

284 Sheffield Street, Mountainside, New Jersey 07092, Phone: 908 789

8900, Fax: 908 789 8922

Prep Standard - Chemical Standard Summary

| Order I | D: | Q1164 |
|---------|----|-------|
| | | |

Test: TCLP ICP Metals

Prepbatch ID: PB166272,

Sequence ID/Qc Batch ID: LB134460,

| ~ . | | _ | |
|------|--|-------|--|
| Star | | | |
| | | | |

MP83499, MP83500, MP84041, MP84063, MP84070, MP84204, MP84206, MP84207, MP84208, MP84209, MP84210, MP84211, MP84212, MP84213, MP84214, MP84215, MP84216, MP84218, MP84219, WP110801, WP110803, WP110804, MP84219, MP84219

Chemical ID:

M5130,M5218,M5223,M5289,M5295,M5298,M5393,M5429,M5466,M5472,M5476,M5496,M5497,M5513,M5519,M5565,M5658,M5697,M5798,M5799,M5800,M5801,M5802,M5806,M5815,M5817,M5819,M5875,M5942,M5959,M5961,M5962,M5976,M5977,M5978,M5985,M5990,M6021,M6023,M6025,M6028,M6030,M6032,M6077,M6118,M6120,M6121,M6126,M6127,M6128,M6144,W3038,W3112,W3113,





Metals STANDARD PREPARATION LOG

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal | | |
|--------------|--------|------------|------------|--------------------|----------------|----------------|------------------|-------------------------------|--|--|
| 170 | 1:1HCL | MP83499 | 12/09/2024 | 01/30/2025 | Eman Mughal | None | None | carasjii caciia. | | |
| | | | | | | | | 12/09/2024 | | |
| | | | | | | | | | | |

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|-------------------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 902 | ICP AES CAL BLK (SO/ICB/CCB) | MP83500 | 12/06/2024 | 01/24/2025 | Kareem Khairalla | None | None | 12/09/2024 |

FROM 125.00000ml of M6121 + 2350.00000ml of W3112 + 25.00000ml of M6126 = Final Quantity: 2500.000 ml



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|--------------|---------|------------|------------|--------------------|----------------|----------------|------------------|-------------------------------|
| 169 | 1:1HNO3 | MP84041 | 01/14/2025 | 07/14/2025 | Eman Mughal | None | None | , |
| | | | | | | | | 01/16/2025 |

FROM 1250.0000ml of M6126 + 1250.0000ml of W3112 = Final Quantity: 2500.000 ml

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|---------------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 994 | ICPAES ISM01.2 S1 (CONC.) | MP84063 | 01/14/2025 | 02/14/2025 | Kareem Khairalla | None | None | 01/16/2025 |

FROM

0.02000 ml of M5815 + 0.03000 ml of M5429 + 0.10000 ml of M5798 + 0.10000 ml of M6028 + 0.14000 ml of M5799 + 0.20000 ml of M5298 + 0.20000 ml of M5476 + 0.20000 ml of M5658 + 0.20000 ml of M5801 + 0.20000 ml of M5817 + 0.20000 ml of M5876 + 0.20000 ml of M6025 + 0.20000 ml of M6030 + 0.30000 ml of M6128 + 0.40000 ml of M5496 + 0.50000 ml of M5697 + 0.50000 ml of M5697 + 0.50000 ml of M5697 + 0.50000 ml of M5800 + 1.00000 ml of M5800 + 1.00000 ml of M5819 + 10.00000 ml of M5819 + 10.00000 ml of M5819 + 10.00000 ml of M5942 + 4.00000 ml of M6032 + 34.24000 ml of MP83500 = Final Quantity: 100.000 ml



 ${\tt 284~Sheffield~Street,~Mountainside,~New~Jersey~07092,~Phone:908~789~8900,}\\$

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Metals STANDARD PREPARATION LOG

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabiit Jaswal |
|--------------|--------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 921 | ICPAES SPIKE SOL#6 | MP84070 | 01/14/2025 | 02/14/2025 | Kareem Khairalla | None | None | 01/16/2025 |

| FROM | 2.50000ml of M5962 + | 50.00000ml of M5565 | + 50.00000ml of M5990 + | + 147.50000ml of MP83500 | = Final Quantity: 250.000 ml |
|------|----------------------|---------------------|-------------------------|--------------------------|------------------------------|
|------|----------------------|---------------------|-------------------------|--------------------------|------------------------------|

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|-------------------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 902 | ICP AES CAL BLK (SO/ICB/CCB) | MP84204 | 01/24/2025 | 02/24/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM 125.00000ml of M6121 + 2350.00000ml of W3112 + 25.00000ml of M6126 = Final Quantity: 2500.000 ml



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Metals STANDARD PREPARATION LOG

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|--------------|-----------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 2480 | ICP AES STD 6 ISM01.3 | MP84206 | 01/24/2025 | 02/04/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM

 $4.00000 ml \ of \ M5289 + 4.00000 ml \ of \ M5298 + 4.00000 ml \ of \ M5497 + 4.00000 ml \ of \ M6127 + 4.00000 ml \ of \ M6144 + 30.00000 ml$

| Recipe ID | NAME | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|---------------------|---------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 1004 | ICPAES ISM01.2 (S5) | MP84207 | 01/24/2025 | 02/04/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM

 $0.25000 \text{ml of M5798} + 0.50000 \text{ml of M5429} + 0.50000 \text{ml of M5476} + 0.50000 \text{ml of M5815} + 0.50000 \text{ml of M5817} + 12.50000 \text{ml of M5519} + 12.50000 \text{ml of M5819} + 12.50000 \text{ml of M6128} + 12.50000 \text{ml of M6144} + 13.75000 \text{ml of M5697} + 14.50000 \text{ml of M5496} + 14.50000 \text{ml of M5496} + 14.50000 \text{ml of M5496} + 2.00000 \text{ml of M5513} + 22.50000 \text{ml of M5497} + 22.50000 \text{ml of M5497} + 22.50000 \text{ml of M5802} + 5.00000 \text{ml of M5875} + 5.00000 \text{ml of M6077} + 303.50000 \text{ml of MP84204} = \\ \text{Final Quantity: } 500.000 \text{ ml}$





Metals STANDARD PREPARATION LOG

| Recipe ID | <u>NAME</u> | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|--------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 1005 | ICPAES ISM01.2(S4) | MP84208 | 01/24/2025 | 02/04/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM 250.00000ml of MP84204 + 250.00000ml of MP84207 = Final Quantity: 500.000 ml

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|--------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 1007 | ICPAES ISM01.2(S3) | MP84209 | 01/24/2025 | 02/04/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM 25.00000ml of MP84207 + 75.00000ml of MP84204 = Final Quantity: 100.000 ml



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|--------------|--------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 1008 | ICPAES ISM01.2(S2) | MP84210 | 01/24/2025 | 02/04/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM 12.50000ml of MP84207 + 87.50000ml of MP84204 = Final Quantity: 100.000 ml

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|---------------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 994 | ICPAES ISM01.2 S1 (CONC.) | MP84211 | 01/24/2025 | 02/04/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM

0.02000 ml of M5815 + 0.03000 ml of M5429 + 0.10000 ml of M5798 + 0.10000 ml of M6028 + 0.14000 ml of M5799 + 0.20000 ml of M5298 + 0.20000 ml of M5476 + 0.20000 ml of M5658 + 0.20000 ml of M5801 + 0.20000 ml of M5817 + 0.20000 ml of M6025 + 0.20000 ml of M6030 + 0.30000 ml of M6128 + 0.40000 ml of M5496 + 0.50000 ml of M5697 + 0.50000 ml of M5697 + 0.50000 ml of M5800 + 1.00000 ml of M5800 + 1.00000 ml of M5819 + 10.00000 ml of M5819 + 10.00000 ml of M5497 + 10.00000 ml of M5978 + 4.00000 ml of M6032 + 34.24000 ml of MP84204 = Final Quantity: 100.000 ml



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Metals STANDARD PREPARATION LOG

| Recipe ID | NAME | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|-------------------|---------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 1003 | ICPAES ISM01.2 S1 | MP84212 | 01/24/2025 | 02/04/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM 0.50000ml of MP84211 + 99.50000ml of MP84204 = Final Quantity: 100.000 ml

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | <u>Prepared</u> <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|------------------|------------|------------|--------------------|------------------------------|----------------|------------------|-------------------------------|
| 912 | ICP AES ICV SOLN | MP84213 | 01/24/2025 | 02/05/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM 0.02500ml of M5429 + 0.02500ml of M5815 + 0.02500ml of M5817 + 0.10000ml of M5466 + 0.25000ml of M5218 + 0.25000ml of M5472 + 10.00000ml of M5295 + 89.77500ml of MP84204 = Final Quantity: 100.000 ml





Metals STANDARD PREPARATION LOG

| 904 ICP AES ICSA SOLN MP84214 01/24/2025 01/31/2025 Kareem Khairalla None None 01/27/2025 | 1 | Recipe ID | <u>NAME</u> | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|---|---|--------------|-------------------|------------|------------|--------------------|----------------|----------------|------------------|-------------------------------|
| | | 904 | ICP AES ICSA SOLN | MP84214 | 01/24/2025 | 01/31/2025 | | None | None | 01/27/2025 |

FROM 25.00000ml of M5130 + 225.00000ml of MP84204 = Final Quantity: 250.000 ml

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|--------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 905 | ICP AES ICSAB SOLN | MP84215 | 01/24/2025 | 01/31/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM 25.00000ml of M5130 + 25.00000ml of M5223 + 200.00000ml of MP84204 = Final Quantity: 250.000 ml



FROM

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Metals STANDARD PREPARATION LOG

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|---------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 1119 | ICPAES ISM01.2(CCV) | MP84216 | 01/24/2025 | 02/04/2025 | Kareem Khairalla | None | None | 01/27/2025 |

0.75000ml of M5497 + 0.75000ml of M6127 + 1.22500ml of M5496 + 1.25000ml of M5298 + 1.25000ml of M6144 + 19.77500ml of MP84204 + 25.0000ml of MP84207 = Final Quantity: 50.000 ml

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|----------------------|------------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 919 | ICP AES INTERNAL STD | MP84218 | 01/24/2025 | 02/24/2025 | Kareem Khairalla | None | None | 01/27/2025 |

FROM 1.00000ml of M5959 + 10.00000ml of M5985 + 1969.00000ml of W3112 + 20.00000ml of M6126 = Final Quantity: 2000.000 ml



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Metals STANDARD PREPARATION LOG

| Recipe ID | NAME | NO. | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Sarabjit Jaswal |
|--------------|--------------------|---------|------------|--------------------|---------------------|----------------|------------------|-------------------------------|
| 903 | ICP AES RINSE SOLN | MP84219 | 01/24/2025 | 02/24/2025 | Kareem Khairalla | None | None | 01/27/2025 |

| FROM | 200.00000ml of M6126 + 9800.00000ml of W3112 = Final Quantity: 10000.000 ml |
|------|---|
| | |

| Recipe | | | | Expiration | <u>Prepared</u> | | | Supervised By |
|-----------|--------------|----------|------------|-------------------|-----------------|----------------|------------------|---------------|
| <u>ID</u> | <u>NAME</u> | NO. | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Iwona Zarych |
| 83 | TCLP Fluid#1 | WP110801 | 11/21/2024 | 05/21/2025 | Jignesh Parikh | WETCHEM_S | None | |
| | | | | | | CALE_8 (WC | | 11/21/2024 |

FROM 114.00000ml of W3038 + 19834.00000ml of W3112 + 52.00000gram of W3113 = Final Quantity: 20000.000 ml





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Wet Chemistry STANDARD PREPARATION LOG

| Recipe ID | NAME | <u>NO.</u> | Prep Date | Expiration Date | Prepared By | <u>ScaleID</u> | <u>PipetteID</u> | Supervised By Iwona Zarych |
|--------------|------------------|------------|------------|--------------------|----------------|----------------|------------------|----------------------------|
| 1789 | HCL for TCLP, 1N | WP110803 | 11/21/2024 | 05/09/2025 | Jignesh Parikh | None | None | |
| | | | | | | | | 11/21/2024 |

| Recipe | | | | Expiration | Prepared | | | Supervised By |
|-----------|-------------------|------------|------------|-------------|----------------|----------------|------------------|---------------|
| <u>ID</u> | <u>NAME</u> | <u>NO.</u> | Prep Date | <u>Date</u> | <u>By</u> | <u>ScaleID</u> | <u>PipetteID</u> | Iwona Zarych |
| 1788 | HNO3 for TCLP, 1N | WP110804 | 11/21/2024 | 05/13/2025 | Jignesh Parikh | None | None | Ţ |
| | | | | | | | | 11/21/2024 |

FROM 64.00000ml of M6120 + 936.00000ml of W3112 = Final Quantity: 1000.000 ml



| 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 (AI) 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 / | Chemtech Lot # |
| EPA | ICV-1 / ICV (ICP/ICPMS) STOCK SOLN | ICV-1014 | 02/05/2025 | 08/07/2024 / jaswal | 04/20/2021 / bin | M5295 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute | 58126 / Fe, 10000 PPM, | 020422 | 02/04/2025 | 05/02/2023 / | 06/15/2022 / | M5298 |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|------------------------------------|--|-----------------|--------------------|----------------------------|---------------------------------|-------------------|
| Inorganic Ventures | CLPP-CAL-3 / CLP CAL SOLUTION #3, 125mL | T2-MEB714159 | 01/13/2027 | 10/12/2022 / bin | 09/19/2022 / bin | M5393 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 57103 / Li, 10000 PPM, 125 ml | 070622 | 07/06/2025 | 01/30/2023 / bin | 01/26/2023 / bin | M5429 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 57058 / Cerium, 1000PPM, 100ML | 061322 | 06/13/2025 | 03/06/2023 / bin | 03/01/2023 / bin | M5466 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 57038 / Sr, 1000 PPM, 125 ml | 082922 | 08/29/2025 | 01/14/2025 / Jaswal | 03/16/2023 / jaswal | M5472 |
| | | 1 | | | L | |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Supplier Absolute Standards, Inc. | ItemCode / ItemName 57138 / Sr, 10000 PPM, 125 ml | Lot # 082922 | | | | |
| Absolute | 57138 / Sr, 10000 PPM, | | Date | Opened By 07/29/2024 / | Received By 03/16/2023 / | Lot # |



| 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. | 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 # |
| Supplier Absolute Standards, Inc. | ItemCode / ItemName 58024 / Chromium, Cr, 500 ml, 1000 PPM | Lot # 060523 | | | | |
| Absolute | 58024 / Chromium, Cr, | | Date | Opened By 08/28/2023 / | Received By 08/25/2023 / | Lot # |



| 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 / | Chemtech Lot # |
| Absolute Standards, Inc. | 57033 / As, 1000 PPM, 125 ml | 111323 | 11/13/2026 | 02/09/2024 / bin | 02/09/2024 / bin | M5801 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 57051 / Sb, 1000 PPM, 125 ml | 120523 | 12/05/2026 | 08/07/2024 / jaswal | 01/03/2024 / jaswal | M5802 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Absolute Standards, Inc. | 58111 / Na, 10000 PPM, 500 ml | 122223 | 12/22/2026 | 08/01/2024 / Jaswal | 01/03/2024 / jaswal | M5806 |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|-----------------------------|--|--------------|--------------------|----------------------------|--------------------------------|-------------------|
| Absolute Standards, Inc. | 57115 / P, 10000 PPM, 125 ml | 041723 | 04/17/2026 | 05/21/2024 / Jaswal | 02/09/2024 / jaswal | M5815 |
| 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 / | Chemtech Lot # |
| Inorganic Ventures | CGTI1-1 / TITANIUM 125mL 1000ug/mL | T2-TI719972 | 06/17/2027 | 06/18/2024 / Jaswal | 02/22/2024 / Jaswal | M5942 |
| | · | | | Data Onemad / | Described Date / | Chemtech |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Lot # |



| 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 # |
| 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 | CGIN10-5 / INDIUM 1 x | U2-IN729349 | 02/21/2028 | 10/08/2024 / Jaswal | 06/14/2024 / Jaswal | M5985 |



Fax: 908 789 8922

| 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 |
| 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) | 22E1662006 | 05/09/2025 | 11/09/2024 / Janvi | 10/09/2024 / Janvi | M6118 |
| 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) | 2310662003 | 05/13/2025 | 11/13/2024 / Eman | 10/13/2024 / Eman | M6120 |
| | | | | | I. | |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Supplier Seidler Chemical | ItemCode / ItemName BA-9530-33 / Hydrochloric Acid, Instra-Analyzed (cs/6x2.5L) | Lot # 0000275677 | - | - | | |
| | BA-9530-33 / Hydrochloric Acid, Instra-Analyzed | | Date | Opened By 11/13/2024 / | Received By 10/13/2024 / | Lot # |



| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
|--|--|---------------------|--------------------|----------------------------|--------------------------------|-------------------|
| Absolute 58112 / Mg, 10000 PP 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 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 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 By | Chemtech Lot # |
| PCI Scientific Supply, Inc. | PC01050-3 / ACETIC ACID, GLACIAL, ACS, 2.5L | 511115 | 06/19/2028 | 06/20/2023 / jignesh | 06/19/2023 / jignesh | W3038 |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |
| Seidler Chemical | DIW / DI Water | Daily Lab-Certified | 07/03/2029 | 07/03/2024 / Iwona | 07/03/2024 / Iwona | W3112 |
| | | | | | | |
| Supplier | ItemCode / ItemName | Lot # | Expiration Date | Date Opened / Opened By | Received Date / Received By | Chemtech Lot # |



Certificate of Analysis

R: 02/22/24 M5986 M5987 M5988 M5989 M5999

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Product Code:

Multi Analyte Custom Grade Solution

Catalog Number:

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,

Thallium,

Cadmium,

40 μg/mL ea: Arsenic,

Alderiie,

20 µg/mL ea: Lead

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE Antimony, Sb **CERTIFIED VALUE**

ANALYTE Arsenic, As **CERTIFIED VALUE**

40.00 ± 0.26 μg/mL

Cadmium, Cd

100.0 ± 0.7 μg/mL 49.99 ± 0.22 μg/mL

Lead. Pb

19.99 ± 0.09 µg/mL

Selenium, Se

50.00 ± 0.23 μg/mL

Thallium, Ti

50.00 ± 0.22 μg/mL

Density:

1.025 g/mL (measured at 20 ± 4 °C)

Assay Information:

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

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

Characterization of CRM/RM by Two or More Methods

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

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

Xi = mean of Assay Method i with standard uncertainty uchar i

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

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

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

k = coverage factor = 2

 $u_{char} \simeq [\Sigma((w_i)^2 (u_{char})^2)]^{1/2}$ 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

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 (±) = $U_{CRM/RM} = k (u^2_{chara} + u^2_{bb} + u^2_{its} + u^2_{ts})^{1/2}$

k = coverage factor = 2

uchar a = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

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

uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

N/A

6.0 INTENDED USE

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

6.2 For products attaining traceability through Inorganic Ventures' Primary Certified Reference Materials (PCRM™) see the Limited License to Use PCRM™ in the Inorganic Ventures <u>Terms and Conditions of Sale.</u>

https://www.inorganicventures.com/terms-and-conditions-sale. The Terms and Conditions contain information on the use of materials traceable to PCRM™ certified reference materials. This Limited License agreement is especially pertinent for laboratories accredited under ISO:17034.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.
- For more information, visit

www.inorganicventures.com/TCT

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.

Paul R Saine

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Joseph Burns Custom VS Manager

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director

Certified Reference Material CRM

M6032

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

CERTIFIED WEIGHT REPORT: Part Number: Lot Number: 010924 57056 Solvent: 24002546 Lot # Nitric Acid Giovannie Lasas EL

Recommended Storage: **Expiration Date:** Description: Ambient (20 °C) 010927 Barium (Ba) 2% 40.0

Nitric Acid

Formulated By:

Giovanni Esposito

010924

Nominal Concentration (µg/mL): Weight shown below was diluted to (mL): **NIST Test Number: 6UTB** 1000 2000.02 0.058 Flask Uncertainty 5E-05 Balance Uncertainty Reviewed By: Expanded Pedro L. Rentas

Lot Nominal SDS Information

Barium nitrate (Ba) IN023 BAD022019A1 RV# Number Conc. (µg/mL) 1000 99.999 38 Purity (%) 0,10 52.3 8 Weight (g) 3.82417 Weight (g) Conc. (µg/mL) 3.82441 1000.1 +/- (µg/mL) 2.0 10022-31-B CAS# 0.5 mg/m3 SRM

Purity Uncertainty Assay Target Actual Actual Uncertainty

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

010924

orl-rat 355 mg/kg 3104a

[1] Spectrum No.1

m/z-> m/z-> m/z-> 2.5E6 5.0E6 2.0E5 1.0ES 2.0≡6 1.0E6 200 110 0 NNO 120 20 [12.514 sec]:58156.D# [Count] [Linear] 230 130 30 140 1040 4 150 NSO 50 160 1200 00 170 70 180 80 190 90 200 100

Part # 57056



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.

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).

