 5 | 2 | 3 | 2 | 3 | | 200 | 1 (| | | 10.02 | 1 | 10.01 | Ş |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 6 | Y | <0.02 | Tm | <0.02 | S | <0.02 | Ru | <0.02 | ŋ | 40,2 | Hø | 40.2 | 21 | 40.02 | <u>.</u> | AD 03 | 2 | 100 | 5 |
| 40.02 Cd 40.02 Dy 40.02 Hf 40.02 Li 40.02 Ni 40.02 Pr 40.02 Se 40.2 Th 40.02 W 40.02 Ca 40.2 Er 40.02 Hf 40.02 Li 40.02 Pr 40.02 Se 40.2 Th 40.02 W 40.02 Ca 40.2 Er 40.02 Ha 40.02 Nb 40.02 Re 40.02 Si 40.02 T 40.02 V 40.02 V | 40.02 Cd 40.02 Dy 40.02 Hf 40.02 Li 40.02 Ni 40.02 Pr 40.02 Se 40.2 Tb 40.02 W 40.02 Ca 40.2 Er 40.02 Hf 40.02 Li 40.02 N 40.02 Se 40.2 Tb 40.02 U 40.02 Ca 40.02 Hr 40.02 Li 40.02 Nb 40.02 Se 40.2 Tb 40.02 U 40.02 Ca 40.02 Hr 40.02 Mg T 0s 40.02 Rb 40.02 Tb 40.02 U 40.02 Ca 40.02 In 40.02 Mg T 0s 40.02 Rb 40.02 Tb 40.02 V 40.02 Ca 40.02 In 40.02 Mg T 0s 40.02 Rb 40.02 Tb 40.02 V 40.02 Fin 40.02 Mg T 0s 40.02 Rb 40.02 | . 6 | IO | 20.02 | 10 | 40.2 | Næ | <0.02 | Rb | <0.02 | Pd | <0.02 | Mn | <0.02 | ŀ | <0.02 | R | <0.02 | S | <0.02 | Ba |
| Cd CD Li < | 40.02 Cd 40.02 Dy 40.02 Hf 40.02 Li 40.02 Ni 40.02 Pr 40.02 Se 40.2 Tb 40.02 W 40.02 Ca 40.2 Er 40.02 Hf 40.02 Li 40.02 Nb 40.02 Se 40.2 Tb 40.02 U 40.02 Ca 40.02 Ho 40.02 Lu 40.02 Nb 40.02 Si 40.02 Tc 40.02 U | 56 | ģ < | 20.02 | | 20.02 | Ag | <0.02 | Rb | <0.02 | 0s | Ţ | Mg | <0.02 | In | <0.02 | 臣 | <0.02 | ŝ | <0.2 | As |
| | <th< td=""><td>3 6</td><td>4 0</td><td>20.02</td><td>1</td><td>20.02</td><td>2</td><td>20.02</td><td>KC</td><td><0.02</td><td>NP</td><td><0.02</td><td>Lu</td><td><0.02</td><td>Но</td><td><0.02</td><td>막</td><td>40.2</td><td>C₂</td><td><0.02</td><td>SP</td></th<> | 3 6 | 4 0 | 20.02 | 1 | 20.02 | 2 | 20.02 | KC | <0.02 | NP | <0.02 | Lu | <0.02 | Но | <0.02 | 막 | 40.2 | C ₂ | <0.02 | SP |
| | | 3 | ; : | 3 | 3 3 | 5 | a g | 10.02 | 1 | 0.02 | 1 | <0.02 | F | 20.02 | HI | 20.02 | Ŋ | <0.02 | 2 | <0.02 | A |
| | | 4 | W | 40.02 | 7 | c (b) | S | 300 | Dr | 3 | | 2003 | 1 | 200 | | | | | | | |

(I) = larget analyte

Physical Characterization:

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

Son P. A.

Certified by:

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

* All standard containers are meticulously cleaned prior to use. the preparation of all standards.

* Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).

* Standards are certifed (+/-) 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).

Part # 58112 Lot # 112124

| Dat # 60036 101 # | m/z->- | 5.067 | m/z-> 1.0⋿8 | 5.067 | m/≥-> 1.0E8 | N.5 8 | 5.006 | 1. Manganese(II) nitrate hydrate (Mn) | Weight sh Compound | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: | CERTIFIED WEIGHT REPORT: Part I Lot Des | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
|--------------------------------|-------------|-------|----------------|-------|----------------|----------|---|---------------------------------------|---|---|--|--|
| Lot # 101124 | Ņ | | 110 | | 10 | | [1] Spectrum No.1 | | Weight shown below was diluted to (mL): Lot RM# Number | Expiration Date: Recommended Storage: Il Concentration (µg/mL): NIST Test Number: | <u>Part Number:</u> Lot Number: Description: | s, Inc. |
| | N N O | | 120 | | 0 0 | | | A1 | | õ | 58025 101124 Manganese (Mn) | |
| | N. 0 | | 100 | | ۵ Ö | | [34.243 sec]:57025.D# [Count] [Linear] | 1000 99.999 | 4000.2 0.10 Fit Nominal Purity U Cone. (ug/mL) (%) F | Ś | R-71/13/2& Solvent: | Се |
| _ | N 4 0 | | 140 | | 4 0 | | 25.D# [Count] | 0.10 20.8 | 0.10 Flask Uncertainty Purity Uncertainty Assay (%) Purity (%) (%) | SE-05 Balance Uncertainty | | rtified Referen |
| 1 of 2 | 260 260 | | 150 160 | | 0. 0. | | [Linear] | | Target Actual Weight (g) Weight (g) | (mL) Nitric Acid | 46 | Certified Reference Material CRM |
| | | | 170 | | 70 | | | | Actual Conc. (ug/mL) | (| | M |
| Prin | | | 180 | | 8 | | | 2.0 15710-66-4 | Expanded Uncertainty (SolVe +/- (µg/mL) CAS# | Pormulated by: | Giovannie | |
| Printed: 1/10/2025, 4:51:16 PM | | | 190 | | 80 | | | 5 mg/m3 | SDS Information (Solvent Safety Info. On Attached pg.) S# OSHA PEL (TWA) LD50 | Pedro L. Rentas | Especite | ANA AR- https: |
| :51:16 PM | | | N 0 0 | | 100 | | | orl-rat >300mg/kg | ttion Attached pg.) LD50 | 101124 | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
| | | | | | | | | g 3132 | NIST | <u>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 </u> | | Accredited e Number Jards.com |

| www.absolutestandards.com | 800-368-1131 | Absolute Standards, |
|---------------------------|--------------|---------------------|
| | | Inc. |