Absolute Standards, Inc. 800-368-1131

www.absolutestandards.com



Certified Reference Material CRM

R 815/24

Solvent:

24002546

Nitric Acid

Lot #

M6028

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

CERTIFIED WEIGHT REPORT:

Part Number:

57048 070124

Lot Number: Description:

Cadmium (Cd)

Nominal Concentration (µg/mL):

NIST Test Number:

6UTB

1000

Recommended Storage:

Expiration Date:

070127 Ambient (20 °C)

Weight shown below was dliuted to (mL):

2000.07

0.100 Flask Uncertainty 5E-05 Balance Uncertainty

2%

40.0 (mL) Nitric Acid

Formulated By:

Alban PROBAN

Aleah O'Brady

070124

Reviewed By:

Pedro L. Rentas

070124

Expanded

Weight (g) Conc. (µg/mL) Uncertainty

Cadmium nitrate tetrahydrate (Cd)

IN024 CDM092021A1

1000

99.999

0.10

36.5

5.4797

5.4804

1000.1

2.0

10022-68-1

0.01 mg/m3

orl-rat 60.2mg/kg

3108

RM#

Number Lot

Conc. (µg/mL)

8

8

Weight (g)

Target

Actual

Actual

Nominal

Purity

Uncertainty Assay Purity (%)

+/- (µg/mL)

CAS#

SDS Information

(Solvent Safety Info. On Attached pg.)
OSHA PEL (TWA) LD50

NIST SRM

m/z-> -z/m m/z-> 1.0E7 2.0E7 5.OE4 1.0E5 2.5E4 5.0M4 [1] Spectrum No.1 010 110 0 220 120 20 [12.514 sec]:58148.D# [Count] [Linear] 230 130 30 240 140 40 N00 150 50 2000 160 60 170 70 180 80 061 Ö 200 100

1 of 2

www.absolutestandards.com

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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| | 20 | MIO | 5, | He | Mn | , , | ₹ | 7 | 1 | E | STATE OF THE PARTY | אפרשוט | 5 | |
| (T) = Target analyte | 40,02 | 20.02 | 5 | ∆ 0.2 | <0.02 | | ≙ 01 | <0.02 | | 40.00 | | vernica | 17:22 | |
| jet anal | × | 7 | 1 | 9 | Pd | | <u>ک</u> | Ş | : | Z. | | Con | | |
| yte | 40.2 | \$0.02 | | A) (2) | <0.02 | 10.00 | 3 | <0.02 | 40.02 | 2002 | | יטא וכף- | | |
| | Sc | Sm | • | 2 | RЪ | 1 | <u> </u> | Re | 1.1 | P | | MU | | |
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| | Ti | Sn | 111 | 1 | 7 | 11 | 3 | Te | 10 | | | | | |
| | <0.02 | 40.02 | 20.07 | 3 | ₩ | 20.02 | 3 | <0.02 | 20.02 | 500 | Age of the owner that the | | | |
| | Zt | Zn | | < | ¥ | ~ | 7 | d | * | | | | | |
| | <0.02 | <0.02 | 20.02 | 3 | 40.02 | 20.02 | | 40.02 | 70.02 | | MATERIAL SECTION AND ADDRESS OF THE PERSON A | | | |

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 # 57048

2 of 2



Certificate of Analysis

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Product Code: Multi Analyte Custom Grade Solution

Catalog Number: CLPP-CAL-1

Lot Number: T2-MEB714417

Matrix: 5% (v/v) HNO3

Value / Analyte(s): 5 000 µg/mL ea:

Calcium, Potassium, Magnesium, Sodium,

2 000 μg/mL ea:

Aluminum, Barium,

1 000 µg/mL ea:

Iron,

500 μg/mL ea:

Nickel, Vanadium, Zinc, Cobalt,

Manganese, 250 μg/mL ea:

Silver, Copper,

200 μg/mL ea: Chromium, 50 μg/mL ea: Beryllium

3.0 CERTIFIED VALUES 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:

| 133 | ay iiii Oi iii atioii. | | | |
|-----|------------------------|-------------|-----------|--------------|
| | ANALYTE | METHOD | NIST SRM# | SRM LOT# |
| | Ag | ICP Assay | 3151 | 160729 |
| | Ag | Volhard | 999c | 999c |
| | Al | ICP Assay | 3101a | 140903 |
| | Al | 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 |
| | Ca | ICP Assay | 3109a | 130213 |
| | Ca | EDTA | 928 | 928 |
| | Co | ICP Assay | 3113 | 190630 |
| | Co | 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 |
| | K | ICP Assay | 3141a | 140813 |
| | K | Gravimetric | | See Sec. 4.2 |
| | Mg | ICP Assay | 3131a | 140110 |
| | Mg | EDTA | 928 | 928 |
| | Mn | ICP Assay | 3132 | 050429 |
| | Mn | EDTA | 928 | 928 |
| | Na | ICP Assay | 3152a | 120715 |
| | Na | Gravimetric | | See Sec. 4.2 |
| | Ni | ICP Assay | 3136 | 120619 |
| | Ni | EDTA | 928 | 928 |
| | 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 Characterization of CRM/RM by One Method Certified Value, X_{CRM/RM}, where two or more methods of characterization are 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} Xa = mean of Assay Method A with $\mathbf{w_i}$ = the weighting factors for each method calculated using the inverse square of u_{char a} = the standard uncertainty of characterization Method A $\mathbf{w_i} = (1/u_{\text{char i}})^2 / (\Sigma (1/(u_{\text{char i}})^2)$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{\frac{1}{2}}$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 a + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ k = coverage factor = 2 k = coverage factor = 2 $\mathbf{u_{char}} = [\Sigma((\mathbf{w_i})^2 (\mathbf{u_{char}}_i)^2)]^{1/2}$ where $\mathbf{u_{char}}_i$ are the errors from each characterization method u_{char a} = the errors from characterization ubb = bottle to bottle homogeneity standard uncertainty $\mathbf{u_{bb}}$ = bottle to bottle homogeneity standard uncertainty ults = long term stability standard uncertainty (storage) u_{lts} = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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; inorganic ventures.com; info@inorganic ventures.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: | |
|-----------------------------|--|
| · Sealeo TCT Bao Oberi Dale | |

- 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

DD9784.



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Product Code: Multi Analyte Custom Grade Solution

CLPP-CAL-3 Catalog Number: T2-MEB714159 Lot Number: Matrix: 7% (v/v) HNO3 Value / Analyte(s):

> Arsenic, Lead, Selenium, Thallium,

500 µg/mL ea: Cadmium

1 000 µg/mL ea:

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

ANALYTE CERTIFIED VALUE ANALYTE CERTIFIED VALUE 1 000 ± 8 µg/mL Cadmium, Cd $500.0 \pm 2.1 \, \mu g/mL$ Arsenic, As Lead, Pb 1 000 ± 5 µg/mL Selenium, Se 1 000 ± 8 µg/mL

Thallium, TI 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 |
| TI | 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 Characterization of CRM/RM by One Method Certified Value, X_{CRM/RM}, where two or more methods of characterization are 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} Xa = mean of Assay Method A with $\mathbf{w_i}$ = the weighting factors for each method calculated using the inverse square of u_{char a} = the standard uncertainty of characterization Method A $\mathbf{w_i} = (1/u_{\text{char i}})^2 / (\Sigma (1/(u_{\text{char i}})^2)$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{\frac{1}{2}}$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 a + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ k = coverage factor = 2 k = coverage factor = 2 $\mathbf{u_{char}} = \left[\sum ((\mathbf{w_i})^2 (\mathbf{u_{char}}_i)^2)\right]^{1/2}$ where $\mathbf{u_{char}}_i$ are the errors from each characterization method u_{char a} = the errors from characterization ubb = bottle to bottle homogeneity standard uncertainty $\mathbf{u_{bb}}$ = bottle to bottle homogeneity standard uncertainty ults = long term stability standard uncertainty (storage) u_{lts} = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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

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; inorganic ventures.com; info@inorganic ventures.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 C | pen 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

20178Ci

800-368-1131 Absolute Standards, Inc.

www.absolutestandards.com



Certified Reference Material CRM

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

R: 815/24 M6025

CERTIFIED WEIGHT REPORT: Part Number: 57182 110923 Solvent: 24002546 Lot #

Nitric Acid

Lot Number: Description: Lead (Pb)

Nominal Concentration (µg/mL): Recommended Storage: 10000 Ambient (20 °C)

Expiration Date:

110926

2%

Nitric Acid

Formulated By:

Lawence Barry

110923

110923

Revience

40.0

Weight shown below was diluted to (mL): **NIST Test Number: 6UTB** Lot 2000.02 Nominal 0.058 Flask Uncertainty 5E-05 Balance Uncertainty Purity Uncertainty Assay Target Actual Actual Uncertainty Reviewed By: Expanded Pedro L. Rentas SDS information

| [F.] | 1. Lead(II) nitrate (Pb) | Compound |
|-------------------|--|--|
| [1] Spectrum No.1 | IN029 PBD122016A1 | Lot Nominal Purity Uncertainty Assay Target Actual RM# Number Conc. (µg/mL) (%) Purity (%) (%) Weight (g) Weight (g) |
| 17.284 5 | 11 | Nominal Purity Uncertainty Assay Conc. (µg/mL) (%) Purity (%) (%) \(\begin{array}{c}\) |
| 7 | 99.999 | Purity (%) |
| של מו | 0.10 | Uncertainty Purity (%) |
| | 62.5 | Assay (%) |
| To a line | 32.0006 | Target Weight (g) |
| | 10000 99.999 0.10 62.5 32.0006 32.0040 | Actual Weight (g) |
| | | Actual Conc. (µg/mL) |
| | 20.0 | Actual Uncertainty onc. (µg/mL) +/- (µg/mL) |
| | 10099-74-8 | (Solv |
| | 10001.1 20.0 10099-74-8 0.05 mg/m3 | Actual Uncertainty (Solvent Safety Info. On Attached pg.) Conc. (ug/mL) +/- (ug/mL) CAS# OSHA PEL (TWA) LD50 |
| | intryns-rat 93 mg/kg 3128 | tached pg.) LD50 |
| | 3128 | NIST SRM |

| 110 120 130 140 150 | 10 20 30 40 | |
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Part # 57182

1 of 2



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

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

| | | | _ | | 20.02 | 2 | 70.02 |
|-------------|-------------------------|------------------------------|---|--|---|--|---|
| | | | | | 3 | ? | 3 |
| <0.02 Pt | | | | | 40.02 | S | 40.02 |
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| | | | | | A.12 | S | 20.02 |
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| | | | | | A | <u></u> | 20.02 |
| | | | | | 40.02 | 5 | 20.02 |
| 7 7 Z S Z 3 | 40.02 40.02 40.02 | Mg 40.02 Hg 40.02 Hg 40.02 | 40.02 Lu 40.02 40.02 Mg 40.01 40.02 Mg 40.02 40.02 Mg 40.02 | Ho 4002 Lu 4002 Li 4002 Mg 4001 Li 4002 Mg 4001 Li 4002 Mg 402 Fe 402 Hg 402 | 40.02 Lu 40.02 40.02 Mg 40.01 40.02 Mg 40.02 40.02 Mg 40.02 | 4002 Ho 4002 Lu 4002 4002 In 4002 Mg 4001 4002 Fe 402 Hg 402 | Er 4002 Ho 4002 Lu 4002 Eu 4002 In 4002 Mg 4001 Gd 4002 Ir 4002 Mn 4002 Ga 4002 Fe 402 Hg 402 |

Physical Characterization:

(T)= Target analyte

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

Son I Mills

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).





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.

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

analyses.

Contains Heavy Metals
HAZARDOUS MATERIAL

Safety Data Sheets Available Upon Request

(A) SAMPLE DESCRIPTION

Enclosed is a set of one (1) or more bottles of 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.**

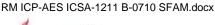
(B) BREAKAGE OR MISSING ITEMS

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: Al, Ca, Fe, and Mg. The ICSB solution contains the analytes: Ag, As, Sb, Ba, Be,







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

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. "CERTIFIED VALUES" FOR INTERFERENCE CHECK SAMPLE ICP-AES ICSA-1211, |
|--|
| AND ICSA-1211 MIXED WITH ICSB-0710 |

| 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) |
|---------|------|------------------|------------------------|-------------------------|-----------------------------|------------------------|-------------------------|
| Al | 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 |
| Ba | 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 |
| Ca | 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 |

ICSA M5126 M5127 M5128 M5129 M5130

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.

value \pm 15 percent of the listed certified value.

ICSB

M5219

M5220

M5221

M5222

M5223



Certificate of Analysis

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Product Code: Multi Analyte Custom Grade Solution

Catalog Number: CHEM-QC-4

Lot Number: S2-MEB711674

Matrix: 3% (v/v) HNO3
 3% (v/v) HF

3 /0 (V/V) I II

Value / Analyte(s): 1 000 μg/mL ea:

Boron, Molybdenum,

Silicon, Tin,

Titanium

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

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE CERTIFIED VALUE ANALYTE CERTIFIED VALUE Boron, B $1\,000\pm7\,\mu\text{g/mL}$ Molybdenum, Mo $1\,000\pm5\,\mu\text{g/mL}$ Silicon, Si $1\,000\pm7\,\mu\text{g/mL}$ Tin, Sn $1\,000\pm5\,\mu\text{g/mL}$

Titanium, Ti $1 001 \pm 6 \mu g/mL$

Density: 1.032 g/mL (measured at 20 \pm 4 °C)

Assay Information:

| 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 |
| Ti | ICP Assay | 3162a | 130925 |

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_{CRM/RM}, where two or more methods of characterization are 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} Xa = mean of Assay Method A with $\mathbf{w_i}$ = the weighting factors for each method calculated using the inverse square of u_{char a} = the standard uncertainty of characterization Method A $\mathbf{w_i} = (1/u_{\text{char i}})^2 / (\Sigma (1/(u_{\text{char i}})^2)$ CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM}$ = k ($u_{char}^2 + u_{bb}^2 + u_{lts}^2 + u_{ts}^2$)^{1/2} CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u_{char}^2 a + u_{bb}^2 + u_{lts}^2 + u_{ts}^2)^{1/2}$ k = coverage factor = 2 k = coverage factor = 2 $\mathbf{u_{char}} = \left[\sum ((\mathbf{w_i})^2 (\mathbf{u_{char}}_i)^2)\right]^{1/2}$ where $\mathbf{u_{char}}_i$ are the errors from each characterization method u_{char a} = the errors from characterization ubb = bottle to bottle homogeneity standard uncertainty $\mathbf{u_{bb}}$ = bottle to bottle homogeneity standard uncertainty u_{lts} = long term stability standard uncertainty (storage) u_{lts} = long term stability standard uncertainty (storage) uts = transport stability standard uncertainty u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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 **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; inorganic ventures.com; info@inorganic ventures.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

- Sealed TCT Rag Open Date:

- 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

| could for bug opon buto. | | • | |
|------------------------------|----------------------------------|---------------------------|------|
| | | | |
| This CDM/DM should not be up | and langer than one year for six | months in the case of a 2 | n ml |

- I his 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.

Michael 2 Booth

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth Director, Quality Control

Certifying Officer:

Paul Gaines

Chairman / Senior Technical Director

Paul R Laine





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.

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

analyses.

Contains Heavy Metals
HAZARDOUS MATERIAL

Safety Data Sheets Available Upon Request

(A) SAMPLE DESCRIPTION

Enclosed is a set of one (1) or more bottles of 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.**

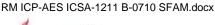
(B) BREAKAGE OR MISSING ITEMS

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: Al, Ca, Fe, and Mg. The ICSB solution contains the analytes: Ag, As, Sb, Ba, Be,







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

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. "CERTIFIED VALUES" FOR INTERFERENCE CHECK SAMPLE ICP-AES ICSA-1211, |
|--|
| AND ICSA-1211 MIXED WITH ICSB-0710 |

| 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) |
|---------|------|------------------|------------------------|-------------------------|-----------------------------|------------------------|-------------------------|
| Al | 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 |
| Ba | 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 |
| Ca | 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 |

ICSA M5126 M5127 M5128 M5129 M5130

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.

value \pm 15 percent of the listed certified value.

ICSB

M5219

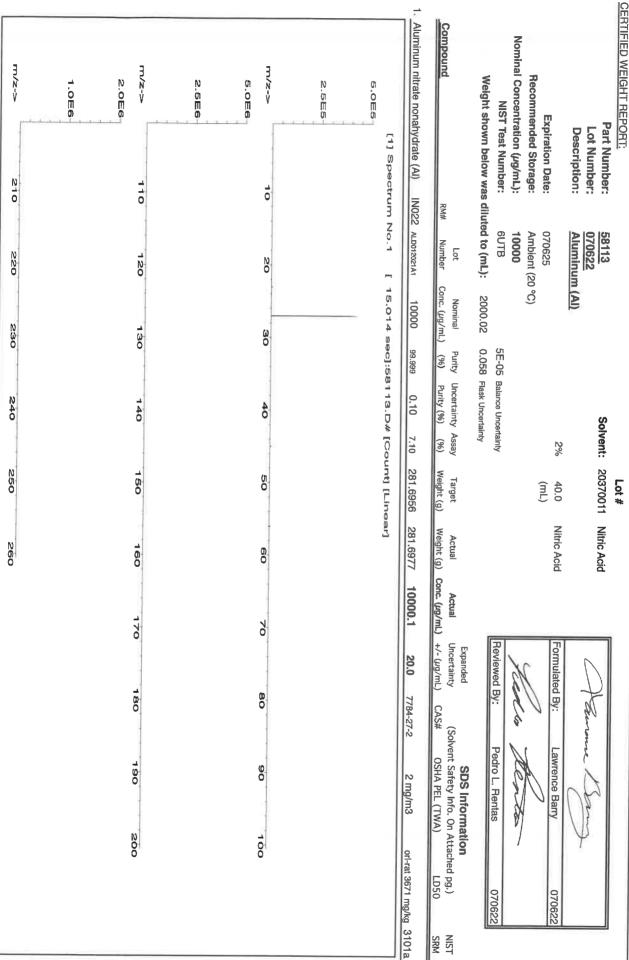
M5220

M5221

M5222

M5223

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



Part # 58113



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

| 7 | Tb <0.02 W |
|---|--|
| _ | A 0.02 |
| | |
| | 3 : |
| | 3 1 |
| | 2 : |
| | Ti <0.02 Zr |
| | Se <0.2 Si <0.02 Ag <0.02 Na <0.02 Si <0.02 Si <0.02 Ag <0.02 Si <0.02 |

Physical Characterization:

(I)= larger analyte

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

Certified by:

- * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated. * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- * All standard containers are meticulously cleaned prior to use.
- * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- * Standards are 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).

2 of 2

Part # 58113



QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY "An ISO 9001:2015 Certified Program" R: 4120/21

Instructions for QATS Reference Material: Inorganic ICV Solutions

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

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

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

CAUTION: Read instructions carefully before opening bottle(s) and proceeding with

the analyses.

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

> Safety Data Sheets Available Upon Request

(A) SAMPLE DESCRIPTION

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

(B) BREAKAGE OR MISSING ITEMS

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

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

(C) ANALYSIS OF SAMPLES

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

ICV1-1014

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

Page 1 of 2



RMs ICV 1, 5, 6 SFAM.docx



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

Instructions for QATS Reference Material: Inorganic ICV Solutions

ICV1-1014

For ICP-MS analysis, use a 50-fold dilution by pipetting 2 mL of the ICV1 concentrate into a 100 mL volumetric flask and dilute to volume with 1% (v/v) nitric acid.

ICV5-0415

For the cold vapor analysis of mercury by AA, use a 100-fold dilution by pipetting 1 mL of the ICV5 concentrate into a 100 mL volumetric flask and dilute to volume with 2% (v/v) nitric acid. The ICV5 concentrate is prepared in 0.05% (w/v) K₂Cr₂O₇ 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 K₃Fe(CN)₆, Type II water, and 0.1 % sodium hydroxide, and will decompose rapidly if exposed to light.

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

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

| | ICV1-1014 | |
|---------|---|--|
| Element | Concentration (µg/L) (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 |

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

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



Certified Reference Material CRM

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

| | | | ا | | | |
|-------------------------|--|--|---|---------------------------------------|--|-----|
| | | INI INI | NIST | g 3126a | | |
| | | 020422 | ned pg.) LD50 | orl-rat 7500mg/kg | | |
| | 13 | 2 /4 | nation On Attac (A) | ō | 100 | |
| | The state of the s | Giovanni Esposito | SDS Information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LDSG | 5 mg/m3 | | |
| | W | Giovar | SI olvent Sal OSH, | | 0 | |
| | iovannie | ž () :: | (So CAS# | 7782-61-8 | 08 | |
| | Lien | Formulated By: | Expanded Uncertainty +/- (µg/mL) | 20.0 | | |
| | ` | | | 15 | 170 | |
| | _ | _ | Actual Conc. (ug/1 | 10001.5 | | |
| | Nitric Acid | Nitric Acid | Actual Actual Weight (g) Conc. (ug/mL) | 30.0090 | 160 | 260 |
| | Lot # 20370011 | (mL) | Target Weight (g) | 30.0044 | 150 | 250 |
| | Solvent: | 5.0% srtainty uinty | Assay (%) | 100.0 | | |
| | Ø. | 5.0% Balance Uncertainty Flask Uncertainty | Uncertainty Assay Purity (%) (%) | 0.10 | 04 641 | 240 |
| | 86 | 5E-05 B | Purity L | 99.999 | | |
| | M5298 | 0000.41 | Nominal Conc. (µg/mL) | 10000 | [1] Spectrum No.1 [30.763 sec]:58126.D# [Count] [Linear] 10 20 30 110 120 130 | 230 |
| | <u>152</u> (Fe) | 020425 Ambient (20 °C) 10000 6UTB ed to (mL): 3 | Lot Number C | 221035107 | 20 20 120 | 660 |
| | 58126 020422 Iron (Fe) | 020425 Ambient 10000 6UTB | | | 30.763 sec | |
| | Ser: Ser: | ate: ige: nL): oer: w was di | RM# |) IN346 | 10 10 110 110 110 110 110 110 110 110 1 | ; |
| Tac | Part Number: Lot Number: Description: | Expiration Date: 020425 Recommended Storage: Ambient (20 Nominal Concentration (µg/mL): 10000 NIST Test Number: 6UTB Weight shown below was diluted to (mL): | | 1. Iron(III) nitrate nonahydrate (Fe) | [1] Spectr | |
| CEBTIFIED WEIGHT BEDORT | 0 7 2 | Explommenc ncentrati NIST Te | | nonahy | 2.0E4 1.0E4 1.0E8 1.0E8 1.0E8 1.0E8 1.0E8 | |
| ID WELD | | Rec ninal Col | Compound | III) nitrate | c E | |
| FRTIFIE | | Non | Com | 1. Iron(| | |
| 0 | 1 | | | | | |

Printed: 2/16/2022, 11:15:09 PM

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):

| 3533553 | Trace Metals Verification by CP-MS (µc 0.02 Li 0.02 Ni 0.010 Ni 0.02 Re 0.02 Li 0.02 Ni 0.02 Re 0.02 Co 0.02 Re 0.02 Co 0.02 Re 0.02 Co 0.02 Co 0.02 Re 0.02 Co 0.03 C | C.O. T. A.O.O. T | Au < 0.02 Pb < 0.02 Nd < 0.03 Pt |
|--|--|--|----------------------------------|
| Cd <0.02 Ca <0.02 Cs <0.02 Cr <0.02 Cr <0.02 Co <0.10 | | | |
| 8 5 5 5 5 5 | -0.02-0.02-0.02-0.02-0.02 | <0.10 | <0.10 |
| | පි සි සී සි ස් | ථ | ņ |

(T)= Target analyte

Physical Characterization:

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



Certified by:

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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).

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Certified Reference Material CRM
[N 403 | 20 | 128 | 125 | 1

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

070622 070622 Pedro L. Rentas Lawrence Barry Formulated By: Reviewed By: Nitric Acid Nitric Acid 20510011 Fot # 20.0 (mL) Solvent: 2% 0.058 Flask Uncertainty 5E-05 Balance Uncertainty 1000.12 Ambient (20 °C) Lithium (Li) Weight shown below was diluted to (mL): 57103 070622 070625 10000 **6UTB** Nominal Concentration (µg/mL): NIST Test Number: Lot Number: Description: Expiration Date: Recommended Storage: Part Number: CERTIFIED WEIGHT REPORT:

| Γ | | | | | | ar] | [9.619 sec]:58103.D# [Count] [Linear] | # [C | 58103.D | sec]:: | _ | No.1 | ctrum | [1] Spectrum No.1 | |
|-----|--|---|-----------|-------------|---------------|------------|--|-------|---|--------|-----------------|------------------|-------|-------------------|----------------------|
| 5 | Byfill 0241 ischio | 2 | | | | | 10000 | | | | | | | | |
| MA | 0.10 10.0 100.0134 100.0173 10000.4 20.0 7790-69-4 5 ma/m3 nd-sat 1428 ma/m NA | 5 ma/m3 | 7790-69-4 | 20.0 | 10000.4 | 100.0173 | 100.0134 | 10.0 | 0.10 | 99.999 | 10000 89.889 0. | IN019 UZ042018A1 | IN019 | | Lithium nitrate (Li) |
| SEM | LD50 | RM# Number Conc. (µg/mL) (%) Purity (%) (%) Weight (g) Conc. (µg/mL) +/- (µg/mL) CAS# OSHA PEL (TWA) LD50 | CAS# | +/- (ug/mL) | Conc. (ug/mL) | Weight (g) | Weight (g) | (%) | Purity (%) | (%) | Conc. (µg/mL) | Number | RM# | | БПроппа |
| | Attached oc.) | (Solvent Safety Info. On Attached pg.) | (Solv | Uncertainty | Actual | Actual | Target | Assay | Nominal Punty Uncertainty Assay. Target | Funty | Nominal | 707 | | | Commonia |
| | ition | SDS Information | | Expanded | | | | | | | | - | | | |

| 1.056 | 6.0E5 | m/z->- 500 250 | 7,2-7 20 10 | m/z-> |
|--------------------------------------|-------|----------------------|-------------------|--|
| L'ON EUROPE | | 0 | 0 | 010 |
| _ | | 00 | 08 | O |
| 9.619 sec]:58103.D# [Count] [Linear] | | .0 | 130 | OR A |
| 3103.D# [Q | | 0 | 041 | entra () istera de activados activados por considera |
| ount) (Lines | | 00 | 150 | * DESCRIPTION OF THE PROPERTY |
| rr] | | .0 | 0 | The state of the s |
| | | 0 | . Q | |
| | | . 0 | 180 | |
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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 Spectroscopy (ICP-MS):

| | | | | | | | Trace Me | stale | Varifics | tion | hy ICP. | MC | (lm/m/) | | | | | | |
|-------------|--------------|--|--------------------------------------|----|---------------|----|--------------|--------|--------------|------|--------------|---------|--------------|-----|-------|----------------|-------|----------|-----------|
| SHIPPING IN | | STREET, STREET | THE RESIDENCE OF THE PERSON NAMED IN | | | - | THE PARTY | | 2011124 | | 1 | 2 | (M) | | | | | | |
| A1 | 2002 | 3 | 2000 | 2 | 88 | 30 | 800 | E | ŧ | 1 | 89 | 4 | | I. | - | | | | |
| 2 : | 70'00 | 3 | 70.00 | 5 | 70.02 | 1 | 70105 | 3 | 1 | Σ, | 70.02 | = | Z0:02 | 3 | 40.2 | 19 | Q 05 | ≥ | 40.02 |
| 3 | <0.02 | రి | 40.2 | 山 | <0.02 | Ho | 40.02 | Ē | 40.02 | ź | 40.02 | 2 | Q .02 | SS. | <0.02 | T _e | <0.02 | ח | <0.02 |
| As | ₩2 | ප | <0.02 | 嵒 | <0.02 | 편 | ₹0.02 | Mg | <0.01 | ő | <0.02 | Rh A | <0.02 | Ag | <0.02 | E | <0.02 | > | Ø 02 |
| Ba | <0.02 | రో | <0.02 | 3 | <0.02 | 卢 | <0.02 | Mn | <0.02 | R | ZO:02 | 2 | Ø.02 | Z | 40.2 | £ | 200 | \$ | 500 |
| Be | <0.01 | ඊ | <0.02 | පී | 40.02 | 괊 | <0.2 | 黑 | \$07 | Δ. | <0.02 | Ra | 900 | J. | <0.02 | ع ا | 8 | * | 200 |
| B. | 40.02 | රි | 40.02 | පී | 20.0 2 | 3 | <0.02 | ₩ W | 40.02 | Æ | <0.02 | SB | <0.02 | S | <0.02 | 5 | 8 | - E | 200 |
| В | <0.02 | ರೆ | <0.02 | Αn | <0.02 | 2 | <0.02 | P | <0.02 | 24 | <0.2 | S | 40.02 | E | <0.02 | F | 000 | 7 12 | 2000 V |

Physical Characterization:

(T)= Target analyte

Certified by:

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

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

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 # 57103

955 N R 2 03 /0

Certified Reference Material CRM



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NIST SRM

Z

CERTIFIED WEIGHT REPORT 1. Cerium nitrate hexahydrate (Ce) Nominal Concentration (µg/mL): Weight shown below was diluted to (mL): Recommended Storage: m/z-> m/z-> m/z-> 2,5E7-5.0E7 1.0E6-2.0E6-5.0EB-NIST Test Number: Expiration Date: Part Number: Description: Lot Number: [1] Spectrum No.1 [43.472 sec]:58158.D# [Count] [Linear] 210 10 5 IN146 Z512CEB1 24 061322 Cerlum (Ce) 000 061325 57058 Ambient (20 °C) Number 헏 220 120 20 Conc. (ug/mL) 1000.12 Nominal 9 230 130 30 99.999 0.058 Flask Uncertainty 5E-05 Balance Uncertainty Purity 3 Uncertainty Assay Purity (%) 0.10 240 140 6 Solvent 22 3 8 20510011 3.04919 Weight (g) Target 250 S O [0] # 150 20.0 (mL) 3.04923 Nitric Acid Weight (g) Conc. (µg/mL) Nitric Acid Actual 260 160 60 1000.0 Actual 170 70 -/- (µg/m) Reviewed By: Formulated By: Uncertainty Expanded 20 10294-41-4 180 8 (Solvent Safety Info. On Attached pg.) Pedro L. Rentas Lawrence Barry OSHA PEL (TWA) SDS Information 190 90 ₹ 200 100 **LD50** ₹ 061322 061322

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

| I. | 1 50 | B | | > | 50 | > | | ı | |
|--------------|-------|--------------|----------------|------------|-------|-------|---|-----------|--------|
| F | - 2 | - 6 | <u>p</u> | 5 | _ | _ | | ı | |
| 40.02 | 40.02 | 40.01 | 40.02 | 40.2 | 40.02 | 40.02 | | | |
| 5 | . ზ | ਹ | ొ | ೮ | ర్జ | ß | | | |
| 40,02 | A0.02 | 40.02 | 40.02 | ⊢ j | 40.2 | <0.02 | | | |
| Au | ව් | වී | හි | 댈 | 罩 | Дy | 7 | | |
| 40.02 | 40,02 | 40.02 | 40.02 | 40.02 | 40.02 | <0.02 | | | |
| 3 | 2 | त्र | 4 | Ħ | 뜡 | Ж | | | |
| 40.02 | 40.02 | 402 | <0.02 | 40,02 | 40,02 | <0.02 | | HACE M | Troop |
| Nd | Mo | H | Mh | Mg. | Lu | E | | erais | + |
| 40.02 | 40.02 | 40.2 | 40.02 | 40,01 | △0.02 | 40,02 | | verilical | こうにかって |
| × | Z | P | Ъ | Š | \$ | Z | | JOH E | |
| 40.2 | 40.02 | 40.02 | 0.02 | 40.02 | <0.02 | <0.02 | | Y ICP-M | |
| Sc | Sm | R | ₹ | 22 | 20 | Pr | i | 9.11 | |
| 40.02 | 40.02 | 40.02 | 40.02 | 40.02 | 40.02 | <0.02 | | (mL) | |
| ia i | S | St | N _a | Ag | S. | æ | | | |
| 40.02 | <0.02 | <0.02 | 4 02 | 40.02 | 40.02 | 40.2 | | | |
| 11 | Sn | Tm | 3 | ᄇ | Te | 41 | | | |
| <0.02 | <0.02 | <0.02 | 40.02 | 40.02 | 40.02 | <0.02 | | | |
| Zr | Zn | × | 4 | < | c | W | | | |
| <0.02 | <0.02 | A).02 | 0.02 | <0.02 | 40.02 | <0.02 | | | |

(T)= Target analyte

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

Physical Characterization:

- * 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 # 57058

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CERTIFIED WEIGHT REPORT:

Part Number: Lot Number:

Certified Reference Material CRM

7 20 23

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Lot #

Solvent: 20510011 Nitric Acid

2%

40.0 (<u>l</u>

Nitric Acid

Formulated By:

Giovanni Esposito

011623

Pedro L. Rentas

011623

Giovannie

Jacob P

Description: Aluminum (AI)

011623 58113

Expiration Date: 011626

Nominal Concentration (µg/mL): Recommended Storage: 10000 Ambient (20 °C)

Weight shown below was diluted to (mL): **NIST Test Number:** 6UTB 2000.02 0.058 Flask Uncertainty 5E-05 Balance Uncertainty Reviewed By:

Compound ₽ ¥ Number ξ Conc. (µg/mL) Nominal 10000 99.999 Purity Uncertainty Assay 38 Purity (%) 0.10 7.30 8 273.9779 Weight (g) Target 274.0078 Weight (g) Conc. (µg/mL) Actual 10001.1 Actual +/- (µg/mL) Uncertainty Expanded 20.0 7784-27-2 CAS# (Solvent Safety Info. On Attached pg.) OSHA PEL (TWA) SDS Information LD50 NIST SRM

1. Aluminum nitrate nonahydrate (Al) IN022 ALM112021A1 m/z-> m/z-> m/z-> 1.0 € 6 2.0 € 6 2.5E6 5.0E6 2.5E5 5.0E5 [1] Spectrum No.1 210 110 0 220 120 20 [15.014 sec]:58113.D# [Count] [Linear] 230 130 30 240 140 40 250 150 50 260 160 60 170 0 180 80 190 90 2 mg/m3 200 100 ori-rat 3671 mg/kg 3101a

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ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com 031523 031523 Giovanni Esposito Pedro L. Rentas Liovanni Formulated By: Reviewed By: Certified Reference Material CRM Nitric Acid Nitric Acid Solvent: 21110221 Fot# 60.0 (mL) % 5E-05 Balance Uncertainty 0.058 Flask Uncertainty 3000.41 Ambient (20 °C) Calcium (Ca) Weight shown below was diluted to (mL): 031523 031526 10000 **6UTB** Recommended Storage: Nominal Concentration (µg/mL): Part Number: Lot Number: Description: **Expiration Date:** NIST Test Number: CERTIFIED WEIGHT REPORT:

| Compound | RM# | Lot Number | Nominal Purity Conc. (µg/mL) (%) | Punty (%) | Purity Uncertainty Assay (%) Purity (%) (%) | | Target Weight (g) | Actual Weight (g) | Expanded Actual Actual Uncertainty (Sc Weight (g) Conc. (µg/mL) +/- (µg/mL) CAS# | Expanded Uncertainty +/- (ug/mL) | (Solv | SDS Information (Solvent Safety Info. On Attached pg.) NS# OSHA PEL (TWA) LD50 | Attached pg.) LD50 | NIST |
|---------------------------|-------------------|-------------------|-------------------------------------|--------------|--|----------|----------------------|----------------------|--|----------------------------------|----------|---|-----------------------|-------|
| 1. Calcium carbonate (Ca) | IN014 | INO14 caboragezat | 10000 99.999 | 666.66 | 0.10 | 38.9 | 75.1990 | 75.2093 | 10001.4 | 20.0 | 471-34-1 | 5 mg/m3 | ort-rat | 3109a |
| [1] S ₁ | [1] Spectrum No.1 | | 4.00 | 8ec]:6 | 12.514 sec]:58120.D# [Count] [Linear] | <u> </u> | unti (Line | ari | | | | | | |
| 1.0E4 | | | | | | | | | | | | | | |
| m/z-> | 0 | .0 | | 000 | .0 | 400400 | 0 | 0 | 2 | | 0 | | 001 | |
| 2. 4 4 | | | | | | | | | | | | | | |
| m/z-> | 0 | 120 | | 90 | 140 | | 150 | 160 | 071 | 0 | 180 | 190 | | |
| 6.0E4 | | | | | | | | | | | | | | |
| m/z-> | 019 | 220 | | 230 | 240 | | 250 | 260 | | | | | | |

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

| | | | | | | Trace Me | tals | Verificat | ioi | by ICP-N | MS (| $(\mu g/m\Gamma)$ | | r | | | | |
|------------|--|--------------|-------------|---------------------------------------|--|------------------|-----------|-----------------|----------|----------|---|--|---|---|--|---|--|--|
| SHEW SHEET | STATE OF THE PARTY OF | | | | SIGNATURE . | STON SAFETY SAGE | S. Parlie | THE SHARE SHARE | Series . | | Sec. | STREET, STREET | - 100 mm | THE PERSON NAMED IN | THE PERSON | State of the last | | |
| 707 | ප | <0.02 | δ | 40.05 | H | <0.02 | II. | <0.02 | Z | <0.02 | ď | <0.02 | Se | <0.2 | 13 | <0.02 | ≥ | <0.02 |
| 700 | రో | H | 卢 | ₹0.02 | 윒 | 20.02 | 3 | <0.02 | ź | <0.02 | 2 | <0.02 | ន | <0.02 | Į. | 40.02 | Þ | ₹0.05 |
| 07 | ඊ | 40.02 | 超 | <0.02 | Я | <0.02 | Mg | 40.01 | ő | <0.02 | 쥪 | <0.02 | Ag | <0.02 | F | <0.02 | > | <0.02 |
| 707 | ర | <0.02 | පි | <0.02 | 片 | <0.02 | Mn | <0.02 | Z | <0.02 | 2 | <0.02 | ž | <0.2 | Ę | <0.02 | ¥9 | 40.02 |
| 100 | Ö | <0.02 | ජි | 40.02 | Ŗ | <0.2 | Hg | 40.2 | م | <0.02 | æ | <0.02 | స | <0.02 | Ę, | <0.02 | ¥ | ₹0.05 |
| 707 | රි | 40.02 | පි | ₹0.02 | 3 | 20.0≥ | Wo | <0.02 | 五 | <0.02 | Sm | <0.02 | S | <0.02 | Sn | <0.02 | 2 | ₹0.02 |
| 707 | ਰੋ | <0.02 | Αū | <0.02 | 2 | <0.02 | PN | <0.02 | × | 40.2 | S | <0.02 | Ta | <0.02 | Ξ | <0.02 | Z | 40.02 |
| | 6.00 6.00 6.00 6.00 6.00 6.00 | | 3 5 5 5 5 5 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | Cd | Cd | Cd | Cd | Cd | Cd -0.02 Dy -0.02 Hf -0.02 Li -0.02 Ca T En -0.02 Ho -0.02 Li -0.02 Ce -0.02 Eu -0.02 in -0.02 Mg -0.02 Cr -0.02 Gd -0.02 Fe -0.02 Mn -0.02 Co -0.02 Ge -0.02 Fe -0.02 Mo -0.02 Cu -0.02 Au -0.02 Fe -0.02 Mo -0.02 | Cd -60.02 Dy -60.02 Hf -60.02 Li -60.02 Ni Ca T En -60.02 Ho -60.02 Lu -60.02 Nh Ca -60.02 Eu -60.02 In -60.02 Mn -60.02 Pd Cr -60.02 Ga -60.02 Fe -60.2 Hg -60.2 Pr Co -60.02 Ga -60.02 La -60.02 Rr -60.02 Rr Cu -60.02 Au -60.02 Pr -60.02 Rr | Cd -6.002 Dy -6.002 Hf -6.002 Li -6.002 Ni -6.002 Ca T En -6.002 Ho -6.002 Lu -6.002 Nh -6.002 Ce -6.002 Eu -6.002 In -6.002 Mg -6.012 Nh -6.002 Cr -6.002 Gd -6.002 Fe -6.02 Mn -6.02 Pd -6.02 Cr -6.002 Gg -6.002 Fe -6.02 Hg -6.02 P -6.02 Co -6.002 Au -6.002 Nh -6.002 F -6.002 Cu -6.002 Au -6.002 Nh -6.002 F -6.002 | Cd -6.002 Dy -6.002 Hf -6.002 Li -6.002 Ni -6.002 Pr Ca T Ea -6.002 Ho -6.002 Lu -6.002 Nb -6.002 Rc Ce -6.002 Eu -6.002 Ir -6.002 Mn -6.002 Rb -6.002 Rb Cr -6.002 Ga -6.002 Fe -6.02 Hg -6.02 Pr -6.02 Ru Co -6.002 Ga -6.002 La -6.02 Rr -6.02 Rr -6.02 Rr Co -6.002 Ga -6.002 Ira -6.02 Ng -6.02 Rr -6.02 Sr Cu -6.002 Au -6.002 Pr -6.002 Rr -6.002 Sr | Cd -0.02 Dy -0.02 Hf -0.02 Li -0.02 Ni -0.02 Pr -0.02 Ca T Ba -0.02 Ho -0.02 Lu -0.02 Nb -0.02 Rb -0.02 Ce -0.02 Bu -0.02 Ir -0.02 Mg -0.01 Os -0.02 Rb -0.02 Cr -0.02 Ga -0.02 Mn -0.02 Pr -0.02 Rb -0.02 Cr -0.02 Ga -0.02 Hg -0.22 Pr -0.02 Ru -0.02 Cr -0.02 Ga -0.02 Hg -0.02 Pr -0.02 Ru -0.02 Cu -0.02 Au -0.02 Nd -0.02 Rr -0.02 Sr -0.02 Cu -0.02 Au -0.02 Nd -0.02 Rr -0.02 Sr -0.02 | Cd -d002 Dy -d002 Hf -d002 Li -d002 Ni -d002 Re -d002 Si Ca T Ea -d002 Ho -d002 Lu -d002 Nb -d002 Re -d002 Si Ca -d002 Ea -d002 Hr -d002 Mn -d002 Rh -d002 Na Cr -d002 Ga -d002 Hg -d02 Pr -d002 Ru -d002 Na Co -d002 Ga -d002 Hg -d002 Rr -d002 Sr -d002 Sr Co -d002 Ga -d002 Hg -d002 Rr -d002 Sr -d002 Sr Cu -d002 Au -d002 Nd -d002 Rr -d002 Sr -d002 Sr -d002 Sr | Cd -0.02 Dy -0.02 Hf -0.02 Li -0.02 Ni -0.02 Pr -0.02 Se -0.02 Ca T Eu -0.02 Ho -0.02 Lu -0.02 Nb -0.02 Rb -0.02 Si -0.02 Ce -0.02 Eu -0.02 In -0.02 Mn -0.02 Rb -0.02 Na -0.02 Ca -0.02 Gd -0.02 Ir -0.02 Mn -0.02 Rb -0.02 Na -0.02 Ca -0.02 Ga -0.02 Hg -0.02 Ru -0.02 Sr -0.02 Ca -0.02 Ga -0.02 Hg -0.02 Rr -0.02 Sr -0.02 Ca -0.02 Ba -0.02 Na -0.02 Rr -0.02 Sr -0.02 Ca -0.02 Au -0.02 Rr -0.02 Sr | Cd 4002 Dy 4002 H 4002 Li 4002 Ni 4002 Pr 4002 Se 402 Th Ca T Ea 4002 Ha 4002 Lu 4002 Nb 4002 Rb 4002 Tr Ca 4002 Eu 4002 Ha 4002 Pd 4002 Rb 4002 Tr Cr 4002 Ga 4002 Hg 402 Pr 4002 Ru 4002 Tr Cr 4002 Ga 4002 Hg 402 Pr 4002 Ru 4002 Tr Cr 4002 Ga 4002 Hg 402 Pr 4002 Sr 4002 Tr Cr 4002 Au 4002 Rr 4002 Rr 4002 Sr 4002 Sr 4002 Cu 4002 Au 4002 Rr 4002 Rr 4002 |

(T) = Target analyte

Physical Characterization:

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



Certified by:

Printed: 3/16/2023, 1:45:15 PM

^{*} 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. 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.

^{*} 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.

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| 800-368-1131 www.absolutestandards.com | 100 | Å | | • | Sertified . | Refere | Since Mai | Certified Reference Material CRM | 1/203 (| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | ANAB ISO 17034 Accredited AR-1539 Certificate Number https://Absolutestandards.com | ANAB ISO 17034 Accredited AR-1539 Certificate Number ttps://Absolutestandards.com | credited Number rds.com |
|--|---------------------|------------------------------|---|---------------------|---|-----------|----------------------|---|---------|--|---------------------------------|--|---|-------------------------------|
| CERTIFIED WEIGHT REPORT: | | | | | | 1 | Lot# | | | る | | | | |
| Fart Number: Lot Number: Description: | | 57182 061522 Lead (Pb) | | | Solvent: | | 20510011 | Nitric Acid | | Hieram | ranvie Ed | peate | | |
| Expiration Date: | | 081525 | | | | % | 40.0 | Nitric Acid | | Formulated By: | Giovann | Giovanní Esposito | 061522 | |
| Recommended Storage: Nominal Concentration (µg/mL): | | Ambient (20 °C) 10000 | Ő | | | | (TE) | | | Ph | May 1 | C/S | | |
| NIST Test Number: 6UTB Weight shown below was diluted to (mL): | r: 6U as diluted | | 2000.02 | 5E-05 B 0.058 FI | 5E-05 Balance Uncertainty 0.058 Flask Uncertainty | inty f | | | | Reviewed By: | Pedro L | Pedro L. Rentas | 061522 | |
| Compound | RM# | Lot Number C | Lot Nominal Purity Uncertaint Number Conc. (µg/ml.) (%) Purity (%) | Purity (| × | - 1 | Target Weight (g) | Expanded Actual Actual Uncertainty Weight (g) Conc. (µg/mL) +/- (µg/mL) | Actual | Expanded Uncertainty (4+-(µg/mL) CAS# | SD: (Solvent Safe S# OSHA | SDS information (Solvent Safety Info. On Attached pg.) # OSHA PEL (TWA) LDSC | l pg.) LD50 | NIST |

SRM

| 1. Lead(II) nitrate (Pb) | INO29 PBD122016A1 | 10000 | 88.888 | 0.10 | 62.5 | 32.0006 | 32.0041 10001.1 | | 20.0 | 10099-74-8 | 0.05 mg/m3 | intryne-rat 83 mo/kg 3128 | 3128 |
|--------------------------|-------------------|---------------------------------------|--------|-------|----------|-----------|-----------------|-----|------|------------|------------|---------------------------|------|
| 1.0E7 | [1] Spectrum No.1 | 17.284 sec]:58182.D# [Count] [Linear] | ec]:58 | 82.D* | Cour | nt] [Line | | 1 | | | | p h | |
| S.0E8 | | | | | | | | | | | | | |
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| 5.0ES | | | | | | | | | | | | | |
| Å | 220 | 230 | | 240 | | 250 | 260 | | | | | | |

Certified Reference Material CRM



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

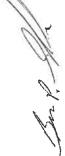
Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

| | | | | | | Ī | Trace Me | stals | Verifica | tion | by ICP- | SM | (ma/m) | | , | | | | |
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Physical Characterization:

(T)= Target analyte

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



Certified by:

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

the preparation of all standards.

Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above). All standard containers are meticulously cleaned prior to use.

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

800-368-1131 Absolute Standards, Inc.

www.absolutestandards.com



Certified Reference Material CRM

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

CERTIFIED WEIGHT REPORT:

Part Number:

Description: Lot Number:

58119 120822 Potassium (K)

Solvent: 20510011 Nitric Acid

Lot #

Javanva

アイクラクスで

60.0 <u>a</u>

2%

Nominal Concentration (µg/mL):

NIST Test Number:

6UTB 10000 Ambient (20 °C) 120825

Recommended Storage:

Expiration Date:

Weight shown below was diluted to (mL):

3000.4

5E-05 Belance Uncertainty

0.06 Flask Uncertainty

Nitric Acid

Formulated By:

Giovanni Esposito

120822

Reviewed By:

Pedro L. Rentas

120822

| 12 [1] | Potassium nitrate (K) | Compound |
|---|---|---|
| [1] Spectrum No.1 [35.763 sec]:58119 D# (Count II Insert | IN034 KD022021A1 10000 99.989 0.10 37.6 79.7990 79.8075 | Lot Nominal Purity Uncertainty Assay Target Actual RM# Number Conc. (µg/mL) (%) Purity (%) (%) Weight (g) Weight (g) C |
| 35.763 se | 10000 | Nominal Purity Uncertainty Assay Conc. (µg/ml.) (%) Purity (%) (%) |
| 9C]:58 | 99.999 | Purity (%) |
| 119.0 | 0.10 | Uncertainty Purity (%) |
| * 0 | 37.6 | Assay (%) |
| inti II ina | 79.7990 | Target Weight (g) |
| | 79.8075 | Actual Weight (g) |
| | 10001.1 | Actual Conc. (µg/mL |
| | 10001.1 20.0 7757-79-1 | Expanded Uncertainty +/- (µg/mL) |
| | 7757-79-1 | (Solv |
| | 5 mg/m3 | Expanded SDS Information Actual Uncertainty (Solvent Safety Info. On Attached pg.) Conc. (µg/mL) +/- (µg/mL) CAS# OSHA PEL (TWA) LD50 |
| | orl-rat 3015 mg/kg 314 | n tached pg.) LD50 |
| | kg 3141a | NIST |

| m/z-y | 5000 | m/z-> | 1.0E5 | m/z-> | 1.000 | 2.016 |
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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.