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

| Г | | | | | | | Trace Mo | etals | Verifica | ition | by ICP- | Ś | (µg/mL) | | | | | | |
|----|-------|----|-------|-----|-------|----|----------|-------|----------|-------|---------|----|---------|----|-------|----|-------|----------------|-------|
| | 3 | 2 | 2000 | | 5 | | 200 | | | | | | | | | | | | |
| Al | <0.02 | 8 | <0.02 | Ðy | <0.02 | Hf | <0.02 | 5 | <0.02 | N | <0.02 | Ŗ | <0.02 | Se | 40.2 | ТЪ | <0.02 | W | <0.02 |
| Sb | <0.02 | Q | <0.2 | Ę | <0.02 | Ho | <0.02 | Ę | <0.02 | N | <0.02 | Re | <0.02 | S | <0.02 | Te | <0.02 | C | <0.02 |
| As | <0.2 | ଚ | <0.02 | Eu | <0.02 | In | <0.02 | Mg | <0.01 | °s | <0.02 | R} | <0.02 | Ag | <0.02 | Ξ | <0.02 | < | <0.02 |
| Ba | <0.02 | Ç | <0.02 | ଜୁ | <0.02 | F, | <0.02 | Mn | Н | Pd | <0.02 | Rb | <0.02 | Na | <0.2 | П | <0.02 | Υ _b | <0.02 |
| Be | <0.01 | ភ្ | <0.02 | ဌ | <0.02 | Fe | <0.2 | Hg | <0.2 | ъ | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | × | <0.02 |
| Bi | <0.02 | S | <0.02 | ନ୍ଚ | <0.02 | La | <0.02 | Mo | <0.02 | P | <0.02 | Sm | <0.02 | s | <0.02 | Sn | <0.02 | Zn | <0.02 |
| в | <0.02 | Q | <0.02 | Au | <0.02 | РЬ | <0.02 | Nd | <0.02 | ĸ | <0.2 | Sc | <0.02 | Ta | <0.02 | E | <0.02 | Zr | <0.02 |
| | | | | | | | | | | | | | | | | | | | |

(T) = Target analyte

Physical Characterization:

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

for P. S.

Certified by:

* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.

* Purified acids, 18.2 megohm delonized 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 certifed (+/-) 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).

Part # 58025 Lot # 101124

| Part # 58111 Lot # 072424 | m/z-> | N. Un M | m/z-> | א. ה ס | 5.0E6 | N 51 11 63 | 5.0E5 | 1. Sodium nitrate (Na) | Compound | Description: Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa | CERTIFIED WEIGHT REPORT: Part Number: Lot Number: | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
|--------------------------------|---------|---------------|-----------------|--------------|--------------|---------------------|--------------------------------------|---------------------------|---|--|---|--|
| 424 | 210 220 | | 110 120 | | น ง ง | | [1] Spectrum No.1 | IN036 NAV01201511 1 | RM# Lot N | Sodium (Na 072427 Ambient (20 ° 10000 6UTB s diluted to (mL): | a a · | Inc. |
| | 230 240 | | 130 140 | | ల ర | | 8.935 sec]:58111.D# [Count] [Linear] | 10000 99.999 0.10 26.9 | Nominal Purity Uncertainty Assay Conc. (ug/mL) (%) Purity (%) (%) | レ WM ら 1 4 4 2% C) SE-05 Balance Uncertainty 4000.2 0.10 Flask Uncertainty | R-> 1/13/2_Solvent: | Certified Re |
| 1 of 2 | 250 260 | | 150 160 1 | | 50 60 | | unt] [Linear] | 148.7096 ###### 10000.0 | Target Actual Actual Weight (g) Weight (g) Conc. (µg/mL) | 80.0 Nitric Acid (mL) | Lot # 24002546 Nitric Acid | Certified Reference Material CRM |
| Printed: 1/10/2025, 4:48:22 PM | | | 170 180 190 200 | | 70 80 90 100 | | | 20.0 7631-99-4 5 mg/m3 or | Expanded SDS Information Uncertainty (Solvent Safety Info. On Attached pg.) .) +/- (µg/mL) CAS# OSHA PEL (TWA) LD50 | Formulated By: Benson Chan | M | ANAB I AR-15: https://Ak |
| 22 PM | | | | | | | | orl-rat 3430 mg/kg 3152a | IChed pg.) NIST LD50 SRM | 072424 072424 | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |

www.absolutestandards.com 800-368-1131 Absolute Standards, Inc.



Certified Reference Material CRM



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

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

| | <0.02 Cu <0.02 | <0.02 Co <0.02 | Be <0.01 Cr <0.02 Ga | <0.02 Cs <0.02 | <0.2 Cc <0.02 | <0.02 Ca <0.2 | <0.02 Cd <0.02 | ARREST AL STATISTICS OF STREET, STATISTICS O | | |
|---|----------------|----------------|----------------------|----------------|---------------|---------------|----------------|--|----------|------|
| | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | O.N. ST. S. MAR. | | |
| | Pb | La | Fe | Ir | In | Ho | Hf | | | |
| | <0.02 | <0.02 | 40.2 | <0.02 | <0.02 | <0.02 | <0.02 | Notific II.A. | Irace Mo | |
| | Nd | Mo | Hg | Mn | Mg | Lu | E | | ietais | |
| Ì | 40.02 | <0.02 | <0.2 | <0.02 | <0.01 | <0.02 | <0.02 | | Verifica | |
| | × | Ŗ | ٩ | Pd | ^S | Nb | Ni | | cion i | |
| | <0.2 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | OY ICP-N | 57 |
| | Sc | Sm | Ru | Rb | Rh | Re | Pr | Presenter of | 10 F | 10 / |
| | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | g/mL) | |
| | Ta | ŝ | Sr | Na | Ag | <u>s</u> | Se | 1001 | | |
| | <0.02 | <0.02 | <0.02 | Т | <0.02 | <0.02 | <0.2 | and the set | | |
| | 13 | Sn | Tm | Th | T | Te | 7 | | | |
| | 40.02 | 40.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | The second s | | |
| | Zr | Zn | Y | Yb | < | U | W | | | |
| | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | |

Physical Characterization:

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

In P. St.

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.