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

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

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

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Product Code:

Multi Analyte Custom Grade Solution

Catalog Number:

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,

Nickel,

Vanadium,

Cabalt

Zinc,

Cobalt,

250 µg/mL ea:

Copper,

200 µg/mL ea: Chromium,

50 µg/mL ea:

Beryllium,

Silver

3.0 CERTIFIED VALUES AND UNCERTAINTIES

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

Density:

1.070 g/mL (measured at 20 ± 4 °C)

Assay Information:

| ANALYTE | METHOD | NIST SRM# | SRM LOT# |
|---------|-------------|-----------|--------------|
| Ag | ICP Assay | 3151 | 160729 |
| Ag | Volhard | 999c | 999c |
| Ag | Calculated | | See Sec. 4.2 |
| Al | ICP Assay | 3101a | 140903 |
| Al | EDTA | 928 | 928 |
| Ba | ICP Assay | 3104a | 140909 |
| Ba | Gravimetric | | See Sec. 4.2 |
| Be | ICP Assay | 3105a | 090514 |
| Be | Calculated | | See Sec. 4.2 |
| Co | ICP Assay | 3113 | 190630 |
| Co | EDTA | 928 | 928 |
| Cr | ICP Assay | 3112a | 170630 |
| Cu | ICP Assay | 3114 | 121207 |
| Cu | EDTA | 928 | 928 |
| Fe | ICP Assay | 3126a | 140812 |
| Fe | EDTA | 928 | 928 |
| Mn | ICP Assay | 3132 | 050429 |
| Mn | EDTA | 928 | 928 |
| Ni | ICP Assay | 3136 | 120619 |
| Ni | EDTA | 928 | 928 |
| V | IC Assay | 3165 | 160906 |
| V | EDTA | 928 | 928 |
| Zn | ICP Assay | 3168a | 120629 |
| Zn | EDTA | 928 | 928 |

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

Characterization of CRM/RM by Two or More Methods

Certified Value, X_{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 = the weighting factors for each method calculated using the inverse square of the variance:

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

CRM/RM Expanded Uncertainty (1) = $U_{CRM/RM} \approx k (u^2_{cher} + v^2_{bb} + v^2_{lts} + v^2_{tr})^{1/2}$

 $u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{\frac{1}{2}}$ 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

Characterization of CRM/RM by One Method

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

 $X_{CRM/RM} = (X_R) (u_{ohar} a)$

X_a = mean of Assay Method A with

Uchar a = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (£) = $U_{CRM/RM} = k \left(u^2_{chara} + u^2_{bb} + u^2_{lib} + u^2_{bb}\right)^{1/2}$

k = coverage factor = 2

 $\mathbf{u}_{\mathrm{char}\,\mathbf{u}}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

uite = long term stability standard uncertainty (storage)

uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

July 27, 2022

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

Certifying Officer:

Paul Gaines
Chairman / Senior Technical Director

Paul R. Lines

Absolute Standards, Inc. 800-368-1131

www.absolutestandards.com



Certified Reference Material CRM

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

CERTIFIED WEIGHT REPORT: Part Number: Lot Number: Description: 58024 060523 Chromium (Cr) 21110221 Lot # Nitric Acid Solvent: Lavense

2.0% 40.0 Nitric Acid

(III)

Formulated By:

Lawrence Barry

060523

060523

Nominal Concentration (µg/mL): Recommended Storage: **Expiration Date:** 1000 Ambient (20 °C) 060526

Compound Volume shown below was diluted to (mL): NIST Test Number: Number Part **BTU9** Number Lot 2000.02 Factor Dilution Vol. (mL) Pipette (mL) Conc. (µg/mL) 0.058 5E-05 Initial Flask Uncertainty Balance Uncertainty Uncertainty Nominal Conc. (µg/mL) Conc. (µg/mL) Initial Final Reviewed By: +/- (µg/mL) Uncertainty Expanded CAS# (Solvent Safety Info. On Attached pg.) OSHA PEL (TWA) Pedro L. Rentas **SDS Information**

P20

TSIN SRM

3112a

 Chromium(III) nitrate nonahydrate (Cr) 58124 071122 0.1000 200.0 0.084 1000 10000.1 1000.0 12 7789-02-8 0.5 mg(Cr)/m3 ort-rat 3250 mg/kg

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Part # 58024



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

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(I)= larget 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).

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Certified Reference Material CRM

M5697 B: 10/27/23

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

| CERTIFIED WEIGHT REPORT: | l | | | | | | Lot # | Solvent: | | | | | | L: |
|---------------------------------------|---|-------------|--------------------------------|----------|-----------------------|---------------------------------------|----------------|-------------------|---|----------------|------------|--|-------------------|------|
| - P | Part Number: Lot Number: Description: | O look life | 58029 102523 Copper (Cu) | 9 | | | 24002546 | Nitric Acid | | | | | | |
| | | | | | | | 2,0% | 40.0 | Nitric Acid | Formulated By: | y: | Benson Chan | 102523 | - |
| Exp | Expiration Date: | | 102526 | 2 | | | | (mL) | | | 0 | D | | |
| Nominal Concentration (µg/mL): | Concentration (µg/mL): | <u></u> > | 1000 | S | | | | | | M | N | tento | | |
| NIST | NIST Test Number: | 0 | втв | | 5E-05 | Balance Uncertainty | inty | | | Reviewed By: | | Pedro L. Rentas | 102523 | |
| Volume sh | Volume shown below was diluted to (mL): | diluted | 1 to (mL): | 2000.02 | 0.058 | Flask Uncertainty | | | | | | | | Ĺ |
| | | | | | | | | | | Expanded | | SDS Information | tion | |
| Compound | z | Part | Lot | Dilution | Initial Vol. (ml.) | Uncertainty Piperta (ml.) | Nominal | Initial | Final | Uncertainty | (Solv | (Solvent Safety Info. On Attached pg.) | Attached pg.) | NIST |
| | | 1400 HOCK | reamber | 1 00000 | AOF (THE) | voir (nint) riporte (nint) (| Conc. (Agrant) | Conc. (July 1982) | Contra (ug/mic) | +/= (Jg/10L) | 50# | OSHA FEL (TWA) | E | MANC |
| 1. Copper(II) nitrate trihydrate (Cu) | | 58129 | 100223 | 0.1000 | 200.0 | 0.084 | 1000 | 10000.1 | 1000.0 | N N | 10031-43-3 | 1 mg/m3 | orl-rat 794 mg/kg | 3114 |
| 1.006 | [1] Spectrum No.1 | Z Z | _ | 3.422 s | əc]:58(| 33.422 sec]:58029.D# [Count] [Linear] | Sount] [Lir | near] | 2004 | | | | | |
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| m/z-> | 10 | | N . | <u>ය</u> | 32 12 | 40 | 50 | 60 | 70 | | 80 | 90 | 100 | |
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| 2.5E7 | | | | | | | | | | | | | | |
| m/z-v | 110 | | 120 | 130 | | 140 | 150 | 160 | 170 | | 180 | 190 | 200 | |
| 2.0€7 | | | | | | | | | | | | | | |
| 1.0€7 | | | | | | | | | | | | | | |
| m/z-> | N 10 | | 200 | 230 | | N 40 | 250 | 260 | | | | | | |
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Instrumental Analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS):

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|----------------------|-------|---------------|---------------|----------|-------|---------------|--------------|----------|--------------|
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| | <0.02 | 40,02 | <0.02 | <0.02 | <0.02 | 40.02 | 40.02 | | |
| | 3 | F | 팖 | = | Ы | Но | Ħ | | |
| | 40.02 | 40.02 | 40.2 | △0.02 | <0.02 | <0.02 | 40.02 | 1 | Trace M |
| | Nd | Мо | Hg | M | Mgg | Lu | <u>E</u> | | letals |
| (T) = Target analyte | A).02 | 40.02 | 40.2 | <0.02 | 10.05 | 40.02 | 40.02 | | Verifica |
| et anal | × | 7 | ק | Ъ | တ္တ | 3 | Z | | - |
| vie | 40.2 | 40.02 | 40.02 | 40.02 | 40.02 | <0.02 | <0.02 | 29 101 | -4-10-14 |
| | & | Sm | Ru | 짱 | Rh | Re | Pr | Ę | |
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1.1

Physical Characterization:

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

Certifled by:

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

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 * 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).

ırt # 58029

2 of 2

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Certified Reference Material CRM



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

CERTIFIED WEIGHT REPORT: Part Number: 57004 102523 02/09/24 Lot # Solvent:

24002546 Nitric Acid

2.0% (IE)

Nominal Concentration (µg/mL):

NIST Test Number:

BTU₉ 1000

Volume shown below was diluted to (mL):

2000.02

0.058

Flask Uncertainty Balance Uncertainty

5E-05

Number

Number Lot

Vol. (mL.)

Part

Dilution Factor

hitia

Uncertainty

Recommended Storage:

Ambient (20 °C) 102526

Expiration Date:

Lot Number: Description:

Beryllium (Be)

40.0

Nitric Acid

Benson Chan

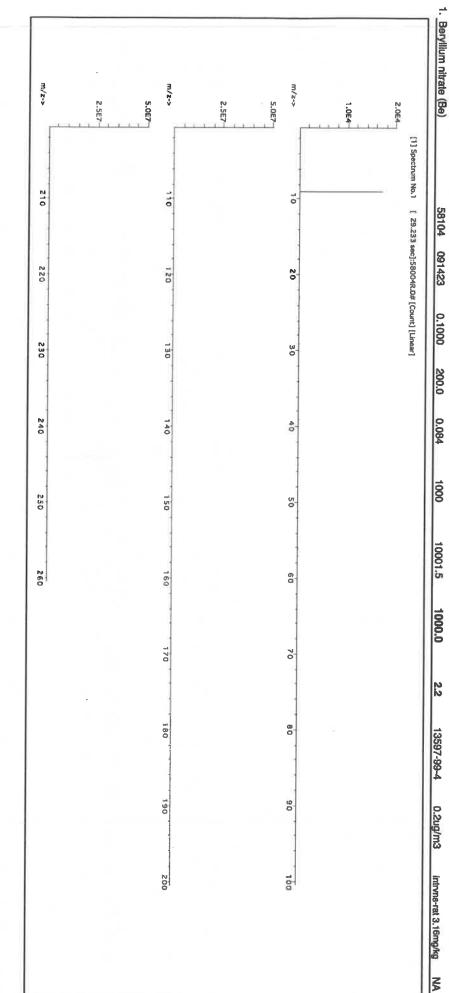
102523

Formulated By:

Reviewed By:

Pedro L. Rentas 102523

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





800-368-1131



Certified Reference Material CRM

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

| | | | | | | | Trace M | etals | Verificat | cation | by ICP-M | (J) SI | ua/mL) | | | | | | |
|----|---------------|----|----------------|-------------|--------------|----------|--------------------------|-------------|-------------------|---------------|----------------|--|--------------|----|-------|----|-------|---|--------------|
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| As | <0.7 | ඊ | <0.02 | 립 | ₩ | ម | ₹0.02 | Mg | 10.0> | ő | <0.02 | Rh | <0.02 | Ag | <0.02 | F | ≪0.02 | > | ₹0.02 |
| Ba | <0.02 | ర | <0.02 | 3 | <0.02 | ㅂ | 40.02 | Mn | <0.02 | 2 | <0.02 | 8 | <0.02 | Z | 40.2 | Ħ | <0.02 | 2 | <0.02 |
| æ | Т | Ç | 40.02 | Ğ | 40.02 | 2 | 40 2 | Hg | <02 | Δ, | <0.02 | Ru | <0.02 | š | <0.02 | Tm | ₹0.02 | × | <0.02 |
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| æ | <0.02 | ರೆ | <0.02 | Au | <0.02 | £ | 40.02 | PK | <0.02 | M | <0.2 | S | 40.02 | Ta | <0.02 | F | <0.02 | Z | 40.02 |

(T) = Target analyte

Physical Characterization:

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

Certified by:



All standard containers are meticulously cleaned prior to use.

2 of 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 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).

122



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

CERTIFIED WEIGHT REPORT:

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

Salvents: 21110221

Nitric Acid Hydrochloric acid

Lot #

22D0562008

Nominal Concentration (µg/mL): Recommended Storage: **NIST Test Number:** Expiration Date: 1000 Ambient (20 °C) 071126

Weight shown below was diluted to (mL): **BTU9** 499.93

RM#

Number

Conc. (µg/mL) Nominal

(%)

Uncertainty Assay
Purity (%) (%)

Weight (g)

Target

ρţ

0.058 Flask Uncertainty 5E-05 Balance Uncertainty

> 10.0 30.0

3 6%

Nitric Acid

Formulated By:

Benson Chan

071123

Hydrochloric acid

Reviewed By:

Pedro L. Rentas

071123

| Weight (g) | ACTUAL | |
|--------------------------|--------------------|-------------|
| Conc. (µg/ml.) | Actual Ur | |
| '- (µg/mL) | certainty | xpanded |
| CAS# OSHA PEL (TWA) LD50 | (Solvent Safety | SUS |
| PEL (TWA) | y Info. On Attache | Information |
| LD50 | d pg.) | |
| SRM | TSIN | |

1. Ammonium hexafluorostannate(IV) (Sn) m/z-> ---X/m --Z/111 2.5E4 5.0E4 1.0ES 2.0E6 2.5E5 S.OEG [1] Spectrum No.1 210 110 0 IN010 SND042023A1 120 220 N [15.034 sec]:58150.D# [Count] [Linear] 1000 230 130 8 240 140 0.10 40 44.2 250 150 Ö 1.13107 1.13286 160 260 60 1001.6 170 70 2.0 180 80 16919-24-7 190 90 7 mg/m3 200 100 ₹ 3161a

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

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(I) = larget analyte

Physical Characterization:

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

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.

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Certified Reference Material CRM

R: 02109124





ANAB ISO 17034 Accredited AR-1539 Certificate Number https:///Absolutestandards.com 091923 091923 (Solvent Safety Info On Attach SDS Information Pedro L. Rentas Lawrence Barry Formulated By: Reviewed By: Expanded Nitric Acid Final Nitric Acid 40.0 (III) hital 24002546 2.0% Nominal Balance Uncertainty Flask Uncertainty 5E-05 0.058 Initial 2000.02 Dilution Ambient (20 °C) Cobalt (Co) Volume shown below was diluted to (mL): 57027 091923 091926 ĕ 1000 **6UTB** Part Description: **Expiration Date:** Recommended Storage: Nominal Concentration (ug/mL): NIST Test Number: Part Number: Lot Number: CERTIFIED WEIGHT REPORT:

| | | | | | | TANK BURNE | 10000 | CHICAGO CONTROL CONTRO | URCH LABILLY | ianioc) | (Solvent Safety Into, On Attached pg.) | rttached pg.) | 202 |
|---|--------|--------|------------|-----------|----------------|--|---------------|--|--------------|------------|---|--|------|
| Compound | Number | Number | Factor | Vol. (mL) | Pipette (mL) C | conc. (ug/ml.) | Conc. (µg/mL) | Conc. (ug/ml.) | +/- (ng/mL) | CAS# | Number Number Factor Vol. (mL) Pipette (mL) Conc. (µg/mL) Conc. (µg/mL) +/- (µg/mL) CAS# OSHA PEL (TWA) | 1050 | SRM |
| | | | | | | | | | | | | | |
| Cobatt(II) nitrate hexahydrate (Co) 58127 050923 0.1000 200.0 | 58127 | 050923 | 0.1000 | | 0.084 | 1000 | 10000 | 100001 100001 | 9.0 | 10008.000 | 000 | 700 | |
| | | | | | | | 20000 | | 7:5 | 100c0-22-9 | O.UZ ING/ITI3 | STEE 10020-22-9 0.02 mg/ms on-rat 691 mg/kg 3113 | 3113 |
| | | | | | | | | | | | | | |
| 2000 | Z Ezz | 1.0 | 9 4 DAG 45 | Cau. Co | CHARLE WAS | [1] Specifical No.1 Cat. 04.04% pool: nacotation of the partition of the p | | | | | | | |

| 1.0E6 | 5.0E5 | m/z-> | 5.0E7 | 1.0E8 | 5.0E7 |
|---|-------|------------|-------|-------|-------|
| | | | | F | |
| | | .0 | | 0 | |
| | | 0 | | 120 | |
| L 34-243 Secj.baok7.D# [Count] [Linear] | | Ō | | 130 | |
| | | .0 | | 140 | |
| | | .09 | | 150 | |
| | | . O | | 160 | |
| | | | | 170 | |
| | | 02 | | | |
| | | 80 | | 160 | |
| | | 00 | | 180 | |
| | | 100 | | 200 | |

Lot # 091923

250

240

230

220

010

W/Z->

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):

| | | | | | | | Trace M | etals | Verifical | tion | by ICP-M | 4S (F | ig/mL) | | | | | | |
|----|--------------|----|---------------|----|----------------|----|--|------------------|---|--------|---------------|---------|-----------------|------------------------|---------------------|----------------|-------|---------------------|-----------------|
| 1 | | | | | | | STREET, STREET | No section lives | ALL DESCRIPTION OF THE PERSON | 10.000 | Market Mark | MINNSH. | San Salar Salar | NAME OF TAXABLE PARTY. | Service of the last | SECOND SECOND | | THE PERSON NAMED IN | STREET, SQUARE, |
| IV | <0.02 | ಶ | 1 | Š | 40.02 Dy 40.02 | Ħ | <0.02 | П | <0.02 | Z | <0.02 | Æ | <0.02 | B | <0.2 | £ | <0.02 | A | <0.02 |
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| As | Q 5 | ප | 40.02 | 呂 | 40.02 | ų | <0.02 | Mg | 10.05 | ő | ₹0.02 | 됩 | <0.02 | Ag | 40.02 | F | <0.02 | > | Ø.02 |
| 쯃 | 40.02 | చ | 40.02 | 3 | 4002 | ㅂ | <0.02 | Ma | <0.02 | 콘 | ₹000 | 2 | 40.02 | N _a | 40.2 | Ę | 20:0> | Ŗ | Ø.02 |
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| 遥 | 40.02 | රි | ۳ | Ğ, | 4002 | ដ | <0.02 | Mo | 40.02 | Æ | 20'0 > | S | <0.02 | S | 40.02 | Sn | 40.02 | Zn | Ø.02 |
| æ | <0.02 | ට් | <0.02 | Αn | <0.02 | 윤 | Z0'0> | P | <0.02 | м | 40.2 | S | <0.02 | Fee Fee | 40,02 | Ħ | Ø.02 | 72 | Ø.02 |

(T)= Target analyte

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 the preparation of all standards.



Lot # 091923

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Certified Reference Material CRM

M5801



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

CERTIFIED WEIGHT REPORT: 1. Arsenic (As) Compound Nominal Concentration (µg/mL): M/2-> m/z-> -z/m 5.OE4 2.5E4 Recommended Storage: 1.0E5 2.0ES 1000 Volume shown below was diluted to (mL): 500 **NIST Test Number: Expiration Date:** Part Number: Description: Lot Number: [1] Spectrum No.1 210 110 0 58133 Number Part **SUTB** 1000 111326 57033 111323 Ambient (20 °C) Arsenic (As) 020522 Number 120 D D ONN NO [34.433 sec]:57033.D# [Count] [Linear] 0.1000 4000.0 Dilution Factor 230 130 30 Vol. (mL) 5E-05 400.0 initial 0.06 Pipette (mL) Conc. (µg/mL) Flask Uncertainty Balance Uncertainty Uncertainty 240 140 40 0.084 24002546 Nominal 2.0% Lot # 100 250 160 50 Conc. (µg/mL) Conc. (µg/mL) Nitric Acid 10001.0 Solvent: Initial 80.0 260 160 60 Nitric Acid 1000.0 Fina 170 0 Formulated By: Reviewed By: +/- (µg/ml.) Uncertainty Expanded 2.0 180 Thomas 80 7440-38-2 (Solvent Safety Info. On Attached pg.) 190 OSHA PEL (TWA) Pedro L. Rentas Lawrence Barry 90 SDS Information 0.5 mg/m3 100 000 orl-rat 500 mg/kg LD50 111323 111323 3103a NIST SRM

Printed: 2/8/2024, 5:01:04 PM

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

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|----------------|---|-------------|---|
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Physical Characterization:

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

Certified by:



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

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Certified Reference Material CRM

R102109124

MURIC

Solvent: 21110221

Nitric Acid

Lot #

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

CERTIFIED WEIGHT REPORT:

Part Number: **Lot Number:**

57115 041723

Description:

Phosphorous (P)

Expiration Date:

041726

Nominal Concentration (µg/mL): Recommended Storage: NIST Test Number: 10000 Ambient (20 °C)

BTUB

5E-05 Balance Uncertainty

Weight shown below was diluted to (mL): 2000.02

Number 5 Conc. (µg/mL) Nominal 0.058 Flask Uncertainty Purity 3 Uncertainty Assay Purity (%) E Target

1. Ammonium dihydrogen phosphate (P)

IN008 PV082019A1

10000

99,999

0.10

27.5

RM#

Compound

22%

40.0

Nitric Acid

Formulated By:

Lawrence Barry

041723

into

Reviewed By:

Pedro L. Rentas

Expanded SDS Information 041723

Weight (g) 72.7287 Weight (g) Conc. (ug/mL) 72.7289 Actual 10000.0 Actual +/- (µg/mL) Uncertainty 20.0 7722-76-1 CAS# (Solvent Safety Info. On Attached pg.)

OSHA PEL (TWA) LD50 5 mg/m3 orl-rat >2000mg/kg 3186 NIST SRM

Part # 57115

1 of 2

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

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| | T _B | S | Ş | Z | ¥ | S | & | | | |
| | 40.02 | ∆ .02 | 6.02 | <u>\$</u> | ∆ 0,02 | 40.02 | 40.2 | | | |
| | 17 | Sh | T | ₽ | ㅂ | Te | 4L | | | |
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| | Zr | Zn | Υ. | \$ | < | Ϥ | W | | | |
| | <0.02 | ∆ 022 | A).02 | ∆.02 | \$0.0 2 | A0.02 | 40.02 | TO THE REAL PROPERTY. | | |

(I)= larget 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).

2 of 2

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

Certified Reference Material CRM

109/24

M5817

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

CERTIFIED WEIGHT REPORT:

Part Number: Lot Number: 071123 57116

Solvent:

071123

ASTM Type 1 Water

Burense

Formulated By:

Lawrence Barry

071123

Lot #

Expiration Date: Description: 071126 Sulfur (S)

Nominal Concentration (µg/mL): NIST Test Number: 10000 Ambient (20 °C)

Recommended Storage:

EU1B

Weight shown below was diluted to (mL): 1999.48 Nominal 0.058 Flask Uncertainty 5E-05 Balance Uncertainty Reviewed By: Pedro L. Rentas SDS Information

 Ammonium sulfate (S) IN117 SLBR7225V 10000 99.9 0.10 24.3 82.4675 82,4682 10000.1 20.0 7783-20-2 Z orl-rat 4250mg/kg 3181

Number Ĕ Conc. (µg/mL) Purity 8 Uncertainty Assay Purity (%) 8 Weight (g) Target Weight (g) Conc. (µg/mL) Actual Actual +/- (µg/mL) OSHA PEL (TWA)

Expanded

071123

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

| m/z-> | 1.005 | m/z-> 2.0E5 | 2.5E5 | 5.0E5 | 1000 | 2000 |
|-------------|-------|----------------|-------|------------|------|------|
| | | | | | | |
| 0 | | 110 | | 0 | | |
| N N O | | 120 | | 20 | | |
| 230 | | 130 | | 3 0 | | |
| 24 | | 140 | | 40 | | |
| 250 | | 150 | | 50 | | |
| 260 | | 190 | | 8 | | |
| | | 170 | | 70 | | |
| | | 180 | | 8. | | |
| | | 190 | | 90 | | |
| | | 200 | | 100 | | |

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

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|---------------------|---|
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| | ≥ 유요요 프 무 ▽ |
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| | 8 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 40,02 |
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| onak. | K P P B S S N |
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| | (µg/mL) |
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| | Z |
| | 666666666666666666666666666666666666666 |

Physical Characterization:

(1)= larger analyte

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

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).

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



Certified Reference Material CRM

2 02/na

とれ

Solvent: 24002546

Nitric Acid

F Lot #

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

CERTIFIED WEIGHT REPORT

Part Number: Lot Number: 58030

Description:

111623 Zinc (Zn)

Ambient (20 °C) 111626

Expiration Date:

Nominal Concentration (µg/mL): Recommended Storage:

NIST Test Number:

BTU9 1000

5E-05 Balance Uncertainty 0.06 Flask Uncertainty

Weight shown below was diluted to (mL):

3000.4

5

Nominal

Purity

Uncertainty Assay

Target

Actual

Actual

Uncertainty

Expanded

<u>%</u> 60.0 <u>a</u>

Nitric Acid

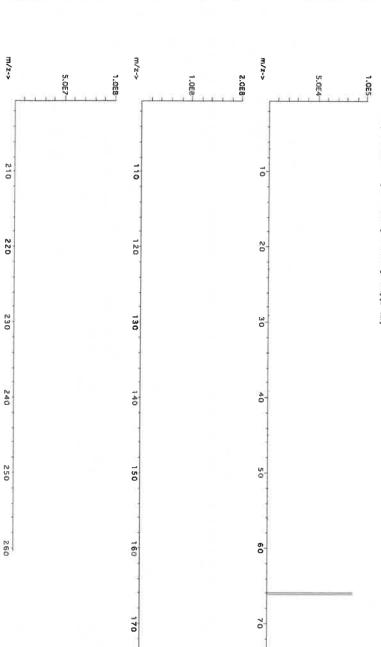
Formulated By: Benson Chan

111623

Reviewed By: Pedro L. Rentas

111623

Zinc nitrate hexahydrate (Zn) Compound [1] Spectrum No.1 [31.103 sec]:58130.D# [Count] [Linear] IN016 ZNE032021A1 RM# Number Conc. (µg/ml.) 1 000 99.999 8 Purity (%) 0.10 24.3 3 Weight (g) 12.3475 Weight (g) Conc. (µg/ml.) 12.3502 1000.2 +/- (µg/mL) 2.0 10196-18-6 CAS# OSHA PEL (TWA) orl-rat 1190mg/kg 3168



(Solvent Safety Info. On Attached pg.)
OSHA PEL (TWA) LD50 **SDS** Information SRM SRM

200

100

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

| | BE BE S S A | Г | |
|----------------|---|----------|--|
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| Threat and the | 40.02 40.02 40.02 40.02 40.02 | Verifica | |
| | X Y T R Q S Y X | tion | |
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| | 000 000 000 000 000 000 000 000 000 | | |
| 100 | 22×2<= | | |
| | \$ 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | | |

(I) = larget 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).



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%

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Value:

 $1002 \pm 5 \mu g/mL$

Density:

1.012 g/mL (measured at 20 ± 4 °C)

Assay Information:

Assay Method #1

1002 ± 4 µg/mL

ICP Assay NIST SRM 3162a Lot Number: 130925

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

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

Characterization of CRM/RM by Two or More Methods

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

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

 \mathbf{X}_{i} = mean of Assay Method i with standard uncertainty u_{char} i

wi = the weighting factors for each method calculated using the inverse square of

 $w_i = (1/u_{chari})^2 / (\Sigma (1/(u_{chari})^2))$

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

k = coverage factor = 2

 $u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{\frac{1}{2}}$ 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

Characterization of CRM/RM by One Method

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

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

X_n = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

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

k = coverage factor = 2

uchar a = the errors from characterization

ubb = bottle to bottle homogeneity standard uncertainty

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

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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

| | M | Ag | < | 0.000536 | М | Eu | < | 0.000268 | 0 | Na | < | 0.032670 | M | Se | | 0.001204 | 0 | Zn | < | 0.003267 |
|---|---|----|---|----------|---|------|---|----------|----|----|---|----------|---|----|---|----------|---|----|---|----------|
| | 0 | Αl | | 0.000872 | 0 | Fe | | 0.003225 | 0 | Nb | < | 0.043560 | 0 | Si | | 0.004735 | 0 | Zr | < | 0.043560 |
| | М | As | < | 0.008586 | M | Ga | < | 0.000268 | M | Nd | < | 0.000268 | M | Sm | < | 0.000268 | | | | |
| | М | Au | < | 0.004577 | M | Gd | < | 0.000268 | 0 | Ni | < | 0.010890 | M | Sn | | 0.000096 | | | | |
| | 0 | В | < | 0.008929 | M | Ge | < | 0.002146 | M | Os | < | 0.000269 | 0 | Sr | | 0.000096 | | | | |
| | М | Ba | < | 0.002683 | M | Hf | | 0.002161 | 0 | P | < | 0.054450 | M | Ta | | 0.010560 | | | | |
| | M | Ве | < | 0.005366 | М | Hg | < | 0.003231 | M | Pb | < | 0.001073 | M | Tb | < | 0.000268 | | | | |
| | M | Bi | < | 0.001609 | M | Но | < | 0.000268 | М | Pd | < | 0.000268 | M | Te | < | 0.001341 | | | | |
| | 0 | Ca | | 0.000676 | M | In | < | 0.002683 | M | Pr | < | 0.000268 | M | Th | < | 0.053663 | | | | |
| | M | Cd | < | 0.000268 | M | lr - | < | 0.000269 | M | Pt | < | 0.000536 | s | Ti | < | | | | | |
| | М | Ce | < | 0.000268 | M | K | | 0.001172 | M | Rb | < | 0.000268 | M | TI | < | 0.000268 | | | | |
| | М | Co | < | 0.004293 | М | Lа | < | 0.000268 | M | Re | < | 0.000268 | M | Tm | < | 0.000268 | | | | |
| | M | Cr | | 0.000752 | 0 | Li | < | 0.027225 | M | Rh | < | 0.000268 | M | U | < | 0.000268 | | | | |
| | М | Cs | < | 0.000268 | М | Lu | < | 0.000268 | M | Ru | < | 0.000269 | M | V | < | 0.019855 | | | | |
| - | 0 | Cu | < | 0.010890 | 0 | Mg | < | 0.005445 | i | S | < | | M | W | | 0.000473 | | | | |
| | М | Dy | < | 0.000268 | 0 | Mn | < | 0.003267 | M: | Sb | < | 0.006976 | M | Υ | < | 0.002146 | | | | |
| | М | Er | < | 0.000268 | M | Мо | | 0.000774 | 0 | Sc | < | 0.004900 | M | 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

CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

June 17, 2022

11.0

- 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

2009784.

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director



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

ACCREDITATION / REGISTRATION 1.0

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 AND UNCERTAINTIES 3.0

Certified Value:

 $10000 \pm 30 \mu g/mL$

Density:

1.032 g/mL (measured at 20 ± 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_{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 uchar i

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

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

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

k = coverage factor = 2

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

u_{bb} = bottle to bottle homogeneity standard uncertainty

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

uts = transport stability standard uncertainty

- ------

Characterization of CRM/RM by One Method
Gertified Value, Xanuary, where one method of characterizat

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

XCDM/DM = (Xa) (Uchar a)

X_a = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u^2_{char} a + u^2_{bb} + u^2_{lts} + u^2_{ts})^{V_2}$

k = coverage factor = 2

uchar a = the errors from characterization

ubb = bottle to bottle homogeneity standard uncertainty

ults = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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

| M | Ag | < | 0.004600 | М | Eu | | 0.009037 | М | Na | | 0.086360 | M: | Se | < | 0.005200 | M | Zn | | 0.030125 |
|---|----|---|----------|---|----|---|----------|---|----|---|----------|----|----|---|----------|---|----|---|----------|
| M | Al | | 0.014862 | 0 | Fe | | 0.002410 | М | Nb | < | 0.000570 | 0 | Si | | 0.024100 | 0 | Zr | < | 0.002600 |
| М | As | < | 0.003500 | М | Ga | < | 0.000570 | M | Nd | | 0.000923 | M | Sm | | 0.000461 | | | | |
| М | Au | < | 0.001700 | М | Gd | < | 0.003500 | M | Ni | < | 0.005700 | M | Sn | < | 0.002300 | | | | |
| 0 | В | | 0.002209 | M | Ge | < | 0.005200 | M | Os | < | 0.001200 | M | Sr | < | 0.004600 | | | | |
| 0 | Ba | < | 0.002500 | М | Hf | < | 0.000570 | n | Р | < | | M | Ta | < | 0.000570 | | | | |
| 0 | Be | < | 0.001400 | М | Hg | < | 0.000570 | M | Pb | | 0.005020 | M | Tb | | 0.001044 | | | | |
| M | Bi | < | 0.003500 | М | Но | | 0.009037 | М | Pd | < | 0.005100 | М | Te | < | 0.002300 | | | | |
| 0 | Ca | | 0.009841 | М | In | < | 0.002300 | M | Pr | < | 0.002300 | М | Th | < | 0.000570 | | | | |
| M | Cd | < | 0.000570 | М | lr | < | 0.000570 | M | Pt | < | 0.000570 | M | Ti | < | 0.003500 | | | | |
| M | Ce | < | 0.002300 | 0 | K | | 0.018677 | М | Rb | < | 0.000570 | М | TI | < | 0.000570 | | | | |
| M | Co | < | 0.000570 | M | La | | 0.000461 | М | Re | < | 0.000570 | М | Tm | < | 0.003500 | | | | |
| M | Cr | < | 0.004000 | 0 | Li | < | 0.009300 | М | Rh | < | 0.008000 | M | U | < | 0.000570 | | | | |
| M | Cs | < | 0.000570 | M | Lu | | 0.000582 | М | Ru | < | 0.000570 | M | V | | 0.001265 | | | | |
| M | Си | | 0.002610 | 0 | Mg | | 0.001486 | n | S | < | | M | W | < | 0.002300 | | | | |
| М | Dy | | 0.003815 | M | Mn | | 0.000582 | М | Sb | | 0.005422 | S | Υ | < | | | | | |
| M | Er | | 0.003615 | M | Мо | < | 0.005700 | М | Sc | < | 0.001200 | M | 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>, https://www.inorganicventures.com/terms-and-conditions-sale. The Terms and Conditions contain information on the use of materials traceable to PCRM™ certified reference materials. This Limited License agreement is especially pertinent for laboratories accredited under ISO:17034.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ 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

chemically stable for years in 2-5% HNO3 / LDPE container.

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 88.91 +3 6 Y(OH)(H2O)x+2 Chemical Compatibility -Soluble in HCl, 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

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

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

| Technique/Line | Estimated D.L. | Order | Interferences (underlined indicates severe) |
|--------------------|------------------------|-------|---|
| ICP-MS 89 amu | 0.8 ppt | N/A | 73Ge16O, 178Hf+2 |
| ICP-OES 360.073 nm | 0.005 / 0.000036 μg/mL | 1 | Ce, Th |
| ICP-OES 371.030 nm | 0.004 / 0.00007 µg/mL | 1 | Се |
| ICP-OES 377.433 nm | 0.005 / 0.0009 µg/mL | 1 | Ta, 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 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

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

Mayyand Man Paul R. Laine

Certificate Approved By:

Muzzammil Khan Stock Laboratory Supervisor

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director



Certified Reference Material CRM

Lot #

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

 Nickel(II) nitrate hexahydrate (Ni) Nominal Concentration (µg/mL): m/z-> Weight shown below was diluted to (mL): Recommended Storage: NIST Test Number: **Expiration Date:** Part Number: Lot Number: Description: [1] Spectrum No.1 210 110 0 N033 NIM052023A1 RM# 6UTB 57028 041124 1000 Ambient (20 °C) 041127 Nickel (Ni) Number <u>6</u> 220 20 [12.374 sec]:58128.D# [Count] [Linear] Conc. (µg/mL) Nominal 249.85 100 230 130 30 0.002 Flask Uncertainty 5E-05 Balance Uncertainty 99.999 Purity Uncertainty Assay 8 Purity (%) 0.10 240 140 40 **Solvent:** 24002546 8 2% 250 150 Weight (g) 50 1.2369 Target 1 5.0 Nitric Acid Nitric Acid Weight (g) 1.2369 Actual 260 160 60 Conc. (µg/mL) 1000.0 Actual 170 0 Reviewed By: +/- (µg/mL) Formulated By: Uncertainty Expanded 2.0 180 80 13478-00-7 CAS# (Solvent Safety Info. On Attached pg.) Pedro L. Rentas Brian Geddes 190 90 OSHA PEL (TWA) SDS Information 1 mg/m3 200 100 orl-rat 1620 mg/kg 041124 041124 3136 NIST SRM

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

| | | | | | | | Ггасе Ме | tals | Verifica | tion | by ICP-I | SN (| μg/mL) | | | | | | |
|----|-------|-----|-------|----|-------|-----|----------|------|-----------------------|------|----------|------|--------|----------------|-------|----------------|-------|----|-------|
| ≥ | <0.02 | ß | <0.02 | Dy | <0.02 | HH. | <0.02 | L | <0.02 | Z. | T | P | <0.02 | Se | <0.2 | 4L | <0.02 | ₩ | 40,02 |
| Sb | <0.02 | Ç | <0.2 | 펅 | <0.02 | Ж | <0.02 | Ē | <0.02 | \$ | <0.02 | Re | <0.02 | S: | <0.02 | T _e | <0.02 | Ϥ | 40.02 |
| As | 402 | င္ပ | <0.02 | Eu | <0.02 | Б | <0.02 | Mg | <0.01 | ွှ | <0.02 | Rh | <0.02 | Ag | <0.02 | ∄ | <0.02 | < | 40,02 |
| Ba | <0.02 | ß | <0.02 | වු | <0.02 | F. | <0.02 | Mn | <0.02 | Pd | <0.02 | RЪ | <0.02 | Z _a | 40.2 | Ħ | <0.02 | 4 | 40.02 |
| Ве | <0.01 | ਨ | <0.02 | Ga | <0.02 | Fe | <0.2 | Hg | 40.2 | Ā | <0.02 | Ru | <0.02 | Sr | <0.02 | Tm | <0.02 | ¥ | 40.02 |
| Bi | <0.02 | င္ပ | <0.02 | ଦୃ | <0.02 | La | <0.02 | Мо | <0.02 | ¥ | <0.02 | Sm | 40.02 | S | <0.02 | Sn | <0.02 | Zn | 40.02 |
| В | <0.02 | Cu | <0.02 | Au | <0.02 | Pb | <0.02 | M | <0.02 | × | <0.2 | Sc | <0.02 | Ta | <0.02 | 7 | <0.02 | Zr | <0.02 |
| | | | | | | | | | (T) - Towart analysis | | that | | | | | | | | |

= larget 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).

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



Certified Reference Material CRM

M5962 R! 06/14/24



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

| m/z-> | | io io | m/z-> | - | Ņ | m/z-> | i i | 1. Selenium (Se) | Compound | | < | | Nominal Co | Re | | | CERTIFIED WEIGHT HEPOHT | מדודודה שובום |
|-------|-------|----------|---------|-------|---|----------------|---------------------------------------|--------------------|--------------------------------------|--|---|---------------------|--------------------------------|----------------------|----------------|-----------------------------|-------------------------|---------------|
| 210 | 1.OE8 | 2.008 | 110 | 1.OE8 | | 10 | [1] Spectrum No.1 | | | | Volume shown below was diluted to (mL): | NIST Test Number: | Nominal Concentration (µg/mL): | Recommended Storage: | 1 | Lot Number: Description: | Part Number: | 1 11000H |
| 0 | | | 0 | | | Ü | Z 2 0 | 58134 | Number | Part | as dilute | | | | | in in in | _ | |
| 220 | | | 120 | | | 20 | - | 071223 | Number | Lot | d to (mL): | 6UTB | 1000 | Ambient (20 °C) | | 060624 Selenium (Se) | 57034 | |
| Ŋ | | | <u></u> | | | ω | 3.702 | 0.1000 | Factor | Dilution | 2000.07 | | | <u>ග</u> | | Se) | | |
| 230 | | | 130 | | | 30 | sec]:58 | 200.0 | Vol. (mL | Initial | 0.100 | 5E-05 | | | | | | |
| 240 | | | 140 | | | 40 | 33.702 sec]:58034.D# [Count] [Linear] | 0.084 | Val. (mL) Pipette (mL) Conc. (μg/mL) | Uncertainty | Flask Uncertainty | Balance Uncertainty | | | | | | |
| 250 | | | 150 | | | 50 | Count) [L | 1000 | Conc. (µg/mL) | Nominal | ťγ | ainty | | | 2.0% | 24007540 | 24002546 | |
| 260 | | | 160 | | | . 60 | inear | 10002.5 | Conc. (µg/mL | Initial | | | | (m_C) | 40.0 | Na Contraction | Solvent: | |
| o | | | | | | 12 33 34 | | 1000.0 | Conc. (µg/mL) Conc. (µg/mL) | Final | | | | | Nitric Acid | | | (1) |
| | | | 170 | | | 70 | | 2.2 | .) +/- (µg/mL) | Uncertainty | Expanded | Reviewed By: | ta | N | Formulated By: | M | | 10 |
| | | | 180 | | | 80 | | 7782-49-2 | C | (So | | y: | de | 11 | By: | | | |
| | | | 190 | | | 90 | | 2 0.2 mg/m3 | OSHA PEL (TWA) | (Solvent Safety Info. On Attached pg.) | SDS Information | Pedro L. Rentas | leenes | | Benson Chan | M | | |
| | | | 2200 | | | 100 | | | VA) |). On Atta | rmation | ntas | , | / | ב | 5 | | |
| | | | | | | - | | orl-rat 6700 mg/kg | 1.050 | ched pg.) | | 060624 | | | 060624 | | | |
| | | | | | | | | 3149 | SRM | NIST | | ٿ | | | 1+2 | | | |

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

| | | | | | | | I race M | 1etals | Verifica | lion | oy ICP-M | S (1) | g/mL) | | | | | | |
|----|-------|-----|-------|----|-------|----|----------|--------|----------|------|----------|-------|-------|----|-------|----|-------|----|-------|
| Al | 40.02 | CG | <0.02 | Dγ | <0.02 | HH | <0.02 | 11 | <0.02 | Z. | <0.02 | Pr | <0.02 | Se | H | 16 | 40.02 | W | 40,02 |
| SЪ | <0.02 | ದ್ದ | <0.2 | 퍜 | <0.02 | 田 | <0.02 | Į. | <0.02 | ₽ | <0.02 | Re | <0.02 | S: | <0.02 | Te | <0.02 | U | <0.02 |
| As | <0.2 | ಕಿ | <0.02 | 핃 | <0.02 | Ы | <0.02 | Mg | <0.01 | ° | <0.02 | Rh | 40.02 | Ag | <0.02 | ∄ | 40.02 | ٧ | <0.02 |
| Ва | <0.02 | င္တ | <0.02 | æ | <0.02 | H. | <0.02 | Mn | <0.02 | Pd | 40.02 | ₽. | <0.02 | Na | <0.2 | Ħ | <0.02 | 4 | <0.02 |
| Ве | 40.01 | ť | 40.02 | Ga | <0.02 | Fe | <0.2 | Hg | A02 | P | <0.02 | Ru | 40.02 | Sr | <0.02 | Tm | <0.02 | ¥ | <0.02 |
| Bi | 40.02 | င္ပ | <0.02 | ଦୁ | <0.02 | Ľ | <0.02 | Mo | <0.02 | 7 | <0.02 | Sm | 40.02 | S | <0.02 | Sn | 40.02 | Zn | <0.02 |
| В | <0.02 | Cι | <0.02 | Au | <0.02 | Pb | <0.02 | M | <0.02 | × | 40.2 | Sc | <0.02 | Ta | <0.02 | Ħ | <0.02 | Zr | <0.02 |

(T) = Target analyte

Physical Characterization:

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

Certified by:

- * The certified value is the concentration calculated from gravimetric and volumetric measurements unless otherwise stated.
 * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in
- the preparation of all standards.
- * All standard containers are meticulously cleaned prior to use.
- * Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).

 * Standards are 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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info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

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



2.0 **PRODUCT DESCRIPTION**

Product Code:

Single Analyte Custom Grade Solution

Catalog Number:

CGMO1

Lot Number:

T2-MO720876

Matrix:

H2O

tr. NH40H

Value / Analyte(s):

1 000 µg/mL ea:

Molybdenum

Starting Material:

Ammonium Molybdate

Starting Material Lot#:

2361

Starting Material Purity: 99.9893%

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Value:

 $998 \pm 7 \, \mu g/mL$

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

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 : with standard uncertainty uchar i

wi = the weighting factors for each method calculated using the inverse square of

 $w_i = (1/u_{chari})^2 / (\Sigma (1/(u_{chari})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{cs})^{1/2}$

k = coverage factor = 2

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

ubb = bottle to bottle homogeneity standard uncertainty

ults = long term stability standard uncertainty (storage)

u_{(s} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

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

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

X_a = mean of Assay Method A with

ucher a = the standard uncertainty of characterization Method A

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

k = coverage factor = 2

uchar a = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

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

```
0.008000 M Zn
M Ag <
          0.000590 M Eu <
                           0.000300 M Na
                                            0.000879 M Se <
                                                                               0.000598
M AI
          0.000563 M Fe <
                          0.006500 M Nb <
                                            0.029000 i
                                                       Si <
                                                                     M Zr <
                                                                               0.001800
M As <
         0.002100 M Ga <
                          0.000300 i
                                     Nd <
                                                   M Sm <
                                                              0.000300
M
   Au <
         0.000300 M Gd <
                          0.000300 M Ni <
                                            0.008000 M Sn <
                                                              0.008900
М
   B <
         0.003300 M
                    Ge <
                          0.000300 M Os <
                                            0.000590 M Sr
                                                              0.000175
                           0.001800 i
М
   Ba
          0.001689 M
                    Hf <
                                     P <
                                                   М
                                                      Ta <
                                                             0.004200
M
  Be <
         0.000890 M Hg <
                          0.003300 M Pb <
                                            0.000300 M
                                                      Tb <
                                                              0.000300
         0.000890 M Ho < 0.000300 M Pd <
M Bi <
                                            0.001800 M
                                                      Te <
                                                             0.021000
  Ca
         0.006334 M In < 0.032000 M Pr <
0
                                            0.013000 M Th <
                                                             0.000300
O Cd <
         0.026000 M Ir < 0.000300 M Pt <
                                            0.000300 O Ti <
                                                             0.032000
M Ce <
         0.008300 M K
                           0.130213 M Rb
                                            0.004575 M TI
                                                             0.001266
M Co
         0.000598 M La < 0.000300 M Re <
                                            0.000300 M Tm <
                                                              0.000300
                           0.000059 M Rh <
M Cr
         0.000527 O Li
                                            0.000300 M U <
                                                             0.005300
M Cs
         0.000527 M Lu <
                           0.000300 M Ru <
                                            0.079000 M V <
                                                             0.000890
М
   Cu
         0.002252 M Mg
                           0.000563 i
                                     S <
                                                   M W
                                                             0.087982
М
   Dy <
         0.000300 M
                    Mn <
                           0.005900 M
                                     Sb
                                            0.001513 M Y <
                                                             0.000300
М
  Er <
         0.000300 s
                    Mo <
                                  M
                                     Sc <
                                            0.001200 M Yb <
                                                             0.000300
```

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

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ 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 - 95.94 +6 6,7,8,9 [MoO4]-2(chemical form as received)

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

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the [MoOF5]-2 for months in 1% HNO3 / LDPE container. 1-10,000 ppm single element solutions as the [MoO4]-2 chemically stable for years in 1% NH40H in a LDPE container.