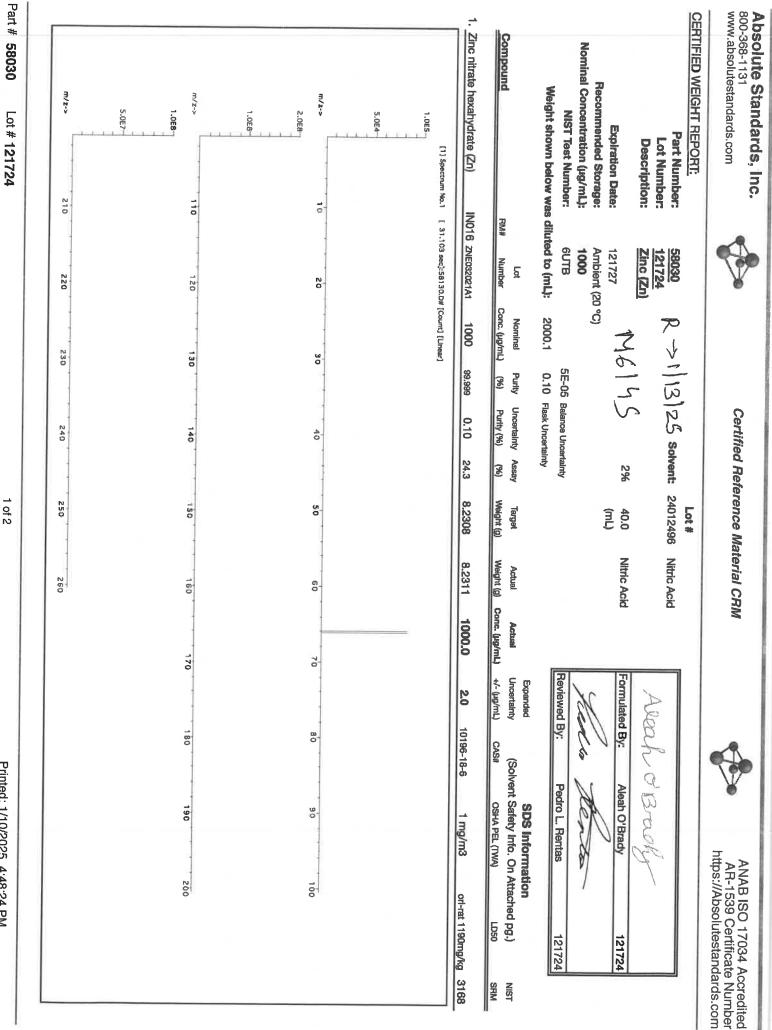
÷

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 certifed (+/-) 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).



1 of 2

Printed: 1/10/2025, 4:48:24 PM

| www.absolutestandards.com | 800-368-1131 | Absolute Standards, |
|---------------------------|--------------|---------------------|
| | | Inc. |





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

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

| | | | | | | | I race M | etais | Verifica | | by icr- | UNIC | /9/111L/ | L | | | | | |
|----|-------|----------------|-------|-----|-------|-----|----------|-------|----------|---|---------|--------|----------|----|-------|-------|-------|----|-------|
| | | | | | | | | | | | | | | | 2 | 77 | 50.02 | W | SUG |
| A1 | cu u- | 1 64 1 | 20.02 | Dv | <0.02 | Hf | <0.02 | Li | 40.02 | Z | 40.02 | P | <0.02 | Se | 202 | 10 | 20.02 | W | 20.02 |
| 2 | 10.01 | 1 | | 1 | 5 | ; | 3 | ; | 2 | Ş | 2002 | R P | <0.02 | 2 | <0.02 | Fe | <0.02 | C | <0.02 |
| S | 20.02 | C ₂ | 2.2 | CT. | 20.02 | 0 M | 10.02 | 5 | 1024 | | 10.01 | 1 | | | 2 | 1 | 50.00 | 4 | 33 |
| Å | 502 | ç | <0.02 | Fu | <0.02 | h | <0.02 | Mg | A0.01 | õ | <0.02 | Kh | 20.02 | Ag | 20.02 | 11 | 70.02 | | -0.01 |
| 1 | | | 5 | 2 | 5 | 7 | 333 | Š | 50.02 | Р | 40.02 | Rb | A0.02 | Na | 4012 | Th | <0.02 | ХP | 20.02 |
| Ba | 20.05 | Ç | 20.02 | 00 | 10.04 | ** | | | | | | , | 5 | ? | 500 | 1 | 33 | < | 30 |
| Re | -001 | R | <0.02 | ନ୍ମ | <0.02 | Fe | <0.2 | Hg | 40.2 | 7 | <0.02 | KU | <0.02 | 2 | 20.02 | L III | 10.01 | 3, | 3 |
| 2 | 2 | 2 | 3 | 2 | 2000 | 5 | 300 | K | <0.02 | Ş | A.02 | Sm | A.02 | S | <0.02 | Sn | <0.02 | 20 | F |
| 10 | 20.02 | Ş | 10.02 | 00 | 10.00 | | | | | | 5 | 2 | 2 | 7 | 33 | 1 | <0 03 | 77 | <0.02 |
| 80 | <0.02 | Q | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | К | 202 | 30 | 20.02 | 1a | 20.02 | | 10.04 | | |

(T) = Target analyte

Physical Characterization:

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

Ser R. She

Certified by:

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

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 certifed (+/-) 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).

Part # 58030 Lot # 121724



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

16150

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.
 - **<u>CAUTION</u>**: 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

(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 $\mu g/L$ (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.

RMs ICV 1, 5, 6 SFAM.docx

Page 1 of 2

QATS Form 20-007F188R00, 04-19-2021



The Quality Assurance Technical Support (QATS) contract is operated by APTIM Federal Services, LLC.



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

| APTIM | 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 ₂ Cr ₂ O 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.

| | ICV1-1014 | | | | | | |
|---------|--|--|--|--|--|--|--|
| Element | Concentration (µg/L) (after 10-fold dilution) | Concentration (µg/L) (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 | | | | | |
| TI | 1000 | 210 | | | | | |
| V | 500 | 100 | | | | | |
| Zn | 1000 | 200 | | | | | |

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

| | ICV5-0415 | and a street | ICV6-0400 |
|---------|---|--------------|---|
| Element | Concentration (µg/L) (after 100-fold dilution) | Analyte | Concentration (µg/L) (after 100-fold dilution) |
| Hg | 4.0 | CN- | 99 |

| _ | | | | / | | | 1. Sodium nitrate (Na) | Compound | Description: Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa | CERTIFIED WEIGHT REPORT: Part Numbei Lot Numbei | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
|-------------|-------------------|-------------------------|----------|----------------|-------|--------------------------------------|------------------------|--|--|---|--|
| m/z-> | N 0 11 0 | m/z-≻ 5.0E6 | N.5 6 | m/z-> 5.0∈6 | 2.5E5 | 5.0E5 | trate (Na) | đ | Description: Sodium (Expiration Date: 12226 Recommended Storage: Ambient (2 I Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was dliuted to (mL): | <u>VEIGHT RE</u> Part I Lot I | standards.c |
| | | | | | | [1] Spec | = | | Description: Expiration Date: nended Storage: ntration (µg/mL): htration (µg/mL): T Test Number: ST Test Number: | HT REPORT: Part Number: Lot Number: | om |
| 0 | | 110 | | 10 | | [1] Spectrum No.1 | IN036 NAV01201511 | Lot RM# Number | Sodiur 12226 Ambien 10000 6UTB 6UTB | <u>58111</u> 122223 | |
| N N O | | 120 | | N. O | | - | | | | 23 | V |
| 230 | | 130 | | а О | | | 10000 99.999 | Nominal Purity Conc. (µg/mL) (%) | 5) 3000.4 0.06 | | RIO |
| | | and here and a starting | | | | 8.935 sec]:58111.D# [Count] [Linear] | 999 0.10 | ity Uncertainty) Purity (%) | 2% 5E-05 Balance Uncertainty 0.06 Flask Uncertainty | | Certi |
| 240 | | 140 | | 6 | | .D# [Cot | 26.9 | Assay (%) | 2% ncertainty ertainty | Solvent: | ified Refu |
| N U O | | 150 | | Ö | | unt) [Line | 111.5406 | Target Weight (g) | 60.0 (mL) | Lot # 24002546 | erence Mi MSR 0 |
| 280 | | 160 | | 0 O | | ar] | 111.5479 | Actual Weight (g) | Nitric Acid | Nitric Acid | Certified Reference Material CRM 5 124 MSR06 MS |
| | | | | N | | | 10000.7 | Actual Conc. (µg/mL) | | 3 | RM 5807 |
| | | 170 | | 70 | | | 20.0 | Expanded Uncertainty +/- (µg/mL) | Formulated By: | Allea | |
| | | 180 | | 80 | | | 7631-99-4 | 0 | By: | aha | |
| | | 190 | | 80 | | | 5 mg/m3 | SUS information (Solvent Safety Info. On Attached pg.) AS# OSHA PEL (TWA) LD50 | Aleah O'Brady | Brad | × |
| | | 200 | | 100 | | | | SUS Information afety Info. On Atta OSHA PEL (TWA) | ady C | All I | ANAB AR-1 https:/// |
| | | ŏ | | ŏ | | | orl-rat 3430 mg/kg | ached pg.) سەءە | 122223 | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |
| | | | | | | | 9/kg 3152a | NIST | 223 | | 4 Accred cate Num andards.c |