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

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

| Technique/Line | Estimated D.L. | Order | Interferences (underlined indicates severe) |
|--------------------|----------------------|-------|---|
| ICP-MS 95 amu | 3 ppt | n/a | 40Ar39K16O,79Br1 |
| | | | 6O,190Os2+,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 CRMRM 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

Meyer Trusing

Certificate Approved By:

Michael Booth Director, Technical Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director Paul R Saine



Refine your results. Redefine your industry.

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Certificate of Analysis M5976, M5977 R : 02/22/24 P: 800-669-6799/540-585-3030 F: 540-585-3012 info@inorganicventures.com

info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

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



2.0 **PRODUCT DESCRIPTION**

Product Code:

Single Analyte Custom Grade Solution

Catalog Number:

CGMO1

Lot Number:

T2-MO720876

Matrix:

H2O

tr. NH40H

Value / Analyte(s):

1 000 µg/mL ea:

Molybdenum

Starting Material:

Ammonium Molybdate

Starting Material Lot#:

2361

Starting Material Purity: 99.9893%

3.0 **CERTIFIED VALUES AND UNCERTAINTIES**

Certified Value:

 $998 \pm 7 \, \mu g/mL$

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

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 : with standard uncertainty uchar i

wi = the weighting factors for each method calculated using the inverse square of

 $w_i = (1/u_{chari})^2 / (\Sigma (1/(u_{chari})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k (u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{cs})^{1/2}$

k = coverage factor = 2

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

ubb = bottle to bottle homogeneity standard uncertainty

ults = long term stability standard uncertainty (storage)

u_{(s} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

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

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

X_a = mean of Assay Method A with

ucher a = the standard uncertainty of characterization Method A

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

k = coverage factor = 2

uchar a = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

ults = long term stability standard uncertainty (storage)

uts = 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.

```
0.008000 M Zn
M Ag <
          0.000590 M Eu <
                           0.000300 M Na
                                            0.000879 M Se <
                                                                               0.000598
M AI
          0.000563 M Fe <
                          0.006500 M Nb <
                                            0.029000 i
                                                       Si <
                                                                     M Zr <
                                                                               0.001800
M As <
         0.002100 M Ga <
                          0.000300 i
                                     Nd <
                                                   M Sm <
                                                              0.000300
M
   Au <
         0.000300 M Gd <
                          0.000300 M Ni <
                                            0.008000 M Sn <
                                                              0.008900
М
   B <
         0.003300 M
                    Ge <
                          0.000300 M Os <
                                            0.000590 M Sr
                                                              0.000175
                           0.001800 i
М
   Ba
          0.001689 M
                    Hf <
                                     P <
                                                   М
                                                      Ta <
                                                             0.004200
M
  Be <
         0.000890 M Hg <
                          0.003300 M Pb <
                                            0.000300 M
                                                      Tb <
                                                              0.000300
         0.000890 M Ho < 0.000300 M Pd <
M Bi <
                                            0.001800 M
                                                      Te <
                                                             0.021000
  Ca
         0.006334 M In < 0.032000 M Pr <
0
                                            0.013000 M Th <
                                                             0.000300
O Cd <
         0.026000 M Ir < 0.000300 M Pt <
                                            0.000300 O Ti <
                                                             0.032000
M Ce <
         0.008300 M K
                           0.130213 M Rb
                                            0.004575 M TI
                                                             0.001266
M Co
         0.000598 M La < 0.000300 M Re <
                                            0.000300 M Tm <
                                                              0.000300
                           0.000059 M Rh <
M Cr
         0.000527 O Li
                                            0.000300 M U <
                                                             0.005300
M Cs
         0.000527 M Lu <
                           0.000300 M Ru <
                                            0.079000 M V <
                                                             0.000890
М
   Cu
         0.002252 M Mg
                           0.000563 i
                                     S <
                                                   M W
                                                             0.087982
М
   Dy <
         0.000300 M
                    Mn <
                           0.005900 M
                                     Sb
                                            0.001513 M Y <
                                                             0.000300
М
  Er <
         0.000300 s
                    Mo <
                                  M
                                     Sc <
                                            0.001200 M Yb <
                                                             0.000300
```

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

6.0 INTENDED USE

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

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ 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 - 95.94 +6 6,7,8,9 [MoO4]-2(chemical form as received)

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

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the [MoOF5]-2 for months in 1% HNO3 / LDPE container. 1-10,000 ppm single element solutions as the [MoO4]-2 chemically stable for years in 1% NH40H in a LDPE container.

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

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

| Technique/Line | Estimated D.L. | Order | Interferences (underlined indicates severe) |
|--------------------|----------------------|-------|---|
| ICP-MS 95 amu | 3 ppt | n/a | 40Ar39K16O,79Br1 |
| | | | 6O,190Os2+,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

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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 CRMRM 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

Meyer Trusing

Certificate Approved By:

Michael Booth Director, Technical Michael 2 Booth

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director Paul R Saine

Certificate of Analysis 6652M , 8782M

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300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com



ACCREDITATION / REGISTRATION

Number QSR-1034). 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 (GSR Certificate INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for

PRODUCT DESCRIPTION

Catalog Number:

Single Analyte Custom Grade Solution Product Code:

CGTN

2% (v/v) HNO3 :xintsM T2-TI719972 Lot Number:

muineill 1 000 hg/mL ea: Value / Analyte(s): tr. HF

Starting Material Lot#: 2094 Starting Material: Ti Metal

Starting Material Purity: 99.9975%

1002 ± 5 µg/mL Certified Value: CERTIFIED VALUES AND UNCERTAINTIES

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

Assay Information:

ICP Assay NIST SRM 3162a Lot Number: 130925 1002 ± 4 µg/mL Assay Method #1

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 $\frac{1}{1000}$

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

XCRANGAM = (x_a) (ucher a) X = x_a mass of Keesy Method A with x_a = x_a the standard uncertainty of

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

Characterization of CRM/RM by One Method Characterization of CRM/RM by Two or More Methods

4.0 TRACEABILITY TO NIST

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

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

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 III bA-Bitter of ore each element, is reported below, solutions tested by ICP-MS were analyzed in an III bA-Bitter of the properties of the properties

e2 M 078220.0 > gN O 882000.0 > u3 M 8g < 0.000536 M Eu <

ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to

Page 2 of 4

INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

> uR M 882000.0

> 9A M 886 0.000.0

> bq M 882000.0 > rq M 888200.0 > rq M 682000.0 > dg M 271100.0

> q O f81200.0 > dq M f82800.0

> iN O 882000.0 > aO M 841200.0

> dN O 322500.0 > N M 862000.0

M - Checked by ICP-MS

Mn < Mg < Li <

> 0H

> 6H

ΉŁ

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

M 976800.0 > 8 | 34500.0 M 576800.0 > 8 M 782600.0

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

> mT M 882000.0 > U M 882000.0 > V M 682000.0 W M

> 6T M 882000.0 > AT M 882000.0

sT M 034450.0 > dT M E70100.0

s 852000.0 M 882000.0

O 69Z000'0

O.043560 O

n2 M 068010.0 89Z000.0 > mS M 89Z000.0

> II

JS

674000.0 228610.0

892000.0 892000.0

0.000268

699630.0

0.001341

892000.0

0.010560

960000'0

960000.0

73260.0 > nZ O 402100.0 038540.0 > nZ O 267400.0

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

7.7 Storage and Handling Recommendations

oM M 882000.0

0.000268 M K 0.000268 M K 0.000268 M K

0.000872 O Fe > 0.008586 M Ga <

O 892000.0

O S37000.0 M 882000.0

M 882000.0

M 603100.0

M 885800.0

M £83200.0 > 00 M GG8020 0.004577 M Gd <

INTENDED USE

W Et < O Cn <

O B <

IA O

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

4.1 Thermometer Calibration

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

Page 3 of 4

- Chemical Testing - Accredited / AZLA Certificate Number 863.01

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

- QSR Certificate Number QSR-1034

1.01 ISO 9001 Qualify Management System Registration

MOITATY STANDARD DOCUMENTATION 0.01

Homogeneity data indicate that the end user should take a minimum ample size of 0.0.2 m L to assume

This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. The Columbiant of the contract of the Columbiant of the Colu

HOMOGENEITY

Please refer to the Safety Data Sheet for information regarding this CRWRM.

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

| Oliver | | | Intormation (ICP-OEC h | Jidoseo manda J |
|---|---------|-----------|--|---------------------------|
| (weiv Isixs/Isib | as ra | are given | Estimated D.L. | Technique/Line |
| Terences (underline 4 : | Inter | Order | 14q Pt | ICP-MS 48 amu |
| ferences (underlined indicates severe) 60, 32514N, | 3281 | A/N | | |
| 60180, | | | | |
| 7N2, 36Ar12C, | INDL | | | |
| Z=X96] 1 | 4009 | | | |
| e X = Zr, Mo, | (wher | | | ICP-0FS 220 4F6 |
| | I(ns | | Jm/gu Se000.0 \ 4500.0 | ICP-OES 334.941 nm |
| | Ce, Ai | | Im/pu 8S0000.0 \ 8E00.0 | ICE-OES 336.121 nm |
| ع. כ ר, ט | BI ,UVI | | | MIN 121,000 0=- |
| ره ره | oM, W | | Jm/gq 450000.0 \ cocord i bosots so basedard ad fon b | note: Inis standard shoul |
| | | | | |

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/a

1:1:1 H2O / HF./ H2SO4 or fuse ash with pyrosulfate if oxide is as plastic pigment and likely in brookite Volentily), Oxide - Northere are repetation; and sociation; restore (Asidone In 1737) Fit Caution Provider (Beschool by Asidone), Oxide - high temperature history (-800EC) brookite (fuse in Pt0 with KCSSO7); Ores (fuse in Pt0 With KC+KSSO7); Ores (fuse in Pt0 With KCSSO7); Ores (fuse in Pt0 With Brookite) (fuse i TI Containing Samples (Preparation and Solution) - Metal (Soluble in H2O / HF caution -powder reacts

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. with a fendency to hydrolyze forming the hydrated oxide in all dilute acids except HE.

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 sincle element solutions as the Ti(F)8-2 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 transition elements unless they are fluorinated). Stable with most inorganic anions with a tendency to hydrolyze forming the hydrafed oxide in all dilute adds except HF. Chemical Compatibility - Soluble in concentrated HCI, HF, H3PO4 H2SO4 and HNO3. Avoid neutral to basic Atomic Weight, Valence; Coordination Number; Chemical Form in Solution - 47.87 +4 6 Ti(F)6-2

- For more information, visit www.inorganicventures.com/TCT

reported density. Do not pipette from the container. Do not refurn 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 $20^{\circ} \pm 4^{\circ}$ C to minimize volumetric dilution error when using the renorded density. Do not biselfe from the container. Do not return removed alticular to container.

A write society in the secied 101 bag, trainspleader of the order two files order two files of the 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. - While stored in the sealed TCT bag, transpiration of this CRWRM is negligible. After opening the sealed TCT bag, transpiration in a creatial increase in the analysis of the contration of the

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

Page 4 of 4

Chairman / Senior Technical Director

- Sealed TCT Bag Open Date:

NAMES AND SIGNATURES OF CERTIFYING OFFICERS

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

CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

norganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.859.5790; 540.855.3030, Fax: 540.555.3012; Inorga - Reference Material Producer - Accredited / A2LA Certificate Number 883.02 10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- This CRMRM 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 CRMRM being stored and handled in accordance with the instructions given in Sec. 7.1.

stability studies conducted on properly stored and handled CRWRMs. 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 CRMRM can be supported by long term

- 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 CRWRM is damaged, confaminated, or otherwise modified.

Thomas Kozikowski Manager, Quality Control Certificate Approved By:

thibils Validity

- June 17, 2027 11.2 Lot Expiration Date

June 17, 2022 11.1 Certification Issue Date

Paul Gaines Certifying Officer:

0.Sr

0.11



Certificate of Analysis

300 Technology Drive Christiansburg, VA 24073 USA inorganicventures.com

M5985 R:6/14/24

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:

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%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value:

 $10022 \pm 30 \mu g/mL$

Density:

1.044 g/mL (measured at 20 ± 4 °C)

Assay Information:

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_{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 uchar i

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

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

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

k = coverage factor = 2

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

ubb = bottle to bottle homogeneity standard uncertainty

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

uts = transport stability standard uncertainty

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

Characterization of CRM/RM by One Method

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

X_a = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k \left(u^2_{chara} + u^2_{bb} + u^2_{lts} + u^2_{ls}\right)^{1/2}$

k = coverage factor = 2

u_{char a} = the errors from characterization

ubb = bottle to bottle homogeneity standard uncertainty

ults = long term stability standard uncertainty (storage)

uts = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

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

4.1 Thermometer Calibration

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

4.2 Balance Calibration

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

4.3 Glassware Calibration

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

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

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

| М | Ag | < | 0.000760 | М | Eu | < | 0.000760 | 0 | Na | | 0.012771 | M | Se | < | 0.023000 | М | Zn | < | 0.006100 |
|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| М | Al | | 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 | M | Os | < | 0.000760 | 0 | Sr | < | 0.000610 | | | | |
| М | Ba | < | 0.001600 | M | Hf | < | 0.000760 | n | Р | < | | М | Ta | < | 0.000760 | | | | |
| 0 | Be | < | 0.000130 | M | Hg | < | 0.003100 | M | Pb | | 0.001400 | М | Tb | < | 0.000760 | | | | |
| M | Bi | < | 0.000760 | М | Но | < | 0.000760 | М | Pd | < | 0.001600 | М | Te | < | 0.000760 | | | | |
| 0 | Ca | | 0.004616 | 8 | In | < | | М | Pr | < | 0.000760 | М | Th | < | 0.000760 | | | | |
| M | Cd | < | 0.000760 | М | lr | < | 0.000760 | M | Pt | < | 0.000760 | 0 | π | < | 0.001100 | | | | |
| М | Ce | < | 0.000760 | 0 | K | | 0.007078 | М | Rb | < | 0.000760 | М | TI | < | 0.000760 | | | | |
| М | Co | < | 0.000760 | М | La | < | 0.000760 | М | Re | < | 0.000760 | М | Tm | < | 0.000760 | | | | |
| 0 | Сг | < | 0.001300 | 0 | Li | < | 0.000130 | М | Rh | < | 0.000760 | М | U | < | 0.000760 | | | | |
| М | Cs | < | 0.000760 | M | Lu | < | 0.000760 | М | Ru | < | 0.000760 | М | ٧ | < | 0.001600 | | | | |
| М | Cu | < | 0.003800 | 0 | Mg | | 0.000707 | n | S | < | | М | W | < | 0.001600 | | | | |
| М | Dy | < | 0.000760 | 0 | Mn | | 0.000149 | M | Sb | < | 0.000760 | М | Υ | < | 0.000760 | | | | |
| М | Er | < | 0.000760 | М | Мо | < | 0.002300 | М | Sc | < | 0.000760 | M | Yb | < | 0.000760 | | | | |
| | | | | | | | | | | | | | | | | | | | |

n - Not Checked For s - Solution Standard Element

M - Checked by ICP-MS O - Checked by ICP-OES

i - Spectral Interference

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> https://www.inorganicventures.com/terms-and-conditions-sale. The Terms and Conditions contain information on the use of materials traceable to PCRM™ certified reference materials. This Limited License agreement is especially pertinent for laboratories accredited under ISO:17034.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.
- For more information, visit www.inorganicventures.com/TCT

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 114.82 +3 6 In(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 HCl / HNO3); Oxide (Soluble in mineral acids); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (Sulfuric/peroxide digestion or 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 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 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

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

| 0 I TOT D 0 | na Datas | |
|----------------------|----------|--|
| - Sealed TCT Bag Ope | en 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 20178hi



300 Technology Drive Christiansburg, VA 24073 USA

inorganicventures.com

Certificate of Analysis

M6074

M6075 M6076 M6077

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

EXP. 9/6/2029

1.0 ACCREDITATION / REGISTRATION

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



2.0 PRODUCT DESCRIPTION

Product Code:

Multi Analyte Custom Grade Solution

Catalog Number:

CHEM-CLP-4

Lot Number:

V2-MEB746762

Matrix:

3% (v/v) HNO3

3% (v/v) HF

Value / Analyte(s):

1 000 µg/mL ea:

Boron,

Molybdenum,

Silicon,

Tin,

Titanium

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE Boron, B **CERTIFIED VALUE**

ANALYTE Molybdenum, Mo **CERTIFIED VALUE**

1 000 ± 5 μg/mL

Silicon, Si

1 000 ± 5 µg/mL

Tin, Sn

1 000 ± 5 µg/mL

Titanium, Ti

1 000 ± 7 μg/mL

1 000 I 5 pg/mL

1 000 ± 6 µg/mL

Density:

1.033 g/mL (measured at 20 \pm 4 °C)

Assay Information:

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

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

Characterization of CRM/RM by Two or More Methods

Certified Value, X_{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 (±) = $U_{CRM/RM} = k (u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{1/2}$

k = coverage factor = 2

 $u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{\frac{1}{2}}$ 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

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:

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

X_a = mean of Assay Method A with

uchar a = the standard uncertainty of characterization Method A

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

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

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.

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

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 Terms and Conditions of Sale. https://www.inorganicventures.com/terms-and-conditions-sale. The Terms and Conditions contain information on the use of materials traceable to PCRM™ certified reference materials. This Limited License agreement is especially pertinent for laboratories accredited under ISO:17034.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ 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.

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.

Paul R Sains

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Joseph Burns Custom VS Manager

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director M6118





Recieve -> 10/9/24

Metdig

Material No.: 9530-33 Batch No.: 22E1662006

Manufactured Date: 2022-04-11 Retest Date: 2027-04-10

Revision No.: 0

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 ppm |
| 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 ppm |
| ACS - Free Chlorine (as Cl2) | ≤ 0.5 ppm | < 0.5 ppm |
| Phosphate (PO ₄) | ≤ 0.05 ppm | < 0.03 ppm |
| Sulfate (SO ₄) | ≤ 0.5 ppm | < 0.3 ppm |
| Sulfite (SO ₃) | ≤ 0.8 ppm | 0.3 ppm |
| Ammonium (NH ₄) | ≤ 3 ppm | < 1 ppm |
| Trace Impurities - Arsenic (As) | ≤ 0.010 ppm | < 0.003 ppm |
| Trace Impurities - Aluminum (AI) | ≤ 10.0 ppb | < 0.2 ppb |
| Arsenic and Antimony (as As) | ≤ 5.0 ppb | < 3.0 ppb |
| Trace Impurities - Barium (Ba) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities - Beryllium (Be) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities - Bismuth (Bi) | ≤ 10.0 ppb | < 1.0 ppb |
| Trace Impurities - Boron (B) | ≤ 20.0 ppb | < 5.0 ppb |
| Trace Impurities - Cadmium (Cd) | ≤ 1.0 ppb | < 0.3 ppb |
| Trace Impurities - Calcium (Ca) | ≤ 50.0 ppb | 37.0 ppb |
| Trace Impurities - Chromium (Cr) | ≤ 1.0 ppb | < 0.4 ppb |
| Trace Impurities - Cobalt (Co) | ≤ 1.0 ppb | < 0.3 ppb |
| Trace Impurities - Copper (Cu) | ≤ 1.0 ppb | < 0.1 ppb |
| Trace Impurities - Gallium (Ga) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities - Germanium (Ge) | ≤ 3.0 ppb | < 2.0 ppb |
| Trace Impurities – Gold (Au) | ≤ 4.0 ppb | 0.2 ppb |
| Heavy Metals (as Pb) | ≤ 100 ppb | < 50 ppb |
| Trace Impurities - Iron (Fe) | ≤ 15 ppb | * * |

>>> Continued on page 2 >>>





Material No.: 9530-33 Batch No.: 22E1662006

| Test | Specification | Result |
|--|---------------|-----------|
| Trace Impurities – Lead (Pb) | ≤ 1.0 ppb | < 0.5 ppb |
| Trace Impurities - Lithium (Li) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities – Magnesium (Mg) | ≤ 10.0 ppb | 1.0 ppb |
| Trace Impurities - Manganese (Mn) | ≤ 1.0 ppb | < 0.4 ppb |
| Trace Impurities – Mercury (Hg) | ≤ 0.5 ppb | 0.1 ppb |
| Trace Impurities - Molybdenum (Mo) | ≤ 10.0 ppb | < 3.0 ppb |
| Trace Impurities - Nickel (Ni) | ≤ 4.0 ppb | < 0.3 ppb |
| Trace Impurities - Niobium (Nb) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities – Potassium (K) | ≤ 9.0 ppb | < 2.0 ppb |
| Trace Impurities – Selenium (Se), For Information Only | | 1.0 ppb |
| Trace Impurities - Silicon (Si) | ≤ 100.0 ppb | < 0.4 ppb |
| Trace Impurities – Silver (Ag) | ≤ 1.0 ppb | < 0.3 ppb |
| Trace Impurities – Sodium (Na) | ≤ 100.0 ppb | 1.9 ppb |
| Trace Impurities – Strontium (Sr) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities – Tantalum (Ta) | ≤ 1.0 ppb | < 0.9 ppb |
| Trace Impurities – Thallium (TI) | ≤ 5.0 ppb | < 2.0 ppb |
| Trace Impurities – Tin (Sn) | ≤ 5.0 ppb | < 0.8 ppb |
| Trace Impurities – Titanium (Ti) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities – Vanadium (V) | ≤ 1.0 ppb | < 0.2 ppb |
| Trace Impurities – Zinc (Zn) | ≤ 5.0 ppb | < 0.3 ppb |
| Frace Impurities - Zirconium (Zr) | ≤ 1.0 ppb | < 0.1 ppb |

Hydrochloric Acid, 36.5-38.0%

BAKER INSTRA-ANALYZED® Reagent
For Trace Metal Analysis





Material No.: 9530-33 Batch No.: 22E1662006

Test Specification Result

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

Country of Origin: USA

Packaging Site: Phillipsburg Mfg Ctr & DC







M6120

R->10/13/24 Met dig

Material No.: 9606-03 Batch No.: 2310662003

Manufactured Date: 2023-08-21 Retest Date: 2028-08-19

Revision No.: 0

Certificate of Analysis

| Test | Specification | Result |
|-----------------------------------|---------------|-------------|
| Assay (HNO3) | 69.0 - 70.0 % | 69.5 % |
| Appearance | Passes Test | Passes Test |
| Color (APHA) | ≤ 10 | 10 |
| Residue after Ignition | ≤ 2 ppm | < 2 ppm |
| Chloride (CI) | ≤ 0.08 ppm | < 0.08 ppm |
| Phosphate (PO ₄) | ≤ 0.10 ppm | < 0.10 ppm |
| Sulfate (SO ₄) | ≤ 0.2 ppm | 0.2 ppm |
| Trace Impurities - Aluminum (AI) | ≤ 40.0 ppb | < 40.0 ppb |
| Arsenic and Antimony (as As) | ≤ 5.0 ppb | < 5.0 ppb |
| Trace Impurities - Barium (Ba) | ≤ 10.0 ppb | < 10.0 ppb |
| Trace Impurities - Beryllium (Be) | ≤ 10.0 ppb | < 10.0 ppb |
| Trace Impurities - Bismuth (Bi) | ≤ 20.0 ppb | < 20.0 ppb |
| Trace Impurities - Boron (B) | ≤ 10.0 ppb | < 10.0 ppb |
| Trace Impurities - Cadmium (Cd) | ≤ 50 ppb | < 50 ppb |
| Trace Impurities – Calcium (Ca) | ≤ 50.0 ppb | < 50.0 ppb |
| Trace Impurities – Chromium (Cr) | ≤ 30.0 ppb | 30.0 ppb |
| Trace Impurities – Cobalt (Co) | ≤ 10.0 ppb | < 10.0 ppb |
| Trace Impurities – Copper (Cu) | ≤ 10.0 ppb | < 10.0 ppb |
| Trace Impurities – Gallium (Ga) | ≤ 10.0 ppb | < 10.0 ppb |
| Trace Impurities – Germanium (Ge) | ≤ 20 ppb | < 20 ppb |
| Trace Impurities – Gold (Au) | ≤ 20 ppb | < 20 ppb |
| Heavy Metals (as Pb) | ≤ 100 ppb | < 100 ppb |
| Trace Impurities – Iron (Fe) | ≤ 40.0 ppb | < 40.0 ppb |
| Frace Impurities – Lead (Pb) | ≤ 20.0 ppb | < 20.0 ppb |
| Frace Impurities – Lithium (Li) | ≤ 10.0 ppb | < 10.0 ppb |
| race Impurities – Magnesium (Mg) | ≤ 20 ppb | < 20 ppb |
| race Impurities – Manganese (Mn) | ≤ 10.0 ppb | < 10.0 ppb |
| race Impurities – Nickel (Ni) | ≤ 20.0 ppb | < 20.0 ppb |

>>> Continued on page 2 >>>





Material No.: 9606-03 Batch No.: 2310662003

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

Nitric Acid 69% CMOS





Material No.: 9606-03 Batch No.: 2310662003

Test

Specification

Result

For Microelectronic Use

Country of Origin: USA

Packaging Site: Phillipsburg Mfg Ctr & DC

Ken Koehnlein Sr. Manager, Quality Assurance

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





R->16/13/24 Met dig

M 6/21

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

Revision No: 1

Certificate of Analysis

| Test | Specification | Result |
|---|---------------|---------|
| ACS - Assay (as HCl) (by acid-base titrn) | 36.5 - 38.0 % | 37.6 |
| ACS - Color (APHA) | <= 10 | 5 |
| ACS - Residue after Ignition | <= 3 ppm | 1 |
| ACS - Specific Gravity at 60°/60°F | 1.185 – 1.192 | 1.190 |
| ACS – Bromide (Br) | <= 0.005 % | < 0.005 |
| ACS - Extractable Organic Substances | <= 5 ppm | 1 |
| ACS - Free Chlorine (as Cl2) | <= 0.5 ppm | < 0.5 |
| Phosphate (PO ₄) | <= 0.05 ppm | < 0.03 |
| Sulfate (SO ₄) | <= 0.5 ppm | < 0.3 |
| Sulfite (SO ₃) | <= 0.8 ppm | 0.3 |
| Ammonium (NH ₄) | <= 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 |
| Frace Impurities – Cadmium (Cd) | <= 1.0 ppb | < 0.3 |
| Frace Impurities – Calcium (Ca) | <= 50.0 ppb | 29.7 |
| race Impurities – Chromium (Cr) | <= 1.0 ppb | < 0.4 |
| race Impurities – Cobalt (Co) | <= 1.0 ppb | < 0.4 |
| race Impurities – Copper (Cu) | <= 1.0 ppb | < 0.1 |
| race Impurities – Gallium (Ga) | <= 1.0 ppb | < 0.2 |

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 | <1 |
| Trace Impurities – Lead (Pb) | <= 1.0 ppb | < 0.5 |
| Trace Impurities – Lithium (Li) | <= 1.0 ppb | 0.2 |
| Trace Impurities – Magnesium (Mg) | <= 10.0 ppb | 0.4 |
| Trace Impurities – Manganese (Mn) | <= 1.0 ppb | < 0.4 |
| Trace Impurities – Mercury (Hg) | <= 0.5 ppb | 0.1 |
| Trace Impurities – Molybdenum (Mo) | <= 10.0 ppb | < 5.0 |
| Trace Impurities – Nickel (Ni) | <= 4.0 ppb | < 0.3 |
| Trace Impurities – Niobium (Nb) | <= 1.0 ppb | < 0.2 |
| Frace Impurities – Potassium (K) | <= 9.0 ppb | < 2.0 |
| Frace Impurities - Selenium (Se), For Information Only | ppb | 1.0 |
| Trace 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 | < 0.9 |
| race Impurities – Thallium (TI) | <= 5.0 ppb | < 2.0 |
| race Impurities – Tin (Sn) | <= 5.0 ppb | < 0.8 |
| race Impurities - Titanium (Ti) | <= 1.0 ppb | 0.8 |
| race Impurities – Vanadium (V) | <= 1.0 ppb | < 0.2 |
| race Impurities – Zinc (Zn) | <= 5.0 ppb | |
| race 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







R -> 11/12/24

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 (PO ₄) | ≤ 0.10 ppm | < 0.03 ppm |
| Sulfate (SO ₄) | ≤ 0.2 ppm | < 0.2 ppm |
| Trace Impurities - Aluminum (AI) | ≤ 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

Cloak

Director Quality Operations, Bioscience Production



Certified Reference Material CRM



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

| m/z-> | 1.0 m 4 | 1000 | m/z-> 2000 | 6.0E6 | 1.0E8 | Compound RM# Number 1. Magnesium nitrate hexahydrate (Mg) IN030 маровгогаал | Nominal Concentration (µg/mL): NIST Test Number: Weight shown below wa | Expiration Date: | Par Lo |
|---------|------------|---------------|---------------|-------|-------------------------|--|--|----------------------------------|---|
| N 10 | | | ō | | [1] Spectrum No.1 | nydrate (Mg) | NIST Test Number: 6UTB Weight shown below was diluted to (mL): | Expiration Date: nended Storage: | Part Number: Lot Number: Description: |
| | | | | | 3 Z 0 | RIM# Nu NO30 MGD0 | 10000 6UTB diluted to (mi | 112 Ami | 112 Ma |
| | Ñ | · - - | 20 | | | - 11 | | 112127 Ambient (20 °C) | 58112 112124 Magnesium |
| ļ. | 130 | | 30 | | 9.923 | Nominal Conc. (µg/mL) 10000 | 2000.07 | 0 | IPM TO |
| | | | | | ec];581 | (%) (%) Purity (| 5E-05 B | 9 | 5 |
| | 4 | | A • | | * | Uncertainty Purity (%) 0.10 | 5E-05 Balance Uncertainty 0.100 Flask Uncertainty | | 10 x 1/13/250 Nont: |
| | | | 70 | | Count | Assay (%) v | ainty ity | 2% | vent: 2 |
| | 150 | | 50 | | | Target Weight (g) 234.9183 | | 40.0 (mL) | 24012496 |
| | 100 | | G . | | .j [6 | Actual Weight (g) | | Nitric Acid | Nitric Acid |
| | 170 | | 70 | | - 11 | Actual Conc. (µg/mL) | | | bid. |
| | | | | | No. | Uncertainty +/- (µg/mL) | Reviewed By: | Formulated By: | 32 |
| | 80 | | 8 . | | 2440- | CAS | By: | M By | iovanni |
| | 190 | | 0 | | 3 | vent | Pedro L. Rentas SDS Inform | | e Esta |
| | NO 0 | | 1 0. | | on-rai | o. On Attachec | ro L. Remas SDS Information | osito | ato a |
| | | | | | on-rat 5440 mg/kg 3131a | рд.) 1050 | 112124 | 112124 | |

Part # 58112

1 of 2

www.absolutestandards.com

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

| В | Ď | 7 | E C | Ва | Às | Sb | Αl | | | |
|-------|----------------|--------------|-------|-------|-------|-------|---------------|---|----------|-----|
| <0.02 | 20.05 | 3 | 0.01 | <0.02 | 402 | <0.02 | <0.02 | | | |
| Cu | 5 | 3 | 유 | స | ဂ္ဂ | C2 | Cd | | | |
| <0.02 | 70.02 | 3 | 40.02 | <0.02 | 40.02 | 0.2 | <0.02 | | | |
| Au | ç | 9 | ලු | 足 | 멸 | 탁 | Dy | | | |
| <0.02 | 10.01 | 3 | <0.02 | <0.02 | 40.02 | <0.02 | <0.02 | | | |
| Pb | į | - | 77 | Ϊ́ | Ĭn | Но | Hf | | ١. | l |
| <0.02 | 10:01 | 3 | 40.2 | <0.02 | <0.02 | <0.02 | 40.02 | | Trace Mo | |
| Nd | | 5 | Hg | Mn | Mg | Ē | Ε. | | etals | |
| <0.02 | 0 00 | 400 | 40.2 | <0.02 | Н | <0.02 | <0.02 | | Verifica | |
| 7 | ; ; | ¥ | Ъ | Pd | ô | B | Z | ı | tion | |
| 70 | 3 | A).02 | <0.02 | <0.02 | 40.02 | <0.02 | △ 0.02 | | oy ICP-N | |
| oc. | 2 | Sm | Ru | Rb | Rh | Ke | , <u>z</u> | | 15 (1) | , |
| 70.05 | 3 | ∆ .02 | <0.02 | <0.02 | 40.02 | 20.02 | 0.02 | | g/mL) | , , |
| 165 | ,] | (A) | Sr | N | Ag | . S | 8 | , | | |
| 20.02 | 3 | <0.02 | <0.02 | 40.2 | 20.02 | 20.02 | 9 6 | | | |
| Ŀ | :1 | Sh | Tm | 15 | 1 = | 1 5 | 7 10 | | l | |
| 10:02 | 3 | 40.02 | 40.02 | 20.02 | 20.02 | 50.02 | 30.02 | 3 | | |
| | 7, | Zn | × | 10 | \$ < | 4 0 | ≒ ≉ | W | | |
| 10.00 | 200 | <0.02 | 40.02 | 20.02 | 0.02 | 200 | 3 6 | 3 | | |

(I) = larget 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 # 58112

2 of 2

www.absolutestandards.com

Part Number:

Lot Number:



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

CERTIFIED WEIGHT REPORT:

Formulated By: Diovannie Giovanni Esposito 2 Septe 101124

Pedro L. Rentas

101124

Recommended Storage: **Expiration Date:** Description: 101124

Manganese (Mn)

Ambient (20 °°)

Manganese (20 °°) 1000

Nominal Concentration (µg/mL): Weight shown below was diluted to (mL): **NIST Test Number:** ETUB ត្ត 4000.2 Nominal 0.10 Flask Uncertainty 5E-05 Balance Uncertainty Purity Uncertainty Assay Target Actual Actual Reviewed By: Uncertainty Expanded (Solvent Safety Info. On Attached pg.)

RM#

Number

Conc. (µg/mL)

8

Purity (%)

8

Weight (g)

Weight (g) Conc. (µg/ml.)

+/- (µg/mL)

CAS#

OSHA PEL (TWA)

LD50

SRM NIST T SDS Information

 Manganese(II) nitrate hydrate (Mn) IN031 MNM082020A1 1000 99.999 0.10 20.8 19.2322 19.2344 1000.1 2. 0 15710-66-4 5 mg/m3 orl-rat >300mg/kg 3132

| m/z-> | 5.0E7 | 1.0E8 | 5.0E7 | 1.0E8 | 7-2/2 | N UI | 5. OE6 |
|-------------|-------|--------|-------|-------|----------|---------|---|
| | | | | | | | [1] 88 |
| 0 | | 110 | | | 0 | | [1] Spectrum No.1 |
| | | | • | | | | NO.1 |
| N N O | | 120 | | | 0 | | و |
| 230 | | 100 | | | 30 | | 1.243 |
| ō | | Ō | | | | | ec]:57(|
| N 40 | | 140 | | | 40 | | [34.243 sec]:57025.D# [Count] [Linear] |
| | | | | | | | Coun |
| N D | | 150 | | | 6 | | tj (Line |
| N O | | 300 | | | 0 | | 2 |
| J | | J | | | | | |
| | | 170 | | | 70 | | |
| | | - | | | Ó | | |
| | | 0 | | | 80 | | |
| | | 90 | | | 0 | | |
| | | | | | | | |
| | | N 0 | on. | | 100 | | |



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

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

| Г | | | | | | | Trace Me | etals | Verifica | tion | by ICP- | SM | (µg/mL) | | | | | | |
|----|---------------|-----|---------------|-----|-------|----|----------|-------|----------|------|---------|----------|--------------|-----------------|-------------|----|-------|----|------------------|
| 2 | ∆ 0.02 | 8 | 40.02 | Dγ | 40.02 | H | <0.02 | | <0.02 | Z | <0.02 | P | <0.02 | Se | 40.2 | 17 | <0.02 | × | A0.02 |
| dS | <0.02 | ರೌ | 40.2 | 뎍 | <0.02 | Н | <0.02 | Ę | 40.02 | Z | <0.02 | Re | <0.02 | ž. | 40.02 | Te | <0.02 | c | 40.02 |
| As | <0.2 | င္ပ | <0.02 | 핃 | <0.02 | In | <0.02 | Mg | 40.01 | 0° | <0.02 | 굦 | <0.02 | A | 8,02 | 1 | <0.02 | < | <0.02 |
| Ba | 40.02 | ဂ္ဂ | 40.02 | හි | <0.02 | Ħ | 40.02 | Mn | H | 꾿 | 40.02 | 공 | 40.02 | Z. | 40,2 | 금 | <0.02 | ⋨ | ♦0.02 |
| Ве | 40.01 | 턴 | 40.02 | ନ୍ଥ | 40.02 | 7. | 40.2 | He | 40.2 | P | 40.02 | R | 40.02 | Sr | A).02 | Tm | <0.02 | × | < 0.02 |
| Bi | 0.02 | ဝ | ∆ 0.02 | ନ୍ମ | 40.02 | La | <0.02 | Mo | 40.02 | 7 | 40.02 | Sm | <0.02 | S | A.02 | Sn | <0.02 | Zn | \$0.02 |
| В | <0.02 | Cu | <0.02 | Au | <0.02 | РЬ | <0.02 | Nd | <0.02 | * | <0.2 | Sc | <0.02 | T ₂₂ | 40.02 | 크 | <0.02 | Zr | <0.02 |
| | | | | | | | | | } | | | | | | | | | | |

(T) = Target analyte

Physical Characterization:

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

Certified by:

Jon 7 Mills

- * 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).

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Certified Reference Material CRM



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

CERTIFIED WEIGHT REPORT: 1. Sodium nitrate (Na) Neminal Concentration (µg/mL): Recommended Storage: Weight shown below was diluted to (mL): m/z-> m/z-> M/X-Y NIST Test Number: 2.5E6 5.0E6 2.500 5.0E6 2.5E5 5.0E5 **Expiration Date:** Part Number: Lot Number: Description: [1] Spectrum No.1 210 110 IN036 NAV01201511 0 RM# **6UTB** 072427 58111 072424 10000 Ambient (20 °C) Sodium (Na) Number Lot 120 220 NO [8.935 sec]:58111.D# [Count] [Linear] Conc. (µg/mL) 10000 4000.2 Nominal M6144 R->1/13/2 Solvent: 130 30 99.999 5E-05 Balance Uncertainty Purity 0.10 Flask Uncertainty (96) Uncertainty Assay Purity (%) 0.10 240 140 4 26.9 8 2% 24002546 Nitric Acid 148.7096 Weight (g) Target (mL) 250 150 50 ###### Weight (g) Conc. (µg/mL) Nitric Acid Actual 160 260 0 10000.0 Actual 170 70 +/- (µg/mL) Uncertainty Reviewed By: Formulated By: Expanded 20.0 7631-99-4 180 80 CAS# (Solvent Safety Info. On Attached pg.) Pedro L. Rentas Benson Chan OSHA PEL (TWA) **SDS** Information 180 90 5 mg/m3 200 100 orl-rat 3430 mg/kg 3152a 072424 072424 TSIN MES.

Printed: 1/10/2025, 4:48:22 PM

1 of 2

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

| В | <u>00</u> | Be | Ba | As | Sb | ≥ | | | |
|-------|-----------|-------|----------|-------|----------------|-------|-----------------|----------|---|
| <0.02 | <0.02 | <0.01 | <0.02 | 40.2 | <0.02 | <0.02 | | | |
| 5 | င္ပ | Ω | င္တ | දි | C ₂ | S | | | |
| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 602 | <0.02 | | | |
| Au | င္ပ | ଦ୍ଧ | <u>ਨ</u> | Eu | ম্র | Ų | | | |
| <0.02 | <0.02 | <0.02 | △0.02 | <0.02 | 40.02 | 40.02 | STATE OF STREET | | |
| Pb | La | Fe | F | In | Но | Нf | | | |
| <0.02 | <0.02 | 40.2 | <0.02 | <0.02 | <0.02 | <0.02 | | Trace M | |
| Z | Mo | Hg | Mn | Mg | L | Ш | | etals | |
| 40.02 | △0.02 | 40.2 | <0.02 | <0.01 | <0.02 | 40,02 | | Verifica | |
| × | 7 | ۵ | Pd | 0° | 3 | Z. | | tion | |
| 40.2 | 40.02 | 0.02 | A.02 | 40,02 | 40.02 | <0.02 | | by ICP-N | |
| Se | Sm | Ru | Rb | Rh | Re | Pr | | S (III | |
| <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | a/mL) | |
| Ta | S | Sr | Z | Ag | S: | & | | | |
| 40,02 | 40.02 | 40,02 | -7 | <0.02 | <0.02 | <0.2 | | | |
| | Sn | Tm | H | ⊒ | Te | 4 | i | | I |
| 40,02 | 40.02 | <0.02 | <0.02 | <0.02 | △0.02 | <0.02 | | | |
| 127 | Zn | Y | 44 | < | C | W | | | |
| 20.02 | 40.02 | 40.02 | <0.02 | <0.02 | <0.02 | <0.02 | III O O O O | | |

(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 # 58111

800-368-1131 Absolute Standards, Inc.

www.absolutestandards.com



Certified Reference Material CRM

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

CERTIFIED WEIGHT REPORT:

Part Number:

58111 122223

Sodium (Na)

Lot Number: Description:

Nominal Concentration (µg/mL):

NIST Test Number:

6UTB 10000

Weight shown below was diluted to (mL):

3000.4

0.06 Flask Uncertainty 5E-05 Balance Uncertainty

RW#

Number Lot

Nominal

Purity

Uncertainty Assay Purity (%)

Target

Actual

8

38

Recommended Storage:

Ambient (20 °C)

122226

Expiration Date:

Lot # M5807

Solvent:

24002546 Nitric Acid

2%

60.0 (III)

Nitric Acid

Formulated By: 13827 P Aleah O'Brady Back

Reviewed By: Pedro L. Rentas

122223

22223

Actual Uncertainty Expanded (Solvent Safety Info. On Attached pg.) **SDS Information** TSIN

CAS#

SE

1. Sodium nitrate (Na) IN036 NAV01201511 Conc. (µg/mL) 10000 98.999 0.10 26.9 111.5406 Weight (g) Weight (g) Conc. (µg/mL) 111.5479 10000.7 +/- (µg/mL) 20.0 7631-99-4 OSHA PEL (TWA) 5 mg/m3 ori-rat 3430 mg/kg 3152a

1 m/z-> 17/z-Y m/z-> N.5E6 5.0E6 2.5E6 5.0E6 2.5E5 5.0E5 [1] Spectrum No.1 210 110 0 220 120 NO. [8.935 sec]:58111.D# [Count] [Linear] 130 230 30 140 240 6 150 250 50 160 260 0 170 70 180 80 190 90 100 200

Part # 58111



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

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

| | As Ba Ba Ba | |
|--------------------|--|----------|
| | 40.2 40.2 40.2 40.0 40.0 40.0 40.0 40.0 | |
| | 585855 | |
| | 40.02 40.02 40.02 40.02 40.02 40.02 | |
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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).

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Certified Reference Material CRM

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

CERTIFIED WEIGHT REPORT: Nominal Concentration (µg/mL): Recommended Storage: Volume shown below was diluted to (mL): **NIST Test Number: Expiration Date:** Part Number: Lot Number: Description: 57051 120523 BTU9 1000 120526 Ambient (20 °C) Antimony (Sb) 3000.41 0.058 5E-05 Flask Uncertainty Balance Uncertainty 24002546 Lot # 2.0% M.5802 Nitric Acid Solvent: 0.00 MSBOS Nitric Acid Formulated By: Reviewed By: Pedro L. Rentas Lawrence Barry 120523 120523

1. Antimony (Sb)

58151

100923

0.1000

300.0

1000

10001.4

1000.0

7440-36-0

0.5 mg/m3

orl-rat 7000 mg/kg 3102a

Number Part

Number Ď

Vol. (ml.)

Pipette (ml.) Conc. (µg/ml.)

Conc. (µg/mL)

Conc. (µg/ml.)

+/- (µg/mt.) Uncertainty Expanded

CAS#

(Solvent Safety Info. On Attached pg.) OSHA PEL (TWA)

LD50

SRM NIST SDS Information

Final

Dilution Factor

Initial

Uncertainty

Nominal

Compound

| -2/m | 1.057 | m/z-> 2.0E7 | 2. 6 8 | 5.0E5 | 2.0 E | 6.OE6 |
|--------|-------|----------------|--------------|--|----------|-------|
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| | | 200 | | 100 | | |

Part # 57051



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

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

| | - | Г | - | | | | | _ | | | | | II | ľ | - | |
|---------------------|-------|--------------|----------------|-------|--------------|---------------|--------|-------------|--------------|------------|-------|-------------------------|--------------|-----------|------|---|
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(1) = 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 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).

Printed: 1/16/2024, 3:48:48 PM

Part # 57051

Lot # 120523

Certified Reference Material CRM

M6030



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

R = 8 | 5 | 24

www.absolutestandards.com

CERTIFIED WEIGHT REPORT:

800-368-1131

Absolute Standards, Inc.