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| Printed: 12/29/2023 2:56:20 PM | Printed: 12/2 | | | | | 2 of 2 | | | | | | | 2223 | Lot # 122223 | | # 58111 | Part # |
|--|---|--|--|---|---|---|--|---|---|---|--|---|--|---|--|---|------------|
| | r sed in | 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 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 certifed (+/-) 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). | nts unless oth ity raw materi e to NIST (see the Uncertaint , D.C. (1994). | ements purity ; eable to ing the gton, D. | The certified value is the concentration calculated from gravimetric and volumetric measureme Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest puri 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 Standards are certifed (+/-) 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 t Measurement Result," NIST Technical Note 1297, U.S. Government Printing Office, Washington, | and the and the ith weig ated. atory co atory co flice, | The certified value is the concentration calculated from gravimetric and volume Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the preparation of all standards. All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that are calibrated with w Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. All Standards should be stored with caps tight and under appropriate laboratory Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelines for Evaluating a Measurement Result," NIST Technical Note 1297, U.S. Government Printing Offi | avimetri ass A g are cali are cali ppropria ernmen | from gra rated Cl ior to us ces that lue, unle under a J.S. Gov | ulated er, calib er, calib er, calib er, calib g baland g baland g baland ght and ght and 1297, L | tion calc zed wat ally usin ally usin araps tio al Note | ncentra ards. meticule 0.5% c 0.5% c lor, B.N Technic | The certified value is the concentration calculated from gravi Purified acids, 18.2 megohm deionized water, calibrated Clas the preparation of all standards. All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that ar Standards are certifed (+/-) 0.5% of the stated value, unless All Standards should be stored with caps tight and under app Uncertainty Reference: Taylor, B.N. and Kuyat, C.E., "Guidelin Measurement Result," NIST Technical Note 1297, U.S. Gover | value i s, 18.2 ion of e prepa e certifi e certifi Referen it Result | certified preparat preparat dards ar dards ar dards ar tandards suremen | * The * Purif * All s * Stan Mea: | |
| Certified by: | e e | | | | | | | standard. | on of this | reparati | ed in the j | ts observ | Physical Characterization: Homogeneity: No heterogeneity was observed in the preparation of this standard. | o heterog | Physical Characterization: Homogeneity: No heterogeneity v | Physi Homog | |
| | - | | | | alyte | (T) = Target analyte | = (T) | | | | | | | | | | |
| 2 2 × 3 < c * | 40.02 40.02 17 40.02 17 17 17 17 17 17 17 17 17 17 | Ta Sr | | | 402 402 402 402 402 402 402 402 402 402 | P P OS NN | | Man Lu Mag | 4 4 4 4 4 4 4 4 4 5 5 5 5 5 5 5 5 5 5 5 | 양 다 다 타 H H | 4 4 4 4 4 4 5 8 8 8 8 8 8 | e e e e e e e | 40.02 40.02 40.02 40.02 | 5 S C C S S S | 40.02 40.02 40.02 40.02 | Bi Bi | |
| | | | (ua/ml) | ומ | rometry (ICP-MS): Verification by ICP-M | ry (ICP | | ass Spect Metals | asma Ma Trace | pled Pla | aly Cou | ductiv | sis by In | Analys | umenta | Instra | |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | * | | | al CRM | Certified Reference Material C | ference | tified Re | Cen | | | | | s, Inc. | ards.con | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | Absolute (800-368-1131 www.absolute | 800 WWW |

| | 1.057 | 2.0年7 | m/z-> | р. С. С. С. | 5.0E5 | 7/2-> | N 0 0 | 5.0E5 | 1. Antimony (Sb) | Compound | Volume shown below was diluted to (mL): | NIST Test Number: | Recommended Storage: Nominal Concentration (µg/mL): | Expiration Date: | Part Number: Lot Number: Description: | CERTIFIED WEIGHT REPORT: | 800-368-1131 www.absolutestandards.com |
|---|-------|-------|-------|----------------------|-------|-------------------------|-------------|---------------------------------------|--------------------|--|---|---------------------|--|-------------------|---|--------------------------|--|
|) | | | 110 | | | 10 | | [1] Spectrum No.1 | 58151 | Part Number | lip sam mo | ber | nL): | ate: | on: | | |
| | | | 12. | | | NO | | 40.1 | 1 100923 | Lot r Number | uted to (mL) | 6UTB | Ambient (20 °C) 1000 | 120526 | 57051 120523 Antimony (Sb) | | |
| | | | | | | | | | 0.1000 | Dilution Factor | : 3000.41 | | 20 °C) | | w (Sb) | | Ri |
| | | | 130 | | | 30 | | 39C]:58 | 300.0 | Initial Vol. (mL) | | 5E-05 | | | | | Certifi (0 1) 03 (2 4 |
| : | | | 140 | | | 4 0 | | 051.D# | 0.084 | Uncertainty) Pipette (mL) | | Balance Uncertainty | | | | ł | Certified |
| | | | 1 80 | | | 50 | | 17.964 sec]:58051.D# [Count] [Línear] | 1000 | Nominal | unty | rteintv | | 2.0% | 24002546 | Lot # | Certified Reference Material CRM (芝り MS802 Mら |
| | | | | | | Ö | | _(near] | 10001.4 | Initial) Conc. (µg/ml | | | | (mL) | Nitric Acid | Solvent: | nce Material |
| | | | 180 | | | 80 | | | 1000.0 | Final nL) Conc. (µg/mL) | | | | Nitric Acid | | | CRM |
| | | | 170 | | | 70 | | | 0 2.1 | Expanded Uncertainty mL) +/- (µg/mL) | | Reviewe | K | id Formulated By: | | | UU UU |
| | | | 180 | | | 80 | | | 7440-36-0 | Ĕ | an of | | 20 | ited By: | Ferre | | |
| | | | 190 | | | 0 | | | | Solvent Sa CAS# OSH/ | | Pertr | the second | Lawr | and b | | V |
| | | | | | | A. and A. and A. and A. | | | 0.5 mg/m3 | SDS Information nt Safety Info. On Attac OSHA PEL (TWA) | | o I Rentas | SA) | Lawrence Barry | De | | Alv AR https |
| | | | 200 | | | 100 | | | orl-rat 7000 mg/kg | SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD50 | | | | | | | ANAB ISO 1:/034 Accreated AR-1539 Certificate Number https://Absolutestandards.com |
| | | | | | | | | |) mg/kg 3102a |) NIST | 120020 | 120523 | | 120523 | | | tificate l standar |

www.absolutestandards.com 800-368-1131 Absolute Standards, Inc.