Part Number: Solvent: 24002546 Lot # Nitric Acid

Lot Number: Description: 57047 122823 Silver (Ag)

Recommended Storage: **Expiration Date:** 1000 122826

Weight shown below was diluted to (mL): 4000.30

1. Silver nitrate (Ag)

IN035 J0612AGA1

1000.0

0.10

63.7

6.27992

6.27998

1000.0

2.0

7761-88-B

10 ug/m3

Z

3151

Nominal Concentration (µg/mL): NIST Test Number: **6UTB** Ambient (20 °C) 0.058 Flask Uncertainty 5E-05 Balance Uncertainty

2% <u>E</u> 80.0 Nitric Acid

Formulated By:

Benson Chan

122823

122823

Reviewed By: Pedro L. Rentas

Compound RM# Number 헏 Conc. (µg/mL) Nominal Purity Uncertainty Assay 8 Purity (%) 38 Weight (g) Target Weight (g) Conc. (µg/mL) Actual Actual +/- (µg/mL) Uncertainty Expanded CAS# (Solvent Safety Info. On Attached pg.) SDS Information NIST SRM

m/z-> m/z-> W-2/m 5.0E6 5.0E5 1.0≡6 2.5E6 5.0E6 1.0€7 [1] Spectrum No.1 210 110 0 120 NNO NO [14.044 sec]:58147.D# [Count] [Linear] 230 130 30 140 240 ò 150 250 50 260 160 00 170 0 180 0 190 000 200 100

www.absolutestandards.com



| | | | | | | | race Me | letals | Verificat | tion | by ICP-I | S | ug/mL) | | | | | | |
|----|--|-----|-------|----|-------|-----|-----------------|--------|-----------|------|----------|---------|---------------|-----|-------|---|---------------|----|--------|
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| В | <0.02 | δ | <0.02 | Au | <0.02 | 광 | <0.02 | Z | <0.02 | * | 40.2 | Sc | <0.02 | ī | <0.02 | Ħ | <0.02 | 2 | <0.02 |

Physical Characterization:

(T)= Target analyte

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

Certified by:

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Certificate of Analysis

ustry. 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%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value:

1001 ± 3 µg/mL

Density:

1.000 g/mL (measured at 20 ± 4 °C)

Assay Information:

Assay Method #1

998 ± 4 µg/mL

ICP Assay NIST SRM 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 uchar i

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

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

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

k = coverage factor = 2

 $u_{char} = [\Sigma((w_i)^2 (u_{char})^2)]^{1/2}$ where u_{char} i 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 (stora

4.0 TRACEABILITY TO NIST

Characterization of CRM/RM by One Method

X_a = mean of Assay Method A with

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

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

- 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 $0.3 \ \mu m$.

| М | Ag | < | 0.001980 | М | Eu | < | 0.000495 | 0 | Na | | 0.000200 | M | Se | < | 0.013862 | 0 | Zn | | 0.000143 |
|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|---|----|---|----------|
| 0 | Al | | 0.000370 | 0 | Fe | | 0.000410 | M | Nb | < | 0.000495 | i | Si | < | | М | Zr | < | 0.000495 |
| M | As | < | 0.000495 | М | Ga | < | 0.000495 | М | Nd | < | 0.000495 | M | Sm | < | 0.000495 | | | | |
| M | Au | < | 0.000989 | М | Gd | < | 0.000495 | 0 | Ni | < | 0.007631 | M | Sn | < | 0.000990 | | | | |
| M | В | < | 0.039606 | М | Ge | < | 0.000495 | М | Os | < | 0.000494 | s | Sr | < | | | | | |
| М | Ba | | 0.006486 | M | Hf | < | 0.000495 | i | Р | < | | М | Та | < | 0.000495 | | | | |
| М | Be | < | 0.000990 | M | Hg | < | 0.000989 | M | Pb | < | 0.002970 | М | Tb | < | 0.000495 | | | | |
| М | Bi | < | 0.000495 | M | Но | < | 0.000495 | М | Pd | < | 0.003957 | М | Te | < | 0.027724 | | | | |
| 0 | Ca | | 0.004255 | M | ln | < | 0.000495 | M | Pr | < | 0.000495 | М | Th | < | 0.000990 | | | | |
| M | Cd | | 0.001339 | M | lr | < | 0.000494 | M | Pt | < | 0.002970 | М | Tī | < | 0.005940 | | | | |
| M | Çe | < | 0.004950 | 0 | K | < | 0.008184 | М | Rb | < | 0.002970 | М | TI | < | 0.000495 | | | | |
| M | Co | < | 0.000495 | M | 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 | M | Lu | < | 0.002970 | М | Ru | < | 0.000989 | М | ٧ | < | 0.001980 | | | | |
| M | 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 | Υ | < | 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.

https://www.inorganicventures.com/terms-and-conditions-sale. The Terms and Conditions contain information on the use of materials traceable to PCRM™ certified reference materials. This Limited License agreement is especially pertinent for laboratories accredited under ISO:17034.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° 30° C while in sealed TCT bag.
- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.
- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° 24° C to minimize the effects of transpiration. Use at $20^{\circ} \pm 4^{\circ}$ 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 HCl, 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 | Се |
| | | | |

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, Ve. 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 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.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Thomas Kozikowski Manager, Quality Control

Certifying Officer:

Paul Gaines Chairman / Senior Technical Director 20178hi

Absolute Standards, Inc. 800-368-1131

www.absolutestandards.com



Certified Reference Material CRM

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

R: 03/16/23 MS473 MS474, MS475, MS Lot #

CERTIFIED WEIGHT REPORT:

Part Number:

56138 082922

Solvent: 20510011

Nitric Acid

2% 20.0 Nitric Acid

<u>P</u>

Nominal Concentration (µg/mL):

NIST Test Number:

6UTB 10000 Recommended Storage:

Ambient (20 °C) 082925

Expiration Date:

Description: Lot Number:

Strontium (Sr)

Weight shown below was diluted to (mL):

1000.12

0.058 Flask Uncertainty 5E-05 Balance Uncertainty

> Formulated By: Lawrence Barry

Pedro L. Rentas

Reviewed By:

082922

082922

SDS Information (Solvent Safety Info. On Attached pg.)

10042-76-9 CAS# OSHA PEL (TWA) Ι₹ LD50

SRM SRM

Strontium nitrate (Sr

IN017 SRZ022018A1

10000

99.997

0.10

41.2

24.2756 Weight (g)

24.2758

10000.1

20.0

RM#

Number

Conc. (µg/mL)

8

Purity (%)

8

Weight (g) Conc. (µg/mL) +/- (µg/mL)

Uncertainty

Expanded

닭

Nominal

Purity Uncertainty Assay

m/z-> m/z-> M/z-> 2.5E6 5.0E6 5.0E5 1.0E6 2.5 € 6 5.0E6 [1] Spectrum No.1 210 110 10 220 120 20 [14.495 sec]:58138.D# [Count] [Linear] 230 130 30 140 240 40 250 150 50 260 160 60 170 0 80 190 90 200 100 orl-rat >2000mg/kg 3153a

www.absolutestandards.com



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

| П | | | | П | | Ш | Trace Me | tals | Verifica | tion | by ICP- | S | μg/mL) | П | | | | | |
|----|-------|----------------|-------|-----|-------|----|----------|------|----------|------------|---------|--------|--------|----------------|-------|----------|-------|----|---------------|
| | | | | I | | I | | | | ı | 8 | ı | | ۱ | | | | | |
| A | <0.02 | 8 | <0.02 | Dу | <0.02 | Ħ | <0.02 | Ľ. | 40.02 | <u>Z</u> . | <0.02 | P. | <0.02 | Se | <0.2 | <u>1</u> | <0.02 | W | <0.02 |
| SЬ | <0.02 | Ca | <0.2 | 缸 | △0.02 | Но | <0.02 | Lu | <0.02 | 子 | <0.02 | Re | <0.02 | S: | <0.02 | Te | 0.02 | Ϥ | <0.02 |
| As | <0.2 | රී | <0.02 | 땹 | <0.02 | F | <0.02 | Mg | <0.01 | ္တ | <0.02 | ₽ | <0.02 | Ag | <0.02 | ∄ | <0.02 | < | △ 0.02 |
| Ba | <0.02 | ე ე | <0.02 | ନ୍ଦ | <0.02 | ī | <0.02 | M | <0.02 | P | <0.02 | ₽ B | <0.02 | N ₂ | <0.2 | ∄ | <0.02 | 4 | △ 0.02 |
| Be | <0.01 | ζ. | <0.02 | ନ୍ଥ | <0.02 | 듔 | <0.2 | Нg | <0.2 | Р | <0.02 | ᇟ | <0.02 | Sr | Т | Tm | <0.02 | * | <0.02 |
| Bi | 0.02 | င္ပ | <0.02 | ဌာ | <0.02 | La | <0.02 | Μo | <0.02 | 뫈 | <0.02 | Sm | <0.02 | S | <0.02 | S | <0.02 | Zn | <0.02 |
| В | <0.02 | C _L | <0.02 | Au | <0.02 | Рь | <0.02 | Nd | 40.02 | × | <0.2 | Sc | <0.02 | Ta | <0.02 | 1 | <0.02 | Zr | <0.02 |
| | | | | | | | | | | | | | | | | | | | |

Physical Characterization:

(T)= Target analyte

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

Certified by:

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

 * Purified acids, 18.2 megohm deionized water, calibrated Class A glassware and the highest purity raw materials are used in the preparation of all standards.
- All standard containers are meticulously cleaned prior to use. Standards are prepared gravimetrically using balances that are calibrated with weights traceable to NIST (see above).
- Standards are 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

Absolute Standards, Inc. 800-368-1131

www.absolutestandards.com



Certified Reference Material CRM

M6023

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

| | | Weight shown below was diluted to (mL): | NIST Test Number: | Nominal Concentration (µg/mL): | Recommended Storage: | Expiration Date: | | Description: | Lot Number: | Part Number: | CERTIFIED WEIGHT REPORT: |
|--|-----------------|---|---------------------------|--------------------------------|----------------------|------------------|----------------|---------------|----------------|-------------------|--------------------------|
| Lot | | ted to (mL): | 8TUB | 1000 | Ambient (20 °C) | 062727 | | Thalllum (TI) | 062724 | 57081 | |
| Nominal | | 2000.1 | | | ၀ (၄) | | | | | | |
| Purity Uncertainty Assay | | 0.10 Flask Uncertainty | 5E-05 Balance Uncertainty | | | | 2% | | | Solvent: | |
| Target | | | | | | (mL) | 40.0 | | | Solvent: 24002546 | Lot # |
| Actual | | | | | | | Nitric Acid | | | Nitric Acid | |
| Actual | | | | | | | | | | | |
| Uncertainty | Expanded | | Reviewed By: | Juna | 1 | | Formulated By: | 4 | TO ST | > | |
| (Solvent Safety Info. On Attached pg.) | SDS Information | | Pedro L. Rentas | " human | A A | | Aleah O'Brady | 0 | San O To asign | 7 | |
| ched pg.) NIST | | | 062724 | | | | 062724 | | | , | |
| 7 | | | | | | | | | | | |

RW#

Number

Conc. (µg/mL) (%)

Purity (%) (%)

Weight (g) Weight (g) Conc. (µg/mL) +/- (µg/mL)

CAS#

OSHA PEL (TWA)

LD50

SRM

| ~-Z/III | 5.0E5 | 1.0E6 | m/z-> | 5000 | 1.0€4 | 1.0E6 | 2.OE6 | |
|---------|-------|-------|----------|------|----------|-------|---|--|
| N | | | -1 | | | | El opegrum No. | |
| 210 | | | 10 | | ö | | 3 | |
| 220 | | | 120 | | N O | | | |
| | | | | | | | 4 0 | |
| 230 | | | 130 | | 9 | | []4.044 sec]:57081.D# [Count] [Linear] | |
| 240 | | | <u> </u> | | 4 | | 57081. | |
| ō | | | 140 | | 40 | | <u> </u> | |
| 250 | | | 1 | | OI. | | | |
| | | | | | | | | |
| 0 | | | 160 | | 60 | | | |
| | | | 4 | | 70 | | | |
| | | | 170 | | 0 | | | |
| | | | 180 | | 80 | | | 100 |
| | | | | | | | | |
| | | | 190 | | 90 | | | or any |
| | | | 200 | | 100 | | | |
| | | | ŏ | | ŏ | | | See all see al |
| | | | | | | | | 0 |

Part # 57081



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

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

| | | Œ | DI | ; <u>;</u> | R. | Da | į į | As | 30 | 2 | 2 | | Ì | | |
|----------------------|-------|--------------|---------------|------------|--------|---------------|------------|-------|----------------|---------------|------------------------------|---|------------|-----------------|---|
| | | 40.02 | 20.02 | 3 8 | A) (1) | 20.02 | e de | 3 | 70.02 | 3 | 40.02 | | | | |
| | İ | 5 | S | , (| ? | CS | , (| 3 | 2 | > | 5 | | | | |
| | | 40.00 | 40.02 | 20.02 | 3 | <0.02 | 20.02 | 3 | 202 | > | 40.02 | | | | |
| | | A II | දි | Ç, | ? | ପୁ | į | 7 | 돧 | , | Dγ | | l | | |
| | 20,02 | 3 | ♦ 0.02 | 20.02 | 3 | ♦ 0.02 | 20.02 | 3 | 40,02 | | A0.02 | Towns of the last | | | |
| | 100 | 5 | L | 2 | 1 | Ħ | Б | 1 | Но | 1 | H | | I. | | |
| | 70.02 | 3 | ∆ .02 | 7.05 | 5 | ∆ .02 | 20.02 | 3 | <u>8</u> .02 | | 40.02 | | | Z D Z | |
| | | ź. | Mo | 9H | | š | ₩ <u></u> | : | L _a | ı | 1.4 | Service III | | 200 | |
| (T) = Target analyte | 20.02 | 3 | A 0.02 | 40.2 | , | A 0.02 | AJ.01 | 2 | ∆ .02 | 40.04 | 2003 | 450 E 3 00 W | 4 61 11160 | Varifics | |
| et anal | F | 4 ; | P | 70 | · ¦ | 전 | င္တ | 1 | Z | 142 | Z. | | | ₹. 2 | |
| yte | 2.05 | 0.01 | 3 | <0.02 | 1000 | 40 02 | <0.02 | | 40.02 | 20.00 | 3 | | Dy ICI | 707 | |
| | SC | E | 3 | R | , | 子 | 공 | | 元 연 | 2 | 2 | | | このこ | |
| | A0.02 | 20.02 | 3 | <0.02 | 40.04 | 2000 | 40.02 | 10101 | 2 | 20.02 | 3000 | | /B/ | | |
| | Ta | ū | n | Sr | TAG | Z . | Ag | Į. | Ç. | č | | | | | |
| | 40,02 | 20.02 | 3 | ∆.02 | 7.07 | 3 | & 20.02 | 20.00 | 3 | 46 | | | | | |
| | 11 | DC | ? | ď | 110 | i | Ħ | i | 7 | 10 | | | | | l |
| | 40.02 | 20.02 | 3 | 40.02 | 70.02 | 2 | H | 70.02 | 3 | ∆ 0.02 | | | | | |
| | Zr | 120 | 1 | × | ID | Ś | < | C | 1, | \$ | | | | | |
| | 40.02 | 40.02 | | A).02 | 20,02 | | A) (2) | 20.02 | 3 | <u>&</u> | THE RESIDENCE AND THE PERSON | | | | |

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 the preparation of all standards.

* All standard containers are meticulously cleaned prior to use.

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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).

800-368-1131 Absolute Standards, Inc.

www.absolutestandards.com



Certified Reference Material CRM

M6021

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

CERTIFIED WEIGHT REPORT Part Number: Lot Number: 57023 062424 24002546 Nitric Acid Solvent:

Nitric Acid

Ambient (20 °C) 2.0% (mL) 40.0

Formulated By:

Aleah O'Brady

062424

ASSET O DE LONG

Recommended Storage:

Expiration Date:

062427

Description:

Vanadium (V)

Nominal Concentration (µg/mL): Volume shown below was diluted to (mL): **NIST Test Number: 6UTB** 1000 2000.3 5E-05 0.06 Balance Uncertainty Flask Uncertainty Reviewed By:

Pedro L. Rentas

062424

Ammonium metavanadate (V) Compound 58123 Number Part 021224 Number ρţ 0.1000 Dilution Factor Vol. (mL) Pipette (mL) Conc. (µg/mL) 200.0 Initial Uncertainty 0.084 Nominal 1000 Conc. (µg/mL) Conc. (µg/mL) 10000.3 nitial 1000.0 Final +/- (µg/mL) Uncertainty Expanded 22 7803-55-6 CAS# (Solvent Safety Info. On Attached pg.) OSHA PEL (TWA) 0.05 mg/m3 **SDS Information** orl-rat 58.1mg/kg LD50 3165 NIST SRM

| 7/2-7 | P. 58 E. 6 | m/z->- 5,0E8 | 1.0E7 | m/z-> 2.0E7 | 1.0厘6 | 2.0E6 |
|-------------|------------|-----------------|-------|----------------|-------|-------|
| | | | | | | |
| 210 | | 110 | | 0 | | |
| 220 | | 1 20 | | N. | | |
| Ö | | Ö | | 0 | | |
| N G O | | 130 | | 30 | | |
| N: | | | | A | | |
| N 4 | | 140 | | 0 | | |
| N 50 | | 50 | | 50 | | |
| b: | | | | | | ı |
| 260 | | 160 | | 60 | | |
| | | 170 | | 70 | | |
| | | | | | | |
| | | d . | | 80 | | |
| | | 190 | | 90 | | |
| | | | | | | |
| | | 200 | | 100 | | |

Part # 57023

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

| | E | Bi | Ве | Ba | AS | 00 | 2 2 | Δ | | |
|----------------------|--|------------|-------|-------------|--------------|---------|---------------|--|----------|---|
| | 40,02 | A),02 | 40.01 | 40.02 | 40.2 | 20.02 | 200 | A | | |
| | 5 | ပ | 유 | సి | င် |) [2 | ۶ د | 2 | | |
| | 40.02 | 40,02 | <0.02 | 40.02 | 40.02 | 40.2 | 20.02 | 3 | | |
| | Au | ဂ္ဂ | స్ట | හු | Ē | 乓 | Ş | | | |
| | 40.02 | 40.02 | 40,02 | 40.02 | 40.02 | <0.02 | 20.02 | | | |
| | 3 | <u>.</u> | 737 | 5 | 급 | Но | H | 1 | | |
| | 40.02 | 40.02 | 40,2 | 0.02 | ₫.02 | 40.02 | 40.02 | | Irace M | |
| | 폽 | Mo | He | Mn | Mg | 댭 | Σ | | etals | |
| (T) = Target analyte | 40.02 | 40.02 | 402 | 40,02 | 10.0> | 40.02 | 40.02 | | Verifica | |
| et analy | ~ | ¥ | P | 2 | ဝွ | 7 | Z | S. St. St. | tion | |
| 6 | A0,2 | A 20.02 | A).02 | A).02 | ₫.02 | <0.02 | 0.02 | DESIGNATIONS OF | oy ICP-N | |
| | Sc | Sm | 7 | 공 | 2 | Re | 7 | | SI) SI | |
| | 40.02 | A (| A | 40.02 | A.02 | <0.02 | <0.02 | | /mL) | |
| | ng (| so s | ? | Z, | Ag | Si | æ | | | l |
| | 40.02 | A 6 | 3 6 | 40.2 | A).02 | 8.02 | <0.2 | | | |
| | # 1 | 8 | 1 | 3 | = | F. | 4T | | | |
| | 40.02 | A 6.2 | 5 6 6 | 3 | A)02 | 40.02 | ∆ 0.02 | | | |
| | 27 | 7, | < 5 | \$. | < | a | ¥ | SPECIAL SECTION OF SEC | | |
| | 6.65 6.65 6.65 6.65 6.65 6.65 6.65 6.65 | 2 6 | 3 6 | § . | -3 | A 0.02 | <0.02 | THE REAL PROPERTY. | | |

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

CORCO CHEMICAL CORPORATION

Manufacturers of ACS Reagents and Semiconductor Grade Chemicals

Office and Plant 299 Cedar Lane Fairless Hills, PA 19030

Phone: 215-295-5006

Fax: 215-295-0781

Acetic Acid, Glacial, ACS

Reagent Grade

0801/201.

SPECIFICATION

MAXIMUM LIMITS

Appearance

Colorless and free from suspended matter or sediment

86/20/2023

Assay

99.7 min.

Color (APHA)

10

Dilution Test

Passes Test

Residue after evaporation

0.001%

Acetic Anhydride

0.01%

Chloride (cl)

1 ppm

Sulfate (SO₄)

1 ppm

Heavy Metals (as Pb)

0.5 ppm

Iron (Fe)

0.2 ppm

Sub. Red. Dichromate

Passes Test

Sub. Red. Permanganate

Passes Test

Titratable Base

0.0004meq/g



Certificate of Analysis

12/14/2022

12/31/2025

Sodium Hydroxide (Pellets)

Material: 0583

Grade: ACS GRADE Batch Number: 23B1556310

Chemical Formula: NaOH
Molecular Weight: 40

CAS #: 1310-73-2

Appearance: Storage: Room Temperature

Pellets

| TEST | SPECIFICATION | ANALYSIS | DISPOSITION |
|--------------------|---------------|----------|-------------|
| Calcium | <= 0.005 % | <0.005 % | PASS |
| Chloride | <= 0.005 % | 0.002 % | PASS |
| Heavy Metals | <= 0.002 % | <0.002 % | PASS |
| Iron | <= 0.001 % | <0.001 % | PASS |
| Magnesium | <= 0.002 % | <0.002 % | PASS |
| Mercury | <= 0.1 ppm | <0.1 ppm | PASS |
| Nickel | <= 0.001 % | <0.001 % | PASS |
| Nitrogen Compounds | <= 0.001 % | <0.001 % | PASS |
| Phosphate | <= 0.001 % | <0.001 % | PASS |
| Potassium | <= 0.02 % | <0.02 % | PASS |
| Purity | >= 97.0 % | 99.2 % | PASS |
| Sodium Carbonate | <= 1.0 % | 0.5 % | PASS |
| Sulfate | <= 0.003 % | <0.003 % | PASS |

Manufacture Date:

Expiration Date:

Internal ID #: 710

Signature Additional Information

We certify that this batch conforms to the specifications listed.

This document has been electronically produced and is valid without a signature.

Leona Edwardson, Quality Control Sr. Manager - Solon VWR Chemicals, LLC.

28600 Fountain Parkway, Solon OH 44139 USA

Analysis may have been rounded to significant digits in specification limits.

Product meets analytical specifications of the grades listed.



Certificate of Analysis

12/14/2022

12/31/2025

Room Temperature

Manufacture Date:

Expiration Date:

Storage:

Sodium Hydroxide (Pellets)

Material: 0583

Grade: ACS GRADE Batch Number: 23B1556310

Chemical Formula: NaOH Molecular Weight: 40

CAS #: 1310-73-2

Appearance:

Pellets

Spec Set: 0583ACS

Internal ID #: 710

Signature Additional Information

We certify that this batch conforms to the specifications listed.

This document has been electronically produced and is valid without a signature.

Leona Edwardson, Quality Control Sr. Manager - Solon VWR Chemicals, LLC. 28600 Fountain Parkway, Solon OH 44139 USA Analysis may have been rounded to significant digits in specification limits.

Product meets analytical specifications of the grades listed.