Certified Reference Material CRM



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

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

| | | | | | | | I race M | etals | Verifica | tion | by ICP-N | IS (II) | g/mL) | | | | | | |
|----------|-------|-----|--------------|-----|-------|-----|--------------------|---------------|-------------------|------|-------------|-----------------|--------|-----|--|------------------|---|-----|-------|
| A | B | 2 | 202 | 2 | - | 1 | MILLION CONTRACTOR | Manual | AND IN THE OWNER. | | | No. of Lot, No. | | | Contraction of the local division of the loc | CONTRACTO | AL INCOME | | |
| 2 | 20.02 | 5 | 20.02 | Dy | 40.02 | Hf | 40.02 | E | <0.02 | Ni | 40.02 | 7 | 20.02 | Se | <0.2 | 7 | 400 | W | 200 |
| SB | | ۍ | 4 | ដ | 2003 | Ľ, | ŝ | 4 | 2 | 1 | | 1 | | | 1012 | | 10.02 | ** | 20.02 |
| | 5, | | | 1 | 20.00 | CR1 | 70.02 | L | 20.02 | NP | 40.02 | Re | 40.02 | 2 | 40.02 | P | 20102 | 9 | 4000 |
| au. | 202 | ß | 20.02 | ñ | 40.02 | 5 | A ,92 | M | 40,01 | õ | 4002 | R. | 23 | A. | 2003 | 3 | 3 | 4 | |
| B | 2020 | ç | 33 | 5 | 5 | ľ | 3 | 5, | | ! | | - | mot on | 94. | TNN | | 20.02 | ~ | 20.02 |
| 1 | | u g | 10.02 | ę | 70.02 | - | 20.05 | MD | 20.02 | Pd | 40.02 | 8 | 40.02 | Za | A | þ | 40.02 | Ş | 3 |
| De | 1000 | ç | 40,02 | ନ୍ଥ | 40,02 | 4 | 402 | He | A 12 | Ð | 300 | 2 | 33 | n' | 3 | 1 | 3 | : : | |
| <u>H</u> | 43 | 3 | 3 | P | 3 | 4 | | | | | | 1111 | 700.00 | ġ | 20.02 | 101 | <u.u2< td=""><td>1</td><td>20.02</td></u.u2<> | 1 | 20.02 |
| | | 1 | 20.02 | G | 20.05 | 5 | 20.02 | Mo | 40.02 | 7 | 0 02 | S | 40.02 | 6 | AN 03 | 3 | 33 | 7 | 3 |
| G | 20UZ | ç | A .02 | Au | | y | A B | K | 200 | 4 | 5 | 2 | 5 | 3, | | | 10.00 | 1 | 70.02 |
| | | | | I | | | | | RAL ON | ļ | 44 | Ŕ | 20.02 | 12 | 20.02 | 11 | 40.02 | 2 | 20.02 |

(T) = Target analyte

Physical Characterization:

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

Certified by:

In P. S.

* The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.

* Purified acids, 18.2 megohm delonized 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).

Part # 57051 Lot # 120523

| N 55 10 0 | m/z-> 110 5.0E6 | រា .0 ៣ ភា | m/≥-> 10 | ហ .0 ព | [1] Spectrum No.1 1.0E7 | 1. Silver nitrate (Ag) | Compound | Part Number: 57047 Lot Number: 122823 Description: Silver (A Description: Silver (A Expiration Date: 122826 Recommended Storage: Ambient (; Nominal Concentration (µg/mL): 1000 NIST Test Number: 6UTB Weight shown below was diluted to (mL): | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com CERTIFIED WEIGHT REPORT: |
|--------------------|--------------------|---------------------|----------|--------------|---------------------------------------|------------------------|--|--|---|
| | 120 | | N. | | - | 5 J0612AGA1 | Lot Nor RM# Number Conc. (| 57047 122823 Silver (Ag) 122826 Ambient (20 Ambient (20 1000 6UTB 6UTB | - |
| | 130 140 | | 90 40 | | 14.044 sec]:58147.D# [Count] [Linear] | 88.8988 0.10 | Nominal Purity Uncertainty Assay Conc. (Jug/mL) (96) Purity (96) (96) | *C) 5E-05 Balance Uncertainty | Certified I R 1 8 5 2 4 |
| | 1 ភូ- O | | 50 | | [Count] [Linear] | 6.27992 | Target Weight (g) | n t: 24002546 2% 80.0 (mL) | Certified Reference Material |
| | 160 170 | | 60 70 | | | 1000.0 | Actual Actual U Weight (g) Conc. (µg/mL) + | Nitric Acid | rial CRM M6030 |
| | 180 | | 80 | | | 2.0 7761-88-8 | Expanded Uncertainty (Solv +/- (µg/mL) CAS# | ad By: |)30 |
| | 190 200 | | 90 100 | | | 10 ug/m3 | SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LD51 | Benson Chan Pedro L. Rentas | http |
| | ŏ | | ŏ | | | | n ached pg.) NIST LD50 SRM | 122823 | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com |

Part # 57047 Lot # 122823

1 of 2

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

| | | | | | | | | -lecais | VCITICA | | by ICFT | SIC 1 | hailer | | | | | | |
|----|--------------|---|------------|----------|--------------|----------|--------------|----------------------|---------|----|------------------------|-------|-----------------------|----------|-------|-----|--------------|----|-------|
| | | | The shares | A COLUMN | THE WAY DOWN | State of | 12.12.2.2016 | 18 - ¹ 19 | | | The state of the state | | 1.40 . 10 . 10 . 10 E | No. | | No. | | | |
| A | <0.02 | 8 | <0.02 | Dy | <0.02 | Hf | <0.02 | 5 | <0.02 | N | <0.02 | 7 | <0.02 | Se | <0.2 | ТЪ | <0.02 | W | <0.02 |
| Sb | <0.02 | ß | <0.2 | 막 | 40.02 | Но | <0.02 | Lu | <0.02 | ĥ | <0.02 | Re | <0.02 | <u>8</u> | <0.02 | Te | 40.02 | q | <0.02 |
| As | 4 0.2 | ĉ | <0.02 | 땹 | <0.02 | h | <0.02 | Mg | <0.01 | õ | <0.02 | Rh | <0.02 | Ag | T | 1 | <0.02 | < | <0.02 |
| Ba | <0.02 | S | <0.02 | ନ୍ଥ | <0.02 | Ħ | <0.02 | Mn | <0.02 | Pd | <0.02 | Rb | <0.02 | Na | <0.2 | Ţ | <0.02 | YЪ | <0.02 |
| Be | <0.01 | Ω | <0.02 | ଦ୍ଧ | <0.02 | Fe | <0.2 | Hg | 40.2 | p | <0.02 | Ru | <0.02 | ş | <0.02 | Tm | <0.02 | × | <0.02 |
| B | <0.02 | S | <0.02 | ନ୍ନ | <0.02 | L | <0.02 | Mo | <0.02 | Ŗ | <0.02 | Sm | <0.02 | Ś | <0.02 | Sh | <0.02 | 2 | <0.02 |
| μ. | <0.02 | ß | <0.02 | Au | <0.02 | Pb | <0.02 | Nd | <0.02 | K | 40 2 | Ş | <0.02 | Ta | <0.02 | Ð | <0.02 | 2 | <0.02 |

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

Physical Characterization:

(T)= Target analyte

Certified by:

In & She

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

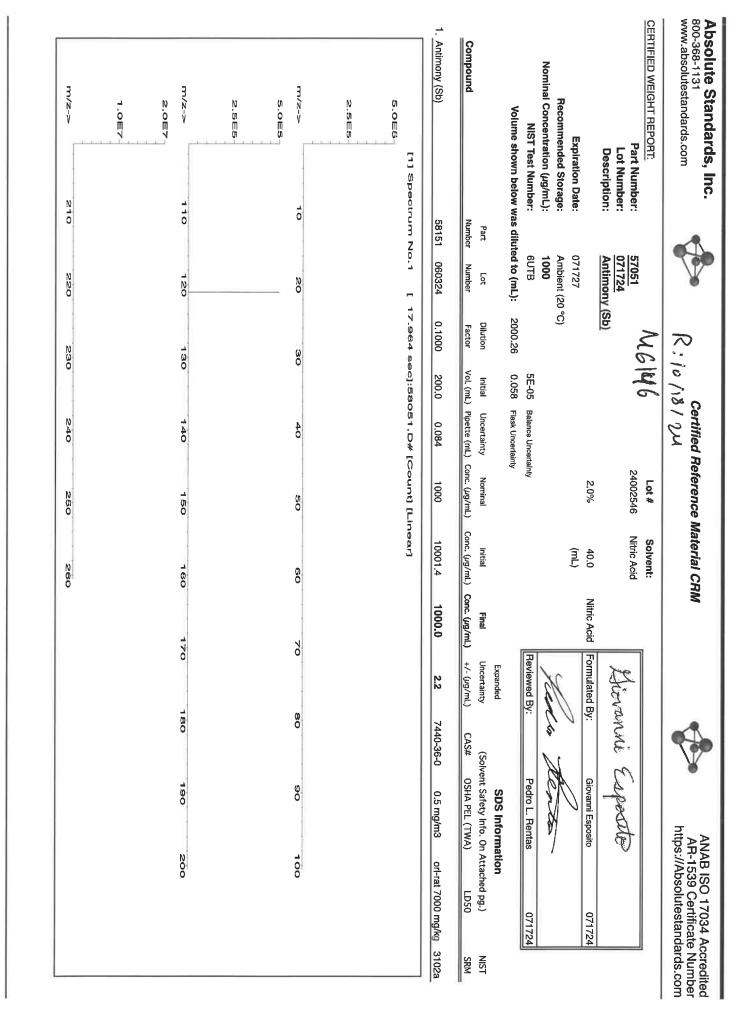
the preparation of all standards.

* 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 certifed (+/-) 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).



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Certified Reference Material CRM



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

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

| | _ | | | | SP | | | |
|-------|-------|-------|-------|--------|-------|-------|----------|--|
| | | | | | T | | | |
| Ω | ŝ | ç | ŝ | ů | Ca | Q | | |
| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.2 | <0.02 | | |
| Au | ନ୍ଚ | Ga | ଜ | En | Ę | Dy | | |
| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | |
| Pb | La | Fe | ŀ | μ | Ho | Hf | | |
| <0.02 | <0.02 | <0.2 | <0.02 | <0.02 | <0.02 | <0.02 | Irace M | |
| Nd | Mo | Hg | Mn | Mg | Lu | Ľ | letais | |
| <0.02 | <0.02 | <0.2 | <0.02 | < 0.01 | <0.02 | <0.02 | Verifica | |
| K | Pt | P | Pd | °s | ĥ | Ni | tion | |
| <0.2 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | by ICP-N | |
| Sc | Sm | Ru | Rb | Rh | Re | P | in) SI | |
| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | g/mL) | |
| Ta | s | Sr | Na | Ag | Si | Se | | |
| <0.02 | <0.02 | <0.02 | <0.2 | <0.02 | <0.02 | <0.2 | | |
| T | Sn | Tm | Τħ | T | Te | Τb | | |
| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | |
| Zr | Zn | Y | Υь | V | Ч | W | | |
| <0.02 | <0.02 | <0.02 | <0.02 | <0,02 | <0.02 | <0.02 | | |

(T) = Target analyte

Physical Characterization:

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

Son P. Mar

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 certifed (+/-) 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

R: 8/5/24 M6019

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: | CGSR1 |
| Lot Number: | U2-SR730227 |
| Matrix: | 0.1% (v/v) HNO3 |
| Value / Analyte(s): | 1 000 μg/mL ea: Strontium |
| Starting Material: | SrCO3 |
| Starting Material Lot#: | M2-2192 |
| Starting Material Purity: | 99.9993% |
| CERTIFIED VALUES AN | ID UNCERTAINTIES |

| Certified Value: | 1001 ± 3 µg/mL |
|------------------|--|
| Density: | 1.000 g/mL (measured at 20 \pm 4 °C) |

Assay Information:

3.0

| Assay Method #1 | 998 ± 4 μg/mL ICP Assay NIST SRM Traceable to 3153a Lot Number: K2-SR650985 |
|-----------------|---|
| Assay Method #2 | 1001 ± 3 μg/mL EDTA NIST SRM 928 Lot Number: 928 |
| Assay Method #3 | 1001 ± 2 µg/mL Calculated NIST SRM Lot Number: See Sec. 4.2 |

- 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:

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

- 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:
 - $w_{i} = (1/u_{char\,i})^{2} / (\Sigma(1/(u_{char\,i})^{2})$

CRM/RM Expanded Uncertainty (±) = U_{CRM/RM} = k ($u^2_{cher} + u^2_{bb} + u^2_{lts} + u^2_{ts}$)^{1/2} k = coverage factor = 2 $u_{cher} = [Z(w_i)^2 (u_{char} i)^2]$ ^{1/2} where u_{char} i are the errors from each characterization method u_{bb} = bottle to bottle homogeneity standard uncertainty

bb - boute to outer homogeneity sandard uncertainty utrs = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

Characterization of CRM/RM by One Method

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

 $X_{CRM/RM} = (X_n) (u_{char e})$ $X_n = mean of Assay Method A with$ $<math>u_{char a} =$ the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = U_{CRM/RM} = k ($u^2_{char a} + u^2_{bb} + u^2_{tts} + u^2_{ts}$)^{1/2} k = coverage factor = 2 uchar a = the errors from characterization u_{bb} = bottle to bottle homogeneity standard uncertainty u_{its} = long term stability standard uncertainty (storage) u_{its} = transport stability standard uncertainty

- 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.

| м | Ag | < | 0.001980 | М | Eu | < | 0.000495 | 0 | Na | | 0.000200 | М | Se | < | 0.013862 | 0 | Zn | | 0.000143 |
|---|----|---|----------|---|----|---|----------|-----|----|---|----------|---|----|---|----------|---|----|---|----------|
| 0 | A | | 0.000370 | 0 | Fe | | 0.000410 | М | Nb | < | 0.000495 | i | Si | < | | М | Zr | < | 0.000495 |
| М | As | < | 0.000495 | М | Ga | < | 0.000495 | М | Nd | < | 0.000495 | М | Sm | < | 0.000495 | | | | |
| М | Au | < | 0.000989 | М | Gd | < | 0.000495 | 0 | Ni | < | 0.007631 | М | Sn | < | 0.000990 | | | | |
| М | в | < | 0.039606 | М | Ge | < | 0.000495 | М | Os | < | 0.000494 | s | Sr | < | | | | | |
| М | Ba | | 0.006486 | М | Hf | < | 0.000495 | i – | Р | < | | М | Та | < | 0.000495 | | | | |
| М | Be | < | 0.000990 | M | Hg | < | 0.000989 | М | Pb | < | 0.002970 | М | Tb | < | 0.000495 | | | | |
| М | Bi | < | 0.000495 | М | Но | < | 0.000495 | М | Pd | < | 0.003957 | М | Те | < | 0.027724 | | | | |
| 0 | Ca | | 0.004255 | М | In | < | 0.000495 | М | Pr | < | 0.000495 | M | Th | < | 0.000990 | | | | |
| М | Cd | | 0.001339 | М | lr | < | 0.000494 | М | Pt | < | 0.002970 | М | Ti | < | 0.005940 | | | | |
| М | Ce | < | 0.004950 | 0 | к | < | 0.008184 | М | Rb | < | 0.002970 | М | TI | < | 0.000495 | | | | |
| М | Со | < | 0.000495 | М | La | < | 0.000495 | М | Re | < | 0.000495 | М | Tm | < | 0.000495 | | | | |
| 0 | Cr | < | 0.003207 | 0 | Li | < | 0.000884 | 0 | Rh | < | 0.012829 | М | U | < | 0.001485 | | | | |
| М | Cs | < | 0.000990 | М | Lu | < | 0.002970 | М | Ru | < | 0.000989 | М | V | < | 0.001980 | | | | |
| М | Cu | | 0.000099 | 0 | Mg | | 0.000064 | i | s | < | | М | W | < | 0.003960 | | | | |
| М | Dy | < | 0.000495 | 0 | Mn | | 0.000066 | М | Sb | < | 0.014852 | 0 | Y | < | 0.000995 | | | | |
| М | Er | < | 0.000495 | М | Мо | < | 0.001980 | М | Sc | < | 0.001980 | М | Yb | < | 0.000495 | | | | |
| | | | | | | | | | | | | | | | | | | | |

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

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. <u>https://www.inorganicventures.com/terms-and-conditions-sale</u>. 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 $4^{\circ} - 24^{\circ}$ C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ 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

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 87.62 +2 6 Sr(H2O)6+2 Chemical Compatibility - Soluble in HCI, and HNO3. Avoid H2SO4, HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate and tungstate in neutral aqueous media.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1 - 3.5% HNO3 / LDPE container.

Sr Containing Samples (Preparation and Solution) -Metal (Best dissolved in diluted HNO3); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (Dry ash and dissolution in dilute 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 88 amu | 1200 ppt | N/A | 72Ge16O, 176Yb+2, |
| | | | 176Lu+2 , 176Hf+2 |
| ICP-OES 407.771 nm | 0.0004 / 0.00006 µg/mL | 1 | U, Ce |
| ICP-OES 421.552 nm | 0.0008 / 0.00004 µg/mL | 1 | Rb |
| ICP-OES 460.733 nm | 0.07 / 0.003 µg/mL | 1 | Ce |
| | | | |

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

CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY 11.0

11.1 Certification Issue Date

March 03, 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

- March 03, 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.

NAMES AND SIGNATURES OF CERTIFYING OFFICERS 12.0

Certificate Approved By:

Thomas Kozikowski Manager, Quality Control

BD9784.

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

| Printed: 9/21/2022, 11:20:01 PM | 1 of 2 | | | Part # 56138 Lot # 082922 |
|---|---|--|--|---|
| 0 | 250 | 240 | 220 230 | m/z-> 210 |
| | | | | N 0 5 0 П П 0 б |
| 160 170 180 190 200 | 150 10 | 0 140 | 120 130 | m/z-> 110 |
| | | | | 5. 0 E 5 |
| 60 70 80 90 100 | 50 | 40 | 20 30 | m/z-> 10 |
| | | | | N.5E6 |
| | unt] [Linear] | 14.495 sec]:58138.D# [Count] [Linear] | _ | [1] Speatrum No.1 5.0E6 |
| 10000.1 20.0 10042-76-9 NA orf-rat >2000mg/kg 3 | | 99.997 0.10 | 7 SRZ022018A1 | trate (Sr) |
| Expanded SDS Information Actual Actual Uncertainty (Solvent Safety Info. On Attached pg.) NIST Weight (g) Conc. (ug/mL) +/- (ug/mL) CAS# OSHA PEL (TWA) LD50 SRM | Target Weight (g) | | Lot Nominal RM# Number Conc. (µg/mL) | Compound |
| Reviewed By: Pedro L. Rentas 082922 | | 5E-05 Balance Uncertainty 0.058 Flask Uncertainty | 6018 diluted to (mL): 1000.12 | Weight shown below was diluted to (mL): |
| Nuic Acid Formulated by: Lawrence barry 082922 | (mL) | 6 1 | 082925 Ambient (20 °C) 10000 | Expiration Date: Recommended Storage: Nominal Concentration (µg/mL): |
| Advance Bary | 20510011 | Solvent: | <u>56138</u> <u>082922</u> <u>Strontium (Sr)</u> | Part Number: Lot Number: Description: |
| I CRM ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | Certified Reference Material CRM いままのション | Certified Ref এ৯।।১।২३ শ | R: | Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com CERTIFIED WEIGHT REPORT: |

| vww.absolutestandards.com | 300-368-1131 | \bsolute Standards, |
|---------------------------|--------------|---------------------|
| | | Inc |



Certified Reference Material CRM



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

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

| | | | | | | | race Me | tais | Verifica | TION | by ICP- | MC (| /Jm/b/ | | | | | | |
|----|-------|----|-------|-----|-------|----|---------|------|----------|----------|---------|---------|--------|----|-------|----|----------|----|--|
| | | | | | 10-31 | | | | | | | | | | 10 T | | 1012 101 | | No. of Concession, No. of Conces |
| AI | <0.02 | Cd | <0.02 | Dy | <0.02 | Hf | <0.02 | Ε. | <0.02 | <u>N</u> | <0.02 | Pr | <0.02 | Se | <0.2 | Tb | <0.02 | W | <0.02 |
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| Ba | <0.02 | ß | <0.02 | ନ୍ଦ | <0.02 | F | <0.02 | M'n | < 0.02 | Pd | <0.02 | RЬ | <0.02 | Na | <0.2 | Ţ | <0.02 | ΥЪ | <0.02 |
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| Bi | <0.02 | ĉ | <0.02 | Ge | <0.02 | La | <0.02 | Mo | <0.02 | Ŗ | <0.02 | Sm | <0.02 | s | <0.02 | Sn | <0.02 | Zn | <0.02 |
| в | <0.02 | Cu | <0.02 | Au | <0.02 | РЪ | <0.02 | Nd | <0.02 | ĸ | <0.2 | Sc | <0.02 | Ta | <0.02 | H | <0.02 | Zr | <0.02 |

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

(T)= Target analyte

Physical Characterization:

Certified by:

Sur & Sur

* 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 certifed (+/-) 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).

Part # 56138 Lot # 082922

2 of 2

| 800-368-1131 www.absolutestandards.com | CERTIFIED WEIGHT REPORT: | Par Loi De | Expiration Date: Recommended Storage: | NIST Tex | Weight showr | | Compound | | N. O | 1.000 | m/z-> | 1.0E4 | 5 0 0 | m/z->- | 1.0世8 | 5. 0 8 | ITVZ-> |
|--|--------------------------|---|--|---------------------------|---|---|--------------------------|---------------------------------------|------|-------|---------|-------|-------------|--------|-------|--------------|--------|
| | E | Part Number: Lot Number: Description: | Expiration Date: nended Storage: | NIST Test Number: | Weight shown below was diluted to (mL): | | VIMH. | [1] Spectrum No.1 | | | 10 | | | 110 | | | 012 |
| | | <u>57081</u> 062724 Thalllum (TI) | 062727 Ambient (20 °C) | 6UTB | ed to (mL): | Lot | Number | - | | | N | | | 120 | | | 220 |
| | | | °C) | 58 | 2000.1 0 | Nominal Pi | Conc. (J/g/mL) | 14.044 sec | | | a O | | | 130 | | | 230 |
| Certified Refi R ! 8]5]24 | | Š | | 5E-05 Balance Uncertainty | 0.10 Flask Uncertainty | Purity Uncertainty Assay | (%) PUTTY (%) | 14.044 sec]:57081.D# [Count] [Linear] | | | 4. 0 | | | 140 | | | 240 |
| Certified Reference Material CRM とという | | Solvent: 2400 | 2% 40 (m | pertainty | ainty | y Assay Target | (%) Weight (g) | ₩ [Count] [Li | | | 01 | | | 150 | | | 250 |
| e Material | | 24002546 Nitric Acid | 40.0 Nitric Acid (mL) | | | get Actual | | [Linear] | | | | | | | | | |
| СRМ М6023 | | loid | cid | | | Actual | Weight (g) Conc. (µg/mL) | | | | 8 | | | 160 | | | 260 |
| 23 | | Alea | Formulated By: | Reviewed By: | | Expanded Uncertainty | L) +/- (µg/mL) | | | | 70 | | | 170 | | | |
| | | 20 | 8 | | | (Solvent | CAS# | | | | 80 | | | 180 | | | |
| http | | Grandly | Aleah O'Brady | Pedro L. Rentas | | SDS Information Safety Info. On Atta | OSHA PEL (TWA) | | | | 8 | | | 190 | | | |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | | | 062724 | 062724 | | SDS Information (Solvent Safety Info. On Attached pg.) | DSG1 | | | | 100 | | | 200 | | | |
| Accredite te Numbe dards.con | ٤ | | 4 | 4 | l | NIST | SKM | | | | | | | | | | |

Part # 57081 Lot # 062724

1 of 2

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| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com |
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https://Absolutestandards.com ANAB ISO 17034 Accredited AR-1539 Certificate Number

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

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(I) = Target analyte

Physical Characterization:

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

Ser P. S.

Certified by:

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

* All standard containers are meticulously cleaned prior to use.

* Standards are certifed (+/-) 0.5% of the stated value, unless otherwise stated. * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).

* 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).

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| Absolute Standards, Inc. 800-368-1131 www.absolutestandards.com | | Part Number: 57023 Lot Number: 062424 Description: Vanadium (V) | Expiration Date: 062427 | | vas dilut | Part Lot Dilution | Compound Number Number Factor | [1] Spectrum No.1 [34.243 2.0E6 | | m/z->- 10 20 | 2.067 | 1.027 | m/z->- 110 120 1 | 2.588 | |
|--|----------|---|-------------------------|---------------------|-------------------|---|-------------------------------|---------------------------------------|--|---------------|-------|-------|------------------|-------|-----|
| B . S Ce | | | | 5E-05 | | n Initial | Vol. (mL) | 3 580]:58(| | 90 | | | 130 | | |
| Certified Reference Material CRM 冬瓜 プレリ | | | | Balance Uncertainty | Flask Uncertainty | Uncertainty | Pipette (mL) Conc. (µg/mL) | 34.243 sec]:58023.D# [Count] [Linear] | | A 0 | | | 140 | | 240 |
| ference M | Lot # | 24002546 | 2,0% | Ż | | Nominal | | ount) [Lin | | 50 | | | 150 | | 250 |
| laterial CR | Solvent: | Nitric Acid | 40.0 (mL) | | | Initial | Conc. (µg/mL) | ear] | | 80 | | | 160 | | 260 |
| M M6021 | - | | Nitric Acid | | | Final | Conc. (µg/mL) | | | 70 | | | 170 | | |
| | | Allea | Formulated By: | Reviewed Rv: | | Expanded | +/- (µg/mL) | | | 1 7 1 | | | | | |
| | | Alleah & Brack | | to Je | | (Solvent | CAS# | | | 80 | | | 180 | | |
| http://www.a | | Apa | Aleah O'Brady | Pedro I. Rentas | | SDS Information Safety Info. On Atta | OSHA PEL (TWA) | | | 80 | | | 190 | | |
| ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | | | 062424 | 062424 | | SDS Information (Solvent Safety Info. On Attached pg.) | A) LD50 | | | 100 | | | 200 | | |
| Accreditec e Number fards.com | ų | | <u> </u> | - | Ľ | NIST | SRM | | | | | | | | |

1 of 2

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Lot # 062424

Part # 57023





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

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

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|----------------------|--------|-------|----------|-------|-------|-------|-------|---|---|----------|-------|--|----------|----------|---|
| (T) = Target analyte | | 40.02 | 70.05 | 3 | 4001 | 20.02 | 3 | A01/2 | 10.02 | 3 | 20.02 | 2 | | | |
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Physical Characterization:

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

In P. Su

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 certifed (+/-) 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).

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